Prof. Dr. Dr.h.c. Alfred Seeger

31 August 1927 – 18 October 2015

Prof. Dr. Dr.h.c. Alfred Seeger passed away on October 18 2015. Born in Stuttgart in Germany in 1927, Alfred Seeger witnessed the catastrophe of the Second World War at first hand. As a 15 year old school student, he was ordered to become an assistant for an anti-aircraft gun. In 1944 he was forced to join a pioneer battalion in the Wehrmacht, the then German Armed Forces. He escaped to become a prisoner of war until the end of the Second World War. After the War, he began studying physics at the Technical University of Stuttgart in 1946. Five years later, in 1951, he was awarded the degree of Dr.rer.nat. (Doctor rerum naturalium, literally 'Doctor of the things of nature', but in English, Doctor of Natural Sciences) for his thesis *Zur Gittertheorie der Versetzungen* ('Lattice theory of dislocations'). Between October 1951 and September 1952 he worked in Bristol as a British Council sponsored postdoctoral research scientist with Sir Nevill Mott, co-recipient of the 1977 Nobel Prize in Physics, after which he returned to Stuttgart, completing his Habilitation thesis *Versetzungen und Kristallplastizität* ('Dislocations and Crystal Plasticity') in 1954. In 1959 he became Professor of Solid State Physics at the Technical University of Stuttgart and a scientific member of the Max-Planck-Institut für Metallforschung (Metal Research) at Stuttgart. Six years later, in 1965, he became the Director of the Institute of Physics at the Max-Planck-Institut für Metallforschung, nowadays the Max-Planck-Institut für Intelligente Systeme.

Alfred Seeger became known to the wider scientific community in the early 1950s with a series of three spectacular and pioneering publications in *Zeitschrift für Physik* on 'The theory of dislocations in one-dimensional rows' with Hans Donth and Albert Kochendörfer as co-authors. These three papers can be considered to be the very first publications in the field of research now known as the theory of solitons. Alfred Seeger found two types of motion of dislocations which he called translatory and oscillatory self-motions of kink pairs, corresponding to the solitons and breathers of soliton theory.

Within the wide field of solid state physics, there is hardly any topic which has not been influenced by valuable contributions and innovations from Alfred Seeger. He introduced the concept that structure-sensitive properties of crystals depend on a relatively few types of lattice imperfections and their interactions. Through a rigorous application of this concept scientifically by Seeger and others, it is now accepted that a large number of physical properties of real crystalline solids can be explained by a finite number of fundamental properties. Some of Seeger's major contributions were in the fields of crystal plasticity, self-diffusion and diffusion of atomic defects in metals and semiconductors, electronic properties of defects, radiation damage by fast particles, and microstructure–property relationships in ferromagnets and superconductors. His interest in superconductors led to the first report in *physica status solidi* in 1966 by his colleagues at the Institute, Hermann Träuble and Uwe Eßmann, of the visibility of the flux line lattice in Type II superconductors, as predicted by Alexei Abrikosov, co-recipient of the 2003 Nobel Prize in Physics. Seeger was the lead

scientist at the Institute in the development and application of nuclear methods, such as the use of positron annihilation spectroscopy for the detection of vacancies and the use of muons and pions as sensors in crystals, as well as in the use of ion-channelling for structure analysis.

Early on in his scientific career, Seeger recognized the importance of transmission electron microscopy for modern solid state physics research. Together with Manfred Wilkens, he developed the Max-Planck-Institut für Metallforschung into one of the world's leading centres for transmission electron microscopy. Investigations on the contrast seen in the transmission electron microscope, the resolving power of high voltage transmission electron microscopes and in-situ experiments in the transmission electron microscope were pioneering studies in this area of research all undertaken at the Institute. Three generations of high voltage transmission electron microscopes at the Institute stand as testament to the success of this scientific work. In addition, a 6 MV pelletron accelerator was installed in the 1980s at the Institute as a result of Seeger's research interests in the interaction of positrons, positive ions and electrons with condensed matter.

An important feature of Seeger's career was his international connection with leading scientists. This began immediately after he had obtained his doctoral degree, with his period in Bristol with Sir Nevill Mott. In addition, he also became friends with Jock Eshelby, Frederick Seitz, Jacques Friedel, Sir Peter Hirsch and Charles Kittel. He was a prolific writer. He published some 650 papers, a number of which have been in *Philosophical Magazine*. During his long and distinguished career he had 150 doctorands and 200 Diploma candidates.

He was active on many Editorial Boards, including the Editorial Advisory Board of *Philosophical Magazine* and *Philosophical Magazine Letters*. He was also a Founding Editor of *physica status solidi*. His work was honoured on a number of occasions. He was the first winner in 1957 of the Masing-Gedächtnispreis (Masing Memorial Award) of the Deutsche Gesellschaft für Metallkunde (now the Deutsche Gesellschaft für Materialkunde), he was elected to the Deutsche Akademie der Naturforscher Leopoldina (the German National Academy of Sciences) in 1976, he was the 1983 winner of the Heyn–Denkmünze (Heyn–Denk medal) of the Deutsche Gesellschaft für Metallkunde, the 1992 winner of the Gold Medal of the Japan Institute of Metals and the joint 1993 winner of the Zener Medal awarded by the Scientific Committee of the International Conference on Internal Friction and Ultrasonic Attenuation in Solids (ICIFUAS).

All of the colleagues, friends and co-workers of Alfred Seeger will remember him as a leading father of solid state physics in the second half of the twentieth century.

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