



Tobias Feger  
PhD candidate

# Physics and astronomy

From research into granny galaxies and supermassive black holes to nano-optical tweezers and SuperDots, Macquarie's physics and astronomy researchers are uniquely positioned to help shape the complex issues that define the future of humanity.

Our scientists enjoy outstanding international collaborative links and publish their research in high-impact journals. As a higher degree research candidate, you'll work alongside outstanding researchers on fundamental and applied physics in optics, photonics and lasers; astronomy and astrophysics; or quantum information science.

We work on a range of cutting-edge projects, involving:

- building powerful new lasers with pure diamond crystals
- constructing 3D quantum logic circuits using high-intensity femtosecond lasers
- designing new sensors based on levitated quantum mechanical systems
- finding cell populations with enhanced therapeutic value using advanced imaging
- harnessing the angular momentum of light at the quantum level
- studying collisions between planets and dying stars
- using nanoparticles to identify diseases.

Our physics and astronomy researchers enjoy an international reputation as leaders in their fields. In the most recent Excellence in Research for Australia evaluation, our physical sciences research received a rating of 5 out of 5 – 'outstanding performance well above world standard', as did our research in the sub-disciplines of astronomical and space sciences, optical physics, and quantum physics.

Macquarie physicists have partnered in successful commercial ventures leading to spin-off companies such as semiconductor producer BluGlass and Laser Micromachining Solutions, which provides microfabrication services to companies and universities across Australia.

Graduates from Macquarie have forged successful careers in Australia and overseas, obtaining academic, post-doctoral research, industry and government positions.

Additionally, our higher degree research candidates have been successful in obtaining national and international awards including the Jak Kelly Award, Royal Society of New South Wales Scholarships, travel grants from The Optical Society and International Society for Advancement of Cytometry, and awards at major conferences.

[mq.edu.au/research/physics-and-astronomy](https://mq.edu.au/research/physics-and-astronomy)



**MACQUARIE**  
University  
SYDNEY · AUSTRALIA



### AREAS OF SPECIALISATION

- Astronomy, astrophysics and astrophotonics
- Biophotonics
- Lasers and light sources, photonic structures and devices
- Molecular physics
- Nanotechnology
- Quantum information science and technology
- Semiconductors and materials



### FACILITIES AND EQUIPMENT

- Access to onshore and offshore 2–8 metre telescopes
- Laser micromachining, nanocharacterisation and diamond growth facility
- More than 30 well-equipped laboratories and clean rooms
- Optical and photonic microcharacterisation and microscopy facilities
- Thin film deposition and crystal growth systems



### RESEARCH HUBS

- Macquarie University Research Centre for Astronomy, Astrophysics and Astrophotonics
- MQ BioFocus Research Centre
- MQ Photonics Research Centre
- Research Centre in Quantum Science and Technology



### FEDERALLY FUNDED CENTRE

- Macquarie is home to major nodes in the ARC Centres of Excellence for Engineered Quantum Systems, Nanoscale BioPhotonics and Ultrahigh-bandwidth Devices for Optical Systems, as well as the OptoFab node of the Australian National Fabrication Facility.



### OUR RESEARCH PRIORITIES

We pursue excellence in a broad range of research areas. Our five interdisciplinary strategic research priorities – Healthy People, Resilient Societies, Prosperous Economies, Secure Planet and Innovative Technologies – respond to globally significant challenges and opportunities to improve the lives of millions. Together, these research priorities provide a focal point for research, with discoveries made under these priorities translating into real improvements in the lives of local, national and global communities.

### JOINTLY SUPERVISED PHD PROGRAMS

Macquarie actively encourages cotutelles and joint degrees – shared supervision arrangements with universities whose research activity strongly aligns with ours. Under each model, you are enrolled at two universities with a principal supervisor at each and may be eligible for additional scholarship support.

[mq.edu.au/cotutelle-and-joint-phd](http://mq.edu.au/cotutelle-and-joint-phd)



#### FIND OUT MORE

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