

Research and Innovation Overview 2024

Department of Physics Experimental Physics

In the academic year 2022-23, the Department of Experimental Physics at Maynooth University comprised six permanent and two temporary academic staff, supported by technical and administrative staff. The department was home to eight PhD students and one Research MSc student, with one PhD student graduating during the year. The department produced 27 peer-reviewed journal articles and five conference proceedings, securing research grants totalling €1,107,044.

Head of Department of Experimental Physics: Dr. Crídhe O'Sullivan



Research Themes and Focus Areas

The department's research spans a wide range of experimental physics topics, with key focus areas including:

- **Terahertz Space Optics:** This research involves designing cutting-edge optics for space missions, with ongoing collaborations on far-infrared interferometers and balloon-based cosmic microwave background experiments.
- **MKID Technology:** The department continues to make significant contributions to the development of Microwave Kinetic Inductance Detectors (MKIDs) for astrophysical applications.
- **Star and Planet Formation:** Research in this area focuses on protostellar jets and exoplanet detection using the latest telescope technologies, such as the Hubble Space Telescope and the Very Large Telescope.



Significant Research Outputs

In 2022-23, the Department of Experimental Physics produced several high-impact research outputs and secured major research funding:

Publications

- Dr Colm Bracken and colleagues published a paper in AIP Advances on energy resolution of MKIDs, furthering the collaboration with The Dublin Institute of Advanced Studies (DIAS).
- The MKID group presented three papers at the 2023 Conference for Low Temperature Detectors, and two papers were accepted for publication in a special issue of Journal of Low Temperature Physics.
- Dr Emma Whelan and her team's research on MHD winds and protostellar jets was featured in a ESO Picture of the Week, highlighting their work with the Very Large Telescope.

Awards

- The MKID project led by Dr Colm Bracken received funding through SFI's Frontiers for the Future programme, securing €613,466 for a four-year period (2023-2026).
- Dr Patrick Kavanagh, recruited in 2023, holds an SFI-IRC Pathway Fellowship worth €336,786, supporting his work on the James Webb Space Telescope (JWST) mission.



Collaborations and Partnerships

The department maintains strong national and international collaborations, with projects that span astrophysics, atmospheric physics, and instrumentation development:

- **QUBIC Experiment:** The department is involved in the QUBIC project, a ground-based experiment designed to measure the B-mode polarisation of the cosmic microwave background. This project is a collaboration between researchers from France, Italy, Argentina, and Ireland, and has begun observations in Argentina.
- **BISOU Project:** The Balloon Interferometer for Spectral Observations of the Universe (BISOU) project, funded by CNES, continues to develop a spectrometer for measuring cosmic microwave background distortions, with Maynooth researchers contributing to the optical design.



Research Impact and Societal Contributions

The department's research is contributing to major advancements in space exploration and astrophysical understanding. In addition, its outreach programs, including <https://www.spaceweek.ie/events/maynooth-astrophysics-2/Spaceweek>, engage thousands of students annually, fostering interest in the physical sciences.



Future Directions

The department plans to continue its pioneering work in terahertz space optics, MKID development, and star and planet formation. Future projects will focus on expanding collaborations with international institutions and contributing to major space missions, including continued involvement in the James Webb Space Telescope and the Hubble Space Telescope.

The Department of Experimental Physics at Maynooth University remains at the forefront of experimental research in physics. With strong research outputs, successful international collaborations, and a commitment to public engagement, the department continues to make significant contributions to both the academic community and the broader field of astrophysics. Another strategic direction will be air pollutant analysis and climate physics.