



# DIAS

Institiúid Ard-Léinn | Dublin Institute for  
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# DIAS

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 SUSTAINABLE  
DEVELOPMENT GOALS



Contributing to the  
Sustainability of  
our World

# Message from DIAS

**In 2015, the United Nations' resolution "Transforming Our World: The 2030 Agenda for Sustainable Development" was adopted by all 193 member states. The 2030 Agenda aims to deliver a more sustainable, prosperous, and peaceful future, and encompasses a framework of 17 Sustainable Development Goals (SDGs).**

In 2018, the Dublin Institute for Advanced Studies made a commitment to the SDGs in its strategy – *"Embedded globally, strength locally"*. Specifically under the strategic goal - **International research collaboration benefitting Ireland and the world**, DIAS has an objective to **"Leverage our excellence and international connectedness, and explore opportunities to contribute through research to the Sustainable Development Goals (SDGs)"**. This Statement reflects on how we have contributed to the SDGs since 2018 and how we will continue to do so in the coming years.

As it did historically, DIAS is currently proactively contributing expertise to global challenges. DIAS is an entity which is highly internationalised and which attains critical mass in its research through national and international collaboration. DIAS explores and pursues opportunities to attain fundamental understanding and this is core to its research and advanced studies. In addition to research, it contributes to the SDGs through the development of infrastructures such as iMARL (an ocean bottom seismometer contributing to deepening knowledge of the oceans), by contributing expertise to global satellite development (e.g. the Webb Space Telescope) and creating a portal to enable virtual access to ancient manuscripts (the Irish Script on Screen initiative). DIAS is also engaged in activity which reflects the unique position of Ireland as the last land mass on the edge of the Europe for measuring seismic activity by being the home of the Irish National Seismic Network (INSN) which contributes significantly to the study of national, European and world seismology.

Other areas of research interest include volcanoes, geothermal systems and potential for geothermal energy, sustainable methodologies for mining, and mapping components of our geological natural resources to enhance our understanding of Ireland's geological resources. DIAS, as an institute for advanced studies, will continue to be driven by the desire to gain and enable understanding for the long-term benefit of humanity, Ireland and the world. Research will also contribute to the Climate Action Plan (2019) and support the Circular Economy transition.

The SDGs going forward will be important to the consideration of future Institute strategy and priorities. DIAS is examining how DIAS can further reduce its environmental footprint, be this through further reduction of its consumption of resources or its approach to research. Furthermore it is working to preserve the cultural and scientific heritage at Dunsink Observatory (1785) and make it more accessible as a public cultural and scientific resource in Dublin City and Fingal County.



**Dr John Hegarty MRIA**  
Chair of the DIAS Council



**Dr Eucharía Meehan MRIA**  
CEO & Registrar of DIAS

# Introduction

## The Dublin Institute for Advanced Studies (DIAS)

The Dublin Institute for Advanced Studies (DIAS) is the world's second, and Ireland's only, institute for advanced studies. It is a globally-embedded institution that attracts talent (from > 20 countries) to fulfil its mandate to conduct fundamental research in three areas with a humanistic and scientific focus: Celtic Studies, Theoretical Physics and Cosmic Physics (encompassing Astronomy, Astrophysics and Geophysics). For over 80 years, DIAS has pushed the boundaries of discovery: our research gains insights into Celtic society and its legacy; progresses our understanding of our island, our planet and the universe; and deciphers the underpinning mathematical principles of nature.

Today from planet, star and universe formation, exoplanets and solar storms to the transmission of quantum information by computers to the nature of space-time; from Earth System change and the availability of water on the planet, to the development of Celtic languages and the origins of our identity, DIAS is positioned to engage with some of the biggest unanswered questions for Ireland and the wider world.

DIAS leads Ireland's participation in a number of global research endeavours and partners with collaborators in over 30 countries to also provide national and international research infrastructure. As a small organisation of 100+ persons, our strong collaborations nationally and internationally enables DIAS be impactful in the global arena.

DIAS is proud to be a beacon of Ireland's commitment to fundamental research. DIAS's presence in in the Irish ecosystem strengthens a key national objective for a diverse, but coherent, research-performing landscape.

DIAS Dunsink Observatory is a designated European site of historical significance for physics and is active in science outreach and public engagement.

## Context of DIAS Statement

DIAS launches this statement at a time of growing geopolitical uncertainty in Europe and worldwide. More critically there is growing concern about the sustainability of our planet and an almost ubiquitous desire to understand our Earth and its natural systems better. The thirst to better understand our universe, our relationship with our sun and to understand everything from a fundamental physical and mathematical perspective has never been greater. Furthermore, the concept of identity and the understanding of our past and ourselves as a people whether that is on our own island, as part of Europe or as global citizens, are growing themes in national and European discourse. In this landscape, DIAS, and more particularly its 100+ researchers, driven by a desire to gain and enable understanding, are contributing to a positive future for the planet and the world.

The UN Sustainable Development Agenda (SDA) calls for governments, businesses, organisations, institutions and individuals to contribute to the improvement of lives of people everywhere by 2030. Ireland's "*Sustainable Development Goals National Implementation Plan*" focuses on the 17 Sustainable Development Goals (SDGs) that are integral to the SDA - covering everything from poverty and climate change to infrastructure development and industry.

Not every goal is relevant to every organisation, but the Dublin Institute for Advanced Studies (DIAS) makes contributions to 12 of the 17 goals, a significant number when one considers the remit and the size of the Institute. Our contribution to the SDGs reflects that broader desire to support the future of the planet and our world. We set out below some current and future activities supporting the SDGs.



## Goal 4. Quality Education

**An institute for advanced studies enhancing higher education**

Since its foundation in 1940, DIAS has been a magnet for established and emerging talent in its disciplines. Although not a degree-awarding body, DIAS provides mentoring and training for hosted postgraduate students and early-career researchers at a stage when independent research is important for their intellectual and professional development. In this spirit, for over 80 years, DIAS has served as a base for hundreds of postgraduate students of its disciplines registered in national and international universities, in addition to postdoctoral researchers.

### DIAS strengthening its disciplines in Ireland

DIAS professors and staff also regularly lecture and provide courses in TCD, UCD and NUIM, with frequent specialist lectures in other institutes also. Each year, each of our Schools holds a statutory public lecture by a recognised research leader at either UCD or TCD for the benefit of the national community. In addition to the international and inter-institutional conferences and workshops also held annually in DIAS, each School/Section holds a regular programme of seminars attended by researchers from across the national ecosystem. DIAS has also established summer schools in each of its disciplines for the benefit of national and international participants.

### Strengthening the global community

Another core function in the institute for advanced studies model globally has been the provision of an International Visitor programme. Whilst the funding for the programme has been limited in recent years, hundreds of self-funded researchers at all levels have made requests to spend time, of varying duration, at DIAS over the last number of years. DIAS has also developed an adjunct model for longer term formal association with the Institute by academics and researchers in other higher education institutions (HEIs) and research performing organisations (RPOs) all over the world so as to strength ties with research partners and others in our fields.



## Goal 5. Gender Equality

**Dignity and respect underpinning equality**

DIAS is committed to being a community that promotes and advances equality, respects and values diversity, and the development of a collegiate environment of excellence, in which the human rights, diversity and responsibilities of all are recognised and respected. DIAS, an institute that is embedded globally, typically hosts researchers from in excess of 20 countries. DIAS already acts to prevent direct and indirect discrimination, sexual harassment, harassment and victimisation on the nine specific grounds outlined in the *Equal Status Acts 2000-2018*.

### A Gender Equality, Diversity and Inclusion Strategy

DIAS recognises that the excellence and impact we seek to deliver are enhanced through gender equality. It is widely acknowledged that change is needed in this regard and this includes changes in everyday behaviours and attitudes, as well as in policies and procedures.

In 2019, DIAS developed a new Gender Equality and Inclusion strategy, a key commitment in our institutional strategy '*Embedded globally, strength locally*'.

Over the next number of years, the Institute and its Schools will work toward the implementation of this Gender Equality and Inclusion strategy and, to achieve this, an institute-wide Gender Equality Implementation Team (GEIT), with representation at all career stages, has been established.

The GEIT reports to the DIAS Council and will drive the operational and cultural changes required at DIAS and in order to achieve its goal of meeting the requirements for Project Juno and Athena SWAN accreditations.

DIAS is currently a Project Juno Supporter and has recently re-affirmed our commitment to the Athena SWAN Ireland principles. DIAS aims to attain Project Juno Practitioner accreditation in the coming year, and Athena SWAN Bronze accreditation as soon as possible after attaining Project Juno Practitioner status.

### Specific initiatives

In an effort to address partially the underrepresentation of women in senior academic roles in its own staff profile, in 2019, DIAS made a successful application for funding for a new Senior Professor in Physics position in the first-round call of the Senior Academic Leadership Initiative (SALI) created by the Department of Education & Skills and operated under the auspices of the Higher Education Authority.

Female researchers from across the Institute took part in a collaboration with “Humans of Dublin” to promote research careers for women on International Womens Day.



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CLEAN WATER  
AND SANITATION

## Goal 6. Clean Water & Sanitation

Gaining understanding of water availability and sources

Most people are well aware of the water cycle of evaporation and precipitation yet, surprisingly, we still do not know how much water there is on planet Earth. Vast quantities of water exist underground – some is free to move as ‘groundwater’ flowing through cracks and fractures in the shallow subsurface, while some is ‘locked up’ in the Earth’s mantle as ions within mineral crystals. Groundwater changes with the season and is intimately related with the end-members of both drought and flooding events, worldwide. The DIAS Geophysics Section is carrying out research that will attempt to ‘weigh’ time-varying groundwater at a national scale in Ireland using high-precision satellite gravity data from the GRACE and GOCE missions – yielding information on Ireland’s total water budget and longer term seasonal changes.

## “Near half of Ireland is underlain by limestone which has been karstified”

DIAS researchers, in collaboration with Irish Centre for Research in Applied Geosciences (iCRAG) focusses on developing new methods for locating and real time monitoring of flowing conduits in Karst. Karst is a landscape developed when the underlying rock is soluble such as limestone. Near half of Ireland is underlain by limestone which has been karstified. Karst is important as a source of drinking water, a potential geohazard in geotechnical and construction projects and in terms of groundwater flooding. Analysis of the seismic data in the pilot study have yielded promising results.

| A karstified area of Ireland



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AFFORDABLE AND  
CLEAN ENERGY

## Goal 7. Affordable, Clean Energy

### Building a legacy in foundational research

Since the establishment of our School of Cosmic Physics, with its joint focus on Geophysics and Astronomy & Astrophysics, a key focus of DIAS' work has been on furthering our understanding of how the Earth's systems operate and influence climate. As early as 1949, researchers at DIAS published a report that highlighted 'phenomenal' weather events that year, while in 1950, Prof Leo Pollak, the first Director of the School of Cosmic Physics and former meteorologist at Met Éireann, gave a public lecture entitled 'Is the Earth Getting Warmer?'

### Future energy sources

Today, together with partners in iCIRAG, the Science Foundation Ireland Research Centre in Applied Geophysics, researchers at DIAS are leading a Sustainable Energy Authority of Ireland-funded fundamental research project to explore the potential for low-enthalpy geothermal energy on the island of Ireland. The project, entitled De-risking Ireland's Geothermal Energy Potential (DIG), integrates multi-disciplinary, multi-scale geophysical, geological and geochemical data analysis and interpretation to complement research at iCIRAG on wind and support Ireland's energy transition.

NEW island-wide geophysical data (long-period MT, seismic tomography, thermal conductivity measurements and Tellus airborne data) →

NEW local-scale geophysical data + structural geology + hydrochemistry data →

Island-scale refined maps of geothermal metrics →

Local-scale – Munster Basin (poor geophysical data coverage, lack of heat flow data)  
Demonstration site, Mallow warm Springs →



### Towards more sustainable energy use at DIAS

DIAS recognises the need to improve energy efficiency in its operations, as well as through its research. Data we collected in 2020 has shown that DIAS has achieved a 41.6% saving in its energy consumption since 2009 through a number of measures at its premises, thereby exceeding the 33% by 2020 target set by Government. While pandemic closures and reductions in staff numbers on site will have influenced this figure, a reduction in energy use of 35.4% since 2009 was reported in 2019, indicative of the success of energy saving measures across our locations.

We will continue to introduce energy efficiency measures in pursuit of the 50% reduction set in the Climate Action Plan (2019) and Programme for Government (2020).

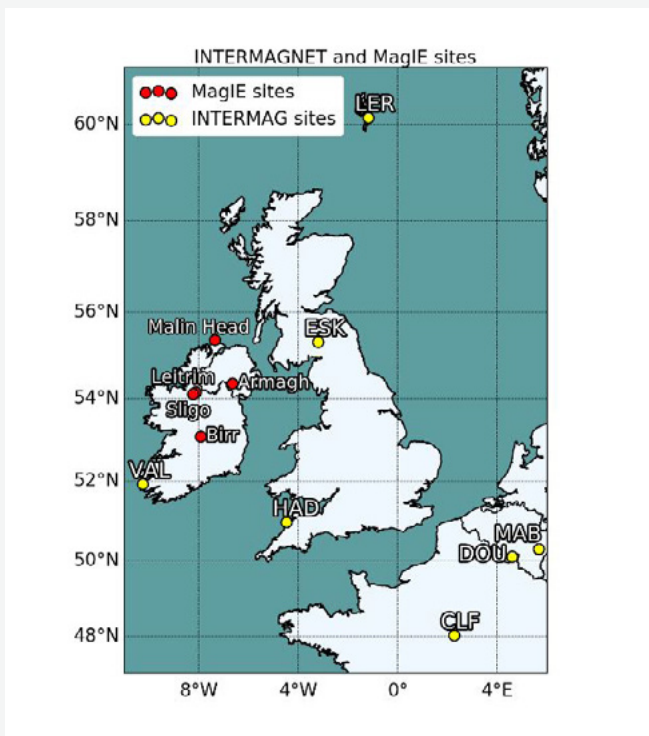




## Goal 9. Industry, Innovation & Infrastructure

**Fundamental research with practical implications for the power grid**

The new knowledge which the researchers at DIAS generate often goes on to have important applications in related areas. Take our work on the Sun-Earth relationship as an example: the Sun is an active star that can produce eruptions of hot gas threaded by magnetic fields. When these solar storms impact the Earth's magnetosphere and upper atmosphere, they can produce spectacular auroral displays which are prized by sky watchers. Though sometimes beautiful, these phenomena can also impact on technology by damaging satellites, interrupting radio communications and navigation systems, and causing fluctuations in electrical power grids on the Earth's surface.



With this in mind, the DIAS School of Cosmic Physics set up the Magnetometer Network of Ireland (MagIE) in conjunction with Trinity College Dublin and Eirgrid plc in 2012 to monitor and give warnings of geomagnetic storms in Ireland. Coupled with comprehensive modelling of the Irish electrical power grid, this is allowing us to test how the Irish power grid responds to geomagnetic variability on a day-

to-day and worst-case basis. In collaboration with the British Geological Survey and the UK Met Office, DIAS has also developed theoretical models to predict the electric fields and currents generated in response to magnetic variations across Ireland and the UK.

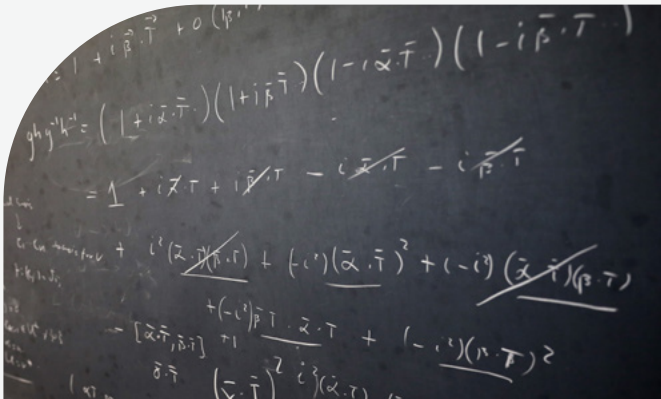
### Data supporting the building of resilient communications infrastructure

Our Astronomy & Astrophysics Section also hosts SolarMonitor.org, a leading on-line tool which automatically reads, calibrates and displays solar data from numerous ground- and space-based observing platforms. Not only does SolarMonitor act as a source for distributing data, it also provides secondary functions such as region flaring probabilities, which are essential to satellite operators, human space-flight and the communications industry in general.

Soon, a more complete understanding of the Sun-Earth connection will become available through ESA's Solar Orbiter Space Craft. DIAS Astronomy & Astrophysics has been involved in writing software and scientific support for the Solar-Telescope Imaging X-rays (STIX) instrument. This instrument will enable us to obtain X-ray images and spectra emitted by solar flares and study fundamental processes involved, such as energy release and electron acceleration and propagation.



Launch of ESA's Solar Orbiter mission from Cape Canaveral Air Force Station in Florida (February 9, 2020). Credit: NASA/Kim Shiflett.



### Theoretical foundations for new technology

The DIAS School of Theoretical Physics investigates the fundamental mathematical structures in which the laws of physics find expression. While this may seem abstract, this research has profound, if long-term, implications not just for our understanding of the structure and origin of the universe, but, through quantum information theory, for the future of computing and the limits of what is computable!

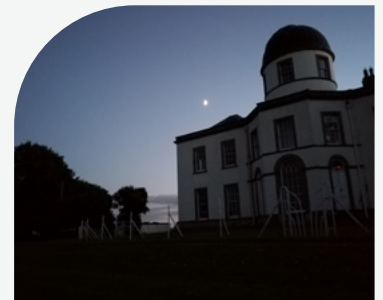
Quantum theory and relativity – two basic applications of mathematics to physics – permeate almost every advance in modern science and technology. In theoretical science, the mutual interaction between mathematics and physics is flourishing. Mathematical concepts and analysis are particularly important in understanding and developing physical theories and, at the same time, ideas from physics have stimulated many new developments in modern mathematics. In this light, quantum computing has been emerging as a new research theme in our School of Theoretical Physics over the course of our current institutional strategy, ‘Embedded globally, strength locally.’ Working with quantum information will transform our technology, with the double challenge of efficient transmission and of quantum computation. New statistical concepts for the description of quantum information and new results on its transmission through noisy channels have already been obtained by our researchers.



## Goal 11. Sustainable Cities and Communities

**Preserving cultural and scientific heritage for the benefit of communities**

DIAS Dunsink Observatory, a part of our Astronomy & Astrophysics Section, has been a centre for astronomical research and public engagement in Ireland since its foundation in 1785 and a home to many of Ireland’s most famous scientists, including Sir William Rowan Hamilton. Each year, Dunsink Observatory hosts a range of public outreach events which allow visitors to explore Ireland’s scientific heritage and learn about how to observe celestial objects. DIAS is working closely with the Office of Public Works, Fingal County Council, and the Department of Further and Higher Education, Research, Innovation and Science to develop the facilities at Dunsink Observatory and to restore and protect its historic infrastructure for generations to come.



In the DIAS School of Celtic Studies, our researchers were informed by earlier challenges faced in the study of Irish manuscripts in the lead-up to seminal publications on Brehon Law and other aspects of the Celtic legacy. In response to this and other concerns, they initiated the visionary Irish Script on Screen (ISOS) initiative in 1999 to digitise and make freely available Ireland’s manuscript wealth online.

Since 1999, ISOS has led to the permanent preservation of 425 of the 5,000 known Irish manuscripts so far and has brought many of those manuscripts now residing outside the country home into a single digital library located in Ireland. The ISOS website receives over 4 million hits from 30 different countries each year and has become a ubiquitous tool for researchers in the field. DIAS and its School of Celtic Studies are currently developing a new fundraising strategy for ISOS, which aims to expand and accelerate the digitisation of the remaining manuscripts.



### Stowe - 792 and 803 AD

Here we see the opening page of the Stowe Missal from The Royal Irish Academy. This is a decorated manuscript which is well over a 1000 years old, having been written sometime between 792 and 803 AD.

DIAS

© Royal Irish Academy, 2001

The Stowe Missal is just one of over 400 manuscripts that have been digitised as part of Irish Script on Screen

fundamental knock-on effects on eruption initiation and the nature of precursory seismicity. These findings could lead to improved eruption forecasting, which is particularly important because scientists expect

glacier-covered volcanoes to erupt more frequently, as ice continues to melt in the years to come.

### Disaster preparedness, resilience and response worldwide

DIAS' research also has important implications for disaster preparedness, resilience and response. There are over 60 active volcanic systems in Europe and European overseas territories. However, because of increased globalisation and international supply chains, Europe is also vulnerable to eruptions worldwide. Therefore, there is also a need for the European volcanological community to provide a coordinated response to global volcanic events.

During 2016 and 2017, ground-breaking new insights into the working of volcanoes were published by DIAS geophysicists. Their work demonstrated that the upper two kilometres of the Earth's crust is substantially weaker than previously thought, which has

Though EUROVOLC has concluded, DIAS is still very much involved in volcano research with ongoing projects in Iceland working on data collecting during the Reykjanes/Fagradalsfjall eruption last year, as well as ongoing deployments at Hekla volcano.

Our Geophysics section are also actively involved in collaborations looking at Sierra Negra volcano in the Galapagos Islands, through the IGUANA project. The research has recently revealed the first ever detailed description of a volcanic eruption from Sierra Negra – one of the world's most active volcanoes – found on Isabela Island, the largest of the Galápagos archipelago and home to nearly 2,000 people. The new understandings developed from the research will allow Ecuadorian volcanologists to track the evolution of unrest for future eruptions in the Galápagos Islands, and communicate it to local authorities and the public.



Sierra Negra volcano is one of the most active volcanoes on the Galapagos Islands, approximately 1,000 km west of continental Ecuador.



Deployment of an Ocean Bottom Seismograph

DIAS plays a role in the development of future researchers through the EU SPIN-ITN (Seismological Parameters and Instrumentation - Innovative Training Network), and the EU IMPROVE ITN (Innovative Multi-disciplinary European Research Training Network on Volcanoes – Innovative Training Network).

### **A tsunami detection precursor**

On the island of Ireland, geological and historical research indicates that, while unlikely, the Irish coast is vulnerable to tsunamis from earthquakes and submarine landslides. Indeed, the Lisbon earthquakes of 1755 and 1761 are known to have caused tsunamis that reached Ireland, as research funded by Geological Survey Ireland has demonstrated. Although Ireland has yet to establish a 24/7 national warning centre, it receives tsunami messages from the French (CENALT) and Portuguese (IPMA) warning centres, which are accredited Tsunami Service Providers of NEAMTWS, via the Global Telecommunications System through Met Éireann.

While relevant work on tsunamis in Ireland has yet to be coordinated into a national system, the DIAS Geophysics Section is contributing knowledge and expertise to this area through the iMARL (Insitu Marine Laboratory for Geosystems Research) infrastructure network of various types of ocean-floor-located

sensors, funded by Science Foundation Ireland and supported by Geological Survey Ireland. In 2018, DIAS became the centre of marine seismology infrastructure and research in Ireland, pioneering the deployment of this broadband ocean-bottom network across a vast area in the North Atlantic, including the development of a permanent ocean-bottom station offshore Ireland.

iMARL comprises broadband Ocean Bottom Seismographs (OBS), broadband acoustic sensors, and sensors for measuring absolute water pressure and temperature at the ocean floor. A precursor system capable of detecting tsunamis forms part of this research infrastructure.

The recent tsunamis felt across Oceania, South East Asia and the Americas as a result of the eruption of Hunga Tonga–Hunga Ha’apai near Tonga highlight the importance of accurate tsunami detection and warning systems and the importance of the work of iMARL.



## Goal 12. Responsible Consumption and Production

### Searching for new means of sustainable mineral exploration and mining

In order to mitigate climate change, we must achieve the sustainable management and efficient use of natural resources.

To satisfy the global metals and mineral demand, for example, a new world-class ore deposit must be discovered roughly every two years. Yet this task is becoming increasingly difficult, as easily accessible deposits are becoming exhausted. Currently, European industry consumes about 20% of the world's mineral products but produces only 3% of them. Despite limited exploration over the last century, there is good potential that new deposits can be found in Europe, but only if modern, innovative technologies are employed, as mining and mineral exploration is taking place at greater depths and in ever more remote locations.

Through its participation in the EU Horizon 2020 project PACIFIC, the DIAS Geophysics Section is contributing fundamental research to a consortium which aims to develop new exploration techniques that respect the environment and incur relatively low costs. The work underway by PACIFIC is focusing on two radically new and complementary techniques based on passive seismic imagery. These techniques will have the accuracy and resolution needed for the minerals industry while at the same time having a relatively low environmental impact.



## Goal 13. Climate Action

### Understanding Earth system change

Understanding of how human activity and anthropogenic carbon release are changing the Earth system - the interaction of our planet's physical, chemical and biological processes - is essential to global sustainable development and to mitigation efforts. Through iCrag, DIAS is a leading partner in Observatory Ireland - Earth System Change, which brings together multi-disciplinary, and multi-institution, research teams to conduct and combine local (in situ) to regional (satellite-based) monitoring of contemporary catchments and marine environments, as well as the study of sedimentary archives that recorded the past physical state of, and changes in, Earth's climates and environment. This aims to improve our understanding of Earth system processes, allowing for improved predictions on how Irish environments, ecosystems and landscapes will respond to anthropogenic climate change, and how this can best be mitigated in a sustainable way.

### Climate change in deep geological time

DIAS pioneered fundamental research into the evolution of the Irish lithosphere, including its vast offshore region, from the foundation of the School of Cosmic Physics. The vast Irish offshore region is a globally unique region to study the longer term (tens of millions of years) impacts of large-scale thermal convective events on non-anthropogenic climate change.

The PORO-CLIM Project is a large, over-arching and multidisciplinary project. It is aimed at understanding the complexity and feedbacks involved in the coupling of atmospheric and ocean processes to those in the Earth's deep convecting mantle. It is built upon the substantial body of work gathered by DIAS researchers and both national and international collaborators along the conjugate continental margins of the North Atlantic. This work involves a large globally distributed team of experts in the diverse scientific fields required for this ambitious project and will introduce the next generation of young researchers to this research viewpoint.

First successful marine experiments took place in the Porcupine Basin and the Hatton-Rockall Basin region to measure critical properties that gauge thermal flux from the Earth in 2021.



### Possible climate change signals in the land-ocean coupling

The interaction with the solid Earth is not confined to the coastal zone. Terrestrial seismometers throughout the world record continuous background low-frequency ground vibrations called microseisms. It is now known that one flavour of these microseisms is generated by ocean waves interacting with the deep ocean floor, well offshore. This has far-reaching consequences for our understanding of the Earth system.

As ocean waves are driven by wind, this means that atmospheric disturbances are coupled to the solid Earth, globally – not merely in areas of terrestrial exposure. This leads to unanswered questions about the potential for atmospheric disturbances to trigger underwater landslides and even possibly trigger earthquakes as they ‘stress’ the sea floor. Employing arrays of terrestrial seismic stations, ocean-sensing infrastructure available through iMARL, and supported by high-end numerical simulations, DIAS using the stormy NE Atlantic as a test bed for investigating the detailed mechanisms associated with ocean–land coupling at regional scales.

In 2013, the publication of a global tomographic model by a researcher at DIAS established the Institute as a leader in seismic tomography of the Earth’s crust and upper mantle. Since then, the model has been used as a reference by Earth scientists all around the world.

This is significant because what happens at depth in the Earth affects topography on the Earth’s surface, which modulates our climate.

At DIAS Geophysics, our researchers are also examining wind- and buoyancy-driven circulations as well as tidally driven circulations within our oceans. Through a collaboration with the European Space Agency (ESA) and its Swarm satellite mission, we are investigating the magnetic signatures of the ocean circulation systems to determine what role the ocean-induced magnetic field may play in this complex process.



## Goal 14. Life below Water

Exploring the deepest ocean

Healthy and productive oceans are essential to sustainable development, yet so much of the Earth’s ocean territory remains unexplored, particularly the sea floor. Strapped to sea-bed landers and deployed on the sea floor, the sensors that make up the Insitu Marine Laboratory for Geosystems Research (iMARL) hosted at DIAS will allow for the detection of offshore earthquakes and offshore storms, in addition to noise in the ocean and biologically generated acoustic signals (e.g. from cetaceans).

While it is intended that this will lead to important impacts in natural resources quantification and natural hazard estimation, iMARL will also facilitate ecological research through environmental and baseline climate-related insitu ocean monitoring and the monitoring of marine noise pollution.

iMARL is also contributing to our understanding of sedimentary basins deep underwater, regions on the planet where vast quantities of sediments accumulate and hydrocarbon resources and deposits are hosted. Broadly, sedimentary basins form when the Earth’s crust is stretched through tectonic processes; however, the details of controls on their evolution are still uncertain.

## “In 2020, DIAS celebrated the 80th anniversary of its foundation as the world’s second and Europe’s first independent institute for advanced study”

DIAS is building on its long history in the study of sedimentary basins through combining new multiscale offshore seismic experiments in the NE Atlantic using a combination iMARL infrastructure and industry data. New high resolution data inversion methods applied to these datasets and supported by very large-scale numerical simulations of seismic wave propagation in offshore regions are leading to a new understanding of basin structure and evolution. These findings have implications for our understanding of geo-resource distributions and past climates in the NE Atlantic region.



### Goal 15. Life on Land

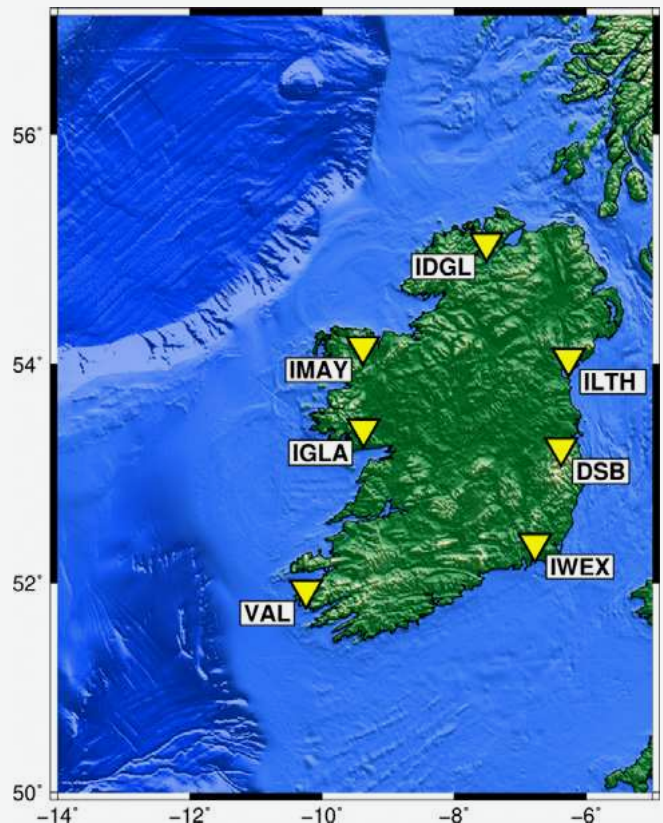
Enabling seismic, climatological and meteorological research globally

Over the eight decades of our existence, a key focus of DIAS’ work has been on furthering our understanding of how the Earth’s systems operate. Complementing our ocean-floor listening operations, the Geophysics Section at DIAS operates and maintains the Irish National Seismic Network (INSN), and since 2018 has done so with support from the Geological Survey Ireland (GSI). The INSN has operated since 1978 and currently comprises seven permanent seismic stations. Data are transmitted from the seismic stations in real-time to the INSN data centre located in 5 Merrion Square, Dublin 2 and to our international partners GFZ (Germany), the British Geological Survey (BGS), ORFEUS and IRIS. The INSN, on the edge of Europe, is part of a global network.

In January 2019, DIAS renewed its commitment to this flagship initiative with an investment of €1.5m to expand and upgrade the network in partnership with GSI. The data provided by INSN plays an important part in enabling research into earth systems which ripples into diverse disciplines such as climatology and meteorology.

### Working to halt biodiversity loss

DIAS Dunsink Observatory sits on a 12.5 acre site. There are two National Monuments and Protected Structures on site, Observatory House and the South Dome but there are also extensive gardens, mostly grass at this time. A plan is being devised, in conjunction with biodiversity specialists, to reduce mowing and improve biodiversity on site.



| Map of current INSN stations across Ireland



DIAS Dunsink  
Observatory



## Goal 16. Peace, Justice and Strong Institutions

### An independent advocate for fundamental research

In 2020, DIAS celebrated the 80th anniversary of its foundation as the world's second – and Europe's first – independent institute for advanced study. A key driver behind the foundation of DIAS in 1940 was the volatile political landscape augured globally by the Second World War. In this context, as well as that of the sustained ideological conflict that engulfed much of the world during the Cold War, DIAS, from its inception, positioned itself to provide a neutral dedicated research space and an intellectual environment that is conducive for local and international researchers to conduct advanced studies, explore ideas, and engage in unconstrained thought. This is reflected in the strong internationalist outlook which continues to characterise the Institute to the present day.

As a neutral player both in Ireland and internationally – and with a unique focus on advanced fundamental research in our core disciplines - we believe that we have a responsibility and duty to our disciplines and, by extension, the associated communities within those systems.

Our commitment to strengthening these disciplines and communities, as well as to contributing the power of independent research to the development and maintenance of strong and just institutions, is reflected in the four goals in our current DIAS institutional strategy, 'Embedded globally, strength locally.'

These are:

- Discovery of new knowledge and understanding through excellence and researcher-led endeavour.
- International research collaboration benefitting Ireland and the world.
- Attraction and cultivation of research leaders.
- Strengthening disciplines and research communities nationally.

### Supporting national policy

DIAS is contributing to the delivery of *"The Global Island: Ireland's foreign policy for a changing world"*, in both general terms and as the host, on behalf of the Department of Foreign Affairs and Trade, of the national office for the Comprehensive Nuclear Test-Ban Treaty Organisation (CTBTO).

DIAS contributes to 'developing North-South research and innovation capability' in a range of areas and is already active on an all-island basis in the areas of astronomy, astrophysics and geophysics.





The then Tánaiste and Minister for Foreign Affairs and Trade, Eamon Gilmore, T.D. jointly opened, with Dr Lassina Zerbo of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Organisation, Ireland's National Data Centre for the Comprehensive Nuclear Test-Ban Treaty Organisation at DIAS. 22 June 2012.



## Goal 17. Partnership for the Goals

**A galvaniser for our disciplines**

DIAS stands out as an entity which, from inception, has been highly internationalised and globally recognised. As a result, DIAS is recognised for its expertise in its areas of advanced study and regularly participates in projects and consortia at national and international levels. DIAS has retained this orientation, both on its own behalf and on behalf of the Irish research community, throughout its history. When we consider the focus of DIAS' core disciplines and the global nature of many of these areas, it is clear that collaboration and cooperation will remain critical to our work into the future.



2022 marks the 75th anniversary of the establishment of our School of Cosmic Physics

In keeping with this character, DIAS is a galvaniser in enabling national infrastructures and collaborative research centres for use by multiple parties in Ireland, including as:

- leader/operator of the (i) the Irish National Seismic Network, (ii) the Irish Script on Screen portal and (iii) iMARL;
- a key partner in national initiatives iCrag and ICHEC (the Irish Centre for High-end Computing).

Furthermore, DIAS is the custodian of national heritage site DIAS Dunsink Observatory.

### An internationalist outlook

In the international arena, DIAS is a clear beacon of Ireland's long-standing commitment to fundamental research and multi-lateral cooperation. As such, researchers at DIAS are contributing their expertise and experience to large-scale projects and infrastructures such as:

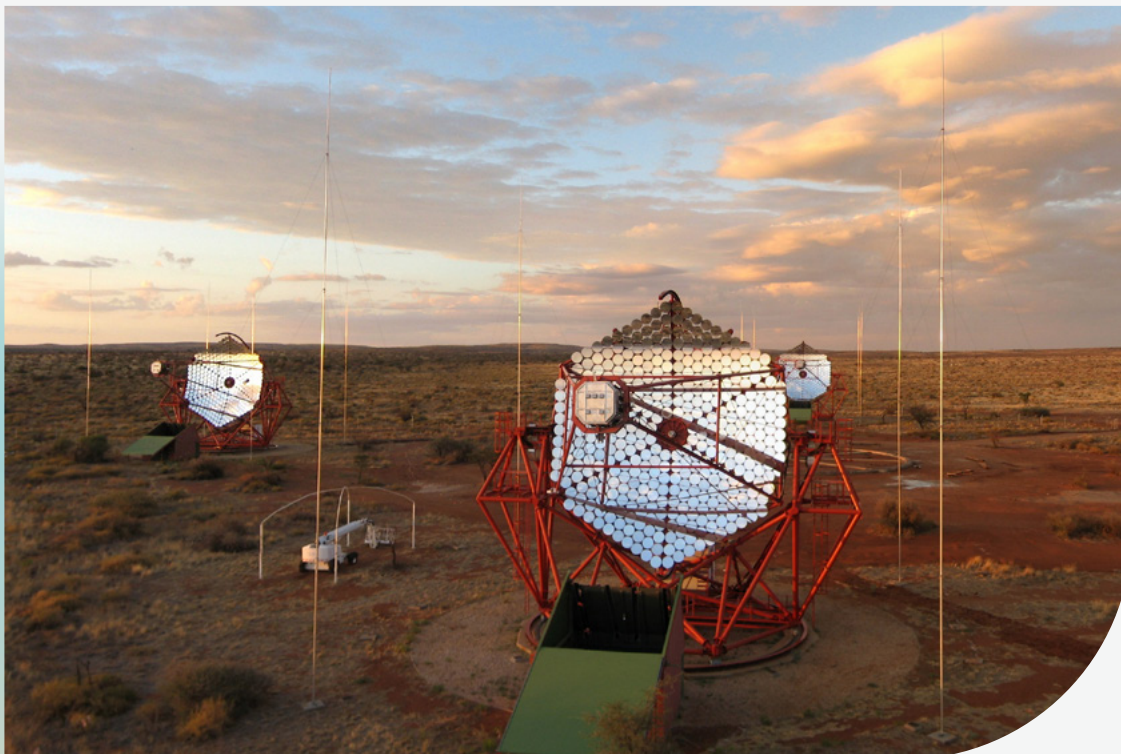
#### Ground based:

- As a key partner in LOFAR , a global radiotelescope array;
- The High Energy Stereoscopic System (HESS) telescope, of which DIAS was an instigator;
- The European Southern Observatory (ESO), as the Irish Government's nominee to ESO's scientific council; and

**Space based:**

- Co-PIs in the European Space Agency's Ariel and Solar Orbiter missions;
- As the only Irish research partner in the NASA/ESA/CSA James Webb Space Telescope (the largest telescope ever built in space).

DIAS Astrophysics is involved in the International Astronomical Union's European Regional Office of Astronomy for Development (E-ROAD). This initiative aims to further the use of astronomy, including its practitioners, skills and infrastructures, as a tool for sustainable development globally. The perspective of astronomy on our place in the universe and the technologies that are developed because of it are powerful tools to foster socio-economic development. The role of science in the achievement of the United Nation's Sustainable Development Goals (UN SDGs) is emphasised strongly and they directly form the framework for the OAD strategy. In particular, goals SGD17, SDG 9.b, and SDG 4.7 are part of the strategic goals of the initiative.

**Read more**[www.astro4dev.eu/about-us/strategic-goals](http://www.astro4dev.eu/about-us/strategic-goals).

The H.E.S.S. telescope in Namibia (image copyright Dalibor Nedbal 2007)

# Conclusion

## Research with long-term, global relevance

Worldwide, there is growing concern about the sustainability of our planet and a strong desire to understand our solar system, our Earth and its natural systems better. Never before has there been such an imperative for progress in terms of our understanding of the underpinning principles for our existence. Alongside these issues, the concept of identity and the understanding of our past and ourselves as a people – whether on our own island, as part of Europe or as global citizens – are also growing themes in public discourse. Such major issues reflect the work conducted across our three Schools. While these Schools operate in different areas of human thought and experience, they have the common purpose of extending the boundaries of knowledge and understanding – and of fostering critical analysis.

As a reflection of this imperative, public outreach to increase the interest and understanding of global citizens in Science, Technology, Engineering & Mathematics (STEM) and Arts, Humanities & Social Sciences (AHSS) disciplines is a core activity at DIAS.

DIAS will continually endeavour to play its role in supporting the sustainable development goals and through frequent review of its work and activities strive to ever enhance its contribution.

DIAS is committed to the achievement of the Sustainable Development Goals



# DIAS

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