



## CAASTRO Newsletter Edition 19, May 2017



### INTRODUCTION FROM CAASTRO DIRECTOR

At the start of this year we said goodbye to two long-serving members of the CAASTRO Executive Committee, Professors Matthew Bailes and Stuart Wyithe.

Matthew is now the Director of OzGrav, the ARC Centre of Excellence for Gravitational Wave Discovery, and Stuart has stepped down to focus on his new role as Deputy Director of CAASTRO-3D.

Both Matthew and Stuart have made tremendous contributions to CAASTRO. Matthew served as node leader for the Swinburne node, as well as leading CAASTRO's Dynamic Universe theme. Stuart was the Evolving Universe theme leader, and node leader at the University of Melbourne node. I thank them both most warmly for their contributions to CAASTRO over the past six years. We are also about to say goodbye to Curtin node leader Professor Carole Jackson, who is moving to the Netherlands this month as the new Director-General of ASTRON. I thank Carole for her contributions to the Executive, and am pleased that she plans to retain a connection to the Centre as an Affiliate member. Very best wishes to Matthew, Stuart and Carole as they take on these important new roles.

In place of the three departing members, we welcome some new faces to the CAASTRO Executive. Dr Ramesh Bhat (Curtin) will take on the new roles of CAASTRO CI and leader of the Curtin node, as well as leading the pulsar projects within CAASTRO's Dynamic theme. Professor Jeremy Mould is the new Swinburne node leader, and Professor Rachel Webster now leads the University of Melbourne node. Please ask Ramesh, Jeremy and Rachel if you need assistance at your node.

Associate Professor Tara Murphy (University of Sydney) is the new Dynamic Universe theme leader and Professor Lister Staveley-Smith has taken on the role of Evolving Universe theme leader in addition to his responsibilities as CAASTRO Deputy Director. Dr Adam Deller (Swinburne) joins Ramesh as a new CAASTRO Chief Investigator, and will lead the Fast Radio Bursts project previously overseen by Matthew. All the new CIs and Executive members are highly experienced

researchers, and I look forward to working with them over the next twelve months.

The ARC has approved our transition plan for the final stage of CAASTRO, and the official end date of the Centre will be 31 March 2018 (seven years from our start date of 1 April 2011). Everything will run as normal until this date, and CAASTRO staff whose contracts extend beyond March 2018 will continue to be employed until their contracts finish later in the year. Mentoring and supervision for these staff will continue to be provided through their node leaders, and Debra Gooley at the University of Sydney will assist with administration and financial issues right up to 31 December 2018. If you have any questions or concerns about what will happen towards the end of the Centre, or later on in 2018, please feel free to contact me or Kate Gunn to discuss your situation.

We have a full program of activities planned for CAASTRO's final year, including the third OzSKA meeting in Sydney next month and the third Australia-China ACAMAR workshop in Hobart in September. We will also be hosting the Dark Energy Collaboration meeting in Brisbane in November, and I am delighted that the members of this large international collaboration will be meeting in Australia for the first time.

You can read about many of our recent activities in this Newsletter, but I'd just like to add how pleased we are that CAASTRO has received a Gold Pleiades Award from the Astronomical Society of Australia. These awards are given to organisations in Astronomy that demonstrate a strong commitment to advancing the careers of women, and the Gold award recognizes "a truly outstanding sustained commitment" to best practice in this area. Many thanks to our Gender Action Committee for their hard work, and to all members of CAASTRO who have embraced our efforts to promote equity and diversity in the workplace.

Finally, I hope to see many of you in person when I next visit the CAASTRO nodes in Melbourne, Canberra, Brisbane and Perth in May, June or July this year.

**Elaine Sadler**  
**Director, CAASTRO**

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## **RESEARCH UPDATE**

### The First Interferometric Detections of Fast Radio Bursts

A CAASTRO PhD student has settled one of astronomy's burning questions with a radio telescope near Canberra that she helped refurbish. Manish Caleb who is enrolled at The Australian National University and works at Swinburne University, has confirmed that mystery bursts of radio waves astronomers have hunted for ten years really do come from outer space.

Caleb teamed up with her Swinburne colleagues to detect three of the 'fast radio bursts' with the University of Sydney's Molonglo radio telescope 40 km from

Canberra. The bursts came from the direction of the constellations Puppis and Hydra. [Read more](#)



*The locations of the three new 'fast radio bursts' (red stars). Credit: James Josephides / Mike Dalley*

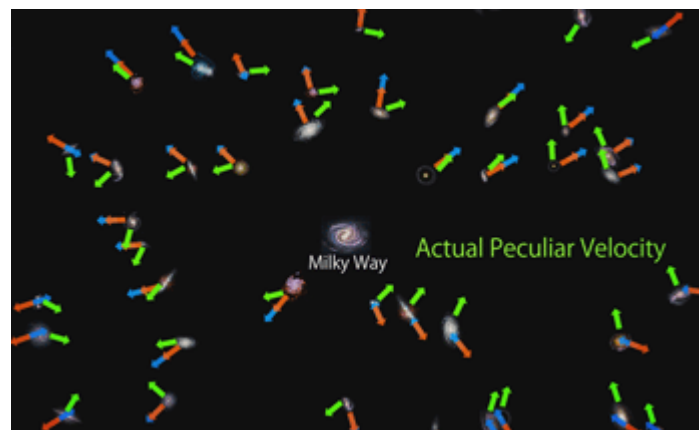
### Publication Details

'[The first interferometric detections of Fast Radio Bursts](#)'. Accepted for publication in *Monthly Notices of the Royal Astronomical Society* (2017). Online at <https://arxiv.org/abs/1703.10173>.

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## The motions of galaxies can put General Relativity to the test

Australia is home to two of the largest surveys of galaxy peculiar velocities ever undertaken: the 6-Degree Field Survey velocity elliptical galaxy sample (containing 9,000 peculiar velocity measurements) and the 2MASS-Tully Fisher Survey (containing 2,000 spiral galaxies). In a recent paper, CAASTRO researcher Dr Cullan Howlett (ICRAR-UWA), together with CAASTRO members Prof Lister Staveley Smith (also ICRAR-UWA) and A/Prof Chris Blake (Swinburne University of Technology), analysed whether combining the data from these surveys will reduce the statistical error inherent to individual surveys. They showed that correlating the positions and peculiar velocities of galaxies in these surveys can provide some of the best measurements of the growth rate – with an improvement of around 20% – and the strongest tests of GR to date. [Read more](#)



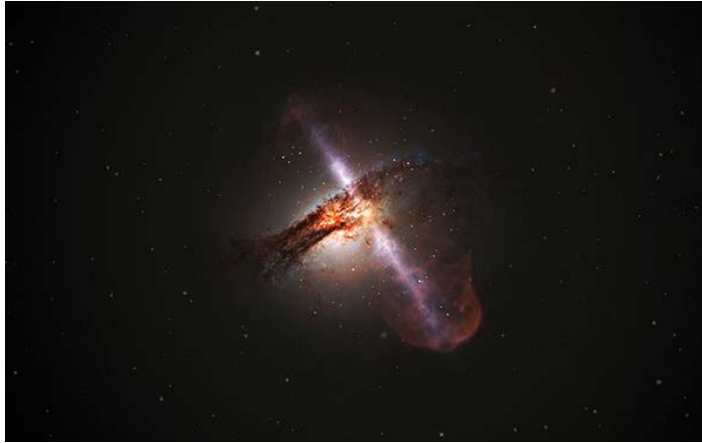
**Publication details:**

Cullan Howlett, Lister Staveley-Smith & Chris Blake in the Monthly Notices of the Royal Astronomical Society (2017): "[Cosmological Forecasts for Combined and Next Generation Peculiar Velocity Surveys](#)"

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## "Peter Pan" radio galaxies may never grow up

A team of astronomers has doubled the number of known young, compact radio galaxies—galaxies powered by newly energized black holes. The improved tally will help astronomers understand the relationship between the size of these radio sources and their age, as well as the nature of the galaxy itself. In particular, it will help astronomers understand why there are so many more young radio galaxies than old. "We do not understand how radio galaxies evolve," says Joe Callingham, who did much of the research as a PhD student with CAASTRO at the University of Sydney and is the lead author on the paper describing the result. [Read more](#)



*Artist's impression of a galaxy within which lies a supermassive black hole. Image credit: ESA/Hubble, L. Calçada (ESO)*

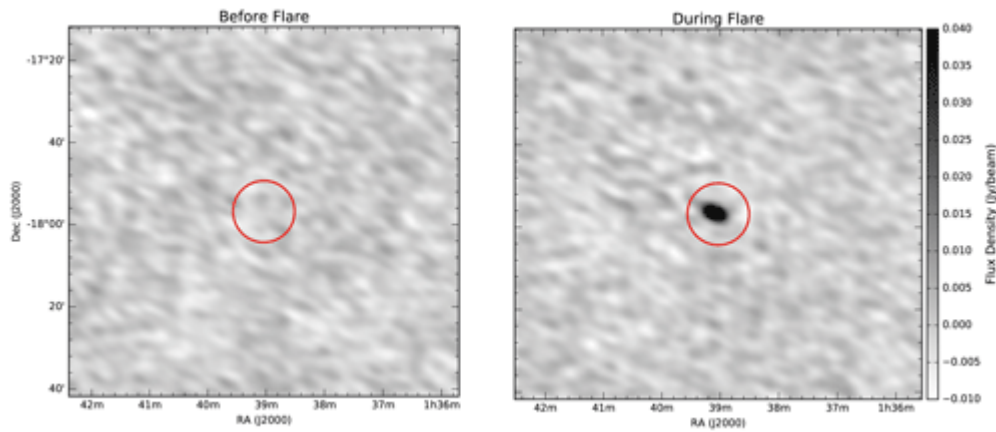
**Publication details:**

J. R. Callingham, R. D. Ekers, B. M. Gaensler, J. L. B. Line et al. in ApJ "[Extragalactic Peaked-Spectrum Radio Sources at Low Frequencies](#)"

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## Identifying habitability of exoplanets through radio astronomy

CAASTRO researcher Dr Christene Lynch (University of Sydney) and colleagues use the Murchison Widefield Array (MWA) low-frequency radio telescope to investigate the impact of star-planet magnetic interactions on the habitability of planets orbiting low-mass stars. In a recent study, they report the detection of four low-intensity, polarised flares from the highly magnetically active low-mass star UV Ceti. Using the polarisation characteristics of the observed flares, they were able to identify the physical process that generated the flares – a first-ever achievement at these frequencies for these stars. Additionally, the team measured the detected radio emission to be associated with a fairly moderate magnetic field strength. [Read more](#)



Brightness of UV Ceti during 11 December 2015 observation, averaged over the 30 minutes before (left) and during (right) the flare. Fig.2 in Lynch et al.

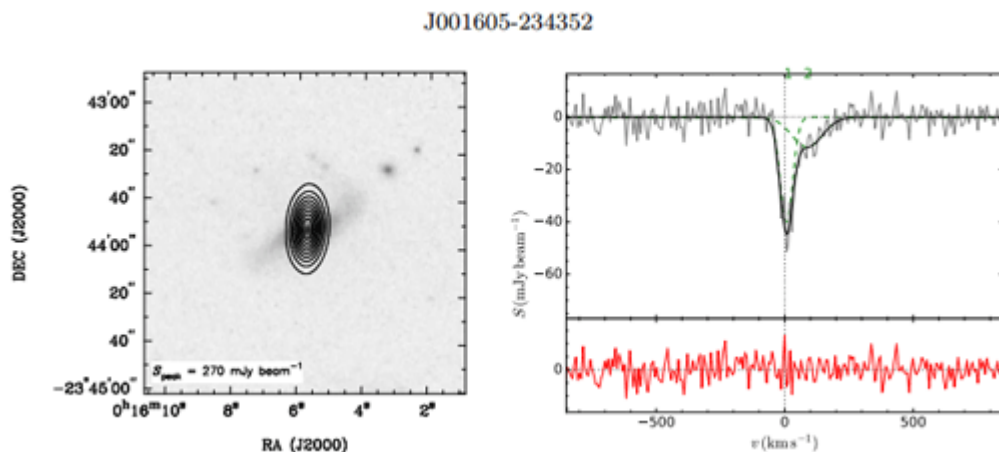
### Publication details:

Christene Lynch, Emil Lenc, Tara Murphy et al. in The Astrophysical Journal Letters (2017): "[154 MHz detection of faint, polarized flares from UV Ceti](#)"

Christene Lynch, Tara Murphy et al. in The Monthly Notices of the Royal Astronomical Society (2017): "[A search for circularly polarised emission from young exoplanets](#)"

## HI absorption survey casts light on feedback in radio galaxies

In a recent paper, CAASTRO PhD student Marcin Glowacki (University of Sydney) and colleagues presented the results of such a HI absorption survey against 66 nearby compact radio sources with the Australia Telescope Compact Array. In total, seven detections of HI absorption were made, five of these new, giving a detection rate of 11%. Two of the detections were made possible by Bayesian line-finding algorithms developed by CAASTRO Affiliate Dr James Allison (CSIRO). [Read more](#)



Detections of HI 21-cm absorption; left: radio image, right: corresponding spectrum. Fig.4 in Glowacki et al. (MNRAS 2017)

### Publication details:

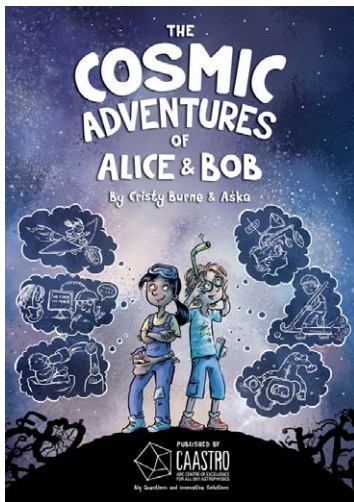
Marcin Glowacki, James Allison, Elaine Sadler, Vanessa Moss, Stephen Curran, Aina Musaeva et al. in the Monthly Notices of the Royal Astronomical Society (2017): "[HI absorption in nearby compact radio galaxies](#)"

# CAASTRO ANNUAL REPORT

The [2016 CAASTRO Annual Report](#) is now published and available to download from the e CAASTRO website: <http://www.caaastro.org/about/annual-reports>.

## CAASTRO EDUCATION AND OUTREACH

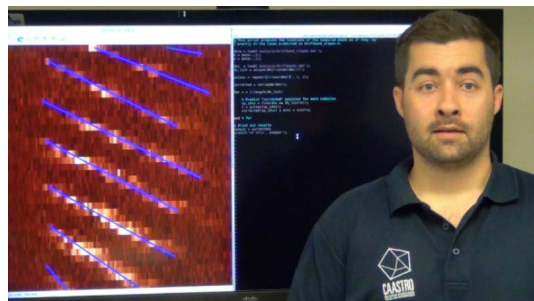
Our portfolio has geared up for a big finale and entered “legacy mode”. Our beautiful “[Bright Stars](#)” wall calendar has been sent out to all Australian high schools and is being distributed to participants in CAASTRO’s outreach partner programs “Telescopes in Schools” and Mount Burnett Observatory, as well as at science teachers’ conferences and public astronomy events.



The CAASTRO comic book “[The Cosmic Adventures of Alice & Bob](#)” got printed in time for its launch at Perth Astrofest on 18 March. Thousands of copies are currently being sent to all Australian primary, combined and special schools – with quantities ranging between single library copies to several class sets. Accompanied by free online teaching notes, this book will be an excellent resource to tell the story of scientific discovery in a very creative and entertaining way.

Despite the poor weather was [Perth Astrofest](#) a successful event once again, seeing around 3,500 visitors getting immersed in astrophotography, interactive science shows and general astronomical awesomeness. This year CAASTRO quite literally took centre stage on two occasions, launching the comic book in a keynote stage show and screening our planetarium show “Capturing the Cosmos”. We raised over \$650 in donations to go towards the new MiaMia indigenous astronomy program at the Gravity Discovery Centre & Gingin Observatory.

In this first quarter of the year, we already published 7 research stories for the CAASTRO website and produced 2 press releases . Collaborating with the University of Toronto and Dunlap Institute for Astronomy and Astrophysics, we promoted ex-CAASTRO PhD student



(University of Sydney) Joe Callingham’s research about young, compact radio galaxies . For our press release to highlight CAASTRO-Curtin PhD student Sam McSweeney’s drifting pulsars, we also created an explanatory video.

Kicking off the 2017 “[Astronomer in Residence](#)” program UWA PhD student Tristan Reynolds has taken up his residency at Ayers Rock Resort. Daily screenings of “Capturing the Cosmos” will continue, in addition to the astronomer’s weekly science

seminars and info stall in the town square.

Dr Wiebke Ebeling is on parental leave and the points of contact in her absence are:

- **Press releases:** Please flag your news-worthy papers with **Helen Sim** [helen.sim@sydney.edu.au](mailto:helen.sim@sydney.edu.au) and remember that the earlier we know about them, the better! We are committed to working with your respective university media office and national / international partners, and these conversations and collaborations take time. Ideally, your paper has only just been submitted when you let us know.
- **Research stories:** As you will know from me having bugged you, we are always keen on feeding our research news to the public via short, semi-technical research stories (appearing under <http://caastro.org/news> and eventually in <http://caastro.org/caastro-readers-digest>). These stories will now be handled by **Kim Steele** [kimberly.steele@curtin.edu.au](mailto:kimberly.steele@curtin.edu.au), and I would like to urge you to assist her if you find her email, bugging you, in your inbox.
- **Social media:** As always, you are welcome to share any articles, event announcements etc. with us for posting to the CAASTRO social media channels; this will also rest with **Kim** [kimberly.steele@curtin.edu.au](mailto:kimberly.steele@curtin.edu.au) – but as you will have noticed over the years, we have our sources!
- **Outreach opportunities:** If you think CAASTRO could participate in, organise or sponsor an outreach event or you have an idea for a new video project, please let **Kate Gunn** [kate.gunn@sydney.edu.au](mailto:kate.gunn@sydney.edu.au) and **Kim** [kimberly.steele@curtin.edu.au](mailto:kimberly.steele@curtin.edu.au) know, for their consideration.

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## CAASTRO IN THE CLASSROOM

[CAASTRO in the Classroom](#) has some exciting changes happening in 2017.

Schools are being offered three types of live sessions this year:

1. Video conferences with curriculum-based presentations
2. Q&A with CAASTRO – and interactive question and answer session delivered via video conferencing or Skype
3. Live streaming events delivered via YouTube Live

If you would like to volunteer to present a Q&A session for a school, please email [citc@caastro.org](mailto:citc@caastro.org), noting some information about your availability, and you will be paired with a school when a suitable booking is received. The school will provide a list of questions to you before the session to give the presenter some time to prepare a few answers to get the conversation started.

The first live streaming session for the year was presented by A/Prof Tara Murphy from the University of Sydney on 11:30am (AEDT) on Tuesday 28 March. PhD student, Rebecca McElroy, hosted the session which had 540 students registered from schools all over Australia. A recording of the session, entitled 'Waves in the Sky', can be viewed via the following link: [https://youtu.be/Z7B1FUFSI\\_g](https://youtu.be/Z7B1FUFSI_g)

At the end of 2016, CAASTRO in the Classroom was successful in receiving a new grant from the Commonwealth Government through the Women in STEM and

Entrepreneurship program. Plans are underway to host the 'CAASTRO Galaxy Convention' and to deliver live streaming events focused on increasing the number of girls and women participating in STEM education and careers.



*Image: Rebecca McElroy and Tara Murphy on set, photo credit: Jenny Lynch*

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## MEMBERSHIP UPDATE

CAASTRO now has 184 members. We welcome most recent members:

- Mohit Bhardwaj, Student (Masters), University of Melbourne
- SeoWon Chang, Research Fellow, ANU
- Qingxiang Chen, Student (PhD), UWA
- Adam Deller, Chief Investigator, Swinburne
- Lincheng Li, Student (PhD), UWA
- Rhys Poulton, Student (PhD), UWA
- Cristy Roberts, Administration Officer, ANU
- Nicholas Swainston, Student (Honours), ICRAR-Curtin

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## CAASTRO MEMBER PROFILES

### **Cristy Roberts, Administration Officer, ANU**

I am the new CAASTRO ANU Node Administration Officer. I have been with the Australian National University for 5 years. I originally started at the ANU coordinating executive and





professional development courses. I then moved into service coordination and quality assurance providing operational and curriculum delivery support for the teaching and learning commons, which was a varied and interesting role. 6 weeks ago I started here at CAASTRO ANU and though I have only been here a short time – I already love working here. The people are fantastic and working in such a scenic location is an extra bonus....The nearby café does a pretty good coffee also.

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**Caitlin Adams, PhD Student,  
Swinburne University of  
Technology**

Caitlin Adams is a second year PhD student working with Chris Blake, Ixandra Achitouv and David Parkinson. This year she developed a new approach for testing the cosmological model at low redshift, and has applied this to peculiar velocities and galaxy positions from the 6dF Galaxy Survey. Her analysis uses the fact that both observables trace the underlying matter distribution: this shared information can reveal more about how gravity behaves on cosmological scales. Caitlin plans to test alternative cosmological models with her approach, and hopes to shed more light on the cause of the Universe's accelerated expansion



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**Steven Murray, Research Staff,  
Curtin University**

Steven Murray is a postdoc working with the MWA Epoch of Reionisation



(EoR) team. His work involves developing sophisticated statistical models of the plethora of radio sources that lie between us and the EoR, obscuring and distorting it. In particular, he has developed an analytic description of how the cosmological structure of the foreground sources interferes with the EoR signal. Alongside this work he also contributes to other projects, including characterisations of the ionosphere in the context of EoR observations and using halo modelling techniques to understand the biasing of HI sources.

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## CAASTRO AWARDED GOLD PLEIADES BY ASA IDEA CHAPTER

The Astronomical Society of Australia's Inclusion, Diversity and Equity in Astronomy (IDEA) Chapter, has awarded CAASTRO a Gold Pleiades Award. This is the very first Gold Pleiades to be awarded, and will take effect from 1st January 2017. It is valid for two years.

All applications are assessed against the selection criteria by an independent panel of astronomers, in a process endorsed by the ASA's executive committee. CAASTRO will be awarded with a certificate at the ASA Annual Science Meeting's IDEA Lunch in July 2017.

Congratulations to the Gender Action Committee for their hard work in this area.

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## CAASTRO LEGACY ITEMS

At the end of its funding period (2017-2018) CAASTRO is keen to leave behind a legacy of useful items for future researchers, outreach and professional staff members working within astrophysics.

The purpose of this survey is to collect information on the legacy items that we have developed within CAASTRO.

We would like all CAASTRO members to think about what we are doing well and complete this form. <http://goo.gl/forms/tK0byVsxy6>

These items could include:

- Intellectual property
  - Software (we will ask you more questions later on this topic)
  - Data product & simulations
  - Case studies
  - Policies – membership, publications, gender etc
  - Outreach programs
  - Tool kits
  - Other programs – ECR, mentoring, busy weeks
  - Templates – annual report, other reporting (project, KPI, budget), presentations etc
  - Processes & procedures
  - Event planning and systems
  - Committee items and ideas – student, postgrads, etc
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## PAST EVENTS

### **CAASTRO-CoEPP Joint Workshop: Connecting Astrophysical Dark Matter with Direct Detection**

30 January -1 February 2017, University of Melbourne, Victoria

The third CAASTRO-CoEPP Joint Workshop, held 30-31 January 2017 at the University of Melbourne, was a great success, bringing together approximately 60 researchers from across astronomy and particle physics, both from Australia and overseas.

The goal of the workshop was to create a venue for interaction and collaboration between members of the astronomy and particle physics communities interested in the problem of dark matter and its role and impact on cosmology. Like the previous CAASTRO-CoEPP Joint Workshop, this event was partly motivated by ongoing and prospective Australian investment in dark matter detection programs at the Stawell Underground Physics Laboratory. Recently, researchers from a range of international universities have put together an exciting new proposal for a directional dark matter detector – one that could distinguish the direction of recoils, and thus potentially determine the direction of travel of dark matter particles. This project, CYGNUS, has already attracted a great deal of interest within CoEPP, and part of the purpose of this workshop was to introduce the concept to members of CAASTRO, since directional detectors may be able to give us detailed information about properties of our Galactic dark matter halo. One outcome of the meeting was a document signed by many participants expressing support for the ongoing use of the Stawell Underground Physics Laboratory for dark matter studies, which was very well received by the Northern Grampians Shire Council.

The workshop consisted of two days of talks followed by a CYGNUS collaboration meeting. The first day of the workshop focused on dark matter's role in astronomy and what we have learned from observations and experiments up to this point. The second day was a deeper dive into the future of dark matter detection experiments, both directional and otherwise. Over the course of the workshop, we heard from a wide range of speakers, from graduate students to group leaders, representing universities from Australia to Asia, America, and Europe. We also had two remote talks from researchers in the US and Europe, and we had remote participation available for attendees who could not be present at Melbourne University.

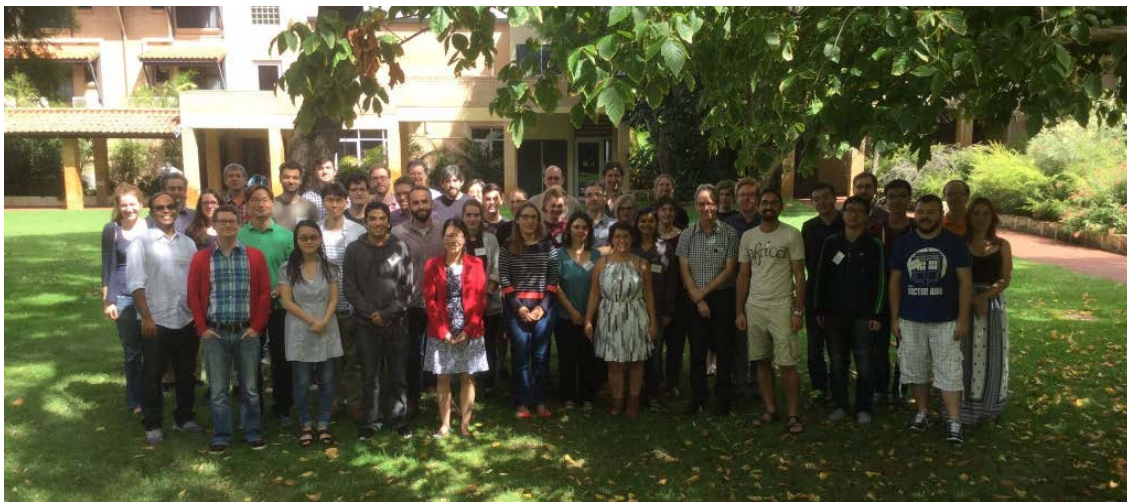
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### **Mock Perth: Challenges for Simulations in the Era of SKA and Large IFU Surveys**

20-22 March 2017, Trinity College, 230 Hampden Rd, Crawley WA

Over the coming decade, the next generation of galaxy surveys will transform how we

view galaxies, ranging from the least massive dwarfs up to the most massive galaxies in the centres of clusters, from the Epoch of Reionization to the present day. How well prepared galaxy formation models are for making predictions for these surveys was the focus of this specialised workshop, held by ICRAR/UWA at Trinity College between March 20th and 22nd. Approximately 40 observational, theoretical, and computational astronomers from around the world came together to discuss what we can expect from forthcoming surveys, based on the current state-of-the-art observations; what current galaxy formation models predict; and what future galaxy formation models need to do if they are to continue to be a useful tool to interpret the cutting edge datasets to come from the SKA, next generation IFUs, etc... There was a particular emphasis on star formation, feedback and environmental processes, such as ram pressure stripping, with special sessions on, for example, the Epoch of Reionization and HI in Galaxies, as well as breakout discussions to understand what the major challenges for simulations are and how these can be overcome. Current simulations can successfully reproduce many statistical properties of the observed galaxy population, but struggle to capture their detailed internal properties, particularly gas content, especially on dwarf scales. The various forms of feedback that modelled; the importance of binary stellar evolution; and the ability to resolve, for example, turbulent pressure within the interstellar medium were highlighted as key astrophysics that must be captured in future models.



Mock Perth Delegates in the grounds of Trinity College, UWA 22 March 2017

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## UPCOMING EVENTS

- [Sydney Astrofest 2017](#), 1 July 2017, 4pm to 9pm, University of Sydney
  - [From Black Hole to Environment: Galaxy Evolution across Multiple Wavelengths](#), 21-24 August 2017, Australian National University, Canberra, Australia
  - [ACAMAR 3. Australia-China Workshop on Astrophysics](#), 18-20 September 2017, Wrest Point Conference Centre, Hobart, Tasmania
  - [Uluru Astronomy Weekend](#), 20-22 October 2017, Uluru, NT, Australia
  - [The Dark Energy Collaboration Meeting](#), 6-10 November 2017, University of Queensland
  - [7th CAASTRO Annual Retreat](#), 21-23 November 2017, Novotel Barossa, Adelaide, SA, Australia
  - [Science at Low Frequencies IV](#), 12-15 December 2017, SNH Building, University of Sydney, Sydney, NSW, Australia
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