Monash University

MONASH PHYSICS AND ASTRONOMY

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GROUP OF EIGHT AUSTRALIA

PHYSICS AND ASTRONOMY

Have you ever wondered if absolute zero temperature can be reached, how a black hole forms, or what the Universe is made of? Have you ever had a CT, an ultrasound or an MRI scan? Do you use a smart phone, the internet or a computer?

Almost everything that makes your life more comfortable, or allows you to work efficiently in the 21st century, is due to engineered solutions based on physical principles. For example, the discovery of electricity, magnetism, relativity and quantum mechanics came about through human curiosity; however, technologies based on these discoveries did not eventuate until much later.

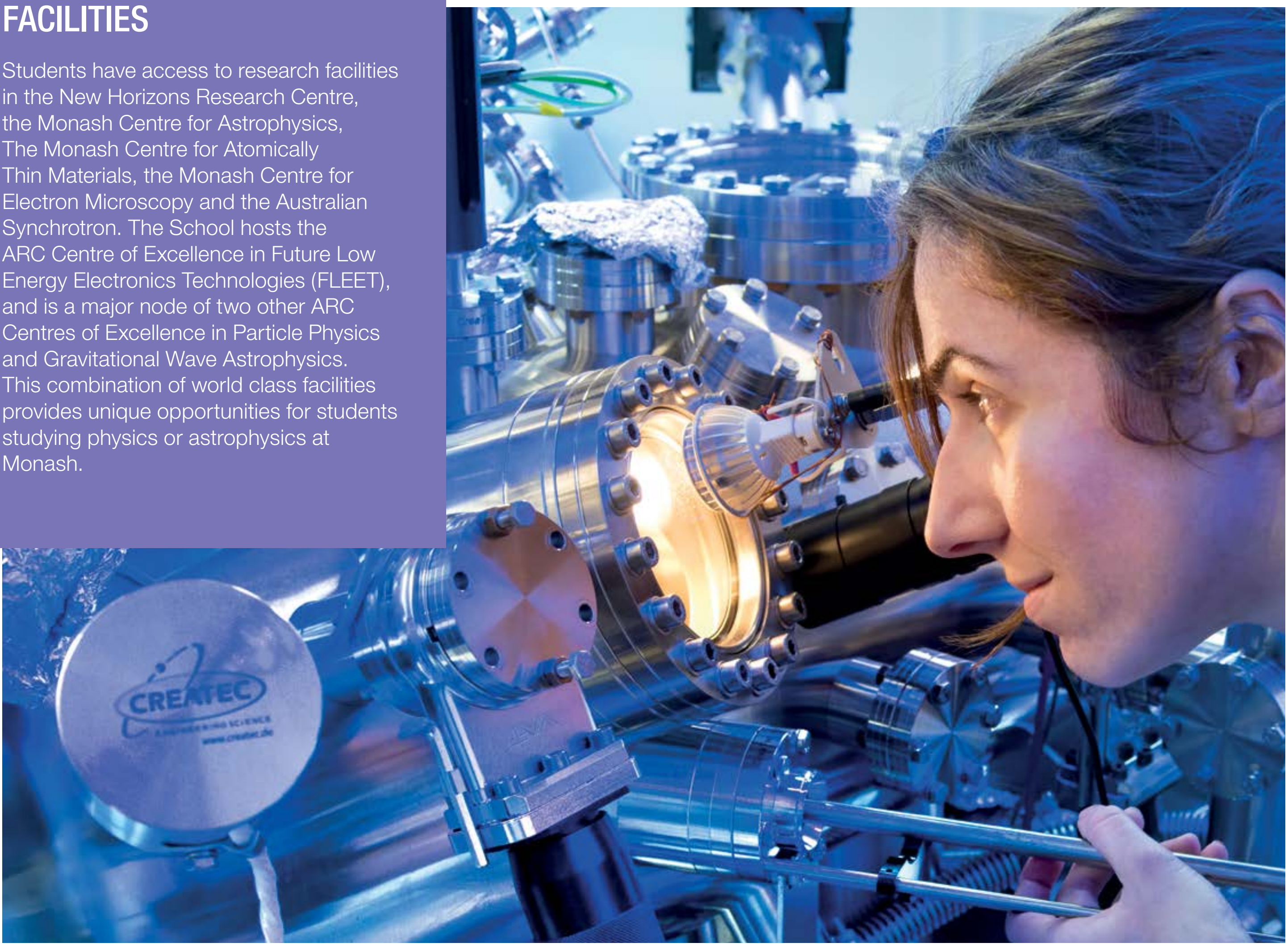
Physicists and Astrophysicists explore the Universe at all scales of length, time and energy – from sub-atomic particles (such as the Higgs boson) to the large scale structure of the Universe; from ultra cold gases (close to absolute zero temperature), to what happened at the Big Bang. Physics seeks to understand the nature of space, time and matter, and in doing so it addresses profound philosophical questions about the nature of reality and the origin of our Universe.

The skills you gain through studying physics and astrophysics at Monash can be used in many areas, such as: developing medical instrumentation, radiotherapy treatment of cancer, modelling climate and weather, analysing big data and financial systems, developing innovative ways to address sustainability, exploring emergent behaviour in complex biological systems, and understanding the function of the brain.

Physics and astronomy at Monash is going through an exciting period of growth – investing significantly in people and facilities. We are working across a broad range of creative, curiosity-driven research areas that will impact on future generations – including biomedical imaging, quantum computing, atomtronics, and novel materials for next generation photonics, optoelectronics and spintronics.

FACILITIES

Students have access to research facilities in the New Horizons Research Centre, the Monash Centre for Astrophysics, The Monash Centre for Atomically Thin Materials, the Monash Centre for Electron Microscopy and the Australian Synchrotron. The School hosts the ARC Centre of Excellence in Future Low Energy Electronics Technologies (FLEET), and is a major node of two other ARC Centres of Excellence in Particle Physics and Gravitational Wave Astrophysics. This combination of world class facilities provides unique opportunities for students studying physics or astrophysics at Monash.



PHYSICS AND ASTRONOMY COLLABORATIVE-LEARNING ENVIRONMENT (PACE)

We've developed a new way of teaching physics and astronomy, which we call PACE. The PACE model of Studio Physics and Astronomy replaces lectures with hands-on learning in small groups.

Studio Physics and Astronomy teaches students creative problem-solving, effective communication, teamwork and adaptability in spaces purpose-built for this way of learning. We are creating a community of students who are active learners and are able to apply the knowledge they have learned, within and outside of the classroom – in creative and imaginative ways.

NEW HORIZONS RESEARCH CENTRE

The New Horizons Research Centre opened in 2013. It is a $175M research and training complex that houses the research laboratories of the School of Physics and Astronomy. The New Horizons Research Centre brings together world-class researchers from Monash and CSIRO, with diverse backgrounds in physics, astrophysics, engineering, IT and biosciences. The scope of the new Horizons Research Centre is beyond anything else that exists in Australia – drawing on an incredible array of talent, state of the art equipment and specialised infrastructure to generate and develop innovative ideas across disciplines. It houses the Monash Centre for Atomically Thin Materials and the ARC-funded Centre of Excellence in Future Low Energy Electronics Technologies (FLEET), where researchers are pushing the boundaries of the new quantum revolution.

WHAT TO EXPECT IN FIRST-YEAR PHYSICS AND ASTRONOMY

Monash is one of a small number of universities in Australia that offers the full spectrum of subjects in physics, astronomy and astrophysics. Studying at Monash allows you to explore everything from atomic physics to ultracold gases; from computational astrophysics to observational astronomy; from condensed matter physics to nanotechnology; from electron microscopy to synchrotron science; from elementary particle physics to quantum cosmology; from biophotonics to optoelectronics; from medical imaging to x-ray science, and much more. If you have a passion for physics and/or astronomy, then Monash is the place for you!

The subjects on offer in the minors, majors and extended majors are complemented by facilities that are the best in the world. The Monash experience includes hands-on activities in our laboratories and the use of optical/radio telescopes at our astronomical observatory. You will have access to state of the art equipment, computing facilities, and custom-designed spaces that promote learning and student-staff interactions. You will have the chance to carry out a genuine research project and publish your work in peer-reviewed journals. You will benefit from working with researchers who are world leaders in their fields. At Monash you have the opportunity to build skills that are highly valued by employers, and to achieve your potential.

SEMESTER ONE

Name	Unit information	What you will study
Classical physics and relativity **PHS1011**	If you have sufficient high school physics and/or mathematics (for specifics, see the handbook entry for this unit) and wish to study physics or astrophysics, you need to take this unit. This unit builds on the topics you have already studied. Calculus is required. MTH1020 (or equivalent) is recommended alongside PHS1011 because this is the level of mathematics required for the subsequent unit, PHS1022, in semester 2.	Classical mechanics, thermal physics and relativity.
Foundation physics **PHS1001**	This unit is for students who wish to study physics or astrophysics but do not meet the requirements for entry to PHS1011. No specific prerequisites; a general science and mathematics background is sufficient. No calculus is used – though, if you study physics beyond this unit you will need calculus. For further progression in physics, MTH1020 (or equivalent) is recommended alongside PHS1001.	Classical mechanics, electricity, waves and modern physics.
Physics for the living world **PHS1031**	Suitable for students with a broad interest in science – of particular relevance to students interested in biology, physiology and biomedicine. No specific prerequisites; a general science and mathematics background is sufficient. No calculus is used.	Important biophysical processes involving: energy, biomechanics, fluids, sound, light and electricity. Key technologies, such as radiation therapy and medical imaging systems, will also be studied.
Earth to cosmos – introductory astronomy **ASP1010**	This unit is suitable for students with a broad interest in science, or to complement your other studies in physics or astrophysics. There are no specific prerequisites; a general science and mathematics background is sufficient. No calculus is used. Note: If you plan to continue with astrophysics at second level, you will need to take PHS1022 or PHS1002 and the relevant mathematics units.	Provides an introduction to astronomy, including planets, the solar system, stars, galaxies, cosmology and extreme events in the Universe.

SEMESTER TWO

Name	Unit information	What you will study
Fields and quantum physics **PHS1022**	This unit continues on from PHS1011; it requires PHS1011 and MTH1020, or equivalent. It provides a route to Level 2 (second year) physics and astrophysics units. MTH1030, or equivalent, is recommended alongside PHS1022 as this is the level of mathematics required for second year (Level 2) physics and astrophysics units.	Gravity, electromagnetism and quantum physics.
Physics for engineering **PHS1002**	This unit continues on from PHS1001; it requires PHS1001, or equivalent, and an understanding of calculus. It provides a route to Level 2 (second year) units. For further progression in physics, MTH1030 (or equivalent) is recommended alongside PHS1002. Physics for engineering can be taken as a stand-alone elective by Engineering students who have sufficient high school physics and/or mathematics (for specifics, see the handbook entry for this unit). However, Engineering students who wish to study some physics (particularly if they wish to continue studying physics into second year) should take the appropriate PHS1001/PHS1002 or PHS1011/PHS1022 stream, if they can fit this into their unit selections.	Rotational mechanics, gravity, electromagnetism and quantum physics.
Life in the universe – astrobiology **ASP1022**	This unit is suitable for students with a broad interest in science, or to complement your other studies in physics or astrophysics. There are no specific prerequisites (e.g., you do NOT require ASP1010 to select ASP1022); a general science and mathematics background is sufficient. No calculus is used. Note: If you plan to continue with astrophysics at second level, you will need to take PHS1022 or PHS1002 and the relevant mathematics units.	The characteristics of life, how life first appeared on Earth and the conditions for life to appear elsewhere in the cosmos.

*Further information about a specific unit can be found by searching the web for “Monash Handbook” and entering the relevant unit code (e.g. PHS1022).

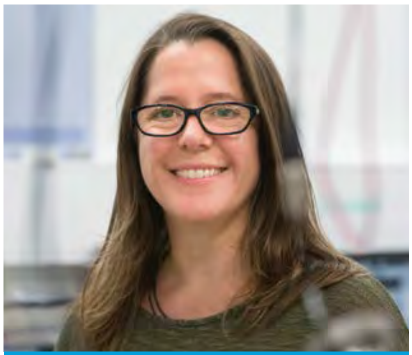
WHERE PHYSICS OR ASTROPHYSICS CAN TAKE YOU

Our graduates have varied and diverse career options

Studying physics or astrophysics at Monash can take you to places we are yet to imagine. Graduates with physics or astrophysics majors are highly skilled in empirical reasoning, computational and theoretical modelling, data analysis and visualisation. At Monash we will help develop and hone these skills and, of equal importance, we will provide you with an environment in which you can work as part of a team, communicate your ideas, think creatively and solve problems. These are essential skills for the workplace, and key to any career.

Some career options include:

- Accelerator physicist
- Acoustician
- AI/machine learning
- Astrophysicist
- Atmospheric physicist
- Big data analyst
- Biophysicist
- Climate modeller
- Electron microscopist
- Energy consultant
- Environmental physicist
- Financial analyst
- Forensic physicist
- Geophysicist
- Industrial physicist
- Information security analyst
- Instrumentation physicist
- Materials scientist
- Metallurgist
- Medical physicist
- Nuclear physicist
- Optical physicist
- Observational astronomer
- Particle physicist
- Patent attorney
- Physics teacher
- Radiation oncology physicist
- Radiation protection practitioner
- Renewable energy manager
- Solar energy physicist
- Synchrotron scientist
- Science journalist
- Telecommunications consultant
- University lecturer



LINDA CROTON

Linda studied astronomy in the United States and Germany, and worked as a spacecraft controller for two NASA science missions at the University of California, Berkeley's Space Sciences Laboratory. After several years away from science, to start a family, and a move to Australia, she decided to pursue a PhD. Monash offered the best opportunity for Linda to combine her experience in image analysis with an interest in medical imaging. She is developing new techniques for imaging the brain to enable the visualisation of soft tissue structures at a higher resolution than was previously possible.

HONOURS AND MASTER'S DEGREES

HONOURS PROGRAMS

Following the completion of an undergraduate BSc degree, you can undertake a one-year program leading to an honours degree in physics or astrophysics – BSc (Hons).

The honours year provides you with the skills to conduct original research and a sound scientific background for our complex and increasingly technologically orientated world.

The program offers a wide choice of lecture topics and a research project that is carried out over the academic year.

For more information visit: **monash.edu/science/schools/physics/honours**

MASTER'S DEGREES

The Master of Science degrees in physics and astrophysics are two-year expert master's courses that prepare you for professional employment or for doctoral research.

These advanced programs are for science graduates who have completed an undergraduate BSc degree in physics, astrophysics or a cognate discipline.

The master's degrees in physics and astrophysics offers a wide range of advanced coursework and a research project that is carried out over two years.

For more information visit: **monash.edu/master-science**

CHRIS WHITTLE

Studying Science at Monash gave Chris flexibility in choosing his subjects, allowing him to build his degree around his passions. Collaboration with physics researchers has been a highlight of his studies, and Chris is a member of the LIGO Scientific Collaboration, which announced the detection of gravitational waves in 2016, one hundred years after their prediction by Einstein. During his honours year, Chris spent three months in the United States working on the commissioning of Advanced LIGO to improve the sensitivity of the interferometer to gravitational waves. Chris is currently undertaking a PhD at the Massachusetts Institute of Technology.

OUR RESEARCH

The School conducts research within four broad research themes

In the most recent national audit of research excellence (ERA 2018), the School obtained the maximum overall rating of 5 for Physical Sciences, including the maximum rating of 5 in each of our assessed fields of research and the highest rating for the impact of our research – one of only a handful of universities in Australia to achieve these outstanding results.

THE QUEST FOR NEW PHYSICS AND SYMMETRIES

Researchers in the School are tackling some of the most profound questions in science, such as the origin of space, time and matter. We study the ultimate building blocks of nature – the basic objects that make up our Universe and the physical laws that govern them. Our research encompasses both standard model physics, such as the electroweak interaction and quantum chromodynamics (which describes quarks and gluons), and physics beyond the standard model, including: dark matter, dark energy, supersymmetry, the origin of neutrino masses, matter-antimatter asymmetry, extra dimensions and quantum cosmology. As a partner in the ARC Centre of Excellence for Particle Physics at the Terascale, we conduct research in collaboration with leading groups worldwide, including CERN – home of the Large Hadron Collider and J-PARC in Japan.

THE NEW QUANTUM REVOLUTION

The first quantum revolution uncovered the rules that govern the behaviour of atoms – quantum mechanics. Understanding and applying these rules are pivotal to technologies that underpin much of modern society. For example, the computer and communications revolution is based on our ability to control electrons and photons.

In the 21st century, we are poised to take advantage of a new quantum revolution – one which will allow us not only to understand the behaviour of atoms, but to engineer and control quantum states of matter and light with unprecedented precision, as in the emerging area of atomtronics.

The School has established the Centre for Atomically Thin Materials, focussed on transformative technologies for society, such as graphene-based electronics, spintronics, photovoltaics and nano-engineered quantum devices.

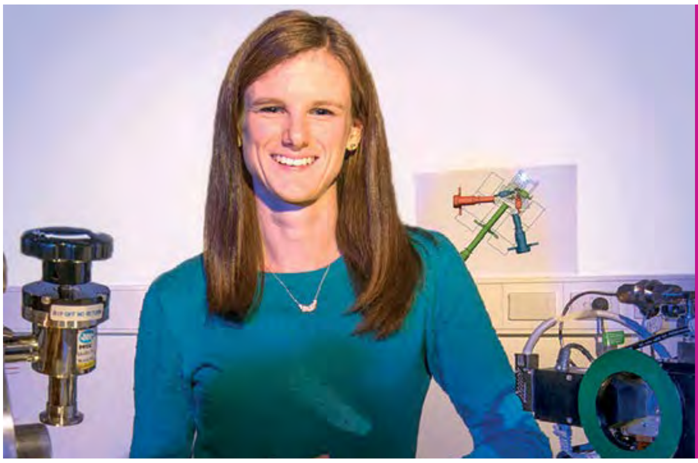
The School is host to a major new ARC Centre of Excellence in Future Low Energy Electronics Technologies (FLEET), which has set itself the ambitious goal of re-inventing the building blocks of the next generation of electronics, based on revolutionary new ideas in topological states of quantum matter.

NEW WINDOWS ON THE UNIVERSE

Astronomers and astrophysicists in the School are exploring the Universe – from the Big Bang and first stars to the largest cosmological scales. The School hosts the Monash Centre for Astrophysics (MoCA), which is one of the most diverse astrophysics research groups in Australia. Major areas of research include: active galaxies, astrophysical fluid dynamics and magnetohydrodynamics, galaxy evolution, first stars, the formation of stars, stellar evolution, stellar nucleosynthesis, nuclear astrophysics, chemical evolution, galactic archaeology, supernovae, supernova remnants, neutron stars, stellar transients, supermassive black holes, high energy astrophysics, gravitational wave astronomy, stellar and planetary dynamics, and exoplanets. Our researchers utilise major observational and supercomputer facilities; we are involved in planning for the next generation of observatories, such as the SKA and Giant Magellan Telescope. The School is also a member of the Joint Institute for Nuclear Astrophysics and has close collaborations with the Center for Nuclear Astrophysics at Shanghai Jiao Tong University. The School is a major partner in the ARC Centre of Excellence for Gravitational Wave Discovery (OzGrav), allowing us to capitalise on the new age of gravitational wave astronomy.

NEW WAYS OF SEEING AND UNDERSTANDING THE WORLD

Imaging and computational sciences have driven discoveries in materials science, biological sciences and medicine. The School is a leader in imaging with light, x-rays and electrons. Using world-class imaging facilities in the Monash Centre for Electron Microscopy (MCEM), the New Horizons Research Centre, the Australian Synchrotron (adjacent to Monash), and synchrotron radiation facilities in Europe, Japan and the United States, we are carrying out research that is positively impacting on the future prosperity and health of our nation. Our insights with x-ray phase contrast imaging of lung aeration at birth have provided better care for infants born preterm with under-developed lungs, thereby increasing survival rates. Other research, focused on imaging the airways during delivery of a treatment for Cystic Fibrosis, has improved our understanding of this genetic disorder. Researchers using the world's most advanced electron microscopes in MCEM are developing new ways of imaging and designing advanced functional materials. From atom to device and from molecule to organism, physics has a critical role to play in 21st century technology and biology – it is central to the development of tools and insights that will enable new discoveries and for the understanding of complex systems.



DR KAYE MORGAN

Kaye is a ARC Future Fellow and former VESKI Fellow, who works in the field of phase contrast x-ray imaging (PCXI) using synchrotron radiation. The techniques developed by Kaye have been applied to sensitively image soft tissue at high resolution. Her work on imaging the airways has led to improved treatment of Cystic Fibrosis. As part of her VESKI Fellowship, Kaye spent two years at the Institute for Advanced Study at the Technical University of Munich, where she developed new generation x-ray sources capable of capturing not only structural information, but also high-speed dynamics in an "x-ray movie".

SOME OF OUR PEOPLE

ASSOCIATE PROFESSOR MEERA PARISH

Meera is a leading theoretical physicist working in ultracold atomic gases and superconductivity. Since obtaining her PhD in 2005, Meera has made significant contributions to our understanding of new states of quantum matter and the collective behaviour of fermionic condensates, superconductivity, and magnetotransport. Her outstanding contributions to these fields led to the award of the Institute of Physics Maxwell Medal and Prize in 2012 (previous winners include Stephen Hawking and Nobel Laureates).

DR JASMINA LAZENDIC-GALLOWAY

After obtaining her PhD in Australia, Jasmina held postdoctoral fellowships at the Harvard-Smithsonian Center for Astrophysics and MIT. She then came to Monash as an inaugural Margaret Clayton Fellow in 2008. Her research involves supernova remnants and neutron stars, both products of massive star explosions. Jasmina is also passionate about learner-centred practices and incorporating the excitement of scientific research into her undergraduate courses. She is using innovative teaching practices in the School's first year Physics and Astronomy Collaborative-learning Environment (PACE), where she teaches introductory astronomy and astrophysics, using a Studio approach to student learning.

ASSOCIATE PROFESSOR DANIEL PRICE

Daniel is a former ARC Future Fellow who started his career with a science degree at Monash. This led to a PhD at the University of Cambridge and two postdoctoral fellowships before he returned to Monash. Daniel develops advanced simulation techniques for astrophysics (using some of the world's most powerful supercomputers) to model the birth of stars from interstellar gas clouds, the formation of planets from discs around newborn stars and the flow of gas around black holes. Techniques and computer codes developed at Monash are used around the world for modelling all kinds of exotic astrophysical phenomena.

DR KAVAN MODI

Kavan is an ARC Future Fellow who works in quantum information sciences. Instead of trying to understand the details of specific systems involving atoms or photons, he tries to make sense of the logic of the quantum world. He investigates how the rules of quantum mechanics could allow us to solve tough problems, make better sensors, and transport energy faster. Kavan has made substantial contributions to our understanding of noisy quantum correlations in quantum technologies, such as quantum computers and sensors. Presently, he is developing a theoretical framework to characterise the most general aspects of quantum dynamics, with applications to quantum batteries and the emerging area of quantum biology.

ASSOCIATE PROFESSOR PETER SKANDS

Peter is a former ARC Future Fellow whose research interests are closely tied to the Large Hadron Collider (LHC) at CERN in Geneva, where he used to work. The LHC is a high energy particle accelerator and the world's largest scientific instrument. Its extreme energies give rise to spectacular phenomena called 'jets' (sprays of nuclear matter produced by fragmenting quarks and gluons) and 'strings' (which enforce confinement of quarks and gluons inside hadrons). Peter is the author of an advanced set of computational tools called PYTHIA, which are used to accurately model high energy particle collisions. PYTHIA was exploited in the discovery of the Higgs boson and is one of the most highly cited particle physics publications in the world.

PROFESSOR MICHAEL FUHRER

Professor Michael Fuhrer is a former ARC Laureate Fellow and Director of the Monash-led ARC Centre of Excellence in Future Low Energy Electronics Technologies (FLEET), which aims to re-invent the transistor based on new developments in condensed matter physics, such as topological insulators. Michael has also set up the Monash Centre for Atomically Thin Materials, to explore the forefront of two-dimensional (2D) materials, such as graphene – a single atomic layer of graphite found in ordinary 'lead' pencils. His research team is investigating many novel 2D layered materials, with applications in spintronics, nanoscale electronics, optoelectronics, and photovoltaics. These new materials have the potential to revolutionise electronics and computing by developing an alternative to silicon-based chips.

SOME OF OUR PEOPLE

PROFESSOR ULRIK EGEDE

Professor Egede is an experimental high energy particle physicist. He is a member of the LHCb collaboration located at the Large Hadron Collider at CERN. Using some of the largest computing networks in the world, Ulrik investigates how the Universe works at the very smallest scales. He arrived at Monash in 2019 from Imperial College London, where he participated in the construction of the LHCb detector and the development of the interface between experimental measurements and theoretical predictions. Ulrik is currently working on analysing data to see if hints of a new type of force-carrying particle, a leptoquark, is supported in the analysis of the latest data.

DR AGUSTIN SCHIFFRIN

Agustin is an ARC Future Fellow and Chief Investigator of the Monash-led ARC Centre of Excellence in Future Low Energy Electronics Technologies (FLEET). His research in experimental condensed matter physics deals with the synthesis and characterisation of low-dimensional nanomaterials. Agustin studies and aims to control the atomic-scale properties as well as the ultrafast dynamics of these materials, with the goal of realising novel electronic, optoelectronic, chemical and magnetic functionalities that could lead to future solid state technologies.

PROFESSOR ILYA MANDEL

Professor Mandel is a theoretical astrophysicist who uses basic physical models in order to understand a variety of complex phenomena in high-energy astrophysics. His interests range from cosmic explosions to dynamics of stars being shredded by the gravity of massive black holes. Ilya is a world leader in the nascent field of gravitational-wave astronomy, where he uses signals from the mergers of compact remnants of massive stars - neutron stars and black holes - to explore the evolution of these stars billions of years ago.

DR MARCUS KITCHEN

After completing his PhD at Monash University in 2006, Dr Kitchen was awarded three consecutive ARC Fellowships, including his current Future Fellowship, to develop advanced X-ray imaging technologies. He co-leads an international collaboration studying lung development at birth. The lung is arguably the most difficult organ to image, yet Marcus has developed techniques for quantifying real-time changes in the structure and function of the lungs at micron scale resolution using minimal X-ray exposure. His innovative imaging techniques have completely changed our understanding of the complex physiology of lung function - providing insights that have been translated into life-saving methods, which are now adopted in clinical practice for resuscitating premature infants who are unable to breathe at birth.

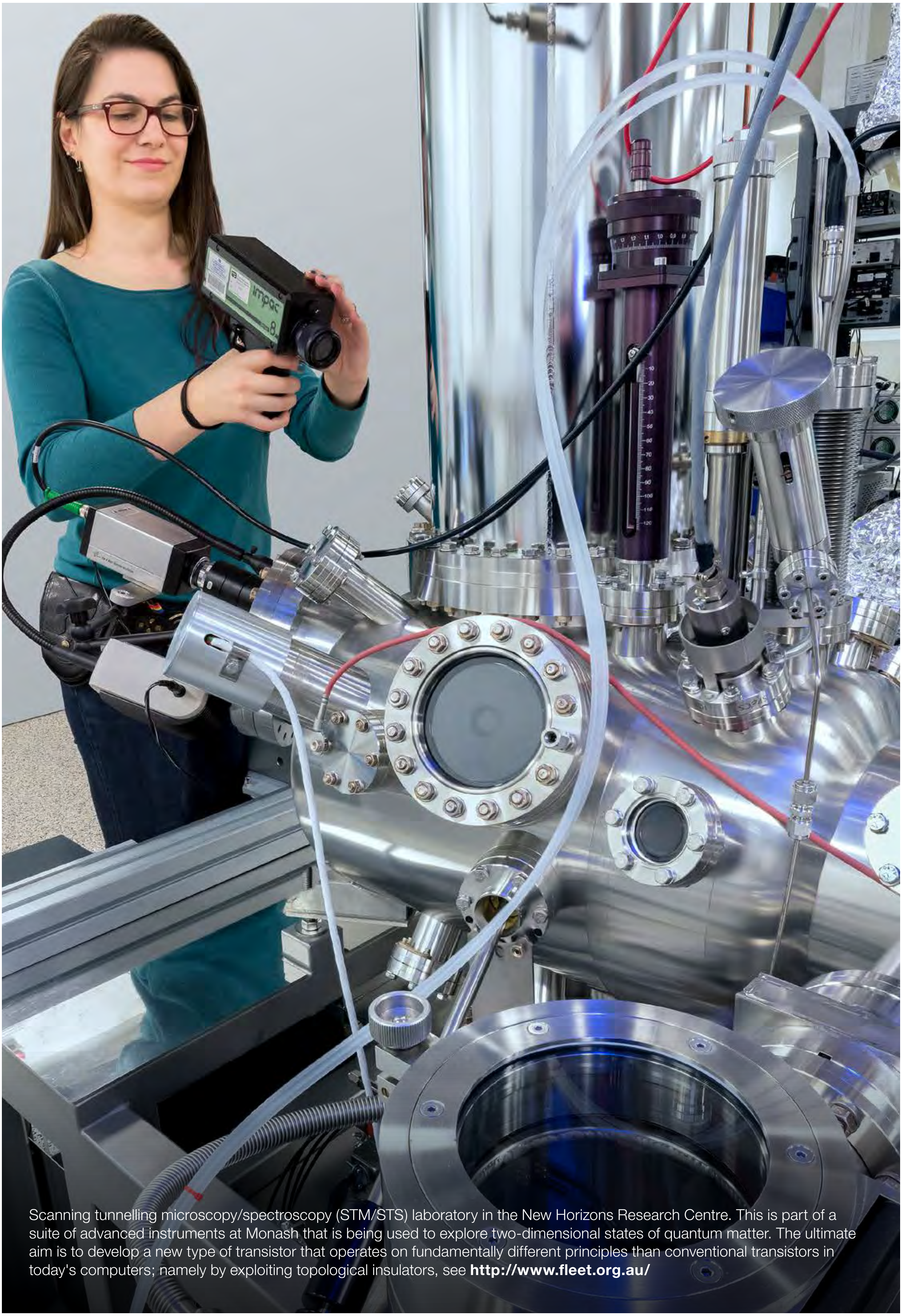
DR BERNHARD MUELLER

Bernhard is an ARC Future Fellow who obtained his undergraduate degree from the Technical University of Munich. Initially educated with a focus on nuclear and particle physics, he later turned his interest to astrophysics and began working on the explosions of stars as supernovae. He uses complex numerical codes that run on thousands of computer processors to simulate these explosions. He is also interested in what neutrinos and gravitational waves from deep inside the exploding star can teach us about supernovae – particularly those that occur within our Milky Way. Bernhard's work has shaped our understanding of supernovae from massive stars for more than a decade, and he has written several influential reviews on the topic.

ASSOCIATE PROFESSOR MICHAEL BROWN

Michael is an observational astronomer and former ARC Future Fellow who is best known for using the spectral light produced by galaxies to study the slow growth of the most massive galaxies in the Universe. Michael uses telescopes and satellites to measure the distribution of galaxies in space and to identify unusual galaxies that challenge current theories of galaxy evolution. His research programs will be enhanced by a new generation of astronomical facilities including the Australian Square Kilometre Array Pathfinder, eROSITA and the James Webb Space Telescope. Michael brings his astronomical expertise to undergraduate teaching, including workshops using Hubble Space Telescope images and projects using Monash's Hutton-Westfold observatory.

The Gravitational-wave Optical Transient Observatory (GOTO) is an array of telescopes located at La Palma in the Canary Islands. GOTO is a joint research project between Monash University and the University of Warwick (UK). The purpose of GOTO is to look for optical counterparts to gravitational wave events created by extreme events in the Universe, such as binary neutron star mergers (photograph courtesy of Dr Krzysztof Ulaczyk). For more details see: **http://goto-observatory.org**



Scanning tunnelling microscopy/spectroscopy (STM/STS) laboratory in the New Horizons Research Centre. This is part of a suite of advanced instruments at Monash that is being used to explore two-dimensional states of quantum matter. The ultimate aim is to develop a new type of transistor that operates on fundamentally different principles than conventional transistors in today's computers; namely by exploiting topological insulators, see **http://www.fleet.org.au/**

SOME OF OUR PEOPLE

ASSOCIATE PROFESSOR AMANDA KARAKAS

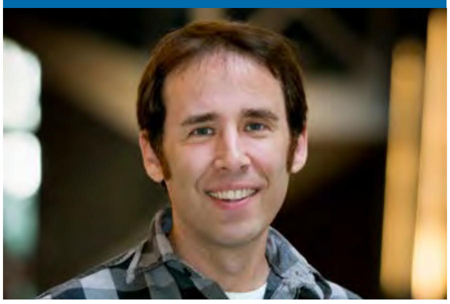
Amanda is a leading astrophysicist working in theoretical stellar and nuclear astrophysics. She obtained her PhD from Monash in 2004 after which she spent time overseas in Canada before moving to the Australian National University to take up an ARC Postdoctoral Fellowship and later, an ARC Future Fellowship, before returning to Monash, where she is the Director of the Monash Centre for Astrophysics. Amanda has made substantial contributions towards our understanding of how Sun-like stars evolve with time and their contribution to the origin of elements in galaxies. Her significant contributions to the field led to the award of the prestigious Royal Astronomical Society Eddington Lectureship in 2019.

DR PAUL LASKY

Paul is an ARC Future Fellow who carries out research on gravitational-wave science, with a particular focus on the astrophysics and fundamental physics of black holes and neutron stars. He was part of the international LIGO team that made the first discovery of gravitational waves from colliding black holes in 2015, which was subsequently awarded the Nobel Prize for Physics in 2017. He was also a major contributor to the discovery of a binary neutron star merger in 2017, which was discovered with both gravitational waves and with telescopes across the electromagnetic spectrum. In 2018 Paul was awarded the Pawsey Medal of the Australian Academy of Science. Currently, Paul and his research group are building the next generation of software to infer the astrophysical properties of gravitational-wave sources.

DR JESPER LEVINSEN

Jesper is an ARC Future Fellow who works on the theory of strongly interacting quantum systems, both in the context of condensed matter physics and the physics of ultracold atomic gases. Jesper has made substantial contributions to our understanding of how the underlying few-body dynamics can impact strongly correlated systems, especially in the context of quantum impurity problems. Ultimately, a greater understanding of correlated many-particle systems would allow us to harness their properties for a new generation of quantum devices, featuring efficient energy storage, rapid energy extraction, and lossless energy transport.



ASSOCIATE PROFESSOR ERIC THRANE

Eric is an ARC Future Fellow working in the field of observational astrophysics. A long time member of the Laser Interferometer Gravitational-wave Observatory (LIGO), Eric uses ripples in the fabric of spacetime called "gravitational waves" to study some of the most extreme phenomena in the Universe, including the mergers of black holes and neutron stars. As the Data Theme Leader for OzGrav, the ARC Centre of Excellence for Gravitational Wave Discovery, Eric is at the forefront of the emerging field of astronomical Big Data.

PROFESSOR KRISTIAN HELMERSON

Kris is an experimental atomic and optical physicist. Before coming to Monash in 2009, he was a research scientist at the National Institute of Standards and Technology (NIST) in the USA and a founding Fellow of the Joint Quantum Institute (JQI) of NIST and the University of Maryland. Kris has performed pioneering research on the application of superfluid Bose-Einstein condensates for matter-wave optics, including atom interferometry and atomtronics. Kris is currently a Chief Investigator and Theme Leader in the Monash-led ARC Centre of Excellence in Future Low Energy Electronics Technologies (FLEET), where he is working on understanding non-equilibrium behaviour in materials for future electronics.

DR LINCOLN TURNER

Lincoln's research seeks to make quantum devices that solve real-world measurement and sensing problems. He is presently developing magnetic sensors based on ultracold atoms for applications in mapping neural circuits. His laboratory applies techniques he developed at the US National Institute of Standards and Technology to realise efficient quantum measurements at temperatures close to absolute zero. Software developed in his research group controls atomic clocks and quantum simulators in laboratories worldwide. Lincoln's teaching has been recognised by two Vice-Chancellor's citations and a fellowship of the Monash Education Academy. He teaches thermal and statistical physics and is a leading proponent of active learning, undergraduate research and coding in the curriculum.

Further information

monash.edu/physics

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