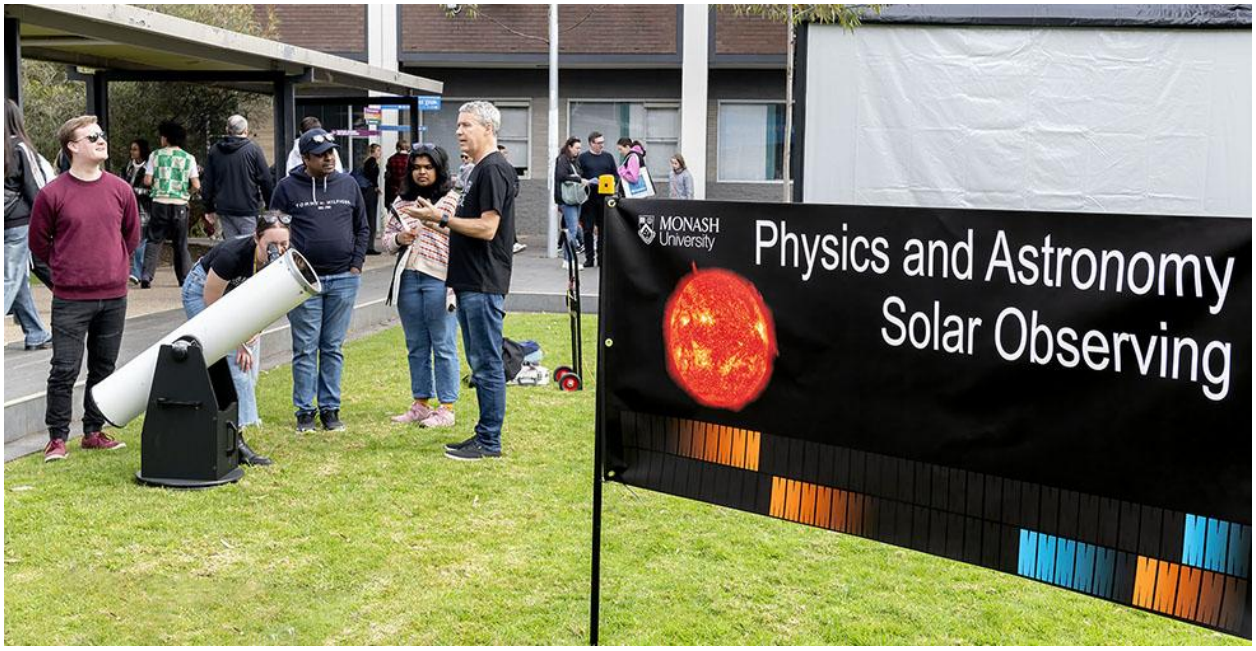
School of Physics and Astronomy News

September 2023



Michael Brown, Madeline Howell and Thomas Maunder demonstrate solar observation at Open Day. Image by Steven Morton.

Upcoming Events

13 Sep @ 2pm - Colloquium: Professor Cathryn Trott, Curtin University

14 Sep @ 10:30am - 'RU OK?' Morning Tea in room 107, 10 College Walk

15 Sep @ 10am - WiNPA coffee at Cinque Lire

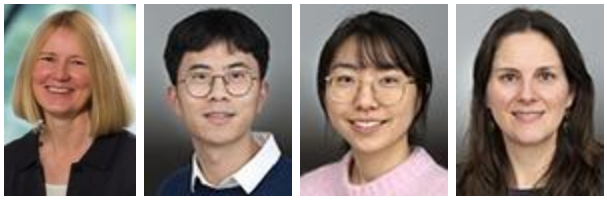
22 Sep @ 5pm - WiNPA craft night in room 110, 10 College Walk

27 Sep @ 2pm - Colloquium: Associate Professor Timothy Atherton, Tufts University

4 Oct @ 2pm Colloquium: Professor Kavan Modi, Monash/Transport for NSW

Welcome

New staff



Joanne Etheridge, Weilun Li, Wei Chao and Cristina Martinez-Lombilla.

Professor Joanne Etheridge has now commenced her role as Laureate Fellow in SPA and Science Director of the Monash Centre for Electron Microscopy. Also starting in the Physics of Imaging group with Joanne Etheridge, are research fellows **Dr Weilun Li** and **Dr Wei Chao**. Both are currently working on the development of electron scattering techniques for the measurement of atomic and electronic structure in functional perovskites and the relationship to their properties (e.g. photoactive, colossal magneto-resistive, etc).

Commencing in Monash Astrophysics, welcome to research fellow **Dr Cristina Martinez-Lombilla**:

During my research career at the Institute of Astrophysics of the Canary Islands (IAC, Spain) and the University of New South Wales (UNSW, Sydney), my interests focused on understanding how galaxies were formed and how they evolve through the study of low surface brightness (i.e. faint) structures. My strong background in astronomical software and instrumentation enabled my new role at Monash where I'll work on the automation of PyWiFeS, the data reduction pipeline for the WiFeS spectrograph to integrate it into the Siding Spring Observatory (SSO) Transient Network of telescopes.

Visitors

Associate Professor Timothy Atherton from Tufts University will join us for two weeks from 24 September and will give a colloquium talk on 27 September.

Hungarian PhD student Balázs Szanyi will be visiting Monash Astrophysics at the end of September for two weeks, working with Amanda Karakas and Giulia Cinqugrana on numerical models of stars.

News

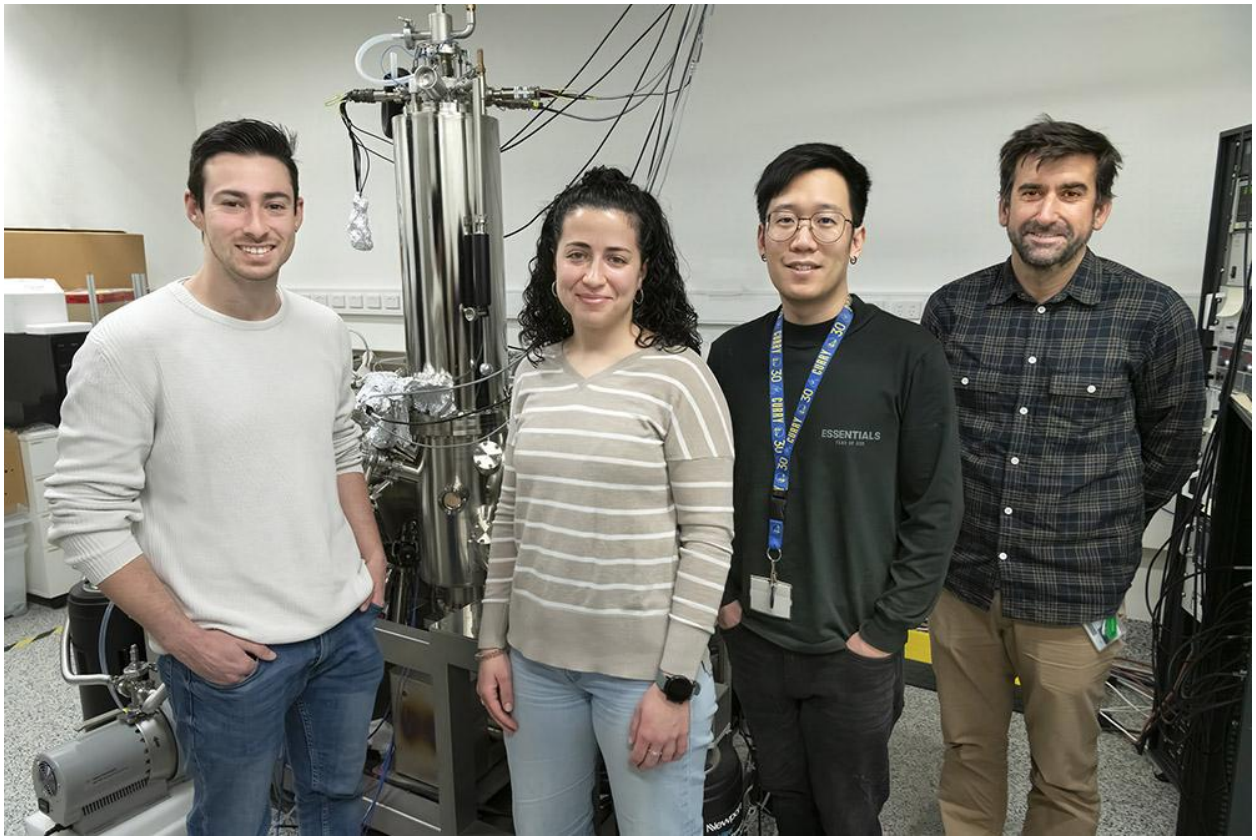
Kaye Morgan Wins Eureka Prize

Kaye Morgan with David Parsons and Martin Donnelley at the 2023 Eureka Awards.

Congratulations to **Associate Professor Kaye Morgan** who with colleagues from Monash, the University of Adelaide, the Women's and Children's Hospital in Adelaide and 4D Medical Pty Ltd, has been awarded the Eureka Prize for Excellence in Interdisciplinary Scientific Research. The team has been working since 2007 on developing and applying new methods of x-ray imaging to measure lung health, particularly when affected by cystic fibrosis.

Read more

Research Uplift Scheme Award



Daniel Moreno Cerrada, Amelia Dominguez Celorrio, Kaijian Xing and Agustin Schiffrin. Image by Steve Morton.

Congratulations to SPA awardees of the Faculty of Science Research Uplift Scheme: **Daniel Moreno Cerrada**, **Amelia Dominguez Celorrio**, **Kaijian Xing** and **Agustin Schiffrin**. Along with Nikhil Medhekar from Materials, Science & Engineering, the group was awarded $3,000 for their project *Electric-field control of quantum phases in 2D metal-organic nanomaterials*.

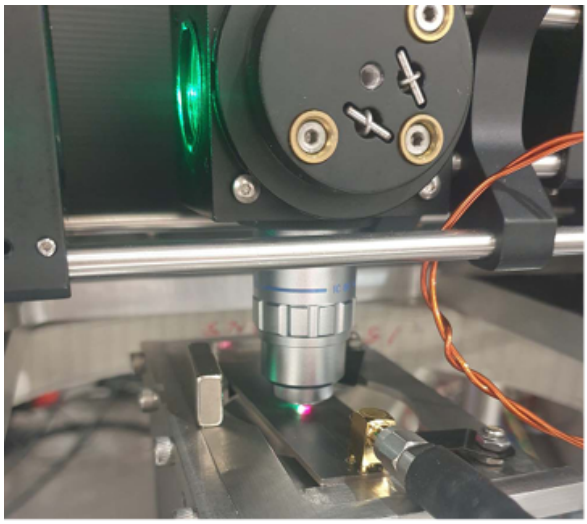
The project aims to design novel functional devices based on electric-field control of many-body quantum phases in two-dimensional metal-organic nanomaterials. It leverages state-of-the-art capabilities of a multidisciplinary team of experimental and theoretical physicists and engineers. The project yields potential for the development of new technologies for efficient electronics, spintronics and information processing.

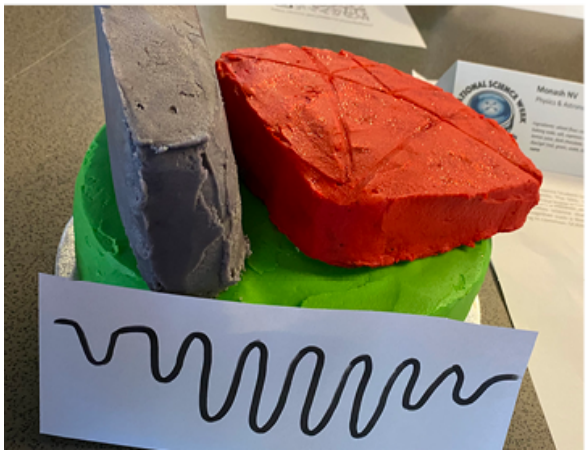
Research Cakes Bake-Off

Baking and science came together at the Faculty of Science's Research Cakes Bake-Off on 16 August. Representing SPA with their incredible cakes were Taylor Christie, Kaye Morgan and Michelle Croughan.

Monash NV baked by Taylor Christie

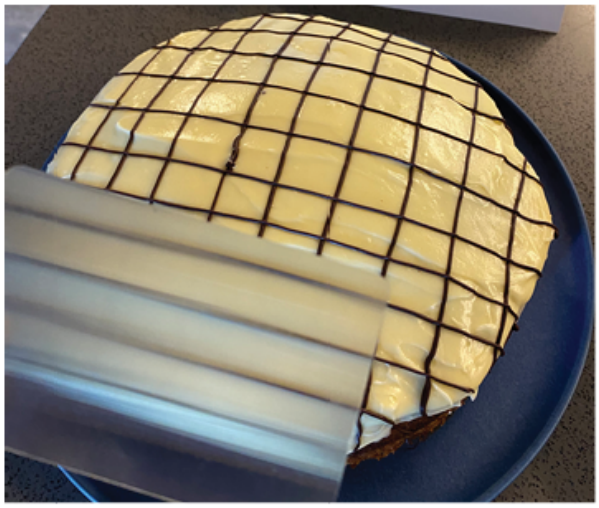
My cake represented the experimental setup of our NV magnetometer. It consists of a green led/laser with an NV diamond placed on top. When excited by green light, the NV centre in the diamond spontaneously emits red light. Microwave pumping at a resonant frequency reduces the amount of red light emitted due to an alternative decay pathway. Applying a DC bias magnetic field (with a bar magnet as shown in cake) lifts the degeneracy in the spin states, resulting in eight resonant frequencies for an ensemble of NV centres. The piece of paper in front of the cake is an example measurement, with frequency as the x axis and fluorescence as the y axis. We analyse the size and frequency of the fluorescence dips to accurately measure tiny magnetic fields.

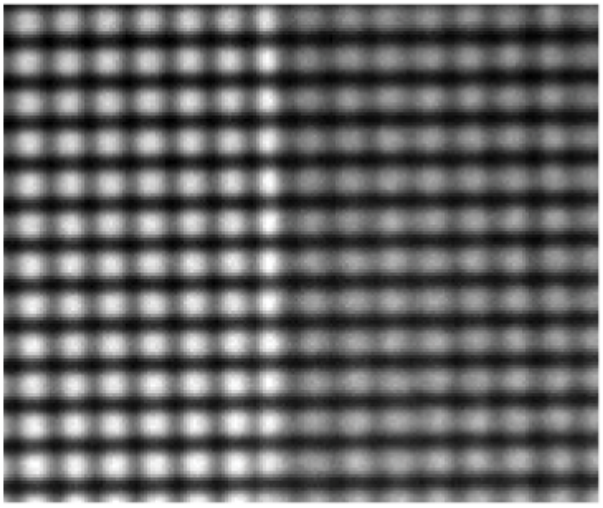




Directional dark-field imaging by Michelle Croughan and Kaye Morgan

A demonstration of the principle of x-ray directional dark-field imaging, the topic of Michelle Croughan's PhD thesis. The grid pattern on the cake is blurred in one direction by a Lubor lens, revealing the orientation of the tiny cylinders that make up the lens and scatter the visible light. In the same way, the x-ray grid pattern we project on a sample is blurred in one direction by any tiny cylinder-like structures in a sample. These could be carbon fibres, dentine tubules or trabecular structures in bones.





3 Minute Thesis Win!

Mitko Oldfield receives his 3MT award from JaneMaree Maher, Academic Director - Research Training.

Congratulations to **Mitko Oldfield** for winning second prize at the University round of the 3MT competition! Mitko represented the Faculty of Science and competed against 11 other presenters across a range of Monash faculties.

Watch Mitko's full presentation: *Why is my device-y spicy?*

Girls in Physics

Taïssa Danilovich at the Ballarat Girls in Physics breakfast.

Dr Taïssa Danilovich from Monash Astrophysics was guest speaker at a regional Girls in Physics breakfast on 25 August. Girls in Physics allows high school students who are considering a career in physics to meet with working scientists over a collaborative breakfast. Taïssa presented at a local school in Ballarat about astronomy and her research.

'RU OK? Day'

By **Michael Brown**

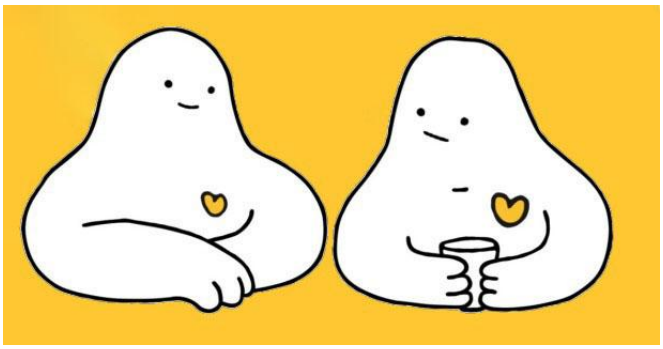
The School of Physics and Astronomy invites you to a morning tea/coffee at **10:30am on Thursday 14 September** (Large Seminar Room, 10 College Walk) to coincide with 'RU OK? Day.'

Staff, students, family and friends face many challenges that can impact mental health and well-being. The morning tea/coffee there will feature a very brief discussion of 'RU OK? Day' and the resources available to Monash staff and students for mental health and well-being. Much of

the event will be social, so you can catch up with colleagues and friends, and meet members of the school who may be unfamiliar to you. Snacks and nibbles will be provided, and there will be urns of hot water for tea and instant coffee.

To find out more about 'RU OK? Day', check their resources page.

To find Mental Health First Aiders in the School and Faculty of Science see MHFA Ambassadors.



In the Media

Dr Amelia Liu featured in Cosmos with an article about her research - *Glass: shattering one of science's biggest mysteries*.

Associate Professor Michael Brown featured in the Washington Post regarding a light display that appeared over Melbourne in August.

Professor Michael Fuhrer has published an article on the Conversation about the recent LK99 'room temperature superconductor' and has also appeared or been quoted in several media outlets including: Sydney Morning Herald (8 Aug), podcast, Business Insider (11 Aug), Next Big Future (2 Aug), Nature (16 Aug), NBC News (4 Aug), Yahoo News (16 Aug), Physics World (15 Aug), Gigazine (4 Aug), Noahpinion (9 Aug), Slashdot (17 Aug), India Today (4 Aug), Taiwan News (17 Aug).

School Manager/Occupational Health and Safety

The OHSMS audit has been postponed for up to 6-8 weeks, date to be confirmed. Thanks to everyone who has been preparing.

Please remember as per recent email communications -

Building Access requires the following to be completed:

1. General Induction (given by Safety Officer, Manny Pumarol Crestar) and
2. Local Area Laboratory/Studio Induction (given by laboratory supervisors/delegate)
3. Training Needs Analysis, TNA checklist needs to be completed for all workers (staff and Phd and those students working on projects through their studies (including MSc/Honours/2nd/3rd yr project students).
4. Supervisors please work with your groups to complete this.

Please send the above documents to physics.inductiontraining@monash.edu

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Recent Publications

Radiative suppression of exciton–exciton annihilation in a two-dimensional semiconductor. Luca Sortino, Merve Gülmüs, Benjamin Tilmann, Leonardo de S. Menezes, *STEFAN A. MAIER*. Light: Science & Applications (2023).

Bridging the Gap between Intermediate and Massive Stars II: Mmas for the most metal–rich stars and implications for Fe CCSNe rates. *GIULIA C CINQUEGRANA*, Meridith Joyce, *AMANDA I KARAKAS*. Monthly Notices of the Royal Astronomical Society (2023).

Quadruple-star systems are not always nested triples: a machine learning approach to dynamical stability. Vynatheya, Pavan, *MARDLING, ROSEMARY A.*, Hamers, Adrian S.. Monthly Notices of the Royal Astronomical Society, in press (2023).

Paraxial diffusion-field retrieval. *DAVID M. PAGANIN*, Daniele Pelliccia, *KAYE S. MORGAN*. Physical Review A (2023).

The Eighteenth Data Release of the Sloan Digital Sky Surveys: Targeting and First Spectra from SDSS-V. Almeida, Andrés, ..., *CASEY, ANDREW R.*, et al. (153 authors not shown). The Astrophysical Journal Supplement Series, 267, 44 (2023).

The role of spin in thermoelectricity. Yang, Guangsai, Sang, Lina, Zhang, Chao, Ye, Ning, Hamilton, Alex, *FUHRER, MICHAEL S.*, Wang, Xiaolin. Nature Reviews Physics, 5, 466 (2023).

Observational constraints on the origin of the elements – VI. Origin and evolution of neutron-capture elements as probed by the Gaia-ESO survey. Jianhui Lian, Nicholas Storm, Guillaume Guiglion, Aldo Serenelli, Benoit Cote, *AMANDA I KARAKAS*, Nick Boardman, Maria Bergemann. Monthly Notices of the Royal Astronomical Society (2023).

Gate-Tunable Renormalization of Spin-Correlated Flat-Band States and Bandgap in a 2D Magnetic Insulator. Pin Lyu, Joachim Sødequist, Xiaoyu Sheng, Zhizhan Qiu, Anton Tadich, Qile Li, *MARK T. EDMONDS*, Meng Zhao, Jesús Redondo, Martin Švec, Peng Song, Thomas Olsen, Jiong Lu. ACS Nano (2023).

Arbitrarily structured quantum emission with a multifunctional metalens. Chi Li, Jaehyuck Jang, Trevon Badloe, Tieshan Yang, Joohoon Kim, Jaekyung Kim, Minh Nguyen, *STEFAN A. MAIER*, Junsuk Rho, Haoran Ren, Igor Aharonovich. eLight (2023).

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Universal mask for hard x rays. David Ceddia, Alaleh Aminzadeh, Philip K. Cook, Daniele Pelliccia, Andrew M. Kingston, *DAVID M. PAGANIN*. Optica (2023).

Magnetic and electronic properties of bulk and two-dimensional FeBi2Te4: A first-principles study. Wang, Qianqian, Zhao, Jianzhou, Wu, Weikang, Zhou, Yinning, *LI, QILE*, *EDMONDS, MARK T.*, Yang, Shengyuan A.. Chinese Physics B, 32, 087506 (2023).

Modelling stellar evolution in mass-transferring binaries and gravitational-wave progenitors with METISSE. Poojan Agrawal, Jarrod Hurley, Simon Stevenson, Carl L Rodriguez, Dorottya Szécsi, *ALEX KEMP*. Monthly Notices of the Royal Astronomical Society (2023).

Multiple Stellar Populations in Metal-poor Globular Clusters with JWST: A NIRCam View of M92. Tuila Ziliotto, Antonino Milone, Anna F. Marino, Aaron L. Dotter, Alvio Renzini, Enrico Vesperini, *AMANDA KARAKAS*, Giacomo Cordoni, Emanuele Dondoglio, Maria V. Legnardi, Edoardo P. Lagioia, Anjana Mohandasan, Sarah Baimukhametova. The Astrophysical Journal (2023).

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Aluminium-26 from Massive Binary Stars. III. Binary Stars up to Core Collapse and Their Impact on the Early Solar System. Brinkman, Hannah E., *DOHERTY, CAROLYN*, Pignatari, Marco, Pols, Onno, Lugaro, Maria. The Astrophysical Journal, 951, 110 (2023).

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Direct CP violation in charmless three-body decays of B± mesons. EGEDE, U., HADAVIZADEH, T., HENDERSON, R. D. L., SINGLA, M., WARD, J. A., et al. Physical Review D, 108, 012008 (2023).

Now on YouTube

Paul Lasky

[What's next in gravitational-wave astronomy?]

To suggest a story or other content please email karen.hewitt@monash.edu. Submissions are due by the last Monday of each month.