German-Speaking Émigré Atomic Scientists and British Nuclear Culture, 1939-1958 – the Cases of Klaus Fuchs and Rudolf Peierls.

'Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor of Philosophy by Jan Christoph Laucht.'

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Table of Contents.

Abstract.

German-Speaking Émigré Atomic Scientists and British Nuclear Culture, 1939-1958 – the Cases of Klaus Fuchs and Rudolf Peierls.

Jan Christoph Laucht

This thesis considers the role of two German-speaking émigré atomic scientists, Klaus Fuchs and Rudolf Peierls, in the development of British nuclear culture. It applies an interdisciplinary approach which combines the fields of cultural history and science and technology studies to examine Fuchs's and Peierls's contributions to the making of British nuclear culture – the practice of nuclear science and the political implications of the atomic scientists' work – within a transnational context through comparisons with West German and especially US nuclear culture. This thesis argues that Fuchs and Peierls considerably shaped atomic culture in the United Kingdom in the period between 1939 and 1958. Their 'Germanness', their being German, was informed by their German origin, in particular their ethnicity as well as their exposure to German culture before coming to the United Kingdom. It had far-reaching consequences for their lives and careers. Fuchs's and Peierls's extraction caused their involvement in molding nuclear culture in the United Kingdom. That Fuchs's and Peierls's schooling in Germany with its strong preference for theoretical physics had equipped them with skills which were urgently needed in the United Kingdom during the war, facilitated their integration into the British physics community and made them assume crucial roles in establishing a new approach to nuclear science during the Second World War. Alongside the two scientists' unique skills, their experiences with National Socialism either personally or through family members and loved ones led to a strong motivation to engage in atomic arms research in both of them. In Fuchs's case, however, these experiences had a particularly strong effect: they radicalized him politically so that he would eventually reveal the secrets of both the British and Allied nuclear weapons projects to the Soviet Union. After Fuchs's confession, the impact of his earlier radicalization in Germany on democracy and political cultures could be felt in Britain and beyond when it influenced public opinion on the efficiency of homeland security in the nuclear age. In a similar fashion, Rudolf Peierls's exposure to German research cultures informed his understanding of the relationship between science and politics and the role he envisioned scientists taking in public education and advising political decision makers. As is shown, this would later be crucial for his involvement with the British atomic scientists' movement, in particular, the Atomic Scientists' Association. The period under investigation ends in 1958 with the disbandment of the Atomic Scientists' Association.

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List of Abbreviations.

AAC	Academic Assistance Council
AB	The Records of the Atomic Weapons Establishment and Predecessors
AEC	Atomic Energy Commission (US)
AERE	Atomic Energy Research Establishment, Harwell, Oxfordshire
AIP	American Institute of Physics
ALAS	Association of Los Alamos Scientists (US)
AM	Air Ministry
ASA	Atomic Scientists' Association
ASC	Atomic Scientists' Committee
AScW	Association of Scientific Workers
ASJ	*Atomic Scientists' Journal*
ASN	*Atomic Scientists' News*
AWE	Atomic Weapons Establishment, Aldermaston, Berkshire (from 1987)
AWRE	Atomic Weapons Research Establishment, Aldermaston, Berkshire (1950-87)
BAS	*Bulletin of the Atomic Scientists* (US)
Ber. Wiss-enschafts-gesch.	*Berichte zur Wissenschaftsgeschichte*
BMFRS	*Biographical Memoirs of Fellows of the Royal Society*
BRER	The Papers and Correspondence of Egon Bretscher
BStU	Die Bundesbeauftragte für die Unterlagen des Staats-sicherheitsdienstes der ehemaligen Deutschen Demokratischen Republik (Germany)
CAB	The Records of the Cabinet Office (CAB)
CARA	Council for Assisting Refugee Academics
CHAD	The Papers of Sir James Chadwick, 1914-1974
CIA	Central Intelligence Agency (US)
CND	Campaign for Nuclear Disarmament
CSWR	Center for Southwest Research (US)
DSIR	Department of Scientific and Industrial Research
ECAS	Emergency Committee of Atomic Scientists
ETH	*Eidgenössische Technische Hochschule* (Switzerland)
F-Division	Fermi Division (Los Alamos)
FAS	Federation of American Scientists
FBI	Federal Bureau of Investigation (US)
FDR	Franklin Delano Roosevelt
FREEZE	The Nuclear Weapons Freeze Campaign
FRG	Federal Republic of Germany
G-Division	Gadget Division (Los Alamos)
GDR	German Democratic Republic
Gestapo	*Geheime Staatspolizei* (Germany)
HSPS	*Historical Studies in the Physical and Biological Sciences*
HUAC	House on Un-American Activities Committee
IRD	Information Research Department
KGB	Soviet Secret Police

KPD	*Kommunistische Partei Deutschlands* (Communist Party of Germany)
KJVD	*Kommunistischer Jugendverband Deutschlands* (Communist Youth Association of Germany)
KV	The Security Service: Personal (PF Series) Files
LAHM	Los Alamos Historical Museum Archive
LANL	Los Alamos National Laboratory
MAP	Ministry of Aircraft Production
MED	Manhattan Engineer District; the Manhattan Project
Met Lab	Metallurgical Laboratory, University of Chicago (US)
MfS	*Ministerium für Staatssicherheit*
MI5	The Security Service (Military Intelligence, Section 5)
NATO	North Atlantic Treaty Organization
NHS	National Health Service
NSDAP	*Nationalsozialistische Deutsche Arbeiter Partei* (Germany)
OSRD	Office of Scientific Research and Development (US)
PAPS	*Proceedings of the American Philosophical Society*
PREM	The Records of the Prime Minister's Office
RARDE	Royal Armament Research and Development Establishment, Fort Halsted, Kent.
RAI	*Radiotelevisione Italiana* (Italy)
RGASPI	The Russian State Archive of Socio-Political History
RSG	*Revolutionäre Studentengruppe* (Germany)
SED	*Sozialistische Einheitspartei Deutschlands* (Germany)
SJL	Special Collections and Archives, Sidney Jones Library, University of Liverpool, Liverpool
SPD	*Sozialdemokratische Partei Deutschlands* (Germany)
SPSL	Society for the Protection of Science and Learning
T-Division	Theoretical Division (Los Alamos)
TA	Tube Alloys
TNA	The National Archives, Richmond, Surrey
TUC	Trades Union Congress
UKAEA	United Kingdom Atomic Energy Authority
UN	United Nations

Chapter One. Introduction.

The appointment of Adolf Hitler as German chancellor by President Paul von Hindenburg on 30 January 1933 marked both the end of the Weimar Republic and the beginning of the twelve-year period of Nationalist Socialist rule over Germany and large portions of Continental Europe. During the following months and years, the Hitler regime imposed numerous restrictive measures in order to consolidate its power.[1] Among these was the notorious Law for the Restoration of the Career Civil Service (*Gesetz zur Wiederherstellung des Berufsbeamtentums*) of 7 April 1933 that aimed at the 'Germanification' of academia.[2] The introduction of so-called *Deutsche Physik* (German physics) whose conduct was exclusively reserved for 'Aryans' had a devastating effect on the German physics community and ended a golden age of internationally acclaimed physics in Germany.

The Nazi policies resulted in an exodus of scientists from Germany and other European countries that was unprecedented in history. In Germany alone, the racist legislation and persecution affected some 875,000 people and an estimated 500,000 people fled Nazi-controlled parts of Central Europe as a consequence of the Nazi seizure of power.[3] Between 1933 and 1939, about 90,000 people emigrated to the United Kingdom, of whom some 2,200 were scholars who had left German polytechnics and universities by 1938.[4] Klaus Fuchs and Rudolf Peierls were among those physicists who emigrated to or, in the case of Peierls, who was on a Rockefeller Fellowship at the time of Hitler's coming to power, stayed on in the United Kingdom.

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[1] Francis R. Nicosia, 'Nazi Persecution in Germany and Austria, 1933-1939', in *The Holocaust: Introductory Essays*, ed. by David Scrase and Wolfgang Mieder (Burlington: The Center for Holocaust Studies at the University of Vermont, 1996), pp. 51-64.

[2] 'Gesetz zur Wiederherstellung des Berufsbeamtentums vom 7. April 1933', *Reichsgesetzblatt*, 1. 34 (8 April 1933), 175-77.

[3] Claus-Dieter Krohn, 'Vereinigte Staaten von Amerika', in *Handbuch der deutschsprachigen Emigration 1933-1945*, ed. by Claus-Dieter Krohn and others (Darmstadt: Wissenschaftliche Buchgesellschaft, 1998), pp. 446-66 (p. 446); Herbert A. Strauss, 'The Movement of People in a Time of Crisis', in *The Muses Flee Hitler: Cultural Transfer and Adaptation 1930-1945*, ed. by Jarrell C. Jackman and Carla M. Borden (Washington, DC: Smithsonian Institution Press, 1983), pp. 45-59 (p. 47).

[4] Gerhard Hirschfeld, 'German Refugee Scholars in Great Britain, 1933-1945', in *Refugees in the Age of Total War*, ed. by Anna C. Bramwell (London: Unwin Hyman, 1988), pp. 152-63 (pp. 152-53); Louise London, *Whitehall and the Jews, 1933-1948: British Immigration Policy and the Holocaust* (Cambridge: Cambridge University Press, 2000; repr. 2003), pp. 11-12.

This thesis considers the role of these two key figures in the development of British nuclear culture. It argues that Klaus Fuchs and Rudolf Peierls considerably shaped atomic culture in the United Kingdom in the period between 1939 and 1958. Their 'Germanness', their being German, was informed by their German origin, in particular their ethnicity as well as their exposure to German culture before coming to the United Kingdom. It stood out not only linguistically as the chief feature which differentiated them from their British-born colleagues, but also had far-reaching consequences for their lives and careers. Ultimately, their extraction caused their (unintentional) involvement in molding nuclear culture – the practice of nuclear science and the political implications of the atomic scientists' work – in the United Kingdom.

Since their German descent prohibited them from working in areas such as radar and proximity fuse that were initially believed to be of greater significance to the Allied war effort, Klaus Fuchs and Rudolf Peierls were pushed almost accidentally into the direction of atomic arms research. That Fuchs's and Peierls's schooling in Germany with its strong preference for theoretical physics had equipped them with skills which were urgently needed in the United Kingdom during the war, facilitated their integration into the British physics community and made them assume crucial roles in establishing a new approach to nuclear science during the Second World War. Alongside the two scientists' unique skills, their experiences with National Socialism either personally or through family members and loved ones led to a strong motivation to engage in atomic arms research in both of them. In Fuchs's case, however, these experiences had a particularly strong effect: they radicalized him politically so that he would eventually reveal the secrets of both the British and Allied nuclear weapons projects to the Soviet Union. After Fuchs's confession, the impact of his earlier radicalization in Germany on democracy and political cultures could be felt in Britain and beyond. In a similar fashion, Rudolf Peierls's exposure to German research cultures informed his understanding of the relationship between science and politics and the role he envisioned scientists taking in public education and advising political decision makers. This would later be crucial for his involvement with the British atomic scientists' movement, in particular the Atomic Scientists' Association (ASA).

But, at the same time, Fuchs's and Peierls's German origin made them the target of defamatory attacks and suspicion. While, on the positive side, this distrust

by their British hosts had played a significant part in bringing them into nuclear research, it also, in its perhaps most notorious form, led to Fuchs's internment as an 'enemy alien' early in the war. Peierls, who was of Jewish origin, later stated that he never faced anti-Semitism. In the aftermath of Fuchs's confession, however, the British Security Service (Military Intelligence, Section 5; MI5) kept Peierls under surveillance because he had been Fuchs's mentor and he was German-born. As the cases of outsiders coming to the United Kingdom, the experiences of Klaus Fuchs and Rudolf Peierls therefore offer a unique window on the study of key features in the making of British nuclear culture because their 'Germanness' shaped atomic culture in their host country considerably.

Born in Germany in 1911 and 1907 respectively, Klaus Fuchs and Rudolf Peierls played pivotal roles in the making of the first atomic bombs. After a difficult beginning in their new host country, the two scientists integrated into the British physics community and Rudolf Peierls in particular became a key player in the early British nuclear weapons project, Tube Alloys (TA). In the course of World War II, Fuchs and Peierls spent some time in the United States where they worked on the joint Anglo-American-Canadian Manhattan Project, at first in New York City and later at the central Los Alamos Laboratory in New Mexico.

After the war, both nuclear scientists returned to the United Kingdom and ceased to engage actively in atomic weapons research. Fuchs held a senior administrative appointment at the Atomic Energy Research Establishment (AERE) at Harwell in Oxfordshire, while Rudolf Peierls resumed his professorship at the University of Birmingham. In early 1950, Klaus Fuchs shocked Britons and Americans alike when he confessed that he had been passing on sensitive nuclear information to the Soviet Union since he had joined TA in the spring of 1941. As one of Fuchs's chief sponsors and the person who had recruited him to work on nuclear weaponry, Rudolf Peierls also became the target of public criticism. Fuchs was tried shortly after his confession and sentenced to fourteen years of imprisonment nine of which he served. After his release from prison in 1959, he emigrated to the German Democratic Republic (GDR). Peierls, by contrast, became a key figure in the British atomic scientists' movement, especially the ASA, after the war.

Rudolf Peierls and Klaus Fuchs as the underlying case studies of this dissertation are woven into the analysis of British nuclear culture through the

application of an 'eco-biographical approach', as David Cassidy has coined it.[5] Following Cassidy's concept, this thesis places crucial episodes from their lives within their broader cultural contexts in order to examine key elements of British nuclear culture.[6] What Charles Thorpe has argued in his sociological study of J. Robert Oppenheimer, writing that '[t]o write the biography of Oppenheimer is [...] to write simultaneously both the account of an individual life and the history of the making of social, institutional, and cultural forms', also applies to the present examination of Klaus Fuchs and Rudolf Peierls.[7]

While countless biographies which adhere to an 'eco-biography'-style approach have examined the lives of leading nuclear scientists with respect to their contributions to their discipline or a particular institution or the political and moral implications of their work, these studies are generally more or less orthodox biographical works in the sense that they normally span the respective scientists' entire lives.[8] The present thesis, by contrast, refrains from a strictly chronological biographical approach that covers Fuchs's and Peierls's entire lives, for such an approach would not help address the issues examined here. Rather, it restricts its focus to episodes from the lives of the two German-speaking émigré nuclear scientists that bear relevance to the specific themes under investigation in the period between 1939 and 1958.[9] These, in the case of Peierls, are his leading roles in both TA and the Manhattan Project as well as his involvement in the ASA after the war, with occasional references to his 'pre-history' such as his training in theoretical physics and the shaping of his views on science and politics in Germany that are relevant to this 'eco-biographical study'. In principle, the same applies to the

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[5] David C. Cassidy, 'Understanding the History of Special Relativity: Bibliographical Essay', *Historical Studies in the Physical and Biological Sciences* (hereafter *HSPS*), 16. 1 (1986), 177-95 (pp. 182-83). On biography, cultural history and science, see also Mary Terrall, 'Biography as Cultural History of Science', *Isis*, 97. 2 (2006), 306-13.

[6] David C. Cassidy, *J. Robert Oppenheimer and the American Century* (New York: Pi Press, 2005); David C. Cassidy, *Uncertainty: The Life and Science of Werner Heisenberg* (New York: Freeman, 1992). Other examples include Michael Eckert, *Die Atomphysiker: Eine Geschichte der theoretischen Physik am Beispiel der Sommerfeldschule* (Braunschweig: Vieweg, 1993); Lewis Pyenson, *The Young Einstein: The Advent of Relativity* (Bristol: Hilger, 1985).

[7] Charles Thorpe, *Oppenheimer: The Tragic Intellect* (Chicago: University of Chicago Press, 2006), p. 18.

[8] See, for example, Mary Jo Nye, *Blackett: Physics, War, and Politics in the Twentieth Century* (Cambridge, MA: Harvard University Press, 2004); G. Pascal Zachary, *Endless Frontier: Vannevar Bush, Engineer of the American Century* (New York: Free Press, 1997; repr. Cambridge, MA: MIT Press, 1999).

[9] Here, this thesis follows an approach that is similar to John L. Heilbron and Robert W. Seidel, *Lawrence and His Laboratory: A History of the Lawrence Berkeley Laboratory* (Berkeley: University of California Press, 1989).

examination of Klaus Fuchs's role in the shaping of British nuclear culture. Besides his difficult integration process into his host country's society and physics community, the present thesis investigates his part in the manufacture of the first atomic bombs and the impact of his espionage for the Soviets had on British public opinion, in general, and other German-speaking émigré atomic scientists, above all, Peierls, in particular. Since Fuchs spent the time after his trial in March 1950 until his release and subsequent move to the GDR in prison, he became a sideshow after 1950.

In this, the dissertation follows a recent paradigm shift in exile studies from a biographical approach 'to a more dynamic scenario of intercultural tension and negotiation', as Gerd Gemünden and Anton Kaes have proposed.[10] As a result, it contributes considerably to understanding the role of German-speaking émigré atomic scientists in the United Kingdom which has not been appropriately foregrounded before. At the same time, while recounting Klaus Fuchs's and Rudolf Peierls's engagement in the making of British nuclear culture, this thesis is not simply a comparative study of two scientists like Silvan Schweber's biography of Hans Bethe and J. Robert Oppenheimer,[11] but follows an approach similar to the one adopted by Gregg Herken in his biographical study of Oppenheimer, Ernest O. Lawrence and Edward Teller or István Hargittai's biography of Theodore von Kármán, Leo Szilard, Eugene (Eugen)[12] P. Wigner, John von Neumann and Edward Teller, focusing (especially in chapters two to four) on the ways their lives were mutually entangled.[13]

The present thesis contributes in part to the biographical study of Rudolf Peierls. Despite the fact that Peierls has recently caught considerable attention and a

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[10] Gerd Gemünden and Anton Kaes, 'Introduction', in *Film and Exile*, ed. by Gemünden and Kaes (= *New German Critique*, 89 (Spring-Summer 2003)), pp. 3-8 (p. 4).

[11] Silvan S. Schweber, *In the Shadow of the Bomb: Oppenheimer, Bethe, and the Moral Responsibility of the Scientist* (Princeton: Princeton University Press, 2000).

[12] Note that in the rare cases where German-speaking émigré scientists Anglicized the spelling of their names (usually quite soon after their arrival in Britain), this form is used throughout the thesis. The original spelling is given in brackets the first time a particular name is mentioned. The case of Franz Simon represents the only exception to this rule because he changed his name in 1946 upon the award of the CBE to Sir Francis Simon.

[13] István Hargittai, *The Martians of Science: Five Physicists Who Changed the Twentieth Century* (New York: Oxford University Press, 2006); Gregg Herken, *Brotherhood of the Bomb: The Tangled Lives and Loyalties of Robert Oppenheimer, Ernest Lawrence, and Edward Teller* (New York: Holt, 2002).

selection of his correspondence is currently being published,[14] no biography of Rudolf Peierls has been produced to date apart from his autobiography, a collection of some of his articles and two short biographical sketches.[15] By contrast, Fuchs's case is much more complicated than Peierls's. While several biographies of Fuchs have been produced over the years, they are by and large highly biased.[16] Early studies of the Fuchs case by Alan Moorehead, Oliver Pilat and Rebecca West were written shortly after his confession and under its direct impact.[17] Later biographies by Harford Montgomery Hyde, Norman Moss and Robert Chadwell Williams were produced with timely distance to the actual events of the Fuchs case, but they were still written under the dictum of the Cold War era and without access to crucial primary sources, especially the MI5 files on the spy case.[18] Like these British and American works, short biographical sketches of Klaus Fuchs that appeared in the GDR have to be read with a critical eye.[19] The same holds true for two recent German Fuchs biographies by Ronald Friedmann and Eberhard Panitz, which is in particular reflected in the subtitle of Friedmann's book *Das Leben des Kommunisten*

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[14] *The Bethe-Peierls Correspondence*, ed. by Sabine Lee (Singapore: World Scientific, 2007); *Sir Rudolf Peierls: Selected Private and Scientific Correspondence*, 2 vols (Singapore: World Scientific, 2007-), I (2007).

[15] Rudolf E. Peierls, *Atomic Histories* (Woodbury, NY: American Institute of Physics Press; New York: Springer, 1997); Rudolf E. Peierls, *Bird of Passage: Recollections of a Physicist* (Princeton: Princeton University Press, 1985); Richard H. Dalitz, 'Peierls, Sir Rudolf Ernst (1907–1995)', in *Oxford Dictionary of National Biography*, Oxford University Press, Sept 2004; online edn, Jan 2008 <http://www.oxforddnb.com/view/article/60076> [accessed 5 Sept 2008]; Sabine Lee, 'Rudolf Ernst Peierls, 5 June 1907 – 19 September 1995', *Biographical Memoirs of Fellows of the Royal Society* (hereafter *BMFRS*), 53 (December 2007), 265-284.

[16] Here two short biographical sketches are perhaps the only exceptions: 'Fuchs, Klaus Emil Julius', in *Biographisches Handbuch der deutschsprachigen Emigration nach 1933*, 3 vols, ed. by Werner Röder and Herbert A. Strauss (Munich: Saur, 1980-83), I (1980), p. 206; Mary Flowers, 'Fuchs, (Emil Julius) Klaus (1911–1988)', in *Oxford Dictionary of National Biography*, Oxford University Press, 2004; online edn, May 2008 <http://www.oxforddnb.com/view/article/40698> [accessed 5 Sept 2008].

[17] Alan Moorehead, *The Traitors: The Double Life of Fuchs, Pontecorvo and Nunn May* (London: Hamish Hamilton, 1952; New York: Harper & Row, 1963); Oliver Pilat. *The Atom Spies* (New York: Putnam, 1952). Originally published by Macmillan in London in 1945, the London-based Reprint Society launched a second enlarged and revised edition of Rebecca West's *The Meaning of Treason* in 1952 which contained additional chapters on atomic espionage. The book was then published by Viking Books (New York) under the title the *The New Meaning of Treason* in the United States in 1964.

[18] Harford Montgomery Hyde, *The Atom Bomb Spies* (London: Hamish Hamilton; New York: Atheneum, 1980); Norman Moss, *Klaus Fuchs: The Man Who Stole the Atom Bomb* (New York: St. Martin's Press, 1987); Robert Chadwell Williams, *Klaus Fuchs, Atom Spy* (Cambridge, MA: Harvard University Press, 1987).

[19] Günter Flach, 'Klaus Fuchs – Sein Erbe bewahren', *Sitzungsberichte der Akademie der Wissenschaften der DDR, Mathematik – Naturwissenschaften – Technik*, 2/N (1990), 5-10; Gert Lange and Joachim Mörke, *Wissenschaft im Interview: Gespräche mit Akademiemitgliedern über ihr Leben und Werk* (Leipzig: Urania, 1979), pp. 33-44. Here, his father's autobiography represents an exception and offers some interesting views on Klaus Fuchs; Emil Fuchs, *Mein Leben*, 2 vols (Leipzig: Köhler & Amelang, 1957-59), II (1959).

und Wissenschaftlers Klaus Fuchs (*The Life of the Communist and Scientist Klaus Fuchs*).[20] To make matters worse, these books lack a solid source basis and thus have little scholarly merit.

Although Fuchs and Peierls were German-born, this thesis does not exclusively restrict its focus to them, but it makes references to émigré atomic scientists from various parts of the Germanophone world – Germany proper, Switzerland as well as the old Austro-Hungarian Empire, including Austria, Czechoslovakia and Hungary – who resided in Britain and the United States. By borrowing this methodological tool from the field of émigré studies and weighing Fuchs's and Peierls's experiences against those of other German-speaking émigré nuclear scientists, the present dissertation aims at arriving at more general conclusions about German-speaking émigré scientists as a cohort.[21] Like Fuchs and Peierls, most of these nuclear scientists had received considerable parts of their higher education in Germany during the country's golden age of international science in the 1920s and early 1930s.[22] Closely connected to their geographic origin was their individual status as emigrant. Since the scientists came from various migration backgrounds, this dissertation applies the fairly broad term 'émigré', as proposed by Jutta Vinzent in a different context.[23] Its usage allows the incorporation of the majority who were part of the Jewish emigration and included, besides Rudolf Peierls, Max Born, Hans Bethe, Edward Teller and Victor Weisskopf as much as the political émigré Klaus Fuchs and the Swiss-German émigrés Felix Bloch, Egon

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[20] Ronald Friedmann, *Der Mann, der kein Spion war: Das Leben des Kommunisten und Wissenschaftlers Klaus Fuchs* (Rostock: Koch, 2005); Eberhard Panitz, *Treffpunkt Banbury oder wie die Atombombe zu den Russen kam: Klaus Fuchs, Ruth Werner und der größte Spionagefall der Geschichte* (Berlin: Das Neue Berlin, 2003).

[21] *Changing Countries: The Experience and Achievement of German-Speaking Exiles from Hitler to Britain, from 1933 to Today*, ed. by Marian Malet and Anthony Grenville (London: Libris, 2002); *Forced Migration and Scientific Change: Émigré German-Speaking Scientists and Scholars after 1933*, ed. by Mitchell G. Ash and Alfons Söllner (Washington, DC: German Historical Institute; New York: Cambridge University Press, 1996); *German-Speaking Exiles in Great Britain*, ed. by Ian Wallace (Amsterdam: Rodopi, 1999); Jan-Christopher Horak, 'On the Road to Hollywood: German-Speaking Filmmakers in Exile 1933-1950', in *Kulturelle Wechselbeziehungen im Exil – Exile Across Cultures*, ed. by Helmut F. Pfanner (Bonn: Bouvier, 1986), pp. 240-48.

[22] John Cornwell, *Hitler's Scientists: Science, War, and the Devil's Pact* (New York: Penguin, 2004), pp. 38-40. That one third of the 100 Nobel Prizes awarded between 1901 and 1932 were given to either Germans or scientists working in Germany, is a strong indicator of Germany's leading role in science at the time; Jean Medawar and David Pyke, *Hitler's Gift: Scientists Who Fled Nazi Germany* (London: Cohen; the European Jewish Publication Society, 2000; repr. London: Piatkus, 2001), p. 3.

[23] Jutta Vinzent, *Identity and Image: Refugee Artists from Nazi Germany in Britain 1933-1945* (Weimar: VDG, 2006), pp. 23-28.

Bretscher and Haus Staub who were not directly part of the forced emigration from Continental Europe but who had often emigrated for economic reasons.

In a similar fashion, this PhD thesis defines British nuclear culture, the object with which Fuchs, Peierls and other émigré scientists engaged, in a broad way. It starts from the premise that 'culture' is what Clifford Geertz termed a 'web of significance'.[24] In other words, 'culture' denotes in the present thesis, as John Tomlinson has argued, 'the *context* within which people give *meanings* to their actions and experiences, and make sense of their lives'.[25] A major prerequisite for such a process of finding meaning to take place is that, Geertz stated, '[c]ulture is public because meaning is.' [26] Here, the present study has to make a concession because from the early days of the British atomic arms project a 'culture of secrecy', David Vincent has demonstrated, pervaded deeply into British nuclear culture and restricted access to some of its crucial parts, in particular those areas concerned with the manufacture of atomic power and arms.[27] Yet, as this PhD dissertation will show, atomic culture in the United Kingdom has always been (to a limited degree) public and even sensitive areas have been at least accessible to varying degrees to its scientific practitioners such as Klaus Fuchs and Rudolf Peierls.

While the study of atomic culture has received considerable attention in the United States, it has still remained largely untouched in Britain. Within the context of American atomic culture, studies such as Paul Boyer's *By the Bomb's Early Light*, Allan Winkler's *Life under a Cloud* or Scott Zeman's and Michael Amundson's edited collection *Atomic Culture* have approached the topic from a broad angle, looking at various discourses on nuclear weapons and energy.[28] Furthermore, many studies have been written on special aspects of American nuclear culture from its origins, in particular the Manhattan Project, to political implications and repercussions of nuclear arms to literature and popular culture, gender, atomic testing

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[24] Clifford Geertz, *The Interpretation of Cultures* (New York: Basic Books, 1973; repr. London: Hutchinson, 1975), p. 5.
[25] John Tomlinson, *Cultural Imperialism: A Critical Introduction* (London: Pinter, 1991), p. 7.
[26] Geertz, p. 12.
[27] David Vincent, *The Culture of Secrecy: Britain, 1832-1998* (Oxford: Oxford University Press, 1998), pp. 9-18, 194-210.
[28] *Atomic Culture: How We Learned to Stop Worrying and Love the Bomb*, ed. by Scott C. Zeman and Michael A. Amundson (Boulder: University Press of Colorado, 2004); Paul S. Boyer, *By the Bomb's Early Light: American Thought and Culture at the Dawn of the Atomic Age* (New York: Pantheon, 1985; repr. Chapel Hill: University of North Carolina Press, 1994); Allan M. Winkler, *Life under a Cloud: American Anxiety about the Atom* (New York: Oxford University Press, 1993; repr. Urbana: University of Illinois Press, 1999).

and its effects, to the antinuclear movement, the environmental impact of nuclear energy and atomic accidents, Native Americans, the regional impact of nuclear weapons and energy on the American West, to architecture and civil defence.[29]

In spite of the fact that several aspects of atomic culture in the United Kingdom have received scholarly attention, including nuclear policy, the anti-nuclear movement, the British atomic arms and energy projects, nuclear testing, civil defence, economic and regional aspects of the British nuclear weapons programme, the architecture and infrastructure of the British nuclear state and delivery systems and military strategy, no study to date has tried to approach British nuclear culture from a broader perspective, as Boyer, Winkler or Zeman and Amundson have attempted in the case of the postwar United States, or looked at the deeper cultural implications of the individual features under investigation.[30] In the only study to date

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[29] The secondary literature on aspects of US nuclear culture is vast and ever-growing, see *Atomic Audit: The Costs and Consequences of U.S. Nuclear Weapons Since 1940*, ed. by Stephen I. Schwartz (Washington, D.C.: Brookings Institution Press, 1998); *The Atomic West*, ed. by Bruce Hevly and John M. Findlay (Seattle: University of Washington Press, 1998); Howard Ball, *Justice Downwind: America's Atomic Testing Program in the 1950s* (New York: Oxford University Press, 1986); Paul Brians, *Nuclear Holocausts: Atomic War in Fiction, 1895-1984* (Kent: Kent State University Press, 1987); Robert A. Divine, *Blowing on the Wind: The Nuclear Test Ban Debate, 1954-60* (New York: Oxford University Press, 1978); Dee Garrison, *Bracing for Armageddon: Why Civil Defense Never Worked* (Oxford: Oxford University Press, 2006); Peter Bacon Hales, *Atomic Spaces: Living on the Manhattan Project* (Urbana: University of Illinois Press, 1997); Ruth H. Howes and Caroline L. Herzenberg, *Their Day in the Sun: Women of the Manhattan Project* (Philadelphia: Temple University Press, 1999); Valerie Kuletz, *The Tainted Desert: Environmental Ruin in the American West* (New York: Routledge, 1998); Elaine Tyler May, *Homeward Bound: American Families in the Cold War Era*, rev. and updated edn (New York: Basic Books, 1999); *The Navajo People and Uranium Mining*, ed. by Doug Brugge, Timothy Benally and Esther Yazzie-Lewis (Albuquerque: University of New Mexico Press, 2006); Richard Rhodes, *The Making of the Atomic Bomb* (New York: Simon & Schuster, 1986); David Seed, *American Science Fiction and the Cold War: Literature and Film* (Edinburgh: Edinburgh University Press, 1999); A. Constandina Titus, *Bombs in the Backyard: Atomic Testing and American Politics*, 2nd edn (Reno: University of Nevada Press, 2001); Tom Vanderbilt, *Survival City: Adventures Among the Ruins of Atomic America* (New York: Princeton Architectural Press, 2002); J. Samuel Walker, *Three Mile Island: A Nuclear Crisis in Historical Perspective* (Berkeley: University of California Press, 2004).

[30] See Lorna Arnold, with Katherine Pyne, *Britain and the H-Bomb* (Basingstoke: Palgrave, 2001); *Cabinets and the Bomb*, ed. by Peter Hennessy (Oxford: Oxford University Press, 2007); Duncan Campbell, *War Plan UK: The Truth about Civil Defence in Britain* (London: Burnett, 1982); Ronald W. Clark, *The Birth of the Bomb: The Untold Story of Britain's Part in the Weapon that Changed the World* (London: Phoenix House, 1961); Wayne D. Cocroft and Roger J. C. Thomas, *Cold War: Building for Nuclear Confrontation 1946-1989* (Swindon: English Heritage, 2003); Lawrence Freedman, *Britain and Nuclear Weapons* (London: Macmillan, 1980); Margaret Gowing, *Britain and Atomic Energy, 1939-1945* (London: Macmillan, 1964); Peter Hennessy, *The Secret State: Whitehall and the Cold War*, rev. edn (London: Penguin, 2003); Brian P. Jamieson, 'Britain's National Deterrent: Scotland's Answer to the Cycle of Unemployment?', *Contemporary British History*, 21. 4 (2007), 449-69; Richard Moore, *The Royal Navy and Nuclear Weapons* (London: Cass, 2001); Maggie Mort, *Building the Trident Network: A Study of the Enrollment of People, Knowledge, and Machines* (Cambridge, MA: MIT Press, 2002); Joan Smith, *Clouds of Deceit: The Deadly Legacy of Britain's Bomb Tests* (London: Faber, 1985); Richard Taylor, *Against the Bomb: The British Peace Movement, 1958-1965* (Oxford: Clarendon Press, 1988).

which has used the term 'British nuclear culture' and examined its origins in the period between 1895 and 1939, Kirk Willis has defined it narrowly as 'the knowledge, imagery, and artifacts of applied nuclear physics'.[31] Other authors have used even more restricted definitions, often as the result of their chosen methodological approach. John Cannady, for example, has attempted to examine 'atomic culture' by 'applying the tools and techniques of literary criticism to uncover the uses of literature in the development and deployment of nuclear weapons and the physics on which they most overtly depend'.[32] Even though Boyer, Winkler and Zeman and Amundson have applied a wider definition of 'nuclear culture' and looked at various discourses over nuclear weapons and energy as they manifested themselves after Hiroshima, they have all focused on the impact of nuclear science and technology on culture.

The present PhD thesis, by contrast, applies a more holistic and comprehensive concept of 'atomic culture'. It is the result of its interdisciplinary approach to British nuclear culture that brings together methods from the two seemingly antagonistic areas of science and humanities which C.P. Snow termed 'the two cultures' by blending the fields of science and technology studies and cultural history.[33] This broader definition of 'nuclear culture', as applied here, contains two components: the practice of nuclear science and the political implications of the scientists' work. While this study uses in part a similar approach to Boyer, Winkler and Zeman and Amundson when it examines the Klaus Fuchs atomic espionage case and Rudolf Peierls's involvement in the ASA in its latter half, it simultaneously widens the definition of 'nuclear culture' by including what Andrew Pickering has called 'scientific culture', comprising 'skills and social relations, machines and instruments, as well as scientific facts and theories'.[34] Consequently, this thesis views science as a cultural practice.[35] It looks at the implications 'scientific culture'

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[31] Kirk Willis, 'The Origins of British Nuclear Culture, 1895-1939', *Journal of British Studies*, 34. 1 (1995), 59-89 (p. 60).

[32] John Cannaday, *The Nuclear Muse: Literature, Physics, and the First Atomic Bombs* (Madison: University of Wisconsin Press, 2000), p. 24.

[33] C. P. Snow, *The Two Cultures and the Scientific Revolution* (Cambridge: Cambridge University Press, 1959), pp. 1-21.

[34] Andrew Pickering, *The Mangle of Practice: Time, Agency and Science* (Chicago: University of Chicago Press, 1995), p. 3. In a similar fashion, Paul R. Josephson has referred to 'engineering culture' as '[t]he most important aspect of atomic culture in the Soviet Union'; 'Atomic-Powered Communism: Nuclear Culture in the Postwar USSR', *Slavic Review*, 55. 2 (1996), 297-324 (p. 298).

[35] Bruno Latour, *Laboratory Life: The Construction of Scientific Facts*, 2nd edn (Princeton: Princeton University Press, 1986); *Science as Practice and Culture*, ed. by Andrew Pickering (Chicago:

had for British nuclear culture, especially democracy and political cultures.[36] Here, the analysis goes beyond viewing Klaus Fuchs and Rudolf Peierls solely as scientists but sees them as cultural actors.[37] Nuclear energy and arms are viewed as culturally manufactured technologies.[38] Therefore, this thesis argues against the orthodox concept of a so-called hard technological determinism – the idea that scientific and technical development is driven by its own logic and shapes culture, history and society.[39] This scientific component of 'atomic culture' is examined in chapters two and three, especially the third one that deals with the emergence of new cultures in nuclear research in the Manhattan Project.

A reciprocal relationship exists between these two elements of British nuclear culture: the scientific practice and the political fallout of the scientists' work. Rudolf Peierls and Klaus Fuchs exemplify this reciprocity particularly well. Since they helped design the first atomic bombs, they had a great share in confronting the world public with a new source of energy. At the same time, these products of 'scientific culture' had a strong impact on their creators and the culture which helped develop them. Therefore, a strong reciprocal relationship exists between the creators and their creations.[40] This reciprocity is also reflected in the structure of the thesis: while chapters two and three focus on the making of the first atomic bombs during World War II, chapters four and five deal with the impact these radically new weapons had on their creators, Fuchs and Peierls, and the culture they lived in.

University of Chicago Press, 1992); Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton: Princeton University Press, 1985).

[36] In a similar fashion, Paul Josephson has stressed the strong intersections of science and politics in nuclear culture within the anti-democratic context of the Soviet Union (p. 298).

[37] Gabriele Metzler, *Internationale Wissenschaft und nationale Kultur: Deutsche Physiker in der internationalen Community 1900-1960* (Göttingen: Vandenhoeck & Ruprecht, 2000), p. 24. See also Mitchell G. Ash, 'Von Vielschichtigkeiten und Verschränkungen: "Kulturen der Wissenschaften – Wissenschaften der Kulturen"', *Berichte zur Wissenschaftsgeschichte* (hereafter *Ber. Wissenschaftsgesch.*), 30. 2 (2007), 91-105; Steven Weinberg, 'Physics and History', *Daedalus*, 127. 1 (Winter 1998), 151-64.

[38] For a similar approach, see Donald MacKenzie, *Inventing Accuracy: A Historical Sociology of Nuclear Missile Guidance* (Cambridge, MA: MIT Press, 1990); Paul N. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, MA: MIT Press, 1996); David E. Nye, *Electrifying America: Social Meanings of a New Technology, 1880-1940* (Cambridge, MA: MIT Press, 1990).

[39] For a critical examination of the concept of 'technological determinism', see *Does Technology Drive History? The Dilemma of Technological Determinism*, ed. by Merrit Roe Smith and Leo Marx (Cambridge, MA: MIT Press, 1994).

[40] On the reciprocal relationship of culture and technology, see *Gender Analysis and the History of Technology*, ed. by Nina E. Lerman, Arwin Palmer Mohun and Ruth Oldenziel (= *Technology and Culture*, 38. 1 (1997)).

Besides its strong reciprocal character, this doctoral thesis also takes British nuclear culture to be multifaceted. 'Atomic culture' thus comprises, as Jutta Weldes, Mark Laffey, Hugh Gusterson and Raymond Duvall have noted in a different context,

> the multiplicity of discourses [...] through which meaning is produced – including discourses about "culture" itself. This multiplicity in turn implies [...] that meanings can be contested. We thus understand culture to be composed of potentially contested codes of representation, as designating a field on which are fought battles over meaning.[41]

Seen as a multifaceted entity, 'nuclear culture' can consequently be self-reflective and even self-critical and include contradictory elements or what Margot Henriksen has termed 'cultures of consensus and dissent'.[42] This feature applies as much to the first part of the thesis which looks at aspects of 'scientific culture' when scientists sometimes followed different and at times contradictory paths, as especially chapter three on the emergence of a new research culture in nuclear science will reveal, as to chapters four and five which deal with the political fallout of nuclear weapons.[43]

British nuclear culture has of course always operated within the wider context of British culture and has been part of British national identity. While a discussion of Britishness deserves a study in its own right, this thesis follows for its purpose Benedict Anderson's definition of 'nation' as 'an imagined political community'.[44] The adjective 'nuclear', however, added a peculiar dimension to it, as it did in other countries, especially the United States. Before mankind entered the nuclear age, atomic imagery had already exerted a strong fascination on contemporaries, in particular by evoking ambivalent associations between hope for the atom's peaceful applications and fears about nuclear devastation.[45] British

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[41] Jutta Weldes and others, 'Introduction: Constructing Insecurity', in *Cultures of Insecurity: States, Communities, and the Production of Danger*, ed. by Weldes and others (Minneapolis: University of Minneapolis Press, 1999), pp. 1-33 (p. 2). Holger Nehring has described a similar phenomenon as 'the cultures of the Cold War'; 'The British and West German Protests against Nuclear Weapons and the Cultures of the Cold War, 1957-64', *Contemporary British History*, 19. 2 (2005), 223-41 (p. 224).

[42] Margot A. Henriksen, *Dr. Strangelove's America: Society and Culture in the Atomic Age* (Berkeley: University of California Press, 1997), p. xxiii.

[43] Ian Hacking, 'The Self-Vindication of the Laboratory Sciences', in *Science as Practice and Culture*, pp. 29-64.

[44] Benedict Anderson, *Imagined Communities: Reflections on the Origin and Spread of Nationalism*, rev. edn (London: Verso, 1991), p. 6. For critical analyses of the concept of 'Britishness', see Linda Colley, *Britons: Forging the Nation 1707-1837*, new edn (London: Pimlico, 2003); Jeffrey Richards, *Films and British National Identity: From Dickens to 'Dad's Army'* (Manchester: Manchester University Press, 1997); Sonya O. Rose, *Which People's War? National Identity and Citizenship in Wartime Britain 1939-1945* (Oxford: Oxford University Press, 2003).

[45] This is explored in Spencer R. Weart, *Nuclear Fear: A History of Images* (Cambridge, MA: Harvard University Press, 1988).

popular culture was one of the first to envisage applications of atomic power. As early as 1914, the writer H.G. Wells had predicted the use of nuclear power for both peaceful and military purposes by the 1950s in his science-fiction novel *The World Set Free*.[46] About twenty years later, director Maurice Elvey's film *The Tunnel* (1935), an adaptation of Bernhard Kellerman's novel of the same title, featured a nuclear-powered drill, which was used to dig a tunnel between the British Isles and the United States.[47] That an accident occurs in the plot which results in the fatal contamination of workers with radioactivity underlines this tension between regarding atomic power as hope and peril.

After the news of Hiroshima had confirmed the existence of the new source of energy to the world public, the atomic bomb assumed the role of what David E. Nye has called 'the technological sublime'.[48] That the United Kingdom was located geo-strategically at the centre of a potential all-out nuclear war between the superpowers certainly created a strong sense of urgency and awareness of the atomic threat. The anti-nuclear movement with its famous march from the London city centre to the Atomic Weapons Research Establishment (AWRE; renamed the Atomic Weapons Establishment [AWE] in 1987) at Aldermaston in Berkshire on Easter 1958 is especially indicative of these concerns. The tensions between the conflicting meanings of nuclear utopia and dystopia were deeply rooted in British culture. They formed part of a tradition of how large portions of British society have confronted and eventually approved of technological progress and change regardless of considerable doubts and skepticism since the late nineteenth century.[49] The multiplicity of meanings inscribed into the adjective 'nuclear' further justifies the use of a multifaceted approach to culture in the present thesis.

Although British nuclear culture was partly built on tradition and people had imagined the benefits and dangers of atomic energy long before it became a reality, it was not a planned development but the result of a long process of scientific investigation and discovery. That Klaus Fuchs and Rudolf Peierls were pushed almost accidentally into the direction of atomic arms research because of their

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[46] H. G. Wells, *The World Set Free* (London: Macmillan, 1914).
[47] Bernhard Kellermann, *The Tunnel* (London: Hodder & Stoughton, 1915).
[48] David E. Nye, *American Technological Sublime* (Cambridge, MA: MIT Press, 1994), pp. 225-56. In his examination of the mushroom cloud as the chief icon of atomic culture, Peter Bacon Hales has also used the term 'the atomic sublime'; 'The Atomic Sublime', *American Studies*, 32. 1 (1991), 5-31.
[49] See Bernhard Rieger, *Technology and the Culture of Modernity in Britain and Germany 1890-1945* (Cambridge: Cambridge University Press, 2005).

German origin, as mentioned earlier, thus not only revealed their unintentional entanglement in the making of British nuclear culture, but it also pointed to its unpremeditated emergence in general.

What differentiated nuclear culture in the United Kingdom from atomic cultures in other countries was its peculiar definition of 'modern' that it took on within the British context in particular by contrast with the United States.[50] After the Second World War, atomic culture in Britain found itself in a tension between traditional and conservative values and symbols linked to the past, perhaps most apparent in the constitutional monarchy and the Empire, which had by then already dissolved in vast areas, on the one hand, and current (as well as future) events, above all, the Cold War, on the other. Perhaps no other occasion marked this special notion of 'modernity' as well as the Coronation of Queen Elizabeth II in 1953: while the ceremony had strong traditional links, in particular, to monarchy, it was at the same time the first major event to be broadcast in the fledging new medium of television in British history and thus ranked among the country's top media events in the first decade after the war. 'Like the Coronation itself', Becky Conekin, Frank Mort and Chris Waters have observed, 'the modern in this period was a hybrid affair, assembled out of tales about the past as well as narratives of the future.'[51]

British nuclear culture situated itself between these seemingly opposing progressive and traditional elements. The discourse over nuclear arms and the necessity for Britain to develop its own nuclear arsenal and shape its future in a way that would allow London to maintain a strong position in the world during the Cold War era often referred back to the days of the British Empire.[52] At the same time, British nuclear culture comprised modern elements which were equivalent to the extravagant media coverage of the Coronation or the reform of the welfare state through the creation of the National Health Service (NHS) in 1946.[53] In a move that

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[50] For a historical examination of the meaning of 'modern' in the British context, see *Meanings of Modernity: Britain from the Late-Victorian Era to World War II*, ed. by Martin Daunton and Bernhard Rieger (Oxford: Berg, 2001); *Modern Times: Reflections on a Century of English Modernity*, ed. by Mica Nava and Alan O'Shea (London: Routledge, 1996).

[51] Becky Conekin, Frank Mort and Chris Waters, 'Introduction', in *Moments of Modernity: Reconstructing Britain 1945-1964*, ed. by Conekin, Mort and Waters (London: Rivers Oram Press, 1999, pp. 1-21 (p. 3).

[52] John Baylis, *Ambiguity and Deterrence: British Nuclear Strategy 1945-1964* (Oxford: Clarendon Press, 1995), p. 180.

[53] Jim Tomlinson, 'Reconstructing Britain: Labour in Power 1945-1951', in *From Blitz to Blair: A New History of Britain Since 1939*, ed. by Nick Tiratsoo (London: Weidenfeld and Nicolson, 1998), pp. 77-101.

was perhaps the most significant amongst these, Britain became the first country in the world to launch a civilian atomic energy programme under the supervision of the newly established United Kingdom Atomic Energy Authority (UKAEA) in 1955.[54] Yet, Queen Elizabeth II's attendance of the opening ceremony for the first of the two reactors at Calder Hall in Cumbria in October 1956 demonstrated that these modern nuclear elements were embedded in the traditional political culture of constitutional monarchy. While the reactors at Calder Hall which adjoined the existing piles at Windscale were the first in the world to generate electricity for the national grid, they simultaneously produced plutonium for the country's aspiring atomic weapons project.[55]

In this calculation nuclear power became an integral part of 'technopolitics', as Gabrielle Hecht has called it in the French context, 'the strategic practice of designing or using technology to constitute, embody, or enact political goals'.[56] Klaus Fuchs and Rudolf Peierls first became involved with the peculiar 'modern' sense of British nuclear culture during the war through their work on the first atomic bombs because it supported Whitehall's determination to acquire its own nuclear weaponry and using this modern technology to make up for the loss of large parts of the Empire. In the postwar period, the revelation of the Klaus Fuchs atomic espionage case strongly influenced public opinion on the efficiency of security agencies in the Cold War with its changed political landscape. Moreover, Peierls aimed at educating the public and political decision makers who often were still rooted in conceptions of the pre-atomic age about the radically new form of energy in whose development he and Fuchs had played a major part.

British nuclear culture, as Fuchs and Peierls helped to shape it, extended well beyond the United Kingdom and into the Empire. This connection is particularly well illustrated in the area of nuclear testing where Australia, New Zealand and the Republic of Kiribati, formerly a part of the Crown colony of Gilbert and Ellice

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[54] R. Darcy Best, 'The United Kingdom Atomic Energy Authority and the Administration of Atomic Energy', *Atomic Scientists' Journal* (hereafter *ASJ*), 5. 3 (January 1956), 157-162; Nigel Calder, 'How They Are Building Nuclear Britain', *New Scientist*, 17 July 1958, pp. 413-14, 416, 418; Central Office of Information, *Nuclear Energy in Britain*, 2nd end (London: HMSO, 1960), pp. 9, 11-13; 'New Nuclear Power Stations', *New Scientist*, 27 December 1956, pp. 10-12; 'The Power Station Programme', *New Scientist*, 20 December 1956, pp. 5-6.

[55] Lorna Arnold, *Windscale 1957: Anatomy of a Nuclear Accident*, 2nd edn (Basingstoke: Palgrave Macmillan, 1995), pp. xxi-xxii, 21-26.

[56] Gabrielle Hecht, *The Radiance of France: Nuclear Power and National Identity after World War II* (Cambridge, MA: MIT Press, 1998), p. 15.

Islands, participated with often devastating consequences for the environment and health of considerable segments of their populations in these tests.[57] Although these locations had been chosen in part because the United Kingdom was simply too densely populated and lacked the remote spaces required for atomic testing and Canberra sanctioned Whitehall's plans to conduct tests on Australian soil, it was especially the choice of the Gilbert and Ellice Islands as the site for thermonuclear testing that exposed another element of British nuclear culture that can perhaps best be described as atomic imperialism. Again, British nuclear culture built on older representations, as '[t]he imperial *leitmotif* figured as an important, long-standing theme in British discussions about technology', Bernhard Rieger has noted, since the 1890s.[58]

But the link between atomic culture and the Empire extended beyond nuclear testing: during World War II, the British Dominions of Australia, Canada and New Zealand made contributions to the development of nuclear weapons and energy.[59] And even before that, the New Zealander Ernest Rutherford provided pivotal basic research with his discovery of alpha and beta rays in uranium for the creation of the atom bomb.[60] Klaus Fuchs and especially Rudolf Peierls experienced these close connections with the Empire in the form of a protective xenophobia, as chapter two will show, shortly after their arrival in Britain when they faced considerable difficulties integrating into their new host country's physics community. But the connections to the Empire went further. The British government, for example, also

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[57] Arnold, *Britain and the H-Bomb*; Lorna Arnold and Mark Smith, *Britain, Australia and the Bomb: The Nuclear Tests and Their Aftermath*, rev. edn (Basingstoke: Palgrave, 2006); John Crawford, '"A Political H-Bomb": New Zealand and the British Thermonuclear Weapon Test of 1957-58', *Journal of Imperial and Commonwealth History*, 26. 1 (1998), 127-50; Roger Cross, 'British Nuclear Tests and the Indigenous People of Australia', in *The British Nuclear Weapons Programme 1952-2002*, ed. by Douglas Holdstock and Frank Barnaby (London: Cass, 2003), pp. 76-90.

[58] Rieger, *Technology and the Culture of Modernity in Britain and Germany*, p. 233.

[59] The Australian-born scientists Marcus Oliphant, Harold Massey and Eric Burhop as well as the New Zealanders Ernest Marsden, K.D. George, R.R. Nimmo, George Page, C.N. Watson-Munro, R.M. Williams and the engineer W.W. Young worked at Manhattan Project installations in the United States and Canada; Ross Galbreath, 'The Ruherford Connection: New Zealand Scientists and the Manhattan and Montreal Projects', *War in History*, 2. 3 (1995), 306-19. On the Canadian contributions, see Donald Howard Avery, 'Atomic Scientific Co-operation and Rivalry Among Allies: The Anglo-Canadian Montreal Laboratory and the Manhattan Project, 1943-1946', *War in History*, 2. 3 (1995), 274-305; Wilfrid Eggleston, *Canada's Nuclear Story* (Toronto: Clarke, Irwin, 1965); Kim Krenz, *Deep Waters: The Ottawa River and Canada's Nuclear Adventure* (Montreal: McGill-Queen's University Press, 2004); M.M.R. Williams, 'The Development of Nuclear Reactor Theory in the Montreal Laboratory of the National Research Council of Canada (Division of Atomic Energy) 1943-1946', *Progress in Nuclear Energy*, 36. 3 (2000), 239-322.

[60] See John L. Heilbron, *Ernest Rutherford and the Explosion of Atoms* (Oxford: Oxford University Press, 2003).

included nuclear weapons in strategic plans to protect its traditional interests in Southeast Asia against the new threats of the Cold War, in particular a possible Communist Chinese expansion. In this scenario, nuclear relations with the United States also played an important role.[61]

Anglo-American co-operation in atomic matters has represented a chief component of British nuclear culture from its early days. Beginning in the Second World War, the British government collaborated with the United States in the Manhattan Project. Here, Klaus Fuchs and in particular Rudolf Peierls played pivotal roles, as will be demonstrated in chapter three. While first cracks in Anglo-American atomic relations appeared during wartime, British-American nuclear co-operation suffered its first severe crisis in August 1946 when the US Congress passed the McMahon Act. Under the new legislation, it was illegal to share nuclear data with foreign governments and this left the United Kingdom virtually cut off from any US atomic information.[62] It was not until October 1957 that the Eisenhower Administration amended the legislation, exempting Britain from the provisions of the McMahon Act. Congress then finally accepted the new terms the following June. Shortly afterwards London and Washington ratified the *Agreement for Co-operation on the Uses of Atomic Energy for Mutual Defence Purposes* in August 1958, which still forms the basis of Anglo-American nuclear partnership today.[63]

Consequently, Whitehall's decision to create a nuclear-capable Britain has not only to be seen against the background of the country's dwindling role in world affairs but the changing state of atomic relations between the United States and the United Kingdom. When faced with a rapid deterioration in the nuclear co-operation between the two countries shortly after World War II, the newly elected Labour government under Prime Minister Clement Attlee vigorously started to pursue an

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[61] Matthew Jones, 'Up the Garden Path? Britain's Nuclear History in the Far East, 1954-1962', *International History Review*, 25. 2 (2003), 306-33.

[62] S.J. Ball, 'Military Nuclear Relations between the United States and Great Britain under the Terms of the McMahon Act, 1946-1958', *Historical Journal*, 38. 2 (1995), 439-454; Septimus H. Paul, *Nuclear Rivals: Anglo-American Atomic Relations, 1941-1952* (Columbus: Ohio State University Press, 2000), pp. 94-108.

[63] *U.S.-UK Nuclear Cooperation After 50 Years*, ed. by Jenifer Mackby and Paul Cornish (Washington, DC: Center for Strategic and International Studies Press, 2008). On Anglo-American nuclear relations, see John Baylis, *Anglo-American Defence Relations 1939-1984: The Special Relationship*, 2nd edn (London: Macmillan, 1984); Michael S. Goodman, *Spying on the Nuclear Bear: Anglo-American Intelligence and the Soviet Bomb* (Stanford: Stanford University Press, 2007); John Simpson, *The Independent Nuclear State: The United States, Britain and the Military Atom* (London: Macmillan, 1983); Stephen Twigge and Len Scott, *Planning Armageddon: Britain, the United States and the Command of Western Nuclear Forces, 1945-1964* (Amsterdam: Harwood Academic, 2000).

ambitious project to develop an independent British nuclear deterrent, which led the United Kingdom become both the world's third nuclear and thermonuclear power after the United States and the Soviet Union in 1952 and 1957 respectively.[64] Marcus Oliphant, a leading scientist in both TA and the Manhattan Project, summarized the British sentiment at the time quite well in May 1948, arguing that 'America's attitude towards atomic energy and towards war and peace, would be modified in a healthy way if Great Britain also, as a result of our own initiative, possessed atomic weapons.'[65]

While the relationship between the United States and Britain in atomic affairs had still been more or less reciprocal during World War II, as chapter three will show, the postwar period saw an increasing reliance and dependence on the United States that went hand in hand with a decline of British power in the world. It thus appears ironic that in spite of the fact that 'Britain had been the midwife of this bomb', as Margaret Gowing observed, the new weapon epitomized both the decline of Britain as a world power and the emergence of the United States as one of the two superpowers.[66] Even after Britain had become an atomic power in 1952, the Suez Crisis four years later revealed dramatically the limitations of British influence in the world vis-à-vis the superpowers in general and in Anglo-American nuclear relations in particular.[67] As a consequence, British nuclear culture cannot be understood without larger trends in American the United States and, to a lesser degree, also developments in the Soviet Union. This thesis thus follows a transnational approach to atomic culture, and comparisons with key events and processes in American nuclear culture are a recurring theme throughout.[68]

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[64] Baylis, *Ambiguity and Deterrence*, pp. 45-52; Margaret Gowing, 'Britain and the Bomb: The Origins of Britain's Determination to Be a Nuclear Power', *Contemporary Record*, 2. 2 (Summer 1988), 36-40.

[65] 'Atomic Energy Study Group: The Atomic Problem. Comments on AE/171 (Revised version), from Prof. M.L. Oliphant', May 1948, the Papers and Correspondence of Sir Rudolf Peierls, 1907-1995, Department of Western Manuscripts, Bodleian Library, University of Oxford, Oxford, United Kingdom (hereafter Peierls Papers), MS Eng. Misc. b. 223, F 5, p. 1.

[66] Margaret Gowing, *Independence and Deterrence: Britain and Atomic Energy, 1945-1952*, 2 vols (London Macmillan, 1974), I, 1-2.

[67] Matthew Jones, 'Anglo-American Relations after Suez: The Rise and Decline of the Working Group Experiment and the French Challenge to NATO, 1957-59', *Diplomacy & Statecraft*, 14. 1 (March 2003), 49-78; Dilwyn Porter, '"Never-Never Land": Britain under the Conservatives 1951-1954', in *From Blitz to Blair* (see Tomlinson, above), pp. 102-31 (pp. 113-16).

[68] Here, this thesis follows an approach similar to Ian Clark and Nicholas J. Wheeler, *The British Origins of Nuclear Strategy 1945-1955* (Oxford: Clarendon Press, 1989) and transnational analyses in science and technology studies; see Thomas P. Hughes, *Networks of Power: Electrification in Western Society, 1880-1930*, new edn (Baltimore: Johns Hopkins University Press, 1993); Eda

Postwar Anglo-American atomic collaboration was not the only realm of British nuclear culture which was characterized by a dominance of the United States.[69] But atomic culture in the United Kingdom was also affected considerably by a general trend towards Americanization that occurred all over Western Europe after the Second World War.[70] The United States clearly functioned as a reference culture in many areas of British (nuclear) culture. Yet, a unique form of atomic culture emerged at the same time in the United Kingdom. Besides the aforementioned distinctive relationship between modernity and tradition, the country's comparatively small size and limited resources affected British 'scientific culture' which operated on a much smaller scale than its American counterpart. A comparison between scientific establishments in the two countries illustrates this: while the United States had its atomic cities at Los Alamos, Oak Ridge and Hanford, Britain had its 'atom village', as a newspaper article labelled the Atomic Energy Research Establishment (AERE) at Harwell in Oxfordshire in 1946.[71] That Britain was still a colonial power by the mid-1950s and engaged simultaneously in the Cold War put a dual strain on the already economically stretched country and limited its nuclear efforts.[72]

By proposing a broad definition of 'British nuclear culture' which includes both Fuchs's and Peierls's scientific practice and the political implications of their work, this thesis calls for a more holistic approach to the topic. Nevertheless, the present study takes into account Clifford Geertz's cautionary note that '[c]ultural analysis is intrinsically incomplete' and does not try to tackle the impossible task of providing an examination of every facet of atomic culture in the United Kingdom.[73] Instead, it intends to inspire and serve as a basis for a debate amongst scholars towards achieving a fuller and more comprehensive examination of the subject. Given the width of the field, this dissertation limits its focus to key features in the production of British atomic culture, which are relevant to the lives and work of

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Kranakis, *Constructing a Bridge: An Exploration of Engineering Culture, Design, and Research in Nineteenth-Century France and America* (Cambridge, MA: MIT Press, 1997).

[69] American science also dominated in Europe; see John Krige, *American Hegemony and the Postwar Reconstruction of Science in Europe* (Cambridge, MA: MIT Press, 2006).

[70] For a concise overview of the Americanization of postwar Britain, see Hugh Wilford, 'Britain: In Between', in *The Americanization of Europe: Culture, Diplomacy, and Anti-Americanism after 1945*, ed. by Alexander Stephan (New York: Berghahn, 2006), pp. 23-43.

[71] 'Atom village is agog – over duckling', *Daily Mirror*, 5 August 1946, p. 5.

[72] This was stressed in the 1954 White Paper on Defence, Cmd. 9075, 'Statement on Defence 1954' (London: HMSO, 1954), p. 4.

[73] Geertz, p. 29.

Klaus Fuchs and Rudolf Peierls. These are the early British nuclear weapons project, Anglo-American nuclear co-operation, the emerging new research culture of Big Science, the production of public opinion on the effectiveness of homeland security in the atomic age and the education of the public and policy makers in nuclear-energy-related matters.

The thesis consists of four main chapters that are organized chronologically into two sections. The first part covers the period of World War II from its outbreak in 1939 when Rudolf Peierls first started to give serious thought to military applications of atomic energy until about one year after hostilities ended and the last British scientists, including Klaus Fuchs, returned home from the United States where they had worked on the Manhattan Project in 1946. These two chapters deal with the process of and events surrounding the making of the first atomic bombs and focus in particular on 'scientific culture'. They show that Fuchs and Peierls contributed to the establishment of the military-industrial-scientific complex of what David Edgerton has called the British 'warfare state'.[74]

Chapter two shows how Fuchs and Peierls contributed to the early British nuclear weapons project. While Ronald Clark and Margaret Gowing have written histories of these efforts, the present study adds to the familiar story by focusing on the input by German-speaking émigré nuclear scientists to atomic arms research in the United Kingdom.[75] And Rudolf Peierls emerged as perhaps the most important TA administrator after James Chadwick (later Sir James) and George Thomson (later Sir George). The chapter starts by considering the many difficulties Fuchs and Peierls had to overcome before they became chief contributors to the early British nuclear weapons project. Owing to their origin, the two scientists were initially classified as 'enemy aliens'. In Fuchs's case, this categorization even led to his internment in Canada. But their status as 'enemy aliens' also had a pivotal effect on Fuchs's and in particular Peierls's future careers: since they were prohibited from working in sensitive areas of war research, especially radar, the two scientists were – almost accidentally – pushed into the direction of atomic weapons research, which was not regarded as particularly relevant to the war effort at the time. That Fuchs and Peierls had acquired unique theoretical qualifications in the relatively new field of

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[74] David Edgerton, *Warfare State: Britain, 1920-1970* (Cambridge: Cambridge University Press, 2006).
[75] Clark; Gowing, *Britain and Atomic Energy*.

nuclear physics in Germany before coming to Britain, which were in short supply in their host country, provided the prerequisite for them to become key players in the British nuclear weapons project. Alongside their skills, their German origin which had led them to experience National Socialism and supplied them with insider knowledge of nuclear scientists available to Hitler's regime for its own atomic arms project translated into an alarm and thus urgency greater than amongst their British-born colleagues. Therefore, Fuchs and especially Peierls became crucial engines behind the early British atomic weapons project.

The third chapter then demonstrates Fuchs's and Peierls's crucial roles in establishing a new approach to research in nuclear science in the joint Anglo-American-Canadian Manhattan Project. It follows them to the United States, at first, to New York City and then especially to the central Manhattan Project laboratory at Los Alamos in New Mexico where they worked on the creation of the first atomic bombs. Although the secondary literature on the Manhattan Project, especially its Los Alamos installation, is vast and ever-growing, no study to date has examined the roles of German-speaking émigré nuclear scientists in the seminal wartime programme.[76] This chapter thus makes a significant contribution to the study of the history of the Manhattan Project. It begins with an analysis of Klaus Fuchs's and Rudolf Peierls's parts in supporting the establishment of Anglo-American nuclear co-operation, a basic precondition for the joint Manhattan Project. Since Peierls had become an important player in the TA project, he was of great significance for setting up the transatlantic collaboration in atomic affairs. The chapter continues by following Fuchs and Peierls to New York City and then in particular to Los Alamos. It then briefly introduces the other German-speaking émigré scientists present at the Manhattan Project laboratory before it examines their role in developing the first atom bombs, in particular the plutonium implosion bomb. Fuchs's and Peierls's contributions are presented in relation to those by other émigrés. As chapter three shows, it was their 'traditionally German' backgrounds in theoretical physics that enabled them to work in close collaboration with experimentalists. As a result of their highly valuable input, Fuchs and Peierls helped step up the establishment of the emerging research culture of Big Science.

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[76] Ferenc M. Szasz's study of the British scientists at Los Alamos is the only study which comes (not even remotely) close to this thesis; *British Scientists and the Manhattan Project: The Los Alamos Years* (New York: St. Martin's Press, 1992).

The second section, which includes chapters four and five, looks at the impact Fuchs's and Peierls's work on nuclear weapons had on them and British culture in the postwar period. It reveals that their atomic arms research led to the production of 'cultures of insecurities', which Jutta Weldes, Mark Laffey, Hugh Gusterson and Raymond Duvall have defined as, 'cultural processes through which insecurities of states and communities – and the identities of the subjects through which insecurities have meaning – are produced, reproduced, and transformed'.[77] This part investigates the production of public opinion and the manufacture of public awareness about atomic energy and the perils and hopes associated with it. What Wolfgang Schivelbusch has noted in a different context, applies particularly well to atomic energy. He argues 'the more efficient the technology, the more catastrophic its destruction when it collapses. There is an exact ratio between the level with which nature is controlled, and the degree of severity of its accidents'. This is further underlined by Schivelbusch's observation that '[a]fter the Industrial Revolution, destruction by technological accident came from the inside. The technical apparatuses destroyed themselves by means of their own power.'[78] After all, it was at Windscale, Cumbria, that the world's first major reactor accident occurred in October 1957 when a fire occurred in Pile No. 1 and released considerable amounts of radioactive fallout. The incident preceded those at Three Mile Island near Harrisburg, Pennsylvania, in the United States, in 1979 and the most serious one so far in the Soviet reactor at Chernobyl in April 1986.[79] Chapters four and five thus have to be seen against the background of Ian Welsh's observation that 'the implementation of nuclear power recasts state-citizen relations' in a way that public confidence in nuclear energy faded and saw the emergence of a risk society.[80]

Chapter four examines the impact of the Klaus Fuchs atomic espionage case on public opinion regarding the efficiency of national security agencies in defending the democratic state. As mentioned earlier, several biographies of Fuchs exist. While these studies, apart from their ideological bias, commonly attempt the impossible task of examining Fuchs's motivation for becoming a Soviet spy, the present thesis, by contrast, looks at the influence Fuchs's confession had on British public opinion.

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[77] Weldes and others, p. 2.
[78] Wolfgang Schivelbusch, *The Railway Journey: The Industrialization of Time and Space in the Nineteenth Century*, new edn (Leamington Spa: Berg, 1986), p. 131.
[79] Arnold, *Windscale 1957*, p. xxii.
[80] Ian Welsh, *Mobilising Modernity: The Nuclear Moment* (London: Routledge, 2000), p. 3.

The chapter starts with a brief overview of the known and established facts of the Fuchs case to give the background information that is necessary for putting the public reception of his case into perspective. It then demonstrates that Fuchs's confession deeply shattered the public belief in the security agencies, especially MI5, and how the Security Service attempted to play down the damage he had done. As the fourth chapter reveals, Klaus Fuchs's confession also had a highly negative impact on Anglo-American relations at a difficult time when Whitehall was trying to restore the wartime nuclear co-operation between the two countries. But the Fuchs case also had serious repercussions for his former mentor Rudolf Peierls and other German-speaking émigré nuclear scientists in Britain and the United States where the news of his confession coincided with the notorious anti-communist witch-hunts of Senator Joseph McCarthy. While David Kaiser has shown that, in general, 'theoretical physicists emerged as the most consistently named whipping-boys of McCarthyism', this chapter demonstrates how German-speaking émigré nuclear scientists in Britain and the United States were affected in particular.[81]

Although Rudolf Peierls only devoted a brief chapter in his autobiography to 'Problems of Nuclear Weapons,' his impact on the British atomic scientists' movement, as chapter five illustrates, was in fact much bigger.[82] The chapter shows how scientists such as Rudolf Peierls who were involved in the making of the atomic bomb, confronted their creation after the war with regard to educating the public and advising political decision makers about the dangers and benefits of nuclear power. It indicates Peierls's significance for the British nuclear scientists' movement through his involvement with the ASA from its beginning shortly after the war to its end in the late 1950s. It starts by showing that the ASA, as the chief body of the British atomic scientists' movement and like many other aspects of British nuclear culture, had American origins. Many future ASA members like Peierls were exposed to the beginnings of the American atomic scientists' movement during their stay at Los Alamos. The chapter then moves on to its chief focus which is on the influence Peierls exerted on the ASA with his repeated calling for a politically objective approach to science. Peierls's ideal of the objective scientist, as the chapter demonstrates, was to varying degrees informed by his socialization in Germany,

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[81] David Kaiser, 'The Atomic Secret in Red Hands? American Suspicions of Theoretical Physicists During the Early Cold War', *Representations*, 90 (Spring 2005), 28-60 (p. 28).
[82] Peierls, *Bird of Passage*, pp. 282-88.

universal scientific norms and his exposure to British research cultures in nuclear science. As a means of probing Peierls's 'Germanness' with regard to his concept of the unpolitical scientist and linking it back to his homeland, chapter five compares his stance on nuclear weapons, science and politics during the postwar period with that of scientists like Werner Heisenberg and Carl Friedrich von Weizsäcker, who had remained in Germany and worked on the National Socialist atomic bomb project during the war, and that of émigrés like Max Born who returned to Germany after the war. Through these further comparisons with scientists in the Federal Republic of Germany (FRG), this study reverses Klaus Hentschel's approach to the postwar German physics community, in which he called '[t]heir distance as émigrés [...] a true mirror – albeit not a plane one – of what was said and thought in Germany after 1945'.[83] The chapter ends with the ASA's disbandment in 1958 when it gave way to an anti-nuclear mass movement, above all, the Campaign for Nuclear Disarmament (CND) and the British atomic scientists movement increasingly operated within international networks, especially the Pugwash movement.

A variety of primary sources from archives in Britain, Germany, the Russian Federation and the United States were used in writing this PhD thesis. These include the personal papers and correspondence of scientists (Rudolf Peierls, James Chadwick, Egon Bretscher, Herbert Fröhlich and Herbert Skinner) and transcripts of several oral history interviews which members of the American Institute of Physics conducted with German-speaking scientists such as Rudolf Peierls, Otto Frisch, Hans Bethe and Victor Weisskopf and which contained valuable information for the present study. The Society for the Protection of Science and Learning Papers[84] provided important information on émigré scientists during the period shortly after their arrival in the United Kingdom when they confronted many difficulties and some were even interned. The Departmental Archives of the H.H. Wills Physics Laboratory at the University of Bristol also contained important information on the internment of German-speaking émigré scientists based at Bristol as well as an important document on Herbert Fröhlich's and Walter Heitler's collaboration on spontaneous fission in uranium. Several series from the National Archives in Kew, Richmond, Surrey, contained new and most helpful information on government

[83] Klaus Hentschel, *The Mental Aftermath: The Mentality of German Physicists 1945-1949*, transl. by Ann M. Hentschel (Oxford: Oxford University Press, 2007), p. 13.

[84] Any information contained in the Society for the Protection of Science and Learning Papers is reproduced with kind permission of the Council for Assisting Refugee Academics (CARA).

departments and offices: besides the Records of the Atomic Weapons Establishment and predecessors, the Records of the Cabinet Office and the Records of the Prime Minister's Office, it was especially the recently released Security Service: Personal (PF Series) Files, especially the files on Klaus Fuchs and Rudolf Peierls that added significantly to the originality of this dissertation. Likewise, the Ferenc M. Szasz Papers, 1894-2005, which hold copies of Klaus Fuchs's FBI (Federal Bureau of Investigation) files, contained many useful primary sources. Because most of the relevant primary documents, which are held at the Los Alamos National Laboratory (LANL) Archives, are still or were classified again in the aftermath of the terrorist attacks of 11 September 2001, chapter three had to rely on canonical works on the technical history of the making of the first atomic bombs at Los Alamos, above all, by David Hawkins as well as Lillian Hoddeson, Paul Hendriksen, Roger Meade and Catherine Westfall.[85] But it presents the information provided by Hawkins and Hoddeson and others in a new light. Despite its closure to the public, however, the LANL Archives provided some copies of non-technical documents, obituaries and secondary literature. The Los Alamos Historical Museum Archives (LAHM), too, supplied some important documents, especially additional oral history interviews with Hans Bethe and Otto Frisch. Besides these American archives, the Comintern Archive, which is located in the Russian State Archive of Socio-Political History (RGASPI) in Moscow, holds previously unused personal files on Fuchs and Peierls. In Germany, the *Bundesbeauftragte für die Unterlagen des Staatssicherheitsdienstes der ehemaligen Deutschen Demokratischen Republik* (Federal Commissioner for the Records of the State Security Service of the former German Democratic Republic; BstU) supplied documents on Klaus Fuchs's time in the GDR, including a videotaped interview the Ministry of State Security (*Ministerium für Staatssicherheit*; MfS) conducted with him in 1984.[86] Two other German archives provided further materials related to Klaus Fuchs: the Archives of the City of Kiel (*Stadtarchiv Kiel*) as well as the Schleswig-Holstein State Archives (*Landesarchiv*

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[85] David Hawkins, *Project Y: The Los Alamos Story, Part I: Toward Trinity* (Los Angeles: Tomash, 1983); Lillian Hoddeson and others, *Critical Assembly: A Technical History of Los Alamos During the Oppenheimer Years, 1943-1945* (Cambridge: Cambridge University Press, 1993). Jeff Hughes has used a similar approach in his book *The Manhattan Project: Big Science and the Atom Bomb* (Cambridge: Icon, 2002), pp. 166-67.

[86] *Prof. Dr. Klaus Fuchs: Kundschafter aus Überzeugung* (1984) Prod. Ministerium für Staatssicherheit. Dir. Tengis Abuladse. Perf. Klaus Fuchs. GDR, Die Bundesbeauftragte für die Unterlagen des Staatessicherheitsdienstes der ehemaligen Deutschen Demokratischen Republik, Berlin, Germany (hereafter BstU), MfS ZAIG/Vi/227.

Schleswig-Holstein), Schleswig. As virtually nothing has been written on the ASA, the final main chapter used, in particular, the association's publications, especially its journal the *Atomic Scientists' News* which later became the *Atomic Scientists' Journal* before it ceased publication and the ASA ran a monthly section in the newly founded weekly magazine *New Scientist*. These are available in their entirety at the Science Museum Library, Imperial College, London.

Chapter Two. Difficult and Almost Accidental Beginnings: From 'Enemy Aliens' to Contributors to the British War Effort.

Introduction

Like the majority of the German-speaking émigré scientists, Klaus Fuchs and Rudolf Peierls did not integrate immediately into their host country's society but had to follow an uneven path through many ambiguities until they finally became contributors to the British war effort. This chapter thus tries to answer the question of what it meant to be a German-speaking émigré atomic scientist in wartime Britain. It deals with the paradoxical situation Klaus Fuchs and Rudolf Peierls faced after their arrival in the United Kingdom: on the one hand, they were confronted with serious reprisals as 'enemy aliens', while, on the other, they became chief contributors to the early British nuclear weapons programme. This chapter covers primarily the four-year period from the outbreak of the Second World War until the merger of the two separate atomic-weapons-research programmes into the joint Manhattan Project in 1943, but it also makes occasional references to crucial developments that occurred in the period between 1933 and 1939.

The chapter is divided into two sections. The first part treats the socio-cultural component of their experiences in Britain. It examines the ambivalent atmosphere that many of the émigrés encountered upon their arrival in Britain. While aid organizations, British industry and individuals offered help to alleviate the serious situation many émigrés found themselves in after their flight from Nazism, having left behind or lost loved ones and without a steady source of income, these people lived under the constant threat of being interned as 'enemy aliens', which often, as in the case of Klaus Fuchs, became real.

The second part deals with another key argument as set out in the first chapter and shows how Fuchs and especially Peierls became, almost accidentally, decisive in starting a British nuclear weapons programme. Two factors which were related to their German origin came into play here: since Fuchs and Peierls came from traditionally 'German' backgrounds in physics with a strong leaning towards theory and, at the same time, their status as 'enemy aliens' prohibited them from working on important war work like radar or the proximity fuse, they engaged in research on atomic arms. This subchapter shows their integration processes into the British

physics community and discusses contributions by German-speaking émigré scientists to the early British atomic weapons research programme.

Difficult Beginnings: Between Survival and Internment

After their arrival in their new host country, Rudolf Peierls and Klaus Fuchs experienced an ambivalent atmosphere between political crises and forced emigration, on the one hand, and major advances in the physical sciences, in particular nuclear physics and solid state physics, on the other. Hans Bethe later described this peculiar ambiance in a lecture under the somewhat ambiguous title 'The Happy Thirties'.[87] In retrospect, Herbert Fröhlich saw 'the particular events of his own life', especially his experience as an émigré in Britain, 'as a fairly amusing adventure film'.[88]

Most émigrés fled to countries which shared borders with Germany such as France, the Netherlands, Belgium or Czechoslovakia in the immediate aftermath of Hitler's rise to power. Peierls and Fuchs were among the few who came to Britain quite early on.[89] Since the scientists' emigration, like the mass exodus of film people or medical personnel, formed, by and large, part of the Jewish emigration, it differed from that of other professions such as writers, publishers, and politicians, whose vocational groups included a higher proportion of political émigrés.[90] Here, the case of Rudolf Peierls was much more typical than that of the political émigré Klaus Fuchs.

Klaus Fuchs, who was still a student at the time, landed at Folkestone on 24 September 1933, coming from Germany via France.[91] Rudolf Peierls, by contrast, had already come to the United Kingdom before Hitler's takeover. When his contract as assistant to Wolfgang Pauli in Zürich ran out after three years in 1932, Pauli

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[87] Hans Bethe, 'The Happy Thirties', in *Nuclear Physics in Retrospect: Proceedings of a Symposium on the 1930s*, ed. by Roger H. Stuewer (Minneapolis: University of Minnesota Press, 1977), pp. 11-31.
[88] Fanchon Fröhlich, 'Biographical Notes', in *Cooperative Phenomena*, ed. by Hermann Haken and Max Wagner (Berlin: Springer, 1973), pp. 420-421 (p. 421).
[89] Strauss, 'Movement of People', pp. 50-51.
[90] Jan-Christopher Horak, 'Filmkünstler im Exil: Ein Weg nach Hollywood', in *Die Künste und die Wissenschaften im Exil 1933 – 1945*, ed. by Edith Böhme and Wolfgang Motzkau-Valeton (Gerlingen: Schneider, 1992), pp. 231-54 (p. 231).
[91] 'Conditional Landing. Immigration Officers Report, 25 September 1933', The National Archives, Kew, Richmond, Surrey, United Kingdom (hereafter TNA), KV 2/1245.

strongly urged Peierls to apply for a Rockefeller fellowship, which he obtained.[92] Like Hans Bethe before him, Rudolf Peierls chose to divide the one-year Rockefeller fellowship between Rome, where he worked with the renowned Italian theoretical physicist Enrico Fermi, and Cambridge, where he worked at the famous Cavendish Laboratory. As the Rockefeller fellowship was about to end, and since Adolf Hitler had come into power in Germany, it became obvious to Peierls that he could not return to his native Germany. Lawrence Bragg (later Sir Lawrence) from Manchester University then arranged a two-year grant so that Peierls could stay in the United Kingdom.[93]

Since the changed political situation did not allow Peierls to return home, he had to turn down an offer to join Otto Stern's laboratory at Hamburg University in early March 1933.[94] He later declared that he had made the decision not to return to Germany even before Adolf Hitler became chancellor. Peierls 'saw the red light', he claimed after the war, when the government of Kurt von Schleicher was replaced by that under Franz von Papen.[95] While Peierls had acted far-sightedly, other German-speaking émigré atomic scientists did not yet perceive the immediate danger posed by Hitler. Otto R. Frisch, who was working as Stern's assistant in Hamburg, for example, recalled his judgment of Hitler at the time, saying: '"Well, chancellors come and chancellors go, and he will be no worse than the rest of them".'[96] By June 1933, however, Frisch had lost his job as Stern's *wissenschaftlicher Hilfsarbeiter* under the new anti-Jewish legislation.[97] And it came clear that Peierls had made the right decision.

Émigrés from National Socialism often went through traumatic experiences, losing family members or relatives. What made it particularly hard for the émigrés was that it was often hard for them to learn about news from Germany. Rudolf Peierls, for example, received most of his information from occasional telephone

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[92] Peierls, *Bird of Passage*, pp. 56-81.
[93] *Refugee Scholars: Conversations with Tess Simpson*, ed. by Ray M. Cooper (Leeds: Moorland, 1992), p. 58; Peierls, *Bird of Passage*, pp. 90-98.
[94] Lenz to Peierls, 9 March 1933, Peierls Papers, MS Eng. Misc. b. 197, A 2, fols 28^{r}-30^{r}; Rudolf E. Peierls, Interview by Charles Weiner, 11-13 August 1969, Oral History Collections, Niels Bohr Library and Archives, American Institute of Physics, College Park, Maryland, United States (hereafter AIP), p. 3.
[95] Peierls, Interview by Weiner, p. 2.
[96] Otto R. Frisch, Interview by Charles Weiner, 3 May 1967, AIP, pp. 12-13.
[97] Clausen to Frisch, 19 June 1933, Society for the Protection of Science and Learning Papers, Department of Western Manuscripts, Bodleian Library, University of Oxford, Oxford, United Kingdom (hereafter MS S.P.S.L.) MS S.P.S.L. 327/10, fol. 460^{r}.

calls to his parents and from newspapers.[98] The rise of the National Socialist regime strongly affected Peierls's family. While his brother Alfred managed to emigrate to the United Kingdom and his father, with his second wife as well as his sister Annie and her husband, left Germany for the United States, Peierls also lost relatives who did not escape National Socialist persecution. To make matters worse, Rudolf Peierls and his wife Genia were also separated from their children, Ronnie and Gaby, in the summer of 1940 when the two children were evacuated to Toronto, Canada, as a precaution against a dreaded German invasion of the British Isles.[99] The Peierls faced a similar fate to that of Franz (later Sir Francis) Simon whose children and wife were also evacuated to Canada.[100]

The case of Klaus Fuchs's family also reveals a great deal of tragedy. In 1933, Fuchs's father Emil was among the first professors in Germany to lose his job and was even arrested for his active engagement in the fight against Nazism. Just two years earlier, Emil Fuchs, who was a Quaker, had been the first Social Democrat to be appointed professor at the Pedagogical Academy in the northern German city of Kiel. At the University of Kiel, Emil Fuchs had openly advocated liberal ideas when he served as the president of the Republican Club, a university group that brought him into contact with liberals such as Otto Baumgarten or Walther Schücking, who would later be targeted by fascist students for their progressive views. Like their father, Klaus Fuchs's siblings Elisabeth and Gerhard faced serious reprisals after Hitler's coming to power. Since they were activists in the *Kommunistische Partei Deutschlands* (Communist Party of Germany; KPD), they both spent some time in prison. While Elisabeth Fuchs committed suicide on 7 August 1939, Gerhard Fuchs managed to emigrate via Prague to Switzerland.[101] So disturbed was Emil Fuchs that

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[98] Peierls, Interview by Weiner, p. 2.

[99] Peierls, *Bird of Passage*, pp. 140-141, 151. See also the correspondence between Rudolf Peierls and his father and stepmother in Germany as well as between Rudolf and Genia Peierls and their children, Peierls Papers, supplementary catalogue (hereafter sup. cat.), A.120.

[100] Nicholas Kurti, 'Franz Eugen Simon, 1893-1956', *BMFRS*, 4 (November 1958), 225-56 (p. 231).

[101] Irene Dittrich, 'Die "Revolutionäre Studentengruppe" an der Christian-Albrechts-Universität zu Kiel (1930-1933)', *Demokratische Geschichte*, 4 (1989), 175-84 (pp. 180-82); Emil Fuchs, *Mein Leben*, II, 200-01, 228-38, 245-68; Peter Wulf, 'Die Stadt auf der Suche nach ihrer neuen Bestimmung (1918 bis 1933)', in *Geschichte der Stadt Kiel*, ed. by Jürgen Jensen and Peter Wulf (Neumünster: Wachholtz, 1991), pp. 303-58 (p. 358); *Vertriebene Wissenschaftler der Christian-Albrechts-Universität zu Kiel (CAU) nach 1933: Zur Geschichte der CAU im Nationalsozialismus – Eine Dokumentation bearbeitet von Uta Cornelia Schmatzler und Matthias Wieben*, ed. by Ralph Uhlig (Frankfurt a. M.: Lang, 1991), pp. 48-49.

he tried to work through his traumatic experience in the Third Reich with the publication of his booklet *Christ in Catastrophe* in 1949.[102]

The loss of home, however, with all its psychological consequences represented only one facet of a complex set of problems which Klaus Fuchs and Rudolf Peierls encountered during and after their migration. And it was, above all, the reception in their new home country that proved almost equally challenging for the two theoretical physicists.[103] Upon their arrival in the United Kingdom, Peierls and Fuchs confronted an ambiguous atmosphere: while they were out of the reach of the National Socialists and aid societies and fellow émigrés offered support to relieve their situation, on the one hand, they found themselves struggling to find employment in order to have a steady income, faced difficulties in integrating into their new host country's society and academic world as well as severe reprisals as so-called enemy aliens, on the other. In many cases, these ambivalences resulted in what Thomas Elsaesser has called a 'two-fold estrangement', a separation of the émigrés both from their homelands and from the attitudes held by many of their hosts towards them and their native lands.[104]

Fellow German-born émigré physicist Max Born under whom Klaus Fuchs worked at the University of Edinburgh expressed such a 'two-fold estrangement' in his autobiography. Despite the atrocities committed by the National Socialist regime, Born recorded that 'there remained an extinguishable homesickness for the German language and landscape'. While 'Scotland had invited and accepted us, given us nothing but kindness, opened our minds to the ways of democracy and political fairness, and widened our horizon by making us members of the great British community of nations, the Commonwealth', he felt that 'we were not Scots and would never be'. In conclusion, Max Born noted on this almost Faustian symbolism of a German and a Scottish soul resting in his breast that: 'Germany meant for us a struggle between hatred and love, Scotland between love and strangeness.'[105] As mentioned by Born, the language barrier constituted indeed a major obstacle for

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[102] Emil Fuchs, *Christ in Catastrophe* (Wallingford, PA: Pendle Hill, 1949).
[103] Marion Berghahn, *Continental Britons: German-Jewish Refugees from Nazi Germany* (Oxford: Berg, 1988), p. 138.
[104] Thomas Elsaesser, 'Ethnicity, Authenticity, and Exile: A Counterfeit Trade? German Filmmakers and Hollywood', in *Home, Exile, Homeland: Film, Media, and the Politics of Place*, ed. by Hamid Naficy (New York: Routledge, 1999), pp. 97-123 (p. 113).
[105] Max Born, *My Life: Recollections of a Nobel Laureate* (London: Taylor & Francis, 1978), p. 281.

many German-speaking émigrés.[106] Apart from the language hurdle, Born's insuperable homesickness (*unüberwindliches Heimweh*)[107] for the German landscape represented another chief aspect of many émigrés' uprooting and emotional disorientation between the societies of home and host country.[108]

Closely linked to the estrangement from both home and host country, was the culture shock many émigré scientists underwent upon their arrival in Britain.[109] It often occurred on the level of every-day life. Rudolf Peierls, for example, was astonished by the lack of flavour in British foods.[110] 'In a thoroughly democratic country', he assumed, 'it would not do for the cook to impose his or her taste on the guests, so everything was boiled until only a neutral matrix remained.' Peierls concluded that, following this democratic tradition, it was then up to the guests to use condiments 'to generate any desired flavor'.[111] In the light of this kind of experience, James M. Ritchie has even argued that the United Kingdom was not a first-choice immigration country because many émigrés 'preferred the continental café culture of Prague to the unknown hazards of English beer and English cooking'.[112] With regard to these cultural differences, Marion Berghahn has also referred to German-Jewish refugees as 'Continental Britons'.[113]

The first experiences of German-speaking émigré atomic scientists with their new host country and its culture differed significantly. In the wake of Hitler's anti-Jewish laws, Otto Frisch had left Germany for England in October 1933, 'the land which Goethe had so much admired that I expected it to be inhabited almost entirely by supermen'.[114] Immediately after his landing at the London docks, however, Frisch's Goethe-influenced view of England was shattered by the harsh realities. It

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[106] Berghahn, p. 82.
[107] In the German version of his autobiography, Max Born uses this term; *Mein Leben: Die Erinnerungen des Nobelpreisträgers* (Munich: Nymphenburger Verlagshandlung, 1975), p. 377.
[108] On the significance of the German landscape and the relationship between German communities abroad and their homelands, see Thomas Lekan, 'German Landscape: Local Promotion of the *Heimat* Abroad', in *The Heimat Abroad: The Boundaries of Germanness*, ed. by Krista O'Donnell, Renate Bridenthal and Nancy Reagin (Ann Arbor: University of Michigan Press, 2005), pp. 141-66.
[109] Daniel Snowman, *The Hitler Émigrés: The Cultural Impact on Britain of Refugees from Nazism* (London: Chatto & Windus, 2002), p. 60.
[110] On food as a marker of ethnic identity, see, for example, Hasia R. Diner, *Hungering for America: Italian, Irish, and Jewish Foodways in the Age of Migration* (Cambridge, MA: Harvard University Press, 2001); Jeremy McClancy, *Consuming Culture: Why You Eat What You Eat* (New York: Holt, 1992).
[111] Peierls, *Atomic Histories*, p. 362.
[112] James M. Ritchie, *German Exiles: British Perspectives* (New York: Lang, 1997), p. 9.
[113] This is even the title of Berghahn's study.
[114] Otto R. Frisch, *What Little I Remember* (Cambridge: Cambridge University Press, 1979), p. 71.

was in particular the 'sort of general messiness and untidiness of everything' that shocked him.[115] Kurt Mendelssohn, by contrast, felt a sense of safety and security after his arrival in the United Kingdom. Decades after his arrival in Britain, he still reminisced about the first night he had spent in his new host country after his flight from Germany: 'I had slept deep, soundly and long – for the first time in many weeks. [...] [T] his was England, sanity, peace and security, and I was deeply grateful for being alive and free'.[116]

With the beginning of the Second World War, this feeling of safety and security soon vanished and the United Kingdom came under attack from the German air force. For the first time in their lives, many of the émigré atomic scientists encountered and shared with their British hosts the direct experience of war. Rudolf Peierls witnessed the destruction caused by air raids in Birmingham.[117] In a letter to Peierls, Otto Frisch described the situation in Liverpool where he was working under Professor James Chadwick at the time, writing:

> I am at present staying with Pryce, my former digs are closed down. We had bombs all around the place, all the windows gone, and a big fire next doors (the church) when our furniture was thrown into the road and the basement flooded; [...]. I accepted Pryce's invitation after the first bad night and I am glad I did for this enabled me to sleep through several more bad nights, when things again got pretty rough in abercromby [*sic*] Square.[118]

In retrospect, Frisch recalled his persistent fear of death and depression in wartime England in a 1967 interview, stating that

> [e]ven after I went to England, I had a pretty strong presentiment that I had only got a few more months to live – so strong that for once I really believed it. I had a feeling: "This is some kind of pre-knowledge of disaster," that I would be hit by the bombs when the bombing started and so on. When the bombing started I felt that the time had come and so forth. I was quite surprised when a year or so later I was still alive and I began to feel that maybe the presentiment had been just a case of depression, which no doubt it was.[119]

That a German invasion of the British Isles appeared to be imminent by May 1940 put additional strain on many émigré atomic scientists.[120]

Apart from the physical threat to life and limb, especially from bombardments by the *Luftwaffe* and a dreaded invasion by German forces, Fuchs and

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[115] Frisch, Interview by Weiner, p. 19.
[116] Kurt Mendelssohn, 'The Coming of the Refugee Scientist', *New Scientist*, 26 May 1960, pp. 1343-344 (p. 1343).
[117] Peierls, *Bird of Passage*, p. 149.
[118] Frisch to Peierls, 13 May 1941, TNA, AB 1/574.
[119] Frisch, Interview by Weiner, p. 40.
[120] Angus Calder, *The People's War: Britain 1939-1945* (London: Cape, 1969; repr. London: Pimlico, 1997), pp. 118-26.

Peierls – like many German-speaking émigrés – faced other existential problems, in particular finding a steady source of income. What aggravated their situation was that émigrés were officially not allowed, as it said on the Alien Registration Form, to 'enter any employment, either paid or unpaid while in the United Kingdom'[121] and needed official approval even if they wanted, as in Klaus Fuchs's case, to accept a university research scholarship at Edinburgh University.[122]

Even as an established scientist, Rudolf Peierls encountered a difficult situation on the job market, which was chiefly the result of two major factors: firstly, Britain suffered at the time from an economic depression, which aggravated the émigrés' situation significantly. Though previously there had been only very few openings in university departments, there was now even less funding available for higher education. To make matters worse for the émigrés, posts at British universities usually had a higher teaching load and the teaching system varied considerably from the German one. For many German-speaking émigré atomic scientists, these fundamental differences, coupled with their, in many cases, poor command of the English language, constituted a seemingly unbridgeable gap. [123]

Secondly, academic protectionism prevailed in many universities and made it harder for Peierls and many other émigrés to find permanent employment.[124] This attitude manifested itself in the form of a kind of academic protectionism towards scientists from non-English-speaking countries, while non-British scientists from English-speaking countries of the Commonwealth such as the Australians Harrie Massey and Marcus Oliphant, Canadians like Jack Allen or New Zealanders such as Ernest Rutherford were in general given priority.[125] It occurred despite the fact that Peierls's list of references read like a *'Who Is Who'* of theoretical physics, including Werner Heisenberg, Niels Bohr, Max Born, Erwin Schrödinger and Paul Dirac.[126]

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[121] 'Alien Registration Form: Fuchs, Emil Julius Klaus', n.d., TNA, KV 2/1259.

[122] The Under Secretary of State, Aliens Department, Home Office, London to Klaus Fuchs, 30 August 1937, TNA, KV 2/1259.

[123] Cited in Paul K. Hoch, 'The Reception of Central European Refugee Physicists of the 1930s: U.S.S.R., U.K., U.S.A.', *Annals of Science*, 40. 3 (1983), 217-46 (p. 222).

[124] Robin E. Rider, 'Alarm and Opportunity: Emigration of Mathematicians and Physicists to Britain and the United States, 1933-1945', *HSPS*, 15 (1985), 101-76 (p. 131).

[125] Hoch, 'Reception of Central European Refugee Physicists', pp. 224-25, 230.

[126] Note that because the Academic Assistance Council (AAC) was renamed the Society for the Protection of Science and Learning (SPSL) in 1936, I refer to the organization hereafter jointly as AAC/SPSL. Rudolf Peierls, personal information form, 11 October 1934, MS S.P.S.L. 335/9, fol. 471[r]. Other émigrés such as Herbert Fröhlich had equally impressive references including Gustav Mie, Erwin Schrödinger and Arnold Sommerfeld; Mie [to AAC/SPSL], 28 April 1933; Schrödinger to

Here, the situation in Britain differed significantly from the United States where German-speaking émigré atomic scientists were more widely accepted. Hans Bethe, who had re-emigrated from Britain to the United States, tried to explain this difference:

> England had been used to having Englishmen and Commonwealth people in their universities, so we refugees were rather a foreign element, whereas America has been a country of immigrants from the word go, and so it was perfectly natural that there would be more immigrants.[127]

Peierls was subjected to this form of protective xenophobia in British academia when he applied for an assistant lectureship at Manchester University. Although Lawrence Bragg was delighted about Peierls's application, he could not hire Peierls. It was explained to Rudolf Peierls that the university had had such bad press after appointing the German-speaking émigré Michael Polanyi as Chair of Physical Chemistry and giving a temporary contract to Hans Bethe that they were unable to hire him in spite of his qualification. Bragg, however, managed to get Peierls a two-year university grant of £ 250 per year.[128] In its size the stipend was similar to those issued by the Academic Assistance Council which was renamed the Society for the Protection of Science and Learning in 1936 (AAC/SPSL).[129] Although the University of Manchester even extended his contract for a third year until October 1936,[130] Peierls accepted the offer to join the Mond Laboratory in Cambridge in 1935 where he stayed until 1937 when he became a permanent member of the faculty of Birmingham University.[131]

Although Peierls never received a grant from the AAC/SPSL, he had completed the general admission form in October 1934 in order to become part of their network.[132] In 1936, his name thus featured on an AAC/SPSL list of displaced scientists who resided in the United Kingdom among the likes of Herbert Freundlich,

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AAC/SPSL, 7 November 1933; Sommerfeld [to Secretary of the AAC/SPSL], 6 November 1933; Mie to AAC/SPSL, MS S.P.S.L. 328/1, fols 10^{r}-13^{r}.

[127] Hans A. Bethe, Interview by Lillian Hoddeson, 29 April 1981, AIP, p. 29.

[128] Walter Moberly, 'Ministry of Labour, Employment and Training Department. Application for Permission to Employ an Alien or Aliens Not Now in the United Kingdom: Peierls, Rudolf', 3 October 1933, MS S.P.S.L. 438/2, fols 266^{r}-266^{v}; Moberly to Gibson, 3 October 1933, MS S.P.S.L. 438/2, fol. 267^{r}; Peierls, *Bird of Passage*, p. 96; Bill Williams, '"Displaced Scholars": Refugees at the University of Manchester', *Melilah: Manchester Journal of Jewish Studies*, 3 (2005) <http://www.mucjs.org/MELILAH/2005/3.pdf> [accessed 21 November 2008], 1-29 (p. 6 note 31).

[129] *Refugee Scholars*, p. 58. For an overview of the history of the AAC/SPSL, see David Zimmerman, 'The Society for the Protection of Science and Learning and the Politicization of British Science in the 1930s', *Minerva*, 44. 1 (2006), 25-45.

[130] Bragg to AAC/SPSL, 1 February 1935, MS S.P.S.L. 335/9, fol. 476^{r}.

[131] Peierls, *Bird of Passage*, pp. 114, 127.

[132] Rudolf Peierls, personal information form, 11 October 1934, MS S.P.S.L. 335/9, fols 471^{r}-475^{r}.

Walter Heitler, Heinrich Kuhn, Nicholas Kurti (Kürti), the brothers Fritz and Heinz London, Kurt Mendelssohn, Michael Polanyi, Eugen J. Rabinowitch, Erwin Schrödinger, Franz Simon and Leo Szilard.[133] The AAC/SPSL also kept personal files on a number of German-speaking émigré atomic scientists, including, apart from Rudolf Peierls and Klaus Fuchs, Hans Bethe, Max Born, Otto R. Frisch, Herbert Fröhlich, Walter Heitler, Nikolai Kemmer, Heinrich Kuhn, Nicholas Kurti, Fritz and Heinz London, Lothar Nordheim, Erwin Schrödinger and Franz Simon.[134]

Besides the AAC/SPSL, several other aid organizations existed to alleviate the serious conditions that many émigrés faced. These included Jewish groups such as the Central British Fund for German Jewry and the Jewish Refugee Committee, the Lord Baldwin Fund, the Refugee Children's Movement and the Council for German Jewry.[135] Furthermore, a number of non-Jewish relief organizations were set up, above all, the Germany Emergency Committee as well as the AAC, which was the chief aid organization for displaced scholars and scientists at the time.[136]

With regard to academia, the AAC/SPSL was perhaps the most important aid organization. It was created at a meeting of émigrés from National Socialism held at the Royal Albert Hall in 1933, chaired by Lord Rutherford and addressed and attended by such famous émigrés as Albert Einstein. Shortly after its formation its membership mounted to about 2,000.[137] Out of his gratitude, Rudolf Peierls became both a member of and a donor to the AAC/SPSL in 1937 when he joined Birmingham University and had a steady income.[138] The aid organization focused in

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[133] AAC/SPSL, 'Displaced Scientists Resident in Great Britain', n.d., attached to letter, Simpson to Mills, 28 February 1936, MS S.P.S.L. 330/1, fols 89^{r}-92^{r}.

[134] Hans Bethe, personal file, MS S.P.S.L. 324/4, fols 125^{r}-138^{r}; Max Born, personal file, MS S.P.S.L. 325/3, fols 43^{r}-198^{r}; Otto R. Frisch, personal file, MS S.P.S.L. 327/10, fols 441^{r}-524^{r}; Nikolai Kemmer, personal file, MS S.P.S.L. 509/4, fols 478^{r}-515^{r}; Heinrich Kuhn, personal file, MS S.P.S.L. 333/3, fols 45^{r}-102^{r}; Nicholas Kurti, personal file, MS S.P.S.L., fols 136^{r}-163^{r}; Fritz London, personal file, MS S.P.S.L. 334/4, fols 260^{r}-340^{r}; Heinz London, personal file, MS S.P.S.L. 334/5, fols 342^{r}-391^{r}; Lothar Nordheim, personal information form, n.d., MS S.P.S.L. 335/7, fols 324^{r}-332^{r}; Erwin Schrödinger, personal file, MS S.P.S.L. 339/4, fols 289^{r}-374^{r}; Franz Simon, personal file, MS S.P.S.L. 339/8, fols 450^{r}-541^{r}.

[135] Ronald Stent, 'Jewish Refugee Organisations', in *Second Chance: Two Centuries of German-Speaking Jews in the United Kingdom*, ed. by Werner E. Mosse and others (Tübingen: Mohr, 1991), pp. 579-98.

[136] William H. Beveridge, *A Defence of Free Learning* (London: Oxford University Press, 1959), pp. 8-22, 24-26; Gerhard Hirschfeld, '"A High Tradition of Eagerness...": British Non-Jewish Organisations in Support of Refugees', in *Second Chance* (see Stent, 'Jewish Refugee Organisations', above), pp. 599-610.

[137] Bernard Wasserstein, 'Intellectual Émigrés in Britain, 1933-1939', in *The Muses Flee Hitler* (see Strauss, 'Movement of People', above), pp. 251-52.

[138] Peierls to Adams, 10 June 1937, MS S.P.S.L. 175/1, fol. 528^{r}; Peierls to Adams, 19 June 1937, MS S.P.S.L. 175/1, fol. 74^{r}.

particular on two primary objectives: firstly, it supplied émigré academics with information on jobs in the United Kingdom and elsewhere, especially the United States. Secondly, it allocated so-called temporary maintenance grants.[139]

Given the limited opportunities the British job market had to offer German-speaking émigré atomic scientists, the AAC/SPSL strongly encouraged their re-emigration, in particular to the United States but also to other, more exotic places.[140] In January 1935, Rudolf Peierls received an offer to apply for a job in Quito, Ecuador, which he declined for monetary reasons because, as he argued, 'I suppose the physicist will not have the same opportunities of earning money in other ways as a Cabinet Minister of Ecuador and will therefore have to live on his salary.'[141] The same job was also offered to Heinrich Kuhn, who had previously turned down the opportunity to join the physics department at the University of Rangoon in Burma.[142]

Owing to the lack of opportunities in Britain, many émigré scientists who had initially come to the United Kingdom re-emigrated, like Hans Bethe, Albert Einstein, Fritz London and Edward Teller to the United States, or like Erwin Schrödinger and Walter Heitler to Ireland.[143] The AAC/SPSL's engagement, however, was not restricted to émigrés residing in the United Kingdom. The council helped, for example, Lothar Nordheim, who later worked at the Manhattan Project installation at Oak Ridge, Tennessee, to find employment in the United States, while he was working in France and the Netherlands.[144] With about 10,000 arrivals in the years between 1939 and 1945, the United States represented the main destination for re-emigrants.[145] In the years between 1933 and 1941, about 100 physicists found refuge there.[146] Like Hollywood, which became the main destination of German-speaking

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[139] Hirschfeld, *"A High Tradition of Eagerness..."*, p. 603.
[140] Hoch, 'Reception of Central European Refugee Physicists', pp. 224-25, 230. See, for example, the case of Hans Bethe where the AAC/SPSL collaborated with the New York City-based Emergency Committee in Aid of Displaced German Scholars, Murrow to Adams, 18 June 1934, MS S.P.S.L. 324/4, fol. 128[r].
[141] Peierls to Adams, 31 January 1935, MS S.P.S.L. 335/9, fol. 507[r].
[142] Skepper to Kuhn, 19 October 1934; Kuhn to Adams, 26 October 1934, fols 78[r]-80[r]; Secretary [of the AAC] to Kuhn, 26 January 1935, MS S.P.S.L. 333/3, fol. 82[r].
[143] Hoch, 'Reception of Central European Refugee Physicists', pp. 222-23.
[144] Skepper to Nordheim, 6 September 1934, MS S.P.S.L. 335/7, fol. 347[r].
[145] Berghahn, p. 122.
[146] Charles Weiner, 'A New Site for the Seminar: The Refugees and American Physics in the 1930s', in *The Intellectual Migration: Europe and America, 1930-1960*, ed. by Donald H. Fleming and Bernard Baylin (Cambridge, MA: Belknap Press of Harvard University Press, 1969), pp. 190-233 (pp. 190-91).

émigré film personnel, the United States eventually became the main haven for most émigré nuclear physicists. [147]

To those émigré scientists who stayed in the United Kingdom, the AAC/SPSL tried to give as much support as possible, in particular awarding temporary maintenance grants. Klaus Fuchs was amongst the recipients of such an award. His mentor, Max Born, actively tried to make funds available for Fuchs through the AAC/SPSL.[148] In November 1937, Fuchs thus registered with the AAC/SPSL.[149] As a result of Born's engagement, Fuchs was awarded an assistance grant of £ 42 per year over a fixed period of twelve months from the AAC/SPSL.[150] When Fuchs received the news of this scholarship, he praised the ideals of the AAC/SPSL, writing to its General Secretary, Walter Adams, 'that the work of your society means to people in my circumstances more than the material benefit we may draw from it'.[151] The *Notgemeinschaft Deutscher Wissenschaftler im Ausland* (Emergency Society of German Scientists Abroad) also became involved in the matter of Klaus Fuchs and approached the AAC/SPSL to negotiate an extension of Fuchs's supplementary grant – in vain.[152] Other beneficiaries who received financial support from the organization included Walter Heitler and Herbert Fröhlich.[153]

Apart from helping displaced scientists find funding and employment, the AAC/SPSL also offered legal advice when Peierls's parents, for example, wanted to leave Germany.[154] Besides Peierls, the organization also provided legal support for Klaus Fuchs as well as Herbert Fröhlich and Egon Orowan.[155] Like many German-speaking émigré atomic scientists, Klaus Fuchs faced serious difficulty with the

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[147] Helmut G. Asper, 'Film', in *Handbuch der deutschsprachigen Emigration* (see Krohn, above), pp. 957-70 (pp. 957, 964); Hoch, 'Reception of Central European Refugee Physicists', pp. 231-34; Strauss, 'Movement of People', p. 50.

[148] Born to Simpson, 27 October 1937; Simpson to Born, 29 October 1937; Born to Simpson, 5 November 1937; Simpson to Born, 6 November 1937, MS S.P.S.L. 328/1, fols 149^{r}-152^{r}.

[149] Klaus Fuchs, personal information form, 8 November 1937, MS S.P.S.L. 328/1, fols 141^{r}-146^{r}.

[150] Adams to Born, 18 January 1938; Born to Adams, 19 January 1938; Adams to Fuchs, 21 January 1938, MS S.P.S.L. 328/1, fols 153^{r}-155^{r}.

[151] Fuchs to Adams, 24 January 1938, MS S.P.S.L. 328/1, fol. 156^{r}.

[152] Demuth to Simpson, 15 July 1938; Simpson to Demuth, 16 July 1938; Adams to Demuth, 22 July 1938, MS S.P.S.L. 328/1, fols 159^{r}-161^{r}.

[153] Herbert Fröhlich, 'Moving On: Experiences of a Scientist in Exile', *University of Liverpool Recorder*, 93 (October 1983), 222-28 (p. 226); Heitler to Adams, 28 February 1936, MS S.P.S.L. 330/1, fol. 93^{r}.

[154] See, for example, Peierls to Simpson, 11 October 1938; Simpson to Cooper, 11 October 1938, MS S.P.S.L. 438/2, fols 276^{r}-277^{r}.

[155] For this purpose the AAC/SPSL, for example, kept copies of the Home Office files of the following scientists: Rudolf Peierls (MS S.P.S.L. 438/2, fols 266^{r}-283^{r}); Klaus Fuchs (MS S.P.S.L. 430/2, fols 286^{r}-351^{r}); Herbert Fröhlich (MS S.P.S.L. 430/2, fols 249^{r}-285^{r}); Egon Orowan (MS S.P.S.L. 428/2, fols 222^{r}-239^{r}).

immigration service. After the German Consulate in Bristol – where Fuchs was studying under Nevill Mott – informed Fuchs that the German Embassy in London refused to issue him a new passport, but only a temporary passport which allowed him to return to Germany in October 1934, Mott immediately contacted the AAC/SPSL to ensure that his student could stay in the United Kingdom.[156] In return, the AAC/SPSL reacted instantly and contacted the authorities.[157] The AAC/SPSL also assisted Klaus Fuchs during the naturalization process just weeks after the beginning of World War II.[158] Besides Fuchs, the society also advised, for instance, Heinz London during his naturalization process.[159]

British industry also funded several displaced physicists. Immediately after the imposition of the infamous Law for the Restoration of the Career Civil Service by the National Socialist regime in Germany, Imperial Chemical Industries (ICI) designed a temporary support scheme for émigré scientists from Nazi Germany under the auspices of Frederick Lindemann, later Viscount Cherwell. Recipients of such fellowships included Erwin Schrödinger at Oxford as well as the atomic scientists Heinrich Kuhn, Nicholas Kurti, Fritz London, Kurt Mendelssohn and Franz Simon at the Clarendon Laboratory in Oxford.[160] In the years from 1930 to 1938, industrial laboratories received a threefold increase in funding. Although this development did not necessarily imply by itself that more German-speaking émigré physicists found employment in industrial research, an occupation many of them did not regard as an adequate surrogate for a university position in any case, some like Wolfgang Berg, Dennis Gabor, Otto Klemperer or Walter Zehden were hired by industry.[161]

Apart from aid organizations and industry, much support was also given on the personal level through the initiative of individuals, often fellow émigrés. Frederick Lindemann represented perhaps the most famous of these individuals. Born in Germany but raised in England, Lindemann attended high school in

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[156] Hartley-Hodder to Fuchs, 23 October 1934, MS S.P.S.L. 430/2, fol. 287^{r}; Mott to The Secretary, AAC, 25 October 1934, MS S.P.S.L. 430/2, fol. 288^{r}.
[157] Skepper to Mott, 26 October 1934; Skepper to The Secretary, The High Commission, 26 October 1934, MS S.P.S.L. 430/2, fols 289^{r}-291^{r}.
[158] Fuchs to Thomson, 15 September 1939; Thomson to Fuchs, 15 September 1939 [included the questionnaire which Fuchs completed and returned to Thomson with his letter (fol. 162^{r}), MS S.P.S.L. 328/1, fols 162^{r}-163^{r}.
[159] Simpson to London, November 1940, MS S.P.S.L. 334/5, fol. 357^{r}.
[160] Rider, pp. 146-150.
[161] Hoch, 'Reception of Central European Refugee Physicists', p. 226.

Germany and even obtained a Ph.D. in physics from the *Physikalisch Technisches Institut* in Berlin where he studied under Walther Nernst before returning to the United Kingdom in 1914. Once the Second World War broke out, Lindemann, as, in the words of Kurt Mendelssohn, a 'famous one-man relief organization', helped many German-speaking scientists, including Franz Simon, Kurt Mendelssohn, Nicholas Kurti and Heinz London, to move to the United Kingdom.[162] It was through his special knowledge of German science, his many contacts with German colleagues, and his connections with ICI that Lindemann became so crucial in helping and supporting numerous German-speaking émigrés.[163]

Rudolf Peierls, however, also became involved in supporting fellow German-speaking émigré scientists. Together with Max Born, he helped Klaus Fuchs find a temporary job. After his AAC/SPSL grant had run out and before his internment in 1940, Fuchs had held a Carnegie Foundation fellowship over £ 250 per annum at the University of Edinburgh from October 1939.[164] When the Carnegie Foundation introduced new regulations under which they funded no longer aliens and they consequently stopped to support Klaus Fuchs, Max Born became active again and alerted the AAC/SPSL to the new situation which threatened to leave Fuchs without an income once he was released from internment.[165] Prior to Fuchs's dismissal from internment, Max Born tried to find a job for his former student, although he was not sure about the exact date. He approached Rudolf Peierls, who showed an interest in hiring Fuchs as a temporary part-time lecturer to relieve him of his teaching load, but also expressed doubts about the feasibility of his plan, in particular on account of the uncertainty of Fuchs's release date and a hostile climate he faced in Birmingham.[166]

Although it looked initially as if Fuchs would not make the move to the University of Birmingham, Peierls remained tireless in his effort to find a job for the talented physicist at his university. In the end, he succeeded and offered Fuchs a

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[162] William Farren and George P. Thomson, 'Frederick Alexander Lindemann, Viscount Cherwell. 1886-1957', *BMFRS*, 4 (November 1958), 45-71 (p. 45); Adrian Fort, *Prof: The Life of Frederick Lindemann* (London: Pimlico, 2004), pp. 15-40, 115-27, 182; Mendelssohn, p. 1343.

[163] For a concise overview of Frederick Lindemann's role in the emigration of several German-speaking émigré scientists see Stefan L. Wolff, 'Frederick Lindemanns Rolle bei der Emigration der aus Deutschland vertriebenen Physiker', in *German-Speaking Exiles in Great Britain*, ed. by Anthony Grenville (Amsterdam: Rodopi, 2000), pp. 25-58.

[164] Fuchs to Thomson, 15 September 1939, MS S.P.S.L. 328/1, fol. 162^{r}.

[165] Born to Simpson, 5 July 1940; Born to Simpson, 24 October 1940; Simpson to Born, 29 October 1940, MS S.P.S.L. 328/1, fols 167^{r}-168^{r}, 170^{r}. Fuchs's former supervisor at the University of Bristol also showed in interest in his whereabouts; Mott to Simpson, 26 October 1940, MS S.P.S.L. 328/1, fol, 169^{r}.

[166] Peierls to Born, 5 November 1940; Peierls to Born, 27 November 1940, TNA, AB 1/572.

temporary position.[167] Apart from giving professional aid, German-speaking émigré atomic scientists also socialized in their private lives, as the case of Peierls reveals, for at one time or another, Bethe, Frisch, Fröhlich and Fuchs stayed at the Peierls's family home for longer durations.[168] Rudolf Peierls also assisted Herbert Fröhlich in his attempt to obtain funding from the AAC/SPSL.[169] Moreover, Peierls tried to help Fröhlich return to the United Kingdom from Leningrad in the Soviet Union where he had spent some time working when his visa was suddenly not renewed.[170]

While personal intervention of individual scientists, aid organizations and industry helped ease the severe situation that many émigrés faced on the job market, there were other obstacles and hardships in the new host country that were much harder to overcome: after the beginning of Hitler's invasion of Poland on 1 September 1939, many émigrés faced a general sentiment of Germanophobia.[171] Max Born and Franz Simon, for example, were affected by anti-German attitudes as proposed by Sir Robert Vansittart in his sixpenny pamphlet *Black Record: Germans Past and Present*.[172] In a letter to Rudolf Peierls, Born expressed his and Simon's relief about the publication of Victor Gollancz' book *Shall Our Children Live or Die?* in 1942, which challenged 'Vansittartism'.[173] To make matters worse, German-speaking émigrés often faced Germanophobia mixed with anti-Semitism.[174]

The individual experiences of German-speaking émigré scientists differed considerably. Despite his German-Jewish origin, Rudolf Peierls, for instance, was fortunate because he did not encounter any kind of 'general xenophobia', as he later

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[167] Born to Peierls, 11 March 1941; Peierls to Born, 12 March 1941; Peierls to Born, 22 March 1941; Peierls to Born, 10 May 1941; Peierls to Born, 16 May 1941; Born to Peierls, n.d. (reply to a letter sent by Peierls to Born dated 26 May 1941), TNA, AB 1/572.

[168] Bethe, Interview by Hoddeson, p. 4; Frisch, *What Little I Remember*, p. 130; Secretary [of the AAC/SPSL] to Fröhlich, 30 July 1935, MS S.P.S.L. 430/2, fol. 253^{r}; W.J. Skardon, 'Emil Julius Klaus Fuchs', 22 December 1949, TNA, KV 2/1249, p. 2.

[169] Secretary [of the AAC/SPSL] to Peierls, 28 January 1935, MS S.P.S.L., 328/1, fol. 41^{r}; Peierls to Adams, 31 January 1935, MS S.P.S.L. 335/9, fol. 507^{r}. Max Born also helped; Born to Adams, n.d.; Adams to Born, 11 June 1935, fols 42^{r}-43^{r}; Born to Adams, 26 June 1935, MS S.P.S.L. 328/1, fols 45^{r}-45^{v}.

[170] Skepper, note, 'Herbert Fröhlich, Physics', 24 January 1935, MS S.P.S.L. 328/1, fol. 14^{r}; Peierls to Adams, 6 July 1935; General Secretary [Adams] to Peierls, 10 July 1935, MS S.P.S.L. 328/1, fols 48^{r}-49^{r}.

[171] Berghahn, p. 139. For an overview of British views on Germany and the Germans during the World War II era see John Ramsden, *Don't Mention the War: The British and the Germans Since 1890* (London: Little, Brown, 2006), pp. 134-211.

[172] Robert Vansittart, *Black Record: Germans Past and Present* (London: Hamish Hamilton, 1941).

[173] Born to Peierls, April 1942, TNA, AB 1/572; Victor Gollancz, *Shall Our Children Live or Die?* (London: Gollancz, 1942).

[174] Berghahn, pp. 140-42; Stent, 'Jewish Refugee Organisations', p. 588.

wrote in his autobiography.[175] 'The man in the street,' stated Kurt Mendelssohn affirmatively, 'fully realized that the refugee scientists living among them were even greater enemies of Hitler himself', adding: 'I do not know of a single case of unpleasantness which they so easily might have encountered.'[176] Mendelssohn's generalization did not apply to all German-speaking émigrés. On the contrary, numerous Jewish and political émigrés encountered a very hostile climate.

Like many political émigrés of the same political *couleur*, Klaus Fuchs was not wholeheartedly welcome in Britain, and Communists faced many difficulties.[177] This became obvious for the first time, when he applied for a new German passport needed to renew his visa in 1934. The Chief Constable of the Bristol Central Police Office informed the Aliens Department about information his agency had received from the German Consulate that indicated that 'Fuchs is a notorious Communist'. This was substantiated by enclosed documents.[178] These documents included crucial pieces of correspondence: an internal letter from the Police Chief of the German city of Kiel where Fuchs had been registered before his flight from Germany, as well as another letter to the German Consulate in Bristol, in which the Police Chief voiced 'political doubts' against issuing Fuchs a new passport.[179]

Moreover, the *Geheime Staatspolizei* (Secret State Police; Gestapo) had planted further evidence of Fuchs's alleged Communist ties in the accompanying correspondence. It contained another, earlier letter from Klaus Fuchs to the Registration Office in Kiel on the back of which the Gestapo Field Office in Kiel had noted (translated) remarks, providing background information on his Communist affiliations.[180] That the Gestapo effectively used the evidence supplied through the German Consulate in Bristol to the British authorities in order to denounce Fuchs, damage his reputation and perhaps even have him extradited is substantiated by the

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[175] Peierls, *Bird of Passage*, p. 145.
[176] Mendelssohn, p. 1344.
[177] Louise London, 'British Immigration Control Procedures and Jewish Refugees 1933-1939', in *Second Chance* (see Stent, 'Jewish Refugee Organisations', above), pp. 485-517 (p. 500).
[178] Chief Constable, Central Police Office, Bristol to Sir Vernon, RE: Emil Julius Klaus Fuchs, 5 November 1934, TNA, KV 2/1245.
[179] Translation of letter, Police Chief, Kiel, to German Consulate, Bristol, 16 October 1934, TNA, KV 2/1245.
[180] Translation of letter, Klaus Fuchs to Registration Office, Kiel, Germany, RE: Certificate of no objections against the new issuing of a passport, 6 October 1934, TNA, KV 2/1245. Reference to this letter is also made, for example, in J.C. Robertson, 'Emil Julius Klaus Fuchs', 23 November 1949, TNA, KV 2/1248, p. 5.

fact that further copies of the correspondence were directly forwarded to the Home Office.[181]

In Fuchs's case, the Gestapo was following one of its common practices to provide governments of countries that harboured émigrés from Nazi Germany with documents which undermined the expatriates' reputation. In their attempt to silence and eradicate any opposition and political agitation in exile, they not only created a network of agents in the respective countries but also enlisted members of the *Nationalsozialistische Deutsche Arbeiter Partei* (National Socialist German Workers' Party; NSDAP) who lived abroad and, as in Fuchs's case, the German diplomatic service. In order to keep a close eye on the émigrés, the Gestapo had ordered the Prussian police as early as May 1933 to collect a list of all persons who had left Germany after 30 January 1933. These local lists of émigrés (*Emigrantenlisten*) were then kept in the Gestapo's central Émigré Archive in Berlin.[182]

Both Fuchs and Peierls were 'emigrants' (*Emigranten*) in the official diction of the Gestapo, which applied the term to Jews and political émigrés (including members of the KPD, the *Sozialdemokratische Partei Deutschlands* [Social Democratic Party of Germany; SPD] and *Zentrum* [Centre Party]) who were living abroad for 'political reasons', regardless of whether they had emigrated before or after Hitler's coming to power.[183] And what is more, Fuchs's name along with that of his brother Gerhard was later also found on a seized document from the Gestapo Field Office in Kiel. This list had been compiled in 1941 for the *Wehrmacht* in anticipation of the attack on the Soviet Union to look out for specific people to arrest.[184] In another case, the Gestapo Field Office in Kiel also initiated the

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[181] German Embassy, London, to German Consulate, Bristol, 7 August 1934; Hartley-Hodder, Konsul, to Fuchs, 9 August 1934; Hartley-Hodder, Konsul, to Fuchs, 23 October 1934, TNA, KV 2/1245.

[182] Charmian Brinson, 'The Gestapo and the German Political Exiles in Britain During the 1930s: The Case of Hans Wesemann – and Others', *German Life and Letters*, 51. 1 (1998), 43-64 (pp. 43-47). See Müller, der Stellvertretende Chef, Preussische Geheime Staatspolizei, Berlin, to Leiter der Staatspolizeistellen oder Vertreter im Amt, RE: Flüchtige Kommunisten, Landesarchiv Schleswig-Holstein, Schleswig, Germany, (hereafter LASH), Abt. 455, Nr. 21. The list for the city of Kiel, however, dates from 1936 and does not contain the name of Klaus Fuchs; 'Emigranten-Liste. Nachweisung über emigrierte Personen, die im Bezirk der Stapo Kiel bekannt georden sind', n.d., LASH, Abt. 455, Nr. 9.

[183] 'Merkblatt zur Beachtung bei der terminmäßigen Berichterstattung an Gestapa', attached to the 'Emigranten-Liste. Nachweisung über emigrierte Personen, die im Bezirk der Stapo Kiel bekannt geworden sind', n.d., LASH, Abt. 455, Nr. 9.

[184] 'Attachment. Received 28.11.49', TNA, KV 2/1248, p. 1.

deprivation of Herbert Frahm's (alias the West-German Chancellor-to-be Willy Brandt) German citizenship after the latter had fled to Norway.[185]

To compound the harassment by the Gestapo, Britain imposed strict regulations on the émigrés' official status. At the time, British immigration policy was, above all, influenced by a perceived national self-interest, and, as Louise London has argued, 'escape to Britain was an exception for a lucky few; exclusion was the fate of the majority'.[186] Even as members of the relatively small and privileged group of intellectual emigrants, whom Laura Fermi referred to as the 'intelligentsia', Fuchs and Peierls were not spared restrictive measures imposed by the British authorities.[187]

In Birmingham, Peierls faced problems because he was an 'enemy alien', but fortunately was not interned.[188] On 26 March 1940, Rudolf Peierls became a naturalized British citizen and was subsequently relieved of the fear of internment that seemed to loom like the sword of Damocles over many non-naturalized foreigners in Britain after the outbreak of the Second World War.[189] Viennese émigré Otto R. Frisch, for example, managed to evade internment because he could prove, with the support of his colleague Philip Moon, that he was involved in important war work on the separation of uranium isotopes.[190] Other émigrés were less fortunate. Rudolf Peierls's brother Alfred as well as the latter's wife were interned on the Isle of Man.[191] Klaus Fuchs faced similar problems when he applied to become a British citizen. His first application for British citizenship in July 1939 was denied and it would take Fuchs until 1942 to become a naturalized British subject.[192] In 1938,

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[185] Gerhard Paul, 'Die Gestapozentrale in der Düppelstraße 23: Die Zentrale des NS-Terrors in Schleswig-Holstein', in *Täter und Opfer unter dem Hakenkreuz: Eine Landespolizei stellt sich der Geschichte*, ed. by Förderverein 'Freundeskreis zur Unterstützung der Polizei Schleswig-Holstein e.V.' (Kiel: Freundeskreis zur Unterstützung der Polizei Schleswig-Holstein, 2001), pp. 43-50 (p. 46).
[186] London, *Whitehall and the Jews*, p. 12.
[187] Laura Fermi, *Illustrious Immigrants: The Intellectual Migration from Europe, 1930/41*, 2nd ed (Chicago: University of Chicago Press, 1971), p. 41; Hirschfeld, '"A High Tradition of Eagerness..."', p. 604.; Wasserstein, pp. 250-251.
[188] Peierls, *Bird of Passage*, p. 145; Peierls, Interview by Weiner, pp. 93-94.
[189] Fletcher to Ladd, RE: Emil Julius Klaus Fuchs, 21 September 1949, Ferenc M. Szasz Papers, Center for Southwest Research, University of New Mexico, Albuquerque, New Mexico, United States, MSS 552 BC (hereafter Klaus Fuchs FBI File), 65-58805-7, vol. 1, serials 1-26, p. 27.
[190] Frisch, *What Little I Remember*, pp. 127-28.
[191] Rudolf Peierls, *Bird of Passage*, p. 151.
[192] 'Fuchs, Klaus', p. 206.

however, the Home Office had changed his visa status, lifting any time limits that could affect his stay in the United Kingdom.[193]

When war with Germany broke out, so-called enemy aliens like Klaus Fuchs and Rudolf Peierls were subject to severe restrictions and had to live with the constant fear of being sent off to an internment camp. The limitations in place for 'enemy aliens' were much more humiliating than those effective in World War I.[194] They needed, for example, permission to own cars, bicycles, and large-scale maps and they were not allowed to move around the country freely. They also had to obey a curfew. These were serious restrictions for people who had to travel considerably between different universities and were used to working late hours in their laboratories.[195]

As early as April 1940, Klaus Fuchs thus had to file an application to be granted permission to reside in Edinburgh, which had by then become a 'protected area'.[196] Even after he had moved to Birmingham, he still had to get official authorization, even if he only intended to pay a short visit to people living in restricted areas.[197] Before his naturalization as a British citizen, Rudolf Peierls had also shared the burden of being an 'enemy alien'. When he wanted to do his part in the war against Nazi Germany by joining the Civil Defence Corps, his application was rejected because of his status as 'enemy alien' and he was forced to join the Auxiliary Fire Service as the least possible form in which he could contribute to the defence of his new host country.[198]

Once war broke out in September 1939, Whitehall put into effect internment measures. The concept of internment was not entirely new but had already been applied in World War I.[199] During the First World War some 30,000 'enemy aliens' had been interned. The Second World War saw the imprisonment of over 25,000

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[193] The Under Secretary of State, Home Office (Aliens Department), London to Fuchs, 17 August 1938; The Chief Constable, City Police, Edinburgh to the Superintendent, Central Register of Aliens, Home Office, RE: Fuchs, Emil Julius Klaus, 23 August 1938, TNA, KV 2/1259.
[194] Berghahn, p. 139.
[195] Frisch, Interview by Weiner, pp. 40-41; Frisch, *What Little I Remember*, p. 127; Peierls, *Bird of Passage*, p. 145.
[196] Klaus Fuchs' 'Application by an Alien for Permission to Reside in a Protected Area, 24 April 1940', TNA, KV 2/1259.
[197] Fuchs to the Chief Constable, the City of Edinburgh, 26 May 1942; Assistant Chief Constable, City of Edinburgh, 28 May 1942; The Chief Constable, City of Birmingham to the Chief Constable, City Police, Edinburgh, RE: Aliens (Movement Restriction) Order, 1940, 30 May 1942, TNA, KV 2/1259.
[198] Peierls, *Bird of Passage*, pp. 145, 147-148.
[199] For an overview see Panikos Panayi, 'An Intolerant Act by an Intolerant Society: The Internment of Germans in Britain During the First World War', in *The Internment of Aliens in Twentieth Century Britain*, ed. by David Cesarani and Tony Kushner (London: Cass, 1993), pp. 53-75.

'enemy aliens', with thousands being deported to far-away Dominions such as Canada or even Australia.[200] The road to internment had been paved by anti-alienism, which enjoyed a long tradition in Britain and was crucial in shaping public opinion.[201] In a Gallup poll which was conducted in July 1939, the overwhelming majority of the respondents (70 per cent) agreed that émigrés should be allowed to enter Britain but, at the same time, 84 per cent of the interviewees who had answered in the affirmative also agreed that restrictions should be imposed on their movements. In another poll taken in May 1940, only 2 per cent of the respondents thought that Whitehall's treatment of aliens residing in the United Kingdom was '[t]oo strict', while 64 per cent regarded it as '[t]oo lenient' and 25 percent as '[a]bout right'. In another survey carried out in the following month, public opinion was divided over the internment of 'enemy aliens': 48 per cent stated that 'only those who may be unfriendly and dangerous' should be interned and 43 per cent called for the internment of all 'enemy aliens'.[202] Until today the internment of 'enemy aliens' remains, by and large, as Tony Kushner and David Cesarani have argued, 'a hidden feature of British history',[203] for it would blemish the myth of 'the Good War' or 'the People's War' as it also has to become known in popular memory.[204] In the new introduction to the 1988 edition of his polemic study, *The Internment of Aliens*, first published in 1940, François Lafitte concluded retrospectively that '[t]he only blessing for which we can thank Britain's rounding up of its "enemy aliens" in 1940 is that it unintentionally accomplished the genius of the Amadeus Quartet' but that '[l]ittle else can be pleaded in defence of the way in which Britain had then treated its refugees from Nazi persecution.'[205]

In line with British government regulations, the 'enemy aliens' Klaus Fuchs and Rudolf Peierls had to appear before a tribunal, which was to determine their

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[200] Peter Gillman and Leni Gillman, *'Collar the Lot!' How Britain Interned and Expelled Its Wartime Refugees* (London: Quartet, 1980), p. 5.

[201] David Cesarani, 'An Alien Concept? The Continuity of Anti-Alienism in British Society Before 1940', in *The Internment of Aliens in Twentieth Century Britain* (see Panayi, above), pp. 25-52.

[202] *The Gallup International Public Opinion Pools: Great Britain 1937-1975*, ed. by George H. Gallup, 2 vols (New York: Random House, 1976), I, 22, 33, 34.

[203] Tony Kushner and David Cesarani, 'Alien Internment in Britain During the Twentieth Century: An Introduction', in *The Internment of Aliens in Twentieth Century Britain* (see Panayi, above), pp. 1-22 (p. 1).

[204] For critical re-evaluations of the concepts of 'the Good War', 'the People's War' respectively, see Steven Fielding, 'The Good War: 1939-1945', in *From Blitz to Blair* (see Jim Tomlinson, before), pp. 25-52; Jose Harris, 'Great Britain: The People's War?', in *Allies at War: The Soviet, American, and British Experience, 1939-1945*, ed. by David Reynolds, Warren F. Kimball and A.O. Chubarian (Basingstoke: Macmillan, 1994), pp. 233-59.

[205] François Lafitte, *The Internment of Aliens*, new edn (London: Libris, 1988), p. vii.

status of loyalty to their new host country. The émigrés were divided into three classes (A, B and C), with those in class A being the ones the tribunals were most doubtful of and those in class C being regarded as the most loyal among the 'enemy aliens'.[206] Both Fuchs and Peierls were placed in category C and thus exempted from internment.[207] In November 1939, Fuchs was summoned to appear before a tribunal in Edinburgh.[208] The reason given for his (as in the case of most émigrés placed in category C) exemption from internment was that he was indeed a '[r]efugee from Nazi oppression'.[209] In order to be granted this status, Fuchs – like all other 'enemy aliens' – had to provide two letters of support. He received one from Paul D. Sturge, the General Secretary of the Friends Service Council, and the second one from his boss Max Born. The latter described him, apart from praising Fuchs's scientific merits, as a 'man of excellent character, deeply devoted not only to his science, but to all human ideals and humanitarian activities'. 'He is passionately opposed to the present German government', Max Born went on, 'and hopes for the victory of the Allies.'[210] Klaus Fuchs and Rudolf Peierls were thus two of over 73,800 aliens whose cases were examined during the first months of the war. Less than one percent of those screened by tribunals were interned and about 64,200 were placed in class C.[211]

Things changed dramatically for Klaus Fuchs in the immediate aftermath of the German invasion of Belgium and the Netherlands, when the government finally adopted a policy of mass internment. The Home Secretary, Sir John Anderson, had previously declined calls for internment of aliens as indefensible. With Winston Churchill, an ardent supporter of the mass internment of 'enemy aliens', taking Neville Chamberlain's place as Prime Minister, the Home Office reluctantly implemented such a policy.[212] This new policy was – perhaps most graphically –

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[206] Ibid., pp. 62-65.
[207] Chief Constable, City Police, Edinburgh to the Chief Constable, City Police, Birmingham, 9 June 1941, TNA, KV 2/1259; Peierls, *Bird of Passage*, pp. 145-46.
[208] Aliens Registration Department, City Police Chambers, Edinburgh to Emil J. K. Fuchs, 25 October 1939; A. Macauley to Chief Constable, Birmingham City Police, RE: Control of Aliens. Emil Julius Klaus Fuchs, - German, 16 August 1941, TNA, KV 2/1259.
[209] 'Male Enemy Alien – Exemption from Internment – Refugee: Fuchs, Emil Julius Klaus, 2 November 1939', TNA KV 2/1259.
[210] Born [to Aliens Tribunal], 30 October 1939; Sturge to the Chairman, Aliens Tribunal, Edinburgh, 30 October 1939, TNA, KV 2/1259.
[211] Gillman and Gillman, p. 45.
[212] London, *Whitehall and the Jews*, p. 170.

summarized in Winston Churchill's infamous order: 'Collar the lot!'[213] The press also played an important part in creating a climate hostile to the émigrés. Highly conservative papers like the *Pictorial*, *Dispatch* and *Sunday Express* launched a major campaign against émigrés, warning that they served Hitler as Fifth Columnists. As Tony Kushner has argued, this xenophobic climate represented a shift to the 'world of "Clubland Heroes", the inter-war thrillers and detective novels of John Buchan, Sapper, Dornford Yates and Agatha Christie'.[214]

Following the newly implemented government policy of mass internment of 'enemy aliens', Klaus Fuchs was, at first, interned at Donaldson's Hospital Internment Camp in Edinburgh on 12 May 1940, before he was transferred to an internment camp on the Isle of Man and finally deported to Canada.[215] Apart from Fuchs, Walter Kellermann, a German-born émigré and collaborator of Max Born at the University of Edinburgh, was interned. Born remarked on their appearances, 'it is rather curious that the Rabbi's son Kellermann, looks 100% Aryan whereas the Pastor's son Fuchs, is of the super-intelligent type frequently found amongst educated Jews'.[216] In his autobiography, Max Born, later described how he found the two men missing from their work places one morning and gradually learnt what had happened to them.[217]

Born immediately intervened on behalf of Fuchs and Kellermann and contacted Esther Simpson, the AAC/SPSL Secretary, assuring her that both scientists 'would be prepared to do work of national importance in any place ascribed to them'. 'I can strongly affirm', he underlined, 'that Dr. Fuchs and Dr. E. W. Kellermann are not only prepared, but extremely keen to do such work, as their fate entirely depends on the victory of this country.'[218] In her reply, Simpson thanked Born for his help and wrote to him: 'You may rest assured that we shall do our best on behalf of the scholars and scientists registered with us.'[219]

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[213] Cited in Gillman and Gillman, p. 153.
[214] Tony Kushner, 'Clubland, Cricket Tests and Alien Internment, 1939-40', in *The Internment of Aliens in Twentieth Century Britain* (see Panayi, above), pp. 79-101 (pp. 87-88).
[215] 'Alien Registration Form: Fuchs, Emil Julius Klaus', n.d., TNA, KV 2/1259; Assistant Chief Constable to the Manager, Employment Exchange, Edinburgh, 1 November 1940, TNA, KV 2/1259; Robert Williams, *Klaus Fuchs*, pp. 32-33.
[216] Born to Sir Thomas, 29 May 1940, TNA, KV 2/1246.
[217] Max Born, *My Life*, p. 286.
[218] Born to Simpson, 22 May 1940, MS S.P.S.L. 328/1, fols 164^{r}-165^{r} (fol. 164^{r}).
[219] Simpson to Born, 25 May 1940, MS S.P.S.L 328/1, fol. 166^{r}.

Other German-speaking émigré physicists who were interned apart from Klaus Fuchs included Walter Kohn and Hans Kronberger, as well as eight members of the Physics Department at Bristol University: Walter Heitler and his brother Hans, Herbert Fröhlich, Kurt Hoselitz, Philipp Gross and Heinz London, and two of their students Robert Arno Sack and G. Eichholz.[220] With a total of eight internees, the University of Bristol's Physics Department was particularly hard hit by what Arthur M. Tyndall appropriately described as a 'bombshell'.[221] Tyndall, who was the head of the department at the time, took a proactive role on behalf of his émigré colleagues early on because he had realized their unique qualifications and significance for TA work.[222] As Tyndall appropriately put it in a letter to Thomson, 'a spanner is thrown in the works if all these friendly aliens are excluded' from TA work.[223] Not all senior scientists in the British nuclear weapons project shared Tyndall's view of German-speaking, in particular German-born scientists, working in sensitive areas such as TA. In a letter to Tyndall, Thomson opined that he was 'a little troubled about the number of people of German origin who are getting to know of the work', adding: 'I hope in particular Peierls has not been indiscreet'. Thomson further declared 'that it is very important that as few of the German refugees as possible should be concerned in this work, as in the present state of things I do not, to speak frankly, feel too confident of any of them'. He proposed a solution to the problem, writing: 'It is different in the case of a man who is naturalised, and has therefore given pledges which he cannot revoke.'[224] While the example of the University of Bristol's Physics Department illustrates the magnitude the internment measures sometimes took, Hans Kronberger's case represents a peculiar personal tragedy. Born in the Austrian city of Linz in 1920, the future collaborator on the

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[220] Heitler and London to Simpson, 1 July 1940, MS S.P.S.L. 328/1, fol. 104^{r}; Hoch, 'Reception of Central European Refugee Physicists', p. 228; Leonard Rotherham, 'Hans Kronberger, 1920-1970', *BMFRS*, 18 (November 1972), 412-26 (p. 414); Tyndall to Heitler, 17 June 1940; 'University of Bristol: Alien Scientists and Research Workers in Internment', 7 August 1940, attached to letter, Tyndall to Under Secretary of State, Aliens Department, 7 August 1940, Departmental Archives of the H.H. Wills Physics Laboratory, University of Bristol, Bristol, United Kingdom (hereafter H.H. Wills Physics Laboratory).

[221] Tyndall to Egerton, 26 June 1940, MS S.P.S.L. 328/1, fols 103^{r}-103^{v} (fol. 103^{r}). Arthur M. Tyndall became involved in the matter of his interned colleagues, Tyndall to [Simpson], 10 July 1940, MS S.P.S.L. 328/1, fol. 105^{r}.

[222] See, for example, Tyndall to Thomson, 12 June 1940; Tyndall, 'Memorandum on Nuclear Physics Work at Wills Physical Laboratory, University, Bristol', n.d., attached to letter, Tyndall to Pye, 24 June 1940, H.H. Wills Physics Laboratory. The memorandum also mentions another German-speaking émigré, K. Sternschluss (p. 2).

[223] Tyndall to Thomson, 18 June 1940, H.H. Wills Physics Laboratory, p. 3.

[224] Thomson to Tyndall, 17 June 1940, H.H. Wills Physics Laboratory, p. 1.

postwar British atomic weapons programme was still a student during the war. Unlike his parents and his only sister who were murdered in the Holocaust, he had managed to emigrate to the United Kingdom in 1938 when Germany invaded Austria. He was then interned from 1940 until 1942, first on the Isle of Man and later deported to Australia.[225]

Another émigré, Oskar Bünemann, was interned in Canada and returned to Liverpool in January 1941.[226] The case of Bünemann represented another injustice of the British practice of interning 'enemy aliens'. Born of German parents in Milan, Italy, Oskar Bünemann attended the highschool *Gelehrtenschule des Johanneums* in Hamburg where he also began to study mathematics at the university. After spending three months during the summer of 1933 in a labour camp, he engaged in clandestine political action against the National Socialist regime. Once exposed as an opponent of the 'Third Reich', he served 18 months in prison. Upon his release in October 1935, Bünemann emigrated to the United Kingdom where he resumed his studies under Douglas R. Hartree at the University of Manchester.[227] He was later engaged in atomic weapons research during the war and joined the Theoretical Division of the AERE Harwell after the war.[228] Even famous scientists such as the Austrian-born Hermann Bondi were not spared the internment experience. Bondi was also deported, but released after six months to conduct crucial work on the improvement of radar.[229]

On 3 July 1940, only a day after about 700 internees had perished on board the Newfoundland-bound *Arandora Star* which was torpedoed and sunk by a German submarine, Fuchs boarded the *Ettrick* at Liverpool and embarked on the two-week-long journey across the Atlantic.[230] The sinking of the *Arandora Star*

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[225] 'Kronberger, Hans', in *Biographisches Handbuch der deutschsprachigen Emigration nach 1933* (see 'Fuchs, Klaus Emil Julius', above), II (1983), p. 668.
[226] Bünemann to The Secretary, Society for Protection of Science [and Learning], 20 January 1941, MS S.P.S.L. 474/3, fols 359^{r}-361^{r}.
[227] Oscar [*sic*] Bünemann, 'Curriculum Vitae', May 1939, MS S.P.S.L. 474/3, fol. 353^{r}.
[228] Perrin to Gorrell Barnes, 'T.A. Staff for U.S.A.', 31 January 1944, TNA, CAB 126/331, p. 3; Chadwick to Bünemann, 1 June 1945; Chadwick to Massey, 25 July 1945, the Papers of Sir James Chadwick, 1914-1974, Churchill Archives Centre, Churchill College, University of Cambridge, Cambridge, United Kingdom (hereafter CHAD), CHAD IV/3/7; 'A.E.R.E. Programme No. 3, September 1947', pp. 1-5.
[229] Wasserstein, p. 254.
[230] Moorehead, *The Traitors*, pp. 78-81; Michael Seyfert, '"His Majesty's Most Loyal Internees": The Internment and Deportation of German and Austrian Refugees as "Enemy Aliens". Historical, Cultural and Literary Aspects', in *Exile in Great Britain: Refugees from Hitler's Germany*, ed. by Gerhard Hirschfeld (Leamington Spa: Berg; Atlantic Highlands, NJ: Humanities Press, 1984), pp.

generated many fears and worries amongst the families and relatives of many internees.[231] Like Fuchs, Nobel-laureate-to-be Max Perutz also traveled on the *Ettrick*. He vividly described the unbearable conditions onboard the ship: 'Suspended like bats from the mess decks' ceilings, row upon row of men swayed to and fro in their hammocks. In heavy seas, their eruptions turned the floors into quagmires emitting a sickening stench'. To make matters worse, '[c]ockroaches asserted their prior tenancy of the ship,' Perutz recalled, and '[t]he commanding colonel called us scum of the earth all the same, and once, in a temper, ordered his soldiers to set their bayonets upon us.'[232] But the conditions on board the *Ettrick* were only a kind of foreboding of what awaited the internees in Canada.

Klaus Fuchs, who bore internee number 417, arrived in Quebec, Canada, on 13 July 1940. He was, at first, interned at Camp L until 16 October 1940 when he was transferred to Camp N where he stayed until he was returned to the United Kingdom on 17 December 1940.[233] Despite all hardships, a university was set up in Camp L and Klaus Fuchs even lectured physics classes. At Camp N, sanitary conditions deteriorated dramatically. The internees, who numbered about 720, were housed in train shacks and had six toilets and five taps at their disposal.[234] Herbert Fröhlich recalled the sudden occurrences of panic and hysteria on the part of the guards in internment camps. These could sometimes take bizarre forms as, for example, in the case of Walter Heitler whom they accused of giving secret signals to German pilots when his wife hung some of his light clothes on a line to dry after she had washed them.[235] In spite of the harsh conditions Klaus Fuchs later noted on his internment experience, 'I felt no bitterness by the internment because I could understand that it was necessary and that at that time England could not spare good

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163-93 (p. 175); Ronald Stent, *A Bespattered Page? The Internment of His Majesty's "Most Loyal Aliens"* (London: Deutsch, 1980), pp. 96-97.

[231] Born to Simpson, 5 July 1940, MS S.P.S.L. 328/1, fol. 167[r].

[232] Max F. Perutz, *Is Science Necessary? Essays on Science & Scientists* (London: Barrie & Jenkins, 1989; repr. Oxford: Oxford University Press, 1992), pp. 102-03.

[233] Klaus Fuchs' internee record in TNA, KV 2/1253. This file contains the following documents which were forwarded by the Royal Canadian Mounted Police and which relate to Fuchs' internment. These include a copy of Fuchs'Canadian Prisoner of War internee record card with a picture of Fuchs wearing his internee number (417) attached, a 'Report on 1st Degree Relatives of Internees Living in Canada, 8 December 1940', a copy of 'Record of Male Internees, "L" Internment Camp: Fuchs, Klaus Emil Ludwig [*sic*] Julius', 27 August 1940, as well as a 'Medical History Sheet', 15 December 1940, and a 'Record of Prisoner of War', n.d., detailing all the transfers of Fuchs to and from as well as between internment camps in Canada.

[234] Robert Williams, *Klaus Fuchs*, p. 33. For a contemporary description of Canadian internment camps see also Dr. Glücksmann's paper cited in Beveridge, pp. 86-90.

[235] Fröhlich, 'Moving On', p. 226.

people to look after the internees, but it did deprive me of the chance of learning more about the real character of the British people'.[236] In a letter to Arthur Tyndall, Robert Sack expressed well the ambiguous feelings he had about his internment, writing:

> It is a strange feeling, though, to be guarded by soldiers within an enclosure of barbed wire, having a Polish mother, a brother serving actively against Hitler – God knows what has happened to my people in France – and having offered my services so wholeheartedly and repeatedly.[237]

An inmate who spent about four months in the same camps with Fuchs in Canada from August 1940 until Klaus Fuchs's return to the United Kingdom indicated that Fuchs had apparently become involved in administrative matters there. The anonymous man described Fuchs's character as 'very far from easy, but not a hermit in the sort of camp life'. The man described the internees at Camps L and N as 'predominantly Jewish', and the atmosphere there, in particular in the latter camp as 'predominantly anti-Nazi'.[238] During the time of his internment in Canada Fuchs, for example, offered moral support for Jewish fellow inmates whom he called retrospectively the 'most displaced' people after Hitler's coming to power. Not only did he try to protect his fellow internees from being accidentally sent to a camp of Nazi POWs but also from being exchanged for Canadian POWs held by the Third Reich, a fear that caused much anxiety among the inmates of the camp at the time. Moreover, he appealed to the authorities not to appoint a son of the former German crown prince as camp leader.[239]

From July 1940 onwards, public opinion had become more benevolent towards the internees because of the tragedy of the *Arandora Star* and after complaints from internees about unbearable conditions on the ships and in the camps

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[236] 'Statement of Emil Julius Klaus Fuchs, of 17 Hillside, Harwell, Berkshire, who saith-', 27 January 1950, TNA, KV 2/1263, p. 6.

[237] Sack to Tyndall, 5 July 1940. See also other correspondence between interned German-speaking émigré scientists (and family members) and Arthur M. Tyndall: Fröhlich to Tyndall, 8 August 1940; Hoselitz to Tyndall, 20 August 1940; Maria Gross to Tyndall, 4 September 1940, H.H. Wills Physics Laboratory.

[238] 'Interrogation by Mr. Serpell at Room 055, 23 March 1950', TNA, KV 2/1270, pp. 2-4. The description of a 'predominantly Jewish' atmosphere at Camps 'L' and 'N' contradicts Alan Moorehead's and Rudolf Peierls's statement that Fuchs was erroneously transferred to a camp for hardcore Nazi sympathizers in Canada; Moorehead, *The Traitors*, pp. 78-81; Peierls, *Bird of Passage*, p. 163.

[239] *Prof. Dr. Klaus Fuchs*; Skardon, 'Emil Julius Klaus Fuchs', 22 December 1949, p. 2. Max Perutz also mentioned the descendant of Emperor William II (pp. 102-03). An anonymous fellow internee of Klaus Fuchs mentions a Prussian Prince by the name of von Dingen who was camp speaker at Camp L in Canada where Fuchs was first interned; 'Interrogation by Mr. Serpell at Room 055, 23 March 1950', TNA, KV 2/1270, p. 11.

had reached the outside world. As a consequence of criticism from all ranks of British society, Whitehall was forced to reconsider and finally to abandon its internment policy.[240] Klaus Fuchs, like many of his fellow internees, was thus officially released from internment on 19 October 1940 and granted permission to return to the United Kingdom and continue his research at Edinburgh University. It was, however, not until 11 January 1941 that he landed in Liverpool and was, by order of the Secretary of State, exempted from internment as well as from the peculiar limitations in place until further notice two days later.[241]

After his return to the United Kingdom, Klaus Fuchs stayed in Edinburgh for a short period until he moved to Birmingham to start his new job under Rudolf Peierls in May 1941. The latter was as impressed with the young German émigré's work as Max Born, who praised Fuchs in 1939 as his 'best and most efficient collaborator' as well as being 'at present the best theoretical physicist of the younger generation in Scotland'.[242] Klaus Fuchs later expressed his gratitude for Max Born's help during his early years in the United Kingdom. He described himself as the 'junior partner' in his collaboration with his mentor.[243] It was through Rudolf Peierls that Fuchs eventually became an integral part of the British effort to develop the atom bomb.

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[240] Louise Burletson, 'The State, Internment and Public Criticism in the Second World War', in *The Internment of Aliens in Twentieth Century Britain* (see Panayi, above), pp. 102-24 (pp. 106, 111-12, 115-16, 121).

[241] 'Internee's Consent to Release and Return to the United Kingdom, RE: Fuchs, Klaus E. J.', n. d., but enclosed with letter, Brigadier-General E. de E. Panet, District Officer Commanding, Military District No. 4 to Director of Internment Operations, Department of the Secretary of State, Ottawa, Ontario, 17 December 1940, and Fuchs's personally signed medical waiver form ('No. 581. Fuchs, K., 15 December 1940), TNA, KV 2/1253; The Under Secretary of State, Home Office (Aliens Department), London to the Chief Constable, City Police, Edinburgh, 17 October 1940; The Chief Constable, City Police Edinburgh to the Superintendent, Central Register of Aliens, Home Office, London, RE: Fuchs, Emil Julius Klaus, 24 January 1941; Macauley to Chief Constable, Birmingham City Police, RE: Control of Aliens. Emil Julius Klaus Fuchs, - German, 16 August 1941, TNA, KV 2/1259. In a similar manner, Herbert Fröhlich, P. Gross, Kurt Hoselitz, Hans and Werner Heitler, Heinz London and Arno Sack were released from internment; The Under Secretary of State, Home Office, Aliens Department to Tyndall, 5 September 1940; The Under Secretary of State, Home Office, Aliens Department to Tyndall, 6 September 1940; Under Secretary of State, Home Office, Aliens Department, 10 September 1940; The Under Secretary of State, Home Office, Aliens Department to Tyndall, 19 September 1940; The Under Secretary of State, Home Office, Aliens Department to Tyndall, 21 September 1940; The Under Secretary of State, Home Office, Aliens Department to Tyndall, 4 November 1940, H.H. Wills Physics Laboratory.

[242] Max Born [to Aliens Tribunal], 30 October 1939, TNA, KV 2/1259; Peierls, *Bird of Passage*, pp. 163-64.

[243] *Prof. Dr. Klaus Fuchs.*

Almost Accidental Beginnings: Work on the Early British Nuclear Weapons Programme

After their arrival in the United Kingdom, German-speaking émigré atomic scientists did not become involved in nuclear weapons research immediately. Like the many existential problems they often had to master during the early days of their lives in their new host country, many of them also had to overcome serious obstacles in order to integrate professionally into the British nuclear physics community. First and foremost, the émigré atomic scientist faced fundamental differences in national preferences in research and teaching styles between Continental Europe and the United Kingdom.

While German universities had a strong emphasis on theory, British schools and physics departments, in general, leaned more towards empirical research.[244] To understand these differences in stylistic preferences, which were rooted in both the historical development and geographical distribution of the main centres of theoretical physics, it is necessary to point to Germany's role in the development of the new physics, above all, quantum physics. During the era of the Weimar Republic, three major centres of modern physics developed at Göttingen, Berlin, and Munich.[245] Cambridge, Copenhagen, Leiden and Zürich were the four remaining world-leading physics institutes outside of Germany.[246] Rudolf Peierls, like most German-speaking émigré atomic scientists at the time, attended more than one of these well-known centres: he studied at the universities of Berlin and Munich, as well as at the ETH (*Eidgenössische Technische Hochschule*, the Federal Institute of Technology) in Zürich and spent half of his Rockefeller scholarship at the Cavendish Laboratory in Cambridge.[247]

In Britain, by contrast, the situation was quite different. Here, the Cavendish Laboratory in Cambridge was an isolated centre of theoretical physics. Aside from the Cavendish, the University of Bristol's H. H. Wills Laboratory with its focus on theoretical solid-state physics represented the only other exception from the

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[244] Berghahn, p. 80; Hoch, 'Reception of Central European Refugee Physicists', pp. 234-39; Helge Kragh, *Quantum Generations: A History of Physics in the Twentieth Century* (Princeton, NJ: Princeton University Press, 1999), p. 249.

[245] Alan D. Beyerchen, *Scientists under Hitler: Politics and the Physics Community in the Third Reich* (New Haven: Yale University Press, 1977), pp. 6-9; Medawar and Pyke, p. 8.

[246] Klaus Bärwinkel, 'Die Austreibung von Physikern unter der deutschen Regierung vor dem Zweiten Weltkrieg. Ausmaß und Auswirkung', in *Die Künste und die Wissenschaften im Exil 1933-1945* (see Horak, 'Filmkünstler im Exil', pp. 569-99 (p. 581).

[247] Peierls, *Bird of Passage*, pp. 16-32, 40-45, 90-98.

primarily experimentalist scheme found at British physics institutes at the time. The award of a major research grant to the Professor of Theoretical Physics at Bristol University, John E. Lennard-Jones, by the governmental Department of Scientific and Industrial Research (DSIR) in June 1930 – the first of its kind to acknowledge theoretical physics on such a large scale – enabled the formation of a theoretical research school there. At one time or another, Lennard-Jones's successor, Nevill Mott, employed several German-speaking émigré atomic scientists, including, apart from Klaus Fuchs, Hans Bethe, Walter Heitler, Herbert Fröhlich, Lorenz Frank, Kurt Hoselitz, Heinz London, Philipp Gross and Robert Arno Sack at the H. H. Wills Laboratory.[248] And they also helped each other: Klaus Fuchs and Heinz London, for example, proofread the manuscript of Herbert Fröhlich's monograph *Elektronentheorie der Metalle* (*Theory of Dielectrics*).[249]

Although the traditional British leaning towards empiricism hampered, in general, the integration of émigré atomic scientists, Rudolf Peierls and Klaus Fuchs faced fewer problems than most members of their cohort. As an established physicist at the time of his departure from Germany, Peierls integrated relatively quickly into the British physics community. Still, he encountered initial problems and, during his early days in Britain, he felt his stay in the United Kingdom had a temporary quality. As a consequence, the Peierls called their daughter Gaby which was a name 'pronounceable in any language of any country where we might eventually live'.[250]

After some fixed-term appointments, Peierls was eventually appointed to a tenured position at the University of Birmingham. The fact that before the war, Max Born and Franz Simon were the only other émigrés to be granted permanent positions at middle-ranking institutions like Birkbeck College and the universities of Birmingham, Bristol, Edinburgh and Oxford where strong clusters of émigré physicists were found, underlined both Peierls's high calibre and the exceptionality of his case. In a different way, Klaus Fuchs's academic career also varied significantly from that of most émigré physicists. As a junior scientist, Klaus Fuchs,

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[248] S. T. Keith and Paul K. Hoch, 'Formation of a Research School: Theoretical Solid State Physics at Bristol 1930-54', *British Journal for the History of Science*, 18. 3 (1986), 19-44 (pp. 19, 33-4); Bernard Lovell, 'Bristol and Manchester – The Years 1931-9', in *The Making of Physicists*, ed. by Rajkumari Williamson (Bristol: IOP Publishing, 1997), pp. 148-160 (p. 156); Tyndall to Secretary, AAC, 19 June 1934, MS S.P.S.L. 324/4, fol. 126[r].

[249] Herbert Fröhlich, *Elektronentheorie der Metalle* (Berlin: Springer, 1936), unpaginated preface (*Vorwort*). Fröhlich's book was published in English by the Oxford-based Clarendon Press in 1949 under the title *Theory of Dielectrics: Dielectric Constant and Dielectric Loss*.

[250] Peierls, Interview by Weiner, p. 35.

like other émigré students such as Hans Kronberger, had not completed his higher education at the time of his arrival in the United Kingdom. As graduates of institutions of higher education in the United Kingdom, Fuchs and Kronberger held British degrees, which helped them pursue impressive careers in their new host country where they became involved in the atomic energy project after the war.[251]

The group of German-speaking émigré atomic scientists that came to Britain was, of course, not exclusively composed of theoreticians but also of experimentalists like Egon Bretscher and Otto R. Frisch. It was certainly easier for experimentalists to integrate into the British physics community with its strong orientation towards experimentation. And of all the German-speaking émigré theoretical physicists who attended Cambridge at one time or another, including Rudolf Peierls, Hans Bethe, Max Born, Richard Courant, Albert Einstein, Paul Ewald, Leopold Infeld, Victor Weisskopf, none eventually settled there. But it was the experimental physicist Otto R. Frisch, who was appointed professor at Cambridge after the war.[252] In spite of their better initial position in their host country's job market, experimentalists still faced considerable problems finding jobs.

Theoreticians like Peierls and Fuchs and experimentalists like Frisch alike faced another major obstacle that lay rooted in the structure and sociology of the British physics community, especially its relatively small size.[253] Their assimilation depended heavily on establishing networks with universities, laboratories, funding bodies, etc., and this further complicated the situation for many émigré nuclear scientists, regardless of their qualification.[254] And there existed indeed a reciprocal relationship between the individual physicists and their particular scientific environment.[255]

Here, Erwin Schrödinger's failure to adapt to the research culture at Oxford University serves perhaps as the most prominent negative example to highlight the

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[251] Francis L. Carsten, 'German Refugees in Great Britain 1933-1945: A Survey', in *Exile in Great Britain* (see Seyfert, above), pp. 11-28 (p.16); Hoch, 'Reception of Central European Refugee Physicists', pp. 231-34.
[252] Hoch, 'Reception of Central European Refugee Physicists', pp. 237-38.
[253] H. Stuart Hughes, *The Sea Change: The Migration of Social Thought, 1930-1965* (New York: Harper & Row, 1975), p. 38; Helge Pröss, *Die Deutsche Akademische Emigration nach den Vereinigten Staaten, 1933-41* (Berlin: Duncker & Humblot, 1955), pp. 33-36.
[254] Hoch, 'Reception of Central European Refugee Physicists', p. 219.
[255] Gustav V.R. Born, 'The Effect of the Scientific Environment in Britain on Refugee Scientists from Germany and Their Effects on Science in Britain', *Ber. Wissenschaftsgesch.*, 7. 3 (1984), 129-43.

complex processes revolving around the integration of émigré atomic scientists.[256] The Viennese émigré philosopher Karl Popper, who met him in Oxford, described Schrödinger as 'very unhappy in Oxford. He had come there from Berlin where he had presided over a seminar for theoretical physics which was probably unique in the history of science', with such illustrious faculty members as Albert Einstein, Max von Laue, Walther Nernst and Max Planck. Although Schrödinger 'had been very hospitably received' at Oxford University, Popper observed that he missed 'the passionate interest in theoretical physics, among students and teachers alike'.[257] Oxford, however, was not the only example of Schrödinger failing to integrate into his scientific environment: in 1946, he unsuccessfully applied for the position as Chair of Theoretical Physics at Liverpool University, which was ultimately given to Herbert Fröhlich instead.[258]

Although many German-speaking émigré atomic scientists initially encountered difficulties in integrating into the British science community, their presence provided an innovative impulse: since their coming to the United Kingdom coincided with an increase in physics centres, they helped spread the advancement of new, interdisciplinary sub-fields within the physical sciences.[259] Klaus Fuchs's and, in particular, Rudolf Peierls's participation in the British nuclear weapons programme is a good indicator of their successful integration process.

That Fuchs and Peierls assumed crucial roles in the British atomic energy project was by and large the consequence of two chief factors: their legal status as 'enemy aliens' and their insider knowledge of the German nuclear physics community and the scientific potential available to the National Socialist regime that translated into an alarm and urgency greater than their British-born colleagues felt. When the Second World War broke out, Peierls's and Fuchs's status as 'enemy aliens' not only brought with it the peril of internment but it also affected significantly the direction of their research. Since this status did not permit them to participate in secret war research on radar or the proximity fuse, they were almost accidentally pushed in the direction of nuclear arms research, which was not

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[256] Paul K. Hoch and E.J. Yoxen, 'Schrödinger at Oxford: A Hypothetical National Cultural Synthesis which Failed', *Annals of Science*, 44. 6 (1987), 593-616.
[257] Karl Popper, *Unended Quest: An Intellectual Biography* (La Salle, IL: Open Court, 1976), p. 108.
[258] Gerard J. Hyland, 'Herbert Fröhlich, FRS: A Physicist Ahead of His Time', in *Herbert Fröhlich, FRS: A Physicist Ahead of His Time*, ed. by Gerard J. Hyland and Peter Rowlands (Liverpool: University of Liverpool, 2006), pp. 221-339 (p. 255).
[259] Hoch, 'Reception of Central European Refugee Physicists', p. 231.

regarded, at the time, as viable for the outcome of the war, and consequently not classified as secret war work.[260]

Apart from this legal factor, their personal experiences with National Socialism and their insider knowledge of the German nuclear physics community served as a strong motivation for them to actively engage in atomic arms research. Both Rudolf Peierls and Klaus Fuchs, for example, had studied under Werner Heisenberg, who now played a key role in Adolf Hitler's atom bomb project.[261] Peierls and Fuchs used their insider knowledge and drafted reports on current atomic-related German-language publications as well as on the activities of physicists inside the Third Reich, covering relevant research, university appointments, etc.[262] Peierls carried on with this scientific intelligence work during the war. He provided James Chadwick, for instance, with a list of physicists inside Nazi Germany who might conduct nuclear weapons research, including the names of Werner Heisenberg, Karl Wirtz, Manfred von Ardenne and Paul Harteck.[263]

After the war, Rudolf Peierls described his reasons for engaging in work on the atom bomb, saying that

> there was never any question that it might be wrong to think out – and not only think out, but agitate for more work on – atomic weapons, for two reasons. The most obvious one was that we were involved with Nazi Germany. There was quite a possibility that they might be at work developing similar things. We didn't know from the start how big the necessary effort would be. And the thought of Hitler being in full possession of such a weapon was, of course, terribly frightening. There was no question that that must be prevented.[264]

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[260] Martin J. Sherwin, *A World Destroyed: The Atomic Bomb and the Grand Alliance* (New York: Knopf, 1975), p. 18.

[261] Rudolf Peierls, 'Als Student bei Heisenberg', in *Werner Heisenberg in Leipzig 1927-1942*, ed. by Christian Kleint and Gerald Wiemers (= *Abhandlungen der Sächsischen Akademie der Wissenschaften zu Leipzig, Mathematisch-naturwissenschaftliche Klasse*, 28. 2 (1993)), pp. 104-07; Peierls, *Bird of Passage*, pp. 34-35, 39-40. Records from the University of Leipzig indicate that Klaus Fuchs was enrolled as a student (registration number 2328) in mathematics and physics from 12 May 1930 until 1 August 1931, taking at least one class (*Übung*) on electrodynamics with Heisenberg; 'Verzeichnis der Studenten und Hörer bei Werner Heisenberg', ed. by Gerald Wiemers, in *Werner Heisenberg in Leipzig 1927-1942* (see Peierls, 'Als Student bei Heisenberg', above), pp. 144-72 (p. 151).

[262] See, for example, 'Report on German Publications', n.d., attached to letter, Peierls to Chadwick, 23 September 1941; Peierls to Chadwick, 20 November 1941, CHAD I/19/6; 'Report on the 46th Meeting of the Deutschen Bunsen Gesellschaft in Zeitschrift für Electrochemie. Volume 47. December 1941. Pp. 819-820'; 'Report on Current German Literature. February, 1942'; 'Report on current German literature. August 1942'; Peierls to Cherwell, 10 December 1942'; Peierls to Simon, 8 March 1943', TNA, AB 3/94.

[263] Peierls to Chadwick, 19 May 1944, TNA, AB 1/631.

[264] Peierls, Interview by Weiner, p. 149.

In 1985, Rudolf Peierls admitted that he had at the time the feeling that 'there was some mild work going on' in Germany, 'no crash program [...] but we didn't dare rely on it'.[265]

Although Klaus Fuchs had a double motivation to engage in the British nuclear weapons programme because of his commitment to the Soviets, which will be discussed in depth in chapter four, he also shared Peierls's great anxiety about an atom bomb in Hitler's hands. Fuchs stressed this point in a video interview conducted by the East German State Security, *Staatssicherheit*, in the mid-1980s. The interviewer confronted him with a passage from Max Born's autobiography. Born was amongst a group of high-profile German-speaking émigré scientists, including Peter Debye, Albert Einstein, Lise Meitner, Erwin Schrödinger, Fritz London, Gerhard Herzberg, Hertha Sponer, and Otto Stern, who chose not to get involved in atomic weapons research for various reasons.[266] Here, Fuchs's former mentor at Edinburgh University described several discussions that he had with Fuchs after the latter had received an invitation to join Rudolf Peierls's team in Birmingham to work on nuclear-weapons-related matters and, in spite of the veil of secrecy, it was obvious to Born what Fuchs was going to work on. As Max Born wrote in his autobiography:

> I believe I had a strong feeling that an atomic super-bomb would be a devilish invention and I wanted nothing to do with it. For though I hated Hitler and the Nazis more than I can express, and though I despised the German people because they had brought him to power and fought for him like lunatics, I could never bring myself to consent to actions by which not only Nazis and Hitler's soldiers were killed but also innocent children and people who shared my feelings. But Fuchs thought otherwise. He hated Hitler and his gang so violently that he was willing to use any weapon to destroy them and to prevent the world from getting into their grip. So he accepted Peierls's offer and disappeared.[267]

When he was confronted with this passage in the 1980s, Klaus Fuchs replied that while he respected the pacifist views of Max Born and his wife Hedwig, the majority of physicists and in particular the émigrés who had experienced National Socialism directly and worked on the development of the atomic bomb such as Hans Bethe, Niels Bohr, Victor Weisskopf were driven by the fear of losing the race for the new weapon to Germany.[268] Later in the interview, he also objected to a phrase

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[265] Rudolf Peierls, Interview by Mark Walker, 7 April 1985, AIP, p. 21.
[266] Klaus Fischer, 'Physik', in *Handbuch der deutschsprachigen Emigration 1933-1945* (see Krohn, above), pp. 824-36 (p. 834).
[267] Max Born, *My Life*, p. 287.
[268] *Professor Dr. Klaus Fuchs*.

used by the interviewer in reference to Born's statement, suggesting the scientists' work at Los Alamos was driven by a 'collective lack of conscience'.[269]

Many German-speaking émigré atomic scientists in the United States such as Hans Bethe, Lothar Nordheim, George Placzek, Leo Szilard, Edward Teller and Eugene Wigner shared these concerns over a German nuclear weapon. And Victor Weisskopf later stated: 'I have often wondered what our attitudes would have been had we known that there was no seriously competitive Nazi effort towards a bomb'.[270] In the United States, these fears galvanized in the so-called Einstein Letter of 2 August 1939. The three Hungarian-born scientists Leo Szilard, Edward Teller and Eugene Wigner convinced Albert Einstein to sign a letter addressed to FDR, warning the President that Germany could possibly produce an atomic bomb in the not too distant future.[271]

In Britain, Rudolf Peierls and Otto Frisch followed suit. Despite the beginning of World War II, a strong internationalism still dominated science, and the important developments in atomic physics made by scientists in Nazi Germany and elsewhere were available for everyone to read. Surprisingly, the outbreak of the Second World War in September 1939 did not initially speed up atomic research, but slowed it down.[272] This was largely the result of the British government's focus on radar, with most scientists involved in radar-related or other research, which was seen as crucial for the war effort.[273]

As a consequence of his fear of a German atomic bomb and the restrictions imposed on 'enemy aliens', Rudolf Peierls started to give serious thought to the feasibility of a nuclear device by trying to calculate the critical mass of uranium in the summer of 1939.[274] Shortly after Otto Frisch had arrived at the University of Birmingham that same summer, the two scientists started their collaboration on what

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[269] Ibid.
[270] Victor Weisskopf, *The Joy of Insight: Passions of a Physicist* (New York: Basic Books, 1991), p. 118-19, 137; Hans Bethe, interview by Mario Balibrera, 9 November 1979, Los Alamos Historical Museum Archives, Los Alamos, New Mexico, United States (hereafter LAHM), p. 14; Lothar Nordheim, interview by Bruce Wheaton, 24 July 1977, AIP, p. 43.
[271] Einstein to Roosevelt, 2 August 1939 (repr. in *The American Atom: A Documentary History of Nuclear Policies from the Discovery of Fission to the Present 1939-1984*, ed. by Robert Chadwell Williams and Philip L. Cantelon (Philadelphia: University of Pennsylvania Press, 1984), pp. 12-14); Richard Rhodes, *Making of the Atomic Bomb*, pp. 303-11.
[272] Gowing, *Britain and Atomic Energy*, pp. 33-34.
[273] Robert Buderi, *The Invention that changed the World: The Story of Radar from War to Peace* (New York: Simon & Schuster, 1996; repr. London: Abacus, 1998), pp. 77-97.
[274] Clark, p. 43.

later became known as the 'Frisch-Peierls Memorandum'.[275] Like Peierls, Frisch was deeply disturbed about the prospect of a nuclear-capable National Socialist regime in Germany.[276]

This pivotal document can only be understood in the context of the scientific discoveries that preceded it, in particular that of nuclear fission as well as the concept of a chain reaction, which is a significant feature of nuclear fission. About six years earlier, Leo Szilard had already discovered the idea of a chain reaction in theory. A chain reaction is based on the emission of neutrons. Starting with a single uranium nucleus, Szilard assumed that fission could not only produce large quantities of energy but could further result in a self-sustaining 'chain reaction' of ever-increasing amounts of energy. If kept in check, this reaction could serve as an endless power source, while uncontrolled it could cause a very destructive explosion. Leo Szilard was partly inspired by the science-fiction writer H.G. Wells, who had almost prophetically predicted the peaceful use of nuclear energy as well as atomic bombs in warfare by the 1950s in his science fiction novel *The World Set Free* in 1914.[277] Consequently, he applied for a patent explaining his findings, which he allocated to the British Admiralty in order to keep his discovery from becoming public knowledge.[278]

Although the patent had been filed in 1934 with the British Patent Office, its transformation into a viable option did not take place until 1938 when nuclear fission was discovered. Otto Frisch and his aunt Lise Meitner played a decisive role in confirming the possibility of nuclear fission. Shortly before Christmas 1938, Otto Hahn sent his longtime collaborator Lise Meitner, who had by then emigrated to Sweden to escape Nazism, a letter with his and his colleague Fritz Strassmann's latest findings to ask for her interpretation. At Christmas, when Otto Frisch was still at Niels Bohr's institute in Copenhagen, he visited his aunt in Kungälv near Gothenburg, Sweden.[279] Subsequently, Frisch and Meitner composed two papers

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[275] Peierls, *Bird of Passage*, p. 153.
[276] Frisch, *What Little I Remember*, pp. 126-27.
[277] Leo Szilard, *Leo Szilard: His Version of the Facts: Selected Recollections and Correspondence*, ed. by Spencer R. Weart and Gertrud Weiss Szilard (Cambridge, MA: MIT Press, 1978), p. 17.
[278] Sherwin, p. 20.
[279] Frisch, Interview by Weiner, pp. 34-37; Otto R. Frisch and John A. Wheeler, 'The Discovery of Fission: How It All Began', *Physics Today*, 20. 11 (November 1967), 43-48 (pp. 47-48); Patricia Rife, *Lise Meitner and the Dawn of the Nuclear Age* (Boston: Birkhäuser, 1999), pp. 20-21, 26-27, 29-39, 178-96; Ruth Lewin Sime, *Lise Meitner: A Life in Physics* (Berkeley: University of California Press, 1996), pp. 231-58.

dealing with Hahn's and Strassmann's discovery that were published in *Nature* in February/March 1939.[280] The term 'fission', which describes the break up of a uranium nucleus with the release of energy, was used here for the first time in connection with atoms. The American biologist William Arnold had suggested it to Frisch.[281] Soon after the news broke, several international research installations, including Columbia University, New York; the Carnegie Institution; Johns Hopkins University, the University of California, Berkeley; as well as Frédéric Joliot-Curie's institute in Paris, confirmed Frisch's and Meitner's theoretical findings.[282] There was, however, only very little discussion of potential military applications of nuclear fission at Niels Bohr's Institute in Copenhagen where Frisch returned to, and stayed, until he moved to Birmingham in July 1939.[283]

As early as 30 April 1939, the *Sunday Express* had run the headline 'Scientists Make An Amazing Discovery' with the highly dramatic subtitle 'Stumble On A Power "Too Great To Trust Humanity With": A Whole Country Might Be Wiped Out In One Second'. The article went into astounding detail, informing readers that the experiments conducted in laboratories in Liverpool, Birmingham and Cambridge and elsewhere in the world 'concern a new way of producing energy in conceivable quantities by splitting the atom of a rare metal, called uranium'.[284]

Rudolf Peierls, who worked at the time at the University of Birmingham, was part of the anonymous group of scientists mentioned in the *Sunday Express*. After calculating that the critical mass of uranium 235 needed for a nuclear device was much smaller than previously anticipated, Rudolf Peierls turned to Otto Frisch for confirmation of his findings. Then, the two physicists began working together on the

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[280] Lise Meitner and Otto R. Frisch, 'Disintegration of Uranium by Neutrons: A New Type of Nuclear Chain Reaction', *Nature*, 143. 3615 (11 February 1939), 239-40; Lise Meitner and Otto R. Frisch, 'Products of the Fission of the Uranium Nucleus', *Nature*, 143. 3620 (18 March 1939), 471-72.

[281] Otto R. Frisch, Interview, 19 June 1973, LAHM, p. 8; Frisch and Wheeler, p. 48.

[282] Lawrence Badash, Elizabeth Hodes and Adolph Tiddens, 'Nuclear Fission: Reaction to the Discovery in 1939', *Proceedings of the American Philosophical Society* (hereafter *PAPS*), 130. 2 (1986), 196-231 (p. 207).

[283] Frisch, Interview by Weiner, p. 39.

[284] C.A. Lyon, 'Scientists Make An Amazing Discovery', *Sunday Express*, 30 April 1939, p. 1. I am grateful to Peter Rowlands for pointing me towards this source. While the article does not mention it, it is possible that Lyon was inspired by an article in the *New York Times* published on the day before; 'Vision Earth Rocked by Isotope Blast: Scientists Say Bit of Uranium Could Wreck New York', *New York Times*, 29 April 1939, p. 1.

problem.[285] Because of fears of espionage they did not even entrust the manuscript to a secretary but Peierls typed it himself.[286]

The so-called Frisch-Peierls Memorandum, which was drafted in February 1940, consisted of two sections, entitled 'Memorandum on the Properties of a Radioactive Super-bomb' and 'On the Construction of a "Super-bomb"; based on a Nuclear Chain Reaction in Uranium'. The first part detailed the effects of a nuclear weapon and raised the moral implications of such a weapon of mass destruction, while the second part was primarily concerned with technical niceties.[287] Frisch and Peierls complimented one another on calculating the approximate amount of fissile material needed for the manufacture of an atomic bomb.[288] Perhaps the greatest achievement of their seminal memorandum lay in the fact that it assumed that the critical mass of these 'super-bombs' measured 'about one pound'.[289] The manufacture of nuclear weapons thus appeared to be feasible. The highly successful co-operation between the theoretician Peierls and the experimentalist Frisch on their memorandum represented, in a nutshell, a new approach to nuclear physics at the time and was a precursor of the path to the creation of the atom bomb that was also be taken at Los Alamos, as chapter three will show.

The 'Frisch-Peierls Memorandum' represents a chief document in the history of science in the 20th century. Not only did it anticipate, for the first time, the feasibility of a working nuclear weapon and describe its effects, but it also indicated that its authors had indeed been correct in following their intuition and had asked the appropriate questions. It appears curious that neither scientists in the United States nor in Nazi Germany had asked the same questions, let alone answered them adequately. Not only did Peierls and Frisch state that an atom bomb was feasible but they detailed the yield, destruction, and the effects of radiation and nuclear fallout. The two émigrés were apparently the first to address the problem of radioactive

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[285] Lorna Arnold, 'The History of Nuclear Weapons: The Frisch-Peierls Memorandum on the Possible Construction of Atomic Bombs of February 1940', *Cold War History*, 3. 3 (April 2003), 111-26 (p.113); Peierls, Interview by Weiner, pp. 90-91.
[286] Peierls, interview by Weiner, p. 92.
[287] Otto Frisch and Rudolf Peierls, 'Memorandum on the properties of a radioactive "super-bomb"', n.d.; Otto Frisch and Rudolf Peierls, 'On the construction of a "super-bomb", based on a nuclear chain reaction in uranium', n.d., TNA, AB 1/210. On the history of the 'Frisch-Peierls Memorandum", see Arnold, 'History of Nuclear Weapons', pp. 111-17.
[288] Peierls, Interview by Weiner, pp. 90-93.
[289] Frisch and Peierls, 'Memorandum on the properties of a radioactive "super-bomb"', p. 1.

fallout and to raise the ethical question of using an atomic weapon of mass destruction.[290]

With regard to the fallout issue, Frisch and Peierls remarked in their memorandum that '[o]wing to the spreading of radioactive substances with the wind, the bomb could probably not be used without killing large numbers of civilians, and this may make it unsuitable as a weapon by this country.'[291] The 'Frisch-Peierls Memorandum' was produced at a time when many felt that the bombing of civilians as in the case of Guernica in 1937 was disgraceful. But the Blitz and the Allied strategic bombing of German cities, which desensitized the public towards large numbers of civilian casualties, were yet to come.[292] Since there appeared to be no defence against the new weapon and its authors, like many contemporaries, condemned its use in war, Frisch and Peierls argued in their seminal memorandum that '[t]he most effective reply would be a counter-threat with a similar bomb'.[293] The 'Frisch-Peierls Memorandum' thus represents, Lorna Arnold has argued, the origin of deterrence theory.[294]

With regard to the 'Frisch-Peierls Memorandum' and its emphasis on deterrence, there remains, however, the question of the credibility of their highly abstract concept of deterrence. What the French existentialist Albert Camus postulated in his critique of capital punishment, 'Reflections on the Guillotine', in 1957, arguing that '[h]eads are cut off not only to punish but to intimidate, by a frightening example, any who might be tempted to imitate the guilty', applies to the idea of nuclear deterrence as well.[295] Since nuclear weapons extend well beyond theory, the idea of a – not yet existing, let alone tested – atom bomb as a deterrent raises the further question as to whether the existence of this weapon as such (without any demonstration) would in practice serve as an effective means of deterrence. It was apparently in part this assumption that led the Truman

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[290] Arnold, 'History of Nuclear Weapons', p. 114; Gowing, *Britain and Atomic Energy*, p. 42; Sabine Lee, 'Birmingham – London – Los Alamos – Hiroshima: Britain and the Atomic Bomb', *Midland History*, 27 (2002), 146-64 (p. 151); Szasz, *British Scientists*, p. 4.
[291] Frisch and Peierls, 'Memorandum on the properties of a radioactive "super-bomb"', p. 2
[292] Arnold, 'History', p. 114.
[293] Frisch and Peierls, 'Memorandum on the properties of a radioactive "super-bomb"', p. 2.
[294] Arnold, 'History', p. 115.
[295] Albert Camus, *Resistance, Rebellion, and Death*, transl. from the French and with an Introduction by Justin O' Brien (New York: Modern Library, 1960), p. 135.

administration to drop the atomic bomb unannounced on the Japanese city of Hiroshima.[296]

When Frisch and Peierls authored their memorandum, the Trinity test, as well as the atomic bombings of Hiroshima and Nagasaki, still lay over five years in the future. The following episode, which occurred in March 1941, after Otto Frisch had transferred to the University of Liverpool to work under James Chadwick, illuminates how abstract the nuclear threat was perceived at the time: after a German parachute mine had exploded in the courtyard behind the Victoria Building, destroying the Engineering Building, James Chadwick asked a colleague to measure the area for increased radiation levels with a Geiger counter because he feared the device could have been a German nuclear weapon.[297]

Similar incidents that underline the highly abstract understanding of the new weapon and its possible effects occurred shortly before the Trinity test of 16 July 1945. In spite of Hans Bethe's calculations, which theoretically refuted the possibility that the implosion bomb would ignite the earth's atmosphere as many of the Los Alamos scientists feared at the time, General Leslie R. Groves called the New Mexico state governor John Dempsey before the test to inform him that there was a chance he might have to declare martial law in central New Mexico. One of the most bizarre arrangements preceding the test was Groves's order to *New York Times* journalist William L. Laurence, who was the only member of the press allowed to witness the explosion, to write three press releases for three different scenarios: firstly, a story about an explosion without any damage or casualties, secondly, an article about an explosion causing severe damage and, thirdly, the obituaries of all persons present at the test, including Laurence.[298] While these accounts reveal a good amount of uncertainty about the atom bomb's destructive power, it was only after World War II and in particular with the superpowers carrying out extensive testing programmes that constantly demonstrated the destructive force of nuclear and, in particular, thermonuclear weapons, that the concept of nuclear deterrence became very credible.

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[296] J. Samuel Walker has put forth this thesis; *Prompt and Utter Destruction: Truman and the Use of Atomic Bombs against Japan*, rev. edn (Chapel Hill: University of North Carolina Press, 2004).
[297] Peter Rowlands, *120 Years of Excellence: The University of Liverpool Physics Department 1881 to 2001* (Liverpool: U-PL Communications; PD Publications, 2001), p. 20.
[298] Ferenc M. Szasz, *The Day the Sun Rose Twice: The Story of the Trinity Site Explosion July 16, 1945* (Albuquerque: University of New Mexico Press, 1984), pp. 57, 77, 86.

The 'Frisch-Peierls Memorandum' was, with the help of Mark Oliphant, passed on to Sir Henry Tizard, the chief British military scientific administrator at the time. As one of the first and foremost results of the document, the Churchill government organized a committee of scientists under the chairmanship of Professor George Thomson, initially under the umbrella of the Air Ministry (AM) and later under the Ministry of Aircraft Production (MAP) in April 1940 to further investigate the feasibility of atomic weaponry.[299] James Chadwick soon became the chief engine in this committee, coordinating the research conducted at the different universities and exerting more influence than George Thomson.[300]

The 'Thomson Committee', however, became more famous under the code name Maud Committee, which originated from one of the most well known anecdotes of the early World War II period. The designation Maud Committee – or M.A.U.D. as it was also spelled to look more official – was derived from a telegram that had been sent by Niels Bohr to Otto Frisch shortly after the German invasion of Denmark, ending with the mysterious line, 'TELL COCKCROFT AND MAUD RAY KENT'. After Frisch had passed it on to Thomson, the odd telegram was among the first issues on the committee's agenda. While several attempts to decipher Bohr's message with regard to vital atomic-weapons-related information were fruitless, the committee finally adopted the cover name Maud Committee. It was only years later that the telegram's sender solved the mystery and it became clear that the telegram had simply been addressed to Professor John Cockcroft and Bohr's former housekeeper by the name of Maud Ray, who lived in Kent.[301] The fact that Bohr's telegram started wild speculation about the state of the German nuclear research program is another example of how deep-rooted the fear of the Third Reich, and in particular a nuclear-capable Nazi Germany, was at the time.

Meetings of the Maud Committee regularly took place at the Royal Society and its earliest members included apart from its chairman, Professor George Thomson, Professors James Chadwick, John Cockcroft, Mark Oliphant, Patrick

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[299] Rudolf Peierls, 'Otto Robert Frisch, 1 October 1904-22 September 1979', *BMFRS*, 27 (November 1981), 283-306 (p. 291); H.M. Treasury, *Statements Relating to the Atomic Bomb* (London: HMSO, 1945), p. 15; David Zimmerman, 'The Tizard Mission and the Development of the Atomic Bomb', *War in History*, 2. 3 (1995), 259-73 (p. 259).

[300] Margaret Gowing, 'James Chadwick and the Atomic Bomb', *Notes and Records of the Royal Society of London*, 47. 1 (January 1993), 79-92 (p. 83). On Chadwick's involvement in Maud work, see also Andrew Brown, *The Neutron and the Bomb: A Biography of Sir James Chadwick* (Oxford: Oxford University Press, 1997), pp. 195-215.

[301] Clark, pp. 76-77; Frisch, *What Little I Remember*, p. 131; Peierls, *Bird of Passage*, p. 156.

Blackett, Charles Ellis, William Haworth and Dr. Philip B. Moon as well as a representative of the AM/MAP.[302] It is ironic that, at first, its initiators, Rudolf Peierls and Otto Frisch, were not allowed to participate in the work of the Maud Committee owing to their status as 'enemy aliens' or in Peierls's case a recently naturalized British subject. It was only after Rudolf Peierls had sent a letter to the committee chairman that the rules were changed and both authors of the 'Frisch-Peierls Memorandum' were fully consulted. To get Peierls and Frisch more involved on the administrative level, a Technical Sub-Committee was also formed on which they served. Other foreign-born atomic scientists such as Hans von Halban, Lew Kowarski, Joseph Rotblat, Franz Simon, or Egon Bretscher, who made considerable contributions to the work of the Maud Committee, also faced similar problems prior to the change of government employment policies regarding aliens and ex-aliens. Their work on atomic weapons research was only made possible through government contracts with universities, for the government itself was still not allowed to hire 'enemy aliens'.[303] Other German-speaking émigrés initially faced similar problems: Herbert Fröhlich, Heinz London and Walter Heitler, for example, also failed to become involved in the work of the Maud Committee. Although they had 'offered to do research on a special field of National [*sic*] importance (which was connected with the research we had done before)', as Walter Heitler wrote to Esther Simpson, and despite the fact that 'Professor Tyndall has done his best to secure our attachment to the committee dealing with these questions but owing to our foreign Nationality [*sic*], he was not successful'.[304]

As a result of these government regulations, the early Maud work was exclusively carried out at university laboratories across the United Kingdom. It was only in autumn 1940 that the British government started spending money on Maud research. The four main laboratories where atomic-weapons-related work was conducted were located at the universities of Liverpool, Birmingham, Oxford and Cambridge with occasional consultation of Herbert Fröhlich, Walter Heitler and Heinz London at Bristol University. Like the three German-speaking émigrés, Paul Dirac was infrequently conferred with over theoretical problems but he was never an

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[302] Gowing, *Britain and Atomic Energy*, p. 45.
[303] Frisch, *What Little I Remember*, p. 131; Gowing, *Britain and Atomic Energy*, p. 46-54; 'Peierls' War Years', n.d., Peierls Papers, MS Eng. Misc. b. 197, A 1, fols 15^{r}-18^{r} (fol. 15^{r}); G.P. Thomson to Air Marshal R.H.M.S. Saundby, 3 May 1940, TNA, KV 2/1658.
[304] Heitler to Simpson, 21 November 1940, MS S.P.S.L. 328/1, fol. 106^{r}.

official member of any Maud team. Because British-born scientists exclusively worked on sensitive projects like radar, a particularly high number of German-speaking émigré nuclear scientists engaged in atomic-weapons research.[305]

At the University of Liverpool, James Chadwick, who had taken first steps to investigate the feasibility of an atomic bomb, especially its size and critical mass, as early as the summer of 1939, was in charge of a Maud team. Following Frisch's and Peierls's seminal memorandum of February 1940 and using the newly acquired cyclotron, Chadwick and his collaborators Joseph Rotblat and Otto Frisch, who had transferred there from Birmingham, began a comprehensive test programme in order to prove the theoretical assumptions outlined in the 'Frisch-Peierls Memorandum'. Some of their work was even extended to include Norman Feather as well as the German-speaking émigrés Egon Bretscher, Herbert Freundlich and Nikolai Kemmer at the Cavendish Laboratory in Cambridge. Among other things, Otto Frisch worked on isotope separation using thermal diffusion processes, which he abandoned in late 1940.[306] Although Joseph Rotblat at Liverpool as well as Egon Bretscher and Norman Feather at Cambridge also reckoned simultaneously yet independently that an element, which is now commonly known as plutonium, could also be used as a nuclear explosive, their ideas had no impact on the British atomic weapons programme at the time.[307] Bretscher later complained that Norman Feather tried to claim all the fame for himself. He wrote to Chadwick in February 1946:

> It may not be known but it is a fact, that I calculated the activation and binding energies for all the heavy nuclei from Bohr-Wheeler, wrote the report and Feather together with me signed it (after he had corrected my English), though he had really not contributed a single idea nor even a sentence to it.[308]

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[305] Gowing, *Britain and Atomic Energy*, pp. 52, 53 note 1. London, for example, worked on the 'electrolytic method'; Simon to Chadwick, 27 September 1941, CHAD I/19/8.

[306] Thomas Vincent Attwood, 'The 37 Inch Cyclotron and Nuclear Structure Research at Liverpool 1935 to 1960' (unpublished masters thesis, University of Liverpool, 1998), pp. 24-43; Gowing, *Britain and Atomic Energy*, p. 54; John R. Holt, 'James Chadwick in Liverpool', *Notes and Records of the Royal Society of London*, 48. 2 (July 1994), 299-308 (p. 304); Charles David King, 'Chadwick, Liverpool and the Bomb' (unpublished doctoral dissertation, University of Liverpool, 1997), pp. 67-137; Peierls, 'Otto Robert Frisch', p. 292; Rudolf Peierls, 'Outline of the Development of the British T.A. Project', n. d., attached to letter from J. Chadwick to D.H.F. Rickett, 31 July 1945, TNA CAB 126/1, p. 2; H.M. Treasury, p. 15. On the work conducted at the Cavendish see also the monthly reports prepared by its staff between 1942 and 1943 such as 'Report on work carried out for the Directorate of Tube Alloys Research of D.S.I.R., February, 1942' or 'Report on work carried out for the Directorate of Tube Alloys Research of D.S.I.R., May, 1943', CHAD I/12/6.

[307] Rudolf Peierls, 'Recollections of James Chadwick', *Notes and Records of the Royal Society of London*, 48. 1 (January 1994), 135-41 (p. 137).

[308] Bretscher to Chadwick, 20 February 1946, CHAD I/24/2, p. 1.

A furious Egon Bretscher went on: 'Similarly to all the patents H[ans] v[on] H[alban] took out, where N[orman] F[eather] figures on equal terms with me as co-inventor, he had contributed absolutely nothing, but being nominally in charge exploited the situation with great skill'.[309]

Apart from Bretscher's and Feather's discovery, the second big achievement at Cambridge was conceived by German-born émigré Hans von Halban and Russian-born émigré Lew Kowarski. The two men had worked at Joliot's laboratory in Paris until the German invasion of France when they came to the United Kingdom, bringing with them the world's main supply of heavy water. Although their findings would not have any direct impact on the British nuclear weapons project, they concluded that heavy water could be used as a moderator in a kind of 'uranium machine' – today known as a nuclear reactor – to generate energy.[310] In early 1940, Otto Frisch independently suggested the same idea.[311]

At Birmingham, another team headed by Rudolf Peierls dealt with theoretical problems. Klaus Fuchs joined this group and made pivotal contributions to its work. Like Chadwick's team, the Birmingham group under Peierls worked on what Ronald W. Clark called the 'esoteric aspects' of atomic weaponry such as the specific features of a nuclear device that were needed to investigate the practicability of an atom bomb.[312] Peierls's team worked on the theoretical side, interpreting the basic nuclear data from experiments run at Liverpool, Cambridge and Oxford. In order to calculate the critical mass required to construct a nuclear explosive, Peierls and Fuchs analysed the mechanics of the chain reaction and performed calculations on the yield of a nuclear weapon, for instance.[313] Klaus Fuchs performed important calculations regarding thermal diffusion based on Liverpool data.[314] Peierls also engaged in work on theoretical features of the research on separation processes using gaseous diffusion which was carried out by Franz Simon at Oxford and which Peierls had initiated.[315] While Liverpool worked in physics as well as chemistry, a second

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[309] Bretscher to Chadwick, 20 February 1946, CHAD I/24/2, p. 2.
[310] Gowing, *Britain and Atomic Energy*, pp. 51, 59.
[311] Peierls, 'Outline of the Development of the British T.A. Project', p. 2.
[312] Clark, p. 86.
[313] 'Peierls' War Years', fol. 15[r]; H.M. Treasury, p. 15.
[314] Clark, p. 118.
[315] 'Peierls' War Years', fol. 15[r].

Birmingham group headed by William Haworth conducted almost all the chemical research.[316]

Besides his work at Birmingham, Rudolf Peierls was also instrumental in engaging Franz Simon in Maud Committee work.[317] Simon's crucial role in the early bomb project epitomized particularly well the paradox many of his fellow German-speaking émigré atomic scientists faced between exclusion from supposedly sensitive war work like radar and being – almost accidentally – entrusted with one of the biggest secrets of World War II: not only was his Oxford team primarily composed of non-British-born members but he was also to become the first Commander of the British Empire who had previously earned the Iron Cross in action.[318]

At the University of Oxford's Clarendon Laboratory, Simon headed a group which included his former colleagues, Nicholas Kurti and Kurt Mendelssohn as well as initially his former student Heinz London, from the *Technische Hochschule* (Polytechnic Institute) in Breslau where he had been Chair of Physical Chemistry.[319] Born in the 1900s, Nicholas Kurti was, like Leo Szilard, Eugen Wigner, John von Neumann, Egon Orowan and Edward Teller, a native of Budapest and a member of a generation of Hungarian-born but German-speaking atomic scientists who later worked on atomic research and subsequently gained international status.[320] Moreover, in the beginning the team also included Heinz London's older brother Fritz who spent only a short period at the Clarendon on a temporary ICI fellowship.[321] Another major German-speaking member, Heinrich Kuhn from the University of Göttingen also joined Simon's team at Oxford.[322]

David Schoenberg referred to the Clarendon appropriately as the 'Breslau colony in Oxford'.[323] The joint migration of Simon and his collaborators in low-temperature physics from Breslau to Oxford represents a rare case of almost an entire

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[316] Gowing, *Britain and Atomic Energy*, p. 61.
[317] Peierls, 'Recollections of James Chadwick', p. 137.
[318] Clark, p. 88; J. H. Sanders, 'Nicholas Kurti, C.B.E.: 14 May 1908-24 November 1998', *BMFRS*, 46 (November 2000), 301-15 (p. 306).
[319] Kurti, 'Franz Eugen Simon', pp. 225, 228-30; David Schoenberg, 'Heinz London, 1907-1970', *BMFRS*, 17 (1971), 441-61 (pp. 443, 445).
[320] Frank R.N. Nabarro and A.S. Aragon, 'Egon Orowan, 2 August 1902-3 August 1989', *BMFRS*, 41 (November 1995), 316-40 (pp. 317-18); Sanders, p. 301.
[321] Rider, pp. 148-49.
[322] Brebis Bleaney, 'Heinrich Gerhard Kuhn, 10 March 1904-26 August 1994', *BMFRS*, 42 (November 1996), 221-32 (pp. 225-26).
[323] Schoenberg, p. 444.

institution moving to a new host country and has to be seen in connection with Frederick Lindemann's effort to strengthen Oxford physics.[324] This kind of 'institutional migration', which underpinned *par excellence* the reconstruction of pre-emigration group networks in the new host country, occurred only seldom as, for instance, in the case of the Warburg Library, which emigrated with most of its staff from Hamburg to London where it was eventually integrated into the University of London and was renamed the Warburg Institute. Other examples of this exceptional form of emigration include the *Institut für Sozialforschung* (School of Social Research), which was moved from Frankfurt via Paris and Geneva to Morningside Heights, New York, where group appointments occurred frequently at the University in Exile at the New School for Social Research. Further cases of 'institutional emigration' were found at the Institute for Advanced Study in Princeton as well as in Turkey, at the universities of Ankara and Istanbul.[325]

The work at the Clarendon Laboratory focused on isotope separation through the method of gaseous diffusion as well as work on diffusion membranes.[326] Simon proved that isotope separation by means of gaseous diffusion appeared to be much more promising and effective than the thermal diffusion method proposed in the 'Frisch-Peierls Memorandum'.[327] Again, Peierls's team assisted Simon's group in theoretical matters.[328] In 1940, Rudolf Peierls laid out theoretical basics regarding the efficiency of various separation processes that could be used in isotope separation on an industrial scale in a technical report.[329] He and Fuchs also jointly tackled theoretical problems concerning uranium separation.[330]

Together Peierls and Simon even put forward a scheme for uranium 235 production through gaseous diffusion on an industrial scale and thus made pivotal

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[324] Farren and Thomson, p. 57; Mendelssohn, p. 1343.
[325] Paul K. Hoch, 'Institutional Versus Intellectual Migrations in the Nucleation of New Scientific Specialities', *Studies in the History and Philosophy of Science*, 18. 4 (1987), 481-500; Strauss, 'Movement of People', pp. 57-58; Dieter Wuttke, 'Die Emigration der Kulturwissenschaftlichen Bibliothek Warburg und die Anfänge des Universitätsfaches Kunstgeschichte in Großbritannien', *Ber. Wissenschaftsgesch.*, 7. 3 (1984), 179-94.
[326] Kurti, 'Franz Eugen Simon', p. 231.
[327] Gowing, *Britain and Atomic Energy*, pp. 56-57.
[328] H.M. Treasury, p. 16.
[329] Rudolf Peierls, 'MS-12: Efficiency of Isotope Separation', n.d., TNA, AB 4/837.
[330] See, for example, Klaus Fuchs and Rudolf Peierls, 'MS-12A: Separation of Isotopes', n.d., TNA, AB 4/838; Klaus Fuchs and Rudolf Peierls, 'MS-47A: Equilibrium time in a separation plant by Fuchs and Peierls', May 1942, TNA, AB 4/882.

assumptions about the nature of the future project.[331] Rudolf Peierls later remarked in an interview how abstract the idea of large-scale isotope separation had initially appeared, saying that

> [s]eparate isotopes on a practical, on a macroscopic scale, seems a crazy idea. It seems like science fiction because nobody had separated isotopes except in microscopic quantities, or perhaps milligram quantities of very light elements where the mass ratio was much bigger and the difference was much bigger between the isotopes and so it was a much easier problem. So to do that with large amounts seemed quite crazy, and therefore, one didn't practically think about what would happen if we separated 235.[332]

Apart from institutions, some individuals were also frequently called upon. Heinz London, who had transferred to Bristol University's H.H. Wills Laboratory in 1936, was sometimes consulted on theoretical matters.[333] Walter Heitler and Herbert Fröhlich, who also worked under Nevill Mott in Bristol, made additional contributions to the work of the Maud Committee. Even before the creation of the committee, at about the same time when Frisch and Peierls drafted their memorandum, Fröhlich and Heitler collaborated on an unpublished paper, 'Chain Reactions in Uranium'.[334] Although the two scientists did not reach a sufficient conclusion in their manuscript, the existence of this document reveals their sense to investigate the right issues related to the development of nuclear arms. It took until December 1942 when a team under the Italian-born émigré Enrico Fermi at the University of Chicago achieved the first controlled chain reaction in natural uranium.[335]

Herbert Fröhlich's and Walter Heitler's work for the Maud Committee was related to spontaneous fission in uranium. This phenomenon was seen as a big problem because it could minimize the yield of a nuclear bomb dramatically.[336] Otto Frisch had measured spontaneous fission, which was emitted from uranium 235, the isotope to be used in the weapon. Rudolf Peierls described the sentiment about

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[331] Thomas Vincent Attwood, 'Uranium Separation in the U.K. during World War II', (unpublished doctoral dissertation, University of Liverpool, 2004), pp. 264-271; Clark, p. 89; H.M. Treasury, pp. 16-17.
[332] Peierls, Interview by Walker, pp. 25-26.
[333] Schoenberg, p. 445.
[334] 'Chain-Reactions in Uranium, by H. Fröhlich and W. Heitler, n.d.', H.H. Wills Physics Laboratory. I am grateful to Gerard J. Hyland for pointing me towards this document and to Brian Pollard providing me with a copy of the document. A fragment of the document is reproduced in Hyland, p. 311. While Hyland dates the document to the period between March 1939 and June 1940 (p. 248 note 61), Nevill Mott dates it to the end of 1939; 'Walter Heinrich Heitler, 2 January 1904-15 November 1981', *BMFRS*, 28 (November 1982), 141-51 (p. 144).
[335] Badash, Hodes and Tiddens, p. 207.
[336] Gowing, *Britain and Atomic Energy*, pp. 55-56.

Frisch's findings at the time, saying that 'in that case the assembly had to be done at high speed. It was contemplated, if necessary, to use a double gun, shooting two projectiles that would meet half-way down the barrel'.[337] Fröhlich's and Heitler's work concentrated on the spontaneous effect in nuclear fission produced by cosmic rays and led them to produce a document entitled 'Fission Produced By Cosmic Ray Neutrons'.[338] Although he had at no point been a full member of the British atomic weapons programme, Herbert Fröhlich was asked to join the Atomic Energy Establishment at Harwell as head of its theoretical division in 1946 and his previous collaborations with Walter Heitler and Nikolai Kemmer on nuclear matters apparently influenced the Physics Department at the University of Liverpool's decision to appoint him as first Professor of Theoretical physics.[339]

That the various Maud Committee laboratories had made such good progress was to a large degree the result of Rudolf Peierls's pivotal part in the Maud Committee work. It is important to note that – perhaps after Chadwick and Thomson – Rudolf Peierls was the most important contributor and administrator in the Maud Committee work although he did not have full access to all its administrative councils. Not only was he a chief connecting link between different laboratories through his theoretical work, but long before the official creation of the Maud Committee, a steady exchange of information had existed between James Chadwick, Otto Frisch and Rudolf Peierls.[340] Peierls's central role in early British atomic arms research is further illustrated by the fact that the Maud Committee Chairman George Thomson entrusted him with the task of compiling a report on the current state of affairs particularly regarding uranium-related problems. In mid-August 1940, Peierls presented him with a ten-page report that was accompanied by nine papers written by him with the help of Otto Frisch and dealing with mathematical clarification of the most burning problems.[341] Rudolf Peierls continued writing progress reports from the theoretical physics point of view on the advancement of the British nuclear weapons programme.[342]

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[337] Peierls, 'Outline of the Development of the British T.A. Project', p. 4.
[338] Peierls to Fröhlich, 7 February 1941; Fröhlich to Peierls, 10 February 1941; Peierls to Frisch, 21 February 1941, TNA, AB 1/574; Fröhlich and Heitler, 'Fission Produced By Cosmic Rays', TNA, AB 4/96.
[339] Peierls to Fröhlich, 26 April 1946, TNA, AB 1/574; Mott, 'Herbert Fröhlich', pp. 149-50.
[340] Clark, p. 84.
[341] Gowing, *Britain and Atomic Energy*, pp. 54-58; 'Peierls' War Years', fol. 15[r].
[342] See, for example, 'Progress Report, March, 1941'; 'Progress Report, March, 1941', TNA, AB 1/494. Original typescripts of Rudolf Peierls' so-called MS reports can be found in AB 1/494,

Partly thanks to Peierls's tireless efforts, the Maud Committee concluded its work in October 1941 with two final reports, 'Use of Uranium for a Bomb' and 'Use of Uranium as a Source of Power', which were of great significance for the future of atomic energy research in the United Kingdom and in the United States. In the first report, the committee concluded that an atom bomb was feasible and described the research that had been conducted so far, and the work of the Maud Committee had put the United Kingdom at least temporarily far ahead in the race for an atom bomb.[343] The War Cabinet's Scientific Advisory Committee sanctioned the view put forth in the two Maud Committee final reports and regarded the atom bomb as crucial to the war effort. Prime Minister Winston Churchill, who had been updated by his chief scientific advisor Frederick Lindemann on the latest developments regarding the Maud Committee, shared these views, declaring that '[a]lthough personally I am quite content with the existing explosives, I feel we must not stand in the path of improvement'.[344]

As a result, an independent British atomic weapons project, under the official cover name 'Directorate of Tube Alloys' or simply 'Tube Alloys', came into existence and was placed under the Department of Scientific and Industrial Research (DSIR) in October 1941. Wallace Akers (later Sir Wallace) of ICI served as TA director and was regularly informed on the progress of the project by members of a Technical Committee that included apart from Rudolf Peierls also James Chadwick, John Cockcroft, Charles Darwin, Mark Oliphant, Norman Feather, Hans von Halban and Franz Simon.[345]

Since it was realized by all committee members quite early on that a separate British programme could only be brought to fruition on a much smaller scale than operations in the United States in the long run, it was necessary to limit the focus of TA to certain areas of inquiry such as verifying basic nuclear data, conducting theoretical studies on the chain reaction, the size, design and yield of an atomic bomb

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including 'Summary of Information on the Uranium Problem' (MS 12 B), 'Speed of Reaction in a Chain Reaction with Slow Neutrons' (MS 2), 'The Effect of Fast Neutrons in Ordinary Uranium' (MS 4), 'On the Critical Size of a U_{235} Sphere' (MS 6), 'Effect of Packaging on Critical Size' (MS 7) and 'Efficiency of Isotope Separation by Thermal Diffusion' (MS 11).

[343] Gowing, *Britain and Atomic Energy*, pp. 76, 85, 394-436.

[344] Winston S. Churchill, *The Grand Alliance* (Boston: Houghton Mifflin, 1950), pp. 814-15; H.M. Treasury, p. 18.

[345] H.M. Treasury, p. 18; 'Tube Alloys Project. Minutes of 5th Meeting of Technical Committee, 16 Old Queen Street, 7th May, 1942'; 'Tube Alloys Project. Minutes of 8th Meeting of Technical Committee, 16 Old Queen Street, 14th August, 1942', CHAD I/30/3.

as well as methods of uranium separation through the gaseous diffusion, including the design and construction of machines necessary in the process. Another area of concentrating TA resources was the investigation of a moderator, which was needed in a reactor to slow down neutrons in order to be able to achieve a controlled chain reaction. This research involved also experiments with and the manufacture of heavy water.[346]

In principle, the teams engaged in nuclear weapons research stayed the same as before. The groups at the universities of Liverpool and Cambridge, which worked on the experimental determination of nuclear data, were significantly strengthened and smaller TA research programmes were started at Bristol and Manchester universities. James Chadwick supervised all this work. At Cambridge, Hans von Halban and Lew Kowarski, in collaboration with Egon Bretscher, were put in charge of the work on slow neutron systems. Von Halban's and Kowarski's team was later moved to Montreal, Canada, and supplemented by newly recruited British, Canadian and American personnel. At Cambridge University, Egon Orowan also contributed significantly to the TA project through his research on the manufacture of uranium metal. Rudolf Peierls continued as head of his Birmingham team. This group, which also included Klaus Fuchs, dealt with theoretical problems like the chain reaction. Fuchs and Peierls also developed the theory of the operation and performance of a uranium separation plant. Peierls consulted Paul Dirac at Cambridge on special problems. At the Clarendon Laboratory in Oxford, Franz Simon's team performed experimental work on the gaseous diffusion method. Nicholas Kurti and Henrich Kuhn assumed leading positions in Oxford. On the theoretical side, the Clarendon group received support from Rudolf Peierls's team, and Haworth's second Birmingham group solved any chemical problems that arose in the course of Simon's work. Peierls and Simon even collaborated with Metropolitan-Vickers Electrical Co. Ltd. on the development and manufacture of machinery used in the process.[347] Rudolf Peierls and Otto Frisch were also involved in discussing the experimental work conducted in Montreal.[348]

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[346] H.M. Treasury, p. 19.
[347] Peierls, 'Outline of the Development of the British T.A. Project', p. 5; H.M. Treasury, pp. 19-20, 22; M.M.R. Williams, 'Development of Nuclear Reactor Theory', pp. 239-322.
[348] 'Discussion on Experimental Programme of T.A. Montreal Group, 16 Old Queen Street, August 12th 1943', CHAD I/30/3.

The various TA programmes were coordinated by three sub-committees that were to report to the TA 'Technical Committee': these were the 'Diffusion Project Committee', which included Rudolf Peierls and Franz Simon, a so-called Chemical Panel, including Simon as well as a 'Metal Panel', on which Simon served and which dealt with uranium metal production and general metallurgical matters.[349] Franz Simon thus also assumed a central position in the TA work.

Although Rudolf Peierls only served on one TA subcommittee, he kept on playing a pivotal role in the early British nuclear weapons project. That he was held in high regard is underlined by the fact that Peierls composed a history of the early British atomic arms programme prior to the period of the joint Manhattan Project. In a letter to the War Cabinet, which accompanied Peierls's history, James Chadwick wrote: 'Peierls is one of the few men who can write about this time from his own knowledge and not from hearsay.' Chadwick added that if he had written this account himself, '[i]t would not differ very much from Peierls''.[350]

Meanwhile, owing to the severe shortage of resources in the United Kingdom, it had become obvious even before the Maud Committee had issued its final report that a viable atomic research program could not be pursued unilaterally by Britain. It was thus deemed necessary to start a large-scale co-operation with the United Sates. In this context, the impact of the 'Frisch-Peierls Memorandum', as well as the reports of the Maud Committee, cannot be emphasized enough because they represented indeed Britain's chief part in getting the Manhattan Project under way.[351]

Conclusion

After Rudolf Peierls and in particular Klaus Fuchs had overcome the many difficulties with regard to their German origin, they became key players in the early British nuclear energy programme. The path towards integration into their host country's society and physics community was rocky and unpaved. They had to

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[349] H.M. Treasury, p. 22; 'Tube Alloys Project. Minutes of 10th Meeting, 13th October 1942'; 'T.A. Project. Minutes of 2nd Meeting of Diffusion Project Committee held at 16 Old Queen Street on 20th July 1943'; 'Tube Alloys Project. Minutes of 1st Meeting of Chemical Panel at 16 Old Queen Street on Dec. 18th 1941', CHAD I/30/3.
[350] Chadwick to Rickett, 31 July 1945, TNA, CAB 126/1.
[351] Lee, 'Birmingham – London – Los Alamos – Hiroshima', p. 153.

overcome their status as 'enemy aliens' in order to improve their standing in both British society and physics.

Fuchs and Peierls, like many of their fellow German-speaking émigrés from Nazism, often faced existential problems. They had, for instance, a hard time finding employment or, in the case of Fuchs, a body to fund his studies. Furthermore, they lived under the constant threat of being deported to an internment camp. While Rudolf Peierls was spared the internment, Klaus Fuchs spent a considerable amount of time in an internment camp in Canada under unbearable conditions. To make matters worse, they were subjected to the bombardments by the German air force.

The professional integration process was equally strenuous. Owing to fundamental differences in national teaching and research styles between the United Kingdom and Continental Europe, Peierls and to a lesser extent Fuchs as a student, had to overcome obstacles in order to fit into the British physics community. Since their immigration status as 'enemy aliens' or, in Peierls' case, as ex-alien prevented them from conducting important war work like the development and refinement of radar, they were – almost accidentally and most ironically – pushed into nuclear weapons research, which eventually became one of the best guarded secrets of the Second World War.

It was in particular Peierls who, in collaboration with Otto Frisch, composed the seminal 'Frisch-Peierls Memorandum'. Not only was this pivotal yet commonly neglected document decisive in starting a serious atomic arms development project in the United Kingdom, but it was also instrumental in starting the joint Anglo-American-Canadian Manhattan Project, as the subsequent chapter will demonstrate.

Chapter Three. American Interlude: Work on the Manhattan Project.

Introduction

As the second chapter has shown, Rudolf Peierls and Klaus Fuchs had to overcome many obstacles before they integrated comparatively well, professionally and socially, into their new host country. With their engagement in TA work, the two scientists had become integral parts of both the British nuclear science community and their host country's secret atomic weapons development project. When the governments of the United States and Britain agreed to merge their nuclear programmes in the Manhattan Engineering District (MED), or simply, Manhattan Project, Rudolf Peierls and Klaus Fuchs travelled to the United States to work, at first, in New York City and later in the secret nuclear weapons laboratory at Los Alamos in the southwestern state of New Mexico.

This chapter looks at Fuchs's and Peierls's contributions to the making of the atomic bomb in the joint Anglo-American-Canadian MED in the period between 1943 and 1946. It is structured into three parts: the first section examines their roles in establishing the Anglo-American nuclear wartime alliance that resulted in the seminal Manhattan Project. It then moves on to assess their impact on the MED, in particular their time at Los Alamos, in more detail in the subsequent two subchapters. Fuchs's and Peierls's work at the secret laboratory in New Mexico is analysed within the context of other German-speaking émigré atomic scientists present at Los Alamos. While the first of the last two sections introduces the other German-speaking émigré scientists at the secret laboratory individually through their administrative and scientific achievements, the final subchapter discusses how Peierls, Fuchs and the other émigrés, as a cohort, helped shape a new approach to research cultures in nuclear science, especially Big Science.

Anglo-American Nuclear Co-operation

In order to examine Klaus Fuchs's and Rudolf Peierls's roles in the Manhattan Project, one best starts with an examination of their roles in establishing atomic co-operation between the United States and Britain. In spite of the crucial first steps towards the development of nuclear weapons in Britain early in the war, the so-called

Einstein Letter is commonly cited as the starting point of a serious (American) nuclear weapons development programme. Alarmed about the possibility of a German nuclear weapons project, Leo Szilard, Edward Teller and Eugene Wigner decided it was high time they informed the Roosevelt administration about the impending danger. When finally the opportunity arose to reach US President Franklin Delano Roosevelt (FDR) through Alexander Sachs, a national economist, the three scientists convinced Albert Einstein of their idea to sign a letter to FDR. The 'Einstein Letter', which was drafted by Szilard and Einstein but only signed by Einstein warned FDR of the perils of a Nazi atomic bomb. It reached the president with considerable delay. Consequently, it had no immediate impact on the decision to initiate a serious atomic arms programme in the United States.[352]

By contrast, it was indeed the 'Frisch-Peierls Memorandum' and the Maud Reports, which have been discussed in the previous chapter in depth, that were decisive in starting a serious atomic weapons research project in the United States. Margaret Gowing assessed these British contributions at a high value, arguing that, 'there is little doubt that, without the British work, World War II would have ended – for better or worse – before an atomic bomb was dropped'.[353]

Nevertheless, despite the significance of the early British work, with pivotal input by Rudolf Peierls and Klaus Fuchs, it soon became evident that the United Kingdom could not maintain a nuclear weapons programme of its own that would produce a working weapon during the war.[354] Here, Anglo-American collaboration seemed to offer a way out of the dilemma. Bilateral co-operation already existed in other areas. In 1940, the so-called Tizard Mission, officially called the British Technical and Scientific Mission to the United States, had embarked to the United States over a year before the Maud Committee released its final reports in order to share Britain's latest technological developments with the American ally. The famous black-box that Sir Henry Tizard brought to America contained, for example, information on the design of the Rolls Royce Merlin plane engine that would later

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[352] Lawrence Badash, *Scientists and the Development of Nuclear Weapons: From Fission to the Limited Test Ban Treaty, 1939-1963* (Amherst, NY: Humanity Books, 1995), pp. 28-29; Jeremy Bernstein, *Oppenheimer: Portrait of an Enigma* (Chicago: Dee, 2004), pp. 66-69.

[353] Gowing, 'James Chadwick and the Atomic Bomb', p. 86. On the importance of the Frisch-Peierls Memorandum see also Andrew Brown, 'A Tale of Two Documents', in *Remembering the Manhattan Project: Perspectives on the Making of the Atomic Bomb and Its Legacy*, ed. by Cynthia C. Kelly (London: World Scientific, 2004), pp. 41-46.

[354] Gowing, *Britain and Atomic Energy*, p. 165.

also power the American Mustang P-50, the proximity fuse, and important radar-related data.[355]

Although John Cockcroft, who was one of Britain's leading atomic physicists at the time, accompanied Tizard to the United States, the delegation did not discuss Anglo-American nuclear co-operation at this stage.[356] This was partly the result of a fundamental misjudgment of the United States' capability by the British government. Since they totally underestimated the growth of the American atomic project, Britain's nuclear programme was severely damaged in the long run and by mid-1942 the British lead in atomic physics was forever lost.[357]

It was around the same time that British scientists, including Rudolf Peierls, realized how far their project had fallen behind the American programme during another visit to the United States. In November 1941, George Pegram and Harold Urey had toured British nuclear research facilities in oder to prepare the sharing of information between the British and American projects. The two American professors had shown particular interest in the work of Franz Simon's team on isotope separation through gaseous diffusion at the Clarendon Laboratory, Oxford. Following their visit, a British delegation which included Rudolf Peierls as well as Hans von Halban and Franz Simon, embarked on a journey to the United States between February and April 1942.[358] Owing to its high percentage of foreign-born members, some American colleagues jokingly remarked that the supposedly British group was indeed not 'very typically British', as Rudolf Peierls recalled.[359] During this journey Peierls met with American high-calibre physicists like Arthur Compton and J. Robert Oppenheimer.[360] The Americans held Peierls in such high esteem that another visit by him and Chadwick was requested in late 1942.[361] Vannevar Bush, however, the director of the Office of Scientific Research and Development (OSRD) that controlled the MED at the time, declined the request to 'invite Peierls' for another visit because Bush was at the time involved in difficult negotiations with the

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[355] Baylis, *Anglo-American Defence Relations*, p. 5; Szasz, *British Scientists*, p. 7.
[356] Zimmerman, 'Tizard Mission', pp. 259-273.
[357] Gowing, *Britain and Atomic Energy*, p. 123; Lee, 'Birmingham – London – Los Alamos – Hiroshima', p. 155.
[358] Peierls, 'Outline of the Development of the British T.A. Project', p. 6; Thewlis to Chadwick, 8 October 1941, CHAD I/12/3.
[359] Peierls, Interview by Weiner, p. 97.
[360] Szasz, *British Scientists*, p. 8.
[361] Conant to Akers, 15 December 1942; NWP to Gorrell Barnes, RE: Prof. Peierls, 2 November 1942, TNA, AB 1/48.

British government over the exchange of nuclear information.[362] As perhaps the most significant result of this mission, the British scientists, to their dismay, had to face the fact that the American project had gathered momentum much faster than previously anticipated.[363]

This painful observation led to the realization that the United Kingdom would not be able to sustain a viable atomic weapons project of its own, let alone on the same scale as the United States. As a consequence, leading atomic scientists and political decision-makers recognized that the country had to fully co-operate with the United States in atomic matters unless it did not want to fall too far behind in nuclear weapons and energy research. In July 1943, the Technical Committee which included Rudolf Peierls and Franz Simon therefore agreed that 'full co-operation with the U.S.A. is the only effective method of realizing the T.A. project under war-time conditions', as it recorded in the minutes of its eighteenth meeting. The delegates further agreed that the United Kingdom should pursue its own nuclear weapons project until a settlement with the United States was reached. At this meeting, Rudolf Peierls revealed a great deal of concern over the viability of TA in the future. As he pointed out, the vagueness of the current state of Anglo-American relations in atomic affairs could affect the TA project significantly as in the case of the diffusion separation programme, which had suffered considerably from this uncertainty.[364]

James Chadwick, too, had fully realized the necessity for Anglo-American nuclear collaboration early on. But he also had ulterior motives that went beyond Anglo-American wartime co-operation: for him this partnership provided also a way to gather vital nuclear data that would be useful to an independent British nuclear programme in the long run, after the end of World War II.[365] As Chadwick put it in early February 1944:

> The American effort is on such a scale that we could not compete with it even in peace time. We could not, for example, devote the number of scientists required for the project at this stage without paralysing our Universities, while the constructional and engineering work is on an unparallelled [*sic*] scale. It is

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[362] Oppenheimer to Manley, 6 November 1942, (repr. in *Robert Oppenheimer: Letters and Correspondence*, ed. by Alice Kimball Smith and Charles Weiner (Cambridge, MA: Harvard University Press, 1980), pp. 236-37 (p. 237)).
[363] Septimus Paul, p. 28.
[364] Minute 128, 'Tube Alloys Project. Minutes of 18th Meeting of Technical Committee, 16 Old Queen Street, 26th July, 1943', CHAD I/30/3.
[365] Perrin to Gorell Barnes, 'T.A. Staff for U.S.A.', 31 January 1944, p. 1; 'Staff Requirements for T.A. Project in U.S.A.', 7 February 1944, TNA, CAB 126/331, pp. 1-2.

> essential that we should acquire the fullest possible knowledge and experience of all phases of the project so that we shall be in a position when the time comes to start work in England on the right lines, profiting by American experience. There is no question, in my opinion, nor in that of the Technical Committee that this policy is to our own interest.[366]

At the same time, reports from Rudolf Peierls and Christopher Frank Kearton on the collaboration with American scientists regarding the diffusion plant brought alarming news. As Wallace Akers informed the Chancellor of the Exchequer, their reports 'indicate that the time may come when the Americans will shut us out from a knowledge of the final stages of design and construction, and also from the operation, of their large-scale diffusion and electro-magnetic plants'.[367]

On the American side, similar fears were present which expressed themselves in acute fears of employing foreign-born scientists in the atomic project, especially those of the Free French movement such as Hans von Halban and Lew Kowarski as well as the many émigrés amongst the British scientists. As US officials argued, legitimate concerns existed that non-naturalized scientists would return to their home countries after the war and take valuable nuclear data with them, which could then be of use to their governments.[368] These worries stood in a sharp contrast to official American foreign policy towards Britain at the time: as early as August 1940, under the so-called Destroyers for Bases Deal, the Roosevelt administration had given Whitehall fifty WWI destroyers. In return, the Churchill government had leased land for the construction of naval bases on eight of its overseas territories in the Western Atlantic and Caribbean to the United States. And by March 1941, both the United States Senate and Congress had sanctioned FDR's Lend-Lease policy under which the United States could now support the British war effort through loans and credits.[369]

From the beginning, Anglo-American relations were ambivalent as a mutual sense of distrust hampered the atomic co-operation between the United Kingdom and the United States. Although Britain engaged in an all-out propaganda effort to break the American neutrality and win the United States over as its ally long before the

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[366] J.S.M. Washington to War Cabinet Offices, London, 3 February 1944, TNA, CAB 126/331, p. 3
[367] Akers to the Chancellor of the Exchequer, 'Tube Alloys Project: Access to American Full-Scale Plant Information', 6 April 1944, TNA, CAB 126/331.
[368] Gowing, *Britain and Atomic Energy*, pp. 176-77.
[369] David Reynolds, *The Creation of the Anglo-American Alliance 1937-41: A Study in Competitive Co-Operation* (London: Europa, 1981), pp. 121, 145-68.

Japanese attack on Pearl Harbor on 7 December 1941,[370] the Churchill government was initially highly sceptical and hesitant when it came to nuclear co-operation.[371] Before Urey's and Pegram's visit to the United Kingdom in November 1941, for example, the secretary of the DSIR, Edward Appleton, instructed Michael Perrin 'to take a full record of all the discussions with Urey and Pegram for use both here and in the States'.[372]

It was especially the heightened security levels which had been raised by the US military that gave the British a feeling of being excluded from vital nuclear information. As Wallace Akers wrote to James B. Conant in mid-December 1942: 'The joint result of these changes has been to leave some doubt in my mind concerning future relations between work to be carried on in America, on the one hand, and in England and Canada on the other.' Akers went on to grumble that

> although we appreciate the desire to avoid as much as possible leakage of information [...], there is a strong feeling among the British group that the division of the work into watertight compartments can be carried to the point at which inefficiency may be considered to outweigh the gain of secrecy.[373]

When the Roosevelt administration became aware of its highly advanced position vis-à-vis Whitehall in nuclear-energy-related matters during the latter half of 1942, Anglo-American atomic collaboration appeared as a less pressing need from Washington's point of view than it had done earlier. In Britain, by contrast, the situation had changed considerably. As the threat of National Socialist Germany which had revealed itself so dramatically at Dunkirk in May and June 1940 still loomed over the Churchill government, Whitehall was now desperate to enter atomic co-operation with the United States. Eventually FDR agreed to Anglo-American atomic collaboration.[374]

After a period of severe problems in nuclear relations between the two countries, plus the realization that Britain herself could not sustain a workable atom bomb project, the Quebec Agreement of August 1943 officially regulated the collaboration between Britain and the United States in nuclear matters, at least for

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[370] On the British propaganda effort in the United States, see Nicholas Cull, *Selling War: The British Propaganda Campaign against American "Neutrality" in World War II* (New York: Oxford University Press, 1995).
[371] Septimus Paul, pp. 9-30.
[372] Chadwick to Simon, 27 October 1941, CHAD I/19/8.
[373] Akers to Conant, 15 December 1942, CHAD I/28/2.
[374] Baylis, *Anglo-American Defence Relations*, p. 3; Septimus Paul, pp. 31-54.

the period of the war.[375] In September 1944, FDR and Churchill made amendments to the Quebec Agreement during a meeting at Hyde Park, New York.[376] With the new agreement in place, the British government provided, for instance, 'all possible assistance' to the American project working on the electromagnetic method, as Michael Perrin declared in late January 1944.[377] There were in particular, on the British side, a considerable number of critical voices demanding that Washington share all its secrets with Great Britain. Since the United States made much bigger contributions to the joint project, the British actually did not come out of the deal too badly after all.[378]

Although nuclear co-operation between the two countries had been formalized under the accords of the Quebec Agreement, relations between Britain and the United States remained far from smooth. The acknowledgement of patents, for example, represented a contentious issue in Anglo-American relations throughout the period of the Manhattan Project. While there is no recorded evidence that Klaus Fuchs and Rudolf Peierls experienced problems in receiving proper recognition for patents, other German-speaking scientists such as Egon Bretscher, Hans von Halban or Leo Szilard faced problems.[379] But German-speaking émigré scientists did not encounter such considerable problems as, for instance, Enrico Fermi, who fought for fifteen years to receive proper recognition of the ownership of an economically highly valuable patent that dealt with a process applied to slow down neutrons in atomic reactions.[380] Despite the many problems in the Anglo-American wartime partnership, the creation of the atomic bombs at Los Alamos, which will be dealt with in the following two subchapters, represented, John Baylis has argued, 'one of the most co-operative ventures of the alliance'.[381]

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[375] Gowing, *Britain and Atomic Energy*, pp. 115-78, 439-40; Szasz, *British Scientists*, p. 11.
[376] Jonathan Rosenberg, 'Before the Bomb and After: Winston Churchill and the Use of Force', in *Cold War Statesmen Confront the Bomb: Nuclear Diplomacy Since 1945*, ed. by John Lewis Gaddis and others (Oxford: Oxford University Press, 1999), pp. 171-93 (p. 180).
[377] Perrin to Gorell Barnes, 'T.A. Staff for U.S.A.', 31 January 1944, TNA, CAB 126/331, p. 1.
[378] Gowing, *Britain and Atomic Energy*, p. 174.
[379] Gowing, pp. 126, 135-38, 142-43, 201-15; Septimus Paul, pp. 19, 62-64; Rhodes, *Making of the Atomic Bomb*, pp. 504-08.
[380] Simone Turchetti, '"For Slow Neutrons, Slow Pay": Enrico Fermi's Patent and the U.S. Atomic Energy Program, 1938-1953', *Isis*, 97. 1 (2006), 1-27. On patents and scientific authorship, see also Mario Biagioli, 'Patent Republic: Representing Inventions, Constructing Rights and Authors', *Social Research*, 73. 4 (2006), 1129-172.
[381] Baylis, *Anglo-American Defence Relations*, p. 15.

Work on the Manhattan Project: New York City and Los Alamos – Individual Contributions

Under the new Anglo-American co-operation, Rudolf Peierls and Klaus Fuchs joined the Manhattan Project. In late 1943, Fuchs, Peierls and his wife Genia sailed on the Royal Navy troop ship *Andes* from Liverpool to the United States.[382] Klaus Fuchs and the Peierls, together with Christopher Frank Kearton and Tony Hilton Royle Skyrme, first moved to New York City as part of a contingent of British scientists working on the separation of uranium 235. Peierls and Fuchs worked at both Columbia University and a private contractor, the Kellex Corporation. Their work focused on the design and operation of a large-scale isotope separation plant.[383] Prior to his stay at Los Alamos, during his time in New York City, Fuchs had contributed highly valuable calculations to the design of the gaseous diffusion plant at Oak Ridge which was used to separate uranium 235 from uranium 238 isotopes.[384] That Fuchs authored ten out of the total of 17 papers produced by the British Mission in New York between January and July 1944, underlined his standing as one of the foremost junior scientists involved in the Manhattan Project.[385] At Columbia University, Nicholas Kurti also worked at the same time on membrane testers used in the gaseous diffusion process. Kurti had come to the United States at the end of 1943 as well and stayed on until April 1944.[386]

It was in New York that Fuchs and Peierls confronted for the first time some peculiarities of American culture. They were, for example, appalled when they witnessed a case of racial discrimination. Although an African-American applicant was the strongest candidate for a post as computing assistant in Peierls's team, her application was rejected.[387] It must have felt awkward for émigrés who had previously experienced National Socialism to come across such racist tendencies in the country which had traditionally proclaimed itself the haven of freedom and democracy.

On the positive side, Fuchs and Peierls found an abundance of goods in the United States. Coming from war-torn Britain with its rationing of food and clothes,

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[382] Fletcher to Ladd, p. 6; Moorehead, *The Traitors*, pp. 94-95.
[383] Gowing, *Britain and Atomic Energy*, p. 240; Peierls, *Bird of Passage*, p. 184; Szasz, *British Scientists*, p. 16.
[384] Robert Williams, *Klaus Fuchs*, pp. 67-70.
[385] W.J. Skardon, 'Emil Julius Klaus Fuchs', 22 December 1949, p. 4.
[386] Sanders, p. 307.
[387] Peierls, *Bird of Passage*, pp. 185-86.

the two physicists, like many of their British colleagues, were deeply impressed by what they came upon in New York City.[388] Because of the severe shortages in England, the Peierls, for example, took the household items which they had acquired during their stay in the United States back home after the war.[389] Years later, Rudolf Peierls still recalled his impressions during an earlier visit to America, saying:

> Then going from the rigor of wartime England to the comfort of a commercial airliner from Montreal to Ottawa, and then coming down in the evening on the brilliantly lit city (from my point of view because we were used to blackouts) was an enormous thrill, and of course then to New York, which I'd never seen before, and then coming into the department there, one was quite impressed with (although theoretically one had known it) the much greater scale of things and size of laboratories, the number of people, the wealth of equipment and so on; together with a sense of purpose and hard work.[390]

They carried this fascination with them to the secret laboratory at Los Alamos where Peierls and Fuchs transferred in 1944. Like other European-born members of the Los Alamos laboratory, German-speaking émigré scientists and their American hosts shared different cultures in the first half of the 1940s. While German-speaking émigrés showed a deep appreciation of 'high culture', in particular classical music (Otto Frisch and Edward Teller were gifted pianists, and Frisch even performed weekly concerts for the local radio station KRS), many of their American-born colleagues joined the square dance club.[391] Klaus Fuchs, Rudolf Peierls, Hans Bethe and, in particular, Egon Bretscher enjoyed extensive hikes and mountain climbing in the nearby Sangre de Cristo and Jemez Mountains. American-born scientists, by contrast, preferred horseback riding and exploring Native American ruins in the area.[392] Unlike American-born scientists, married German-speaking émigrés such as Rudolf Peierls, Hans Bethe, Edward Teller, and Victor Weisskopf also commonly ignored the tight security regime in place and told their wives about the purpose of their stay at the laboratory town and even discussed crucial issues with their spouses.[393]

While Rudolf and Genia Peierls came to 'the Hill', as Los Alamosans also called their hometown, in early 1944, Klaus Fuchs did not arrive at Los Alamos until

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[388] Calder, pp. 231, 239-40, 276, 404-06.
[389] Peierls, *Bird of Passage*, pp. 207-208.
[390] Peierls, Interview by Weiner, p. 97.
[391] Bernice Brode, *Tales of Los Alamos: Life on the Mesa 1943-1945* (Los Alamos, NM: Los Alamos Historical Society, 1997), 72-75, 124; Frisch, Interview, pp. 4, 18-19.
[392] Françoise Ulam, Interview by Theresa Strottman, 1992, LAHM, p. 5.
[393] Schweber, *In the Shadow of the Bomb*, p. 150 notes 3 and 4.

August 1944.[394] The northern New Mexican installation was the Manhattan Project's central laboratory. Apart from Los Alamos, the MED's two other chief installations were Oak Ridge, Tennessee, which focused primarily on the production of uranium 235, and Hanford, Washington, which produced plutonium.[395] Located on several isolated mesas overlooking the Rio Grande Valley, the Los Alamos scientists lived under sparse conditions. Still, compared to the severe shortages at home in the United Kingdom, the supply of food and especially laboratory materials appeared, in their eyes, magnificent and made it thus easier for them to acclimatize in the locale of northern New Mexico.[396] In April 1943, the first scientists arrived at Los Alamos which had been home to the famous Los Alamos Ranch School until it was taken over by the US Army earlier in the same year.[397] The laboratory's official designation was Site Y and after the war, it became the Los Alamos Scientific Laboratory. [398]

The setting in the iconic landscape of the American Southwest evoked associations to the nineteenth-century Frontier days in many of the Los Alamos scientists and the Frontier myth served as a major source of motivation for many of them.[399] Even the Manhattan Project's commanding officer himself, General Groves, cited the Frontier myth as a primary force of motivation.[400] While the primitive conditions under which the scientists lived at Los Alamos bore a certain resemblance to those of the women and men of the nineteenth-century Frontier, Fuchs and Peierls represented important nuclear pioneers who conducted pivotal work on the atomic frontier.

Although Los Alamos was the smallest of the three 'atomic cities' in terms of size and population, it hosted the *crème de la crème* of nuclear scientists.[401] Alongside the Italians Enrico Fermi and Emilio Segrè, three German-speaking future

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[394] Robert Williams, *Klaus Fuchs*, p. 16.
[395] Leland Johnson and Daniel Schaffer, *Oak Ridge National Laboratory: The First Fifty Years* (Knoxville: University of Tennessee Press, 1994), pp. 1-27; Michele Stenehjem Gerber, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site*, 3rd edn (Lincoln, NE: Bison Books, 2007), pp. 31-36.
[396] Frisch, Interview, pp. 4-5; Jon Hunner, *Inventing Los Alamos: The Growth of an Atomic Community* (Norman: University of Oklahoma Press, 2004), p. 36.
[397] John D. Wirth and Linda Harvey Aldrich, *Los Alamos: The Ranch School Years, 1917-1943* (Albuquerque: University of New Mexico Press, 2003), pp. 157-58.
[398] Szasz, *Day the Sun Rose Twice*, pp. 15, 179.
[399] Hunner, *Inventing Los Alamos*, p. 38.
[400] Leslie R. Groves, *Now It Can Be Told The Story of the Manhattan Project* (New York: Harper, 1962; repr. New York: Da Capo Press, 1983), p. 415.
[401] Charles W. Johnson and Charles O. Jackson, *City Behind a Fence: Oak Ridge, Tennessee 1942-1946* (Knoxville: University of Tennessee Press, 1981), p. xix.

Nobel laureates worked on 'the Hill': Hans Bethe, Felix Bloch and Maria Göppert-Mayer. In the face of the great concentration of international high-calibre atomic scientists, the northern New Mexican town of Los Alamos represented arguably something of a modern version of the Ancient Greek *mouseion* of Alexandria or, as one wartime resident remarked, 'Los Alamos stood for the same sort of thing that Hollywood represents to an aspiring starlet.'[402]

On 'the Hill', Rudolf Peierls and Klaus Fuchs came across many former colleagues and friends. Decades later, Peierls still recalled 'a strange sensation to meet so many old friends from various phases of our lives in such an outlandish place as Los Alamos'. These 'old friends' included, apart from Klaus Fuchs, Hans Bethe, Egon Bretscher, Otto Frisch, John von Neumann, Georg Placzek and Victor F. Weisskopf, but also the Italians Enrico Fermi and Emilio Segrè as well as the Danes Niels Bohr and his son Aage.[403] Apparently, 'an enormous international reunion of the atomic physics community', as Edward Teller later wrote in his autobiography, took place at Los Alamos.[404] In a graphic way, Los Alamos also visualized the relatively small size of the comparatively young nuclear physics community at the time. Many of the theoreticians among the Los Alamos scientists, including Enrico Fermi, Klaus Fuchs, Maria Göppert-Mayer, Edward Teller, Victor Weisskopf and even the scientific director of Los Alamos, J. Robert Oppenheimer, had been students of Max Born at one time or another, for instance.[405] Such 'old friends' often helped each other prior to their arrival on 'the Hill'. Rudolf Peierls, for example, informed George Placzek in detail about professional and private aspects of life at Los Alamos, warning him: 'Don't of course expect a Fifth Avenue here.'[406] And Hans Bethe's wife Rose sent Genia Peierls a long letter describing the conditions on 'the Hill'.[407]

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[402] Ruth Marshak, 'Secret City', in *Standing By and Making Do: Women of Wartime Los Alamos*, ed. by Jane S. Wilson and Charlotte Serber (Los Alamos, NM: Los Alamos Historical Society, 1988), pp. 1-19 (p. 11).
[403] Peierls, *Bird of Passage*, pp. 191-92.
[404] Edward Teller, with Judith Shoolery, *Memoirs: A Twentieth-Century Journey in Science and Politics* (Cambridge, MA: Perseus Publishing, 2001), p. 184.
[405] Nancy Thorndike Greenspan, *The End of the Certain World: The Life and Science of Max Born* (Chichester: Wiley, 2005), p. 262; Victor F. Weisskopf, 'Meine Göttinger Studienjahre mit Born und Franck', in *Max Born, James Franck, der Luxus des Gewissens: Physiker in ihrer Zeit*, ed. by Jost Lemmerich (Berlin [West]: Staatsbibliothek Preußischer Kulturbesitz, 1982), pp. 80-83.
[406] Peierls to Placzek, 10 September 1944, TNA, AB 1/576.
[407] Bethe to Peierls, 22 May 1944, TNA, AB 1/635.

The many émigré scientists whom Peierls and Fuchs encountered at Los Alamos usually came to the secret laboratory by two routes. While Bretscher, Frisch and Placzek, like Fuchs and Peierls, joined the Los Alamos laboratory as members of the British Mission, Bethe, von Neumann, Rabi and Weisskopf, together with Felix Bloch, Martin Deutsch, Maria Göppert-Mayer, Rolf Landshoff, Hans Staub and Edward Teller came to 'the Hill' as naturalized American subjects directly from universities in the United States where they had found employment after their departure from Europe. Together, these German-speaking scientists had a tremendous share in helping achieve the successful completion of the Manhattan Project. In comparison with Oak Ridge and Hanford, German-speaking émigré nuclear scientists were of particular significance at Los Alamos.

The theoretical physicist Lothar Nordheim was amongst the few German-speaking émigrés who were engaged in work at other Manhattan Project installations. At Oak Ridge, he oversaw the X-10 project, a pilot reactor for the plant that was later to be built at Hanford. After the war, he served as director of Oak Ridge's Physics Division from 1945 to 1947.[408] At the Chalk River site near Montreal, Canada, Hans von Halban collaborated with Lew Kowarski on reactor theory. Herbert Freundlich and Nikolai Kemmer also worked at the Montreal Manhattan Project installation.[409] At the MED's Berkeley laboratory, Oscar Bünemann worked as a theoretical physicist.[410]

The strong quantitative presence of German-speaking émigré atomic scientists found perhaps its most graphic expression in their many appointments to senior administrative posts in the laboratory's scientific top management. The British mission to Los Alamos clearly demonstrates this phenomenon, for six of its twenty-four members were group leaders, including the four German-speaking émigrés Peierls, Bretscher, Frisch and Placzek.[411] Amongst all Los Alamos group leaders, Rudolf Peierls was perhaps the most important one. Not only was he in charge of directing a team but he also assumed the role of the leader of the British group when James Chadwick received orders to go to Washington, DC.[412] Soon after his arrival

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[408] Nordheim, Interview by Wheaton, pp. 39-44; Johnson and Schaffer, pp. 17-21, 55-56.
[409] King, p. 221; M.M.R. Williams, *Development of Nuclear Reactor Theory*, p. 312.
[410] Perrin to Gorrell Barnes, 'T.A. Staff for U.S.A.', p. 3; Chadwick to Bünemann, 1 June 1945; Chadwick to Massey, 25 July 1945, CHAD IV/3/7.
[411] Szasz, *British Scientists*, p. 18.
[412] Brown, *Neutron and the Bomb*, p. 286; Gowing, *Britain and Atomic Energy*, pp. 265-66; Szasz, *British Scientists*, p. 40.

at Los Alamos, Peierls had taken over leadership of Edward Teller's T-1 Implosion Hydrodynamics group, which formed part of the Theoretical Division.[413] Peierls's group used early computational and analytical methods in order to examine the compression of materials under varying impacts. Hans Bethe commented on Peierls's presence at Los Alamos: 'What we needed was the combination between the scientific talent of Peierls's group and the computational facilities.'[414] Since the British scientists were far advanced in the gaseous diffusion processes, Rudolf Peierls and Klaus Fuchs worked in this area, as they had done in New York City before.[415] That the American government awarded Peierls the Presidential Medal of Merit, the highest medal a civilian can receive in the United States, for his contributions to the Manhattan Project after the war, underlined both his exceptional contributions to the making of the first atomic bombs and his distinguished reputation.[416]

Peierls's long-time friend and collaborator Otto R. Frisch was among the other three members of the British Mission who held positions as group leaders. After Peierls, he was one of the most important members of the British Mission. With the creation of the Gadget (G) Division in August 1944, Frisch became leader of the group working on critical assemblies.[417] It was in particular his so-called Dragon Experiment, which came as close as possible to a nuclear explosion, that demonstrated Frisch's importance. He made a critical mass of uranium 235 subcritical by cutting a hole into its centre. The missing piece which fit exactly into the opening was then dropped through a barrel. Although the uranium 235 briefly became critical, Frisch averted an explosion because the piece of uranium 235 fell quickly through the hole and the nuclear reaction declined. This test was crucial in the building of a working nuclear weapon because it averted the need to test the uranium-fission bomb. Given the limited amount of fissile material available at this point, Frisch's experiment was a priceless achievement.[418]

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[413] Hawkins, p. 76.
[414] Bethe, Interview by Balibrera, p. 10.
[415] Gowing, *Britain and Atomic Energy*, pp. 250-56.
[416] Besides Peierls, William Penney was the only other member of the British Mission to Los Alamos who received the medal of merit. But in Britain, Franz Simon was also presented with it; Chadwick to Nichols, 12 March 1946, CHAD IV/3/15.
[417] Hawkins, p. 197.
[418] Otto R. Frisch, 'The First Nuclear Explosion', *New Scientist*, 6 August 1970, p. 274; Hoddeson and others, pp. 346-48.

George Placzek, another close friend whom Peierls met at Los Alamos, is perhaps the most underestimated and usually forgotten German-speaking member of the British team. Like Rudolf Peierls and Hans Bethe, the Czech-born theoretical physicist had studied for a short period under Werner Heisenberg at the University of Leipzig.[419] Placzek had been professor at Cornell University, Ithaca, New York, before he became involved in the Manhattan Project, at first, in Montreal, Canada, where he was leader of the Theoretical Physics Division and then later at Los Alamos as part of the British Mission.[420] He was a distinguished expert on neutron diffusion theory.[421] From May 1945, he directed a newly formed group within the Theoretical Division, which worked on possibilities of creating a combined plutonium-uranium weapon. Shortly after the war, Georg Placzek even replaced Hans Bethe as the head of the reorganised T-Division, which is a good indicator of his high calibre.[422]

Apart from Frisch and Placzek, Peierls had also previously known Egon Bretscher who, like Klaus Fuchs, had not quite yet achieved the same status as Frisch and Peierls but who had perhaps been the first one to predict the use of plutonium as a source of energy.[423] Following the laboratory's reorganization with the subsequent creation of the F-Division under the leadership of Enrico Fermi, Bretscher headed a group on Super experimentation.[424]

Among the German-speaking members of the British Mission, Klaus Fuchs was the only one not to hold a senior administrative post as group leader. As in New York City before, he was Peierls's assistant.[425] Fuchs was valued for his theoretical skills and his report on the scaling for blast waves became a widely accepted key study.[426] Hans Bethe praised Fuchs as 'perhaps the most hard-working member of our entire division' who 'worked day and night' and 'contributed greatly to the success of the Los Alamos project'.[427] In spite of his great talent and work ethic,

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[419] Peierls, *Bird of Passage*, p. 39.
[420] Klaus Fischer, *Changing Landscapes of Nuclear Physics: A Scientometric Study on the Social and Cognitive Position of German-Speaking Emigrants Within the Nuclear Physics Community, 1921-1947* (Berlin: Springer, 1993), pp. 25-27; Peierls, *Bird of Passage*, p. 188; M.M.R. Williams, 'Development of Nuclear Reactor Theory', pp. 255-56.
[421] Szasz, *British Scientists*, p. 25.
[422] Hoddeson and others, pp. 246-47, 399.
[423] Szasz, *British Scientists*, p. 18.
[424] Hawkins, p. 184.
[425] Gowing, *Britain and Atomic Energy*, p. 262; Peierls, *Bird of Passage*, p. 200.
[426] Szasz, *British Scientists*, p. 89.
[427] Bethe, Interview by Balibrera, p. 8.

Fuchs had not yet advanced into the same league as Rudolf Peierls and Otto Frisch. Klaus Fuchs himself later suggested that many of his colleagues had regarded him together with Richard Feynman as the most gifted junior scientists at Los Alamos.[428]

At Site Y, Fuchs, Peierls and the other members of the British Mission collaborated with other German-speaking émigré atomic scientists who had come to Los Alamos from American universities. Hans Bethe, who was perhaps the most important German-speaking émigré atomic scientist at wartime Los Alamos, was among this group. Alongside the Italian-born Enrico Fermi, Bethe was the only European-born division leader at Los Alamos. He had come to Los Alamos via Cornell University, where he had found employment in 1935. On 'the Hill', Bethe directed one of the initially five divisions, the Theoretical or simply T-Division.[429] Both Klaus Fuchs and Rudolf Peierls worked in Bethe's division. Because of his work ethic Bethe was nicknamed '[t]he Battleship' by his colleagues.[430] J. Robert Oppenheimer held T-Division in high esteem, in particular with regard to their calculations relating to problems of efficiency and critical mass.[431]

Shortly before the completion of the project, Hans Bethe assumed a pivotal role when he refuted with his calculations substantial fears that the high temperatures and pressures inside the Trinity explosion might trigger a reaction which would result in the creation of a new star, igniting the entire planet's atmosphere.[432] On 28 February 1945, Hans Bethe also attended a crucial meeting, which included J. Robert Oppenheimer, General Groves, James B. Conant, George Kistiakowsky, and was to settle pivotal questions regarding the schedule and design of the implosion weapon. From 1 March 1945, Bethe was also a member of the so-called Cowpuncher Committee. Set up by J. Robert Oppenheimer to direct the final stage of the implosion project, this potent board included, besides Bethe and Oppenheimer, George Kistiakowsky, William Parsons, Robert Bacher, Samuel Alison, and Cyril Smith as well as Kenneth Bainbridge.[433]

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[428] *Prof. Dr. Klaus Fuchs.*
[429] Bethe, Interview by Balibrera, pp. 4-5.
[430] Ben Dobbin, ' "Last giant" of LANL dies at 98', *Santa Fe New Mexican*, 8 March 2005, pp. A1, A5 (p. A1).
[431] Hoddeson and others, pp. 77, 408.
[432] Bethe, Interview by Balibrera, p. 11; Szasz, *Day the Sun Rose Twice*, pp. 20-21, 57.
[433] Hoddeson and others, pp. 312, 316.

At Los Alamos, Rudolf Peierls also met his Viennese friend Victor F. Weisskopf, whom he had come across in various places before.[434] At the secret Manhattan Project installation, Weisskopf worked as a group leader in Bethe's Theoretical Division. At first, his task was to interpret experiments which had been conducted by some of the experimental groups in order to determine the critical mass. Later, he assessed the yield of nuclear explosions and efficiency. On account of his very successful approach to solving problems primarily based on his intuition, there was a sign in the hallway pointing to his office, which read 'To the Los Alamos Oracle'.[435] Hans Bethe acknowledged Weisskopf's talent by appointing him as deputy of the Theoretical Division.[436]

Edward Teller and Hans Staub were the two remaining German-speaking group leaders at Los Alamos. Teller, who had previously worked at the University of Chicago's Metallurgical Laboratory, was one of a group of four Hungarian-born scientists who worked on the Manhattan Project.[437] Born in Budapest during the time of the Austro-Hungarian Empire, Edward Teller, Eugene Wigner, Leo Szilard and John von Neumann all had attended the Lutheran *Gymnasium* (high school) in their hometown. When a severe upsurge of anti-Semitism swept through Hungary in the aftermath of the First World War, the four men left their native country for Germany where they received substantial parts of their higher education. Adolf Hitler's ascension to power in early 1933, however, forced them to continue the westward move that eventually led them to the United States and into the Manhattan Project.[438]

While Eugene Wigner as well as Leo Szilard were both engaged in work at the University of Chicago and John von Neumann only visited 'the Hill' occasionally, Edward Teller and his wife Mici were the only Hungarians permanently residing at Los Alamos.[439] At Los Alamos, Edward Teller assumed the role of a spokesperson, communicating on behalf of the laboratory with the Manhattan Project installation at Columbia University, New York City.[440] But soon tensions started to grow between the Hungarian-born émigré and the scientific

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[434] Peierls, *Bird of Passage*, p. 191.
[435] Bethe, Interview by Balibrera, p. 5; Hoddeson and others, p. 246.
[436] J. David Jackson and Kurt Gottfried, *Victor Frederick Weisskopf, 1908-2002: A Biographical Memoir*, Biographical Memoirs, 84 (Washington, DC: National Academies Press, 2003), p. 14.
[437] Hawkins, p. 7.
[438] Hargittai, pp. 3-87.
[439] Peierls, *Bird of Passage*, p. 192; Teller, *Memoirs*, p. 170; Eugene P. Wigner, *The Recollections of Eugene P. Wigner: as Told to Andrew Szanton* (New York: Plenum Press, 1992), pp. 211, 222-25.
[440] Teller, *Memoirs*, p. 178.

director of the Los Alamos laboratory that continued through the war years and eventually peaked in Teller's testimony against his former boss in the Oppenheimer security hearings of 1954.[441] Edward Teller had first felt aggravated and disappointed when J. Robert Oppenheimer had picked Hans Bethe over him as head of the Theoretical Division.[442] In addition, Teller had started to show signs of becoming increasingly obsessed with the idea of a thermonuclear weapon – the so-called Super. And, owing to his infatuation with the 'Super', he had become more and more reluctant to fulfil his assigned tasks, especially performing calculations for the implosion weapon. When his division leader, Hans Bethe, complained to Oppenheimer about Teller's behaviour, Oppenheimer stripped him of his duties as group leader. And it was Rudolf Peierls who then took over the leadership of Teller's group in T-Division shortly after his arrival on 'the Hill'.[443]

But Teller was still not excluded from work at the laboratory. Instead, Oppenheimer separated his group from T-Division and gave Teller the freedom to investigate further into the 'Super', provided that he reported directly to Oppenheimer.[444] Teller pursued his new assignment with the kind of passion and vigour that was characteristic of him. As Herbert Fröhlich, who had previously worked with Teller at Bristol University, recalled the Hungarian's 'relentless ambition to succeed (in whatever activity he undertook)', even table tennis.[445] Because of Teller's reluctance to co-operate on issues other than the Super, J. Robert Oppenheimer is even said to have expressed his annoyance about the émigré scientist's behaviour, saying: 'May the Lord preserve us from the enemy without and from the Hungarians within'.[446]

The remaining German-speaking group leader at Los Alamos was Hans Staub. While the majority of German-speaking scientists at Site Y, including Rudolf Peierls, Klaus Fuchs, George Placzek, Hans Bethe, Victor Weisskopf and Edward Teller, were theoreticians and thus worked in the Theoretical Division, Hans Staub,

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[441] Peierls, *Bird of Peierls*, p. 200
[442] Herken, *Brotherhood of the Bomb*, pp. 85-86; Rhodes, *Making of the Atomic Bomb*, p. 539.
[443] Kai Bird and Martin J. Sherwin, *American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer* (New York: Knopf, 2005), pp. 282-83; Peter Goodchild, *J. Robert Oppenheimer: 'Shatterer of Worlds'* (London: British Broadcasting Corporation, 1980), p. 83.
[444] Hoddeson and others, p. 204.
[445] Hyland, p. 252 note 66.
[446] Cited in Charles L. Critchfield, 'The Robert Oppenheimer I Knew', in *Behind Tall Fences: Stories and Experiences About Los Alamos at Its Beginning*, ed. by Mary Mann and John C. Allred (Los Alamos, NM: Los Alamos Historical Society; Exceptional Books, 1996), pp. 169-77 (p. 173).

like Otto Frisch and Egon Bretscher, was an experimental physicist. The Swiss-born Staub, who had previously held a post at Stanford University, worked closely with the Italian-born Bruno Rossi in the Experimental Physics Division. At first, Staub headed a group, which was formed in July 1943 and was concerned with the improvement of counters. In September 1943, his team was combined with Rossi's group, which had worked on developing enhanced electronic techniques, under the latter's direction as the Detector Group.[447] Staub's co-operation with Rossi was crucial in constructing instrumentation for Robert Serber's so-called RaLa method. This method was named after the element Radio Lanthanum, which the scientists used to emit rays for diagnosing implosion in numerous tests in order to examine the feasibility of a plutonium implosion weapon.[448] When the Research and F-Divisions were merged in the Physics Division in November 1945, Hans Staub and Egon Bretscher became co-leaders of the P-4 team working on Thermonuclear Reaction.[449]

Other German-speaking émigré atomic scientists at wartime Los Alamos who did not hold positions as group leaders included the Hungarian-born theoretician John von Neumann as well as the German-born Rolf Landshoff and Maria Göppert-Mayer, the Swiss-born Felix Bloch as well as the Austrian-born Martin Deutsch. While Bloch and Landshoff resided permanently on 'the Hill', Mayer and von Neumann only visited occasionally but made pivotal contributions to the creation of the first atomic bombs.[450] Together with the Danish-born Niels Bohr who also occasionally visited Los Alamos and the Italian-born Enrico Fermi, von Neumann ranked in the eyes of Hans Bethe amongst 'the greatest intellects at Los Alamos'.[451] As the following subchapter will show, John von Neumann played a critical role in making the implosion principle work.[452] Maria Göppert-Mayer first engaged in Manhattan-Project-related work on gaseous diffusion at Columbia University. She visited Los Alamos on several occasions to work with Edward Teller.[453]

Felix Bloch, who belonged to the minority of experimentalists among the German-speaking émigré scientists at Los Alamos, came to the secret MED facility from Stanford University where he had previously focused on analysing the fission

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[447] Frisch, *What Little I Remember*, p. 191; Hawkins, pp. 7, 90.
[448] Hoddeson and others, pp. 148-56, 268-71.
[449] Hawkins, p. 310.
[450] Howes and Herzenberg, p. 37; Peierls, *Bird of Passage*, p. 192.
[451] Bethe, interview by Balibrera, p. 16.
[452] Hoddeson and others, p. 131.
[453] Howes and Herzenberg, pp. 40, 47; Teller, *Memoirs*, p. 187.

spectrum by applying proton recoil studies in ionisation chambers. At Site Y, Bloch was a member of the implosion group.[454] Owing to tensions with Oppenheimer and his frustration with the organisation of the laboratory, Bloch decided to leave Los Alamos like Edward U. Condon before the final wartime mission was completed.[455]

Edward Teller recruited Rolf Landshoff for his group at Los Alamos. During a visit to Chicago Eugene P. Wigner told Edward Teller about Landshoff, one of his former students from his Berlin days. After a few attempts, Edward Teller finally succeeded in recruiting Landshoff for Los Alamos where he joined Teller's team in November 1944.[456] In the spring of 1946, Landshoff left Teller's group on the Super and became leader of a group working on the Super and radiation hydrodynamics.[457] Like Landshoff, Martin Deutsch came to Site Y directly from an American university. At Los Alamos, Deutsch worked under Emilio Segrè.[458]

When it was decided in August 1945 to compile a series of edited volumes on the technical history of the achievements of the Los Alamos laboratory in the style of the German *Handbuch der Physik* (*Physics Handbook*), dubbed the Los Alamos Technical Series, five of the twenty-four volumes were edited by German-speaking émigrés, three of whom (Peierls, Frisch and Placzek) were members of the British Mission: Rudolf Peierls ('Theory of Implosion'), Otto Frisch ('Critical Assemblies'), Georg Placzek ('Neutron Diffusion Theory'). Hans Bethe ('Blast Wave') and Victor Weisskopf ('Efficiency') edited two further volumes.[459] Their participation in the Los Alamos Technical Series underlined once more the significance of German-speaking émigré nuclear scientists at wartime Los Alamos in general and within the British Mission in particular.

Work on the Manhattan Project: The Formation of a New Approach to Nuclear Science

Apart from their individual contributions, Klaus Fuchs and especially Rudolf Peierls were instrumental in shaping a new approach to nuclear physics. This new methodology was primarily based on three determining factors: firstly, the Los

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[454] Hoddeson and others, pp. 49, 134, 141; Szasz, *Day the Sun Rose Twice*, p. 9.
[455] Teller, *Memoirs*, p. 180.
[456] Teller, *Memoirs*, p. 190.
[457] Hawkins, pp. 305-06.
[458] 'Martin Deutsch, MIT Physicist Who Discovered Positronium, Dies at 85', *MIT Physics Annual* (2003), 12-15.
[459] Hawkins, p. 349.

Alamos scientists had to work under tremendous time pressure and tight scheduling to achieve their goal of beating the 'Third Reich' in the race for the atom bomb. Secondly, and closely connected to the first point, the fear of nuclear weapons in the hands of the National Socialist regime in Germany secured abundant financial support from government sources. And, finally, the fact that the making of atomic arms was, above all, an engineering task represented a peculiar novelty. As a result, many theoreticians engaged in experimental work and the dividing lines between experimental and theoretical physics started blurring and became increasingly porous.[460]

In the making of this new approach, which eventually led to the development of the atom bomb, Klaus Fuchs and Rudolf Peierls came in fittingly and combined their more 'traditionally German' theoretical skills with the Anglo-American leaning towards experimentation.[461] At Los Alamos, Fuchs and Peierls not only came into contact with Anglo-American experimentalism; they were also exposed to the Italian school of Enrico Fermi, represented by its founder and one of his long-time collaborators, Emilio Segrè.[462]

Rudolf Peierls and to a lesser degree Klaus Fuchs, like the overwhelming majority of the other German-speaking scientists at Los Alamos, had received considerable parts of their higher education in Germany during the country's golden age of international science in the 1920s and early 1930s.[463] The list of graduates from German universities included other famous members of the Los Alamos laboratory. The Ukrainian-born explosives expert George Kistiakowsky, for example, had received a PhD in chemistry from Berlin University in 1925 and, in 1927, even the scientific director of the laboratory, J. Robert Oppenheimer, had earned a PhD in physics from Göttingen University. [464]

While a strong separation between experimental and theoretical orientation had dominated nuclear science in Germany before 1933, Fuchs and Peierls were now

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[460] Hoddeson and others, pp. 4-5, 9-10; Teller, *Memoirs*, p. 171; Victor F. Weisskopf, Interview by Charles Weiner and Gloria Lubkin, 22 September and 5 December 1966, AIP, p. 31.
[461] Bethe, Interview by Hoddeson, pp. 12-14.
[462] Paul K. Hoch, 'Migration and the Generation of New Scientific Ideas', *Minerva*, 25. 3 (1987), 209-37 (pp. 212-13).
[463] Cornwell, p. 38.
[464] Klaus Hoffmann, *J. Robert Oppenheimer: Schöpfer der ersten Atombombe* (Berlin: Springer, 1995), pp. 26-34; Elizabeth Noble Shor, 'Kistiakowsky, George Bogdan (18 Nov. 1900-7 Dec. 1982)', in *American National Biography*, ed. by John A. Garraty and Mark C. Carnes, 24 vols (Oxford: Oxford University Press, 1999), XII, 776-78 (p. 776).

forced into co-operation with experimentalists.[465] During his time in the United Kingdom, Peierls had already demonstrated his ability to collaborate with experimental physicists, for example, at Birmingham University in his work with Marcus Oliphant as well as his collaboration with Otto Frisch on the seminal 'Frisch-Peierls Memorandum', as has been shown in chapter two. Other German-speaking émigré theoreticians also engaged in close co-operation with experimentalists: Hans Bethe, Peierls's long-time personal friend and superior in the Theoretical Division, had previously co-operated with Milton Livingston at Cornell University, for instance.[466]

But it was at the Los Alamos laboratory that this combination of different research cultures was taken to a new, unprecedented level and played an essential part in the development of the first atomic bombs.[467] German-speaking émigré nuclear scientists had a huge share in promoting this highly interdisciplinary approach to problem solving. Since the Manhattan Project operated under tremendous pressure and an extremely tight schedule and conventional analytic modes of investigation could not produce results within the given time, the Los Alamos scientists came up with a completely new method that relied primarily on empiricism: experimental scientists conducted experiments to verify the validity of hypotheses in close co-operation with theoreticians.[468]

Hans Bethe's T-Division, which comprised a high number of German-speaking émigrés, was pivotal in forging this new methodology because, as Bethe himself said, it 'had to do with practically everything in the laboratory'.[469] As members of the Theoretical Division, Rudolf Peierls and Klaus Fuchs thus became

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[465] Hoch, 'Reception of Central European Refugee Physicists', p. 238.

[466] Paul K. Hoch, 'Some Contributions to Physics by German-Jewish Émigrés in Britain and Elsewhere', in *Second Chance* (see Stent, 'Jewish Refugee Organisations', above), pp. 229-41 (pp. 232-33). On the relationship between theoretical and experimental nuclear physics, see Jeff Hughes, '"Modernists with a Vengeance": Changing Cultures of Theory in Nuclear Science, 1920-1930', *Studies in History and Philosophy of Modern Physics*, 29. 3 (1998), 339-67. On the role of theoretical physicists, see Silvan S. Schweber's case study within the context of the United States; 'The Empiricist Temper Regnant: Theoretical Physicists in the United States 1920-1950', *HSPS*, 17. 1 (1986), 55-98.

[467] On the different national preferences in research cultures, see Eckert, *Die Atomphysiker*, pp. 105-106, 199; Kragh, p. 249. On national cultural differences and Big Science, see Sharon Traweek, 'Big Science and Colonialist Discourse: Building High-Energy Physics in Japan', in *Big Science: The Growth of Large-Scale Research*, ed. by Peter Galison and Bruce Hevly (Stanford: Stanford University Press, 1992), pp. 100-28. Mitchell G. Ash also makes a similar point in his study of German-speaking émigré psychologists, 'Disziplinentwicklung und Wissenschaftstransfer – Deutschsprachige Psychologen in der Emigration', *Ber. Wissenschaftsgesch.*, 7. 4 (1984), 207-26.

[468] Hoddeson and others, pp. 9-10.

[469] Bethe, interview by Balibrera, p. 4.

'bridge-builders' between the preferred research styles of their home and host countries, as Paul K. Hoch has generally called émigré physicists.[470] Fuchs and Peierls consequently represented a scientific variant of what Margaret Connell Szasz has termed in a different context the 'cultural broker'.[471] As the site where this 'cultural brokerage' took place, Los Alamos was a powerful example of Peter Galison's concept of the 'trading zone' that signifies the 'social and intellectual mortar binding together the disunified traditions of experimenting, theorizing, and instrument building'.[472] The 'bridge-building' between two different research cultures in the Los Alamos 'trading zone' marked *par excellence* the process which Roger H. Stuewer has generally referred to as a 'multifaceted symbiosis' between émigré nuclear physicists and their American-born colleagues.[473] As a further consequence of Fuchs's and Peierls's 'cultural brokerage', nuclear science underwent a denationalization process, when their German-influenced research styles amalgamated with those practised in Britain and the United States.[474] That all Los Alamos scientists spoke the transnational language of nuclear science facilitated the communication between the émigrés and their American-, British- and Canadian-born colleagues tremendously.[475] Here, émigré atomic scientists clearly had an advantage over primarily language-based professions such as literati.

Their rare qualifications in a field that was at the time underrepresented in the United Kingdom and the United States enabled Peierls and Fuchs to work in interdisciplinary areas such as applied mathematics.[476] Although one should be aware of the perils of counterfactual historical argument, it appears very plausible that in the case of the Manhattan Project, as Mitchell G. Ash and Alfons Söllner have argued, 'forced migration made possible careers that could not have happened in the smaller, more restrictive university and science systems of Central Europe' and 'the pressure to respond to new circumstances may have led to innovations that might not

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[470] Hoch, 'Some Contributions to Physics', pp. 232-33.
[471] Margaret Connell Szasz, 'Introduction', in *Between White and Indian Worlds: The Cultural Broker*, ed. by Szasz (Norman: University of Oklahoma Press, 1994), pp. 3-20.
[472] Peter Galison, 'Trading Zone: Coordinating Action and Belief', in *The Science Studies Reader*, ed. by Mario Biagioli (New York: Routledge, 1999), pp. 137-60 (p. 146).
[473] Roger H. Stuewer, 'Nuclear Physics in a New World: The Émigrés of the 1930s in America', *Ber. Wissenschaftsgesch.*, 7. 1 (1984), 23-40 (p. 33).
[474] Paul K. Hoch and Jennifer Platt, 'Migration and the Denationalization of Science', in *Denationalizing Science: The Contexts of International Scientific Practice*, ed. by Elisabeth Crawford, Terry Shinn and Sverker Sörlin (Dordrecht: Kluwer, 1992), pp. 133-52 (pp. 135-39).
[475] Hales, *Atomic Spaces*, pp. 244-45.
[476] Hoch, 'Some Contributions to Physics', pp. 232-33.

have occurred in the same way otherwise'.[477] In a similar fashion, Max Born's son Gustav also called '[e]nforced migration [...] the most potent antidote known against laziness, complacency and degeneracy'.[478]

Klaus Fuchs's and Rudolf Peierls's roles in shaping the innovative approach to nuclear science at Los Alamos is particularly well illustrated by their contributions to the development of the plutonium implosion bomb. In retrospect, Peierls himself valued his work on the implosion principle as his most significant contribution to accomplishing the mission of the Los Alamos laboratory.[479] In the early stages of the Manhattan Project, the Los Alamos laboratory investigated the feasibility of designing both uranium and plutonium fission weapons that used a gun to shoot a piece of either uranium or plutonium into a sub-critical to achieve a critical mass. And work on implosion, by contrast, was regarded as secondary at the time.[480] This changed fundamentally in the summer of 1944 when a group working under Emilio Segrè and including Martin Deutsch discovered that pile-produced plutonium emitted five times more neutrons than anticipated.[481]

This high neutron flux meant that spontaneous fission would occur and a gun-type plutonium weapon would pre-detonate, or 'fizzle', before reaching critical mass. Like a so-called dirty bomb, such a device would release substantial amounts of radioactive fallout, but fail to trigger a nuclear explosion. 'The greatest problem,' Hans Bethe later reminisced, 'was how to assemble the active material and assemble it in a way that it would not prematurely detonate.'[482] Here, implosion seemed to offer a promising way out of the crisis. As a result, Los Alamos's primary mission basically changed to pursue what had previously been regarded as a secondary option. The new direction in the laboratory's research prompted a massive re-organization of its divisions and groups. Apart from these administrative alterations, the mission change went hand in hand with a further alteration of the established practice: implosion research up to that point had explored its feasibility in both uranium and plutonium, it focused now exclusively on a plutonium implosion bomb.

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[477] Mitchell G. Ash and Alfons Söllner, 'Introduction: Forced Migration and Scientific Change after 1933', in *Forced Migration and Scientific Change after 1933*, pp. 1-19 (p. 4).
[478] Gustav Born, p. 141.
[479] 'Peierls' War Years', fol. 18[r].
[480] Edwin M. McMillan, 'Early Days at Los Alamos', in *Reminiscences of Los Alamos, 1943-1945*, ed. by Lawrence Badash, Joseph O. Hirschfelder and Herbert P. Broida (Dordrecht: Reidel, 1980), pp. 13-19 (p. 16).
[481] Hoddeson and others, pp. 206, 228; 'Martin Deutsch', p. 14.
[482] Bethe, interview by Balibrera, p. 6.

By contrast, the programme working on a gun weapon now concentrated solely on uranium.

Since the theoretical considerations regarding the gun assembly were basically understood at the time, the laboratory's primary aim thus changed to exploring the hitherto uncertain implosion principle. Klaus Fuchs and especially Rudolf Peierls played crucial roles in the development of the implosion weapon. While the making of the atom bomb was chiefly an engineering task, it would be wrong to assume that well-trained engineers themselves could have produced a fission bomb, let alone, an implosion bomb, without the input by theoreticians such as Fuchs and Peierls as well as Hans Bethe, John von Neumann, Edward Teller and Victor Weisskopf.[483]

Given the Manhattan Project's lavish funding by the United States government and working under the tremendous time constraints of World War II, J. Robert Oppenheimer was able to simultaneously approach specific problems from various angles in order to speed up progress. It was this principle that enabled the scientists to achieve a mission change at Los Alamos so quickly. The case of the implosion method revealed particularly well Oppenheimer's critical role in organizing and scheduling the Los Alamos operation because its perfection not only involved a mission change of the laboratory but also abandoning previously taken and often well established paths of scientific investigation.[484]

In spite of the widespread belief in the early days of the Manhattan Project that the implosion project was considered to be only secondary to the gun-assembly principle, Rudolf Peierls had made significant contributions to its advancement quite early on. The directorship of the Los Alamos laboratory had stepped up the implosion programme after a visit by John von Neumann in September 1943. Above all, von Neumann's trip to 'the Hill' gave a boost to the early work on implosion by Seth Neddermeyer's group, which was regarded as peripheral at the time. In discussions with Edward Teller, von Neumann developed the idea of achieving a faster implosion by placing explosive charges around the bomb core. Soon theoreticians such as Edward Teller, Hans Bethe and even Los Alamos's scientific director J. Robert Oppenheimer were convinced that such an implosion weapon was

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[483] Lillian Hoddeson, 'Mission Change in the Large Laboratory: The Los Alamos Implosion Program, 1943-1945', in *Big Science* (see Traweek, 'Big Science', above), pp. 265-89 (pp. 272-75, 280-88).
[484] Thorpe, *Oppenheimer*, pp. 134-38.

far more powerful than a gun-type device and von Neumann's suggestions and ideas led to the extension of the implosion work.[485] As a result, George Kistiakowsky – the leading explosives expert in the United States at the time – was appointed as consultant in October 1943 and eventually made a full member of the laboratory in February 1944. The following month, Hans Bethe also assigned a theoretical group under the leadership of Edward Teller to further investigate implosion-related problems.[486]

When Teller's group encountered calculation problems, Rudolf Peierls, who visited Los Alamos in March 1943, was instrumental in enabling them to use punch-card machines to find numerical solutions to the equations defining the implosion. Inasmuch as this formula was identical to that used by Peierls in his numerical experiments to determine blast waves in air, Peierls's experience proved decisive in moving the implosion programme ahead.[487] During another brief visit to Los Alamos in February 1944, Peierls had provided Oppenheimer with insights into the British approach to integrating blast wave equations to the problem of the hydrodynamics of the implosion. And Oppenheimer subsequently wrote to Groves that he was 'planning to attack the implosion problem along these lines with the highest possible urgency'.[488]

For its work on the implosion principle, Bethe's Theoretical Division, which both Fuchs and Peierls joined after their transfer to Los Alamos, used some of the latest computation technology available at the time, especially the IBM machines that were used to calculate the implosion.[489] Since Hans Bethe's T-Division based its mission, as has been discussed earlier, on a close collaboration of its members with experimentalists in all areas of the laboratory, it played a crucial role in establishing this new methodology. When he replaced Edward Teller as leader of the T-1 'Implosion and Hydrodynamics' group shortly after his move to Los Alamos, Rudolf Peierls became deeply involved in implosion research on a permanent basis.

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[485] Bethe, interview by Balibrera, pp. 7-8; Hoddeson and others, pp. 130-36; Robert W. Seidel, *Los Alamos and the Development of the Atomic Bomb* (Los Alamos, NM: Otowi Crossing Press, 1995), pp. 82-86.
[486] Hoddeson, 'Mission Change', pp. 265-67, 271-72.
[487] Bethe, interview by Balibrera, p. 8; Peierls, *Bird of Passage*, p. 187.
[488] Oppenheimer to Groves, 14 February 1944 (repr. in *Robert Oppenheimer: Letters and Correspondence* (see Oppenheimer to Manley, above), pp. 271-72 (p. 272)).
[489] Bethe, interview by Balibrera, p. 11.

One of the chief obstacles that Rudolf Peierls and his colleagues in the Theoretical Division had to master concerned the question of how the plutonium could be compressed so quickly that it would produce a proper nuclear explosion and not 'fizzle'. Here, so-called explosive lenses offered a solution. These lenses consisted of explosives, which were shaped in order to focus the explosion into the desired direction. Their production proved to be one of the most difficult tasks at Los Alamos. Early on, Peierls and Bethe had thus been among those scientists at Los Alamos who backed George Kistakowsky against sceptical voices in the laboratory by insisting that despite the large amount of manpower and material required to pursue the development of explosive lenses, these were indeed a crucial component of a working implosion weapon.

James Tuck's arrival at Los Alamos in May 1944 was crucial in advancing progress in designing these lenses. Tuck who had previously conducted research in this area came to 'the Hill' as a member of the British Mission and brought up the idea of a three-dimensional lens. Shortly afterwards, Rudolf Peierls and Hans Bethe commenced with their quest for an appropriate design for explosive lenses, but remained unsuccessful. It was then John von Neumann who suggested a first feasible design. When the shape of the lens was finalized in July 1944, Rudolf Peierls started to explore theoretical aspects of explosive lens design.[490] That von Neumann's design worked, marked in Bethe's words 'perhaps the most important invention to make implosion go'.[491]

In order to cope with the highly complex calculations, Rudolf Peierls's T-1 group received increased assistance from the T-6 'Numerical Calculations' group under Stanley Frankel and Eldred Nelson, after August 1944. Since Peierls's team had almost fully completed calculations of an ideal spherical implosion at this point, they started to focus more on incongruities between theoretical data and that obtained from actual tests. Peierls and his group focused in particular on two areas, velocity and density, because they had previously calculated them higher than had in fact occurred in the experiments.[492]

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[490] Hoddeson and others, pp. 163, 168, 295, 300; McAllister Hull, with Amy Bianco, *Rider of the Pale Horse: A Memoir of Los Alamos and Beyond* (Albuquerque: University of New Mexico Press, 2005), pp. 29-30.
[491] Bethe, interview by Balibrera, p. 8.
[492] Hoddeson and others, p. 307.

On the motivational level, Peierls also played an important role in the development of the so-called Christy Gadget. As group leader, he strongly supported one of his team members, Robert Christy, to overcome the problem of asymmetry in the implosion principle by using a solid core rather than hollow spheres.[493] Klaus Fuchs, who was a member of Peierls's group, also contributed greatly to the solution of a further problem, namely the development of an implosion initiator. Fuchs who had previously conducted research on the theory of jets had considerable input in working out an elementary theory of the so-called urchin design together with Hans Bethe, Paul Stein and Robert Christy. By April 1945, Fuchs had formulated a suitable theory for the initiator design in collaboration with Hans Bethe and Charles Critchfield.

Rudolf Peierls and his theoretical group worked in other areas of implosion research, too. His work in diagnostics serves particularly well to illustrate the close collaboration between members of T-Division and experimentalists as, for example, in the X-ray project. Here, Peierls made a crucial contribution when he proposed the so-called heap-of-disks experiment. In this test, a mound of metal disks was positioned close to high explosives and later scattered by the blast wave generated by an explosion. Through X-ray photography of each disk's relocation, the scientists gained important insights into the qualities of different explosives. This was not Rudolf Peierls's only contribution to implosion diagnostics. Together with the experimental physicist Otto Frisch, Peierls was among a group of nuclear scientists that proposed the basic ideas of an electric method of diagnosis called the 'pin method' in July 1944.[494]

With their input, Klaus Fuchs and, in particular, Rudolf Peierls had thus not only helped secure the successful completion of the Manhattan Project's mission, but they had also participated in shaping a new approach to nuclear science. The visible product of this new methodology was the so-called Fat Man implosion device that was successfully tested on 16 July 1945 in central New Mexico's Jornada del Muerto region near the town of Socorro.[495] The detonation, which marked both mankind's entry into the age of nuclear weapons and the successful completion of the Manhattan Project's mission, confronted Peierls, Fuchs and their colleagues for the

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[493] Szasz, *British Scientists*, p. 25.
[494] Hoddeson and others, pp. 156, 275, 278, 293, 317, 331.
[495] On the history of the Trinity Test, see Szasz, *Day the Sun Rose Twice*.

first time directly with the results of their work. Although they had achieved their mission, not all scientists left 'the Hill' immediately.

Because Norris Bradbury, who replaced J. Robert Oppenheimer as scientific director of the Los Alamos Laboratory in the fall of 1945, held Klaus Fuchs's skills in very high esteem, he requested the latter's stay until after the first US postwar atomic tests in the summer of 1946.[496] 'Of course, I do not wish to express any opinion about the absolute importance of the project work now going on here', wrote George Placzek to Chadwick in early February 1946, 'I merely want to state that Fuchs would be a great help for its successful completion.'[497] The British, too, had realized his talent and, in the summer of 1946, demanded his immediate return to the United Kingdom to resume work on their nuclear energy program.[498] Before his return, Klaus Fuchs worked in two major areas: first, Bradbury wanted him 'to give theoretical advice concerning the predicted effect and methods for determining the efficiency of the atomic weapon used in the Naval Tests'. Secondly, he was expected to help refine the first atomic bombs, especially through his expertise in hydrodynamics.[499] Despite his pivotal role during the war, Rudolf Peierls's presence, by contrast, was not deemed important for postwar work at Los Alamos.[500]

But the work of Peierls, Fuchs and other members of the British Mission had a dual consequence: while they played crucial roles in creating the first atomic weapons, at the same time, they profited greatly from their Los Alamos experience after their return to the United Kingdom when some of them resumed work on their (adopted) home country's nuclear energy programme. During his early days at Harwell, Klaus Fuchs, for example, worked especially in the area of isotope separation. And Oskar Bünemann, who had been engaged in research at the MED's Berkeley laboratory, worked in various projects in Harwell's Theoretical Physics and Nuclear Physics Divisions including 'Piles of Plutonium & Power Production', 'Slow Fission Reactors', 'Cyclotron', 'Fission Products' and 'Gas cooled piles for production of plutonium and power'.[501]

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[496] Chadwick to Bradbury, 23 January 1946; Bradbury to Chadwick, 5 February 1946; Chadwick to Fuchs, 24 January 1946, CHAD IV/3/6.
[497] Placzek to Chadwick, 4 February 1946, CHAD IV/3/6.
[498] Rudolf Peierls to Klaus Fuchs, 29 May 1946, TNA, AB 1/574.
[499] Bradbury to Chadwick, 5 February 1946, CHAD IV/3/6, p. 1.
[500] Chadwick to Groves, 9 January 1946, CHAD IV/3/6.
[501] 'A.E.R.E. Programme No. 3, September 1947', CHAD I/8/1.

While some work of their work on 'the Hill' was without immediate impact on the outcome of the Manhattan Project, it would reveal its merits later in different contexts. Klaus Fuchs's engagement in early work on thermonuclear weapons would be of great significance after the war for his work at the AERE Harwell. At Los Alamos, Fuchs collaborated with John von Neumann on the Super. On 28 May 1946, Klaus Fuchs and John von Neumann filed a joint patent application for the radiation implosion principle to be used in the hydrogen bomb, the so-called classical Super, but it surpassed the mathematical tools available at the time to improve it. In August 1946, Teller thus proposed the so-called Alarm Clock design, which was then pursued.[502] That Klaus Fuchs and Egon Bretscher, who both later joined the AERE, attended a conference on the Super organized by Teller at Los Alamos in April 1946 further aided the British postwar hydrogen weapons project.[503] The British thermonuclear project also benefited greatly from the experimental work that Bretscher's F-3 group had carried out at Los Alamos. Besides Bretscher, the team included two other British scientists, Anthony P. French and Michael J. Poole.[504] Consequently, Egon Bretscher was, apart from Klaus Fuchs, another major source of knowledge for an independent British (thermo)nuclear arms project after the war.[505]

Besides their pivotal role in establishing a new scientific approach which relied heavily on a combination of experimental and theoretical methodologies, Fuchs's and Peierls's work on the Manhattan Project also had an impressive legacy in the postwar era. First and foremost, as 'cultural brokers', they had a considerable impact on the development of the research culture of Big Science, as it is widely known today.[506] With their work on the design and operation of a large-scale isotope separation plant at Columbia University as well as for the Kellex Corporation during their time in New York City, they provided a significant part of the theoretical foundation for the K-25 uranium separation plant at the MED's Oak Ridge facility in

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[502] Arnold, *Britain and the H-Bomb*, pp. 7-9; Szasz, *British Scientists*, 26; Herken, *Brotherhood of the Bomb*, p. 374 note 92.
[503] Arnold, *Britain and the H-Bomb*, p. 38.
[504] Hoddeson and others, p. 345.
[505] On Egon Bretscher's importance for the postwar British H-bomb project, see, for example, Chadwick to Bretscher, 22 December 1945; Chadwick to Bragg, 15 January 1946, CHAD IV/3/6.
[506] On the concept of 'Big Science', see James H. Chapshew and Karen A. Rader, 'Big Science: Price to the Present', in *Science after '40*, ed. by Arnold Thackray (= *Osiris*, 2nd series, 7 (1992)), pp. 2-25; *Big Science* (see Traweek, 'Big Science', above); Derek J. de Solla Price, *Little Science, Big Science* (New York: Columbia University Press, 1963). For a culture-based approach to Big Science, see Sharon Traweek, *Beamtimes and Lifetimes: The World of High Energy Physicists* (Cambridge, MA: Harvard University Press, 1988).

Tennessee. Through their pivotal contributions to the establishment of the K-25 installation, Klaus Fuchs and Rudolf Peierls aided the advancement of the culture of Big Science in two areas.[507] The isotope separation plant came to symbolize the new gargantuan spatial dimension of Big Science. Since Union Carbide operated the K-25 facility, it also embodied the close co-operation between the US government and private contractors which David Edgerton has called 'the warfare state' in the British context.[508]

During their time at Los Alamos, Fuchs and Peierls continued to foster and accelerate the development of Big Science through their engagement in the formation of new approaches to nuclear science, as this subchapter has shown.[509] As one of the chief consequences of the emerging culture of Big Science, teamwork became the major scientific production mode in gargantuan research endeavours like the Manhattan Project. This development had a great impact on scientific authorship in nuclear weapons research, which became increasingly complex. In a 1955 article in the *Bulletin of Atomic Scientists*, which referred to the creation of the hydrogen bomb but equally applied to the making of the atom bomb, Edward Teller pointed out that the development of nuclear arms was indeed 'the work of many excellent people'. Although 'modern technical and scientific development' depended, in Teller's opinion, on '[h]undreds of ideas and thousands of skills', the public was commonly presented with a different story: 'only too often', he observed, success was attributed to 'a brilliant idea' or 'the name of a single individual'.[510] Ironically, Teller himself has often been called 'the father' of the hydrogen bomb. The anthropologist Hugh Gusterson has convincingly argued that it was especially in nuclear weapons laboratories where work is carried out in a Big-Science-oriented research mode based on teamwork as well as under a veil of secrecy that, as he phrased it, 'the distinctive contributions of individual scientists have been repressed or gathered together under the sign of sacralized individuals standing for groups'.[511] Gusterson's observation helps explain in part why J. Robert Oppenheimer has

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[507] Gowing, *Britain and Atomic Energy*, p. 240; Peierls, *Bird of Passage*, p. 184; Szasz, *British Scientists*, p. 16.
[508] Edgerton; Johnson and Jackson, p. 8.
[509] Jeff Hughes, *Manhattan Project*, p. 13.
[510] Edward Teller, 'The Work of Many People', *Science*, 121 (25 February 1955), 267-75 (p. 267).
[511] Hugh Gusterson, *People of the Bomb: Portraits of America's Nuclear Complex* (Minneapolis: University of Minnesota Press, 2004), pp. 188-89.

commonly been credited with the development of the atomic bomb and Edward Teller with that of thermonuclear weapons.

Closely connected with the emergence of Big Science was also the massive financial government support for science projects. Here, Fuchs and especially Peierls had a strong impact on the function and scope of government spending in relation to science, in particular as scientists would increasingly act as lobbyists for massive government support. Since European émigré scientists had long been used to state-funded research in the sciences in their homelands, German-speaking scientists had welcomed government funding early on while in particular their American-born colleagues discussed its effect on science.[512] Peter Bacon Hales has thus concisely summed up the essence of the Manhattan Project, calling it 'one manifestation of a complex and evolving ideology blending corporate capitalism, government social management, and military codes of coercion and obedience'.[513]

As one chief result of the massive government spending on science, a great number of scientists found employment outside universities in the United States and the United Kingdom after the war. The Second World War had a tremendous impact on university physics departments in Britain and the United States and the formation of what has come to be known as the military-industrial complex.[514] The Los Alamos laboratory, for example, was turned into a permanent nuclear weapons research establishment.[515] While the Los Alamos Scientific Laboratory, as it became officially known in 1945, and the other two chief MED sites at Oak Ridge and Hanford became permanent facilities and the Argonne National Laboratories near Chicago, Illinois, or the Sandia National Laboratories in Albuquerque, New Mexico, evolved directly out of the Manhattan Project, other atomic-arms-and-energy-related

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[512] Gerald D. Nash, *The American West Transformed: The Impact of the Second World War* (Bloomington: Indiana University Press, 1985), p. 164.
[513] Hales, *Atomic Spaces*, p. 3.
[514] See, for example, *Cold War, Hot Science: Applied Research in Britain's Defence Laboratories, 1945-1990*, ed. by Robert Bud and Philip Gummett (Amsterdam: Harwood Academic; Abingdon: Marston, 1999; repr. London: Science Museum, 2002); Peter Galison, 'Physics Between War and Peace', in *Science, Technology and the Military*, ed. by Everett Mendelsohn, Merritt Roe Smith and Peter Weingart (= *Sociology of the Sciences*, 12. 1 (1988)), pp. 47-86; Silvan S. Schweber, 'The Mutual Embrace of Science and the Military: ONR and the Growth of Physics in the United States after World War II', in *Science, Technology and the Military* (see Galison, 'Physics Between War and Peace', above), pp. 1-45 (pp. 4-6).
[515] Ferenc M. Szasz, *Larger Than Life: New Mexico in the Twentieth Century* (Albuquerque: University of New Mexico Press, 2006), pp. 125-50.

installations like the Lawrence Livermore National Laboratory in Livermore, California, were newly founded a couple of years later.[516]

In the United Kingdom where both Peierls and Fuchs returned after the war, similar laboratories were founded. Apart from the AERE Harwell, Berkshire, these included the Royal Armament Research and Development Establishment (RARDE) at Fort Halstead, Kent, where initially some nuclear weapons research was conducted, and later the AWRE Aldermaston.[517] But Britain was unable to compete with the United States in scientific matters in the long run. Alongside Fuchs's and Peierls's role in accelerating the establishment of the research culture of Big Science with its massive government-funded research installations (and as a consequence of their work for the MED), the two scientists as well as the other members of the community of high-level German-speaking émigré scientists who worked on the Manhattan Project proved significant for changing the global positioning of modern physics in favour of the United States.[518] Although Fuchs and Peierls returned to the United Kingdom where they both engaged in physical research after the war, they could certainly not alter or halt, let alone, reverse this general trend, even if they had intended to invert it. After all, British nuclear culture operated on a much smaller scale than atomic culture in the United States with 'atomic villages' rather than 'atomic cities', as has been shown in chapter one.

Klaus Fuchs became head of the AERE's Theoretical Physics Division. The AERE formed part of the British nuclear energy programme which had been established in 1947 with the firm decision to develop and test a British atom bomb. Apart from atomic weaponry, British scientists also investigated civilian applications of nuclear energy. While Klaus Fuchs worked at the AERE, which was concerned with civilian applications of atomic power, he also continued to play a crucial part in the British nuclear weapons development project which was at the time headquartered at Fort Halstead in Kent and which was moved to Aldermaston in

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[516] On the histories of these laboratories, see Jack M. Holl, *Argonne National Laboratory, 1946-96* (Urbana: University of Illinois Press, 1997); *History and Reflections of Engineering at Lawrence Livermore National Laboratory 1952-2002*, ed. by Camille Minichino (Livermore, CA: Lawrence Livermore National Laboratory, 2002); Necah Stewart Furman, *Sandia National Laboratories: The Postwar Decade* (Albuquerque: University of New Mexico Press, 1990); Szasz, *Larger than Life*, pp. 125-50.

[517] Robert Bud and Philip Gummett, 'Introduction: Don't You Know There's a War On', in *Cold War, Hot Science*, pp. 1-28 (p. 17).

[518] Bärwinkel, pp. 594-96.

Berkshire in 1950.[519] Apart from Klaus Fuchs and Oskar Bünemann, other German-speaking émigré scientists also worked at Harwell: in the General Physics Division, Heinz London was also working on Isotope Separation and in the Chemistry Division, Eugen Glueckauf (Glückauf) worked in two groups, Production Pile and Fundamental Research. In 1947, the AERE had also two further German-speaking émigré scientists engaged in what was known as Extra Mural Research: Max Born of the University of Edinburgh provided thermal diffusion calculations and Egon Orowan who was based at the Cavendish, investigated the mechanical properties of uranium at normal and higher temperatures.[520]

Owing to his attempt to understand all the research areas at Los Alamos, Klaus Fuchs proved to be of greatest significance for the British espionage effort on their American allies. James Chadwick ordered Fuchs, for example, to visit the Manhattan Project installation at Chalk River near Montreal in Canada to get a better picture of the current state of research going on there.[521] Chadwick even urged members of the British Mission to assemble a sort of 'nuclear almanac' for future research in the United Kingdom.[522] While Klaus Fuchs worked at the AERE Harwell which was concerned with civilian applications of atomic power, he also continued to play a crucial part in the British nuclear weapons development project.[523] Given the fact that British weaponeers had to rely at the start of the British H-bomb programme almost exclusively on information from Los Alamos until the summer of 1946, a clearer picture of Fuchs's importance for the British hydrogen bomb project emerges.[524] Fuchs remained an important source of information for the British H-bomb project and in 1952, for example, Sir William Penney, the chief scientist behind the British thermonuclear project visited him in prison.[525] Since the United Kingdom was far behind the United States in its own H-bomb project, much of this information exceeded present British knowledge of thermonuclear arms and the science involved at the time and thus severely restricted the successful evaluation of

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[519] Gowing, *Independence and Deterrence*, II, 3, 144-145.
[520] 'A.E.R.E. Programme No. 3, September 1947', CHAD I/8/1. D. H. Everett, 'Eugen Glueckauf. 9 April 1906 – 12 September 1981', *BMFRS*, 30 (November 1984), 193-224 (p. 193 note).
[521] Chadwick to Fuchs, 24 January 1946, TNA, AB 1/444.
[522] Michael S. Goodman, 'The Grandfather of the Hydrogen Bomb?: Anglo-American Intelligence and Klaus Fuchs', *HSPS*, 34. 1 (2003), 1-22 (p. 15).
[523] Margaret Gowing, *Independence and Deterrence*, II, 144-45.
[524] Arnold, *Britain and the H-Bomb*, pp. 40-41, 74-75.
[525] Goodman, 'Grandfather of the Hydrogen Bomb', p. 16.

Fuchs's information by the British.[526] An MI5 report stressed Fuchs's pivotal role for the British nuclear energy project: 'To his fellow scientists he had become one of the world's leading mathematical physicists.'[527]

Rudolf Peierls returned to his professorship at the University of Birmingham. Peierls declined an offer to join Cambridge University. Peierls wrote to Chadwick in February 1946:

> I think the chief argument that finally tipped the balance was the rather attractive prospects of experimental physics in Birmingham as compared with the uncertain situation in Cambridge and the need, in general, to build up the modern universities to get a fairer share of the good students, not to the detriment of Cambridge, but to re-establish fair proportions.[528]

Apart from his university post, Rudolf Peierls also served as consultant to the AERE until 1957 and again from 1964.[529]

While Fuchs and Peierls returned to Britain without any major complications, the re-integration of German-speaking émigré atomic scientists was not always smooth as Egon Bretscher's case reveals. Even before the Trinity test, Bretscher voiced unhappiness about the flow of information in the British Mission. 'I can not [*sic*] help feeling that I was good enough to provide ideas and supply data useful to the T.A.-project,' he wrote to Chadwick, 'and for the rest to be left in the cold.' 'After this has happened,' he added, 'I am not inclined to accept similar conditions in future.'[530] In late 1945, Bretscher expressed his desire to eventually return to the United Kingdom.[531] It was agreed that he should stay at Los Alamos until June 1946 to finish important parts of his current work.[532] In a letter to James Chadwick, he complained that the position that the Cavendish Laboratory in Cambridge where he had worked prior to his departure to the United States had offered him was 'unsatisfactory'.[533]

As a result of his disappointment with John Cockcroft and especially Lawrence Bragg, Bretscher entered into negotiations with American universities.[534]

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[526] Goodman, *Spying on the Nuclear Bear*, pp. 58, 62-63.
[527] 'The Case of Dr. Klaus Fuchs', 2 March 1950, TNA, KV 2/1253, p. 1.
[528] Peierls to Chadwick, 26 February 1946, CHAD I/24, p. 1.
[529] Peierls, *Bird of Passage*, pp. 322-324; Vick to Peierls, 21 February 1964; Peierls to Vick, 12 February 1964; Peierls to Sandford, 12 February 1964; Marshall to Oates, 11 February 1964; Marshall to Bretscher, 27 May 1964; Marshall to Peierls, 28 May 1964, Peierls Papers, MS Eng. Misc b. 223, F 3.
[530] Bretscher to Chadwick, 2 July 1945, CHAD IV/3/6.
[531] Chadwick to Bretscher, 22 December 1945, CHAD I/24/2.
[532] Chadwick to Bragg, 15 January 1946, CHAD I/24/2.
[533] Bretscher to Chadwick, 20 February 1946, CHAD I/24/2.
[534] Bretscher to Chadwick, 28 February 1946; Bragg to Chadwick, 12 March 1946, CHAD I/24/2.

An angry Egon Bretscher wrote to James Chadwick: 'It seems that neither Bragg nor Cockcroft consider it desirable that I return to England.' He added: 'Under the circumstances I am certainly sorry that out of loyalty to England I refused to consider positions in this country [USA] at a time when the best jobs were going.' In the post scriptum to the letter, Bretscher admitted: 'Hanni burst into tears when she realised that Cambridge is out of the picture now. Unfortunately she (and I too) is very attached to the place. However such is life!'[535] While Syracuse University showed considerable interest in Bretscher and made him an excellent job offer, Bretscher wrote: 'The idea that we have to sever all the old ties and have to start all over again in a foreign country has cast a depression over household which is slowly becoming intolerable.'[536]

John Cockcroft suggested Bretscher join Harwell, which he eventually did, but Chadwick thought that Bretscher belonged in a university. James Chadwick thus even proposed that Bretscher join his department at the University of Liverpool and be in charge of the Van de Graaf machine they planned on building.[537] Bretscher was not fond of the idea of joining Harwell.[538] In spite of his complaints about, as well as his reluctance to join, Harwell, Egon Bretscher also saw an advantage in returning to the United Kingdom: 'One attraction Britain can offer', he argued, 'lies in the possibility to keep in close contact with the future development of [the] physical and chemical side of T.A.'[539]

Conclusion

Rudolf Peierls especially and to a lesser degree Klaus Fuchs played crucial roles in establishing close Anglo-American nuclear co-operation that eventually led to the formation of the joint Anglo-American-Canadian Manhattan Project. With their participation in the MED, Fuchs and Peierls further established themselves in the field of nuclear physics. The two scientists made pivotal contributions to the making of the atomic bomb, at first, in New York City and later, in particular, at the Los Alamos laboratory. While Klaus Fuchs was still amongst the junior scientists, Rudolf

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[535] Bretscher to Chadwick, 18 March 1946, CHAD I/24/2.
[536] Bretscher to Chadwick, 16 March 1946; Bretscher to Chadwick, 17 May 1946, CHAD I/24/2.
[537] Chadwick to Bretscher, 27 April 1946, CHAD I/24/2.
[538] Chadwick to Bragg, 2 April 1946, CHAD I/24/2.
[539] Bretscher to Chadwick, 17 May 1946, CHAD I/24/2.

Peierls held the rank of group leader in the Theoretical Division and even assumed the leadership of the British Mission to Los Alamos. Both scientists played crucial roles in the advancement of the implosion principle. In their endeavour, as this chapter has shown, Fuchs and Peierls were aided by a number of fellow German-speaking émigré atomic scientists who had come to Los Alamos either as members of the British Mission or from American universities. Rudolf Peierls's and Klaus Fuchs's involvement in the Manhattan Project had a lasting legacy and helped change the face of nuclear science considerably, in particular the emerging research culture of Big Science. With their departure from Los Alamos ended both Fuchs's and Peierls's active role in nuclear weapons research.

Chapter Four. A Nation Betrayed? The Impact of the Klaus Fuchs Atomic Espionage Case on Democracy and Postwar Political Cultures.

Introduction

After their return from Los Alamos to the United Kingdom, Rudolf Peierls's and Klaus Fuchs's ways parted: while Peierls resumed his professorship at Birmingham University, Klaus Fuchs joined the AERE Harwell where he became head of the theoretical physics division. Harwell formed part of the British nuclear energy programme which was established in 1947 with the firm decision to develop and test a British atom bomb and to explore civilian applications of atomic power. While Klaus Fuchs worked at Harwell, which was concerned with civilian applications of atomic power, he also continued to play a crucial part in the British nuclear weapons development project which was at the time headquartered at Fort Halstead in Kent and which was moved to Aldermaston in Berkshire in 1950.[540]

That Klaus Fuchs had been passing on sensitive nuclear information to the Soviet Union since 1940 had remained unnoticed by the British Security Service. When Fuchs confessed his espionage activities for the Soviets during and after the war to William Skardon in early 1950, he unleashed an unparalleled secrecy mania and paranoia that shook the foundations of the democratic state and led many Britons to view the efficiency of homeland security agencies in the early nuclear age very critically. Although MI5 had at times kept a close eye on Fuchs because of his Communist affiliations, they had never gathered any evidence of Fuchs being a spy. Instead, he had even become a key player in both the MED and Britain's postwar atomic weapons research project. The Fuchs case also affected Rudolf Peierls, who had recruited Fuchs for the TA project, and, until recently, allegations of being a Soviet spy have been brought forward against him.

While chapters two and three have examined Klaus Fuchs's and Rudolf Peierls's integration into their host country's nuclear physics community and the making of the first atomic bombs in the Manhattan Project, this chapter deals with a crucial feature of British postwar nuclear culture and analyses the impact of the Klaus Fuchs case on democracy and postwar political cultures in Britain. It situates

[540] Gowing, *Independence and Deterrence*, II, 3, 144-145.

the spy affair against the background of the Cold War and the emerging national security state.[541] The chapter is divided into three parts, the first of which serves as a brief historical introduction and provides the important background information for understanding the subsequent two sections. This subchapter demonstrates how Fuchs's German origin eventually led him to spy for the Soviets. In a flashback it goes back to his time in Germany before his flight and elaborates on his radicalization there that laid the foundation for his later espionage for the Soviet Union in Britain before it moves on to present the known facts of the case. The second part shows how the spy case around Klaus Fuchs influenced the manufacture of public opinion on homeland security and the efficiency of security agencies in the early atomic age, especially in the United Kingdom but also in the United States. The final section then deals more specifically with the impact of the Fuchs case on the German-speaking émigré atomic scientists' community in Britain in general and on Fuchs's long-time mentor Rudolf Peierls in particular.

The Klaus Fuchs Atomic Espionage Case: The Known Facts

The impact of the Klaus Fuchs atomic espionage case on public opinion and national security can best be assessed by starting with a brief overview of the spy affair and its historical background. It was in the northern German city of Kiel, as an MI5 report on the Fuchs case appropriately put it, where 'the seeds were sown' for Klaus Fuchs's turn towards Communism.[542] The United States Congress, too, realized the importance of Fuchs's stay in Kiel for his political development. As a result, the city was featured as one of the places where Klaus Fuchs resided on a 1950 map of Europe, entitled *The Geographical Focal Points of Espionage*.[543] In his statement during Klaus Fuchs's court hearing on 1 March 1950, Fuchs's defence lawyer Curtis Bennett also suggested to Judge Lord Goddard that one 'might be able to understand what was acting in this man's [Fuchs's] brain as a result of what happened in 1932

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[541] For a definition of the term 'national security state' see Jessica Wang, *American Science in an Age of Anxiety: Scientists, Anticommunism & the Cold War* (Chapel Hill: University of North Carolina Press, 1999), p. 297 note 3. On the interplay of science and national security see, for example, Paul Forman, 'Behind Quantum Electronics: National Security as Basis for Physical Research in the United States, 1940-1960', *HSPS*, 18. 1 (1987), 149-229.

[542] 'The Case of Dr. Klaus Fuchs', 2 March 1950, TNA, KV 2/1253, p. 3.

[543] United States. Cong. House. Joint Committee on Atomic Energy, *Soviet Atomic Espionage*, 82nd Cong., 1st sess. (Washington, DC: GPO, 1951), unpaginated.

and 1933'.[544] Given the tremendous impact that the rise of National Socialism had on the lives of Klaus Fuchs and his family, as chapter two has also shown, Alan Moorehead rightly argued in *The Traitors* – despite the otherwise fairly strong anti-communist bias of his book – that '[o]ne of the things that must be put down against the Nazis is that they probably did more towards the corruption of Klaus Fuchs's mind than anything the Communists ever achieved.'[545]

Fuchs's time at Kiel University in the northern German province of Schleswig-Holstein, where he studied mathematics and physics from autmn 1931 until spring 1933, coincided with the final period of political turmoil, destabilization and violence of the Weimar Republic.[546] As a consequence, this period was crucial for Klaus Fuchs's political radicalization and is thus decisive for understanding his espionage activities during and after the war.[547] Klaus Fuchs had come to the Baltic Sea port of Kiel shortly after his father Emil was appointed professor of religion at the city's Pedagogical Academy in May 1931.[548] Emil Fuchs played a pivotal role in shaping his son's ethical beliefs, especially his conscience. In his confession of his atomic espionage activities to William Skardon in early 1950, Klaus Fuchs declared, 'the one thing that most stands out is that my father always did what he believed to be the right thing to do and he always told us that we had to go our own way even if he disagreed'.[549]

While Fuchs's father was crucial in shaping his conscience, it was the highly conservative and authoritarian political environment in Kiel that radicalized him. As early as 1920, Albert Einstein, who had close ties to the maritime city, in particular through his contributions to the development of the gyro compass by Herrmann Anschütz-Kaempfe, experienced this highly conservative and even anti-Semitic

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[544] Metropolitan Police Special Branch, p. 23.
[545] Moorehead, *The Traitors*, p. 58.
[546] Downing to Harbo, RE: Foocase, espionage, 9 March 1950, Klaus Fuchs FBI File, 65-58805, vol. 15, serials 720-780. On the end of the Weimar Republic and the political crises, see Detlev Peukert, *Die Weimarer Republik: Krisenjahre der Klassischen Moderne* (Frankfurt a.M.: Suhrkamp, 1987), pp. 243-65.
[547] Fuchs himself devoted considerable space in interviews and statements relating to his confession to his time at Kiel University, see W.J. Skardon, 'Emil Julius Klaus Fuchs. Fourth, Fifth, Sixth and Seventh Interviews', 31 January 1950, TNA, KV 2/1250, p. 1; 'Statement of Emil Julius Klaus Fuchs', pp. 1-4.
[548] Emil Fuchs, *Mein Leben*, II, 189, 201-02. The records of the local government office for registration of residents in the City of Kiel indicate that Emil Fuchs and his wife, two sons and one daughter moved from Eisenach to Kiel on 12 May 1931, 'Auskunft des Archivs des Einwohnermeldeamtes Kiel', Stadtarchiv Kiel, Kiel, Germany, Klaus Fuchs folder.
[549] 'Statement of Emil Julius Klaus Fuchs', p. 1. Fuchs later reiterated this point; *Prof. Dr. Klaus Fuchs*.

atmosphere, when the announcement of a lecture to be given by him on the theory of relativity at the Kiel Autumn Week for the Sciences and Arts sufficed to trigger strong protests.[550] Two years later, in spite of his fondness for the city and for sailing, Einstein declined Anschütz-Kaempfe's suggestion that he buy the house of a famous doctor from Kiel because, he argued, '[t]he climate in Kiel seems to make the people rather stormy as well.' 'Sometimes one feels among human beings as if one were in a herd of buffalos,' Einstein added. 'In themselves they are not mean, but one must be careful not to be trampled by them.'[551]

The general elections of 31 July 1932 saw a dramatic polarization in the province of Schleswig-Holstein because about 70 per cent of the electorate had voted for oppositional anti-democratic parties. With the best turnout in all of the Weimar Republic, Schleswig-Holstein became the heartland of the NSDAP.[552] Beginning in the latter half of the year 1932, political radicalization and polarization increased in the city of Kiel, resulting in verbal and physical violence against political opponents from Nazi supporters on a daily basis.[553] This general political climate also affected Klaus Fuchs's immediate environment, Kiel University, where numerous professors, like many of their colleagues elsewhere in the Weimar Republic, had never fully internalized the democratic constitution of 1919. This also held true for significant numbers of students, and, as early as 1927, a National Socialist student organization had started to gradually increase its influence amongst students.[554]

Klaus Fuchs's political development has to be seen against this background and his membership in political parties serves as a good indicator of his growing radicalization. Having initially joined the SPD before he came to Kiel, Klaus Fuchs and two of his siblings, Gerhard and Elisabeth, who studied at Kiel, too, finally

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[550] Bernhardt Schell, 'Einleitung/Introduction', in *Einstein, Anschütz und der Kieler Kreiselkompass, Der Briefwechsel zwischen Albert Einstein und Herrmann Anschütz-Kaempfe und andere Dokumente / Einstein, Anschütz and the Kiel Gyro Compass, the Correspondence between Albert Einstein and Herrmann Anschütz-Kaempfe as well as other Documents*, ed. by Dieter Lohmeier and Bernhardt Schell, transl. by Anita Cervenák, 2nd rev. edn (Kiel: Raytheon Marine GmbH, 2005), pp. 13-87 (pp. 57-66).

[551] Einstein to Anschütz, Berlin, 12 July 1922, in *Einstein, Anschütz und der Kieler Kreiselkompass/Einstein, Anschütz and the Kiel Gyro Compass* (see Schell, above), pp. 168-69 (p. 169).

[552] Michael Legband, 'Von der Provinz zum Bundesland – Schleswig-Holstein im 20. Jahrhundert', in *Schleswig-Holstein von den Ursprüngen bis zur Gegenwart: Eine Landesgeschichte*, ed. by Jann Markus Witt and Heiko Vosgerau (Hamburg: Convent, 2002), pp. 327-83 (p. 330).

[553] Peter Wulf, 'Zustimmung, Mitmachen, Verfolgung und Widerstand – Schleswig-Holstein in der Zeit des Nationalsozialismus', in *Geschichte Schleswig-Holsteins: Von den Anfängen bis zur Gegenwart*, ed. by Ulrich Lange, 2nd edn (Neumünster: Wachholtz, 2003), pp. 585-621 (p. 588).

[554] Peter Wulf, 'Die Stadt auf der Suche', (pp. 357-58).

broke with the SPD over its policy of tacit support for Hindenburg in the presidential elections of 1932. As a result, Klaus, Gerhard, and Elisabeth Fuchs joined the *Sozialistische Arbeiterjugend* (Socialist Workers' Youth) and the KPD. At Kiel University, Klaus Fuchs also became active in the free Socialist student group called the *Revolutionäre Studentengruppe* (Revolutionary Group of Students; RSG). The RSG members, however, did not restrict their propagandistic efforts to the university campus as they also worked off-campus closely with the KPD and the *Kommunistischer Jugendverband Deutschlands* (Communist Youth Association of Germany; KJVD).[555] Fuchs, for instance, also instructed members of the *Sozialistische Schülergemeinschaft* (Community of Socialist High School Students) in Marxist-Leninist doctrine.[556] Klaus Fuchs and his brother Gerhard enjoyed the reputation as talented public speakers in Kiel's leftwing circles and appeared frequently at KPD meetings. As was standard practice at the time, they also showed up at Nazi gatherings and tried to disturb them.[557] In return, members and sympathizers of the NSDAP repeatedly harassed Klaus Fuchs and even made an attempt on his life.[558]

Since Klaus Fuchs was a known Communist in Kiel, he left the city for Berlin where he enrolled at the *Friedrich-Wilhelms-Universität* in mathematics and physics after the National Socialist takeover. That he took the train to Berlin very early on the morning after the burning of the *Reichstag* proved to be the right choice because only a few hours after his departure the Gestapo came to his apartment looking for him.[559] The Nazi students at Kiel University, however, maintained influential political contacts all over Germany so that Fuchs was finally expelled from Berlin University by decree of its rector on 3 October 1933.[560] Fuchs was

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[555] Dittrich, pp. 175-182. See also the Hedwig Gerth's testimony; 'Report, Made by Joseph C. Walsh, RE: Emil Julius Klaus Fuchs', 9 November 1950, Klaus Fuchs FBI File, 65-58805, vol. 41, serials 1457-1500; 'Statement of Emil Julius Klaus Fuchs', pp. 1-3.

[556] Reuven Golan, 'Aus der Erlebniswelt eines jüdischen Jugendlichen in Kiel Anfang der dreißiger Jahre', in *'Wir bauen das Reich': Aufstieg und erste Herrschaftsjahre des Nationalsozialismus in Schleswig-Holstein*, ed. by Erich Hoffmann and Peter Wulf (Neumünster: Wachholtz, 1983), pp. 361-68 (p. 366).

[557] Dittrich, pp. 180-82. On Communists and political violence at the time, see also Eve Rosenhaft, *Beating the Fascists?: The German Communists and Political Violence, 1929-1933* (Cambridge: Cambridge University Press, 1983; repr. 2008).

[558] Emil Fuchs, *Mein Leben*, II, 221; 'Statement of Emil Julius Klaus Fuchs', p. 3.

[559] Emil Fuchs, *Mein Leben*, II, 200-01; *Prof. Dr. Klaus Fuchs*; 'Statement of Emil Julius Klaus Fuchs', p. 4.

[560] SAC, NY, to Director, FBI, RE: Foocase, espionage, 26 July 1950, the Los Alamos National Laboratory Archives, Los Alamos, New Mexico, United States (hereafter LANL), VFA 529; Downing to Harbo.

forced to remain in the underground until he left Germany for France and finally the United Kingdom.[561] As chapter two has shown, several members of his family were less fortunate and were subjected to National Socialist terror.

Therefore, Fuchs's time especially in Kiel and later also Berlin undoubtedly had a very strong impact on the political radicalization that led him eventually to pass nuclear information to the Soviets during and after the Second World War. While it remains an impossible task to fully evaluate Fuchs's inner motivations to spy for the Soviet Union, as he presented them in statements to British, American and East German security services, the fact that he usually did not accept payments for his services, apart from his expenses in the early days of his work for the Soviet Union and a symbolic payment of £100 which he received shortly after his return to the United Kingdom in 1946 as a means of expressing his dedication to the Soviet cause, stresses his commitment to both the Communist cause and the Soviet Union.[562] And Klaus Fuchs never lost that commitment. After his arrival in the GDR in 1959, he collaborated with Soviet scientists on fast neutron reactions and was an active member in the German-Soviet Friendship Society as late as the mid-1980s.[563]

Klaus Fuchs's dedication to Communism led him to pass many of the innermost nuclear secrets to the Soviets. Once he joined the TA project, he realized that he had to share all the information which was made available to him with the Soviet Union so that the country would not fall too far behind in the development of nuclear weapons.[564] Fuchs thus established contact with the Soviets through Jürgen Kuczynski who was at the time the leader of a London-based underground KPD cell.[565] His first contact was later identified as Simon Kremer who served as the secretary to the military attaché at the Soviet Embassy at the time.[566] Kuczynski's

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[561] 'Statement of Emil Julius Klaus Fuchs', p. 5.

[562] SAC, NY, to Director, FBI, p. 26; Skardon, 'Emil Julius Klaus Fuchs. Fourth, Fifth, Sixth and Seventh Interviews', p. 2.

[563] 'Secret Report, Soviet Embassy, GDR', 9 April 1986, Klaus Fuchs personal file ('Lichnoe delo Fuks Klaus'), the Comintern Archives, the Russian States Archive of Socio-Political History, Moscow, Russian Federation (hereafter RGASPI), Komintern, F. 495, op. 205, d. 6612, p. 4. I am grateful to Serge Simonov for translating the RGASPI files from Russian into English.

[564] *Prof. Dr. Klaus Fuchs*; 'Statement by Klaus Fuchs to Hugh Clegg and Robert J. Lamphere, Wormwood Scrubs Prison, London, England, May 26, 1950', LANL, VFA 529, p. 1.

[565] SAC, New York, to Director, FBI, pp. 6-7; Ruth Werner, *Sonjas Rapport*, new expanded edn (Berlin: Neues Leben, 2006), p. 292.

[566] 'The Case of Dr. Klaus Fuchs', p. 2. On Fuchs's espionage activities see also 'The Case of Dr. Klaus Fuchs – Appendix B: Summary of Information Obtained from Dr. Fuchs Regarding His Espionage Contacts', 2 March 1950, TNA, KV 2/1253.

sister Ursula later also served as Fuchs's courier in Banbury on several occasions.[567] He worked then under the KGB code names of 'Rest' and 'Charles' respectively.[568]

By 1949, MI5 and the FBI had launched investigations of Klaus Fuchs. Within the context of the discovery of the Klaus Fuchs spy case, it is important to mention the so-called Gouzenko affair. In the autumn of 1945, Soviet cipher expert Igor Gozenko defected in Ottawa, Canada. His defection represented an important first step towards uncovering atom spies such as Klaus Fuchs and Alan Nunn May.[569] Fuchs became a chief suspect thanks to the efforts of the FBI, in particular Robert Lamphere and Meredith Gardner. After his appointment as director of the espionage division at the FBI headquarters in Washington, DC, Lamphere assigned the senior cryptographer Gardner to the task of decoding several intercepted Venona messages which had been sent from the Soviet consulate in New York City to the KGB headquarters in Moscow between 1944 and 1945. It was soon discovered that someone had passed on top-secret atomic information to the consulate in New York. Early on, the FBI suspected that the KGB spy was among the members of the British Mission.[570] While Fuchs had authored the intercepted report, all four members of the British team who were based in New York City at the time (apart from Fuchs these were Rudolf Peierls, Tony Skyrme and Christopher Frank Kearton) were suspects.[571] Suspicion against Peierls was grounded in the fact that sensitive data was easily accessible to him as a senior scientist in the British Mission. Moreover, he was a German-born refugee from Nazism married to a Russian-born woman. Once the FBI realized it could not produce any evidence against Peierls, the suspicion vanished.[572]

In late 1949, the evidence gathered by the FBI pointed to Klaus Fuchs as the main suspect. The FBI then shared the information with MI5 who started working on

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[567] Werner, *Sonjas Rapport*, new expanded edn, pp. 289-95. Ursula Kuczynski went by several names: after her marriage she became Ursula Hamburger but was also known as Ruth Werner and Sonja Ludwig; Ursula Kuczynski (Ursula Hamburger; Sonja Ludwig) personal file ('Lichnoe delo Kuchinski Ursula [Gamburger Ursula, Liudvig Sonia]'), RGASPI, Komintern, F. 495, op. 205, d. 1721.

[568] Klaus Fuchs operated, at first, under the code name 'Rest' which was changed to 'Charles' in May 1944; Alexander Feklisov and Sergei Kostin, *The Man Behind the Rosenbergs: Memoirs of the KGB Spymaster Who also Controlled Klaus Fuchs and Helped Resolve the Cuban Missile Crisis*, transl. by Catherine Drop (New York: Enigma Books, 2001), p. 416 note 54.

[569] On the Gouzenko affair and its impact, see Hyde, pp. 1-48.

[570] Robert J. Lamphere and Tom Shachtmann, *The FBI-KGB War: A Special Agent's Story* (New York: Random House, 1986), pp. 85-86, 133. On the Venona files, see also John Earl Haynes and Harvey Klehr, *Venona: Decoding Soviet Espionage in America* (New Haven: Yale University Press, 1999).

[571] Hoover to McMahon, 6 April 1950, Klaus Fuchs FBI File, 65-588805, vol. 28, serials 1039-1105.

[572] Szasz, *British Scientists*, p. 83.

a plan to expose Fuchs.[573] MI5 decided that Fuchs's telephones at home and work should be tapped, his correspondence monitored, microphones installed in his office, his banking account checked, his movements observed, all his contacts, including Rudolf Peierls, investigated and that Wing Commander Henry Arnold, the security officer at Harwell and one of Fuchs's few close friends, should be involved in the investigation.[574] An opportunity appeared when Klaus Fuchs approached Arnold to ask for advice on how he should behave because Emil Fuchs had just accepted a post at the University of Leipzig. Fuchs feared that his father's move to East Germany might mean that he was seen as a security risk.[575] William Skardon who had also been involved in the interrogation of William Joyce alias Lord Haw Haw was put in charge of interrogating Klaus Fuchs by mid-December 1949. It was hoped that Skardon would eventually make Fuchs confess by applying a 'soft approach' in his interrogations.[576]

During the course of the first in a series of a total of seven interviews with Fuchs, William Skardon confronted him with the espionage allegations, which Fuchs vehemently denied. Klaus Fuchs remained outwardly unimpressed and protested his innocence or, as he later described it himself, 'played the scientist' despite William Skardon's assurance that he was stating a given fact and not probing him about this matter.[577] 'Reviewing all the facts in the light of the interrogation', Skardon wrote in the report after the meeting, 'I feel sure that we have selected the right man, unless by chance someone in the nature of a twin brother was in New York when he was there.'[578] Because of Klaus Fuchs's (initial) unwillingness to confess to the charges of atomic espionage on behalf of the Soviet Union, MI5 drew up a contingency plan, including his surveillance and the wiretapping of phone lines of Fuchs and some of his colleagues and friends at Harwell as well as his arrest in case he tried to defect.[579]

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[573] Gowing, *Independence and Deterrence*, II, 144-53.
[574] J.C. Robertson, 'Emil Julius Klaus Fuchs,' 7 September 1949; J.C. Robertson, 'Meeting with W/Cdr. Arnold on 9th September, 1949', 9 September 1949; J.C. Robertson, 'Klaus Fuchs. Further Investigation Plan', 12 September 1949, TNA, KV 2/1246.
[575] Szasz, *British Scientists*, pp. 83-84.
[576] 'A legacy of interrogation: Traditional tactics used by British soldiers', *The Times*, 17 November 1971, p. 16; Hyde, p. 99; J.C. Robertson, 'Proposed Interrogation of Fuchs', 16 December 1949, TNA, KV 2/1249.
[577] *Prof. Dr. Klaus Fuchs*.
[578] Skardon, 'Emil Julius Klaus Fuchs', 22 December 1949, pp. 3, 6.
[579] J.C. Robertson, 'Action following Fuchs Interrogation', 21 December 1949, TNA, KV 2/1249.

While Klaus Fuchs continued to reject all allegations against him in the second and third interviews, it was in the crucial fourth interrogation on 24 January 1950 that he confessed to William Skardon his espionage activities for the Soviets. Fuchs had requested to see Skardon at his private home at 17 Hillside in Harwell that day, and another meeting had been arranged through Wing Commander Arnold. For the first two hours, Fuchs apparently intended to 'play the scientist' again but was, as William Skardon observed, under 'considerable mental stress'. He gave a lengthy account of his underground activities for the KPD in Germany prior to his flight. After Skardon let Fuchs know that it appeared to him as if he had just a 'long story providing a motive for acts' but not given any hints of the nature of the acts right before they went off for lunch, Fuchs still assured him, 'I will never be persuaded by you to talk.'[580]

As Skardon noted in his report, Fuchs seemed to 'be revolving the matter and to be considerably abstracted' over lunch to such an extent that he urged Skardon to return to his house quickly after the two men had finished their lunch. Upon their arrival at Fuchs's private home, Klaus Fuchs informed Skardon about his decision to co-operate and answer the latter's questions. While he indicated he had a 'clear conscience at present', Fuchs voiced serious worries about the 'effect of his behaviour upon the friendships [which] he had contracted at Harwell'. Moreover, Klaus Fuchs cited his disapproval of Stalinism indirectly as a further reason to confess his activities. As William Skardon recalled, Fuchs declared that while he still believed in the ideals of Communism, he rejected it in the form it was currently taking in the Soviet Union which had transformed it into 'something to fight against'.[581] Rudolf Peierls commented on Fuchs's turn away from Communism and his regret for his betrayal of both his host country and his friends that '[f]rom his [Fuchs's] point of view this is perhaps the most tragic: that he now does not even have the satisfaction of suffering for a cause in which he believes.'[582] On 27 January 1950, Fuchs and Skardon met again, this time at the War Office, and Klaus Fuchs

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[580] W.J. Skardon, 'Emil Julius Klaus Fuchs. Second Interview', 2 January 1950, TNA, KV 2/1249; Skardon, 'Emil Julius Klaus Fuchs. Fourth, Fifth, Sixth and Seventh Interviews', p. 1.
[581] Skardon, 'Emil Julius Klaus Fuchs. Fourth, Fifth, Sixth and Seventh Interviews', p. 1.
[582] Rudolf Peierls, 'The Lessons of the Fuchs Case', n.d., Peierls Papers, b.197, A 16, p. 3.

dictated to Skardon a statement going into detail about his activities for the Soviet Union.[583]

In his confession, Fuchs explained to William Skardon his major reasoning for becoming engaged in nuclear espionage. Besides his 'complete confidence in Russian policy' at the time, Fuchs 'believed that the Western Allies deliberately allowed Russia and Germany to fight each other to the death'. And he regarded his actions as a natural consequence of political and historical developments during the period. In the end, two factors were, according to Fuchs, crucial in forming his decision to confess his spying to the British authorities: first, he felt a growing uneasiness about his betrayal of personal friends as a consequence of his passing of classified information to the Soviets; and, secondly, he stated, he could no longer tolerate Communism as practiced in Stalinist Russia. But it was in particular his betrayal of his close friends, Fuchs argued, under which he crumpled, according to his own description, in the end. While Klaus Fuchs declared that he had initially intended to control the inner conflict between betraying his friends and spying for the Soviets by establishing 'two separate compartments' in his mind, one where he could 'make friendships, to have personal relations, to help people and to be in all personal ways the kind of man I wanted to be', and a second compartment where Fuchs could be 'completely independent of the surrounding forces of society' and betray his friends. 'Looking back at it now', Fuchs appropriately evaluated his own behaviour, 'the best way of expressing it seems to be to call it a controlled schizophrenia.'[584]

That Fuchs kept a low profile and a rational appearance did not remain unnoticed to outsiders. An MI5 surveillance report praised Fuchs's work ethic and described him as 'pre-eminently intellectual, but not a cold-blooded intellectual', concluding: 'His life, in short, is always under the strict control of his intellect.'[585] Gaby Peierls later also recalled that Fuchs had come over to her parents house in Los Alamos frequently on Sundays and that he had been quite popular among the children of Los Alamos.[586] Fuchs's behaviour was not entirely new. In order to

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[583] 'Statement of Emil Julius Klaus Fuchs'. A typescript of the statement is available in TNA, KV 2/1250.

[584] 'Statement of Emil Julius Klaus Fuchs', pp. 6-7. Fuchs himself continued to apply the term 'controlled schizophrenia' to describe his actions. See, for example, Fuchs to Genia Peierls, 6 February 1950, Peierls Papers, sup. cat., D.52. In the MfS interview Fuchs provided a detailed overview of his tactics, including the befriending of his colleagues; *Prof. Dr. Klaus Fuchs*.

[585] Robertson, 'Emil Julius Klaus Fuchs', 23 November 1949, pp. 11, 18.

[586] Katrina Mason, *Children of Los Alamos: An Oral History of the Town Where the Atomic Age Began* (New York: Twayne, 1995), p. 136.

resolve what he felt was a clash of interests, he chose a kind of 'mental reservation', as Stephen Toulmin has argued, as intellectuals before him did. But this 'mental reservation', which allowed him to pass on vital nuclear data to the Soviets although he had signed the Official Secrets Act, worked only while the Soviet Union was Britain's ally.[587]

Klaus Fuchs had apparently overestimated his ability to control his feelings for his friends and had to pass, as he later declared, a serious test after the arrest of the Soviet atomic spy Alan Nunn May in 1946.[588] Hanni Bretscher was among the curious Los Alamosans who discussed the espionage case with Carson Mark, Nunn May's former colleague at Montreal. Fuchs was also present at this meeting. Hanni Bretscher later recalled that when Else Placzek who had also known May personally replied to a question concerning Alan Nunn May's character that he was a very nice person '"just like Klaus Fuchs here",' Bretscher detected 'how embarrassed and red Fuchs got' but did not make anything of it.[589] Despite Bretscher's observation, Fuchs himself did not realize, as he later admitted, that Nunn May's arrest was a wake up call to rethink his behaviour. Instead, he continued to suppress the question of loyalty to his friends.[590]

That Fuchs was under much strain did not remain unnoticed to friends and colleagues. In May 1948, he wrote, for example, an offensive letter to his Harwell colleague Egon Bretscher, accusing him of 'trying again to evade your responsibility' in the case of an AERE operation which Bretscher had overseen. Klaus Fuchs went on to grumble that Bretscher had 'failed to direct the trials in such a manner that they would yield the required answer'.[591] Hanni Bretscher recalled that she and her husband could not comprehend Fuchs's behaviour at the time, but that 'it all fell into place once he was arrested for treason'. Bretscher suspected that Klaus Fuchs might have thought that she and her husband 'guessed he was not trustworthy'. During a dinner party held on the occasion of Emil Fuchs's visit to Harwell, which the AERE security officer Henry Arnold also attended, Hanni

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[587] Stephen Toulmin, 'The Conscientious Spy', *New York Review of Books*, 19 November 1987, pp. 54-60 (p. 56).
[588] *Prof. Dr. Klaus Fuchs.*
[589] Hedy [*sic*] Bretscher, interview by John Bennett and Anne Shepherd, 21 June 1984, AIP, p. 42. Note that Bretscher's first name was Hanni and not Hedy, as erroneously stated in the interview, email, Mark S. Bretscher to author, 30 March 2007.
[590] *Prof. Dr. Klaus Fuchs.*
[591] Fuchs to Bretscher, 13 May 1948, the Papers and Correspondence of Egon Bretscher, Churchill Archives Centre, Cambridge, United Kingdom (hereafter BRER), BRER, H. 29.

Bretscher argued, Klaus Fuchs acted even stranger, which 'was in fact the first clear indication for the security officer (Henry Arnold) that Fuchs had something to hide'.[592] When it became known to some of Klaus Fuchs's friends and colleagues that serious allegations of spying for the Soviet Union were brought forward against him, many still did not believe what they heard. Klaus Fuchs's colleague and close friend Herbert Skinner assured him that all his Harwell co-workers would support him if he affirmed his innocence. As a result of his friends' support, Fuchs claimed, he was unable to disguise his activities as a Soviet informant any longer.[593] As a consequence, Fuchs not only pleaded guilty on all charges brought forward against him in his trial but stressed in his final statement,

> I have also committed some other crimes which are not crimes in the eyes of the law – crimes against my friends – and when I asked my counsel to put certain facts before you I did not do it because I wanted to lighten my sentence. I did it in order to atone for those other crimes.[594]

Like the examination of Fuchs's motives for engaging in and finally abandon his espionage, it remains a difficult task to assess the value of the nuclear data passed on by him to the Soviet Union. Nevertheless, a brief overview of the known facts and estimates is necessary to be able to evaluate his impact on public opinion. Fuchs provided most of the technical details which he revealed to MI5 and the FBI in the interviews with Michael Perrin. These included in the first period of his espionage activities for the Soviet Union, which lasted from 1942 until December 1943, above all, the results of his own work on theoretical aspects of the uranium 235 isotope separation process through gaseous diffusion at Birmingham University which were part of the so-called M.S. series. Moreover, he informed his contact in more general terms about progress of the British and to a much lesser extent, as far as he was able to judge it, the US nuclear weapons project. During his time in New York from December 1943 until August 1944, Fuchs started to give information, which was not only the result of his own work, to the Soviets, including data on gaseous diffusion processes and all reports drafted by the British Mission at New York. But it was then during his stay at Los Alamos between August 1944 and the summer of 1946 that

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[592] Hanni Bretscher, note, 1 April 1987, attached to letter, Fuchs to Bretscher, 13 May 1948, BRER, H. 29. Emil Fuchs visited England from autumn 1947 until spring 1948; *Mein Leben*, II, 287-89.
[593] *Prof. Dr. Klaus Fuchs*. Herbert Skinner even offered Fuchs financial help to pay for a solicitor, J.C. Robertson, 'Subject: Klaus Emil Julius Fuchs', 6 February 1950, TNA, KV 2/1661, p. 1. Support was not restricted to Harwell colleagues. F.C. Champion, for example, also offered help to find a solicitor for Fuchs; Peierls to Champion, 6 February 1950, Peierls Papers, MS Eng. Misc. b. 223, F6.
[594] Metropolitan Police Special Branch, p. 24.

Fuchs fully grasped the scale of the Manhattan Project for the first time and gave away the most valuable information he ever passed on to the Soviet Union, in particular the principle of the design of the plutonium implosion bomb. In addition, he passed on information on the critical mass of both uranium and plutonium and informed his Soviet handlers about the upcoming Trinity Test.

After his return to the United Kingdom in the summer of 1946, when he was at Harwell, Fuchs later claimed that he restricted the flow of information to the Soviets until he finally ceased his espionage work for them in the spring of 1949. While this period was marked by increasing doubts on the part of Fuchs, as he maintained, about the Stalinist practice of Socialism in the Soviet Union, he completed Los Alamos related information by giving away the so-called Bethe formula, for example, which is used to calculate the efficiency of a nuclear detonation and he reported on the state of the art of the British atomic arms and energy programmes.[595]

His passing on of the principal outline of the implosion bomb was perhaps Fuchs's single most important item given to the Soviets. 'I did what I consider to be the worst I have done', he told William Skardon in his confession, 'namely to give information about the principle of the design of the plutonium bomb.'[596] It is certainly true that the United States government promoted the proliferation of nuclear information, as Klaus Fuchs argued in the 1980s, through the publication of Henry DeWolf Smyth's report *Atomic Energy for Military Purposes*.[597] Yet, he failed to mention that the published report omitted the crucial implosion principle and that it was indeed Soviet agents such as himself, Alan Nunn May, Ted Hall and David Greenglass who informed the Soviets about implosion-related matters.[598]

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[595] 'Record of Interview with Dr. K. Fuchs on 30th January, 1950 by M.W. Perrin'. The description given by Fuchs here is almost identical with that provided by him in *Prof. Dr. Klaus Fuchs*.
[596] 'Statement of Emil Julius Klaus Fuchs', p. 10.
[597] *Prof. Dr. Klaus Fuchs*; Henry DeWolf Smyth, *Atomic Energy for Military Purposes: The Official Report on the Development of the Atomic Bomb Under the Auspices of the United States Government, 1940-1945* (Princeton: Princeton University Press, 1945; repr. Stanford: Stanford University Press, 1989).
[598] Jeffrey T. Richelson, *Spying on the Bomb: American Nuclear Intelligence from Nazi Germany to Iran and North Korea* (New York: Norton, 2006), p. 65. On the 'Smyth Report' and the Soviet nuclear weapons programme, see also Goodman, *Spying on the Nuclear Bear*, pp. 20-21. On Fuchs and implosion-related information, see 'Statement of Emil Julius Klaus Fuchs', p. 10. Fuchs also made this point when he was interviewed by Michael Perrin; 'Record of Interview with Dr. K. Fuchs on 30th January', p. 4. Fuchs's assessment is backed by the secondary literature, see Goodman, 'Grandfather of the Hydrogen Bomb', p. 6.

If it has remained a difficult undertaking to assess the value of the information passed on by Fuchs to the Soviet Union, it has remained even more complex to give approximations of how much time he saved the Soviet Union in its nuclear weapons programme. In an interview by the FBI, Fuchs calculated that his information saved the Soviet Union approximately 'at least one year'.[599] While Fuchs's estimate of one year which he saved the Soviets seems modest, his former KGB case officer, Alexander Feklisov overemphasized Fuchs's importance as informer for the Soviet atomic programme in a two-part article published in a major Soviet historical journal in 1990. According to Feklisov, the information Fuchs passed on to him and other handlers of Fuchs allowed the Soviet Union to produce a working nuclear weapon six years earlier than the West expected.[600] Although it is virtually impossible to give an exact amount of time that the information furnished by Klaus Fuchs saved the Soviet atomic bomb project a figure between one and two years appears to be plausible.[601] After all, the development of a Soviet plutonium bomb was inevitable and the country's scientists had been working on it since 1943.[602] Yet, American and British intelligence services failed to forecast the first Soviet nuclear test accurately.[603] And even Klaus Fuchs himself showed surprise about the fact that the Soviet Union had been able to develop its own atomic bomb so quickly.[604]

Although Fuchs's information was considered to be of 'inestimable value' to the Soviet Union, as an FBI memorandum prepared for J. Edgar Hoover put it, Soviet nuclear scientists still had to do considerable work to produce a working plutonium bomb.[605] To give an appropriate comparison, in spite of the fact that the British mission had played a pivotal role in designing the first uranium and

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[599] Hoover to Neal, Subject: Emil Julius Klaus Fuchs Espionage – R, 18 June 1950, Klaus Fuchs FBI File, 65-58805, vol. 36, serials 1346-1366, pp. 1-2.
[600] Alexander Feklisov, 'Podvig Klaus Fuksa', *Voenno-Istoricheskii Zhurnal*, 12 (1990), 22-29; Alexander Feklisov, 'Podvig Klaus Fuksa', *Voenno-Istoricheskii Zhurnal*, 1 (1991), 34-43. I am grateful to Serge Simonov for translating the articles from Russian into English.
[601] David Holloway, *Stalin and the Bomb: The Soviet Union and Atomic Energy, 1939-1956* (New Haven: Yale University Press, 1994), p. 222. H. Montgomery Hyde, for example, estimated that Fuchs helped save the Soviets about 18 months in their plutonium bomb project (p. 222).
[602] Yuli Khariton and Yuri Smirnov, 'The Soviet Bomb: The Khariton Version', *Bulletin of the Atomic Scientists* (hereafter *BAS*), 49. 4 (May 1993), 20-31. Fuchs himself made a similar point; *Prof. Dr. Klaus Fuchs*.
[603] The details of the intelligence failure are discussed in Goodman, *Spying on the Nuclear Bear*, pp. 7-56.
[604] 'Record of Interview with Dr. K. Fuchs on 30th January, 1950 by M.W. Perrin', p. 5.
[605] Ladd to Hoover, Re: Emil Julius Klaus Fuchs, 1 February 1950, Klaus Fuchs FBI File, 65-58805, vol. 3, serials 83-171.

plutonium bombs at Los Alamos, it took British scientists, after the end of the Anglo-American wartime nuclear alliance in 1946, until 1952 to deliver a working plutonium bomb. And, as they did not know whether the data provided by Klaus Fuchs and other spies was correct or not, Soviet scientists were forced to repeat most of the experiments themselves. But the Soviet Union's small supply of uranium ore proved to be the major factor that hampered their plutonium bomb programme until they started to mine uranium ore in East Germany.[606]

While the view that Fuchs provided valuable information for the production of the Soviet plutonium bomb has become widely established, recent scholarship, which is based on Russian archives, also suggests that Klaus Fuchs played a bigger role than previously assumed in the making of the Soviet hydrogen bomb.[607] These new findings seem to contradict the older view that although Fuchs attended a conference on 'the Super' at Los Alamos in April 1946, he could not have given the Soviets any valuable information on the H-bomb because the scientists on 'the Hill' were on a wrong path at the time. While J. Robert Oppenheimer played down the significance of the data passed on by Fuchs, Edward Teller was convinced that Fuchs had supplied the Soviets with highly important H-bomb-related information and thus enabled the country to pursue its hydrogen bomb project much quicker.[608]

Although Fuchs's passing of early work on thermonuclear weapons did not enable atomic scientists in the Soviet Union to create a working H-bomb, his role can perhaps be best described as a kind of catalyst for both the Soviet H- and A-bombs. Still, the German-born Soviet atomic spy had a tremendous share in ensuring that the Soviet Union beat the United Kingdom in the race to become not only the world's second atomic but also a thermonuclear power. While the Soviet Union tested its first hydrogen bomb in 1953, it took the United Kingdom until spring 1957 to detonate its first working thermonuclear device.[609]

Shortly before his trial, Fuchs identified Jürgen Kuczynski and Hannah Klopstech to William Skardon as the persons who put him in contact with the Soviets, Kuczynski in 1942 and Klopstech after his return to Britain from the United

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[606] Holloway, pp. 174-78, 199, 222-23; Rainer Karlsch, *Uran für Moskau: Die Wismut – Eine populäre Geschichte* (Berlin: Links, 2007).
[607] This is discussed in Goodman, 'Grandfather of the Hydrogen Bomb', pp. 1-22.
[608] Herken, *Brotherhood of the Bomb*, p. 219; Priscilla J. McMillan, *The Ruin of J. Robert Oppenheimer: And the Birth of the Modern Arms Race* (New York: Penguin, 2005), pp. 65-66.
[609] Arnold, *Britain and the H-Bomb*, pp. 24, 131-50; Richard Rhodes, *Dark Sun: The Making of the Hydrogen Bomb* (New York: Simon & Schuster, 1995), pp. 523-25.

States after the war.[610] In Kuczynski's case, MI5 started an investigation into his possible involvement in the recruitment of agents for the Soviet Union in the United Kingdom, which concluded in its final report that '[t]he evidence from his file does not enable one to reach any definite conclusion.'[611] Fuchs also identified Harry Gold as his contact 'Raymond' during the interviews conducted by two FBI officers in London.[612] The MI5 also investigated the possibility that the German Communist Hans Kahle, who had fought in the Spanish Civil war, was in some way involved in the 'selection and indoctrination' of Fuchs during his time of internment in Canada.[613]

The Klaus Fuchs Case, Democracy and Postwar Political Cultures

While Klaus Fuchs had helped the Soviet atomic and thermonuclear projects tremendously, his confession had perhaps an even bigger impact on public opinion regarding the effectiveness of security agencies in their defence of the democratic order. That he had been able to operate as a Soviet informer in both the United Kingdom and the United States without being detected by the security services led Britons to question the efficiency of homeland security agencies, in particular MI5. So concerned were MI5 officials about the Security Service's reputation that they circulated a short internal document to its staff, offering 'some guidance on facts' to prepare their personnel for public discussions, especially of questions regarding MI5's security checks of Fuchs and its knowledge of his Communist affiliations. The memorandum, which clearly has to be seen as an attempt to establish an official line of argumentation within the Security Service, identified three main questions as the foci on which public criticism centred: 'Why was Fuchs taken on for employment in Atomic Energy?', 'Why was Fuchs' espionage activity not detected?' and 'Why is it that the Americans appear to have known all about Dr. Fuchs' Communist history but not the British?'[614]

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[610] W.J. Skardon, 'Emil Julius Klaus Fuchs.', 9 March 1950, TNA, KV 2/1879.
[611] 'Jürgen Kuczynski', 11 March 1950, TNA, KV 2/1879, p. 3.
[612] SAC, New York, to Director, FBI, pp. 1-3; W.J. Skardon, 'Interrogation of Dr. Fuchs by Officers of the F.B.I.', 9 June 1950, TNA, KV 2/1255, p. 1; Joseph C. Walsh, 'Emil Julius Klaus Fuchs, was', 10 October 1950, Klaus Fuchs FBI File, 65-58805, vol. 39, serials 1432-1454.
[613] 'The Case of Emil Julius Klaus Fuchs', 24 November 1950, TNA, KV 2/1256, pp. 5, 12.
[614] 'The Case of Dr. Klaus Fuchs. – Appendix A', 2 March 1950, TNA, KV 2/1253, p. 1-2.

The document provided the 'official' answers to all three questions. In response to the first question, the internal paper stressed Fuchs's significance and expertise in his field that simply made him invaluable for the British and later joint Allied Manhattan Project. While it admitted that the Gestapo, as has been shown in chapter two, furnished evidence of Fuchs's alleged Communist affiliations, the memorandum rightly questioned the reliability and validity of this source of information, arguing that this was 'an allegation which had been groundlessly made against countless other refugees who later made a notable contribution to the allied war effort'.[615] In other words, Fuchs's skills were simply deemed so important for the British war effort that the authorities were willing to take security risks, especially if they did not appear as such at the time. After all, the fact that the National Socialist regime accused Fuchs of being a Communist made it very unlikely that he was spying for Germany – the country with which Britain was engaged in all-out war and which temporarily threatened the very existence of the United Kingdom. In the face of his many contributions to the British nuclear weapons programme and the grave international crisis, MI5 regarded these allegations made by the enemy as being of minor importance. And the benefits of Fuchs's work for the British seemed to outweigh the potential risks of his employment, even after the war when the Security Service shifted its attention to Communists as potential threat to national security.[616] It was only after Fuchs's confession and his forced retirement from the AERE Harwell that members of the British nuclear weapons project fully realized the significance of his work, especially since the McMahon Act had cut off British scientists from any American nuclear data and Fuchs had become a major source of information to tap by the British authorities.[617]

The central question as to why MI5 had failed to expose Fuchs as a Soviet spy was an equally thorny one. As the Security Service document convincingly argued, Klaus Fuchs's covert mode of operation 'made the detection of Dr. Fuchs an exceptionally difficult problem in any democratically governed state'.[618] Although MI5's answer appears slightly evasive by simply using Britain's democratic order, which arguably prevented the Security Service from furnishing conclusive evidence of Fuchs's espionage activities, as an excuse to direct blame away from the agency, it

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[615] 'The Case of Dr. Klaus Fuchs. – Appendix A', p. 1.
[616] Gowing, *Independence and Deterrence*, II, 147-48.
[617] Goodman, 'Grandfather of the Hydrogen Bomb', pp. 15, 22.
[618] 'The Case of Dr. Klaus Fuchs. – Appendix A', 2 March 1950, p. 2.

also contains an element of truth. While members of the British public have often used after-the-fact reasoning when they accused the security agency in the aftermath of Fuchs's confession, MI5 had in fact faced many difficulties in their investigations of Fuchs. First and foremost, Klaus Fuchs managed to keep a low profile and to disguise his espionage activities well. Consequently, the local police in both Bristol in 1934 (before he engaged in espionage activities) and Edinburgh in 1942 did not have anything against him in their files.[619]

Even the fact that he showed sympathies for Communism and the Soviet Union did not necessarily make him a security risk. In his autobiography, Max Born under whom Fuchs worked at the University of Edinburgh claimed retrospectively that Nevill Mott had sent Fuchs to Edinburgh because '"[h]e spread communist propaganda among the undergraduates."'[620] Nevill Mott rejected Born's allegations heavily and even described Fuchs's leaning toward Communism as acceptable at the time because 'anyone who was against the Nazis would have been'.[621] With his statement, Mott captured well an attitude that many Britons shared in the face of the threat that the 'Third Reich' posed to their country during the war. Rudolf Peierls, as one of Fuchs's chief mentors, made a similar point about his political views during World War II.[622] Klaus Fuchs and other scientists such as Nevill Mott openly showed sympathy for the Soviets and were both members of the Bristol branch of the Society for Cultural Relations with the Soviet Union in the 1930s.[623] Still, Fuchs's and Mott's participation in the society did not attract MI5's attention because it was not seen as a potential threat to national security at the time. That MI5 did not expose Fuchs as a Soviet agent earlier lay also in the fact that he kept a low profile as a Communist. He engaged, for example, in work on a committee set up to help the Republican forces in the Spanish Civil War during his time in Bristol and while in Edinburgh he directed the shipment of propaganda leaflets to Germany on behalf of the KPD.[624] Max Born later recalled that although Fuchs 'never concealed that he was a convinced communist', 'he did not speak about politics very much, except during the time of the

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[619] Robertson, 'Emil Julius Klaus Fuchs', 23 November 1949, pp. 6, 9, 19.
[620] Max Born, *My Life*, p. 284. See also Nevill Mott's reply to Born's allegations in a note on the same page.
[621] Nevill Mott, *A Life in Science* (London: Taylor & Francis, 1986), p. 50.
[622] Peierls, interview by Weiner, p. 153.
[623] Mott, *A Life in Science*, p. 51.
[624] SAC, New York, to Director, FBI, pp. 4-5; *Prof. Dr. Klaus Fuchs*; Skardon, 'Emil Julius Klaus Fuchs', 22 December 1949, p. 2.

Soviet-Finnish war. All of us in the department, including Indians and Chinese, were sympathetic to the Finnish side, while Fuchs was passionately pro-Russian'.[625] At the time of the war between the Soviet Union and Finland, however, Fuchs was not yet a Soviet agent. And, in any case, it was not a criminal offence in a democratic society like the United Kingdom to show sympathy for the Soviet Union and to openly sympathize with Communism.

The public recriminations against the Security Service have to be seen against the background of a general re-emergence of anti-Communism in postwar Britain. In addition, MI5 was not yet geared for the new challenges of the Cold War era. As David Vincent has argued, 'Britain strode into the nuclear age protected by patched clothing designed for a time when dreadnoughts constituted the leading edge of defence technology, and waiters with German accents represented the chief threat to national security.'[626] In 1948, the Attlee Government ordered a civil service purge to ensure that neither fascists nor Communists worked in sensitive areas of government work.[627] In May 1949, Wallace Akers spoke out in favour of barring Communists from employment in sensitive areas of the public service, in particular atomic research.[628] It was, however, not until after and as a result of the espionage cases of Klaus Fuchs, Bruno Pontecorvo, Guy Burgess and Donald Maclean and owing to pressure from Washington that Whitehall implemented the practice of 'positive vetting' in January 1952.[629] This new measure allowed security agencies to investigate the private and political background of people working in sensitive areas of government such as atomic research. 'Positive vetting' formed one of the crucial components of what David Vincent has referred to as a 'culture of secrecy' in the emerging national security state in general and in nuclear matters in particular.[630] An earlier introduction of this procedure could possibly have led to an earlier exposure of Klaus Fuchs.

A strong anti-Communist bias affected the trial of Klaus Fuchs, too. It was in particular the statements by the prosecution and the Chief Justice Lord Goddard that

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[625] Max Born, *My Life*, p. 284.
[626] Vincent, p. 206.
[627] Joan Mahoney, 'Civil Liberties in Britain During the Cold War: The Role of the Central Government', *American Journal of Legal History*, 33. 1 (1989), 53-100 (pp. 82-92).
[628] Akers to Peierls, 2 May 1949, Peierls Papers, sup. cat., A.13.
[629] Peter Hennessy and Gail Brownfeld, 'Britain's Cold War Security Purge: The Origins of Positive Vetting', *Historical Journal* , 25. 4 (1982), 965-74 (pp. 968-70).
[630] Vincent, pp. 1-25, 194-210.

were decisive in laying the foundation for the public discourse on the espionage case. At the court hearing which took place at the Old Bailey on 1 March 1950 two key issues dominated the event: firstly, the prosecution's as well as the judge's flamboyant anti-Communist rhetoric and secondly, closely connected, their branding of Fuchs as a 'traitor' to the British people.

So important was Fuchs's case that the Attorney General himself, Sir Hartley Shawcross represented the prosecution. 'The prisoner is a communist, and that is at once the explanation and indeed the tragedy of this case,' summarized Shawcross. His remarks were slightly reminiscent of McCarthyrite rhetoric when he declared:

> In this country the number of communists is fortunately very few, and it may be that a great many of those people who support the communist movement believe, as the prisoner at one time apparently believed, misguidedly if sincerely, that that movement is seeking to build a new world. What they don't realise is that it is to be a world dominated by a single power and that the supporters of the Communist Party, the true adherents of communism, indoctrinated with the communist belief, must become traitors to their own country and are expected to subordinate the interests of their own country to the interests, or what they are told to be interests, of the International Communist Movement.

In a similar fashion, the Lord Chief Justice told Fuchs: 'You have betrayed the hospitality and protection given to you by the grossest treachery.' Lord Goddard's final remarks before reading out the verdict also reveal the great emotional impact of the Klaus Fuchs trial on its participants:

> Your statement which has been read shows to me the depth of self deception into which people like yourself can fall. Your crime to me is only thinly differentiated from high treason. In this country we observe rigidly the rule of law, and as technically it is not high treason, so you are not tried for that offence.
> I have now to assess the penalty which it is right I should impose. It is not so much for punishment that I impose it, for punishment can mean nothing to a man of your mentality.
> My duty is to safeguard this country and how can I be sure that a man, whose mentality is shown in that statement you have made may not, at any other minute, allow some curious working of your mind to lead you further to betray secrets of the greatest possible value and importance to this land?[631]

Klaus Fuchs then received the maximum sentence of fourteen years for his espionage activities. Since the Soviet Union had not been an enemy of the United Kingdom during World War II, Fuchs could not be charged with treason under the Official Secrets Act of 1911.[632]

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[631] Metropolitan Police Special Branch, pp. 3, 24, 25.
[632] Robert Williams, *Klaus Fuchs*, p. 3.

At the trial, Fuchs's split loyalties to his host country and the Soviet Union formed the second chief aspect to be addressed and represented one of the most pronounced markers of the strong anti-Communist sentiment. As the Attorney General pointed out, Fuchs had done irreparable

> damage in breach of the loyalty that he would, one would suppose naturally, feel towards the country which had befriended him, which had enabled him to complete his training and to become a great scientist, damage he did in breach of his security undertaking, in breach of his Oath of Allegiance to the King who had granted him the privilege of British nationality. But although these were loyalties which appeared to have meant something to him, they were, unhappily, loyalties he cast aside in favour of his loyalty to the spurious ideology of Russian Communism.

Sir Hartley's polemical reference to the 'spurious ideology of Russian Communism' is indicative of the heated atmosphere at the court hearing, for it remains doubtful whether loyalty to a 'non-spurious' ideology would have been a defence in law. Curtis Bennett, Klaus Fuchs's defence lawyer, attempted to have his client's sentence reduced by using a kind of insanity-defence-based argument in which he elaborated on Fuchs's 'state of mind', in particular his 'controlled schizophrenia'. Lord Goddard, however, rejected this argument, saying: 'I cannot understand that metaphysical philosophy or whatever you like to call it. [...] He [Fuchs] stands before me as a sane man and not relying on the disease of schizophrenia or anything else.'[633]

Immediately after Klaus Fuchs's trial, newspapers ran headlines like 'Atomic Secrets Betrayed' that emphasized the high degree of treason that the German-born émigré physicist had committed.[634] The *Daily Epress* featured a series of articles by Bernard Newman, entitled 'The Spies Are Among Us' which fuelled an anti-Communist hysteria.[635] For the next few years, the fear of atomic espionage remained in the news thanks to journalists like Alan Moorehead and Rebecca West.[636] Numerous series continued to be published by newspapers such as the *Sunday Express* with 'Stalin's Atom Spies' or Rebecca West's 'The Traitors' on the

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[633] Metropolitan Police Special Branch, pp. 11, 17-18.

[634] 'Atomic Secrets Betrayed: Fuchs Sentenced to 14 Years', *The Times*, 2 March 1950, p. 6. This sentiment of betrayal lasted see, for instance, Justin Atholl, 'How the Man to Whom Britain gave Shelter became Our Deadliest Traitor', *Sunday Express*, 3 March 1952, TNA, KV 2/1258.

[635] J.C. Robertson, 'Press Comments on DR. Fuchs' Espionage Methods & Comments.', 7 March 1950, TNA, KV 2/1254.

[636] See, for example, an advertisement for a series of articles by Alan Moorehead, entitled 'Atom-Bomb Traitors' and published in the *Sunday Times*, 20 June 1952, p. 5; Rebecca West, 'The Terrifying Impact of the Fuchs Case', *New York Times*, 4 March 1951, pp. 10, 29, 31.

'the most sinister figures of our time' in the *Evening Standard* which opened with a piece on Klaus Fuchs.[637]

Rebecca West argued that the Fuchs case revealed the entirely altered significance of treachery in the post-World War II world. In her eyes, the term 'ideological espionage' did not suffice to characterize Fuchs's spying because he epitomized the archetype of the 'traitor scientist' who had abused the hospitality and trust of the British people through his dedication to Communism.[638] MI5 shared this view, as a report stated: 'The history of Emil Julius Klaus Fuchs is a curious mixture of brilliant scholarship and achievement in the field of scientific research, blind devotion to the doctrines of Communism and cold-blooded treachery to the country which had done most to welcome and reward him.'[639]

The feeling that Fuchs had betrayed King and host country ran so deep that it eventually peaked in his denaturalization. On 20 December 1950, the Deprivation of Citizenship Committee convened and unanimously recommended that Fuchs be stripped of his British citizenship. 'It is just as likely and in our view probably more likely', the committee defended its verdict, 'that the communist philosophy, in which the respondent [Klaus Fuchs] is so steeped, will again assert its ascendancy and submerge the feelings of loyalty towards the Crown, which he at present professes.'[640] Again, the issues of loyalty to state and anti-Communism were closely connected in the recommendation by the Deprivation of Citizenship Committee.

Fuchs's denaturalization had such strong repercussions in the media that a film company approached the Home Office about a biopic on Klaus Fuchs. In tune with the political climate at the time, the executive producer Brock Williams of Pinnacle Production Ltd. jumped on the anti-Communist band wagon and suggested that 'such a film produced at the present time as a first class "feature" for world distribution will prove a source of healthy enlightenment to the great cinema-going

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[637] Justin Atholl, 'How Fuchs Was Found Out: Clue by Clue the World's Deadliest Spy Is Trapped in Britain', *Sunday Express*, 10 February 1952, TNA, KV 2/1258; Rebecca West, 'The Traitors', *Evening Standard*, 4 June 1951, TNA, KV 2/1257.

[638] Rebecca West, 'The Terrifying Impact of the Klaus Fuchs Case', *New York Times Magazine*, 4 March 1951, pp. 6, 29-34 (pp. 31-32). An MI5 report drafted in November 1950 put forth a similar idea declaring that 'Fuchs was an ideological Communist and became a spy for that reason'; 'The Case of Emil Julius Klaus Fuchs', p. 5.

[639] 'The Case of Emil Julius Klaus Fuchs', p. 5.

[640] H. Wynn Parry, 'Deprivation of Citizenship Committee, British Nationality Act, 1948, re Klaus Emil Julius Fuchs', 30 January 1951, TNA, KV 2/1257.

audiences and an effective antidote to the spread of Communist propaganda'.[641] The London-based publishing house Hamish Hamilton used the endemic anti-Communist paranoia to advertise the first edition of Alan Moorehead's Fuchs biography *The Traitors* in 1952. 'The loyalties of the atomic scientist in general and the whole question of security,' it read on its sleeve, 'are discussed, while always in the background looms the possibility that other traitors, as dangerous as Fuchs, may still be at large.'

While anti-Communism had been part of British politics before 1939, the political climate change which occurred in the immediate postwar period was rooted in the Second World War. During the final stages of World War II, the first breaches had occurred between the Western Allies and the Soviet Union. In contrast to popular belief, it was principally the United Kingdom (and not the United States) that sought a confrontation with the Soviet Union in the years between 1945 and 1947.[642] At the time of Clement Attlee's Labour government between 1945 and 1951, a strong anti-Communist consensus emerged in the United Kingdom.[643] At the same time, revelations about the party's strategies, objectives and techniques by former, disillusioned Communists provided the British public with 'insiders' views'. Works like the autobiography of Douglas Hyde, a former editor of the *Daily Worker*, as well as a collection of essays by Arthur Koestler and five other intellectuals, entitled *The God That Failed*, presented sombre accounts of the sinister character of Communism.[644]

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[641] Executive Producer to the Under Secretary of State, Home Office, Whitehall, 2 January 1951; Williams to the Under Secretary of State, Home Office, Whitehall, 3 February 1951, TNA, KV 2/1257.

[642] David Reynolds, 'Great Britain', in *The Origins of the Cold War in Europe: International Perspectives*, ed. by David Reynolds (New Haven: Yale University Press, 1994), 77-95 (pp. 80-81).

[643] The development of this anti-Communist consensus is still debated: historians such as Peter Weiler have viewed this emergence of consent as unspontaneous and constructed arguing that Clement Attlee's Labour government (1945-1951) started to manufacture a broad anti-Communist consensus in British society, in particular through the newly founded governmental propaganda agency, the Information Research Department (IRD), as well as by relying on the anti-Communist Trades Union Congress (TUC); *British Labour and the Cold War* (Stanford: Stanford University Press, 1988), pp. 189-229. Richard Thurlow, by contrast, has regarded the development of anti-Communist consensus in early postwar Britain as more of a 'symbiotic and dialectical relationship [...] rather than a manipulative conspiracy on the part of the establishment'; *The Secret State: British Internal Security in the Twentieth Century* (Oxford: Blackwell, 1994), pp. 285-86.

[644] Douglas Hyde, *I Believed: The Autobiography of a Former British Communist* (London: Heinemann, 1950); *The God That Failed: Six Studies in Communism by Arthur Koestler, Ignazio Silone, André Gide Presented by Enid Starkie, Richard Wright, Louis Fischer, Stephen Spender*, ed. by Richard H. S. Crossman (London: Hamish Hamilton, 1950).

The Fuchs case also had an impact on the discourse over individual rights in a democratic society. The commonly voiced criticism regarding Fuchs's allegiance to his host country and, closely connected with that, the role he granted his conscience, is symptomatic of the anti-Communist consensus present in early 1950s Britain. Klaus Fuchs's conscience clashed with his loyalty to the United Kingdom, putting his scruples against his responsibility and accountability to his host country. Fuchs claimed that his conscience had served him as a crucial moral guide. William Skardon noted in the report of his first interrogation of Klaus Fuchs that while he 'established that Fuchs recognises that his Oath of Allegiance is a serious matter and a thing to be observed', he simultaneously 'claims freedom to act in accordance with conscience should circumstances arise in this country comparable to those which existed in Germany in 1932 and 1933, when he would act on a loyalty which he possesses to humanity generally'.[645]

Skardon's account names two of Klaus Fuchs's multiple allegiances, one to Britain and one to his conscience. Besides these two he also had allegiances to the Soviet Union and to his friends. At times Fuchs had faded out one or more of these multiple allegiances. Rebecca West especially challenged Fuchs's concept of loyalty to his conscience with her central line of argumentation that reduced 'conscience' to ego, arguing that 'if a state gives a citizen protection it has a claim to his allegiance'.[646] According to West, Fuchs should have subordinated the allegiance to his individual conscience under the good of his host nation which had offered him a haven from National Socialist persecution. West's argument bears striking resemblance to fascist and National Socialist beliefs. In a similar fashion, Alan Moorehead underlined Fuchs's egoism, writing: 'This is the peculiar menace of Fuchs, for if he were to propagate himself, if thousands and tens of thousands of Fuchses and their consciences were let loose on the world, they would be almost as deadly as the worst atomic bomb invented yet.'[647] Apart from journalists and writers, former colleagues of Fuchs's also expressed similar thoughts on his split loyalties. Fuchs's longtime friend and boss at Harwell, Herbert Skinner, collectively judged the actions of Klaus Fuchs, Ethel and Julius Rosenberg, Alan Nunn May, David Greenglass and Harry Gold, writing that '[t]hey were all driven by the force of the

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[645] Skardon, 'Emil Julius Klaus Fuchs', 22 December 1949, p. 1.
[646] Rebecca West, *New Meaning of Treason*, p. 361.
[647] Moorehead, *The Traitors*, p. 58. Moorehead even called *The Traitors* in the new preface to the 1963 edition 'a book about conscience' (p. ix).

communist philosophy to take matters of life and death, perhaps for millions of people, into their own hands, and those who confessed could only in the end say, feebly, that they had simply been wrong.'[648] Many commentators have afterwards continued to propagate similar views of Fuchs as voiced by West, Moorehead and Skinner.[649]

In spite of his spying for the Soviet Union and unknown to the public at the time, Fuchs intended, as he assured Michael Perrin, to fully co-operate with the British authorities in order to limit the damage done as much as possible.[650] 'I formed the impression,' Perrin noted, 'that throughout the interview Fuchs was trying to remember and report all the information that he had given to the Russian agents with whom he had been in contact and that he was not withholding anything.' Perrin observed: 'He seemed, on the contrary, to be trying his best to help me to evaluate the present position of atomic energy work in Russia in the light of the information that he had, and had not, passed to them.'[651] Fuchs's insistence that he would not talk with Skardon about any classified technical data because the latter did not have the necessary security clearance which finally led to Michael Perrin interviewing Fuchs shows another seemingly paradoxical and almost pedantic attitude of Klaus Fuchs.[652]

This stance was reflected in Fuchs's multiple allegiances to his adopted home country, the United States and the Soviet Union. Fuchs did not only work for the Manhattan Project, but he also helped the Soviet nuclear weapons programme, as has been shown before, significantly and, at the end of his stay in Los Alamos, when it became clear that the Anglo-American wartime nuclear alliance would not be carried over into the postwar period, he even spied for Britain. Klaus Fuchs thus had a pivotal part in both the atomic and hydrogen weapons programmes of the United

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[648] Herbert Skinner, 'The Atomic Bomb Conspiracy', n.d., Papers of Professor Herbert W. B. Skinner, FRS, Special Collections and Archives, Sidney Jones Library, University of Liverpool, Liverpool, United Kingdom (hereafter SJL), D.982/3/5, p. 6.

[649] See, for example, Stanley Goldberg, 'The Secret about Secrets', in *Secret Agents: The Rosenberg Case, McCarthyism & Fifties America*, ed. by Marjorie Garber and Rebecca L. Walkowitz (New York: Routledge, 1995), pp. 47-58 (p. 51); Chapman Pincher, *Traitors: The Anatomy of Treason* (New York: St. Martin's Press, 1987), pp. 276-80; Chapman Pincher, *Too Secret Too Long* (London: Sedgwick & Jackson, 1984), p. 87; Richard C.S. Trahair, 'A Psychohistorical Approach to Espionage: Klaus Fuchs (1911-1988)', *Mentalities*, 9. 2 (1994), 28-49 (p. 29).

[650] Skardon, 'Emil Julius Klaus Fuchs. Fourth, Fifth, Sixth and Seventh Interviews', p. 1; 'Record of Interview with Dr. K. Fuchs on 30th January, 1950 by M.W. Perrin', TNA, KV 2/1253, p. 5; 'Statement of Emil Julius Klaus Fuchs', p. 9.

[651] 'Record of Interview with Dr. K. Fuchs on 30th January, 1950 by M.W. Perrin', p. 5.

[652] Hyde, p. 103.

Kingdom, the United States, and the Soviet Union.[653] This has to be weighed against the harsh public condemnation of Fuchs. Through his work for the British nuclear arms project and against the United States, Fuchs continued to try to break the American monopoly on nuclear weaponry and helped weaken the McMahon Act, which Whitehall regarded as a major obstacle in its quest to establish its own nuclear weapons project.[654] While Fuchs was never credited for his work for the British A- and H-bomb projects, it seems understandable why MI5 tried to cover up the Fuchs case. As a consequence it appears almost ironic that MI5's plan failed and the Fuchs case marked the beginning of an enmity in MI5-FBI relations.[655]

Fuchs also showed a great deal of loyalty to his host country during the interviews: while he told Michael Perrin about the information on thermonuclear weapons which he had passed on to the Soviets, he did not mention this in his interrogation by FBI agents. The FBI, however, was to some degree aware of these omissions as MI5 had partially informed them.[656] And J. Edgar Hoover wrote in a letter to the State Department reporting on the interviews with Fuchs conducted by two FBI agents in the United Kingdom that Fuchs 'declined to furnish the details of what he had given to the Soviet Union after his return to England regarding the hydrogen bomb because of the lack of co-operation between the United States and Great Britain at the present time with regard to atomic research'.[657]

David Vincent has argued that, in the aftermath of Klaus Fuchs's confession and Bruno Pontecorvo's defection, '[t]he glad confidence in the value of science to the citizens of the welfare state was replaced by a less trusting and respectful attitude to those charged with discovering the hidden mysteries of nature.'[658] Alan Moorehead appropriately assessed the degree of Klaus Fuchs's deed saying that 'Fuchs had committed the crime society is least able to forgive; he made society

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[653] Lorna Arnold, *Britain and the H-Bomb*, pp. 25-26; Goodman, 'Grandfather of the Hydrogen Bomb', pp. 1-22. Both Cockroft and Peierls were also in favour of promoting Fuchs owing to his achievements; Cockroft to Peierls, 22 June 1948; Peierls to Cockroft, 24 June 1948, Peierls Papers, b. 205, C66.

[654] Goodman, 'Grandfather of the Hydrogen Bomb', p. 22.

[655] Michael S. Goodman, 'Who Is Trying to Keep What Secret from Whom and Why? MI5-FBI Relations and the Klaus Fuchs Case', *Journal of Cold War Studies*, 7. 3 (Summer 2005), 124-46 (pp. 132-34).

[656] Goodman, 'Grandfather of the Hydrogen Bomb', p. 20. On the technical details Fuchs passed on to the Soviet Union, as he told the FBI, see, for example: Hoover to AEC, Re: Emil Julius Klaus Fuchs Espionage – R, 15 June 1950, Klaus Fuchs FBI file, 65-58805, vol. 36, serials 1346-1366.

[657] Hoover to Neal, p. 2. The FBI agents were accompanied by William Skardon; Skardon, 'Interrogation of Dr. Fuchs by Officers of the F.B.I.'.

[658] Vincent, p. 202.

distrust itself. And for that he was hated.'[659] Still, despite the security purge with its practice of 'positive vetting', Britain was far away from experiencing anything remotely like McCarthyism.[660] The only exception to this trend was perhaps Roy Boulting's picture *High Treason* (1951). It was inspired by the public uproar about an explosion that occurred at the Portsmouth naval base in July 1950 and that destroyed several ships loaded with weapons and ammunition to be shipped to British forces in Korea. Since the incident was largely attributed to foreign-directed sabotage, it fuelled fears of a Communist fifth column operating within Britain. The film, which opens with a recreation of the incident and then elaborates on the idea of a Communist plot to sabotage power stations in the United Kingdom, represents a rare case of a British kind of Red Scare.[661]

While MI5 had come under severe criticism at home, the Security Service also became the target of condemnation from abroad. As implied in the third key question, 'Why is it that the Americans appear to have known all about Dr. Fuchs' Communist history but not the British?', Washington heavily criticized MI5 for their failure to detect Fuchs as a Soviet spy earlier.[662] The commanding officer of the Manhattan Project, General Leslie R. Groves, described Fuchs's espionage as the 'most disastrous break in security' within the Manhattan Project. Although he admitted that '[o]ur acceptance of Fuchs into the project was a mistake', he pointed out that '[i]t was a British responsibility'. With his delegation of blame towards the British security agencies that had vetted Fuchs and on whose judgement the US Army had relied, Groves's reaction exemplified a judgement commonly made by Americans. 'The United Kingdom,' the General complained, 'not only failed us, but herself as well.'[663]

While the Security Service has repeatedly been criticized for their supposedly lax screenings of Fuchs,[664] these allegations appear to be by and large unjustified and often the result of after-the-fact reasoning.[665] As stated before, the introduction of

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[659] Moorehead, *The Traitors*, p. 172.
[660] Hennessy and Brownfeld, p. 970. On Britain and McCarthyism, see also John P. Rossi, 'The British Reaction to McCarthyism, 1950-54', *Mid-America*, 70. 1 (1988), 5-18.
[661] Stephen Guy, '*High Treason* (1951): Britain's Cold War Fifth Column', *Historical Journal of Film, Radio and Television*, 13. 1 (1993), 35-47; Tony Shaw, *British Cinema and the Cold War: The State, Propaganda and Consensus* (London: I.B. Tauris, 2001), pp. 40-45.
[662] 'The Case of Dr. Klaus Fuchs. – Appendix A', p. 1-2.
[663] Groves, pp. 143-44.
[664] Robert Williams, *Klaus Fuchs*, pp. 141-50.
[665] Gowing, *Independence and Deterrence*, II, 145-50.

'positive vetting' at an earlier time might have – but not necessarily must have – led to Fuchs's exposure as a Soviet spy before 1950. Klaus Fuchs's former Los Alamos colleague, John Manley, rightly stressed the fact that it was relatively easy for Fuchs to pass on secrets to the Soviets. Owing to his important role in the Theoretical Division, Manley argued, Fuchs did not even have to penetrate the project.[666] Fuchs himself later made a similar point in an interview.[667] The internal MI5 memorandum thus rightly stated that it appeared doubtful whether the Americans could have provided any information 'which would have modified the British assessment of Dr. Fuchs' security record'.[668]

The news of Klaus Fuchs's confession came at a very bad time for Anglo-American relations, as affairs between the two countries had dramatically cooled down after the end of the war. Two fields, finance and atomic co-operation, suffered particularly from Washington's lack of interest and support. In the area of finance, the Truman administration had ceased its Lend-Lease policy immediately after the end of hostilities in the Pacific theatre in August 1945 and thus left Britain without much needed American credits for its economy. What aggravated the situation further was the United States' reluctance to continue to treat Britain equally as a super power – American government officials rather regarded its European ally now as a subordinate nation. With the passing of the McMahon act of 1946, which virtually cut the United Kingdom off from any American nuclear data, Britain found itself in a disadvantageous position in the early atomic age.[669]

In the United States, Klaus Fuchs's confession fuelled existing anti-Communist hysteria and paranoia. Together with events that occurred in the late 1940s and early 1950s like the Berlin Blockade, the 'loss' of China to Mao Zedong, the first Soviet atomic test and the Korean War, the Fuchs case added to the production of a sense of crisis and helped forge anti-Communist consensus further in the face of the much dreaded global expansion of Communism.[670] Americans learnt first about Fuchs's confession on the day after President Truman had ordered a crash

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[666] John H. Manley, 'A New Laboratory Is Born', in *Reminiscences of Los Alamos* (see Edwin McMillan, above), pp. 21-40 (pp. 37-38).
[667] *Prof. Dr. Klaus Fuchs*.
[668] 'The Case of Dr. Klaus Fuchs. – Appendix A', p. 2.
[669] David Reynolds, *Britannia Overruled: British Policy & World Power in the 20th Century* (London: Longman, 1991), p. 159.
[670] Robert A. Goldberg, *Enemies Within: The Culture of Conspiracy in Modern America* (New Haven: Yale University Press, 2001), p. 26.

programme to beat the Soviet Union in the race for the hydrogen bomb.[671] It also coincided with the rise of McCarthyism. Although it did not concern atomic espionage directly, the Alger Hiss case of 1948-49 was crucial in influencing public fears of Communist Fifth Columnists in the United States prior to Fuchs's disclosure.[672] A week after Fuchs's confession, Senator Joseph McCarthy presented in his infamous speech in Wheeling, West Virginia, a list of over 200 alleged Communists who, he claimed, had infiltrated the US State Department which heated up Americans' anxieties of Communist infiltration and expansion.

The House Committee on Un-American Activities (HUAC) under Senator Joseph McCarthy was initially almost obsessed with investigating alleged acts of atomic espionage. HUAC even constructed the myth that Communist supporters inside the Manhattan Project had given sensitive atomic-arms-related information to the Soviet Union because these cases guaranteed a lot of publicity. But when the news of Klaus Fuchs's confession broke, HUAC finally abandoned its investigation of suspected atomic spies because none of its 'witnesses' had been associated with Fuchs and, as Ellen Schrecker has observed, the committee's 'quest [...] had produced many headlines, several volumes of testimony, and not a single spy'.[673]

Despite HUAC's shift of focus away from former Manhattan Project scientists, 'theoretical physicists emerged', according to David Kaiser, 'as the most consistently named whipping-boys of McCarthyism'[674] Here, similarities existed between Britain, where journalists such as Rebecca West coined the term 'traitor scientist' to characterize Klaus Fuchs and his espionage, and the United States during the era of McCarthyism. In 1951, the chief of the FBI, J. Edgar Hoover, called Fuchs's espionage activities 'the crime of the century' in an article in *Reader's Digest*.[675] In a much more balanced way, the American *Bulletin of the Atomic Scientists* also devoted considerable attention to the Fuchs and other atomic

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[671] Peter Galison and Barton Bernstein, 'In Any Light: Scientists and the Decision to Build the Superbomb, 1952-1954', *HSPS*, 19. 2 (1989), 267-348 (pp. 310-12).
[672] Ellen W. Schrecker, 'Before the Rosenbergs: Espionage Scenarios in the Early Cold War', in *Secret Agents* (see Stanley Goldberg, above), pp. 127-41 (p. 136). On Communists as conspirators in American culture, see also Robert Goldberg, pp. 22-46.
[673] Ellen W. Schrecker, *No Ivory Tower: McCarthyism and the Universities* (New York: Oxford University Press, 1986), pp. 8, 131, 142.
[674] Kaiser, p. 28.
[675] J. Edgar Hoover, 'The Crime of the Century: The Case of the A-Bomb Spies', *Reader's Digest*, 58 (May 1951), 149-68 (p. 155).

espionage cases.[676] Public suspicion of theoretical physicists was to a large degree rooted in the openly international character and exchange of science which seemed in the eyes of many Americans to jeopardize the emerging national security state.[677]

The investigation and confession of Fuchs had eventually led to the apprehension of a number of other Soviet atom spies such as his courier Harry Gold alias 'Raymond' and David Greenglass, as well as Ethel and Julius Rosenberg. Greenglass was the younger brother of Ethel Rosenberg, whose husband Julius had served as a courier for the Soviet Union.[678] After his arrest, David Greenglass testified in court against his brother-in-law, accusing him of espionage for the Soviet Union in order to reduce his sentence. In spite of heavy international protests, the Rosenbergs, who represent perhaps both the most famous and tragic victims of McCarthyism, were subsequently executed in the electric chair in 1953.[679] The phobia of the Red Menace pervaded deep into American society and culture. Hollywood produced films like *Conspirator* (1949), *The Red Menace* (1949) and *The Whip Hand* (1951), and popular singers like Carson Robinson and His Pleasant Valley Boys warned listeners in their song 'I'm No Communist' (1952) that 'Communists and spies are making monkeys out of us.'[680]

Given its strong repercussions in the United States, it comes as no surprise that Chief Justice Lord Goddard listed the negative impact that Fuchs's confession had on Anglo-American relations amongst the 'gravest aspects' of Fuchs's crime in his concluding statement at Fuchs's trial.[681] So grave was the impact of Fuchs's confession on the affairs between the two countries that the Prime Minister even shortly considered extraditing Fuchs after he had served his sentence in Britain. Under the Extradition Treaty with the United States at the time, however, this was

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[676] See, for example, 'Atomic Spy Trials: A Summary of the Trials', *BAS*, 7. 4 (April 1951), 125-26; 'Dr. Klaus Fuchs to Stand Trial', *BAS*, 6. 3 (March 1950), 68, 94; Eugene Rabinowitch, 'Atomic Spy Trials: Heretical Afterthoughts', *BAS*, 7. 5 (May 1951), 139-42, 157; 'Soviet Atomic Espionage', *BAS*, 7. 5 (May 1951), 143-48.

[677] Lawrence Badash, 'Science and McCarthyism', *Minerva*, 38. 1 (2000), 53-80 (p. 60).

[678] Joseph Albright and Marcia Kunstel, *Bombshell: The Secret Story of America's Unknown Atomic Spy Conspiracy* (New York: Times Books, 1997), p. 112.

[679] Richard M. Fried, *Nightmare in Red: The McCarthy Era in Perspective* (New York: Oxford University Press, 1990), p. 115.

[680] On anti-Communism in American popular culture at the time, see Cyndy Hendershot, *Anti-Communism and Popular Culture in Mid-Century America* (Jefferson, NC: McFarland, 2003).

[681] Metropolitan Police Special Branch, pp. 24-25. For an assessment of the impact Klaus Fuchs's confession had on Anglo-American nuclear relations see also Richard J. Aldrich, *The Hidden Hand: Britain, America and Cold War Secret Intelligence* (London: Murray, 2001), pp. 380-84.

impossible and the idea was consequently abandoned.[682] The decline in postwar trans-Atlantic nuclear relations has to be seen as part of a larger trend of Anglophobia in the United States.[683] And, as early as 1943, there had been a good deal of distrust towards the British contributions to the Manhattan Project on the part of senior American officials such as Vannevar Bush, James B. Conant and General Leslie R. Groves.[684]

That Fuchs was given a quick trial at the Old Bailey on 1 March 1950, just a few weeks after his confession, has to be regarded as an attempt by the British authorities, especially MI5, to limit the damage done by his confession to Anglo-American relations. 'The Fuchs trial did nothing to acquaint the public with the true nature of his offence,' Rebecca West rightly observed, but 'it did something to disguise it.'[685] Officially, MI5 fully co-operated with the FBI when they forwarded, for example, a transcript of the court hearing to J. Edgar Hoover.[686] Behind the scenes, however, MI5 withheld crucial information from their American counterparts in order not to further harm the deteriorating Anglo-American relations. MI5 not only tried to play down the case because of their own security breaches and failures but because Klaus Fuchs had gathered information on the US atomic arms programme during his time in Los Alamos.[687]

The Klaus Fuchs atomic espionage case was part of a series of events of deception by MI5 in order to limit damage to its public image. It was during the dictation of his statement to William Skardon that Fuchs pointed out that, after it had become clear to him that he would have to leave the AERE, and when Skardon presented him with the evidence of him passing on classified information to the Soviet Union during his stay in New York, 'I was given the chance of admitting it and staying at Harwell or of clearing out.' Fuchs added: 'I was not sure enough of

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[682] Makins to Colville, 24 May 1952; Colville to Makins, 26 May 1952, TNA, PREM 11/2799.
[683] John E. Moser, *Twisting the Lion's Tail: American Anglophobia Between the World Wars* (New York: New York University Press, 1999), pp. 172-74.
[684] Robert S. Norris, *Racing for the Bomb: General Leslie R. Groves, the Manhattan Project's Indispensable Man* (South Royalton, VT: Steerforth Press, 2002), p. 327; Septimus Paul, p. 41. Whitehall was aware of the American attempts to exclude British scientists from sensitive parts of the project, see, for instance, Akers to Chancellor of the Exchequer, Re: Tube Alloy Project: Access to American Full-Scale Plant Information, 6 April 1944, TNA, CAB 126/331.
[685] Rebecca West, *New Meaning of Treason*, p. 195.
[686] Metropolitan Police Special Branch; a copy of the transcript was also forwarded to J. Edgar Hoover; Whitson to Director, FBI, Re: Foocase, 3 March 1950, Klaus Fuchs FBI File, 65-58805, vol. 21, serials 897-915.
[687] On the Klaus Fuchs case and Anglo-American relations, see Goodman, 'Who Is Trying to Keep What Secret from Whom and Why', pp. 124-46.

myself to stay at Harwell and therefore I denied the allegations and decided that I would have to leave Harwell.'[688] By early January 1950, it had already become official amongst members of the Security Service that Fuchs would have to leave Harwell for security reasons and, initially, it was the plan to find him a university position.[689] This suggests that MI5 deliberately misled Klaus Fuchs into the false belief that he could stay at Harwell after his confession in order to achieve his maximum co-operation and for its public image not to suffer a major blow.[690] Fuchs's defence lawyer also pointed to this fact during the court hearing.[691]

In retrospect, Klaus Fuchs described the time of his confession, trial and arrest as a 'dream' and a 'psychological state'. Initially, he had believed that he would be sentenced to death and had already finished with his life. It was only at his trial that his attorney informed him that the maximum penalty for his crime was fourteen years. During the first time in custody, Fuchs suffered from the living conditions at the prison: not only was he kept in solitary confinement but some of the guards were also particularly tough on the 'traitor' Klaus Fuchs. His cell, for example, had a broken ventilation flap so that it remained open. Even though it was deepest winter, the guards did not do anything to fix it but prohibited Klaus Fuchs from using cardboard to insulate his cell, arguing that this was against the rules.[692]

Not only did the Security Service deceive Fuchs and lure him into his confession, while restricting the flow of information to the FBI, but MI5 also deliberately misinformed the Prime Minister and the British public about the Fuchs affair. As a major consequence of this campaign, Clement Attlee in a speech to the House of Commons publicly defended MI5's clearance of Klaus Fuchs for sensitive nuclear research and helped restore the secret service's public image.[693] MI5 even drew on the publicist Alan Moorehead for their cause. Amongst other things, the

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[688] 'Statement of Emil Julius Klaus Fuchs', p. 8.
[689] Sillitoe to Rowlands, 19 January 1950, TNA, KV 2/1250.
[690] Goodman, 'Who Is Trying to Keep What Secret from Whom and Why', pp. 130-31.
[691] Metropolitan Police Special Branch, p. 22.
[692] *Prof. Dr. Klaus Fuchs.*
[693] Michael S. Goodman and Chapman Pincher, 'Research Note: Clement Attlee, Percy Sillitoe and the Security Aspects of the Fuchs Case', *Contemporary British History*, 19. 1 (2005), 67-77. The day following Fuchs's trial, the *Daily Mirror*, for example, had run the headline 'MI5 Duped for 6 Years – Why?' on its front page (2 March 1950). When a 1951 article by Rebecca West questioned MI5's practice of security checks in the Fuchs case again, Percy Sillitoe reaffirmed the Prime Minister that it was not his service's fault that Fuchs was not exposed earlier; Sillitoe to Rickett, 5 June 1951, TNA, KV 2/1257. Whitehall and the Foreign Office also monitored American press and media coverage of Fuchs's trial; Sir O. Franks to Whitehall and Foreign Office, RE: Press and Radio Comment on the Trial and Sentence of Dr. Fuchs, 10 March 1950, TNA, KV 2/1254.

Security Service provided him with information on Fuchs's mother, who had suffered from depression and, like her mother before and her daughter Elisabeth later, committed suicide. In this connection, the security service spurred speculation about '[i]nsanity in the family'.[694] This manoeuvre did not remain unnoticed to the FBI which regarded Moorehead's book *The Traitors* 'generally as an attempt to whitewash the previous Labour Government and the British Security Services in connection with their investigation of the spy cases involving Klaus Fuchs, Allan Nunn May and Bruno Pontecorvo'.[695]

In Britain, MI5's restored image was short-lived because later in 1950 the Italian-born émigré atomic scientist Bruno Pontecorvo, who had also been cleared by the Security Service for secret work on both TA and the Manhattan Project, defected to the Soviet Union.[696] While affairs between Britain and the United States had suffered severely from the cases of Fuchs and Pontecorvo, it was the defection of Guy Burgess and Donald Maclean in 1951 that would affect relations between the two countries for years.[697] Although MI5 continued its strategy of playing down these spy cases, it was rather unsuccessful and clashed with the press which had decided to exploit these cases to the fullest extent.[698]

That Klaus Fuchs had become a household name, is, for example, illustrated in the case of a former German POW, who had spent several years in captivity in the Soviet Union and who was now tried for espionage for the Soviets in a US court in West Berlin in 1952. While *The Times* reported that the judge referred to the defendant as '"a pocket edition of the atomic spy Klaus Fuchs"', the paper conceded 'but the evidence bore no resemblance to that in the Fuchs trial'.[699] In spite of his many crucial achievements that included the directorship of TA, a 1957 biographical profile in the *New Scientist* introduced Michael Perrin with the headline 'The Man to Whom Fuchs Confessed'.[700] The Fuchs case also cast a long shadow over British

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[694] See the correspondence between MI5 and Alan Moorehead: 'Supplementary Notes on Fuchs' background given to Mr. Alan Moorehead on Monday, 24th September, 1951', TNA, KV 2/1257. On Fuchs's mother, see Emil Fuchs, *Mein Leben*, II, 204-06.

[695] Belmont to Ladd, Re: 'The Traitors', Book by Alan Moorehead, British Author, 2 June 1952, Klaus Fuchs FBI File, 65-58805, vol. 42, serials 1501-1566.

[696] On the Pontecorvo case, see Simone Turchetti, 'Atomic Secrets and Governmental Lies: Nuclear Science, Politics and Security in the Pontecorvo Case', *British Journal for the History of Science*, 36. 4 (2003), 389-415.

[697] Septimus Paul, pp. 166-87.

[698] Turchetti, 'Atomic Secrets and Governmental Lies', pp. 408-09.

[699] 'Berlin Impressed by Allied Note', *The Times*, 15 May 1952, 6.

[700] 'The man to whom Fuchs confessed', *New Scientist*, 24 January pp. 1957, 27-28 (p. 28).

foreign relations with countries other than the United States. When the British press criticized France over its atomic arms development project in 1959, in particular for their reliance on German-speaking émigré scientists, the *Paris-Presse* responded in due kind, writing: '"The British are ill-placed to accuse us of employing Germans, since their best atomic scientist was the German Klaus Fuchs".'[701]

Rudolf Peierls and the Klaus Fuchs Espionage Case

Klaus Fuchs's confession had not only a considerable impact on the manufacture of public opinion regarding national security and efficiency of security agencies in the early atomic age, but it also strongly affected the community of German-speaking émigré scientists in Britain. As one of Fuchs's chief mentors, Rudolf Peierls experienced its repercussions particularly strongly. While Esther Simpson of the AAC/SPSL was optimistic and rather idealistic with regard to the consequences of Fuchs's confession, writing to Peierls that Fuchs's 'action has done a tremendous damage, but I have the feeling that British commonsense and kindliness and decency will prevent these effects from becoming exaggerated', the Fuchs case severely affected many foreign-born scientists in Britain and the United States, including some of Klaus Fuchs's closest friends and sponsors, in particular Rudolf Peierls.[702]

Although Peierls praised the reasonable response to the Fuchs case by the British public, which generally did not lead to a McCarthyist anti-Communist hysteria, as has been shown in the previous subchapter, he did become the target of suspicion and accusations.[703] As soon as the news of Fuchs's arrest and the charges brought forward against him reached Rudolf Peierls, the latter requested permission to see his friend and former colleague in prison. In an interview with MI5 prior to his visit, Peierls still expressed disbelief about the allegations against Fuchs.[704] The subsequent meeting between the two men was 'slow and difficult, and both seemed a

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[701] Cited in 'Entente Cordiale Under Strain', *The Times*, 20 August 1959, p. 8.
[702] Simpson to Peierls, 27 March 1950, Peierls Papers, b. 226, F 47.
[703] Rudolf Peierls, 'President's Report', *Atomic Scientists' News* (hereafter *ASN*), 4. 1 (August 1950), 6-8 (p. 7). Peierls later reiterated this point, see, for example, Rudolf Peierls, 'Britain in the Atomic Age', in *Alamogordo Plus Twenty-Five Years: The Impact of Atomic Energy on Science, Technology, and World Politics*, ed. by Richard S. Lewis and Jane Wilson, with Eugene Rabinowitch (New York: Viking Press, 1970), pp. 91-105 (p. 102); Peierls, interview by Weiner, p. 153.
[704] J.H. Marriott, 'Note', 6 February 1950, TNA, KV 2/1661.

trifle embarrassed', as one report put it. Peierls, however, tried to convince Fuchs to fully co-operate with the authorities.[705]

Fuchs told Peierls during the meeting that he believed that 'knowledge of atomic research should not be the private property of any one country, but should be shared with the rest of the world for the benefit of mankind'.[706] After the meeting Rudolf Peierls was deeply disappointed and even shocked by Fuchs's behaviour.[707] He described Fuchs's actions and the reasons behind his motivation to spy for the Soviet Union as furnished by him as incoherent, naïve and foolish 'which [did] not suit him at all'. Peierls even declared that his 'concern [was] now not the fate of Fuchs, but the bigger issues involved'. As a consequence of the – from Peierls's point of view – deeply disturbing meeting, he reaffirmed his and his wife's full co-operation with the British authorities which included a letter to be sent by Genia Peierls to Fuchs.[708] In her very personal and emotional letter, Genia Peierls expressed her deep disappointment at Fuchs betraying his closest friends, writing: 'You were enjoying the best of the world you were trying to destroy. It is not honest.'[709]

In his reply to Genia Peierls, Klaus Fuchs called the realization that he had betrayed his friends his 'greatest horror'. He complimented Peierls on her direct words: 'Funny that women see such things so much clearer than men. And that they are so much kinder by saying hard words straight out.' 'And don't worry,' Fuchs assured Genia Peierls, 'if you don't see the tears. I have learned to cry again. And to love again.'[710] As an immediate consequence of Fuchs's confession, Rudolf Peierls also revoked his proposal to have Fuchs elected as a Fellow of the Royal Society.[711] In spite of the Peierlses' disappointment about Fuchs's behaviour, Rudolf Peierls contacted Fuchs's attorney and offered assistance.[712] Peierls even acted in a most

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[705] Robertson, 'Subject: Klaus Emil Julius Fuchs', p. 1.
[706] Ibid.
[707] Peierls to Bethe, 15 February 1950, Peierls Papers, b. 202, C17.
[708] Peierls to Burt, n.d. [received 6 February 1950], TNA, KV 2/1661; Peierls to the Governor, Brixton Prison, 27 February 1950, Peierls Papers, b. 207, C111. On Peierls's disillusionment with Fuchs, see also: Peierls to Taylor, 7 February 1950, Peierls Papers, suppl. cat., D.52.
[709] [Genia] Peierls to Fuchs, n.d. KV 2/1251. While the letter is not dated, the accompanying documents strongly suggest that it was written between 4 and 6 February 1950; J.C. Robertson, 'Note', 6 February 1950, TNA, KV 2/1251.
[710] Fuchs to [Genia] Peierls, 6 February 1950, Peierls Papers, supplementary catalogue, D. 52.
[711] Peierls to Brunt, 22 April 1950; Brunt to Peierls, 24 April 1950, Peierls Papers, b. 207, C111.
[712] Peierls to Halsall, 13 February 1950; Halsall to Peierls, 14 February 1950; Peierls to Halsall, 21 February 1950, Peierls Papers, b. 207, C111.

gentlemanly way when he sent Klaus Fuchs a letter shortly before the latter's release from prison to see if he 'need[ed] any help in getting started in life'.[713]

Perhaps the most devastating effect that Fuchs's actions had on his colleagues was the spreading of a feeling of mutual distrust within the scientific community. As Norris Bradbury, a former Los Alamos colleague of Fuchs, put it: 'For the first time Fuchs raised the question among the scientists, "Who can you trust?" We felt as if we'd all been betrayed.'[714] Driven by a strong feeling of betrayal and disillusionment with Fuchs, Genia Peierls confronted him with the legitimate question in her aforementioned letter, asking: 'Do you realize what will be the effect of your trial on scientists here and in America?' She then went on, 'Do you realize that they will be suspected not only by officials but by their own friends, because if you could, why not they?'[715] Rudolf Peierls also received letters of solidarity from colleagues at home and abroad.[716]

In the immediate aftermath of Pontecorvo's defection, the *Sunday Express* ran the headline 'Perturbed Men: Foreign-born atom experts disturbed by Pontecorvo case' on its front page on 29 October 1950, featuring pictures of Rudolf Peierls, Max Born, Otto Frisch, Nicholas Kurti, Francis Simon and Joseph Rotblat. The authors claimed in their article that '[m]any of them feel that the British Government should issue a statement testifying to their loyalty.' Furthermore, they falsely maintained that some of the 'perturbed men' had handed their passports over to the British authorities to show their loyalty to their adopted host country.[717]

The *Sunday Express* article represented perhaps one of the most outspoken attacks on German-speaking émigré scientists in the United Kingdom after the war. Max Born appropriately referred to the article and the accompanying pictures as a '"rogues' gallery"'.[718] Immediately after the publication of the sensationalist headline Rudolf Peierls complained strongly to the news editor of the *Sunday Express* and sent him a statement entitled 'I Am Not Perturbed' which the editor promised to publish without any changes unless made by Peierls and in which

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[713] Peierls to Fuchs, 15 June 1950, Peierls Papers, sup. cat., D. 52.
[714] Cited in Lansing Lamont, *Day of Trinity* (New York: Atheneum, 1965), p. 283.
[715] Genia Peierls to Klaus Fuchs, [c. 4-6 February 1950]; Robertson, 'Note', 6 February 1950.
[716] See, for example, Ward to Peierls, 10 March 1950, Peierls Papers, b. 207, C111.
[717] Sidney Rodin and Joseph Garrity, 'Perturbed Men: Foreign-born Atom Experts Disturbed by Pontecorvo Case', *Sunday Express*, 29 October 1950, pp. 1, 7.
[718] Max Born, *My Life*, p. 288.

Peierls – also on behalf of all the other 'perturbed men' – appealed to the spirit of fairness in British society.[719]

This was, however, not the only incident in which a tabloid reported falsely on Peierls, and he had indeed good reason to be distrustful of the British press. Immediately after Fuchs's confession, for example, he explicitly told the *Daily Mail* not to quote or refer to his opinions on this matter, which the editors ignored. As he wrote to the *Daily Mail* news editor, 'I must be grateful for the lesson you have taught me and I shall in future take care not to have anything to do with the cheap sensational section of the Press.' [720] In other instances with the *Daily Mail*, Peierls also took or threatened to take legal actions against defamations spread by the paper.[721]

Rudolf Peierls and many of the German-speaking émigré nuclear scientists, who had had a tremendous share in the manufacture of the first atomic bombs at Los Alamos now faced a paradoxical situation where many Britons often accused them of being dangers to national security. And, in a way, it appeared the Fuchs case represented a big setback to their previously successful social and professional integration into their host country's society and physics community and their origin became once again the reason for their discrimination. 'I believe it is fair to say that if from the atomic energy teams in England and in America one had excluded all foreign born scientists as well as those who in their youth had held extreme political views of one kind or other,' as Peierls later aptly phrased it, and as chapter three has also demonstrated, 'the leakage of atomic secrets would have been prevented by the fact that there would have been no atomic secrets.'[722]

The case of a 'concerned' member of the American public, Frederick Schlinck, who also tried to actively support the anti-Communist witch-hunts and whose letter to J. Edgar Hoover even found its way to the British authorities, is a good example of this distrust of foreigners which was often coupled with anti-

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[719] Peierls to the News Editor, *Sunday Express*, 6 November 1950; Cudlipp to Peierls, 7 November 1950; Peierls to Cudlipp, 8 November 1950. Peierls also distributed copies of his statement to Born, Frisch, Kurti, Rotblat and Simon; Peierls to Born, Frisch, Kurti, Rotblat, Simon, 9 November 1950, Peierls Papers, b. 197, A 16.

[720] Peierls to the News Editor, *Daily Mail*, 2 March 1950. For the preceeding exchange of letters, see Hallows to Peierls, 23 February 1950; Peierls to the News Editor, *Daily Mail*, 27 February 1950, Peierls Papers, b.207, C111.

[721] Temple to *Daily Mail*, 7 September 1951. Peierls also kept himself well informed about reports in the daily press, see, for instance, 'Extracts from "Intelligence Digest"', 1951, Peierls Papers, suppl. cat. A.15.

[722] Peierls, 'The Lesson of the Fuchs Case', p. 4.

Communist hysteria. Deeply convinced that Pelican Books, a subdivision of Penguin Books and publisher of Peierls's co-edited collection of articles entitled *Atomic Energy*, was a Communist enterprise because their books were 'sold at Communist book shops [...] [and] either written by left-wingers or play[ed] a left-wing line in the text', the author of the letter was highly suspicious of Peierls. As Schlinck concluded: 'A refugee scientist, if he were a careful and responsible person, would tend perhaps more than a native Englishman to avoid the appearances of evil association.' [723] J. Edgar Hoover even thanked Schlinck in a personal letter. Although the FBI director publicly denied an investigation of Peierls by his agency, he assured him that his 'courtesy of forwarding this information is indeed appreciated'.[724]

Apart from his German origin, Peierls's Jewishness was also played up and linked to Communism. In 1951, for example, an MI5 report argued that Peierls used a Marxist dialectical material approach to science which he regarded as the 'panacea of mankind'. 'Another strong influence on his outlook is his Jewish origin,' the report stated, 'which gives rise to his strong opposition to German re-armament.' It then concluded: 'His love of peace under all circumstances is so strong that, called upon to decide between war and Communism, he would undoubtedly choose a Communist peace as the lesser evil.'[725]

In a similar fashion, MI5 justified in part suspicions against Erna Skinner, the wife of Fuchs's long-time personal friend and colleague Herbert Skinner. Erna Skinner, whom MI5 suspected of having an affair with Klaus Fuchs and to whom Fuchs had apparently disclosed his espionage activities a week prior to his confession to William Skardon, had come to the security service's attention early on during the Fuchs investigation.[726] Apart from her Austrian origin, MI5 critically

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[723] Schlinck to Hoover, 20 November 1952, attached to letter, O'Brien to Marriott, 16 December 1952, TNA, KV 2/1662.
[724] Hoover to Schlinck, 3 November 1952, Klaus Fuchs FBI File, 65-58805, vol. 15, serials 720-780.
[725] 'Report', 20 January 1951, TNA, KV 2/1661. Rudolf Peierls cautiously observed anti-Semitism. See, for example, the exchange of letters with the Bishop of Oxford regarding the *Pamyat* movement in Russia; Peierls to the Rt. Rev. the Bishop of Oxford, 7 October 1989; The Bishop of Oxford to Peierls, 10 November 1989, Peierls Papers, suppl. cat. A. 19.
[726] J.C. Robertson, 'Meeting with W/Cdr. Arnold on 9th September, 1949', 9 September 1949, TNA, KV 2/1246, p. 2; Robertson, 'Emil Julius Klaus Fuchs', 23 November 1949, p. 12; Arnold to Robertson, 7 October 1952, TNA, KV 2/1259; C. Grose-Hodge, 'Professor Rudolph [*sic*] Ernst Peierls, C.B.E. ('46), F.R.S. ('45), M.A. (Cantab), D.Phil. (Leipzig)', 6 December 1950, TNA, KV 2/1661, p. 4.

observed that all of her friends except for Fuchs were Jewish.[727] An MI5 report also harshly judged her as 'woman whose unfaithfulness to her husband is a matter of common knowledge in Harwell', adding that '[s]he is a Jewess of Central European origin.'[728] These anti-Semitic comments in reports by the secret services were remainders from the World War II era which continuously became part of the anti-Communist rhetoric.[729]

Although Fuchs repeatedly stressed that none of his friends and colleagues such as Rudolf Peierls, Hans Bethe, Martin Deutsch, Richard Feynman, J. Robert Oppenheimer, George Placzek, Edward Teller and Victor Weisskopf were either Communists or knew of or were involved in his espionage activities, they faced – often unknown to them – serious investigations by British and American security services.[730] To a certain degree Fuchs himself was responsible for this purge because he had indicated at several points during his interrogations by MI5 and FBI officers that his contacts during and after the war sometimes confronted him with such detailed questions and mentioned processes unknown to him so that he suspected there must have been other Soviet spies.[731] Fuchs was apparently asked precise questions on specific items such as the tritium bomb or electro-magnetic processes of isotope separation which suggested that the Soviets had other informers apart from him.[732]

In the United States, the former scientific director of the Los Alamos laboratory, J. Robert Oppenheimer, was interviewed by FBI agents and testified that 'Fuchs impressed him [Oppenheimer] at that time [at Los Alamos] as a man who was carrying the "woes of the world" on his shoulders and thought of him as a "Christian democrat" and religious man but not as a "political fanatic", or member of the Communist Party.'[733] In the aftermath of Klaus Fuchs's confession, the FBI also

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[727] Robertson, 'Emil Julius Klaus Fuchs', 23 November 1949, p. 12-14, 17.
[728] J.C. Robertson, 'Press Comments on Dr. Fuchs' Espionage Methods & Contacts', 6 March 1950, TNA, KV 2/1254, p. 1.
[729] Kaiser, p. 46.
[730] Skardon, 'Emil Julius Klaus Fuchs', p. 4; SAC, New York, to Director, FBI, pp. 29-32, 34.
[731] Skardon, 'Emil Julius Klaus Fuchs. Fourth, Fifth, Sixth and Seventh Interviews', p. 3; 'Record of Interview with Dr. K. Fuchs on 30th January, 1950 by M.W. Perrin', pp. 1, 4-5; SAC, New York, to Director, FBI, p. 37.
[732] 'Record of Interview with Dr. K. Fuchs on 30th January, 1950 by M.W. Perrin', pp. 1, 4.
[733] Carlton C. Lenz, 'Emil Julius Klaus Fuchs, was', 6 April 1950, Klaus Fuchs FBI File, 65-58805, vol. 27, serials 1031-1078, p. 2.

interviewed many of his and Rudolf Peierls's former Los Alamos colleagues.[734] Apart from Oppenheimer, Hans Bethe, Enrico Fermi, Philip Morrison and Robert Serber also came under suspicion and faced detailed investigations by the FBI.[735] In the United Kingdom, MI5 also checked former colleagues of Fuchs such as Egon Bretscher, for example.[736] 'When I heard the news I felt it to be incredible', Fuchs's former mentor at Bristol University, Nevill Mott, described his feelings and experiences after Fuchs's confession, 'but it was only too true. In fact the intelligence people descended on me and grilled me on why I had signed his naturalization certificate – not at all a pleasant experience.'[737]

The FBI did not limit its investigations solely to associates of Klaus Fuchs but simultaneously investigated a number of Rudolf Peierls's colleagues and friends in the United States who were often the same as Fuchs's, including Edward M. Corson, Martin Deutsch, Edward Teller and Victor Weisskopf all of whom spoke out in favour of Peierls. Given the heated political climate of McCarthyism in the United States at the time, it appears ironic that the FBI confused Teller who was one of the most outspoken anti-Communists with a certain Edward Teller who taught the history of the Soviet Communist party, political economy as well as Marxism-Leninism at the Communist Workers School in New York City in 1941.[738] And, what is more, the FBI even investigated Rudolf Peierls's family and relatives in the United States.[739]

While the Fuchs case had certainly renewed MI5's interest in Rudolf Peierls, there had been earlier investigations by MI5 in his case. As early as 1938, Rudolf Peierls had received some attention by the British authorities owing to the fact that he had many academic contacts with the Soviet Union.[740] In late 1946, MI5 launched

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[734] 'Re: Rudolph Ernst Peierls', 24 January 1951, Klaus Fuchs FBI File, 65-58805, vol. 41, serials 1457-1500.
[735] Peter F. Maxson, 'Emil Julius Klaus Fuchs', 17 February 1950, Klaus Fuchs FBI File, 65-58805, vol. 6, serials 301-385; Ladd to the Director, 5 February 1950, Klaus Fuchs FBI File, 65-58805, vol. 8, serials 406-75; Nigel West, *Mortal Crimes: The Greatest Theft in History: The Soviet Penetration of the Manhattan Project* (New York: Enigma Books, 2004), pp. 229-31.
[736] Sillitoe to Morren, 13 March 1950, TNA, KV 2/1253.
[737] Mott, *A Life in Science*, p. 50.
[738] 'Re: Rudolph Ernst Peierls', 24 January 1951, attached to letter, Patterson to Director-General, 25 January 1951, TNA, KV 2/1661.
[739] Patterson to Director-General of the Security Service, 16 November 1949, TNA, KV 2/1660. An FBI report states that Peierls's father Heinrich was alleged of having made pro-German remarks during World War II; 'Emil Julius Klaus Fuchs, was'; Rudolf Ernst Peierls', 31 October 1949, Klaus Fuchs FBI File, 65-58805, vol. 2, serials 27-80.
[740] Metropolitan Police, Port of Harwich, to Special Branch, Metropolitan Police, Scotland House, 21 April 1938, TNA, KV2/1658. Furthermore, Peierls also came under suspicion when he accompanied

a major investigation of Peierls which was based on three issues: his professional and private relationship with Klaus Fuchs, his wife's Russian origin, and the fact that Peierls had previously visited the Soviet Union.[741] Because of his work in sensitive areas as well as his Russian-born wife, MI5 'closely investigated' Rudolf Peierls 'by covert methods for a period in 1947 and again more intensively, in 1949-50', an MI5 report summarized his case, 'when it was known that he was a friend of Klaus Fuchs'.[742]

These 'methods' included a Home Office warrant for Peierls's communications.[743] In 1949 even a telephone tap was ordered for Peierls.[744] This measure was then put in place again immediately after Klaus Fuchs's arrest.[745] While it appears legitimate that, under the Home Office warrant, security staff voiced concerns about details like the location of uranium ore deposits in publications authored by Peierls,[746] it seems rather odd that they even opened and checked letters sent from Peierls's children to their parents.[747]

A major investigation was also launched into Peierls's alleged Communist affiliations.[748] As a result, many of Rudolf and Genia Peierls's close friends and associates such as Alexander Baykov and his second wife Inna Arian-Baykov, Roy and Fania Pascal, Herbert and Erna Skinner, Max Born and even Paul Dirac came

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Niels and Aage Bohr who had been exempted from any restrictions applying to aliens to the Aliens Registration Office after their landing in the UK in 1943; Chief Constable, Birmingham Police to Major D.B. Dykes, 21 October 1943, TNA, KV 2/1658. See also the following exchange of letters: D.B. Dykes, Major, to E.J.R. Corin, RE: Neils [*sic*] Henrik David Bohr and Aage Niels Bohr, 3 November 1943, and the reply, Captain E.J. Corin to Major D.B. Dykes, 3 November 1943, TNA, KV 2/1658.

[741] Although no evidence existed against either Peierls or Fuchs, the cases of both men were investigated by MI5; D.D.G. to D.C., C.2., D.B., B.1., 20 December 1946. See also Liddell to Maxwell, 23 January 1947, TNA, KV 2/1658.

[742] 'Rudolph Ernest [*sic*] Peierls', 18 March 1954, TNA, KV 2/1663, p. 3.

[743] R.H. Hollis to B.1.a, 14 Jaunary 1947; Mitchell to Allan, RE: Professor Rudolf Ernst Peierls, The University, Birmingham, 24 January 1947. For copies of intercepted letters see, for example, Peierls to Fuchs, 22 March 1947; Peierls to Fuchs, 24 March 1947; Peierls to Fuchs, 10 May 1947; Fröhlich to Peierls, 22 September 1949, TNA, KV 2/1658. Note that the person inspecting the letter was unable to identify the sender as Herbert Fröhlich.

[744] J.C. Robertson, 'Klaus Fuchs. Further Investigation Plan', 12 September 1949, TNA, KV 2/1246, p. 2; J.C. Robertson to Allan, 13 September 1949; J.C. Roberts to G.P. Saffery, 13 September 1949, TNA, KV 2/1658.

[745] J.C. Robertson, 'Telephone Check Coverage following Fuchs' Arrest', 2 February 1950, TNA, KV 2/1250.

[746] C.2.a. to B.2.a., 12 December 1949, TNA, KV 2/1660.

[747] Ronnie Peierls to Rudolf Peierls, 1 January 1950, TNA, KV 2/1660.

[748] See the correspondence between Sir Percy Sillitoe and E.J. Dodd, the Chief Constable of Birmingham, May to September 1950; Box 500, Parliamentary Street B.O., London, S.W.1 to the Chief Constable of Birmingham, 31 May 1950; Sir Percy Sillitoe to Dodd, 30 August 1950; Dodd to Sir Percy Sillitoe, 11 September 1950, TNA, KV 2/1661.

under scrutiny by MI5.[749] These measures, however, failed to produce any positive evidence against Peierls.[750] As a result, MI5 closed its file on Rudolf Peierls concluding that '[i]n our view there is no substantial doubt about the loyalty of Professor Peierls.'[751] Given Peierls's pivotal role in the British atomic energy project, Michael Perrin was cited in an MI5 report speaking out in favour of Peierls that '[h]e had been in the Atomic Energy Project from the beginning and had, in fact, built the ground floor. [...] Therefore, we had quite a lot to gain and little to lose in retaining his services.'[752]

American security agencies, by contrast, were highly sceptical of Peierls's innocence and suspected him of having had at least partial knowledge of Fuchs's activities and therefore viewed him as a 'bad security risk'.[753] Once hard evidence was produced against Klaus Fuchs, the FBI started to investigate Fuchs's and Peierls's movements during their time in the United States.[754] These investigations of Peierls have to be seen against the background of the general political climate of McCarthyism in the United States at the time. Furthermore, the American public was also particularly suspicious of scientists' increasing political activism and engagement as well as the internationalism of the academic world.[755] These scientific ideals clashed with the emerging national security state and the anti-Communist rhetoric of the day.[756]

As early as 1946, when the British Atomic Energy Act was passed, Peierls and the ASA of which he was then an executive vice-president heavily debated the secrecy clause of the newly passed act.[757] In October 1946, Rudolf Peierls and Philip

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[749] C. Grose-Hodge, 'Professor Rudolph [*sic*] Ernst Peierls, C.B.E. ('46), F.R.S. ('45), M.A. (Cantab), D.Phil. (Leipzig)', 6 December 1950, TNA, KV 2/1661, pp. 2-5.
[750] J.C. Robertson, 'Note.', 22 November 1949, TNA, KV 2/1660.
[751] 'Rudolph Ernest Peierls', p. 6.
[752] R.H. Morton, 'Note', 3 January 1951, TNA, KV 2/1661.
[753] Battersby to Patterson, 11 January 1951. Apart from Peierls, the American security services also investigated other British scientists like P.M.S. Blackett, S.C. Curran, Otto Frisch and T.G. Pickavance with regard to their political beliefs; DeBardeleben to Badham, 28 December 1950, TNA, KV 2/1661.
[754] Patterson to Director-General of the Security Service, Subject: Emil Fuchs, Rudolf Ernest [*sic*] Peierls, 2 December 1949, TNA, KV 2/1249. On the reconstruction of Rudolf Peierls' whereabouts see, for example, J. Jerome Maxwell, 'Emil Julius Klaus Fuchs, was', 20 October 1949, Klaus Fuchs FBI File, 65-58805, vol. 1, serials 1-26; J. Jerome Maxwell, 'Emil Julius Klaus Fuchs, was', 23 January 1950, Klaus Fuchs FBI File, 65-58805, vol. 2, serials 27-80, p. 6.
[755] Badash, 'Science and McCarthyism', pp. 60-62.
[756] Wang p. 43.
[757] 'The Secrecy Clause in the Atomic Energy Bill', n.d. Peierls Papers, b. 223, F 8; Gowing, *Independence and Deterrence*, II, 118; Rudolf E. Peierls, 'The British Atomic Scientists' Association', *BAS*, 6. 2 (February 1950), 59. On the British Atomic Energy Bill and the scientists'

B. Moon sent a letter to the editor of *The Times* on behalf of the ASA. Speaking for 'a majority of the scientists who have been or are connected with the atomic energy project', Moon and Peierls criticized two points in the new piece of legislation, the '[l]ack of provision for expert advice' and in particular the bill's clause dealing with secrecy. 'The clause, as it stands, will tend to prevent free discussion between collaborators in fields of research bordering on the subject of atomic energy, which include a great deal of physics, chemistry, and engineering,' the two ASA officials argued, adding:

> We believe that this obstacle to scientific progress is too high a price to pay for the sake of preventing a fraction of the future discoveries from being made public, particularly when we remember that scientists in the past have almost without exception first informed their Government of any new development of apparent military significance.[758]

Or, as James Chadwick later put it, '"When you lock the doors of a laboratory, you lock out more than you lock in".'[759]

Peierls's overt criticism of Western governments, especially the United States but also the United Kingdom, and their security measures which, in Peierls's view, posed a threat to the free exchange of scientific ideas brought him also to the attention of the FBI. It was in particular a summary of two talks given by Rudolf Peierls and Sir Henry Dale at the British Atomic Scientists' Association conference held in October 1948 in London and published in the April 1949 issue of the *Bulletin of Atomic Scientists* that aroused much suspicion on the part of the American security agency.[760] In its June and October 1948 issues, the *Atomic Scientists' News* had already reported on the latest developments in the United States with regard to security investigations of American scientists.[761]

Two points made by Peierls received peculiar attention from the FBI: firstly, his severe criticism of the United States government and their practice of science-

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role, see 'International Control of Atomic Energy (I)', *Nature*, 157. 3999 (22 June 1946), 817-20 (pp. 819-20). For a contemporary comparison of legislation in Britain and the United States, see 'Comparison of British and American Atomic Energy Acts', *BAS*, 3. 2 (February 1947), 50-51.

[758] Philip B. Moon and Rudolf E. Peierls, 'Atomic Energy: Second Reading of the Bill, Two Points of Criticism', *The Times*, 8 October 1946, p. 5. See also Philip B. Moon and Rudolf E. Peierls, 'Atomic Energy', *The Times*, 5 November 1946, p. 5.

[759] James Chadwick, 'The Bomb: International Co-Operation and Security', *ASN*, n.s. 1. 4 (March 1952), 125-27 (p. 127).

[760] Sir Henry Dale and R.E. Peierls, 'Freedom of Science', *BAS*, 5. 4 (April 1949), 106-09. For a digest of Peierls' and dale's talks see also 'Freedom of Science', *ASN*, 2. 4 (7 January 1949), 88-93. Another British scientist, Michael Polanyi also published a more philosophical treatment of the issue; 'Freedom in Science', *BAS*, 6. 7 (July 1950), 195-98, 224.

[761] Edward U. Condon, '"Un-American Activities"', *ASN*, 1. 11 (4 June 1948), 178-80; 'American Scientists Involved in Security Investigations', *ASN*, 2. 3 (27 October 1948), 49-54.

related security and, secondly, as an FBI report phrased it, Peierls's and Dale's expressed 'desirability of scientific intercourse with Iron Curtain countries'.[762] With regard to Peierls's attitude towards security, an anonymous MI5 informant remarked that 'Peierls frequently behaves like a silly ass in matters of security and appears to go out of his way to advertise the fact that he considers security to be nonsense'.[763]

Despite all the possible repercussions of his engagement for the freedom of science, Peierls did not abandon his views but frequently spoke out in their favour.[764] In 1950, he was, for example, involved in a critical statement by the ASA Council on the recent secret purge in the British civil service.[765] In September 1951, Peierls stated in an essay:

> If it is true that military strength is a vital factor in preventing war, then we must include in it the moral strength that depends on the beliefs in our principles. Free discussion, which strengthens the basis of this belief, is therefore an important military asset.[766]

In 1956, he even accepted the invitation to attend a conference in Moscow in 1956 because he believed that a rekindling of scientific exchange between Soviet and Western scientists was a crucial opportunity in the post-Stalinist era.[767] While Peierls's struggle for East-West scientific co-operation made him appear suspicious to many, he was always highly critical of the Soviet Union, he wrote in a letter to William Penney, 'I have many good personal reasons for hating their system like poison, just as I had good personal reasons to hate the Nazis in Germany.'[768]

Articles in the journals *Nature* and *Economist* criticized especially the ASA's promotion of the idea of free scientific exchange across the Iron Curtain in connection with their proposals on international control of nuclear energy. 'It is difficult to see,' the *Economist* concluded, 'how anything could come of such "collaboration" except a one-way traffic to the disadvantage of the Western

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[762] 'Re: Rudolph Ernst Peierls', 24 January 1951, p. 7, attached to letter, Patterson to Director-General, 25 January 1951, TNA, KV 2/1661.
[763] Anonymous letter to Grose-Hodge, 'Professor Peierls', 15 January 1951, TNA, KV 2/1661. Note that the informant is referred to as a 'scientist' and the name 'Charwell' was added in handwriting. It could not be defined whether Lord Cherwell was in fact the anonymous informer.
[764] Peierls, *Bird of Passage*, p. 321.
[765] 'The Civil Service Purge', *ASN*, 3. 5 (May 1950), 108-09. The statement was even reprinted in the *BAS*; 'The Civil Service Purge in Britain: Statement by the British Atomic Scientists' Association', *BAS*, 6. 6 (June 1950), 185.
[766] Rudolf Peierls, 'Bathwater and the Baby: Some Thoughts about the Cold War', *ASN*, n.s. 1. 1 (September 1951), 10-13 (p. 13).
[767] 'British Physicists For Moscow', *The Times*, 11 May 1956, p. 8; Peierls, *Bird of Passage*, pp. 266-68.
[768] Peierls to Penney, 6 March 1956, Peierls Papers, suppl. cat. A. 17, p. 3.

democracies.'[769] In a letter to the editor of the *Economist*, Rudolf Peierls in his function as the current president of the ASA defended the statement. He was particularly keen on diffusing any impression that the ASA aimed at giving away secrets, writing:

> we are under an obligation to guard these secrets and, whether we like it or not, we are well accustomed to observe the rules in talking to those of our colleagues here, or in western Europe, or in America, to whom we have not been instructed to reveal our secrets.[770]

As a consequence of his appraisal of the ideal of the freedom of science, Peierls faced serious problems in obtaining a US visa on two occasions in 1951: firstly, American authorities refused to give him a visitor's visa to attend the International Conference on Nuclear Physics in Chicago. Peierls suspected his membership in the ASA to be the main reason for the Americans' refusal to grant him a visa.[771] Secondly, he even had severe difficulties in applying for a visa to go to the United States on official British government business to attend a conference on declassification in Washington, DC. Still in the shadow of Klaus Fuchs's confession, American security agencies brought forward numerous accusations against Peierls and cited, amongst other things, the latter's German origin, Genia Peierls' Russian origin, his former time in the Soviet Union and his close friendship with Klaus Fuchs as major points of objection. Although most of the allegations against Peierls (and also his wife) such as his active engagement in the ASA, which the latter himself had identified as one of the reasons behind the Americans' behaviour and which American security services regarded as '"a Communist Front organisation"', were 'pure McCarthyism', as a British official rightly labelled them, the American objections to Peierls's visit to the United States indicated a deep rift in Anglo-

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[769] 'Dilemma of the Atomists', *Economist*, 24 July 1948, 140; 'Science and Its Social Relations', *Nature*, 162. 4111 (14 August 1948), 235-237 (p. 237). On the echo in the press see also: 'Some Press Reactions to Our memorandum on International Control', *ASN*, 2. 2 (3 September 1948), 31-34; '*Nature* and Our Memorandum on International Control', *ASN*, 2. 3 (27 October 1948), 64-66.

[770] Rudolf Peierls, 'Dilemma of the Atomists', *Economist*, 4 September 1948, 375. For the accompanying correspondence see: Kurti to Peierls, 27 July 1948; Peierls to the editor of the Economist, 5 August 1948; Editor of the Economist to Peierls, 9 August 1948; Peierls to the editor of the *Economist*, 23 August 1948, Peierls Papers, MS Eng. Misc. b. 223, F 6. ASA Vice-President Nevill Mott wrote a letter to the editor of *Nature* in which he argued along similar lines and observed that the 'view expressed in *Nature* suggests a change in the traditional policy of the journal, which has always stressed the international aspects of science, and it shows strikingly the way in which military considerations can affect the outlook of scientific workers and lead them to adopt against their will a totalitarian view of their function'; 'International Exchange of Scientific Information', *Nature*, 162. 4115 (11 September 1948), 417.

[771] 'Some British Experiences: II. R.E. Peierls', in *American Visa Policy and Foreign Scientists*, ed. by Edward A. Shils (= *BAS*, 8.7 (October 1952)), pp. 229-30 (p. 229).

American relations. Since the American authorities cited the McCarran Internal Security Act, a piece of internal delegation that imposed severe restrictions on the freedom of Communists in the United States, they met with fierce opposition from the British government and risked a complete British withdrawal from the declassification conference.[772] Peierls was finally granted a visa to attend this meeting.[773] Peierls used this visa then also to go to the Nuclear Physics Conference in Chicago.[774] He experienced further difficulties in obtaining a visa for a visit to the Institute of Advanced Study in Princeton which he received only at the very last minute.[775]

The cases in which US visas had initially been denied to Rudolf Peierls or where the issuing process had considerably been delayed were no singular occurrences but rather have to be seen within the context of US government policies during and after the time of McCarthyism.[776] The visa problem was apparently so aggravating for the scientific community that the *Bulletin of the Atomic Scientists* dedicated a special issue in October 1952 to 'American Visa Policy and Foreign Scientists'.[777] Prominent foreign-born American scientists like Hans Bethe spoke out against these policies predicting that they would 'be increasingly detrimental to the development of science in the United States'.[778] The United States' visa policy continued to impair science and in March 1955, the Federation of American Scientists (FAS) called upon readers of the *Atomic Scientists' Journal* to share their experiences so that the American organization could assess the impact of the US immigration legislation at the time on science.[779]

Apart from foreign-born scientists experiencing difficulties in obtaining US visas, the State Department also refused to issue or confiscated passports of

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[772] B.J.S.M. Washington to Cabinet Office, 23 August 1951, TNA, KV 2/1662. Both Peierls and Fuchs (before his confession) served on the Publication and Declassification Sub-Committee; J.H. Awbery and J.F. Jackson, 'Publication and Declassification Sub-Committee', 22 July 1948, CHAD I/19/8.

[773] Cabinet Office to B.J.S.M. Washington, 27 August 1951, TNA, KV 2/1662.

[774] Peierls, *Bird of Passage*, p. 321. Note that Peierls' account differs here from the aforementioned documents in the two preceding notes. Unlike he claims in his autobiography, he was not automatically granted a US visa to attend the declassification conference as a British government official.

[775] Peierls, *Bird of Passage*, p. 322.

[776] Badash, 'Science and McCarthyism', pp. 65-66.

[777] The general problem is summarized in: Edward A. Shils, 'Editorial: America's Paper Curtain', in *American Visa Policy and Foreign Scientists* (see 'Some British Experiences', above), pp. 210-17.

[778] 'Eminent American Scientists Give Their Views on American Visa Policy', in *American Visa Policy and Foreign Scientists* ('Some British Experiences', above), pp. 217-20.

[779] 'Scientists and U.S. Visas', *ASJ*, 4. 4 (March 1955), 202-03.

American scientists such as Linus Pauling who allegedly held left-wing or Communist views.[780] The most prominent victim of the State Department's obscure passport policy was perhaps David Bohm. As a result of this dubious practice, he left the United States for Brazil where he took up a position at the University of São Paulo and obtained Brazilian citizenship before he finally moved to the United Kingdom via Israel.[781] In Britain, the Foreign Office also intervened when Eric Burhop was invited to visit Moscow in July 1951.[782]

Rudolf Peierls and the ASA also took clear sides in what was perhaps the most prominent example of how this repressive political climate affected science – the case of J. Robert Oppenheimer. While Oppenheimer had not been central to HUAC's investigations, the FBI had launched an inquiry into his alleged Communist affiliations even before World War II.[783] To date it remains a contentious issue whether Oppenheimer joined the Communist party or not.[784] Once the news of Klaus Fuchs's confession broke, Lewis Strauss who served on the Atomic Energy Commission (AEC) started his own investigation of J. Robert Oppenheimer which finally peaked in the infamous Oppenheimer security hearings of 1954 when the AEC stripped Oppenheimer of his security clearance and thus ended his role as AEC advisor.[785] The *Atomic Scientists' Journal* dedicated considerable attention to the Oppenheimer case, including a long review article of the published transcripts and documents of the hearings by Rudolf Peierls who concluded on the possible impact of the Oppenheimer security hearings:

> But if this case were to shake, even slightly, the enthusiasm of the educated people of a country for its way of life, if it were to sow any doubt as to the survival of freedom, fairness and reason and the importance of bringing sacrifices for these principles, then the loss of moral strength which it would cause would be the equivalent of many superbombs or ships or planes.[786]

Like many of his colleagues, Rudolf Peierls was deeply disturbed about the attacks on Oppenheimer. As he wrote to J. Robert Oppenheimer in a personal letter,

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[780] Badash, 'Science and McCarthyism', pp. 62-64.
[781] Wang, pp. 277-78.
[782] 'Dr. Burhop and the Press', ASN, n.s. 2. 6 (July 1953), 366-68 (p. 366).
[783] Schrecker, *No Ivory Tower*, p. 139; Schrecker, 'Before the Rosenbergs', pp. 130-34.
[784] While Gregg Herken has argued that Oppenheimer was a Communist (*Brotherhood of the Bomb*, pp. 43-62), Kai Bird and Martin J. Sherwin have refuted this claim (pp. 119-24).
[785] Bird and Sherwin, p. 434; Priscilla McMillan, p. 66.
[786] Rudolf Peierls, '"In the Matter of J. Robert Oppenheimer"', *ASJ*, 4. 3 (January 1955), 145-54 (p. 154). Apart from Peierls's piece, this issue of the *ASJ* contained in its editorial two articles dealing with case, entitled 'The Oppenheimer Case' (pp. 141-43) and 'The Hidden Struggle for the H-Bomb' (pp. 143-44), as well as a short bibliographical essay following Peierls's review entitled 'Further Articles on the Oppenheimer Case', p. 154.

remarking on the charges brought forward against the latter because of his critical attitude towards the development of the H-bomb: 'In a Communist or Nazi state one expects as a matter of routine, the holders of minority views to be regarded, and treated, as traitors, but if this happens elsewhere it makes us despondent about the prospects of survival of free society.'[787]

Throughout his life Peierls kept on warning against the perils of an infringement of the freedom of science by security measures, as the Oppenheimer case demonstrated all too dramatically. In his autobiography Rudolf Peierls later argued in favour of a critical engagement with anti-democratic ideas. 'The problem of ensuring the loyalty of people entrusted with sensitive, confidential information', he wrote, 'is sometimes confused with a desire to keep "undesirables" from entering the country or any particular profession.' While this revealed in Peierls's eyes 'a failure to appreciate that the strength of a stable democracy rests on its citizens' understanding of the basic issues and their ability to reject simplistic extreme ideologies' because 'Marxist or fascist ideas are not like an infectious disease that can be contracted by exposure to it'. By contrast, he argued, 'familiarity with them helps to give a firmer basis to one's own convictions, and makes one's arguments against such ideas stronger'.[788]

The Fuchs case cast a long shadow over Rudolf and Genia Peierls's lives. Indeed there seems to exist a continuing history of allegations against them. One of the most obscure instances occurred in 1979 when the journalist Richard Deacon intended to publish his book *The British Connection*. Wrongly assuming that Rudolf Peierls was dead, the author unleashed a barrage of accusations against Peierls. When Peierls received news about the book's impending publication, he took immediate legal action and prevented its release.[789]

Even after their deaths, Rudolf and Genia Peierls remained the target of defamatory allegations, being subjected to accusations of having been Soviet agents. When the transcripts of a good number of the Venona messages intercepted in World War II were finally declassified and made publicly available in 1995, new accusations against Rudolf and Genia Peierls surfaced. Their names were wrongly related to those of two unidentified Soviet spies, codenames 'Tina' and

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[787] Peierls to Oppenheimer, 16 April 1954, Peierls Papers, suppl. cat. A. 16.
[788] Peierls, *Bird of Passage*, p. 321.
[789] Ibid., pp. 324-25.

'Fogel/Pers'.[790] Another prominent posthumous victim of such libel was Niels Bohr.[791] In 1966 Peierls was, for instance, interviewed by the Italian public television channel *Radiotelevisione Italiana* (RAI) for a programme on Fuchs.[792] In 1984 he declined an offer to participate in a documentary on his former colleague.[793]

Conclusion

The Klaus Fuchs atomic espionage case had a deep impact on postwar British nuclear culture and emphasized the intersections between nuclear science, German-speaking émigré atomic scientists and democracy, and postwar political cultures in the United Kingdom. While it remains a difficult task to examine Fuchs's precise motivations to spy for the Soviets as well as to confess his espionage activities in early 1950, his declaration of guilt led Britons to discuss the state of democracy in their country. It especially spurred distrust in the effectiveness of national security measures in Britain at home and abroad, especially in the United States.

The name Klaus Fuchs became an epitome of betrayal of their hospitality for many Britons and he was turned into a larger than life figure. Although the Soviet Union would have eventually developed both its own atomic and thermonuclear arms, many contemporaries believed that atomic spies such as Klaus Fuchs and Alan Nunn May had provided the Soviets almost with blueprints of these weapons. Instead, secret agents like Fuchs helped speed up the programme, probably by about one or two years. Besides the public repercussions the Fuchs case had in Britain and its impact on Anglo-American relations, it particularly affected the lives of other German-speaking émigré nuclear scientists, especially Rudolf Peierls, because of their origins. But Rudolf Peierls's German extraction also informed his views on the role he foresaw nuclear scientists taking in the atomic age.

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[790] Sabine Lee, 'The Spy That Never Was', *Intelligence and National Security*, 17. 4 (Winter 2002), 77-99 (pp. 85-96).

[791] For a concise overview and convincing rejection of claims that Bohr was a spy Hans Bethe, Kurt Gottfried and Roald Z. Sagdeev, 'Did Bohr Share Nuclear Secrets?', *American Scientific*, (May 1995), pp. 84-90.

[792] Mattioli to Peierls, 31 May 1966; Mattioli to Peierls, 14 June 1966; Peierls to Mattioli, 16 June 1966, Peierls Papers, b. 219, D 22.

[793] Young to Peierls, 18 June 1984; Peierls to Young, 19 June 1984; Peierls to Humphreys, 5 August 1984; Humphreys to Peierls, 13 August 1984; Peierls to Humphreys, 15 August 1984. The script of the documentary, 'The Brilliant Scientist', is also contained in the file; Peierls Papers, suppl. cat., D. 54.

Chapter Five. The Unpolitical Scientist: Rudolf Peierls and the British Atomic Scientists' Movement.

Introduction

Like Klaus Fuchs, Rudolf Peierls ceased to work on nuclear weapons after the war. But unlike Fuchs, who had passed on crucial nuclear information to the Soviet Union to prevent, or better shorten the period during which the United States held a monopoly on atomic weapons, Peierls's dealt differently with the responsibility that he felt was emerging out of his previous atomic arms research. After his return to the United Kingdom, he became a chief engine behind the British atomic scientists' movement. As the preceding chapter has demonstrated, Klaus Fuchs's confession had a strong impact on democracy and political cultures in Britain and the United States, in particular with regard to the production of public opinion on these issues. This chapter, by contrast, examines Rudolf Peierls's views on the atomic scientist's political responsibility in the nuclear age, especially education of the public, and of science advising to political decision-makers.

This chapter analyses Rudolf Peierls's role in the formation and disbandment of the chief organization of the British nuclear scientists' movement, the ASA, by focusing on his ambivalent concept of the (politically) objective scientist. It is structured into three subchapters the first of which deals with the association's beginnings in the United States. As many future ASA members, including Rudolf Peierls, worked during the Second World War as part of the British Mission at Los Alamos, they witnessed at first hand the formation of the American nuclear scientists' movement which would provide a direct model for its British counterpart in many ways. The subsequent subchapter looks at the ASA and its agenda in respect to Peierls's vision of the unpolitical scientist. It compares his approach to those of other German-speaking émigré atomic scientists in the United States and the FAS, the ASA's American sister organization, as well as scientists such as Werner Heisenberg and Carl Friedrich von Weizsäcker, who worked on the German nuclear weapons project during World War II and became involved in politics in the FRG after the war. The final part then provides a critical examination of Peierls's concept of the objective scientist, in particular the degrees to which his ideal was informed by universal and national, German and British, scientific principles and cultures. This

subchapter links Peierls's ambiguous concept of the unpolitical scientist in part back to his socialization in Germany and therefore closes the circle in the investigation of his and Fuchs's roles in the making of British nuclear culture. The period under investigation in this chapter ends in 1958 with the dissolution of the ASA.

The American Beginnings of the British Atomic Scientists Movement

While the invention and use of poison gas during World War I had affected warfare significantly and confronted scientists such as Fritz Haber with ethical questions,[794] the creation of the atomic bomb moved the question of science and morality to a higher and much more complex level.[795] This development went hand in hand with an increasing turn from low to high technology. Although inventions like the Higgins Boat or Liberty Ships, penicillin, the proximity fuse and especially radar played decisive roles in the Allied war effort during World War II, it was the advent of nuclear weapons that not only changed the face of warfare fundamentally but also raised existential questions about human survival in the subsequent nuclear age.[796] Shortly after the war, J. Robert Oppenheimer, the wartime scientific director of the Los Alamos laboratory, stressed that '[t]he obvious consequence of this intimate participation of scientists is a quite new sense of responsibility and concern for what they have done and for what may come of it.'[797]

The Trinity test of 16 July 1945 confronted Rudolf Peierls and his Los Alamos colleagues morally and ethically for the first time with the results of their work. About forty years after the event, Rudolf Peierls still recollected 'the feeling of awe at the terrible power of this weapon mixed with elation at the success of the work'.[798] Many of Peierls's colleagues shared these ambivalent feelings and were

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[794] On Fritz Haber and the ethical implications of his work, see Henry Harris, '"To Serve Mankind in Peace and the Fatherland in War": The Case of Fritz Haber', *German History*, 10. 1 (1992), 24-38.
[795] On the question of science and morality, see Schweber, *In the Shadow of the Bomb*; Priscilla McMillan; Brian VanDeMark, *Pandora's Keepers: Nine Men and the Atomic Bomb* (New York: Back Bay Books, 2003).
[796] Robert Bud, *Penicillin: Triumph and Tragedy* (Oxford: Oxford University Press, 2007); Daniel J. Kevles, *The Physicists: The History of a Scientific Community in Modern America*, new edn (Cambridge, MA: Harvard University Press, 1995), pp. 307-08; Jerry E. Strahan, *Andrew Jackson Higgins and the Boats That Won World War II* (Baton Rouge: Louisiana State University Press, 1994).
[797] J. Robert Oppenheimer, 'The New Weapon: The Turn of the Screw', in *One World or None: A Report to the Public on the Full Meaning of the Atomic Bomb*, ed. by Dexter Masters and Katherine Way (New York: Whittlesey House; McGraw-Hill, 1946), pp. 22-25 (p. 23).
[798] Peierls, *Bird of Passage*, p. 202.

often forced, as Jon Hunner has pointed out, 'to culturally code switch' in order to comprehend the magnitude of the new weapon.[799] Klaus Fuchs recalled that while he enjoyed the sight of the explosion, he found himself confronted with unsettling questions about the future of the atom bomb, in particular its control through the military, and felt that it was the scientists' duty to prevent its use in war.[800] Hans Bethe summarized his ambivalent feelings, saying: 'It was awesome. We had calculated it all, and we knew pretty well what would happen, and still it was a tremendous impression when it really did happen. The size of it was so enormous that everybody was terribly impressed.'[801] In what became perhaps the most famous instance of 'cultural code switching' J. Robert Oppenheimer is said to have quoted the lines 'I am become Death, / The shatterer of worlds' from the Hindu epic *Bhagavad-Gita* shortly after the Trinity explosion.[802]

While the Trinity test visualized in a most dramatic way the destructive force of the new weapon, Rudolf Peierls and many of his colleagues faced another moral dilemma. Since they had originally set out to win the race over the atom bomb in favour of the Allies, the unconditional German surrender in early May 1945 deprived them of their justification for working on the project. Unknown to the vast majority of Los Alamos scientists at the time, the so-called ALSOS teams which had been sent into Germany in search of nuclear scientists and research installations under the direction of physicist Samuel A. Goudsmit had furnished conclusive evidence that Hitler had not even come close to having a working nuclear weapon at his disposal.[803]

But General Leslie R. Groves had no interest in informing Peierls and his colleagues about these findings because this information might undermine the scientists' morale and thus jeopardize the continuation of work on the atomic arms programme.[804] As a consequence, most Los Alamos scientists were not aware of British and American intelligence reports that revealed that Germany did not possess

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[799] Jon Hunner, 'Reinventing Los Alamos: Code Switching and Suburbia at America's Atomic City', in *Atomic Culture*, p. 34.
[800] *Professor Dr. Klaus Fuchs*.
[801] Bethe, interview by Balibrera, p. 12.
[802] Cited in Lamont, p. 180.
[803] Samuel A. Goudsmit, *Alsos: The Failure of German Science* (London: Sigma Books, 1947); Richelson, pp. 17-61; Mark Walker, *Nazi Science: Myth, Truth, and the German Atomic Bomb* (Cambridge, MA: Perseus, 1995), pp. 183-241.
[804] For a discussion of Groves' motivation behind the use of the atom bomb see Norris, pp. 373-94; Barton J. Bernstein, 'Reconsidering the "Atomic General": Leslie R. Groves', *Journal of Military History*, 67. 3 (2003), 883-920 (pp. 902-11).

a working nuclear device and voiced, at first, virtually no moral or political concerns about the continuation of their work on nuclear weapons.[805] At this stage, the Polish émigré physicist Joseph Rotblat was the only scientist to leave Los Alamos as a result of the changed geopolitical situation.[806]

J. Robert Oppenheimer also contributed significantly to the project's progress, especially by suppressing debates on moral and political issues among the scientists through enforcing a strict regime of scheduling and time management.[807] Victor Weisskopf described the numbing impact that the daily routine as a key part of Oppenheimer's scheduling had on his moral quandaries, writing:

> As we became more deeply involved in the day-to-day work of our collective task, any misgivings that we had at the start began to fade, and slowly the great aim became the overriding driving force: We had to achieve what we had set out to do.[808]

And, as Weisskopf's statement reveals, Oppenheimer had managed to forge what Silvan S. Schweber has called a 'sense of wholeness' at Los Alamos.[809]

Oppenheimer's success in suppressing moral and political discussions in order to motivate scientists to resume work on the atomic bomb was largely based on his 'charismatic authority', as Charles Thorpe and Steven Shapin have argued.[810] Rudolf Peierls had high confidence in J. Robert Oppenheimer, in particular as a mediator between the scientists and both the military leadership and political decision makers.[811] Through the effective use of his 'charismatic authority', Oppenheimer held back the circulation of a document which Leo Szilard had drafted on behalf of a group of scientists at the University of Chicago's Metallurgical Laboratory, the so-called Met Lab. In his petition to President Truman Szilard urged the US president not to use the atomic bomb against Japanese cities.[812] As a result of

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[805] Schweber, *In the Shadow of the Bomb*, p. 153.
[806] Joseph Rotblat, 'Leaving the Bomb Project', *BAS*, 41. 7 (August 1985), 16-19.
[807] Thorpe, *Oppenheimer*, pp. 153-55.
[808] Weisskopf, *Joy of Insight*, pp. 127-28.
[809] Schweber, *In the Shadow of the Bomb*, p. 105.
[810] Charles Thorpe and Steven Shapin, 'Who Was J. Robert Oppenheimer? Charisma and Complex Organization', *Social Studies of Science*, 30. 4 (August 2000), 545-90.
[811] Peierls, interview by Weiner, pp. 149-50.
[812] Leo Szilard, 'A Petition to the President of the United States', in *The Atomic Age: Scientists in National and World Affairs, Articles from the Bulletin of the Atomic Scientists 1945-1962*, ed. by Morton Grodzins and Eugene Rabinowitch (New York: Basic Books, 1963), pp. 28-29 (p. 28); Edward Teller, with Allen Brown, *The Legacy of Hiroshima* (Garden City, NY: Doubleday, 1962), p. 13.

Oppenheimer's successful repression of any dissent, Rudolf Peierls, too, was at that time not aware of the activities of his Chicago colleagues.[813]

Szilard's petition came about one month after scientists at the Met Lab around the German-born émigré James Franck had drafted a report in which they also advised against the use of nuclear weapons against Japan and in favour of a demonstration of the new weapon before a United Nations (UN) delegation before using it. They passed the document on to the Secretary of War, Henry L. Stimson, through Arthur Holly Compton. While the so-called Franck Report had no effect on the Truman administration's decision-making process with regard to the use of the atom bomb, it would provide an important impetus for the newly formed scientists' movement after the war.[814] Despite these appeals by Chicago scientists, President Truman authorized the use of two atomic bombs, one against Hiroshima on 6 August and a second one against Nagasaki on 8 August 1945.[815] The British Prime Minister Winston Churchill fully backed this decision.[816]

The news of the atomic bombing of Hiroshima, which would overshadow the discourse over nuclear weapons for decades to come, elicited mixed emotions in Rudolf Peierls and many of his Los Alamos colleagues. Peierls later wrote that 'with the feeling of elation there was horror at the death and suffering that must have resulted, though we had no details yet'. His uneasiness about the consequences of the nuclear attack increased after the second atomic strike against Nagasaki just two days later.[817] Klaus Fuchs described an atmosphere of temporary joy about the successful outcome of the Manhattan Project, but added that this soon gave way to serious moral and ethical quandaries.[818] Still, Rudolf Peierls, like Klaus Fuchs and many other Manhattan Project scientists, justified his participation in the creation of the

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[813] Peierls, interview by Weiner, p. 150.
[814] 'A Report to the Secretary of War', *BAS*, 1. 5 (May 1946), 2-4, 16; Matt Price, 'Roots of Dissent: The Chicago Met Lab and the Origins of the Franck Report', *Isis*, 86. 2 (1995), 222-44 (pp. 222-23).
[815] As J. Samuel Walker has argued, the eventual use of the atomic bomb was an established fact from the beginning of the Manhattan Project; *Prompt and Utter Destruction*, pp. 60-61, 76-97. Despite its many flaws, Michael D. Gordin provides an up-to-date historiographical review of the existing literature on President Truman's decision to drop the atomic bomb; *Five Days in August: How World War II Became a Nuclear War* (Princeton: Princeton University Press, 2007), pp. 141-44.
[816] Rosenberg, pp. 180-82.
[817] Peierls, *Bird of Passage*, p. 203. Hans Bethe and Victor Weisskopf shared these views; Hans Bethe, interview by Balibrera, p. 14; Weisskopf, *Joy of Insight*, pp. 127-28.
[818] *Professor Dr. Klaus Fuchs*.

atom bomb and refrained from offering any after-the-fact-reasoning or counterfactual arguments to excuse his wartime work.[819]

The atomic scientists became the centre of considerable public attention when newspapers on both sides of the Atlantic ran countless headlines and articles about the development of the new weapon and they found themselves all of a sudden in the limelight.[820] 'For a brief but crucial interval', Paul Boyer observed, 'scientists played a central role in molding the public's earliest nuclear perceptions and attitudes.'[821] In Peierls's case, the awareness of the scientists' responsibility was a direct result of his work on the atomic bomb during World War II.[822] Peierls believed that 'public opinion should be influenced in the right direction' once the existence of the atomic bomb had become public knowledge in the immediate aftermath of Hiroshima. 'It was immediately clear that scientists had a job there', he argued, 'because you can't have a reasonably intelligent public discussion without some understanding of simple technical facts; and it was up to the scientist to explain them.'[823]

During the remainder of his stay at Los Alamos, Peierls witnessed the formation of the atomic scientists' movement in the United States, which would become crucial for his own role in the British nuclear scientists' movement. While Peierls and many of his colleagues engaged in work on the development of the atomic bomb, only a few scientists took action to stop these developments. As early as September 1942, Leo Szilard, who had previously drafted together with Albert Einstein the famous letter to FDR to call for the creation of such a weapon, now voiced serious concerns about the impact that the bomb would have on the postwar world. The Danish émigré physicist Niels Bohr had similar fears and warned of a postwar nuclear arms race. He even approached FDR and Churchill to promote the idea of international control of atomic weapons and energy. It was the British Prime

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[819] Peierls, *Bird of Passage*, pp. 204-05. Hans Bethe, for example, shared this view; interview by Balibrera, p. 14.
[820] See, for instance, 'Atom Bomb Made in 3 Hidden "Cities"', *New York Times*, 7 August 1945, p. 1; 'Atomic Age', *Time*, 20 August 1945, pp. 29-36; 'First Atomic Bomb Hits Japan', *The Times*, 7 August 1945, p. 4; 'Text of Statements by Truman, Stimson on Development of Atomic Bomb', *New York Times* 7 August 1945, p. 4; Clifton Daniel, 'Report by Britain', *New York Times*, 7 August 1945, pp. 1, 9. 'British Statements Reviewing the Allies' Cooperation in Development of Historic Missile', *New York Times*, 7 August 1945, p. 8; 'Atomic Bomb Used on Japan', *Manchester Guardian*, 7 August 1945, p. 5.
[821] Boyer, *By the Bomb's Early Light*, pp. 59-64.
[822] Peierls, interview by Weiner, p. 149.
[823] Ibid., p. 151.

Minister who especially opposed Bohr's ideas and who, at one point, wanted to have the Danish émigré arrested.[824]

As a result of a growing awareness of their moral responsibility in the early atomic age, Los Alamos scientists such as Robert Christy, Richard Feynman, Edward Teller and Victor Weisskopf started to organize themselves as the Association of Los Alamos Scientists (ALAS).[825] The group intended, as it declared in its statement of purpose, '"to promote the attainment and use of scientific and technical advances in the best interests of humanity".'[826] It formed at a time when the Los Alamos laboratory, including the British Mission members Klaus Fuchs and Egon Bretscher, started preparations for Operation Crossroads, the first postwar series of nuclear tests at the Bikini Atoll.[827] Similar organizations emerged at other Manhattan Project installations: at Oak Ridge, Tennessee, the Oak Ridge Association of Scientists and Engineers formed shortly after the war.[828] Here, Lothar Nordheim engaged in the organization's efforts.[829] At the Chicago Met Lab, the Committee on Social and Political Implications that had been established under the chairmanship of James Franck at the Met Lab shortly after Hiroshima and Nagasaki,[830] evolved into the Atomic Scientists of Chicago, Inc. in early September 1945.[831]

In an attempt to disseminate information about the nature of the new weapon to the wider public, the ALAS drafted and distributed a statement on 'the Hill' as one of its first major activities. When it became apparent that the US Army would not clear its contents for distribution outside the perimeter fence of Los Alamos, Robert Wilson breached the security rules and rewrote the statement in his own words and sent it off to the *New York Times*, which printed it on the first page.[832]

The document emphasized six main points: firstly, the use of nuclear weapons in future wars would be disastrous; secondly, there was no defence against the new weapon; thirdly, the United States' monopoly of atomic weaponry would be

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[824] Lawrence S. Wittner, *The Struggle Against the Bomb*, 3 vols (Stanford: Stanford University Press, 1993-2003), I (1993), 20-22.
[825] Hunner, *Inventing Los Alamos*, p. 112.
[826] Cited in Robert R. Wilson, 'Hiroshima: The Scientists' Social and Political Reaction', *PAPS*, 140. 3 (1996), 350-57 (p. 352).
[827] Hunner, *Inventing Los Alamos*, p. 112.
[828] Johnson and Jackson, p. 177.
[829] Nordheim, Interview by Wheaton, pp. 42-43.
[830] Alice Kimball Smith, 'Behind the Decision to Use the Atomic Bomb: Chicago 1944-45', *BAS*, 14. 8 (October 1958), 288-312 (p. 300).
[831] Sean Labat, 'Chicago Atomic Scientists and United States Foreign Policy, 1945-1950', *Journal of Illinois History*, 3 (Summer 2000), 121-40 (p. 126).
[832] Robert Wilson, p. 353.

temporary; fourthly, there was a peril of a nuclear arms race with disastrous consequence; fifthly, there was an urgent need for the international control of nuclear weapons and power; and, finally, peaceful applications of nuclear energy should be pursued within a framework of international control.[833] It generated particular interest amongst the members of the British Mission to Los Alamos. Klaus Fuchs was among the signatories of a letter to Sir James Chadwick to which they attached a copy of the statement and in which they assured Chadwick that they supported the points expressed by their American colleagues. Owing to their immigration status as alien subjects, however, the members of the British Mission noted that '[i]t seems inappropriate that we should sign a document addressed to a department of the American Government and to the American press.' They added they 'would be very interested in lending our support to a similar statement addressed to the British Government and press'.[834] Consequently, the ALAS statement marked the starting point of a concerted effort by British atomic scientists to express their thoughts on nuclear weapons and energy univocally.

Despite concerns over their status as 'guests' in the United States, Rudolf Peierls and several members of the British Mission drafted a 'Memorandum from British Scientists at the Los Alamos Laboratory, New Mexico' in the autumn of 1945. Its signatories included – apart from Peierls – Klaus Fuchs, Egon Bretscher, Anthony French, James Hughes, William Marley, Donald Marshall, Philip Moon, William Penney, Tony Skyrme, Ernest Titterton and James Tuck. In the document, the undersigned atomic scientists revealed great concern about 'the implications of this completely new weapon'. They went on to explain the purpose of their statement: 'We feel it our duty to bring our knowledge and ideas on this subject to the attention of those responsible for British policy.' The memorandum repeated, by and large, the principal points made in the ALAS statement, especially the new quality of the atom bomb's destructive force, the insufficiency of an appropriate defence against nuclear weaponry, and the need for the international control of military and civilian applications of atomic energy, as well as the necessity of the '[f]ree movement of scientific personnel and information'.

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[833] R. Christy and others, 'The Committee proposes to submit this document first to the President's Interim Committee for Atomic power and subsequently to the public', n.d., attached to letter, Titterton and others to Chadwick, 6 September 1945, CHAD IV/12/2.
[834] Titterton and others to Chadwick.

The British scientists at Los Alamos aimed at giving more weight to their statement when they followed the example of their American colleagues and used fear as a tool in conveying their message. 'A single bomb of the present type can completely cripple the life and resources of a city the size of Bristol or Coventry,' they stated, adding: 'There is no specific defence against atomic bombs.' The members of the British Mission further stressed the defencelessness against nuclear arms in their memorandum, arguing: 'The prospects of preventing their delivery, or intercepting a large fraction of them, seem extremely remote, particularly since they could be delivered in a variety of ways, for example by rockets of the V. 2 type.'[835] With their discourse on the effects of atomic arms, the authors of the memorandum followed an ambivalent approach that, as Hugh Gusterson has argued, 'is perched on a razor's edge between the bomb's need for bodies to display its power and society's need to conceal and transmogrify the bodies of victims and executioners if that power is to be stable'.[836]

On 1 November 1945, the groups that had organized at the Manhattan Project installations at Chicago, Los Alamos, Oak Ridge and New York merged in the Federation of Atomic Scientists which was shortly after its inauguration renamed the FAS. The newly formed organization arranged the National Committee on Atomic Information (NCAI) to provide public education of atomic matters. This was further aided by the launch of the *Bulletin of the Atomic Scientists of Chicago* by Eugene Rabinowitch and Hyman Goldsmith in December. Officially not an FAS publication, the journal, which was a short time later renamed the *Bulletin of the Atomic Scientists*, became the scientists' movement's chief organ at home and abroad. As a fundraising organization, the Emergency Committee of Atomic Scientists (ECAS) was set up in May 1946. Chaired by Albert Einstein, it included the German-speaking émigré scientists Hans Bethe, Leo Szilard and Victor Weisskopf.[837]

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[835] 'Memorandum from British Scientists at the Los Alamos Laboratory, New Mexico', n.d., pp. 1, 2, 4, 5. While the memorandum is not dated, it is attached and referred to in a letter from William G. Marley to D. Rickett, dated 23 October 1945, CHAD IV/12/2. On fear as a tool used by the early American scientists' movement, see Boyer, *By the Bomb's Early Light*, pp. 65-75.
[836] Hugh Gusterson, *Nuclear Rites: A Weapons Laboratory at the End of the Cold War* (Berkeley: University of California Press, 1996), p. 109.
[837] Wittner, I, 59-61.

Rudolf Peierls and the Atomic Scientists' Association

For Rudolf Peierls, the scientist's new moral responsibility translated into his strong personal engagement with the ASA after his return to the United Kingdom. The ASA was the British counterpart of the FAS and had similar goals as its American sister organization.[838] Initially Rudolf Peierls served besides Maurice H. L. Pryce as one of the ASA's two Executive Vice-Presidents.[839] At the General Meeting in Oxford in late June 1948, Peierls was elected President of the ASA.[840] He was re-elected twice and stayed in office until October 1950 when he became one of the organization's several vice-presidents.[841] So significant was Peierls's role as a leading functionary in the association that it prompted the Central Committee of the Soviet Communist Party to gather and compile information on him.[842] Unlike many of his colleagues who became politically active and did not refrain from making political statements in public, Rudolf Peierls, however, followed a different path and advocated the ideology of apolitical science.

As one of the chief consequences of his promotion of the concept of political objectivity, Peierls influenced the course of the ASA from its beginning. Even before the ASA was founded, its predecessor, the Atomic Scientists' Committee (ASC), which had been founded under the auspices of the Association of Scientific Workers (AScW), struggled with the broad political spectrum of its members.[843] In February 1946, Peierls informed Sir James Chadwick about 'a somewhat complicated situation with the Committee of Atomic Scientists'. In his letter, he expressed serious concern about the ASC's dependence on the leftwing AScW because, in his eyes, 'such a connection would only antagonize certain people'. What Peierls disliked in particular

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[838] Peierls, 'Britain in the Atomic Age', p. 95.
[839] Philip B. Moon and Eric H.S. Burhop, *Atomic Survey: A Short Guide to the Scientific and Political Problems of Atomic Energy* ([n.p.]: Atomic Scientists' Association, [1946]), p. 32.
[840] 'Editorial', *ASN*, 2. 1 (15 July 1948), 1.
[841] 'Annual General Meeting', *ASN*, 3. 1 (21 July 1949), 3-7 (p. 7); 'Annual General Meeting: Elections to Council', *ASN*, 4. 1 (August 1950), 6.
[842] The Central Committee of the Communist Party of the Soviet Union kept a news digest of statements made by Peierls in the period from 1947 until 1950, see Rudolf Peierls personal file (note that Peierls's last name is misspelled in the archive's catalogue as 'Peyerles, Rudolph F.' including a false middle initial; 'Lichnoe delo Peierls Rudol'f'), RGASPI, Komintern, F. 495, op. 198, d. 1811. Peierls's personal file makes, for example, reference to a statement made by him at an ASA meeting on 15 February 1948 (p. 9), his visit to and a public lecture given by him in Stockholm, Sweden, in March 1949 (p. 8), Peierls's statement on the H-bomb in a special issue of the *ASN* (p. 3), Peierls's letter to the editor of *The Times* (13 July 1950) in reply to statements made by a Conservative MP who spoke out in favour of using the atomic bomb in Korea (p. 2) and an article published in the 14 September 1950 issue of the *ASN* (p. 1).
[843] 'Atomic Scientists' Association', *Nature*, 157. 3996 (1 June 1946), 725.

about the umbrella organization was 'that the two activities at present attempted by the Association of Scientific Workers, namely, to act as a trade union for scientists, and to express the general view of scientists as unbiased experts, do not mix and should be carried out by separate bodies'. As a consequence, Peierls suggested the formation of an independent committee. He was aware of possible problems that such an independent council in the style of the FAS could face because its formation would require the acceptance of members 'from all branches of science outside of the project' which generated 'much controversy' in the current discussions of the group.[844] But it was not only political activism from the left that Peierls distrusted. For example, he disagreed completely with some of Lord Cherwell's ideas and, at a conference in Chicago in 1951, these opposing views led to Peierls's falling out with Cherwell.[845] In his reply to Peierls, Sir James Chadwick shared the latter's concerns. Although Sir James acknowledged that the FAS 'is doing quite well', he disagreed 'with a good deal of what they say publicly'. Chadwick criticized its political involvement because he thought that 'they have gone too far and that they have lost support by being too emphatic'. It was in particular Harold Urey, a leading figure in the FAS, whom Chadwick viewed critically and who, he believed, was 'now losing ground'.[846]

By mid-March 1946, plans to found the Association of Atomic Scientists, as it was initially called, had become much more concrete when an interim committee that continued the work of the ASC was formed. Peierls was a member of this new committee which operated independently of the AScW. While the Association of Atomic Scientists followed in many ways the example of the FAS, Peierls envisaged some essential differences to the American organization, especially with regard to political statements. As he wrote to Sir James Chadwick on 12 March 1946:

> We are trying to avoid some of the mistakes made by the Americans, by insisting from the outset that a proper division should be made between statements of scientific facts and opinions held by scientists, and that on the latter type of question the association should not express any definite views or advocate any definite policies. Their job should primarily be to promote discussions which will help to make clear the implications of views drawn up by individuals either inside the association or outside on their own behalf. They should, as an association, advocate views on such questions only if, after submitting proposals to all the members, they are

[844] Peierls to Chadwick, 26 February 1946, CHAD I 24/2.
[845] Peierls, *Bird of Passage*, p. 283.
[846] Chadwick to Peierls, 6 March 1946, CHAD I 24/2.

> found to be shared by all, or essentially all, the scientists in the association.[847]

Peierls's strong belief that such an organization would be capable of reaching decisions unanimously through a democratic decision-making process indicates a good deal of idealism on his part. In retrospect, Peierls admitted that '[t]here was also a friction because some of the vice-presidents objected to statements being made without their approval.'[848]

In comparison to the FAS, however, the ASA was comparatively small with about 140 members. It was led by a national council which was directly elected by its members.[849] The council consisted of a president and a secretary and several vice presidents.[850] While full membership in the association was restricted to atomic scientists so that the ASA comprised of experts in nuclear matters, all members of the public could become associate members.[851] In 1950, the ASA had about 500 such associate memberships.[852]

In spite of the fact that it had been founded as an independent body, the ASA faced many problems owing to its members' diverse political views throughout its existence. On the left end, Patrick Blackett, who had served as the AScW's President from 1943-47, and Eric Burhop, another leading figure in the union, were members of the ASA's Council from the beginning. Blackett was amongst the sharpest internal critics of the association.[853] An article by Eric Burhop published in the April 1949 issue of the *Atomic Scientists' News* on the civil service purge in Britain generated dissent amongst many ASA members.[854] On the other end, Lord Cherwell or Sir George Thomson stood for conservative values.[855] Lord Cherwell, for example, opposed a statement suggested to be made by the ASA council on the hydrogen

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[847] Peierls to Chadwick, 12 March 1946, CHAD I 24/2.
[848] Peierls, *Bird of Passage*, p. 284.
[849] Peierls, 'The British Atomic Scientists' Association', p. 59.
[850] Peierls, *Bird of Passage*, p. 283.
[851] 'Atomic Scientists' Association', *Nature*, 157. 3996 (1 June 1946), p. 725; Atomic Scientists' Association, *Atom Train: Guide to the Travelling Exhibition on Atomic Energy* (London: Atomic Scientists' Association, 1947), unpaginated [last page]; Bryce Halliday, 'Professor Rotblat and the Atom Train', in *War and Peace: The Life and Work of Sir Joseph Rotblat*, ed. by Peter Rowlands and Vincent Attwood (Liverpool: University of Liverpool, 2006), pp. 139-44 (p. 139).
[852] Peierls, 'The British Atomic Scientists' Association', p. 59.
[853] 'Election of Officers', *ASN*, 1. 1 (11 July 1947), 2; Greta Jones, 'The Mushroom-Shaped Cloud: British Scientists' Opposition to Nuclear Weapons Policy, 1945-57', *Annals of Science*, 43. 1 (1986), 1-26 (p. 7); Mary Jo Nye, p. 161.
[854] Eric H.S. Burhop, 'The Scientist and Dangerous Thoughts', *ASN*, 2. 6 (28 April 1949), 137-40. On reactions, see Nevill F. Mott's reply 'The Scientist and Dangerous Thoughts', *ASN*, 2. 6 (28 April 1949), 171-72; M.A. Short, letter to the editor, *ASN*, 2. 6 (28 April 1949), 172-73.
[855] Peierls, *Bird of Passage*, p. 283.

bomb and wrote to the ASA's Honorary General Secretary, F.C. Champion: 'To prevent misunderstanding perhaps I should make it plain that I do not [original emphasis] wish to sign the statement concerning the Hydrogen bomb' and expressed grave concerns over a forthcoming statement by the association on 'the so-called Civil Service purge'.[856] In his function as president of the ASA, Rudolf Peierls replied to Cherwell's letter, defending the association's policy on decision-making:

> In order to avoid misunderstandings I would like to explain the constitutional position. Such statements are usually made by, or on behalf of, the Council which is an elected body. We invite Vice-Presidents who do not also happen to be members of the Council to come to our meetings and send them all the papers, but they do not have any vote if they do attend and are, therefore, not responsible for the opinions expressed in Council statements. It has been our practice in the past to publish statements if they were agreed upon by Council or if a large majority of Council were agreed; in the latter case the minority (usually the left wing) were invited to state their views as a minority opinion, but have never yet done so.[857]

But Peierls himself was 'very disturbed' by the proposed statement on the hydrogen bomb, writing to F.C. Champion: 'I appreciate, of course, the idea behind it but I take strong exception to the words "aggravates the arms race".' He feared especially its negative impact on both the ASA's public reputation and Anglo-American relations. Peierls added: 'I am certainly not prepared to sign this and I feel that this must not be allowed to come out from [*sic*] the office of the Association even if it bears only a few signatures [...] as long as it does not come out with the authority of Council.'[858] In the end, the proposed statement by the ASA on thermonuclear weapons was never released to the press as a statement sanctioned by the association's council.[859] That all decisions and statements had to be sanctioned by the council was indeed highly democratic. To illustrate this process, even an article in which the ASA introduced itself to the readers of the *Bulletin of the Atomic Scientists* had to undergo this procedure and had to be approved by the council.[860]

The ideal of political objectivity not only generated internal problems for the ASA, but it would also have a serious impact on its mission. What seemed to work in

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[856] Cherwell to Hon. General Secretary [F.C. Champion], 11 February 1950, Peierls Papers, MS Eng. Misc. b. 223, F 6.
[857] Peierls to Cherwell, 23 March 1950, Peierls Papers, MS Eng. Misc. b. 223, F 6.
[858] Peierls to Champion, 13 February 1950. See also Nabarro to Champion, 13 February 1950, Peierls Papers, MS Eng. Misc. b. 223, F 6.
[859] Champion to Peierls, 14 February 1950, Peierls Papers, MS Eng. Misc. b. 223, F 6.
[860] F.C. Champion, 'Atomic Scientists' Association. Limited by Guarantee. The British Atomic Scientists' Association', n.d.; R.E. Peierls, 'Atomic Scientists' Association. Limited by Guarantee. The British Atomic Scientists' Association', n.d.; Peierls to Simpson, 7 November 1949, Peierls Papers, MS Eng. Misc. b 223, F 6.

the immediate postwar period became soon outdated and was, as Matt Price has argued in the context of the United States, 'a fiction'.[861] The ASA had three primary objectives, as its mission statement read:

> 1. To bring before the public of this country the true facts about Atomic Energy and its implications.
> 2. To investigate and make proposals for the international control of Atomic Energy in order to help in the solution of this most pressing problem.
> 3. To help to shape the policy of this country in all matters relating to Atomic Energy.[862]

Public outreach and education represented a key concern of the newly formed association. The ASA followed the examples of the FAS and the ALAS whose activities many ASA members had directly experienced during their time at Los Alamos. The ALAS had published a weekly newsletter, the *Los Alamos Newsletter*, as well as Robert Serber's eyewitness account about the situation in Hiroshima and Nagasaki shortly after the atomic bombings.[863] While ASA members participated in public discussions on the political implications of nuclear power, Rudolf Peierls insisted the association refrain from 'offering and advocating a patent remedy'. By contrast, he argued that the ASA's 'line has been to help people to think about the issues and to examine carefully any constructive proposal that is offered'.[864]

In an article published in the journal *Endeavour* in April 1947, Rudolf Peierls warned that '[i]n public discussion of the prospects of atomic energy, the threat to the future of civilization which the atomic bomb represents tends to overshadow the promise of benefits from the constructive applications of atomic power.' He went on to emphasize that '[a]fter the first public announcements on the bomb, exaggerated claims for the possibilities of an impending "atomic age" appeared, particularly in the popular press, and the reaction to them discredited the whole subject.'[865]

Peierls's motivation to write his article has to be seen against the ambivalent public opinion towards atomic weaponry at the start of the nuclear age. As in the

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[861] Price, p. 244.
[862] The ASA's mission statement was reprinted on the back sleeve of its accompanying catalogue for the Atom Train exhibition, see Atomic Scientists' Association, *Atom Train*, unpaginated [last page]. While the ASA had initially phrased its goals slightly differently as for example in Moon and Burhop (p. 32), the three objectives cited in the main body of the text would emerge as the three predominant and recurring aims. They were, for example, printed in the imprint of the ASA's journal; see, for example, *ASN*, 3. 1 (21 July 1949); *ASN* n.s. 1. 1 (September 1951); *ASJ*, 5. 6 (July 1956).
[863] Hunner, *Inventing Los Alamos*, p. 114.
[864] Peierls, 'The British Atomic Scientists' Association', p. 59.
[865] Rudolf Peierls, 'Atomic Energy: Threat and Promise', *Endeavour*, 6 (April 1947), 51-57 (repr. in Rudolf Peierls, *Atomic Histories* (New York: Springer, 1997), pp. 198-209 (p. 198)).

United States, the news of Hiroshima produced an ambiguous response from the British public.[866] Here, British nuclear culture comprised two opposing 'energy narratives', as David E. Nye has termed them in a different context: 'the transformation narrative', which presented nuclear power highly optimistically as the source of limitless energy, while the 'apocalyptic narrative' that emerged after Hiroshima emphasized the atom's destructive potential.[867] By 1946, many Britons felt that the negative consequences of nuclear energy would outweigh its benefits in the long run. The radio broadcast of John Hersey's book *Hiroshima* (1946) served as a catalyst to reinforce these pessimistic feelings and a majority of British people believed that only strong global organizations could cope with the crisis produced by nuclear weaponry.[868] In a Gallup poll of May 1946, 46 per cent of the respondents agreed that nuclear power would do 'more harm than good' in the long run, while only 28 per cent saw a more positive outcome of atomic energy in the future and 26 per cent were undecided. And these figures did not change considerably over the next two years.[869] In 1946, Whitehall's publication of a report by a British team that had visited the cities of Hiroshima and Nagasaki in November 1945 had a further negative impact on public opinion. The booklet, which was entitled *The Effects of the Atomic Bombs at Hiroshima and Nagasaki*, informed the British public for the first time in detail about the nuclear bombings of the two cities. While its authors stated in more abstract terms in the foreword that with the coming of nuclear weapons 'bombing had changed its character and its scale beyond recognition', they literally brought the impact of atomic arms powerfully home to their British readers in the conclusion. After detailing the effect of a single Hiroshima- or Nagasaki-type atomic bomb on an average urban area in the United Kingdom by citing statistics and quoting figures, the report concluded: 'The overall picture, then, is sombre.'[870]

These ambivalent feelings towards nuclear energy pervaded the highest circles of the British government, for it has been argued that Prime Minister Attlee's

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[866] Paul S. Boyer, *Fallout: A Historian Reflects on America's Half-Century Encounter with Nuclear Weapons* (Columbus: Ohio State University Press, 1998), p. 7; Christoph Laucht, '*The Beginning or the End*? Early Cultural Fallout from the Atom Bomb', *Literatur in Wissenschaft und Unterricht*, 36. 1 (2003), 59-75 (pp. 67-72); Wittner, I, p. 81.

[867] David E. Nye, *Narratives and Spaces: Technology and the Construction of American Culture* (New York: Columbia University Press, 1997), pp. 81-83.

[868] John Hersey, *Hiroshima* (Harmondsworth: Penguin, 1946); Wittner, I, pp. 82-83.

[869] *Gallup International Public Opinion Polls*, I, 132, 183-84.

[870] *The Effects of the Atomic Bombs at Hiroshima and Nagasaki: Report of the British Mission to Japan* (London: HMSO, 1946), pp. iii, vi, 19-20.

ambiguous attitude towards pursuing a national atomic power programme and the international control of nuclear energy delayed a decision to pursue a weapons project until 1947.[871] This ambivalence towards technological innovation has to be seen as part of a longer tradition, which dated back to the end of the nineteenth century when Britons ambivalently regarded technological revolution as having both constructive and destructive applications.[872]

As a consequence, Peierls set out in his article to present a more balanced picture of nuclear energy. Peierls dedicated only a short section to the atom bomb which he described as 'the only important practical application' of the young nuclear age and whose 'comparative cheapness' he identified as its 'essential new feature'. The 'comparative cheapness' of atomic weapons, especially in the long run in comparison to large conventional militaries, represented indeed one of the major reasons why the United Kingdom took the decision to pursue its own nuclear weapons project before the Marshall Plan and the North Atlantic Treaty Organization (NATO) revealed a stronger American dedication to Europe.[873] This 'comparative cheapness' of atomic arms was to be a major reason behind President Dwight D. Eisenhower's policy of the New Look, which built largely on nuclear weapons rather than a large standing army.[874]

Apart from unleashing an unprecedented destructive force, nuclear energy initially seemed to offer endless possibilities and solutions to many problems. This resulted in a true nuclear euphoria in parts of the population. Originating in the United States, much speculation went on about the benefits of nuclear power. Writers and journalists fantasized about a transportation revolution through atomic planes, trains, cars and ships, and medical science also appeared to be a major benefactor of the new energy source.[875] Amongst the first and most influential books to deal with these atomic hopes was *Atomic Energy in the Coming Era* by the popular science writer David Dietz.[876] It was first published in the United Kingdom in 1946 under the title *Atomic Energy Now and Tomorrow*. In the first chapter, 'The Era of Atomic

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[871] Baylis, *Ambiguity and Deterrence*, p. 55.
[872] Bernhard Rieger, '"Modern Wonders": Technological Innovation and Public Ambivalence in Britain and Germany, 1890s to 1933', *History Workshop Journal*, 55 (2003), 153-76 (p. 154).
[873] Greta Jones, p. 3.
[874] Fred Kaplan, *The Wizards of Armageddon*, new edn (Stanford: Stanford University Press, 1991), pp. 174-84.
[875] Boyer, *By the Bomb's Early Light*, pp. 109-21.
[876] David Dietz, *Atomic Energy in the Coming Era* (New York: Dodd, Mead, 1945).

Energy', Dietz speculated how nuclear energy could revolutionize life and 'turn the Era of Atomic Energy into the Age of Plenty'.[877] Sometimes, these nuclear fantasies took on a particularly British edge. In August 1949, the *Daily Mirror*, ran an article on the 'Atom Queen', a nuclear-powered version of the famous cruise liner *Queen Elizabeth* which would revolutionize transatlantic travel.[878] The theme of nuclear energy also entered the realm of sports when a horse named Atom raced at the famous Newmarket Racecourse in Suffolk shortly after the war.[879]

While Rudolf Peierls intended to present a less dramatized picture of the wider applications of atomic power, in particular the peaceful ones, it was also against this euphoria and these fantasies that he set out with his article in *Endeavour*. He thus aimed at giving a more realistic picture of the peaceful uses of nuclear power. Some of Peierls's thoughts were truly visionary and ahead of their time. He mentioned, for example, the use of nuclear devices for landscape engineering.[880] This principle would later also be suggested and in a few cases seriously pursued in the AEC's Project Plowshare in the United States.[881] At the same time, he delivered a blow to predictions like David Dietz's one of the nuclear age as an 'Age of Plenty', when he concluded that 'we can hardly expect a revolutionary change in the price of electricity'.[882] As late as 1954, AEC chairman Lewis Strauss still predicted that nuclear power would generate 'electrical energy too cheap to meter' for future generations.[883] Peierls went on to point out that the supply of nuclear fuel was uncertain before destroying some atomic fantasies like nuclear-powered cars or rockets with arguments based on scientific facts. By contrast, he suggested many possible (and much more realistic) applications in the medical field. At the end of his essay, Peierls concluded that '[i]t may well be that the really important applications will not be thought of until the world has got more used to the new possibilities.'[884]

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[877] David Dietz, *Atomic Energy Now and in the Future* (London: Westhouse, 1946), pp. 14-15.
[878] Ronald Bedford, 'The Atom Queen Will Sail Without Fuel', *Daily Mirror*, 16 August 1949, p. 2.
[879] 'Newmarket Race Card', *Daily Mirror*, 16 July 1946, p. 7.
[880] Peierls, 'Atomic Energy: Threat and Promise', pp. 199-200.
[881] On Project Plowshare, see Scott Kirsch, *Proving Grounds: Project Plowshare and the Unrealized Dream of Nuclear Earthmoving* (New Brunswick: Rutgers University Press, 2005); Dan O'Neill, *The Firecracker Boys* (New York: St. Martin's Press, 1994); Ferenc M. Szasz, 'New Mexico's Forgotten Nuclear Tests: Projects Gnome (1961) and Gasbuggy (1967)', *New Mexico Historical Review*, 73. 4 (1998), 347-70.
[882] Peierls, 'Atomic Energy: Threat and Promise', p. 203.
[883] Cited in Weart, p. 166.
[884] Peierls, 'Atomic Energy: Threat and Promise', pp. 204-09.

It was in this idealist spirit that Rudolf Peierls and the ASA stepped up as the major forum in the United Kingdom to educate members of the general public about the perils and benefits of atomic power in what they claimed was a politically objective way. As informed citizens, they believed, these laymen would consequently form their own opinions about the subject. Here, the ASA offered a third way, an alternative to public information campaigns launched by the churches, the British Council of Churches and the Anglican Church, and Whitehall. In the preface to Philip B. Moon's and Eric H. S. Burhop's booklet *Atomic Survey: A Short Guide to the Scientific and Political Problems of Atomic Energy*, which the ASA published in 1946, Rudolf Peierls underlined the organization's commitment to 'provide the non-expert reader with a basis on which to think out his attitude to the problem' of nuclear energy.[885]

Other groups and institutions took approaches to the issue of nuclear weaponry which differed considerably from the ASA. Along with pacifists, members of the clergy had been the first and foremost critics of nuclear weapons after the news of Hiroshima had reached Britain.[886] Unlike American churchmen, the British clergy acted almost unanimously.[887] While the ASA spoke with the voice of scientific experts who had been involved in the creation of the new weapons and could thus use their 'insider' knowledge to inform the public about the full prospects of nuclear energy as they presented themselves at the dawn of the atomic age, the British Council of Churches intended to assume the role of a guardian of ethics and morality. In 1946, it published the report *The Era of Atomic Power*.[888] The report was the result of the work of a commission, the first ecumenical one of its kind, which had been appointed by the British Council of Churches.[889] It opened by comparing the development of nuclear weapons to the harnessing of fire. In line with the general public opinion at the time, the commission ambiguously referred to the coming of the atomic age 'as one of the great turning points in history, with illimitable potentialities for good or evil'. Although the authors of the report claimed

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[885] Rudolf E. Peierls, 'Preface', in *Atomic Survey*, unpaginated.
[886] Wittner, II, 80.
[887] Kirk Willis, '"God and the Atom": British Churchmen and the Challenge of Nuclear Power 1945-1950', *Albion*, 29. 3 (1997), 422-57 (p. 424).
[888] British Council of Churches, *The Era of Atomic Power: Report of a Commission Appointed by the British Council of Churches* (London: S.C.M. Press, 1946). Two years later, the Anglican Church published its own report: Church of England, *The Church and the Atom: A Study of the Moral and Theological Aspects of Peace and War* ([n.p]: Church Assembly, 1948).
[889] Willis, '"God and the Atom", pp. 445-47.

that it was their aim 'to understand what is implied in the challenge of this event to mankind and what answer it demands', *The Era of Atomic Power* failed to provide answers. As a result, the church lost credibility as a chief guardian of morality.[890] An article in *Nature* reviewed the booklet with the criticism that it 'has little to say on practical policy, but seeks to determine the principles on which policy should be based'.[891] At the beginning of the atomic age, the ASA thus had a decisive programmatic advantage over the British Council of Churches because it never intended to offer any 'patent remedy', as Peierls put it.

Alongside the British Council of Churches, the British government also tried to educate its citizens about the new era of nuclear power. Shortly after the atomic bombings of Hiroshima and Nagasaki, the British and United States governments both published their versions of the story of the making of the atomic bomb. The Truman administration put forth a detailed account in the form of Henry DeWolf Smyth's *Atomic Energy for Military Purposes*, the so-called Smyth Report, which started to propagate the myth of an almost solely American-made atom bomb only weeks after the bombings of Hiroshima and Nagasaki. Although Whitehall launched the publication of a report on its contributions to the Manhattan Project entitled *Statements Relating to the Atomic Bomb*, the forty-page booklet was unable to compete with its American counterpart and thus failed to provide a corrective to the Americanized version.[892] Not surprisingly, Sir James Chadwick was 'most disappointed with the British statement' as he wrote to Sir Edward Appleton, the wartime secretary of the Department of Scientific and Industrial Research (DSIR) in early September 1945, because the booklet 'failed, almost completely, to emphasize the value of the British contribution'.[893] By contrast, the 'Smyth Report', which was published by Princeton University Press, sold over 100,000 copies within its first year of publication.[894] To illustrate the wide circulation of this book, it is important to mention that only 10,000 copies of Moon's and Burhop's *Atomic Survey* were printed.[895]

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[890] British Council of Churches, p. 7.
[891] 'International Control of Atomic Energy (II)', *Nature*, 157. 4000 (29 June 1946), 853-55 (p. 853).
[892] H.M. Treasury.
[893] Chadwick to Appleton, 5 September 1945, CHAD IV/3/13.
[894] Szasz, *British Scientists*, pp. xiii-xiv.
[895] N.F. Mott, 'The President's Report on the Year', *ASN*, 1.1 (11 July 1947), 1.

Following the example of the American scientists movement, the ASA started to publish a monthly journal in July 1947 as a major form of outreach.[896] Compared to the American *Bulletin of the Atomic Scientists*, the *Atomic Scientists' News* was, as Rudolf Peierls rightly observed, '[i]n size, scope, and circulation [...] very modest'.[897] Like its American counterpart, which occasionally featured articles from the *Atomic Scientists' News*,[898] the ASA's journal quite frequently included essays that had previously appeared in the *Bulletin of the Atomic Scientists*.[899] In September 1951, the ASA started with a new series of the *Atomic Scientists' News* which was published bi-monthly by Taylor & Francis.[900] In an attempt to reach a wider readership, the *Atomic Scientists' News. New Series* was renamed the *Atomic Scientists' Journal* in September 1953.[901] With its July 1956 issue, the *Atomic Scientists' Journal* was cancelled because, as it stated in its final editorial, 'the Association's aims were not now being fully met by a publication which, by its very nature, could never reach a wide public'.[902] That the ASA's journal had failed to attract a larger audience was partly the result of the concept of political objectivity which Rudolf Peierls had ardently advocated and which the ASA had closely followed. Although the association was now left without its own published organ, the ASA co-operated with the editors of the newly launched weekly magazine the *New Scientist* and prepared a monthly 'Atomic Science' section as well as a news review section. Rudolf Peierls was amongst the contributors to the first 'Atomic Science' section in the *New Scientist*'s 3 January 1957 issue.[903] Paradoxically, the ASA continued to follow the ideal of political objectivity that had led to the cancellation of its own journal, as its then president, Harrie Massey, emphasized in the first 'Atomic

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[896] Ibid.
[897] Peierls, 'The British Atomic Scientists' Association', p. 59.
[898] See, for example, 'The International Control of Atomic Energy: Statement by the Council of the Atomic Scientists' Association, July, 1948', *ASN*, 2. 1 (15 July 1948), 13-14, was reprinted under the title 'British Atomic Scientists' Proposals for International Control of Atomic Energy', *BAS*, 3. 2 (February 1947), 42-43, 49; William Penney, 'The Montebello Explosion', *ASN*, n.s. 2. 3 (January 1953), 151-54, was reprinted under the same title in the *BAS*, 8. 9 (December 1952), 295-96; Peierls's article 'Bathwater and the Baby' was reprinted as guest editorial under the title 'Basic Science and the Cold War', *BAS*, 9. 3 (April 1953), 66-67.
[899] See, for example, Joseph O. Hirschfelder, 'The Effects of Atomic Weapons', *BAS*, 6. 8-9 (August-September 1950), 236-40, 285-86, was reprinted under the same title in the *ASN*, 4. 2 (November 1950), 36-42; Leo Szilard, 'Calling for a Crusade...', *BAS*, 3. 4-5 (April-May 1947), 102-06, 125, was published under the same title in the *ASN*, 1. 1 (11 July 1947), 6-7.
[900] 'Editorial', *ASN*, n.s. 1. 1 (September 1951), 1.
[901] 'Editorial', *ASJ*, 3. 1 (September 1953), 1-3.
[902] 'Editorial: The Final Volume', *ASJ*, 5. 6 (July 1956), 355.
[903] R.E. Peierls, 'A New Way to Fuse Atoms', *New Scientist*, 3 January 1957, pp. 36-37.

Science' section, writing: 'As before, every effort will be made to present all sides of a controversial issue while at the same time being particularly careful that scientific facts should be distinguished from opinion.'[904]

While the ASA adhered to the outdated concept of the politically neutral scientist as late as 1957, the association was aware that successful public outreach could only be achieved if their statements were understandable for the interested non-expert. Here, the *New Scientist* seemed to provide a promising medium because the new periodical was, as its editors declared in its first issue, 'published for all those men and women who are interested in scientific discovery and in its industrial, commercial and social consequences'. They emphasized that articles were to be published 'in language as free as possible from technicalities' and that '[l]eading scientists will contribute articles explaining their work to the layman.'[905] With its focus on 'the layman' as the target audience, both the editors of the *New Scientist* and the ASA followed a general understanding in the 1940s and 1950s that regarded the public on the whole as 'informed laymen'.[906] By 1950, the ASA had already realized that the recruitment of associate members was a pivotal factor in the scientists reaching out to ' the interested layman'.[907] They now followed suit with their new publication format.

Besides a continuous publication, the ASA planned and realized what was perhaps its most spectacular outreach event – a travelling exhibition under the title the Atom Train. While the government's *Statements Relating to the Atomic Bomb* had not received the desired effect, government organs collaborated with the ASA in bringing the exhibition home to people all across the United Kingdom. Rudolf Peierls played a chief role in organizing the Atom Train exhibition. He served on a special committee which the ASA's Council had appointed for this purpose. Besides Peierls, it included F.C. Champion, William G. Marley, Philip B. Moon as well as John Curry, Michael Moore and Joseph Rotblat from the University of Liverpool's

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[904] H.S.W. Massey, 'The Section's Purpose', *New Scientist*, 3 January 1957, p. 31.
[905] 'This Is Our Policy', *New Scientist*, 22 November 1956, p. 5.
[906] Sophie Forgan, 'Atoms in Wonderland', *History and Technology*, 19. 3 (2003), 177-96 (p. 178). On the concept of the 'non-specialist public', see Stefan Collini, *English Pasts: Essays in History and Culture* (Oxford: Oxford University Press, 1999), pp. 305-25. On how experts imagine the layperson, see Alessandro Maranta and others, 'The Reality of Experts and the Imagined Lay Person', *Acta Sociologica*, 46. 2 (2003), 150-65. On scientists and the lay public, see Claire McInerney, Nora Bird and Mary Nucci, 'The Flow of Scientific Knowledge from Lab to the Lay Public: The Case of Genetically Modified Food', *Science Communication*, 26. 1 (2004), 44-74.
[907] 'Editorial', *ASN*, 4. 1 (August 1950), 1-2 (p. 1).

Physics Department where the exhibition was put together.[908] The association worked in co-operation with the Ministry of Supply's Atomic Energy Department and its Directorate of Information as well as the AERE Harwell.[909] Sir James Chadwick opened it officially in Liverpool's Central Station in early November 1947.[910] With 146,000 visitors and travelling the United Kingdom for 168 days, the Atom Train was a huge success for ASA. The accompanying exhibition catalogue sold 46,000 copies and supplied an ample financial stock for the young organization.[911] The Atom Train later even toured Scandinavia and visited Paris and participated in a conference organized by the UN Educational, Scientific and Cultural Organization in Beirut, Lebanon.[912] Given the severe shortages and rationing of goods shortly after the war, the Atom Train was comparatively well equipped.[913]

While the ASA initially faced some difficulty in mobilizing sponsors and partners for the travelling exhibition, Rudolf Peierls suggested early on that the ASA actively seek support from and closely work with the British government in planning and carrying out the exhibition.[914] Bryce Halliday, who was in charge of running all the equipment on board the Atom Train, recalled how enthusiastic Peierls was about the exhibition when he visited together with Joseph Rotblat the Edge Hill train station in Liverpool where its final assembly took place, writing: 'Joe [Rotblat] and the Prof. were talking very animatedly and loudly, Joe in his strong Polish accent and the Prof[.] very Germanic. The Prof[.] finally left and Joe and I set off to return to the Lab when he turned to me and said "The trouble with these foreigners is they are so excitable!!!"'[915]

In some locations where the Atom Train called, Atomic Energy Weeks were held simultaneously during its stopover. These were in many places organized by the

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[908] 'Opening of the Atomic Energy Exhibition', *ASN*, 1. 5 (21 November 1947), 66-67; Joseph Rotblat, 'The Atomic Energy Exhibition Is Coming', *ASN*, 1. 3 (17 September 1947), 31-34 (p. 32). The Atom Train's importance for the ASA translated into considerable coverage in the *ASN*, see, for example, 'The Atomic Energy Exhibition', *ASN*, 1. 6 (19 December 1947), 80-81; 'Atomic Energy Exhibition', *ASN*, 1. 7 (30 January 1948), 104-05; 'The Atom Train', *ASN*, 1. 8 (6 March 1948), 109-10.

[909] Atomic Scientists' Association, *Atom Train*, unpaginated acknowledgement section.

[910] 'Opening of the Atomic Energy Exhibition', *ASN*, 1. 5 (21 November 1947), 66-67.

[911] Joseph Rotblat, 'The Atom Train: A Successful Experiment', *ASN*, 2. 1 (15 July 1948), 4-8 (p. 5); Peierls, 'The British Atomic Scientists' Association', p. 59.

[912] Rotblat, 'The Atom Train', pp. 4-5; Joseph Rotblat, 'The Atomic Energy Exhibition in Beirut', *ASN*, 2. 5 (9 March 1949), 120-25.

[913] Forgan, p. 177.

[914] Peierls to Massey, 14 May 1946, Peierls Papers, MS Eng. Misc. b. 223, F 4.

[915] Halliday, p. 141.

local UN Association chapter. At these events, films such as the Gaumont-British Instructional's animated short film *Atomic Physics* (1947) enjoyed great popularity.[916] Moreover, these 'Atom Weeks' featured meetings, an ASA press release advertised them as events, 'to discuss what the ordinary citizen can do to ensure that atomic power is used for our benefit and not for our destruction'.[917] Nearby universities usually provided students as tour guides. Rudolf Peierls delivered public lectures among the likes of other senior scientists like Sir James Chadwick, Marcus Oliphant or Sir John Cockcroft.[918]

Following the ideal of political impartiality and a similar educational purpose as outlined in detail by Rudolf Peierls in his 1947 *Endeavour* article, the organizers informed visitors in the introduction to the brochure, which accompanied the Atom Train exhibition, stating that: 'The Atom Train Exhibition has been brought to your town to help you understand the facts about atomic energy. Everyone knows that this new power can be used for destruction; much less is known as yet of its possibilities for good.' They stressed: 'One can get a balanced view only by understanding a little of what is behind it,' and thus underlined the ASA's role as an objective educator.[919]

Despite these idealistic claims, many of the panels featured in the exhibition were clearly intended to provoke a strong audience response and consequently were by no means completely free of any political statement. The first picture, entitled 'Atomic Energy for Good or Evil', showed a human hand and a skeleton hand which both point their index finger from opposite sides at an idealized atom at the centre.[920] Since such sharp contrasts were a recurring theme in the exhibition, this panel set the tone for the exhibition. Another window that bore the title 'The Choice' depicted two conflicting images: one showed a lone child sitting in front of bombed-out ruins, whereas the other depicted two unharmed children who did not appear to show any signs of fear of the future.[921] In this regard, the section dealing with the atomic bomb was even more problematic. Here, the organizers relied on the use of fear by displaying a map of Central London that showed the effects of a Hiroshima-type

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[916] Rotblat, 'The Atom Train', p. 7; Joseph Rotblat, 'The Atomic Energy Exhibition Is Coming', *ASN*, 1. 3 (17 September 1947), 31-34 (pp. 33-34).
[917] 'Atom Train', n.d., Peierls Papers, MS Eng. Misc. b. 223, F 5.
[918] June Clayton, 'A Noble Man of Science, A Nobel Man of Peace: Professor Sir Joseph Rotblat, FRS, Nobel Peace Prize Laureate 1995' (unpublished master's thesis, University of Liverpool, 2003), p. 78.
[919] Atomic Scientists' Association, *Atom Train*, unpaginated introduction.
[920] Ibid, unpaginated.
[921] Clayton, p. 76.

nuclear attack on the City. In the accompanying text, the ASA gave a detailed account of the damage inflicted upon Hiroshima. In conclusion, the organizers emphasized that 'there is no defence against them [nuclear weapons]'.[922] To bring the peril of the effects of nuclear war further home, the exhibition also contained a map of the town where the train was currently calling that specified the effects of such an attack on the local area.[923] This strategy has remained popular on both sides of the Atlantic into the twenty-first century.[924]

With the presentation of these facts to sharpen public awareness of the perils of nuclear warfare, the ASA made a clearly political statement. The association borrowed this technique in particular from the American scientists' movement. Early on, as has been shown in the previous subchapter, members of the British Mission to Los Alamos, including Peierls and several other future ASA members, had used fear in their 'Memorandum from British Scientists at Los Alamos, New Mexico'.[925] Like the FAS, the ASA's campaign to educate the public in nuclear matters had a catalytic effect on public opinion, especially the intensification of the fear of nuclear war that many Britons shared at the time.[926] Some ASA members welcomed these partial statements. In a review of the Church of England's booklet *The Church and the Atom*, Gwyn Owain Jones made the criticism that '[t]he relevance and sincerity of the Report compare unfavourably with that of the message presented in, say, the "Atom Train" exhibition.' [927] That even ASA members were aware of and agreed with such more or less political statements, which contravened Rudolf Peierls's concept of the politically neutral scientist, revealed how impracticable this ideal was from the beginning. 54 per cent of the respondents to a Gallup poll of August 1950 replied affirmatively that they believed nuclear weapons would be used against

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[922] Atomic Scientists' Association, *Atom Train*, pp. 18-22.
[923] Halliday, p. 142.
[924] See, for example, Lynn Eden, 'City on Fire', *BAS*, 60. 1 (January/February 2004), pp. 32-37, 40-43. In the British context see, for example, Frank Barnaby, 'Nuclear Terrorism: Today's Nuclear Threat', in *The British Nuclear Weapons Programme 1952-2002* (see Cross, above), pp. 122-130; Owen Green and others, *London After the Bomb: What a Nuclear Attack Really Means* (Oxford: Oxford University Press, 1982).
[925] 'The Atomic Bomb and Our Cities: From the Report of US Strategic Bombing Survey', *BAS*, 2. 3-4 (August 1946), 29-30; 'The City of Washington and an Atomic Attack', *BAS*, 6. 1 (January 1950), 29-30; Ralph E. Lapp, 'Atomic Bomb Explosions – Effects on an American City', *BAS*, 4. 2 (February 1948), 39-43, 48; 'Memorandum from British Scientists at the Los Alamos Laboratory, New Mexico', p. 1.
[926] Paul S. Boyer's findings also apply to the British context; *By the Bomb's Early Light* pp. 67-68.
[927] Gwyn Owain Jones, 'Review of *The Church and the Atom*', *ASN*, 1. 11 (4 June 1948), 184-85 (p. 185).

civilians in a future world war. The same percentage agreed that there was no 'real protection from the atom bomb'.[928]

Besides creating a heightened public awareness, the ideal of scientific impartiality in political matters also governed the ASA's third main objective – the international control of nuclear energy. Shortly after the war, Rudolf Peierls and many of his colleagues started to advocate this idea 'to help in the solution of this most pressing problem', as the ASA declared in its mission statement.[929] The organization devoted considerable time and energy to discussing this issue.[930] How significant the idea of international control was deemed at the time was, for example, revealed in an article in *Nature* in June 1946 which concluded in a bleak tone on the current state of affairs: 'Until the individual nations are prepared to renounce national sovereignty to that limited extent, atomic energy will continue to represent the great menace of our age, and its potentialities for good will remain an unsubstantial shadow.'[931]

First thoughts had been given to the concept of international control of nuclear power during the final stages of the Manhattan Project. In their 'Memorandum from British Scientists at the Los Alamos Laboratory, New Mexico', Rudolf Peierls and other members of the British Mission to Los Alamos – many of whom later joined the ASA – had already spoken in favour of the idea of international control of atomic power in the autumn of 1945.[932] In a memorandum to Sir John Anderson, which built on the Los Alamos memorandum, Rudolf Peierls had made further recommendations, especially on the imposition of a system of inspection, as early as November 1945. 'I may add that the important point seems to me', Peierls wrote, 'to envisage an inspection system based not necessarily on a 100% inspection of every inch of territory, or every ounce of raw material, but one

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[928] *Gallup International Public Opinion Polls*, I, 224.
[929] Atomic Scientists' Association, *Atom Train*, back sleeve.
[930] Peierls, *Bird of Passage*, p. 283. It received, for example, considerable coverage in the first issue of the *ASN*, see Cuthbert Daniel and Arthur M. Squires, 'The International Control of Safe Atomic Energy', *ASN*, 1. 1 (11 July 1947), 9-10; 'Mr. Gromyko's Speech at the U.N.A.E.C. Meeting of June 11th', *ASN*, 1. 1 (11 July 1947), 3-5. See also '"The Effects of the Atomic Bomb on National Security"', *ASN*, 1. 2 (22 August 1947), 17-18; N.F. Mott, 'International Control of Atomic Energy: The Choice Before This Country', *ASN*, 1. 3 (17 September 1947), 25-31 (p. 31).
[931] 'International Control of Atomic Energy (I)', p. 820.
[932] 'Memorandum from British Scientists at the Los Alamos Laboratory, New Mexico', pp. 2-3.

based on intelligence methods looking for significant clues and following them up.'[933]

Shortly after its formation, the ASA had adopted a line on the international control of atomic energy that closely followed the American Lilienthal-Acheson Plan and later the Baruch Plan as it was presented before the UN.[934] Originally, the US Secretary of War, Henry Stimson, and Undersecretary of State Dean Acheson had proposed a plan under which all future nuclear arms were to be placed under international control. In early 1946, Acheson was appointed as head of a committee in charge of drafting a plan on the international control of atomic energy to be presented before the AEC by Secretary of State James F. Byrnes. This led to the so-called Acheson-Lilienthal Report which promoted the international control of nuclear power across a broad range of areas from atom bombs to uranium ore. Subsequently, President Harry S. Truman appointed Bernard M. Baruch to present the proposals to the United Nations Atomic Energy Commission's first session on 14 June 1946. Baruch amended the plan substantially so that it allowed the United States to continue its nuclear arms research and granted the Truman administration the right to veto the plan if it had not been properly implemented. For the Soviet Union, Andrei Gromyko delivered the official reply to Baruch's proposals, insisting that all nations, including the United States, should ratify a moratorium on the development and use of nuclear arms before any accord on the issue of the international control of atomic power could be reached. Unsurprisingly, the Soviet Union vetoed the 'Baruch Plan' in the UN Security Council.[935]

Prime Minister Clement Attlee also took an ambivalent stance: while his government officially backed American plans during 1946 and 1947, Whitehall was, at the same time, deeply concerned about the implications these proposals would have on Britain, especially civil applications of nuclear power. Although the international control of atomic energy had initially seemed to provide solutions to many problems created by the atomic bomb, growing distrust of the Soviet Union

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[933] Peierls, untitled memorandum, 14 November 1945, attached to letter, Peierls to Anderson, 14 November 1945, TNA, AB I/572, p. 1.
[934] 'International Control of Atomic Energy (I)', p. 817.
[935] For the text of the 'Baruch Plan', see Truman to Baruch, 7 June 1946, (repr. in *The American Atom* (see Einstein to Roosevelt, above), pp. 92-97). For an assessment of the Baruch and Gromyko Plans see Paul S. Boyer, *By the Bomb's Early Light*, pp. 53-57; James Chace, 'After Hiroshima: Sharing the Atom Bomb', *Foreign Affairs*, 75. 1 (1996), 129-144; Holloway, pp. 161-165; 'Mr. Gromyko's Speech at the U.N.A.E.C. Meeting of June 11th', *ASN*, 1. 1 (11 July 1947), 3-5.

finally led Attlee to decide that Britain should pursue its own nuclear weapons research project.[936] In hindsight, Rudolf Peierls viewed the feasibility of the Baruch Plan very sceptically, admitting that '[t]here never was a chance of getting such a plan accepted by the Soviet Union.'[937]

At the time, however, Rudolf Peierls and the ASA were enthusiastic about the idea of instituting a system of international control. On 20 January 1947, the ASA Council released a press statement on international control that was reprinted in the *Bulletin of the Atomic Scientists*.[938] Following its democratic decision-making process, various drafts of the document were circulated amongst members of the council before its publication.[939] In spite of the failure to reach an agreement on the terms under which an international control scheme could be implemented in the United States Security Council, the ASA was still optimistic about the idea in February 1947, declaring that 'efforts must be continued to find a workable scheme acceptable to all countries'. Although it officially still followed its impartial approach to politics, the ASA openly argued, as the 'most important objection to the Baruch Plan from the point of view of other nations', that 'technically Congress could withhold ratification at any rate'. Following similar proposals as those made by Rudolf Peierls to Sir John Anderson in November 1945, the ASA recommended inspection as a key feature to achieve a working system of international control.[940]

In its conclusion, the statement acknowledged the fact that 'an effective system of control acceptable to all concerned is a very doubtful proposition in the present state of distrust between nations, since it must contain, at least in embryonic form, a measure of world government'.[941] The idea of a One World government in charge of all nuclear matters – military and civilian – had already been promoted by the ALAS.[942] The engine behind the promotion of this principle remained in the United States where many scientists, including Albert Einstein, saw the concept of a world government as an adequate answer to the vast problems caused by atomic

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[936] John Baylis, *Ambiguity and Deterrence*, pp. 37-45.
[937] Peierls, *Bird of Passage*, p. 282.
[938] 'Atomic Energy Control', *The Times*, 21 January 1947, p. 4; 'British Atomic Scientists' Proposals for International Control of Atomic Energy', *BAS*, 3. 2 (February 1947), 42-43, 49.
[939] 'A.S.A. Council Meeting: Draft statement on International Control', n. d., attached to letter, Peierls to Chadwick, 20 September 1946; 'Atomic Scientists' Association: Statement on International Control', n.d., CHAD I 19/6.
[940] 'British Atomic Scientists' Proposals for International Control of Atomic Energy', pp. 42-43, 49.
[941] Ibid., p. 49.
[942] Hunner, *Inventing Los Alamos*, p. 113.

weaponry in the immediate postwar period.[943] The idea of a world government was also popular with the British public: in a Gallup poll conducted in September 1946, 50 per cent of the respondents stated that the United Kingdom should follow suit if other leading countries placed their conventional and atomic forces under the command of a world parliament.[944] While the ASA intended to stay away from any partial judgments, the FAS even contributed a statement to Dexter Master's and Katharine Way's edited collection of essays *One World or None: A Report to the Public on the Full Meaning of the Atomic Bomb*, a key text in galvanizing nuclear fears in order to promote the world government idea.[945] Philip Morrison's chapter represented perhaps one of the most dramatic usages of fear by the early scientists' movement. Morrison, who had worked at Los Alamos and visited Hiroshima shortly after V-J day, drew a sombre picture of the dawning nuclear age by blending his experience gained at Hiroshima with fictional elements. After detailing a hypothetical nuclear attack on New York City, Morrison concluded: 'New York City had thus suffered under one bomb, and the story is unreal in only one way: The bombs will never again, as in Japan, come in ones or twos. They will come in hundreds, even in thousands.' He then ended his essay by giving a bleak outlook at the future in the atomic age, warning: 'If the bomb gets out of hand, if we do not learn to live together so that science will be our help and not our hurt, there is only one sure future. The cities of men on earth will perish.'[946]

Where the FAS, Philip Morrison and German-speaking scientists like Hans Bethe, Albert Einstein, Leo Szilard and Eugene P. Wigner publicly sided with the One World movement in a publication that relied heavily on the evocation of angst, [947] Rudolf Peierls sympathized with the more abstract and less polemic proposals by Niels Bohr, who had put forward a 'Memorandum on the Open World' shortly after

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[943] Boyer, *By the Bomb's Early Light*, pp. 33-45.
[944] *Gallup International Public Opinion Polls*, I, 139.
[945] Federation of American (Atomic) Scientists, 'Survival Is at Stake', in *One World or None* (see Oppenheimer, 'The New Weapons', above), pp. 78-79. The collection was published in Britain in 1947 by the London-based publisher Latimer House.
[946] Philip Morrison, 'If the Bomb Gets Out of Hand', in *One World Or None* (see Oppenheimer, 'The New Weapon', above), pp. 1-6 (p. 6).
[947] Albert Einstein, 'The Way Out' (pp. 76-77); Frederick Seitz and Hans Bethe, 'How Close Is the Danger?' (pp. 42-46); Leo Szilard, 'Can We Avert an Arms by an Inspection System?' (pp. 61-65); Eugene P. Wigner, 'Roots of the Atomic Age' (pp. 11-15).

the war.[948] Once again, Peierls acted ambivalently when his name was among the signatories of a statement that was published in *The Times* and that called on the Prime Minister and the Foreign Secretary to advocate the international control of atomic energy and weapons in March 1947.[949] The same year, Peierls shared his thoughts on international control with the readers of the *Bulletin of the Atomic Scientists* on the occasion of the second anniversary of the bombing of Hiroshima. He argued that British scientists showed a similar degree of awareness of the necessity to achieve a regime of international control of nuclear energy as American scientists. '[T]hey tend to visualize atomic warfare from the receiving end,' Peierls observed, 'both because of the practical experience of ordinary bombing and because of the geographical factors which make this country so vulnerable to atomic attack.' Rudolf Peierls went on to stress Britain's role as an intermediary between the superpowers, accentuating that 'this function, however, can hardly be assisted by public action and propaganda – it is essentially a question of diplomacy'.[950]

With the chances of reaching significant progress in the area of the international control of atomic power becoming slimmer, the ASA Council issued a new statement in July 1948. It acknowledged the fact that the ASA's second objective had basically failed by the summer of 1948 because 'the sources of disagreement between the major powers are so deep that the institution and working of a control scheme would be much more difficult than at first supposed'. While the ASA Council declared that it still believed in 'some form of International Control of Atomic Energy as the most desirable ultimate solution of the problem of atomic weapons', the authors stressed that 'it does not, however, consider that any good purpose will be served by pressing for it now'. In a broad and general way, the Council recommended measures 'to maintain and improve contacts between the scientists of countries in the East of Europe and those of Western Europe and America'.[951] That the ASA was lobbying for an increasingly unpopular cause was, for example, revealed in a Gallup poll of October 1948 where only 3 per cent of the

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[948] Peierls, Interview by Weiner, p. 152. Although Bohr provided the foreword to *One World or None*, he refrained from generating public fear as did many of the contributors; Boyer, *By the Bomb's Early Light*, p. 71.

[949] 'Banning of Atomic Weapons: Request for International Authority', *The Times*, 8 March 1947, p. 4.

[950] 'Statements on the Second Anniversary of Hiroshima', *BAS*, 3. 9 (September 1947), 235-236, 252 (p. 236).

[951] 'The International Control of Atomic Energy: Statement by the Council of the Atomic Scientists', pp. 13-14.

respondents specified the control of atomic arms as 'the most urgent international problem at the present time' after British-Soviet relations (25 per cent), preserving peace (24 per cent), the Berlin question (22 per cent), miscellaneous issues (14 per cent) and undecided interviewees (12 per cent).[952]

In spite of these figures, the ASA continued to pay considerable attention to the issue of international control of atomic energy. With the coming age of thermonuclear weapons, the ASA and the FAS held a joint meeting in Oxford on 14 and 15 September 1950 where this matter was at the top of the agenda.[953] Besides Rudolf Peierls, participants in the two-day meeting included from the ASA J. I. Michiels, Kathleen Lonsdale, Nevill Mott and Herbert Skinner and from the FAS its chairman William Higinbotham, A. Roberts, Samuel Allison, D.L. Hill, Carson Mark, George Placzek and M. Shapiro as well as Lew Kowarski of the French Atomic Energy Commission.[954] Over time though, the ASA adapted its line on this issue to the changed realties of the progressing age of the H-bomb. Since international control of nuclear energy could not be achieved and an ever-increasing number of countries worldwide sought to acquire atomic power for either military or civilian purposes or both, the problem of instituting a global control scheme had been replaced by the problem of nuclear proliferation. As a consequence, Rudolf Peierls, together with L.F. Bates, Norman Feather, Gwyn Owain Jones, Kathleen Lonsdale, Philip Moon, Maurice Pryce, Joseph Rotblat and George Thomson, called attention to this new danger in a letter to the editor of the *The Times* in November 1957.[955]

While both the education of the public in nuclear matters and the proposals for international control had often conflicted with Peierls's and the ASA's ideal of political objectivity, the association's third objective, '[t]o help to shape the policy of this country in all matters relating to Atomic Energy' proved even more problematic.[956] As a consequence, Peierls and other ASA members became

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[952] *Gallup International Public Opinion Polls*, I, 185.
[953] 'Conference with the Federation of American Scientists', *ASN*, 4. 3 (January 1951), 51-55.
[954] William A. Higinbotham, 'Scientists Discuss War and Peace', *BAS*, 6. 11 (November 1950), 350; Peierls to the Chairman of the Federation of American Scientists [Higinbotham], n.d., Peierls Papers, MS Eng. Misc. b. 223, F 7.
[955] L.F. Bates and others, 'Safeguards on Nuclear Production', *The Times*, 29 November 1957, p. 11.
[956] ASA's mission statement was reprinted on the back sleeve of its accompanying catalogue for the Atom Train exhibition, Atomic Scientists' Association, *Atom Train: Guide to the Travelling Exhibition on Atomic Energy* (London: Atomic Scientists' Association, 1947), unpaginated [last page].

inevitably involved in British politics. In November 1945, Peierls assured Sir John Anderson in a letter, writing:

> I hope you will feel sure that at any rate all British scientists in this country are aware of the difficulties that confront the statesmen in this situation, and desire nothing more than to assist them in this task by making available to them all technical information they possess, all conclusions they feel they have to draw from these facts, or from their experience of the day-to-day working of international collaboration in this field.[957]

Although Peierls underlined once again his idealistic intention that he and his colleagues would 'desire nothing more than to assist' politicians in reaching informed decisions, he became (perhaps unconsciously) more deeply involved in politics.

From December 1945, Rudolf Peierls became officially involved in advising the British government on nuclear energy matters. On 20 August 1945, the Prime Minister formed an 'Advisory Committee on Atomic Energy' to determine the feasibility of both military and civilian applications of nuclear power in the United Kingdom and to explore possible ways to achieve the international control of atomic energy in close coordination with Stimson and Acheson. Chaired by Sir John Anderson, members of the 'Advisory Committee on Atomic Energy' included Sir Edward Appleton, Patrick Blackett, Sir Henry Dale, Sir James Chadwick as well as Sir George Thomson.[958] Rudolf Peierls – along with Blackett, Sir John Cockcroft, Sir Charles Galton Darwin, Norman Feather, Maurice H. L. Pryce and Thomson – served on its technical 'Subcommittee on Nuclear Physics', which was set up in December 1945 under the chairmanship of Sir James Chadwick.[959]

In a letter to Harrie Massey of 14 May 1946 regarding the Atom Train exhibition, Rudolf Peierls suggested early on 'to make contact with some people on a high level in government circles and convince them that the activities of the Association [of Atomic Scientists] are going to be constructive and that our aims are the same as the those of the Government' in order to secure support for the project and not to jeopardize its realization. In Peierls's view, Sir John Anderson, a former member of Churchill's War Cabinet and Chancellor of the Exchequer who now chaired the Advisory Committee on Atomic Energy, Lord Portal, who had served as the Ministry of Supply's Controller of Production of Atomic Energy since January

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[957] Peierls to Anderson, 14 November 1945, TNA, AB I/572.
[958] 'Advisory Committee on Atomic Energy: Composition and Terms of Refernce. Note by the Secretary of the Cabinet', 20 August 1945, CHAD I 15/6.
[959] Mary Jo Nye, p. 86.

1946, and the Minister of Supply were crucial contacts in this endeavour. Peierls suggested that he could use his personal contacts with Sir John Anderson to make the ASA's agenda known to key players in the government.[960]

In late May 1946, Peierls consequently wrote to Sir John. In his letter, Peierls once again defined the ASA's role as an impartial educator of the public in nuclear-energy-related matters. 'At the same time', Peierls tried to diffuse any fear on the part of Anderson that the ASA would work against the government, saying, 'we realize our obligations not to infringe the limitations about disclosure to which we have to adhere and, in general, not to make irresponsible statements that would embarrass the Government.' Attached to his letter, Peierls also sent Anderson the text of a memorandum on international control which the ASA was about to submit to the United Nations Atomic Energy Commission and asked him for a personal meeting.[961] Anderson replied immediately and agreed to meet Peierls.[962]

Initially, Rudolf Peierls intended to co-operate with the government in order not 'to embarrass' Whitehall, as he wrote to Sir John Anderson. He made a similar point in the letter to Harrie Massie regarding the Atom Train exhibition. Peierls, however, did not always support government action. In a letter to the editor of the *The Times*, Peierls and F.C. Champion openly criticized Whitehall's information policy regarding nuclear energy in January 1950, writing on behalf of the ASA:

> A document of the type of a White Paper issued every few years is not an adequate means of keeping the public informed both of what has been achieved in this country and of the plans and possibilities for the future development of atomic energy.[963]

With his argument that there was no working defence against nuclear weapons, which he had first made in the 'Frisch-Peierls Memorandum', Peierls also undermined official British government policy with regard to civil defence.[964] On behalf of the ASA, Rudolf Peierls reiterated this point in an article in *Nature* in 1946, warning that '[a]ny attempt to blind ourselves to the seriousness of the dangers is liable to diminish the sense of urgency that alone will ensure a determined and

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[960] Peierls to Massey, 14 May 1946, Peierls Papers, MS Eng. Misc. b. 223, F 4.
[961] Peierls to Anderson, 29 May 1946, Peierls Papers, MS Eng. Misc. b. 223, F 4.
[962] Anderson to Peierls, 30 May 1946, Peierls Papers, MS Eng. Misc. b. 223, F 4.
[963] Rudolf E. Peierls and F.C. Champion, 'Information on Atomic Energy', *The Times*, 23 January 1950, p. 5.
[964] Frisch and Peierls, 'Memorandum on the properties of a radioactive "super-bomb"', p. 1.

sustained attack on the problem.'[965] Other leading atomic scientists such as Sir James Chadwick shared this view.[966] Before the Soviets detonated their first nuclear bomb, the ASA adopted this stance and published a report on the effects of atomic arms and civil defence in the 21 July 1949 issue of the *Atomic Scientists' News*. In spite of its usual avoidance of giving qualitative comments, the authors underlined in the introduction the defencelessness against atomic weaponry, writing: 'To avoid misunderstandings it should be said from the outset that even the best civil defence organization will be unable to afford complete protection or even to reduce the order of magnitude of the disaster.' They added that 'it would be quite wrong to expect a state in which the prospect of atomic attack on this country could be faced with equanimity.'[967]

By contrast, the government played down the effects of nuclear war in its first official civil defence pamphlet on atomic warfare. The *Civil Defence Manual of Basic Training, Vol. II: Atomic Warfare* was based on the data gathered at Hiroshima and Nagasaki.[968] A review of the handbook in the *Atomic Scientists' News* criticized 'that it has not included enough general information on the "large-scale" picture of a city after an atomic bomb attack, and that consequently it fails to give a sufficient indication of the magnitude of the task facing the Civil Defence forces'.[969] The government booklet revealed that perceptions of nuclear war were still deeply rooted in the experience of World War II. Even after the so-called Strath Report, a secret document that assessed the damage of a hypothetical thermonuclear attack on the United Kingdom, confirmed that civil defence had become nothing more than wishful thinking in the thermonuclear age, Whitehall continued to promote it.[970] As late as October 1957, the Civil Defence Corps was presented as the fourth Crown Service besides the Army, the Royal Navy and the Royal Air Force to suggest an air

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[965] Rudolf Peierls, 'Defence Against the Atomic Bomb', *Nature*, 158. 4011 (14 September 1946), 379. This article was a critique of D. G. Christopherson's article 'Defence Against the Atomic Bomb', *Nature*, 158. 4005 (3 August 1946), 151-53, which argued that the effects of nuclear arms were overestimated.

[966] Chapman Pincher, 'The Atomic Bomb: A Statement by the Man Who Is Back Here to Brief the Premier', *Daily Express*, 8 November 1945, University Press Cuttings, 5 November 1941 – 31 December 1947, SJL, S. 2523, fol. 154[r].

[967] 'Atomic Weapons and Civil Defence', *ASN*, 3. 1 (21 July 1949), 10-16 (p. 10).

[968] Home Office Civil Defence Department, *Civil Defence Manual of Basic Training. Vol. II: Atomic Warfare* (London: HMSO, 1950), p. 5.

[969] D.F. Bracher, rev. of *Civil Defence Manual of Basic Training. Volume II: Atomic Warfare* by Home Office Civil Defence Department (London: HMSO, 1950), *ASN*, 4. 2 (November 1950), 42-46 (p. 46).

[970] Jeff Hughes, 'The Strath Report: Britain Confronts the H-Bomb, 1954-1955', *History and Technology*, 19. 3 (2003), 257-75 (p. 263). See also Hennessy, *Secret State*, pp. 135-46.

of preparedness and to create the illusion that the effects of (thermo)nuclear war could be contained just like those of a conventional war.[971] Peierls had clearly been ahead of his time. In the face of thermonuclear weapons, Dee Garrison has recently compared the concept of civil defence to a 'classic tragicomedy' because it 'contains within itself all the dominant themes of dark comedy – the bestial components of humankind, the absurdity of the world, and the ubiquitous negation that is death'.[972]

Peierls's Concept of the Unpolitical Scientist: A Critical Assessment

That Peierls's concept of political objectivity was ambiguous and varied occasionally was also revealed in his comments on a memorandum to be published by the Atomic Energy Study Group. Starting in the summer of 1946, he participated in several meetings of the group under the chairmanship of Sir Henry Dale at the Royal Institute of Foreign Affairs. These gatherings led to the 1948 publication of the book *Atomic Energy: Its International Implications. A Discussion by a Chatham Study Group*, to which Rudolf Peierls contributed the first part of a chapter describing 'The Scientific and Technical Backgrounds' of nuclear power.[973] When the Atomic Energy Study Group decided to publish a further article in the periodical *International Affairs*, shortly after the launch of the book, to react to the changed political situation, in particular with regard to realistic chances of implementing a system of international control of nuclear energy fading, its members – in the style of the ASA – engaged in a discussion of draft versions of the proposed essay. Air Chief Marshal Sir Roderic Hill prepared the first draft with Sir Arthur Salter's assistance.[974] Its text was tainted by strong anti-Communist rhetoric.[975] Rudolf Peierls disagreed with this political colouring and called once again for objectivity because 'one may doubt whether a statement on the wider issues is within the terms

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[971] 'Four Straightforward, Simple facts about Civil Defence Today', *Daily Mirror*, 10 October 1957, p. 16. The advertisement was, for example, also published in the 10 October 1957 issue of *The Times* under the same title (p. 7).
[972] Garrison, p. 14.
[973] 'Atomic Energy Study Group: The Atomic Problem', 20 March 1948, Peierls Papers, MS Eng. Misc. b. 223, F 5, p. 1; Rudolf Peierls, 'The Scientific and Technical Backgrounds: I. The Scientific Background', in *Atomic Energy: Its International Implications. A Discussion by a Chatham Study Group*, ed. by Royal Institute of International Affairs (London: Royal Institute of International Affairs, 1948), pp. 29-36. The second part ('The Practical Realization of the Release of Atomic Energy and of Atomic Weapons', pp. 36-41) was authored by Marcus Oliphant.
[974] H. E. Wimperis, 'Atomic Energy Study Group: The Atomic Problem', 23 March 1948, Peierls Papers, MS Eng. Misc. b. 223, F 5.
[975] 'Atomic Energy Study Group: The Atomic Problem', 20 March 1948, Peierls Papers, MS Eng. Misc. b. 223, F 5, pp. 1, 3-4.

of reference of the Study Group'. Since 'any rational discussion of policy must also take account of the other side, and I would be unhappy if a Study Group, whose aim is a rational and impartial discussion of the problems, would fail in this,' he argued, the group should also consider Soviet concerns. Peierls thus called for moderation in adopting a policy towards the Soviet Union, arguing '[i]f the reasoning is accepted, the right policy must steer a delicate course between two extremes; in the words of the shaving cream advertisement, "not too little, not too much, but just right".'[976]

While Peierls's comments suggest his insistence on the ideology of objective science and the article was eventually published in the journal *International Affairs* with substantial revisions and devoid of any politicized statements, he made a further, highly ambivalent remark during his discussion of the draft.[977] 'As a scientific member of the Study Group,' he wrote, 'I feel I ought to present my comments in two parts, the first referring to problems that have a relation to technical points, the rest to political problems on which my right to express opinions is no different from that of any other citizen.'[978] This statement suggests that Rudolf Peierls believed in a separation of his political mindedness: a professional sphere which was governed by the ideal of political objectivity and a private sphere where he, as citizen of a democratic country, was allowed to make political statements. Here, Peierls acted like Werner Heisenberg, who had been a chief contributor to the German nuclear weapons project during the Second World War. Heisenberg, whose concept of objectivity evolved considerably over time, became involved in politics in the FRG after the war. Cathryn Carson has shown that 'over his career he found himself weakening the notion of the scientist's objectivity in sometimes self-conscious ways' and 'ended up with a liberal pluralism of perspectives held together by increasingly tenuous forms of discursive coherence'.[979]

Like Heisenberg's, Peierls's concept of political objectivity was highly complex and informed by several factors. Besides two chief aspects which Peierls shared with Heisenberg, namely his socialization in the German intellectual milieu

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[976] 'Atomic Energy Study Group: The Atomic Problem. Comments on the memorandum AE/171 (dated 20 March 1948) by Professor Peierls', 3 April 1948, Peierls Papers, MS Eng. Misc. b. 223, F 5, pp. 2-3.
[977] H. E. Wimperis, 'Atomic Energy Control: The Present Position', *International Affairs*, 24. 4 (October 1948), 515-23.
[978] 'Atomic Energy Study Group: The Atomic Problem. Comments on the memorandum AE/171 (dated 20 March 1948) by Professor Peierls', p. 1.
[979] Cathryn Carson, 'Objectivity and the Scientist: Heisenberg Rethinks', *Science in Context*, 16. 1-2 (2003), 243-69 (p. 244).

and his acknowledgement of universal scientific principles, Peierls was also exposed to British scientific cultures. Like many of his colleagues around the world, he was a strong proponent of the ideology of apolitical science. Although it is presented as being objective, this concept is in fact highly subjective. Since the norms which form the underlying basis of this ideology depend both on their particular context and the consensus of a specific group of scientists, in Peierls's case, in particular, with respect to the ASA, they cannot be objective as Peierls and other scientists have often claimed. As a result of this subjectivity of their respective scientific norms, scientists who follow this ideology act ambiguously. Claiming that science is objective and unprejudiced, they define any conduct or statement which is in line with the established norms and as such based on consensus, in this case the ASA Council, as apolitical. By contrast, they classify any behaviour that violates these norms and has not been reached by consensus as political.[980] This ideology partly explains, for example, why Peierls made what he thought were unpolitical statements but which outsiders often perceived as political statements when he actively campaigned for the freedom of science, as has been shown in chapter three.

But this ideology has a further consequence that links the area of politics with that of morality: a scientist like Peierls, who follows the ASA's rules, regulations and argumentation, for example, on the division of pure and applied science, can claim that he is apolitical, regardless of the practical applications of his work. Peierls addressed this distinction in an article entitled 'Bathwater and the Baby: Some Thoughts about the Cold War' in the *Atomic Scientists' News* in September 1951.[981] Although Peierls was 'not wildly enthusiastic about it',[982] his article received wide circulation and was featured under the more graphic title 'Basic Science and the Cold War' as guest editorial in the *Bulletin of the Atomic Scientists* in April 1954.[983] In his article, Peierls warned that hysteria amongst scientists about an imminent war could translate into 'turning over whole laboratories or their senior staff from academic work to [...] war research' and thus harm basic research significantly. Such short-sighted decisions, Peierls feared, would imperil 'the long-term interests of science'

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[980] For a concise overview of the ideology of apolitical science, see Mark Walker, 'Legenden um die deutsche Atombombe', *Vierteljahrshefte für Zeitgeschichte*, 38. 1 (1990), 45-74 (p. 54).
[981] Peierls, 'Bathwater and the Baby', pp. 10-13.
[982] Peierls to Allan, 12 August 1951, Peierls Papers, MS Eng. Misc. b. 223, F7.
[983] Rudolf Peierls, 'Basic Science and the Cold War', *BAS*, 9. 3 (April 1953), 66-67.

and 'endanger the future development by neglecting the training of younger people'.[984]

Many Manhattan Project scientists, who often apologetically referred to the making of the atomic bomb retrospectively as an engineering task, used the division between pure and applied research – at least in part – to cope with their involvement in the Manhattan Project.[985] In 1946, J. Robert Oppenheimer wrote that 'knowledge is a good in itself'.[986] Still, Oppenheimer, like other Los Alamos scientists such as Hans Bethe, Richard Feynman and Edward Teller, was aware that pure knowledge could find both peaceful and destructive applications.[987] 'At present the research in nuclear physics in the universities,' wrote Rudolf Peierls, 'is similarly directed to a better understanding of the basic laws of physics, and is part of our search for the truth about nature.' He added: 'It is most unlikely that any particular part of this work will in the near future find any practical application.' While this statement can certainly be read as an attempt by Peierls to come to terms with his past involvement in atomic-weapons-related work, it is important to remember that he ceased working on nuclear weapons after the war and called on his colleagues' 'duty to science' not to jeopardize the future of independent pure research and thus the advance of theoretical physics in the long run.[988]

At the same time, however, Peierls admitted in his 1951 article 'Bathwater and the Baby' that it was often a difficult task 'to define the exact boundary between pure science and its practical application', especially 'where science has application to warfare, the best-known (though not the only) example being atomic energy'.[989] In a statement issued in 1947, the ASA had already expressed this view, declaring: 'We do not believe that it is necessary to class research on atomic explosives as a dangerous activity; the danger does not come from research as such, but from the application of the results.'[990] Shortly after Peierls's article had appeared in the *Atomic Scientists' News*, Albert Einstein formulated these thoughts as a question, asking readers of the *Bulletin of the Atomic Scientists*,

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[984] Peierls, 'Bathwater and the Baby', p. 13.
[985] Schweber, *In the Shadow of the Bomb*, pp. 16-17.
[986] J. Robert Oppenheimer, 'Atomic Weapons', *PAPS*, 90. 1 (1946), 7-10 (p. 7).
[987] Schweber, *In the Shadow of the Bomb*, p. 19.
[988] Peierls, 'Bathwater and the Baby', pp. 12-13.
[989] Ibid., p. 11.
[990] 'British Atomic Scientists' Proposals for International Control of Atomic Energy', *BAS*, 3. 2 (February 1947), 42-43, 49 (p. 43).

> should we consider the search for truth – or, more modestly expressed, our efforts to understand the knowable universe through constructive logical thought – as an autonomous objective of our work? Or should our search for truth be subordinated to some other objective, for example to a "practical" one?[991]

Accordingly, Einstein clearly saw the peril of scientists becoming tools of government policies and, using their knowledge for their respective government's sake. The German-born rocket pioneer Wernher von Braun represents perhaps the most notorious example of what Michael J. Neufeld has called 'technocratic amorality' because of 'his single-minded obsession with his technical dreams' which differentiated von Braun from thousands of other Nazi 'fellow travelers'.[992]

Besides Peierls's statements on the division of pure and applied knowledge, his comments on the morality of nuclear weapons were especially – although perhaps most often subconsciously – political. In response to a Conservative MP's proposition made in Parliament that supported President Truman's threat to use nuclear weapons in the Korean War, Peierls wrote a letter to the editor of the *The Times* on behalf of the ASA, arguing the atomic bomb 'was most unsuitable as a "police weapon" to enforce order in local disputes'.[993] Since Peierls followed one of the ASA's main lines of argumentation which had declared in 1946 that it 'does not commit itself to regarding the atomic bomb as a desirable or suitable weapon for police functions', his statement was, from the association's subjective point of view, unpolitical.[994] What frightened Peierls in particular about nuclear weaponry was the ease with which it could be used and the disproportionality of its use in a conventional war because, as he drew a comparison in 1950, 'after all, the police in this country still go unarmed in the face of risks because of the feeling that if they carry weapons they might use them under stress where violence would not be necessary, and that this would be immoral'.[995] Although Peierls's comments on the

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[991] Albert Einstein, 'On the Moral Obligation of the Scientist', *BAS*, 8. 2 (February 1952), 34-35 (p. 34).

[992] Michael J. Neufeld, 'Wernher von Braun, the SS, and Concentration Camp Labor: Questions of Moral, Political, and Criminal Responsibility', *German Studies Review*, 25. 1 (2001), 57-78 (p. 73). These issues are also further explored in Rainer Eisfeld, *Mondsüchtig: Wernher von Braun und die Geburt der Raumfahrt aus dem Geist der Barbarei* (Reinbek: Rowohlt, 1996).

[993] Rudolf E. Peierls, 'Atom Bombs on Korea', *The Times*, 13 July 1950, p. 7. Peierls later reiterated this point, see, for example, L.F. Bates and others, 'Safeguards on Nuclear Production', *The Times*, 29 November 1957, p. 11.

[994] 'International Control of Atomic Energy (I)', p. 819.

[995] Rudolf E. Peierls, 'The Moral Question', *ASN*, 4. 1 (August 1950), 3. The issue also featured Peierls's letter to the editor of the *The Times*; Peierls, 'Atom Bombs on Korea', p. 7; and his article 'The Morality of Atomic Warfare', *ASJ*, 4. 1 (September 1954), 17-20 (p. 19).

potential use of atomic weaponry in Korea can certainly be read as a statement (partially) against nuclear deterrence, they are, at the same time, early manifestations of his condemnation of NATO's doctrine of limited nuclear war in the early 1980s which relied on the use of tactical nuclear arms in Europe in a future war if a conventional offensive by Warsaw Pact troops could not be stopped. Peierls condemned this use of atomic arms in a limited nuclear war because it would undermine the role of the atom bomb as a deterrent that made it impossible for either belligerent party to win a war.[996]

While Peierls clearly condemned any use of atomic arms as 'police weapons' alongside conventional warfare in regional conflicts like the Korean War as 'immoral', he firmly believed in the atom bomb's potential as a deterrent on the global scale. He and Otto Frisch had come up with the concept of nuclear deterrence in their seminal memorandum in early 1940, as discussed in chapter two. In an article published in the journal *Endeavour* in 1947, Peierls envisioned the atom bomb's future role as a deterrent because 'the destructive nature of atomic weapons may itself be of ultimate benefit if it helps to bring home to everyone the lesson that the use of military force for aggression does not pay'.[997] In 1949, Peierls made the point that global war was in his view unlikely, stating: 'The more we believe in the imminence of war, the more we shall be concerned with the effect of our policy on the course of the war and its outcome.' He added: 'If we believe war is unavoidable, we must only think of minimizing the loss it will bring us, even at the risk of thereby precipitating it at an earlier date.'[998] And Peierls remained a proponent of nuclear deterrence well into the thermonuclear age when he argued in 1954, for example, that 'on the whole, the likely effect [of nuclear weapons] is to reduce the danger of war', in particular in the era of the H-bomb.[999] In some ways, it appears ironic that Peierls's belief in nuclear deterrence has simultaneously become what Hugh Gusterson termed 'the "central axiom" of laboratory life'. According to this maxim, scientists create atomic arms to preserve peace in a world governed by a nuclear

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[996] Rudolf Peierls, 'Limited Nuclear War?', *Bulletin of the Atomic Scientists*, 38. 5 (May 1982), 2; Rudolf Peierls, 'Counting Weapons', *London Review of Books*, 5 March 1981, 16-18.
[997] Peierls, 'Atomic Energy: Threat and Promise', pp. 198-99.
[998] Rudolf Peierls, 'Some Notes on the International Situation', *ASN*, 2. 5 (9 March 1949), 105-11 (p. 105). Peierls reiterated this point, for example, in his essay 'Bathwater and the Baby' (p. 10).
[999] Peierls, 'The Morality of Atomic Warfare', p. 20. Peierls later emphasized the importance of nuclear deterrence in his review of Herman Kahn's book *On Thermonuclear War* (Princeton: Princeton University Press, 1960); 'Agonising Misappraisal', *Spectator*, 28 April 1961, pp. 592-93.

stalemate between the superpowers.[1000] Peierls, however, approached this from the other end and called on his colleagues' 'duty to science' to pursue pure research.

Besides these universal factors, Peierls's schooling in Germany played a role in the formation of his (a)political awareness. The writer Thomas Mann popularized this view of the 'unpolitical German' in his polemical treatise *Betrachtungen eines Unpolitischen* (*Reflections of an Unpolitical Man*) in 1918.[1001] Born into a middle-class *Bildungsbürgertum* milieu in the period of the German Empire, Rudolf Peierls received his higher education during the subsequent era of the Weimar Republic. It thus seems very likely that Peierls, like many Germans of his generation, often unconsciously made political statements while they were in the belief that they were acting unpolitically.[1002] Furthermore, Peierls was sceptical of a strong political influence in science as his rejection of the AScW's role as both a trade union and impartial informer of the public, for example, indicated. While scientists worldwide commonly followed an anti-political ideology to protect their own interests such as authority, standing, reputation and rank of members of their respective scientific community from any political interference, this principle underwent a significant modification in Weimar Germany. The middle and upper classes who usually provided the scientific staff and scholars at the time and who in many cases were still rooted politically in the monarchical and anti-democratic ideology of the former *Kaiserreich* utilized this more universal ideology for their nationalistic purposes. Out of an aversion against the democratic Weimar constitution, they believed, as Paul Forman has shown, that '[t]he bureaucratic authoritarianism of the old regime, basing policy not on "politics" but on objective, impartial judgments, served the true

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[1000] Gusterson, *Nuclear Rites*, p. 56.

[1001] Thomas Mann, *Betrachtungen eines Unpolitischen*, 3re edn (Frankfurt a.M.: Fischer, 2001). Gordon A. Craig explores this mindset in his a series of case studies of German writers in *Politics of the Unpolitical: German Writers and the Problem of Power, 1770-1871* (Oxford: Oxford University Press, 1995).

[1002] One of the first studies to analyse this were Ralf Dahrendorf, *Gesellschaft und Demokratie in Deutschland* (Munich: Piper, 1965) and Fritz Stern, *The Failure of Illiberalism: Essays on the Political Culture of Modern Germany* (New York: Knopf, 1972), especially pp. xi-xliv, 3-25. For a critical review of these works, see Konrad H. Jarausch, 'Illiberalism and Beyond: German History in Search of a Paradigm', *Journal of Modern History*, 55. 2 (1983), 268-84. For more recent research in this area, see Tomas Jaehn, 'The Unpolitical German in New Mexico, 1848-1914', *New Mexico Historical Review*, 71. 1 (1996), 1-24; Jan Palmowski, 'The Politics of the "Unpolitical German": Liberalism in German Local Government, 1860-1880', *Historical Journal*, 42. 3 (1999), 675-704.

interests of the nation, while every policy of the parliamentary-democratic Weimar regime was *ipso facto* "political", unobjective.'[1003]

Although Rudolf Peierls had first-hand experience of this German ideology and seemed to be sceptical of government influence in science, he held a deep belief in the democratic values and institutions of the United Kingdom and the United States. This was reflected in the structure of the decision-making process in the ASA Council, which he had decisively influenced and advocated. Arguably, his exposure to British political and scientific cultures had resulted in Peierls's partial Anglicization. Here, a comparison between Rudolf Peierls and the postwar political involvement of those scientists such as Werner Heisenberg and Carl Friedrich von Weizsäcker, who had stayed inside Germany during the war and occupied leading positions in the German nuclear weapons project during the war, is instructive.

After the war, these two scientists were among the most outspoken critics of nuclear weaponry in the FRG. Heisenberg and von Weizsäcker acted more politically than scientists had been permitted to during the interwar years and commented on numerous issues on the political agenda such as the hotly debated nuclear armament of the newly founded West German army, the *Bundeswehr*.[1004] Because of their opposition to the proposals by the West German chancellor Konrad Adenauer and the minister of defence, Franz Josef Strauß, who called for a nuclear-armed *Bundeswehr*, their names appeared among those of the so-called 'Göttingen 18', the signatories of the famous '*Erklärung der 18 Atomwissenschaftler*' ('Declaration of 18 Atomic Scientists', commonly known as the 'Göttingen Manifesto') in 1957.[1005] Max Born, who had re-emigrated to the FRG in 1954, also signed this manifesto and frequently warned the public about the dangers of nuclear weapons.[1006] Arne Schirrmacher has appropriately referred to the West German physicists' political

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[1003] Paul Forman, 'Scientific Internationalism and the Weimar Physicists: The Ideology and Its Manipulation in Germany after World War I', *Isis*, 64. 2 (1973), 150-80 (pp. 170-71).
[1004] Cathryn Carson, 'New Models for Science in Politics: Heisenberg in West Germany', *HSPS*, 30. 1 (1999), 115-71; David Clay Large, *Germans to the Front: West German Rearmament in the Adenauer Era* (Chapel Hill: University of North Carolina Press, 1996), pp. 218-219, 224-225; Metzler, pp. 220-21; Carl Friedrich von Weizsäcker, 'Should Germany Have Atomic Arms?', *BAS*, 13. 8 (October 1957), 283-91; Carl Friedrich von Weizsäcker, 'Do We Want to Save Ourselves?', *BAS*, 14. 5 (May 1958), 180-84.
[1005] 'Declaration of the German Nuclear Physicists', *BAS*, 13. 6 (June 1957), 228. On the 'Göttingen manifesto', see also Richard H. Beyler, 'The Demon of Technology, Mass Society, and Atomic Physics in West Germany, 1945-1957, *History and Technology*, 19. 3 (2003), 227-39 (pp. 232-37).
[1006] Max Born, 'Man and the Atom', *BAS*, 13. 6 (June 1957), 186-94.

activism as '*politisches Grenzgängertum*', as scientists' engagement with politics.[1007] While a biographical sketch in the *New Scientist* on Otto Hahn, who had signed the Göttingen declaration, referred to him as '"[o]ne of those anglicised Berliners"' because he had spent considerable time in the United Kingdom, Rudolf Peierls, himself a native of the former German capital, had indeed evolved into much more of an 'anglicised Berliner' and still refrained from such political statements.[1008]

In their political mindedness, scientists such as Werner Heisenberg and Carl Friedrich von Weizsäcker intended to pick up (and at times even reinforce) a German academic tradition, which had existed since the late nineteenth century.[1009] With the exception of the Weimar Republic and the immediate postwar years before the foundation of the two German states, scientists had traditionally viewed support for the government as apolitical and opposition to it as political.[1010] In Germany, physicists had regarded themselves traditionally as both the country's scientific and cultural elite.[1011] Physics, as a form of education (*Bildung*), was intrinsically linked with culture.[1012] Fritz Ringer termed this group of German academics 'mandarins' who represented 'a social and cultural elite which owes its status primarily to educational qualities'. These omnipotent 'mandarin intellectuals' were found across all disciplines ranging from chemistry and physics to the humanities and the social sciences.[1013]

But what partly motivated Heisenberg's and von Weizsäcker's open engagement in politics was their past involvement with the German atomic bomb project. The two scientists thus invented and promoted what Mark Walker has termed the 'apologetic thesis' to rid them of any guilt for their collaboration with the National Socialist regime. According to this notion, German scientists around Heisenberg claimed they had kept the atom bomb out of Hitler's hands for moral

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[1007] Arne Schirrmacher, 'Physik und Politik in der frühen Bundesrepublik Deutschland: Max Born, Werner Heisenberg und Pascual Jordan als politische Grenzgänger', *Ber. Wissenschaftsgesch.*, 30. 1 (2007), 13-31 (pp. 15-19).

[1008] 'Profile: Otto Hahn', *New Scientist*, 20 June 1957, pp. 26-27 (p. 27).

[1009] Metzler, pp. 196-98.

[1010] Mark Walker, 'Legenden um die deutsche Atombombe', pp. 54-55.

[1011] Lothar Burchhardt, 'Naturwissenschaftliche Universitätslehrer im Kaiserreich', in *Deutsche Hochschullehrer als Elite 1815-1945*, ed. by Klaus Schwabe (Boppard: Boldt, 1988), pp. 151-214.

[1012] On the link between education and culture in Germany, see Georg Bollenbeck, *Bildung und Kultur: Glanz und Elend eines deutschen Deutungsmusters* (Frankfurt a.M.: Insel, 1994). For a concise overview of the German concept of *Bildung*, see Fritz Ringer, '*Bildung*: The Social and Ideological Context of the German Historical Tradition', *History of European Ideas*, 10. 2 (1989), 193-202.

[1013] Fritz K. Ringer, *The Decline of the German Mandarins: The German Academic Community, 1890-1933* (Cambridge, MA: Harvard University Press, 1969), pp. 5-6.

reasons.[1014] Robert Jungk and later Thomas Powers popularized the legend of Werner Heisenberg.[1015] By contrast, former proponents of the so-called *Deutsche Physik* became scapegoats to focus criticism of German physicists' work during National Socialist times onto these few scientists.[1016]

Rudolf Peierls, by contrast, never assumed the role of a 'mandarin', but had become partly Anglicized in his view of science and politics. His constant calling on scientists and the ASA assuming the position as suppliers of information was how many of his British colleagues defined their role. It was thus a major marker of his Anglicization and differentiated him from West German scientists such as Heisenberg and von Weizsäcker who acted as political and moral observers.[1017] In spite of the inevitable involvement with politics, especially in the realm of science advising, Rudolf Peierls and the ASA were less political than science advisors, especially in the United States.[1018] Here, other German-speaking émigré scientists, who had played important roles in the development of the atom bomb, such as Hans Bethe, Albert Einstein, Leo Szilard and Victor Weisskopf, for example, made public statements against the development of atomic arms, especially hydrogen bombs.[1019]

[1014] Mark Walker, *Nazi Science*, pp. 243-68. Here, the so-called Farm-Hall Protocols were of great significance, too; Mark Walker, 'Selbstreflexion deutscher Atomphysiker: Die Farm Hall-Protokolle und die Entstehung neuer Legenden um die "deutsche Atombombe"', *Vierteljahrshefte für Zeitgeschichte*, 41. 4 (1993), 519-42.

[1015] Robert Jungk, *Brighter than a Thousand Suns: A Personal History of the Atomic Scientists*, transl. from the German by James Cleugh (New York: Harcourt Brace, 1958); Thomas Powers, *Heisenberg's War: The Secret History of the German Bomb* (New York: Knopf, 1993). For critical reviews of these two books and Heisenberg's wartime work, see, Hans A. Bethe, rev. of *Brighter than a Thousand Suns* by Robert Jungk, *BAS*, 14. 10 (December 1958), 426-428; Nevill Mott and Rudolf Peierls, 'Werner Heisenberg: 5 December 1901 – 1 February 1976', *BMFRS*, 23 (November 1977), 212-57 (pp. 231-36); Rudolf Peierls, 'Atomic Germans', *New York Review of Books*, 1 July 1971, pp. 23-24; Rudolf Peierls, 'The Bomb That Never Was', *New York Review of Books*, 22 April 1993, 6-9; Mark Walker, *Nazi Science*, pp. 199, 243-68.

[1016] Michael Eckert, 'Die Deutsche Physikalische Gesellschaft und die "Deutsche Physik"', in *Physiker zwischen Autonomie und Anpassung: Die Deutsche Physikalische Gesellschaft im Dritten Reich*, ed. by Dieter Hoffmann and Mark Walker (Weinheim: Wiley-VCH, 2007), pp. 139-72; Mark Walker, 'The Nazification and Denazification of Physics', in *Hochschule und Nationalsozialismus: Referate beim Workshop zur Geschichte der Carolo-Wilhelmina am 5. und 6. Juli 1993*, ed. by Walter Kertz (Braunschweig: Universitätsbibliothek der TH Braunschweig, 1994), pp. 79-89 (pp. 86-87).

[1017] Holger Nehring, 'Cold War, Apocalypse and Peaceful Atoms: Interpretations of Nuclear Energy in the British and West German Anti-Nuclear Weapons Movements, 1955-1964', *Historical Social Research*, 29. 3 (2004), 150-70 (p. 161).

[1018] On the role of science advising see, for example, Benjamin P. Greene, *Eisenhower, Science Advice, and the Nuclear Test-Ban Debate, 1945-1963* (Stanford: Stanford University Press, 2007); Gregg Herken, *Cardinal Choices: Presidential Science Advising From the Atomic Bomb to SDI*, rev. and expanded edn (Stanford: Stanford University Press, 2000); Kaplan; *The Presidency and Science Advising*, ed. by Kenneth W. Thompson (Lanham: University Press of America, 1986); Herbert F. York, *The Advisors: Oppenheimer, Teller & the Superbomb* (San Francisco: Freeman, 1976).

[1019] See, for example, Hans Bethe, 'The Hydrogen Bomb', *BAS*, 6. 4 (April 1950), 99-104, 125; Albert Einstein, 'Arms Can Bring No Security', *BAS*, 6. 3 (March 1950), 71; Frederick Seitz and Hans A.

At the other end of the spectrum, Edward Teller became almost over-motivated in his determination to develop the hydrogen bomb when he issued his call 'Back to the Laboratories' to fellow scientists to commence work on the next generation of atomic arms.[1020]

Rudolf Peierls remained a supporter of the ideology of political objectivity in science until the ASA's demise and beyond. On the occasion of the second anniversary of the nuclear bombing of Hiroshima, he postulated his idea of the scientist's role in politics, writing:

> The scientists' job is [...] an unspectacular one [...]. It is necessary to make and keep public opinion alive to the importance of the problem and ready to support or criticize any scheme that in the future may reach a stage where one can realistically talk about its practical implications.[1021]

But Peierls's favoured concept was not unanimously accepted in the ASA and generated some controversy amongst its members from the beginning. As early as October 1947, Kathleen Lonsdale voiced the criticism that 'not only has the Atomic Scientists' Association not agreed views but that [...] its members have not given sufficient consideration to the serious questions at all' because of its policy of apolitical mindedness.[1022] Yet, Rudolf Peierls insisted on this principle, for example, at the association's annual conference in October 1948.[1023] Peierls reiterated his view in the context of the ASA when he published a lengthy discussion of the current international situation in the *Atomic Scientists' News* in 1949 that opened with the words:

> The policy of the A.S.A. is to make pronouncements only on matters on which Council (or perhaps on some occasions all members) are unanimous or very nearly unanimous. This may be expected to happen in questions of technical and scientific fact, but it would be surprising in questions in which we are influenced by our political outlook. On such problems the Association wants to encourage objective discussion so as to clear up the issues and help others to form their views with least prejudice.[1024]

Bethe, 'How Close Is the Danger?', in *One World or None* (see Oppenheimer, 'The New Weapon', above), pp. 42-46; Szilard, 'Calling for a Crusade...', 102-06, 125; Leo Szilard, 'Letter to Stalin', *BAS*, 3. 12 (December 1947), 347-49, 376; Victor F. Weisskopf, 'On Avoiding Nuclear Holocaust', *Technology Review*, (October 1980), 28-35; Victor F. Weisskopf, 'Science for Its Own Sake', *Scientific Monthly*, 78. 3 (March 1954), 133-35.

[1020] Edward Teller, 'Back to the Laboratories', *BAS*, 6. 3 (March 1950), 71-72.

[1021] 'Statements on the Second Anniversary of Hiroshima', *BAS*, 3. 9 (September 1947), 235-36, 252 (p. 252).

[1022] Kathleen Lonsdale, 'Use of Atomic Energy: The Choice Before Scientists', *ASN*, 1. 4 (17 October 1947), 47-49 (p. 47).

[1023] 'Atomic Energy and Society', *ASN*, 2. 4 (7 January 1949), 70-97 (p. 70); 'Atomic Energy and Society', *Nature*, 162. 4130 (25 December 1948), 1005-006 (p. 1005).

[1024] Peierls, 'Some Notes on the International Situation', p. 105. Peierls's later essay 'Bathwater and the Baby' was written in the same spirit.

In his 1949 annual presidential report, Peierls stressed: 'As in the past the contribution that scientists, and in particular scientists in this country, may make is an extremely modest one. Our job is to help in a dispassionate discussion of the issues, in particular, of their technical aspects.'[1025] That Peierls and the ASA still refrained from commenting on political questions, but intended 'to encourage objective discussion' as late as 1949 reveals a good deal of idealism on the part of Peierls and the association.

On several occasions, the purpose and future course to be taken by the association was debated in one form or another.[1026] In order to receive input by members, the ASA had also published a questionnaire in spring 1948.[1027] In July 1951, Herbert Skinner commented in the *Atomic Scientists' News* on 'The Policy of the Atomic Scientists' Association'. His article, which referred to a letter from the ASA Executive Vice-President Kathleen Londsdale and the association's Honorary General Secretary J.L. Michiels to the editor of *The Times*, showed the growing discontent within the association. It was in particular the ASA's 'policy [...] in regard to the general political question of the international control of atomic energy' that 'worried' Skinner in the statement in particular and in the organization's approach to politics in general. The letter to the editor, he complained, revealed 'woolliness of thought in its advocacy of "compromise" between conflicting international views on the international control atomic weapons, and of armaments generally' and was symptomatic of the ASA. Skinner added that neither Londsdale nor Michiels had been engaged in the development of the atomic bomb, which led him to ask the question:

> "Do such publications represent the views of genuine atomic scientists; may they not make them look foolish, and possibly even do a certain amount of harm in misleading the Russians into thinking that workers in atomic projects are not behind the policy of the government in these matters?"

He therefore criticized that 'the real Atomic Scientists' working at nuclear installations like the AERE Harwell were 'represented by [...] ex-Atomic Scientists and [...] people who have never had anything to do with this type of work'. But not only were 'genuine atomic scientists' inappropriately represented; Skinner went on

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[1025] Rudolf Peierls, 'The President's Report', *ASN*, 3. 1 (21 July 1949), 4-6 (p. 4).
[1026] 'Future of the Association', *ASN*, 2. 4 (7 January 1949), 93-97; P.F.D. Shaw, 'The Future of the Atomic Scientists' Association', *ASJ*, 3. 3 (January 1954), 149-51.
[1027] 'Editorial', *ASN*, 1. 9 (5 April 1948), 125; 'Association News: The Questionnaire', *ASN*, 1. 11 (4 June 1948), 169-70.

to 'query whether there is really any such thing as an "Atomic Scientist's" point of view in political matters' such as the international control of nuclear power. This lack of more pronounced statements, he declared, was largely the consequence of the association's diverse make-up, writing: 'All that results is a wishy-washy compromise between the diametrically opposed opinions of various members of the council.' He referred to the *Bulletin of the Atomic Scientists* as a positive example of 'how it is possible to maintain a live and interesting periodical on these matters'. In the case of the ASA, however, Skinner suggested that 'the Association should abstain altogether from political subjects' because 'its views on political matters are simply worth nothing at all'.[1028]

It appears remarkable that the ASA still followed its unpolitical course, while leading atomic scientists such as Marcus Oliphant had argued as early as 1946 that

> [t]he unprecedented rapidity of this translation of an academic discovery into the most powerful agent of military tactics has insured that the drive and interest of scientific men, particularly those engaged in the final stages of its preparation, should be turned naturally to the consideration of the ticklish technical and political problems of its control.[1029]

Apart from insiders, outsiders also viewed the ASA's apolitical approach to science as problematic. As early as July 1948, a *Nature* article called a statement by the organization on the international control of nuclear energy 'lamentably weak' and criticized that, '[i]n its anxiety to avoid taking sides [...] the Council of the Association has become vague'. 'The commendable attempt to avoid political bias', the review added, 'is carried too far when it avoids passing judgment of facts.' [1030] In a similar fashion, the *Economist* described the statement as 'commendably free from political bias' and called the ASA's argument that war was simply to be avoided in the atomic age 'platitudinous'.[1031]

In February 1950, the internal dissent over an ASA statement on the H-bomb revealed a deep rift within the organization. As its Honorary General Secretary, F.C. Champion, wrote to Rudolf Peierls, the then ASA president in connection with the debacle over reaching a common line regarding the H-bomb:

[1028] Kathleen Londsdale and J.L. Michiels, 'Atomic Energy', *The Times*, 22 November 1950, 7; Herbert W. B. Skinner, 'The Policy of the Atomic Scientists' Association', *ASN*, 4. 4 (July 1951), 78-79.
[1029] Marcus L. Oliphant, 'Control of Atomic Energy', *Nature*, 157. 3995 (25 May 1946), 679-80 (p. 679).
[1030] 'Science and Its Social Relations', *Nature*, 162. 4111 (14 August 1948), 235-37 (p. 236).
[1031] 'Dilemma of the Atomists', *Economist*, 24 July 1948, 140.

> Not unconnected with all these difficulties is the question whether our Association can continue to function. How prominent members of our Association can still be expected to have a disinterested and scientific opinion on vital issues when they are already tied to existing authority as Government consultants, official civil servants, by the Official Secrets Act etc., is a difficulty I cannot resolve. Massey and others agree that this issue of the continuance of our Association depends on whether or no we have anything to say about the H-bomb. I agree. It was easy enough for the ASA and governments to see eye to eye in the deceptively optimistic atmosphere of 1945-46 because all were apparently moving in a constructive direction. I deny that an atomic arms race is a constructive proposition and since the published aim of our Association is to help influence Government policy forward towards a constructive use of atomic energy the least duty some of us can perform to our members is to show clearly that we are aware of the discrepancy.[1032]

Unlike twelve of their American colleagues, including Hans Bethe, Victor Weisskopf, Samuel Allison and Frederick Seitz, who received considerable media coverage with their public statement demanding that the Truman administration renounce the pre-emptive use of the hydrogen bomb, ASA members failed to attract similar attention from the press on the issue of thermonuclear weapons.[1033]

The clergy, by contrast, took a much stronger stance against the H-bomb and appeared to be much more political than shortly after the end of the Second World War.[1034] The Archbishop of York demanded the H-Bomb be outlawed and the Archdeacon of London called it a decisive issue in the 1950 elections.[1035] In April 1950, the British Council of Churches supported a statement made by the Executive Committee of the World Council of Churches[1036] that called on governments to engage in peaceful co-operation, warning against the danger of future thermonuclear war:

> The hydrogen bomb is the latest and most terrible step in the crescendo of warfare which has changed war from a fight between men and nations to a mass murder of human life. Man's rebellion against his Creator has reached such a point that, unless stayed, it will bring self-destruction upon

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[1032] Champion to Peierls, 14 February 1950, Peierls Papers, MS Eng. Misc. b. 223, F 6.
[1033] 'U.S. Physicists' Plea: Renunciation of First Use of Bomb', *The Times*, 6 February 1950, p. 6.
[1034] 'Atom Weapons "Are Contrary to God": Congregationalists' Appeal', *The Times*, 19 May 1955, p. 6. On British churches and nuclear weapons, see David Omrod, 'The Churches and the Nuclear Arms Race, 1945-1985', in *Campaigns for Peace: British Peace Movements in the Twentieth Century*, ed. by Richard Taylor and Nigel Young (Manchester: Manchester University Press, 1987), pp. 189-220.
[1035] 'Hydrogen Bomb Danger: Dr. Garbett on the Alternative', *The Times*, 6 February 1950, p. 6; 'The Hydrogen Bomb: Archdeacon on Crucial Election Issue', *The Times*, 20 February 1950, p. 3. See also: 'Approach to Soviet Urged: Dr. Garbett on Peril of Hydrogen Bomb', *The Times*, 1 March 1950, p. 3; 'Hydrogen Bomb Control: Dr. Fisher on Need for Agreement', *The Times*, 24 February 1950, p. 3; 'Renunciation of the Hydrogen Bomb: Dr. Barnes on Britain's Duty', *The Times*, 28 February 1950, p. 6.
[1036] 'Control of Atomic Weapons: Government Urged to Initiate Talks', *The Times*, 21 April 1950, p. 3.

> him. All this is a perversion; it is against the moral order by which man is bound; it is sin against God.[1037]

Although the coming age of thermonuclear weapons received considerable attention from the ASA, the association failed once again to make a clear statement on the issue. In March 1950, the ASA dedicated a special issue of the *Atomic Scientists' News* to the H-bomb that had evolved out of a symposium organized by the association on the topic.[1038] The *Daily Mirror* devoted an article on the front page of its 25 March 1950 issue to the special issue of the ASA's journal, informing Britons that '[s]ome of Britain's leading atom scientists are shocked at the prospect of being asked to help develop the hydrogen bomb, said to be a thousand times more powerful than the atomic bomb.' The article specifically mentioned Rudolf Peierls's contribution to the *Atomic Scientists' News*' special issue.[1039]

In his article, Peierls commented on the issue of global security in the age of thermonuclear weapons, writing:

> The news that the United States is developing a "hydrogen bomb" came to most people as a distressing reminder of the state of the world. It is a terrifying thought that weapons so much more powerful than even the atom bomb should be regarded as technically possible. It is a bad sign for the state of the world that it should be thought necessary to invest a large effort to provide powers of mass destruction, without expecting at the same time – as in the atom bomb project – to gain new constructive powers.

Here, Peierls clearly differentiated between work on the atom bomb in which he had been involved himself during the war and which had implied the capacity 'to gain new constructive powers', on the one hand, and work on the H-bomb with its purely destructive potential, on the other.

In a very ambiguous way which emphasized the hydrogen bomb's function as a deterrent, Peierls went on to comment on the role of scientists in this progress that

> [i]t is certainly true that all those scientists whose duties lie in the academic sphere have every reason to be thankful that they have not been faced with the question whether to help develop the hydrogen bomb. It is a most unpleasant thought to be engaged in work on such a terrible weapon, and to be in part responsible for its existence. Yet there is responsibility in inaction as well as in action, and if the scientists in America or anywhere else collectively boycotted this project their responsibility might be very hard to bear if later on their country was attacked with this or a similar weapon.

[1037] 'Danger of World Suicide: Churches' Appeal for New Peace Effort', *The Times*, 25 February 1950, p. 5.
[1038] The contributions included: 'American Scientists' Statements', *ASN*, 3. 4 (March 1950), 98; Max Born, 'The Position of the Scientist', *ASN*, 3. 4 (March 1950), 93; Otto Frisch, 'The Physics of the Hydrogen Bomb', *ASN*, 3. 4 (March 1950), 78-81.
[1039] 'Scientists Jib at H-Bomb Jobs', *Daily Mirror*, 25 March 1950, p. 1.

Peierls thus warned against the simple condemnation of American scientists engaged in the hydrogen bomb project, asking: 'Are we, then, to blame our American colleagues for being optimistic about the working, in the long run, of democratic institutions?'[1040] The debate over political and moral issues involved in the development of the H-bomb was more complex and went beyond the discussions revolving around the making of the atomic bomb during the war. While Edward Teller was one of the most enthusiastic supporters of President Truman's decision that the United States should acquire thermonuclear weapons, others such as George Placzek and Victor Weisskopf opposed the H-bomb project. And, still, others like Hans Bethe flip-flopped in their positions.[1041]

Given the gravity of the debate over the hydrogen bomb, Peierls's apolitical approach appeared to be outdated and a remnant of the immediate postwar period. As he stayed away from either backing or opposing his colleagues who worked on the new weapon, he concluded his article in a similar, general manner, writing:

> I think we should suppress our indignation and consider instead what contribution we can make to the problem of making war impossible, and with it any use of the hydrogen bomb. For this, there is no magic formula, but we must continue to re-examine all possibilities and, in particular, the proposals for the control of atomic energy, in the light of the rapidly changing situation.

As a solution, Peierls proposed a scheme of mutual inspections.[1042] It remains doubtful whether such a suggestion would have worked in practice after international control had basically failed by 1948.

The ASA continued to cover the hydrogen bomb because, the editorial of the following issue stated, '[t]he importance of adequate public discussion of this subject cannot be over-estimated.'[1043] Perhaps intended as a compromise to present more opinonated articles, the May 1950 issue featured a ten-page section 'The Hydrogen Bomb – American Reactions' entirely made up of reprinted articles from the *Bulletin of the Atomic Scientists*' March issue.[1044] In 1957, the *New Scientist*'s 'Atomic

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[1040] Rudolf Peierls, 'The Hydrogen Bomb and World Security', *ASN*, 3. 4 (March 1950), 85-87 (pp. 85-87).
[1041] Galison and Bernstein, 267-347; Schweber, *In the Shadow of the Bomb*, pp. 156-68.
[1042] Peierls, 'The Hydrogen Bomb and World Security', p. 87.
[1043] 'Editorial', *ASN*, 3. 5 (May 1950), 104-06 (p. 104).
[1044] 'The Hydrogen Bomb – American Reactions', *ASN*, 3. 5 (May 1950), 110-20. The H-bomb remained of interest so that the subsequent issue of the *ASN* featured another article from the *BAS*: Robert F. Bacher, 'The Hydrogen Bomb', *ASN*, 3. 6 (June 1950), 134-45, previously published under the same title in the *BAS*, 6. 5 (May 1950), 133-38. The first 'Atomic Science' section in the *New Scientist* also featured an article on the H-bomb: Joseph Rotblat, 'The Hazards of H-Bomb Tests',

Science' section featured two highly biased articles on the H-bomb, one by Bertrand Russell and another by Angus Maude, a Conservative MP. Russell, who had played a significant role in galvanizing public opinion against the H-bomb when he had co-authored the famous Einstein-Russell Manifesto in July 1955,[1045] emphasized the perils of the H-bomb and called for a test stop and urged Whitehall to cease its H-bomb development programme, justifying his engagement by writing: 'My deepest ground is that I do not wish to be an accomplice in a vast atrocity which threatens the world with overwhelming disaster'.[1046] Angus Maude, by contrast, argued in favour of a continuation of the British hydrogen bomb tests, emphasizing the H-bomb's 'peculiar effectiveness [...] as a deterrent, [...] a total destroyer', concluding that, '[a]fter all, the risk of possible mutations in a hundred years has to be compared with the risk of universal destruction in ten.' He added: 'I know which I would choose, even if I did not believe that we may soon have the chance to prevent both.'[1047]

While this form of presenting two opposing views represented an improvement in terms of furthering the public discussion about nuclear energy, and despite the fact that the ASA continued to cover key issues of the nuclear age like fallout, especially from strontium-90, and civil defence, Peierls's and the ASA's insistence on refraining from making political statements had become obsolete with time.[1048] The ideology of apolitical science was thus a major factor in bringing about

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New Scientist, 3 January 1957, pp. 38-39. The first British thermonuclear tests also received coverage: 'Experiment in the Pacific', *New Scientist*, 28 March 1957, p. 23.

[1045] Arnold, *Britain and the H-Bomb*, p. 115.

[1046] Bertrand Russell, 'The Tests Should Be Stopped', *New Scientist*, 28 March 1957, pp. 24-25 (p. 25).

[1047] Angus Maude, 'The Tests Must Go On', *New Scientist*, 28 March 1957, pp. 26-27 (p. 27).

[1048] On fallout, see, for example, Santimay Chatterjee, 'Radioactive Ashes over Calcutta and a Method of Dating a Nuclear Explosion', *ASJ*, 4. 5 (May 1955), 273-78; 'Genetic Effects of Nuclear Explosions', *ASJ*, 4. 4 (March 1955), 202; Harold A. Knapp, 'South Woodley Looks at the H-Bomb', *ASJ*, 4. 5 (May 1955), 261-72; Frank R.N. Nabarro, 'The Possible Scale of Radioactive Contamination by the Fission Products of Uranium 235', *ASN*, 3. 6 (June 1950), 166-68; Yasushi Nikushiwaki, 'Effects of H-Bomb Tests in 1954', *ASJ*, 4. 5 (May 1955), 279-88; P.A. Sheppard, 'Radioactive Fall-Out and the Weather', *New Scientist*, 15 August 1957, pp. 23-25. In October 1950, the ASA and the London-based Institute of Biology organized a joint conference on the 'Biological Hazards of Atomic Energy' at the Royal Institution in London; 'Biological Hazards of Atomic Energy', *Nature*, 167. 4244 (3 March 1951), 335-38 (p. 335); *Biological Hazards of Atomic Energy: Being the Papers Read at the Conference Convened by the Institute of Biology and the Atomic Scientists' Association October 1950*, ed. by A. Haddow (Oxford: Clarendon Press, 1952). On civil defence, see for example, 'The Atom Bomb and Civil Defence', *ASN*, 2. 3 (27 October 1948), 62-64; 'Atomic Weapons and Civil Defence', *ASN*, 3. 1 (21 July 1949), 10-16 (pp. 12-13). The ASA devoted much of its May 1952 issue of the *ASN*, 1. 5 to civil defence, 'Editorial' (pp. 181-82); E.C. Allen, 'The Assessment of Atomic Casualties' (pp. 184-92). See, for instance, W.G. Marley, 'Radioactivity and Civil Defence' (pp. 193-97); D.G. Arnott, 'Atomic warfare: The Biological Component' (pp. 198-209); Claude Frankau, 'The Casualty Service' (pp. 210-14); Sidney L. Harford, 'Civil Defence: Administration and Organisation' (pp. 215-20).

the ASA's disbandment. Rudolf Peierls wrote in his autobiography that the ASA 'ran out of steam' during the 1950s. He retrospectively blamed this development primarily on two factors: firstly, the ASA failed to attract the adequate number of younger people needed to keep the association up and running perhaps because, Peierls supposed, 'the younger people did not feel that they had any particular expertise in the subject'. Secondly, and more importantly, he attributed the ASA's demise to a general feeling that 'however important the international problems, there was little that a British organisation could do' because '[t]he future depended essentially on what the United States and the Soviet Union were doing'.[1049]

While Rudolf Peierls had defined Britain's role euphemistically as a mediator between the superpowers to achieve international control of atomic power on the second anniversary of Hiroshima in 1947, he relativized his position shortly afterwards when the Soviets vetoed the Baruch Plan and detonated their own atomic bomb. In a 1950 article in the *Bulletin of Atomic Scientists* he had already revealed a good deal of pessimism about the realization of the ASA's mission, admitting: 'We have not so far seen a solution which could be worked for by organizations in Great Britain and which offered a realistic chance of success.'[1050] In 1970, he elaborated on Britain's dwindling role as a world power as a major reason for the ASA's decline and final disbandment in the late 1950s, arguing that

> the dominant fear is of the possibility of global conflict, which would involve American and Soviet weapons. [...] Britain's nuclear weapons, if perhaps not very useful [...], do not seem very dangerous in the presence of the larger arsenals, and would, of course, be regulated as a by-product of any disarmament treaty. For this reason the danger of world war looks from here almost as it looks from the "have-not" viewpoint of the non-nuclear countries. [...] This is one reason why the groups of scientists and others who are acutely worried about these problems in this country found it more difficult to enlist active support than has been the case in the United States. The prospect of giving abstract thought to possible solutions which might commend themselves to others does not attract wide support.[1051]

As Peierls rightly observed, the changed international situation certainly had a major impact on the ASA's significance. The fact that the international control of nuclear energy as one of its chief objectives had failed by the late 1940s, in particular after the Soviet Union had successfully tested its own atomic bomb in 1949, played a substantial role in the association's slow but steady decline and posed a serious

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[1049] Peierls, *Bird of Passage*, p. 284.
[1050] Peierls, 'The British Atomic Scientists' Association', p. 59.
[1051] Peierls, 'Britain in the Atomic Age', pp. 94-95.

problem for justifying both its existence and purpose, as some of its members had already realized along the way.[1052] In the United States, similar developments occurred: the NCAI collapsed and membership in the FAS declined significantly.[1053] The Atom Train exhibition had epitomized the ASA's heyday when its objectives still seemed achievable. Like their American colleagues, British scientists would never again feature so prominently in the public eye as during the 1940s.[1054]

Rudolf Peierls's comments about the ASA's loss of significance in the face of Britain's decline as a world power reveal the limitations of groups like the ASA whose members Holger Nehring has classified as 'nationalist internationalists', movements that had objectives connected to global issues like the international control of atomic energy but that simultaneously viewed these problems from a national perspective.[1055] In the case of the ASA, the scientific practice of atomic scientists, in particular physicists, who had traditionally been highly international in their professional conduct collided with a more nationalist political agenda.[1056] This clash was often a source of conflict between governments and individual scientists, as has been shown in the case of Rudolf Peierls in the previous chapter. Although German scientists had represented a special case and had not always been as fully integrated into international networks as their American or British colleagues, Rudolf Peierls, together with Hans Bethe, Klaus Fuchs, Werner Heisenberg, Pascual Jordan, Wolfgang Pauli and Victor Weisskopf, had been among the first generation of physicists based in Germany to participate more regularly in international events and networks, even before the forced departure of the many émigrés amongst this group occurred.[1057] After the ASA's demise in 1958, Rudolf Peierls, along with many

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[1052] G.P. Thomson, 'The Russian Atomic Explosion', *ASN*, 3. 3 (21 December 1949), 59-60 (p. 59). The same issue contained a couple of articles on the topic: E.H.S. Burhop, 'International Control – The Present Position' (pp. 61-63); H.R. Allan, 'American Reactions' (pp. 63-67); K. Lonsdale, 'Russia's Atom Bomb' (pp. 68-72); 'Editorial', *ASN*, 4. 1 (August 1950), 1-2 (p. 1).

[1053] Boyer, *By the Bomb's Early Light*, pp. 96-98; Alice Kimball Smith, *A Peril and Hope: The Scientists' Movement in America, 1945-1947* (Chicago: University of Chicago Press, 1965), p. 265.

[1054] Boyer's observation also applies within the British context; *By the Bomb's Early Light*, p. 99.

[1055] Holger Nehring, 'National Internationalists: British and West German Protests against Nuclear Weapons, the Politics of Transnational Communications and the Social History of the Cold War, 1957-1964', *Contemporary European History*, 14. 4 (2005), 559-82.

[1056] For a concise overview, see Jean-Jacques Salomon, 'The *Internationale* of Science', *Science Studies*, 1. 1 (1971), 23-43.

[1057] Metzler, p. 29. On nationalism and internationalism within the physics community before World War II, see, for example, Elisabeth Crawford, *Nationalism and Internationalism in Science, 1880-1939: Four Studies of the Nobel Population* (Cambridge: Cambridge University Press, 1992); Michael Desser, *Zwischen Skylla und Charybdis: Die 'scientific community' der Physiker 1919-1939* (Vienna: Böhlau, 1991).

former ASA members, became involved in the international Pugwash Conferences that started at about the same time.[1058]

While Peierls had rightly assumed that the United Kingdom's decreasing weight on the international stage was a crucial factor in bringing about the end of the ASA, his explanation as to why the association failed to attract more young members, so desperately needed to operate it, appeared to be somewhat idealistic. The ASA faced severe recruitment problems quite early on. By 1950, dwindling numbers of full members started to pose a serious problem to the organization and started to threaten it financially.[1059] Here, apart from the changing geo-strategic realities and its lack of political mindedness, it was especially the question of membership that was discussed. As early as April 1948, it was proposed to introduce a 'Graduate Membership' that was 'open to all holding degrees in Science, the widest interpretation being given to the word "Science" in order to cover social science, psychology and the medical subjects, even economics, but not borderline subjects such as history'.[1060]

A significant part of the problem was that the ASA comprised an elitist circle of full members, with non-atomic-scientists only being granted associate membership status. As Peierls remarked on membership and the ASA's position among the existing organizations as early as 1946:

> We have considered the question of widening this, as the Americans have done, into an organisation including all scientists in this country, but it was felt that this would be invading territory which at present other such as the A.Sc.W. and the British Association [for the Advancement of Science] regard as their own, and that it would be wiser to wait until the new association had shown itself to be a sensible form of organisation, and until means of working through existing organizations had been explored, without, in doing so, getting definitely labelled in any political direction, as would be the case under the A.Sc.W.'.[1061]

Unlike the FAS or the AScW, which represented a broader spectrum of scientists and as a trade union had very good connections to the Labour Party, the ASA officially remained apolitical.[1062] Later attempts failed to revive the association such as the renaming of *Atomic Scientists' News. New Series* as the *Atomic Scientists' Journal* in September 1953 which went hand in hand with the association's reassessment of its

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[1058] Peierls, 'Britain in the Atomic Age', pp. 95-96.
[1059] 'Editorial', *ASN*, 4. 1 (August 1950), 1-2 (p. 1); Rudolf Peierls, 'President's Report', *ASN*, 4. 1 (August 1950), 6-8 (pp. 7-8).
[1060] C.I. Snow, 'The Future of the A.S.A.', *ASN*, 1. 9 (5 April 1948), 137-38 (p. 137).
[1061] Peierls to Chadwick, 12 March 1946, CHAD I 24/2.
[1062] Greta Jones, p. 7.

strategy and goals as well as possible ways of attracting more members and readers of its journal.[1063]

Conclusion

At about the time the ASA disbanded, a highly opinionated article by J.B. Priestley in the 2 November 1957 issue of the *New Statesman* was crucial for mobilizing a broad anti-nuclear movement, with the Campaign for Nuclear Disarmament (CND) becoming the chief organization.[1064] After its creation in 1958, an increasing politicization Rudolf Peierls had always warned against in the ASA took place in the CND. It seemed his concept of the apolitical scientist was dead once and for all. As the new left won considerable influence over the CND in the early 1960s, the organization took – by comparison with the ASA – highly politicized views when it demanded from Whitehall that Britain leave NATO, for example.[1065] It was perhaps against the background of his experience with the ASA and the emergence of the highly political anti-nuclear movement that Peierls showed signs of resignation during the late 1950s. Although he became involved in the Pugwash movement, he did not attend any of their conferences until the 1960 meeting in Moscow.[1066] Despite the eventual failure of his concept of the unpolitical scientist and the disbandment of the ASA, his involvement in the British atomic scientists' movement had paved the way for an anti-nuclear mass movement, notably the CND. And the awareness of nuclear issues had clearly entered the public arena.

[1063] 'Editorial', *ASJ*, 3. 1 (September 1953), 1-3; 'Atomic Scientists' Association', *Nature*, 173. 4392 (2 January 1954), 18-19.

[1064] J.B. Priestley, "Britain and the Nuclear Bombs', *New Statesman*, 2 November 1957, pp. 554-56; Duncan Rees, 'Resisting the British Bomb: The Early Years', in *The British Nuclear Weapons Programme 1952-2002* (see Cross, above), pp. 56-63 (p. 57).

[1065] Mark Phythian, 'CND's Cold War', *Contemporary British History*, 15. 3 (2001), 133-56 (pp. 137-39). There existed also a close relationship between the CND and the Labour Party, see Richard Taylor, 'The Labour Party and CND: 1957 to 1984', in *Campaigns for Peace* (see Omrod, above), pp. 100-30.

[1066] Peierls, interview by Weiner, p. 154.

Chapter Six. Conclusions and Afterthoughts.

This PhD thesis has demonstrated that Klaus Fuchs and Rudolf Peierls significantly shaped British nuclear culture in terms of scientific practice and the political implications of their work in the years from 1939 until 1958. Their 'Germanness' – their being German which was informed by their German origin, in particular their ethnicity and their exposure to German culture before their arrival in Britain – influenced their involvement with atomic culture in their adopted host country ambivalently and in a reciprocal way to varying degrees. Fuchs's and Peierls's experiences with National Socialism and their personal knowledge of some of the key scientists who were believed to be behind the German nuclear weapons project led to a strong determination in both of them to become involved in nuclear arms research and to beat Germany in the race over the atomic bomb. At the same time, however, as chapter two has shown, their German origin made them 'enemy aliens' and did not allow them to work on important war projects such as radar so that they were – almost accidentally – pushed into the direction of nuclear weapons research, which was not deemed as crucial to the war effort in 1939. And because of his 'Germanness', Fuchs was even interned in Canada for several months.

Rudolf Peierls became one of the chief engines behind the early British nuclear weapons project. It was in particular the seminal memorandum, which he co-authored with the Austrian-born émigré physicist Otto Frisch in early 1940, that galvanized Whitehall's efforts to pursue its own atomic arms programme. Not only did it lead to the two Maud Reports and the establishment of TA but it also had a strong impact on the formation of the Allied Manhattan Project. In what would later have serious implications for Peierls in the aftermath of Klaus Fuchs's confession of espionage for the Soviet Union, he also recruited Fuchs into TA work.

In 1943, Fuchs and Peierls joined the Manhattan Project and worked, at first, briefly in New York City and then at the secret laboratory at Los Alamos, New Mexico. Chapter three has demonstrated that Peierls made crucial contributions to getting the Anglo-American nuclear co-operation that culminated in the Manhattan Project underway. At Los Alamos, Klaus Fuchs and Rudolf Peierls came across many German-speaking émigré atomic scientists including Hans Bethe, Egon Bretscher, Otto Frisch, George Placzek, Edward Teller and Victor Weisskopf. Peierls and Fuchs, together with the other German-speaking émigré scientists, as a cohort,

tremendously helped shape a new approach, as the chapter has argued, to nuclear science that consisted of a close co-operation between theoretical and experimental scientists and built on large-scale government funding. Here, many German-speaking émigré scientists profited from their education in German universities with their focus on the theoretical side of science and their experience with state-funded universities in Continental Europe. With their input into the creation of the first atomic bombs at Los Alamos, Fuchs and Peierls thus stepped up the establishment of the emerging culture of Big Science.

After the war, Fuchs and Peierls returned to Britain where their ways parted. While Peierls resumed his professorship at the University of Birmingham, Klaus Fuchs became head of the theoretical physics division at the newly founded AERE Harwell. Fuchs shocked the British public in early 1950 when he confessed that he had spied on his host country for the Soviet Union since the day he had become engaged in TA work. As chapter four has demonstrated, Fuchs's experience with National Socialism not only led to a strong motivation to work on the British and Allied nuclear weapons projects but also radicalized him politically so that he spied for the Soviet Union. The Fuchs case affected public opinion in Britain where it led people to question the efficiency of national security agencies, especially MI5, in their defence of the democratic order. But the espionage affair had further repercussions for Anglo-American relations and even led MI5 to deceive both the British public as well as the Prime Minister and other key political decision-makers to restore its image. While Klaus Fuchs's confession in general had a strong effect on public opinion, it had particularly serious implications for Fuchs's former mentor Rudolf Peierls and other German-speaking émigré atomic scientists in Britain and the United States owing to their German origin. The effects of Fuchs's radicalization in Germany thus could long be felt.

Rudolf Peierls engaged with another area of British nuclear culture, namely public education and science advising. After his return from the United States, Peierls became a crucial figure in the emerging British atomic scientists' movement through his involvement in the ASA. Chapter five has clearly shown that Peierls's exposure to German research cultures informed his understanding of the relationship between science and politics and the role he envisioned for science in public education and advising political decision makers. The resulting concept of the unpolitical scientist was decisive in the formation as well as the end of the ASA.

Ultimately, Fuchs's and Peierls's 'Germanness' strongly influenced the making of British nuclear culture in the period from 1939 to 1958. Acknowledging this – which has not been done before – helps us to understand contemporary British history, and it has important repercussions for the general understanding of British political culture in the nuclear age, in particular the role of science for public policy making. As predicted, the interdisciplinary approach which combines the fields of cultural history and science and technology studies has borne fruit in allowing us to see Fuchs's and Peierls's roles in the making of British nuclear culture within a transnational context through comparisons with West German and especially US nuclear culture. My thesis thus makes an original contribution to the study of twentieth-century British and transnational history.

My findings support a further project related to the study of British nuclear culture, which is related to this PhD thesis and concerns the examination of the relationship between science, democracy and policy making during the Cold War era. Here, the ASA as the chief organization of the British atomic scientists' movement merits further research, especially with regard to how the association confronted the coming of thermonuclear weapons. At the same time, this project would allow a further deepening of the transnational angle which transcends the post-1945 boundaries, in particular through additional comparisons with Werner Heisenberg, who played a leading role in the establishment of the *Deutscher Forschungsrat* (German Research Council), set up shortly after the war with the goal of helping restore science in the newly founded FRG.

While the time period under investigation ends in 1958, Rudolf Peierls did not withdraw from nuclear culture. After the ASA's demise, Rudolf Peierls, along with many former ASA members, became involved in the international Pugwash Conferences that started at about the same time.[1067] The Polish-born émigré physicist Joseph Rotblat, who served as Secretary-General of the Pugwash movement, was the driving force behind these meeting the first of which was held in the town of Pugwash, Nova Scotia, Canada, in 1957.[1068] Peierls became the first chairman of the

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[1067] Peierls, 'Britain in the Atomic Age', pp. 95-96.

[1068] Jack Harris, 'Joseph Rotblat and Pugwash', in *War and Peace* (see Halliday, above), pp. 189-99 (pp. 195-97); Mary Palevsky, *Atomic Fragments: A Daughter's Questions* (Berkeley: University of California Press, 2000), pp. 160-85. On the early history of the Pugwash movement see also Joseph Rotblat, *Scientists in the Quest for Peace: A History of the Pugwash Conferences* (Cambridge, MA: MIT Press, 1972).

British Pugwash Group and later also served as chairman of the International Pugwash Group until he retired from the posts in 1974.[1069]

Peierls still adhered to his belief in the ideology of apolitical science as late as 1976 when he wrote to Herbert Fröhlich in September 1976 in his function as chairman of the British Pugwash Group: 'We believe that there is a need, particularly in the scientific community, for unbiased information, and for a forum for objective discussion.'[1070] But later, he started to act in increasingly overt political ways. As a consequence of Britain's declining role as a nuclear world power, Peierls became involved with the British branch of the Nuclear Weapons Freeze Campaign, the so-called Nuclear Freeze movement, that demanded Britain's unilateral abandonment of its nuclear weapons programme in 1985. The following year, he even assumed its directorship.[1071] Here, Peierls promoted the slogan that 'nuclear weapons are not battleships'.[1072] Although the British movement was modeled on the American Nuclear Weapons Freeze Campaign, it was rather short-lived.[1073] In 1995, Rudolf Peierls co-authored in collaboration with C.R. Hill, R.S. Pease and Joseph Rotblat a report by the British Pugwash Group, entitled *Does Britain Need Nuclear Weapons?*, that made a case against an independent British nuclear deterrent.[1074]

Peierls also engaged increasingly in science advising and made more pronounced political statements. In February 1957, he accepted an invitation by the British government to serve as a representative of universities on the Governing Board of the newly founded National Institute of Research in Nuclear Science.[1075] In late December 1964, the Foreign Office invited Rudolf Peierls to serve on a 'Consultation Panel on Disarmament' that comprised 'outside experts in the field of disarmament', which he accepted.[1076] The same year Peierls resumed his consultancy

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[1069] Dalitz, 'Peierls, Sir Rudolf Ernst (1907–1995)'.
[1070] Peierls to Fröhlich, 20 May 1976, Papers of Herbert Fröhlich, FRS, SJL, D. 56, F. 222.
[1071] Dalitz, 'Peierls, Sir Rudolf Ernst (1907–1995)'.
[1072] Peierls, *Bird of Passage*, p. 288.
[1073] Wittner, III, 33.
[1074] C.R. Hill and others, *Does Britain Need Nuclear Weapons?: A Report from the British Pugwash Group* (London: British Pugwash Group, 1995), pp. 61-63. I am thankful to Professor Robert Hinde of the British Pugwash Group for providing me with a copy of the report.
[1075] Thorneycroft to Peierls, 15 February 1957; Peierls to Thorneycroft, 16 February 1957, Peierls Papers, Eng. Misc. b. 224, F 20; 'National Research Institute: Governing Body Named', *Times*, 13 March 1957, p. 4.
[1076] Chalfont to Peierls, 29 December 1964; Peierls to Chalfont, 31 December 1964, Peierls Papers, MS Eng. Misc. b. 223, F 1.

for the AERE Harwell.[1077] In 1965, Peierls also presented a paper on 'Disarmament – the answer to nuclear stalemate: A scientific view' at a United Nations' 'Conference on Defence and Disarmament' which underlines his international stature.[1078] With his continued backing of the concept of nuclear deterrence and his rejection of NATO's doctrine of using tactical nuclear weapons in a potential war with the Warsaw Pact in Europe during the early 1980s, Peierls also clearly left the unpolitical terrain.[1079]

While Peierls's host country honoured his legacy with symposia dedicated to his scientific legacy and, above all, his knighthood in 1968, Klaus Fuchs's confession overshadowed his legacy in the United Kingdom and beyond.[1080] And, apart from his notorious acts of espionage, little is known about his scientific work in Britain today. A recent Radio 4 radio play, entitled *Atomic Lunch* (25 July 2005) and the second episode of the five-part BBC 2 miniseries *Nuclear Secrets*, which bore the title 'Superspy' (22 January 2007) dealt with Fuchs's espionage for the Soviets. After serving nine years of his fourteen-year prison sentence, he moved to the GDR where he settled in Dresden and became deputy director of the nearby Rossendorf atomic energy research installation.[1081] Klaus Fuchs became a member of the Central Committee of the Socialist Unity Party (SED), a member of the Academy of Science (*Akademie der Wissenschaften*) and a member of the GDR Research Council (*Forschungsrat der DDR*) and received the Order of Patriotic Merit (*Vaterländischer Verdienstorden*) in silver (1962) and gold (1971).[1082] By the mid-1980s, he ceased to take an active part in its work due to his age and deteriorating health. Fuchs, who had remained an active member of German-Soviet Friendship Society, described his

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[1077] Vick to Peierls, 21 February 1964; Peierls to Vick, 12 February 1964; Peierls to Sandford, 12 February 1964; Marshall to Oates, 11 February 1964; Marshall to Bretscher, 27 May 1964; Marshall to Peierls, 28 May 1964, Peierls Papers, MS Eng. Misc b. 223, F 3.

[1078] Crane to Peierls, 7 May 1965; Peierls to Crane, 14 May 1965, Peierls Papers, MS Eng. Misc. b. 223, F1.

[1079] Peierls, 'Limited Nuclear War?', 2. Peierls, 'Counting Weapons', *London Review of Books*, pp. 16-18.

[1080] *A Breadth of Physics: The Proceedings of the Peierls 80th Birthday Symposium*, ed. by Richard H. Dalitz (Singapore: World Scientific, 1988); *Rudolf Peierls and Theoretical Physics: Proceedings of the Symposium Held in Oxford on July 11th, 1974 to Mark the Occasion of the Retirement of Professor Sir Rudolf E. Peierls, F.R.S., C.B.E.*, ed. by Ian J. R. Aitchison and J. E. Paton (Oxford: Pergamon, 1977); Peierls, *Bird of Passage*, p. 320.

[1081] Lange and Mörke, p. 40.

[1082] 'Prof. Dr. habil. Fuchs, Klaus', 24 September 1974, BStU, MfS, HA XVIII, Abt. 5-VSH. The SED's official daily also featured an article on the occasion of Fuchs's seventy-fifth birthday; Günter Flach, 'Als Physiker aktiv im Kampf für den Frieden: Zum 75. Geburtstag von Prof. em. Dr. phil. Dr. rer. nat. habil. Klaus Fuchs', *Neues Deutschland*, 29 December 1986, p. 4.

collaboration with Soviet Scientists on fast-neutron reactors as the most important legacy of his life.[1083] In spite of his service to the Soviet Union, Fuchs kept a very low profile in the GDR.[1084] He published a few articles on the importance of science for the socialist state and spoke out occasionally when he accused the West German government, for example, of pursuing the development of nuclear weapons.[1085] Even Klaus Fuchs's courier, the anonymous woman with whom he had met several times in Banbury, alias Ruth Werner did not mention Klaus Fuchs at all in the first edition of her autobiography *Sonjas Rapport*.[1086] It was only after the end of the Cold War that an expanded edition was published first in English translation under the title *Sonya's Report* in 1991 and then in 2006 in German; this comprises several pages of previously withheld material on Fuchs.[1087] But the Soviet Union apparently held Klaus Fuchs in such high esteem that he and his wife spent three weeks in August 1968 for medical attention in the Central Committee's resort of Barhiva near Moscow.[1088] Ironically, his boss at Rossendorf, Heinz Barwich, spied for the Central Intelligence Agency (CIA) and defected to the United States in 1964.[1089]

Despite their contributions to the making of British nuclear culture, the achievements of Fuchs – apart from his spying – and Peierls are fairly unknown to the British public. Here, Albert Einstein represents a rare exception to the fate which Fuchs, Peierls and the overwhelming majority of German-speaking émigré scientists in Britain and the United States share. Rudolf Peierls remarked on Einstein's fame: 'This has even proved very convenient to physicists like myself when asked in social contact to explain one's profession.' He added: 'The occasion usually does not

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[1083] 'Secret Report, Soviet Embassy, GDR', 9 April 1986, Klaus Fuchs personal file, RGASPI, Komintern, F. 495, op. 205, d. 6612, p. 4.

[1084] Markus Wolf, the former head of the East German Foreign Intelligence Service, argued that Fuchs did so 'on the orders of Soviet military intelligence'; Wolf, with Anne McElvoy, *Man without a Face: The Autobiography of Communism's Greatest Spymaster* (New York: Times Books, 1997), p. 228.

[1085] 'Atomspion Klaus Fuchs behauptet: In zwei Jahren hat Bonn die A-Bombe', *Quick*, 21 November 1965, BStU, MfS, AP 4189/88, pp. 51-56; Klaus Fuchs, 'Wissenschaft und Produktion in der sozialistischen Revolution', *Sitzungsberichte der Akademie der Wissenschaften der DDR, Gesellschaftswissenschaften*, 2/G (1983), 3-21; Klaus Fuchs, 'Zur Bedeutung der theoretischen Physik für die Naturwissenschaften', *Sitzungsberichte der Akademie der Wissenschaften der DDR, Mathematik – Naturwissenschaften – Technik*, 5/N (1975), 5-16.

[1086] Ruth Werner, *Sonjas Rapport* (Berlin [East]: Neues Leben, 1977).

[1087] Ruth Werner, *Sonya's Report*, transl. by Renate Simpson (London: Chatto & Windus, 1991); Werner, *Sonjas Rapport*, new expanded edn, pp. 289-95. The new German edition even includes interviews with Ruth Werner's children (pp. 345-71).

[1088] 'Central Committee Note', n.d., RGASPI, Komintern, F. 495, op. 205, d. 6612, p. 15.

[1089] Heinz Barwich and Elfi Barwich, *Das rote Atom: Als deutscher Wissenschaftler im Geheimkreis der russischen Kernphysik* (Munich: Scherz, 1967), pp. 239-50. See also Paul Maddrell, 'The Scientist Who Came in from the Cold: Heinz Barwich's Flight from the GDR', *Intelligence and National Security*, 20. 4 (2005), 608-30.

warrant a dissertation on the nature of physics; the answer "Einstein was a theoretical physicist" generally satisfies, even if it does not enlighten, the questioner.'[1090]

The situation regarding the public awareness of German-speaking émigré nuclear scientists was complicated by the (often forced) recruitment of German rocket scientists like Wernher von Braun and Ernst Stuhlinger by the United States and the Soviet Union.[1091] Paradoxically, scientists such as von Braun who had served under the National Socialist regime found themselves in the limelight. As they were celebrated in the United States for their success in the space race, they seemed to overshadow the legacy of the émigré atomic scientists who had come to Britain and the United States after Hitler's coming to power and supported the Allied war effort. A Gallup poll conducted in the United Kingdom in January 1959 demonstrates this phenomenon: 39 per cent of the respondents declared that '[f]ormer German scientists' were the engine behind the United States' advancement in rocketry and satellites, while only 20 per cent accredited the progress in space technology to American scientists and 40 per cent did not give a clear answer. When asked about the Soviet space and missile programmes, a similar picture emerged (34 per cent for the 'German scientists'; 28 per cent for 'Russian scientists' and 38 per cent did not know the answer).[1092]

Popular culture also capitalized on this increased awareness of German or 'former German' scientists as in the espionage film *Ice Station Zebra* (1968). After an Anglo-American rescue party have recovered a special film developed by American scientists which had been abducted together with a secret British-made camera by Soviet agents, the British security officer David Jones (Patrick McGoohan) explains to US Navy Commander James Ferraday (Rock Hudson) how the film found its way not only into Russian hands but also onboard of one of their satellites, saying 'then the Russians put our camera, made by our German scientists, and your film, made by your German scientists, into their satellite, made by their German scientists'. While the Gallup poll indicated that many Britons were in general aware of the presence of German scientists in Britain, the United States and

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[1090] Rudolf Peierls, 'Twentieth-Century Physics', in *Next Year in Jerusalem: Jews in the Twentieth Century*, ed. by Douglas Villiers (London: Harrap, 1976), pp. 295-307 (p. 295).
[1091] On the little-known British efforts to recruit German scientists, see Andrew Nahum, '"I believe the Americans have not yet taken them all!": The Exploitation of German Aeronautical Science in Postwar Britain', in *Tackling Transport*, ed. by Helmuth Trischler and Stefan Zeilinger (London: Science Museum, 2003), pp. 99-138.
[1092] *Gallup International Public Opinion Polls*, I, 492.

the Soviet Union, Jones's statement reveals a self-conscious cynicism of the way in which the two superpowers used German science and scientists in the Cold War context. In his deeply cynical song 'Wernher von Braun' (1965), Tom Lehrer summarized well von Braun's attitude: 'Don't say that he's hypocritical, / Say rather that he's apolitical. / "Once the rockets are up, who cares where they come down? / That's not my department", says Wernher von Braun.'

But it was then in the character of Dr. Strangelove (Peter Sellers), the protagonist of Stanley Kubrick's 1964 film of the same title that these deeply cynical views of Wernher von Braun were blended with negative stereotypes of German-speaking émigré nuclear scientists. In the film, Dr. Strangelove embodies the nuclear threat in a supposedly 'German' body, which comprises an ambivalent and contradictory hodge-podge of traits drawn from various scientists from Leo Szilard to Edward Teller to Wernher von Braun. Kubrick's picture has emerged as perhaps the most dominant epitome of the German-speaking émigré nuclear scientist.

It is against such stereotypes that the present thesis set out to examine the pivotal roles played by Rudolf Peierls and Klaus Fuchs in the making of British nuclear culture. The context for this stands in a time in British history that is witnessing a kind of atomic renaissance. This revival places questions concerning the renewal of the United Kingdom's nuclear deterrent and the construction of new atomic power stations, which are reminiscent of those Britons confronted during the period under investigation, on the agenda. In his foreword to the White Paper on 'The Future of the United Kingdom's Nuclear Deterrent' of December 2006, Prime Minister Tony Blair justified his government's decision to replace the existing atomic-powered submarines carrying Trident nuclear missiles, writing: 'We believe that an independent British nuclear deterrent is an essential part of our insurance against the uncertainties and risks of the future.'[1093] Under its new policy of remaining at the high atomic table, Whitehall decided not only to build new nuclear submarines but also to participate in the United States' Trident II D 5 missile life-extension programme to secure that the American-made missiles, which form

[1093] Tony Blair, 'Foreword to the White Paper by the Prime Minister', in Cm. 6994, 'The Future of the United Kingdom's Nuclear Deterrent' (London: HMSO, 2006), p. 5.

together with the submarines the backbone of Britain's nuclear deterrent, remain operational.[1094]

Shortly after it had revealed its plans to keep atomic weapons as an 'insurance against the risks of the future', as Tony Blair has put it, the British government further announced that it intended to build new nuclear power stations as part of the United Kingdom's energy mix and in an attempt to ensure energy security and fight climate change.[1095] Over 60 years after the world public had forcibly been introduced to the atomic age with the nuclear bombing of the Japanese cities of Hiroshima and Nagasaki, it seems that British nuclear culture is undergoing a revival. In the face of uncertain threats to the United Kingdom's national security almost two decades after the end of the Cold War, climate change, increasing energy prices and a growing scarcity of raw materials, atomic energy once again appeared to be the solution to many of the burning problems of the early twenty-first century. 'Nuclear is UK's new North Sea oil' prophesied a headline in the *Guardian* in March 2008.[1096] At the same time, however, the CND celebrated its fiftieth anniversary and criticized the Brown Government for its affirmative stance on a nuclear-capable United Kingdom, reiterating its chief aim: 'The only safe future is one free from nuclear weapons'.[1097]

This nuclear renaissance with its emphasis on both atomic weapons and power as well as continued opposition to these government plans from the anti-nuclear movement, in particular the CND, reveals not only the complex, multifaceted and often ambiguous nature but also key issues of atomic culture in the United Kingdom. While these major features of British nuclear culture have received much public attention, Britons still know comparatively little about atomic scientists, and in particular those from German-speaking backgrounds, who contributed significantly to its making. With the Blair Government's insistence on the necessity of an independent British nuclear deterrent and its effectiveness, the prime minister echoed Rudolf Peierls's and Otto Frisch's concept which the first scientists first

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[1094] Blair to Bush, 7 December 2006; Bush to Blair, 7 December 2006, (repr. in *Cabinets and the Bomb*, pp. 333-37); 'The Future of the United Kingdom's Nuclear Deterrent', pp. 6-8.
[1095] Cm. 7296, 'White Paper on Nuclear Energy, January 2008' (London: HMSO, 2008), pp. 43-133.
[1096] Andrew Sparrow and Patrick Wintour, 'Nuclear Is UK's New North Sea Oil', *Guardian*, 26 March 2008, p. 1.
[1097] Duncan Campbell and Rachel Williams, 'CND Veterans Remain Unbowed, 50 Years On', *Guardian*, 16 February 2008, p. 21; 'The Only Safe Future Is One Free From Nuclear Weapons', *Guardian*, 16 February 2008, p. 30.

outlined in their seminal memorandum in early 1940. At the same time, Whitehall's announcement of participating in the US life-extension programme for ageing British (but American-made) Trident II D 5 missiles indicated the government's willingness to continue the Anglo-American nuclear co-operation Fuchs and Peierls helped forge during the war. Moreover, the Brown government openly debated and approved of the construction of new atomic reactors as a means of reducing both Britain's dependence on coal, oil and gas imports, and the emission of carbon dioxide in the face of climate change. That nuclear power featured as a supposedly 'clean' energy source in official debates and government statements after the accidents of Windscale, Harrisburg and Chernobyl demonstrated that, while Peierls's concept of the unpolitical scientist failed without doubt, he succeeded in advocating an open debate about nuclear issues. This legacy of Peierls's involvement in the ASA is further underlined by the fact that the CND, for which the association once paved the way, is still active and keeps on providing the chief anti-nuclear platform. Arguably, Klaus Fuchs also contributed to these current debates through his sensitization of both the British public and government to issues of national (in)security. Perhaps in the current revival of British nuclear culture lies Fuchs's and Peierls's ultimate legacy.

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