School of Physics and Astronomy News

July 2023

Welcome to our July newsletter!

As you will see in the news section below, we can be proud of a number of significant events that occurred over the last weeks. Let me particularly thank our EDI committee for their hard and dedicated work towards the successful Pleiades Silver Award application, and our PACE and teaching team for a smooth closure of the teaching and examination period. More good news — I am delighted to announce that Kaye Morgan, Scott Findlay, and Andy Casey have been promoted to Associate Professor, and Kavan Modi to Professor.

Enjoy perusing this newsletter, and for those of you utilising this time for international engagements — safe travels.

Stefan

Upcoming Events

11 July @ 10am - Physics of Imaging teaching demonstration by Konstantin Pavlov

12 July @ 10am - Physics of Imaging research presentation by Konstantin Pavlov

17 - 21 July - Lepton Photon Conference, Melbourne Convention Centre

18 July @ 12pm - Monash Astrophysics seminar by Dr Valentina D'Orazi

19 July @ 2pm - School Colloquium: Prof Michael Johnston, Oxford Department of Physics

20 July @ 2:30pm - Faculty of Science Awards: Register here

21 July @ 3pm - ECR event: Science careers outside academia (more info below)

26 July @ 2pm - School Colloquium: Prof. Francesca Di Lodovico, King's College London

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Visitors

Welcome to all our current and upcoming visitors!

- Adjunct Prof Yuri Levin, Columbia University
- Assoc Prof Valentina D'Orazi, University of Rome (Campbell)
- Assoc Prof Pilar Gil-Pons, UPC Spain (Campbell)
- Assoc Prof Adam Shaffique, National University of Singapore (FLEET)
- Oliver Phillips, exchange student from Imperial College London (Maier)

News

Physics and Astronomy receives its first Pleiades Silver Award

by **Michael Brown, Amelia Liu and Kaye Morgan on behalf of the EDI Committee**

In mid-June the School of Physics and Astronomy received news of its first Astronomical Society of Australia Silver Pleiades Award for Equity, Diversity and Inclusion (EDI). Over the past 8 years the school has previously received Pleiades Bronze awards, and the elevation to Pleiades Silver recognises the hard work of staff and students (past and present) who have endeavoured to make our school a better place for everyone in our community.

Initiatives that have sought to improve equity, diversity and inclusion within the School include the Pleiades Parenting Room, mental health first aiders, transparent teaching workloads that mitigate gender bias, culture surveys, scholarships for women and non-binary students, WiNPA (Women and Non-binary People in Physics and Astronomy, an informal social and mentoring group) and better hiring practices.

There are now six continuing female staff in the school, whereas a decade ago there were none. This highlights how far we have come, but also how far we need to go. Feedback from the Astronomical Society of Australia's Inclusion, Diversity and Equity in Astronomy (IDEA) chapter recognised our successes, but also highlighted the need to consider different axes of diversity and intersectionality.

The School of Physics and Astronomy will be officially presented with its Silver Pleiades Award at the upcoming Annual Scientific Meeting of the Astronomical Society of Australia which is being held 3-7 July at Macquarie University.

The School of Physics and Astronomy EDI committee meets every 6-8 weeks, and while there is a core group of members, we encourage all students and staff (including professional staff) with an interest in EDI to attend.

Particle Physics joins LHCb experiment

by **Tom Hadavizadeh**

As of 1st June 2023 the Monash particle physics group has officially been made a full member of the LHCb collaboration. For the past four years Monash has been contributing to the LHCb experiment as an associate member, through the close connection to Warwick University in the UK. The transfer to full member status recognises the group's significant contribution to the running and operations of the collaboration as well as our contribution to physics analyses. Moving forward, the Monash group will now have a say in strategic decisions within the collaboration, helping shape the future of the experiment.

The LHCb experiment

The Large Hadron Collider at CERN hosts four large particle detectors, specially designed to measure the debris left over after high-energy particle collisions. The LHCb experiment specialises in collisions that produce the b and c quarks, heavier cousins of the u and d quarks that make up the world around us. The b and c quarks only survive for around a picosecond before decaying to lighter particles. Both the production and decay of these elusive particles can give new insights into the Standard Model of Particle Physics. One key phenomenon the experiment aims to measure is the difference in the rates of decay between matter and antimatter particles. Physics beyond our current understanding is required to explain why the universe is made of matter - measurements of these differences can help us understand why.

The Monash LHCb group

The group consists of two academics (Ulrik Egede, Tom Hadavizadeh), two postdocs (Yuki Fujii, Jake Lane) and eight students. Collectively, we make around 1% of the LHCb collaboration, currently comprised of 1116 members. Here at Monash one of our research areas involves performing measurements of rare decays of b-quarks. These processes are very sensitive to new particles or forces that can quantum mechanically interfere with Standard Model particles, leading to deviations from predictions. This area is subject to significant interest due to a number of ‘b-anomalies’ that have been observed over the previous years. The group is also involved in measuring the production of particles containing two heavy quarks. This can provide new information about the dynamics of the strong force during particle collisions - this research has created new, fruitful areas of collaboration between experimental and theoretical particle physicists within the Monash Group.

Multi-planet circumbinary system discovery

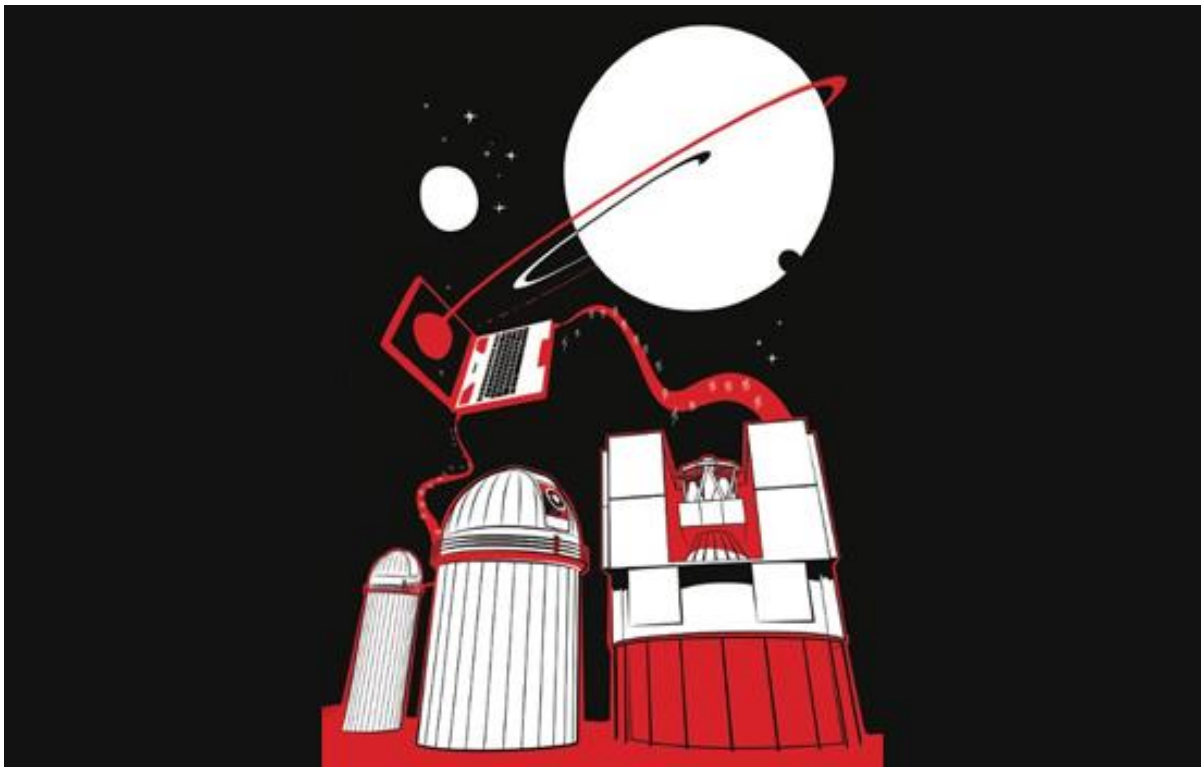

Illustration celebrating the discovery of the circumbinary planet BEBOP-1c using the radial-velocity method. Credit: Amanda Smith, University of Birmingham.

Congratulations to Dr Rosemary Mardling and former PhD student Dr David Martin who were part of an international team that identified a multi-planet circumbinary system. Using the wobble method, the team discovered planet BEBOP-1c, a gas giant that resembles Saturn and revolves around two stars. Published in June in Nature Astronomy, this discovery of more than one planet in a circumbinary system is only the second of its kind.

Read more

Evidence for a Pair-instability Supernova from a very massive first star

Image: Stellar fossil - imprints of pair-instability supernovae from very massive first stars. (Credit: NAOC).

Congratulations to Professor Alexander Heger for a joint publication in Nature this month, with researchers from the National Astronomical Observatories of the Chinese Academy of Sciences, Yunnan Observatories and the National Astronomical Observatory of Japan. The international study outlines the first definitive association of a Galactic halo star with an abundance pattern originating from a PISN.

Read more

Wins at the 3MT Competition

Fantastic work from PhD students Mitko Oldfield and Michelle Croughan who dominated the Faculty round of the Three Minute Thesis Competition on 7 June. Mitko won first place while Michelle took home the people's choice award. Two big wins in a competitive round of presenters from across the Faculty of Science.

Congratulations to both, and good luck to Mitko who will next present *Why is my device-y spicy?* at the 3MT University round in August.

NameExoWorlds2022: meet *Wattle* and *Banksia*

Image: from NASA Exoplanets Exploration

Monash Astrophysics PhD student Giulia Cinquegrana, Professor Alexander Heger and Associate Professor Paul Lasky partnered with students and teachers at Brandon Park Primary

School to win astro naming rights as part of NameExoWorlds 2022. *Wattle* and *Banksia* were the winning entries to name WASP-19, a yellow dwarf star and WASP-19b, a gas giant in the Velo system. The competition is run by the International Astronomy Union (IAU) and encourages community outreach and education about exoplanets. Guilia gave a talk to students at the school, followed by a star gazing session that included views of Saturn.

Read the winning entries

ECR Event - *Science Careers Outside Academia* on 21 July

by **Michael Barson and Gary Beane**

Do you love working in science and research but are considering a career that strays outside of traditional academic positions? Then the Faculty of Science - Early career network (ECN) committee is hosting an event for you! We have a panel of experts who have made the transition from post-doctorate academia to industry/government who are going to discuss their experiences and offer advice. They are from start-ups, government, industry and business

sectors. Post-doctorate and post-graduate (e.g. PhD students) are welcome to attend this event! The event is catered with drinks and food. Please RSVP here.

Recent Publications

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Increased phase coherence length in a porous topological insulator. Nguyen, Alexander, Akhgar, Golrokh, Cortie, David L., Bake, Abdulhakim, Pastuovic, Zeljko, Zhao, Weiyao, Liu, Chang, *CHEN, YI-HSUN*, Suzuki, Kiyonori, *FUHRER, MICHAEL S.*, Culcer, Dimitrie, Hamilton, Alexander R., *EDMONDS, MARK T.*, Karel, Julie. Physical Review Materials, 7, 064202 (2023).

Simulating cosmic string loop captured by a rotating black hole. Deng, Heling, Gruzinov, Andrei, *LEVIN, YURI*, Vilenkin, Alexander. Physical Review D, 107, 123016 (2023).

Measurement of the Z boson production cross-section in proton-lead collisions at √{sNN} = 8.16 TeV. LHCb Collaboration, ..., *EGEDE, U.*,*HADAVIZADEH, T.*, *HENDERSON, R. D. L, SINGLA, M, et al. (plus authors not shown). Journal of High Energy Physics, 2023, 22 (2023).

Engineering Quantum Nanophotonic Components from Hexagonal Boron Nitride. Milad Nonahal, Chi Li, *HAORAN REN*, Lesley Spencer, Mehran Kianinia, Milos Toth, Igor Aharonovich. Laser & Photonics Reviews (2023).

Planetesimals drifting through dusty and gaseous white dwarf debris discs: Types I, II and III-like migration. Veras, Dimitri, Ida, Shigeru, *GRISHIN, EVGENI*, Kenyon, Scott J., Bromley, Benjamin C.. Monthly Notices of the Royal Astronomical Society, in press (2023).

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Rapid population synthesis of black-hole high-mass X-ray binaries: implications for binary stellar evolution. Isobel Romero-Shaw, *RYOSUKE HIRAI*, Arash Bahramian, Reinhold Willcox, *ILYA MANDEL*. Monthly Notices of the Royal Astronomical Society (2023).

Extraordinary bulk-insulating behavior in the strongly correlated materials FeSi and FeSb2. Eo, Yun Suk, Avers, Keenan, Horn, Jarryd A., Yoon, Hyeok, Saha, Shanta R., Suarez, Alonso, *FUHRER, MICHAEL S.*, Paglione, Johnpierre. Applied Physics Letters, 122, 233102 (2023).

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Taïssa Danilovich
Chemical Tracers of an Eccentric Binary Orbit

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