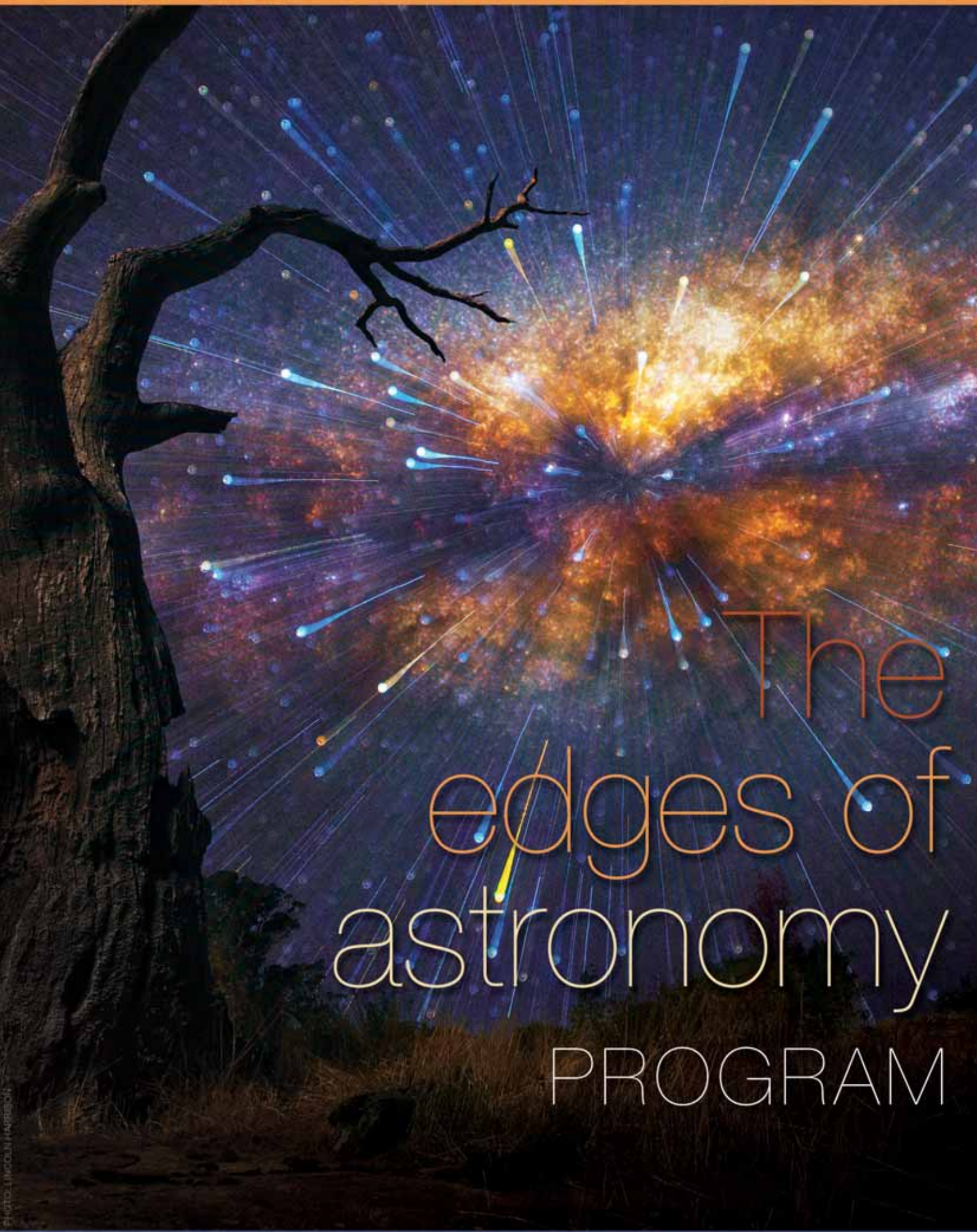
Australian Academy of Science

2014 AUSTRALIAN FRONTIERS OF SCIENCE
SHINE DOME, CANBERRA 2–4 DECEMBER



The edges of astronomy

PROGRAM

PHOTO: MICHAEL HARRISON

Foreword

The Australian Academy of Science has hosted the Australian Frontiers of Science symposium since 2003, bringing together the very best young Australian scientists to discuss emerging technologies, new opportunities and exciting cutting-edge advances in their fields.

This year, 70 outstanding early- and mid-career researchers will explore the boundary between astronomy and the outside world, including its interface with society, government, industry and other disciplines. Since this year's meeting goes beyond the traditional astronomy research space, mentors with experience from disciplines at the edges of astronomy will also be involved to pass on their perspectives to the younger generation. Together they will share knowledge and experiences about the potential economic benefits of this area of basic research, look at some of its dramatic technological spinoffs, such as wi-fi, see how astronomy has influenced public awareness of science and look at the impact of an astronomy background on careers in other disciplines.

The 2014 Australian Frontiers of Science symposium is generously supported by the Theo Murphy (Australia) Fund, courtesy of the Royal Society of London. The Academy is delighted to have this funding available, enabling some of Australia's brightest young scientists to engage in fresh thinking about the edges of astronomy, and to develop networks that will enrich their careers.

Professor Andrew Holmes AM PresAA FTSE FRS
President, Australian Academy of Science

Symposium organisers

ORGANISING COMMITTEE

Dr Tara Murphy, Chair
(Session 5: Career paths after a PhD in astronomy)
Senior Lecturer, School of Physics,
University of Sydney

Dr Douglas Bock
(Session 3: The economic impact of basic research)
Research Director, Australia Telescope National Facility Operations, CSIRO Astronomy and Space Science

Dr Kate Brooks
(Session 8: The community of astronomers—Indigenous engagement)
Deputy Head Operations, Australia Telescope National Facility Operations, CSIRO Astronomy and Space Science

Associate Professor Darren Croton
(Session 6: Science in the cloud—big data and new technology)
Queen Elizabeth II Research Fellow,
Centre for Astrophysics and Supercomputing,
Swinburne University of Technology

Associate Professor Tamara Davis
(Session 2: Cosmology—the physical edges of the Universe)
Australian Research Council Future Fellow,
School of Mathematics and Physics,
The University of Queensland

Dr Alan Duffy
(Session 7: Outreach—why reach out?)
Research Fellow, Centre for Astrophysics and Supercomputing, Swinburne University of Technology

Professor Carole Jackson
(Session 4: Astronomy and industry—building successful partnerships)
Western Australian Premier's Research Fellow,
International Centre for Radio Astronomy Research (ICRAR), Curtin University

Professor Stuart Wyithe
(Session 1: Highlights from the Decadal Plan of the National Committee for Astronomy)
Australian Laureate Fellow, School of Physics,
University of Melbourne

OVERSIGHT COMMITTEE

Professor Ron Ekers FAA FRS, Chair
Fellow, CSIRO

Professor Bob Frater AO FAA FTSE
Vice President for Innovation, ResMed

Professor Brian Schmidt AC FAA FRS
Distinguished Professor, The Australian National University

ACADEMY SECRETARIAT

Dr Camille Couralet
Early- and Mid-Career Researcher Policy Officer

Mr Mitchell Piercey
Events Manager

Program

DAY ONE—TUESDAY 2 DECEMBER

4.30 pm	**Registration and poster setup**
5.00 pm	**Opening and welcome** Professor Andrew Holmes AM PresAA FRS FTSE, President, Australian Academy of Science
5.10 pm	**Poster session**
6.00 pm	**Public lecture** *Building the world's biggest telescope* Dr Lisa Harvey-Smith, CSIRO Astronomy and Space Science
7.00 pm	**Cocktail reception**

DAY TWO—WEDNESDAY 3 DECEMBER

8.45 am	**General introduction**
9.00 am	**Session 1: Highlights from the Decadal Plan of the National Committee for Astronomy** Chair Professor Stuart Wyithe, University of Melbourne Mentor Dr Brian Boyle, Australian Government Department of Industry
9.00 am	*What is a decadal plan?* Professor Stuart Wyithe, University of Melbourne (10 min presentation + 5 min questions)
9.15 am	*Implementing a decadal plan* Dr Yeshe Fenner, Astronomy Australia Limited (10 min presentation + 5 min questions)
9.30 am	*The long tail of Australian astronomy: extreme astrophysics with international-scale facilities* Dr Duncan Galloway, Monash University (10 min presentation + 5 min questions)
9.45 am	*The role and importance of demographics studies in a decadal plan* Ms Céline d'Orgeville, The Australian National University (10 min presentation + 5 min questions)
10.00 am	Panel discussion and Q&A with all participants
10.30 am	MORNING TEA
11.00 am	**Session 2: Cosmology—the physical edges of the Universe** Chair Associate Professor Tamara Davis, The University of Queensland Mentor Professor Brian Schmidt AC FAA FRS, The Australian National University
11.00 am	*The edge of the Universe—a fundamental limit how much we can know?* Associate Professor Tamara Davis, The University of Queensland
11.15 am	*The small-scale spatial limits to the Universe* Dr Alessandro Fedrizzi, The University of Queensland
11.30 am	*The edge of time: What happened at the big bang?* Dr Luke Barnes University of Sydney
11.45 am	*The edges of knowledge—the 'physics is done' syndrome* Associate Professor Michael Murphy, Swinburne University of Technology
12.00 pm	Panel discussion and Q&A with all participants, moderated by Professor Brian Schmidt
12.30 pm	LUNCH
1.30 pm	**Session 3: The economic impact of basic research** Chair Dr Douglas Bock, CSIRO Astronomy and Space Science Mentor Dr John O'Sullivan FAA FIEAust FTSE
1.30 pm	*Economic impacts of basic research* Dr Jenny Gordon, Productivity Commission

1.45 pm	*Placing science at the centre of industry policy* Dr Rob Porteous, Australian Government Department of Industry
2.00 pm	*The role of venture capital in bringing basic research to impact* Dr Larry Marshall, Southern Cross Ventures
2.15 pm	Dr John O'Sullivan interviewed by Professor Brian Schmidt
2.35 pm	Panel discussion and Q&A with all participants
3:00 pm	**AFTERNOON TEA**
3:30 pm	**Session 4: Astronomy and industry—building successful partnerships** Chair Professor Carole Jackson, Curtin University Mentor Mr Roger Franzen, The Australian National University Keynote presentation *Relationship building between research and industry* Mr Roger Franzen, The Australian National University
4.00 pm	**Panel introduction** (5–7 minutes for each panellist) Professor Carole Jackson, Curtin University Associate Professor Andrew Hopkins, Australian Astronomical Observatory Mr Steve Negus, Aurecon Mr Noel Wainwright, Lockheed Martin Australia
4.30 pm	Panel discussion and Q&A with all participants
5.00 pm	**END OF DAY TWO**

6.00 pm	Coach departs the Shine Dome for dinner
6.30 pm	**Dinner at the Australian National Botanic Gardens**, Clunies Ross street, Acton Speaker Mr Simon Pampena, Australian Numeracy Ambassador
9.30 pm	Dinner close and coach returns to QT hotel

DAY THREE—THURSDAY 4 DECEMBER

8.30 am	**Session 5: Career paths after a PhD in astronomy** Chair Dr Tara Murphy, University of Sydney Mentor Professor Bob Frater AO FAA FTSE, ResMed
8.30 am	*From astronomy to archaeology, art history and art conservation* Dr Haida Liang, Nottingham Trent University, UK
8.45 am	*Radio galaxies meet cancer therapy: from Earth rotation aperture synthesis to patient rotation computed tomography* Dr Ilana Feain, University of Sydney
9.00 am	*When your hobby and your career change places* Dr Paul Brooks Trident Subsea Cables
9.15 am	*From science to industry—a career perspective* Professor Bob Frater, ResMed
9.30 am	Panel discussion and Q&A with all participants
10.00 am	**MORNING TEA**

10.30 am	**Session 6: Science in the cloud—big data and new technology** **Chair** Associate Professor Darren Croton, Swinburne University of Technology
10.30 am	*Big data challenges for the next generation of radio telescopes* Professor Steven Tingay, International Centre for Radio Astronomy Research
10.45 am	*Discovering the unknown—unknowns in big data* Professor Ray Norris, CSIRO Australia Telescope National Facility
11.00 am	*Machine learning for scientific discovery* Dr Cheng Soon Ong, NICTA
11.15 am	Panel discussion and Q&A with all participants
12.00 pm	**LUNCH**
12.45 pm	**Session 7: Outreach—why reach out?** **Chair** Dr Alan Duffy, Swinburne University of Technology **Mentor** Ms Margaret Wertheim, The Institute For Figuring, Los Angeles, US
12.45 pm	*Why does science communication matter?* Ms Margaret Wertheim, The Institute For Figuring
1.15 pm	*Science can change lives* Miss Renae Sayers, SciTech
1.25 pm	*Engaging policymakers through science* Dr Alexander Cooke, Australian Government Department of Industry
1.35 pm	*Professional science communication: challenges and rewards* Mr Pete Wheeler, International Centre for Radio Astronomy Research
1.45 pm	Panel discussion and Q&A with all participants
2.15 pm	**COFFEE BREAK**
2.30 pm	**Session 8: The community of astronomers—Indigenous engagement** **Chair** Dr Kate Brooks, CSIRO Astronomy and Space Science **Mentors** Dr Marian Heard, CSIRO Education and Outreach Ms Annette Cairnduff, University of Sydney
2.35 pm	*Studies in Indigenous astronomy* Dr Duane Hamacher, University of New South Wales
2.50 pm	*Working with Indigenous students and communities* Ms Emma Woodward, CSIRO Ecosystem Sciences
3.05 pm	*Mentoring program between CSIRO astronomers and the Pia Wadjarri remote community school* Dr Lisa Harvey-Smith, CSIRO Astronomy and Space Science
3.20 pm	Panel discussion and Q&A with all participants
4.00 pm	**Closing remarks**
4.30 pm	Coach departs the Shine Dome for the airport

Welcome

Professor Andrew Holmes AM PresAA FRS FTSE, President, Australian Academy of Science

Andrew Holmes was Professor of Organic and Polymer Chemistry and Director of the Melville Laboratory for Polymer Synthesis at the University of Cambridge. In 2004 he was awarded an ARC Federation Fellowship and Inaugural veski Innovation Fellowship at the Bio21 Institute in the University of Melbourne. He was a CSIRO Fellow, a University of Melbourne Laureate Professor at the University of Melbourne, Distinguished Research Fellow at Imperial College and was the Newton Abraham Visiting Professor, University of Oxford in 2011–12.

His research interests involve applications of synthesis to materials science and biology. He has made extensive contributions in the area of light emitting and photovoltaic devices. He was elected a Fellow of the Royal Society in 2000, and a Fellow of the Australian Academy of Science and the Australian Academy of Technological Sciences and Engineering in 2006. He is President of the Australian Academy of Science. From 2000–03 he was Chairman of the Editorial Board of *Chemical Communications* and he has been an Associate Editor of *Organic Letters* since April 2006.

Dinner speaker

Mr Simon Pampena, Australian Numeracy Ambassador

Simon Pampena is one of the world's leading mathematical communicators performing year-round to audiences in the UK, USA and all across Australia. He has been the Australian Numeracy Ambassador since 2009 and is a regular contributor to ABC1 Catalyst, Discovery Channel's You Have Been Warned and groundbreaking YouTube channel Numberphile. His pioneering blend of comedy and mathematics has been wowing crowds around the world with numerous seasons at the Melbourne International Comedy Festival, Adelaide Fringe and the Edinburgh International Science Festival. To see one of Simon's shows is to experience mathematics his way: a rocket-pack strapped full of maths enthusiasm!

Presentation abstracts

The thematic sessions will vary in format but each session will last 1.5 hours and include time for interactive discussions with all the meeting participants. The program will include presentations and high-level panel discussions with speakers from Australia and overseas.

SESSION 1 HIGHLIGHTS FROM THE DECADAL PLAN OF THE NATIONAL COMMITTEE FOR ASTRONOMY

This session will be a discussion of the importance, processes and outcomes from the strategic planning that Australian astronomers are undertaking as part of the Australian Astronomy Decadal Plan. Why are we doing this? What do we hope to achieve? What has our experience been both of working within our past plan and developing our future directions?

Chair

Professor Stuart Wyithe
University of Melbourne

Mentor

Dr Brian Boyle
Australian Government Department of Industry

Presentations

What is a decadal plan?

Professor Stuart Wyithe
University of Melbourne

The Australian astronomical community carries out a formal strategic planning process on a 10-year time scale. This process provides the opportunity for Australian astronomy to carry out a stock take of its capabilities, assess its impact both nationally and internationally, provide a vision for the future and to set priorities and develop strategies on how that vision might be implemented. The resultant decadal plan can then be used as a highly influential document to present our vision to key stakeholders outside the research sector. In this talk I will briefly describe the process that the Australian community has pursued over the past 12 months, and the outcomes that we hope to achieve.

Implementing a decadal plan

Dr Yeshe Fenner
Astronomy Australia Limited

The *New horizons: a Decadal Plan for Australian astronomy 2006–2015* called for 'A peak body to coordinate Australia's astronomical activities and to represent it in international partnerships. Such a body may not necessarily have formal authority over all the diverse elements that comprise Australian astronomy, but it can provide an effective governance mechanism. The ability to seek and administer funds will also be a key element in the effectiveness of such a body.' (p. 24). In 2007, Astronomy Australia Ltd (AAL) was established as an impartial and independent body, to manage the Australian Government's $45 million National Collaborative Research Infrastructure Strategy (NCRIS) investment in astronomy infrastructure and advance the goals in the Decadal Plan for Australian astronomy. AAL has since coordinated the Australian astronomy response to, and managed the funding for, a range of other national schemes and projects, with AAL's funding allocations totalling over $120 million. AAL's strategic decisions are made by its independent skills-based Board of Directors, with input from member representatives and advisory committees. In this presentation, I will describe AAL's role, experience, challenges and successes in implementing the infrastructure priorities of the Decadal Plan for Australian astronomy.

The long tail of Australian astronomy: extreme astrophysics with international-scale facilities

Dr Duncan Galloway
Monash University

Australian astronomy has long been known for its strength in research and instrumentation, particularly in the optical and radio wavebands. However, a substantial fraction of the Australian community is focussed on the exploration of objects and phenomena that can best be explored with much more exotic instruments, designed to detect ultra-high energy gamma-rays; neutrinos; and even gravitational waves. The Decadal Plan currently in preparation includes for the first time a working group with the goal of assessing the current research

strengths and future opportunities in these areas. Although diverse, this group has in common a high level of engagement with large collaborations developing international-scale facilities, which can help to mitigate the perceived disadvantage of insufficient local 'critical mass'. I will discuss the formation, demographics and development of this group, as well as our conclusions for the current Decadal Plan and how they can contribute to the broader national effort.

The role and importance of demographics studies in a decadal plan

Ms Céline d'Orgeville
The Australian National University

Last year, the National Committee for Astronomy of the Australian Academy of Science initiated work towards preparing the 2016–2025 Decadal Plan for Australian astronomy. A number of working groups (WG) were formed to discuss science topics, research facilities, as well as broader aspects of Australian astronomy. Among those, WG3.1—Demographics was tasked with conducting a census of Australian astronomers and astronomy institutions. This demographics survey aims to understand the current state of the Australian astronomy workforce and to assess its scientific impact, thus allowing the astronomy community to assess its strengths and more effectively plan for the future. This presentation reports on the methodology used to perform the survey, provides a snapshot of key findings to date, and reflects on the merits and benefits of going through this process on a regular basis.

SESSION 2
COSMOLOGY—THE PHYSICAL EDGES OF THE UNIVERSE

This session will be an exploration of the edges of the Universe, and the edges of knowledge. There are things that we cannot in principle observe. Are there things we cannot in principle know? Which is the most fundamental limit: the small and large edges of space, the edges of time, the edges of knowledge, or something else?

Chair

Associate Professor Tamara Davis
The University of Queensland

Mentor

Professor Brian Schmidt AC FAA FRS
The Australian National University

Presentations

The edge of the Universe—a fundamental limit how much we can know?

Associate Professor Tamara Davis
The University of Queensland

This talk will focus on the edges of space on the large scale. How far can we currently see and where will our view be permanently obscured? Are we like ancient mariners, looking at the horizon and fearing we'll fall off the edge? Are we modern seafarers who have now surveyed the whole Earth and realised there is nowhere else to sail? It is timely to discuss the ultimate limits to our view, as the next generations of telescopes will soon be able to survey almost the entire volume of the Universe, in all directions, all the way back to almost the beginning of time. What will we learn, and what will be forever beyond our view?

The small-scale spatial limits to the Universe

Dr Alessandro Fedrizzi
The University of Queensland

The edges of the Universe and the smallest scales in the quantum world are separated by more than 60 orders of magnitude. It is at the intersection between these two strikingly different worlds where we encounter the, perhaps final, frontier of scientific knowledge. This talk will zoom in on very small things: photons at the Planck scale, quantum foam in vacuum, and the very reality of the quantum wavefunction. What are the fundamental limits of measurability, and what do these quantum effects tell us about as-yet-unexplained cosmological phenomena such as dark energy and inflation?

The edge of time: What happened at the big bang?

Dr Luke Barnes
University of Sydney

Was the big bang the beginning of time? Does the Universe have a beginning? These age-old questions have been remarkably informed by modern cosmology. In this presentation, I will follow the theorems, evidence and hints that lead us back in time. In particular, I will discuss the expansion of space, the physics of the very early Universe, cosmic inflation, the impact of quantum physics, and the reason (or one of them) why Stephen Hawking is famous.

The edges of knowledge—the 'physics is done' syndrome

Associate Professor Michael Murphy
Swinburne University of Technology

Over the last century, physicists have established that the Standard Model of particle physics and General Relativity explain all the phenomena we observe in our Universe (with a possible exception or two). To some, it can seem like 'physics is done'. At the same time, though, physicists repeatedly attempt new observations and experiments, aiming to test—and hopefully break—the predictions of these theories and/or to search for new phenomena altogether. The problem is this: physicists seem convinced that, despite their success, current theories seem incomplete and more than a little unsatisfying. For example, one can ask seemingly well-motivated questions, such as 'Why does electromagnetism has the strength it has?', and our current theories have no answers. In this presentation, I will give an observational astronomer's view on the 'physics is done' syndrome and physicists' attempts to test current theories and find new phenomena. I will try to speculate on the possible edges of knowledge—on what we can and cannot know, in principle—about our Universe.

SESSION 3
THE ECONOMIC IMPACT OF BASIC RESEARCH

The economic impact of basic research is often proposed as a justification for public funding. However, timescales for creating knowledge may be long while the benefits may be well outside the funded field. How can scientists quantify and articulate the benefits to government and the public? In the most basic research fields such as astronomy should we tout our trained problem-solvers or the broader impact of our instrumentation programs? How can economic impacts of research conducted by a medium-sized country like Australia be secured on-shore?

Chair

Dr Douglas Bock
CSIRO Astronomy and Space Science

Mentor

Dr John O'Sullivan FAA FIEAust FTSE

Presentations

Economic impacts of basic research

Dr Jenny Gordon
Productivity Commission

The economic impacts of basic research are notoriously hard to measure in any comprehensive way. The pathway between basic research and impact is often long and unpredictable, and innovations often draw on many different findings from basic research. Yet policy makers still want guidance on public investment strategies—and estimates of the impact of basic research is part of the information base of this decision making. Estimating impact comes down to mapping the outputs of basic research to impacts—new goods and services, new production processes that add to GDP and/or to the quality of life of Australians. The presentation will provide examples of some evaluations to explain how economists go about imperfectly estimating the impact of some basic research.

Placing science at the centre of industry policy

Dr Rob Porteous
Australian Government Department of Industry

Science, research and innovation are essential for increasing productivity growth and ensuring a strong future for the Australian economy. In recognition of this, the Australian Government is working to maximise the commercial return from our investment in research. By placing science at the centre of industry policy, the government is committed to making stronger and more meaningful connections between science and business to produce better commercial outcomes. This presentation will outline the Australian Government's initiatives to improve the practical applications of science and research, including those announced as part of the Industry Innovation and Competitiveness Agenda. The presentation will also discuss the role of the newly established Commonwealth Science Council in providing high-level advice to government about its science and research investment.

The role of venture capital in bringing basic research to impact

Dr Larry Marshall
Southern Cross Ventures

SESSION 4
ASTRONOMY AND INDUSTRY—BUILDING SUCCESSFUL PARTNERSHIPS

Given the size and complexity of many astronomy projects, the astronomy community seeks to 'engage' with industry. The question remains whether we do so effectively. The Australian astronomy decadal plan mid-term review in 2011 identified a number of lessons from past engagements. The decadal plan is an opportunity to refresh how we, as a community, can approach this issue to ensure the decadal plan delivers benefits for all involved. Astronomy is not alone in this endeavour and other high-cost science areas face the same challenges. We find that developing commercial (professional) skills via close interaction with industry-based personnel—through to developing practical mega-project execution processes—would be practical steps to improvement. In this session we will hear about successful relationships that have built a path between the two cultures (commercial and academia). A panel of experts will discuss such topics as:

- successes (and lessons) learnt
- relationship building between commerce and academia
- how academics can develop commercial awareness (to the market, to project imperatives)
- the value and flow of PhD skills in and out of academia and industry.

Chair

Professor Carole Jackson
Curtin University

Mentor

Mr Roger Franzen
The Australian National University

Keynote presentation

Relationship building between research and industry

Mr Roger Franzen
The Australian National University

The world of science today is changing significantly, incorporating ever more complex engineered systems to provide the scientific data required by researchers. The complexity of these engineered systems is growing beyond the effective/efficient ability of traditional laboratory construction methods. To achieve their instrumentation requirements with ever more constrained budgets and timelines, today's researchers must learn to engage with professional engineers using structured engineering management methods. Such methods are regularly used successfully by industry, but are still largely foreign to the research community. This talk will explore how these trends may effect the every day researcher and how, with respect to instrumentation, the traditional role of the Principal Investigator may become more likened to that of the role of an architect. The talk will reference Australia's current involvement in the Giant Magellan Telescope project.

Panellists

Professor Carole Jackson
Curtin University

Associate Professor Andrew Hopkins
Australian Astronomical Observatory

Mr Steve Negus
Aurecon

Mr Noel Wainwright
Lockheed Martin Australia

SESSION 5
CAREER PATHS AFTER A PHD IN ASTRONOMY

A PhD in astronomy provides excellent training for careers beyond astronomy and beyond science. In this session, our speakers will discuss their own career path, talk about the benefits of a PhD in astronomy, and discuss how the training could be improved for future students.

Chair

Dr Tara Murphy
University of Sydney

Mentor

Professor Bob Frater AO FAA FTSE
ResMed

Presentations

From astronomy to archaeology, art history and art conservation

Dr Haida Liang
Nottingham Trent University, UK

Astronomy is both a fundamental science and an applied science. Nothing could be more fundamental than understanding the expansion of the Universe. Yet, astrophysics is also applied physics and uses pretty much every branch of physics. Astronomy deals with faint signals, which requires working at the forefront of imaging science. Imaging science is therefore often the link between astronomy and other

disciplines. While the fact that the research occurs in such a specialised area might give the impression that astronomy is a rather narrow subject, it is only narrow in the area of application. The knowledge base necessary to carry out this research relies on a broad physics and engineering background. Observational astronomy provides rigorous training in image processing, statistics and programming, while astronomy itself deals with the interaction between light and matter—which is fundamental to understanding the materials that make up an ancient object of art and its sensitivity to light-induced degradation. Astronomy is a study of the history of the Universe, and uses advanced remote imaging and analytical techniques to study the objects in it. Archaeology and art history rely on the same advanced imaging and analytical techniques—as these techniques are by default non-invasive—to study the ancient objects and infer the history of culture.

Radio galaxies meet cancer therapy: from Earth rotation aperture synthesis to patient rotation computed tomography

Dr Ilana Feain
University of Sydney

It is no exaggeration to say that cancer represents the biggest global health burden facing the world in the next few decades. Cancer is going to impact low and middle-income countries the hardest, where there is little to no access to adequate cancer treatments. Radiation therapy is recommended in about half of all cancer treatments. Amortised over the lifetime of the machine, radiotherapy is the most cost-effective way to treat patients both curatively and palliatively. But, that is the problem. Current best-practice radiotherapy machines cost $5–6 million each. This is without adding the costs of a radiation-shielded room or the service and maintenance of this highly complicated engineering equipment. Using frugal innovation, our team has invented (and patented) Nano-X: a novel radiotherapy system, which delivers best-practice treatment at about 10% of the cost of current best-practice treatment machines. Our solution drastically simplifies the radiotherapy machine for remote usability. Conventional radiotherapy machines require a patient to lie motionless on their back while a 3000 kilogram gantry rotates the X-ray treatment beam around the patient. Our solution does away with the gantry, and rotates the patient on a custom-designed couch. I am the project lead for Nano-X. My background in radio astronomy image processing, and as a project scientist for the Australian Square Kilometre Array Pathfinder, is utterly pertinent. Tangible skills that are associated with this project include (i) real-time tomographic image reconstruction with a self-calibration feedback loop, (ii) complex machines contracted to a company in China to be shipped to a remote location where cooling and power are major challenges, and (iii) heavily radiation-shielded rooms. The intangible skills include developing, advocating and demonstrating a novel—and potentially paradigm-shifting—technological solution to a traditionally conservative community. Changing careers is very humbling, but incredibly thrilling. It means leaving behind your track record, your knowledge of the literature, the jargon, the ‘right people’ to side with, and often those mentors and sponsors that have in many ways kept you afloat over the years. I spent more than a third of my life commissioning receiver systems and studying radio galaxy evolution and feedback over most redshifts and most luminosities. I still feel there are many unanswered questions I would like to get back to one day. But, wherever I go next, I know I can rely on my astronomy skillset and background.

When your hobby and your career change places

Dr Paul Brooks
Trident Subsea Cables

Growing up, I was captivated by space and the planned orbiting telescopes, and set my sights on becoming an astronomical scientist—ideally a mission specialist on the proposed Space Shuttle to do science in space. Connecting early microcomputers to interface with the outside world and each other was fun. Along the way, advances in technology and communications meant it was no longer necessary to look through telescopes, or to go into orbit to use a telescope. In addition, the new phenomenon, called the internet, took over, and astronomers played a major role in the development and expansion of the early internet. Now, I build the internet for a career, and astronomy is a hobby. However, the lessons learnt during higher education have been vital to me, and my latest projects are closing the circle and bringing me back to astronomy and space again.

From science to industry—a career perspective

Professor Bob Frater
ResMed

SESSION 6
SCIENCE IN THE CLOUD—BIG DATA AND NEW TECHNOLOGY

The way science is undertaken has changed dramatically in the past 10–15 years, and it is set to change even more in the coming decade. New technologies, such as online databases, virtual machines, cloud computing and machine learning are becoming commonplace. This session will explore such innovations and their role in maximising the scientific value from astronomy data, in particular from the next generation of telescopes and simulations.

Chair

Associate Professor Darren Croton
Swinburne University of Technology

Presentations

Big data challenges for the next generation of radio telescopes

Professor Steven Tingay
International Centre for Radio Astronomy Research

I will discuss the challenges in modern radio astronomy connected with the next generation of radio telescopes, in particular the challenges posed by the massive computing requirements set by the ambitious science goals. These challenges are starting to be met already, with telescopes like the Murchison Widefield Array (MWA) generating multiple petabytes of data and requiring massive computer facilities. The MWA is a precursor for the Square Kilometre Array (SKA), which will move into the exascale computing regime within a decade. I will review the science and technology that is pushing radio astronomy in this direction, give real-world examples of how the MWA is coping with the challenge thus far, and will extrapolate to the era of the SKA.

Discovering the unknown—unknowns in big data

Professor Ray Norris
CSIRO Australia Telescope National Facility

The Evolutionary Map of the Universe (EMU) project will transform our view of the radio sky, going 30 times deeper than any other large radio survey, and discovering about 70 million galaxies. The EMU, like other ground-breaking surveys, is exploring an unexplored part of the observational phase space, and experience tells us that such projects nearly always discover unexpected new phenomena—the 'unknown unknowns' of astronomy. Even more importantly, these discoveries dominate the scientific productivity of major new telescopes. For example, of the ten most important discoveries made with the Hubble Space Telescope, only one featured in its original science goals. However, while surveys such as the EMU are certainly likely to stumble across major 'unknown unknowns', we may be incapable of recognising them because (a) the data volumes are too large to query the data except through a well-posed question (to find the 'known unknowns'), and (b) the complexity of new instruments may prevent a human from distinguishing a genuine discovery from an instrumental artefact. So, can we build software to mine the data, searching for the unexpected? History suggests that, if we do not, we will miss 90% of the potential discoveries.

Machine learning for scientific discovery

Dr Cheng Soon Ong
NICTA

Advances in algorithms and computation have allowed researchers to analyse ever larger quantities of data. This has resulted in an increasingly data-driven approach to scientific research, for which machine learning has turned out to be a popular paradigm. This talk is about a personal journey of discovery in the biomedical sciences through the lens of machine learning. After introducing a few basic machine learning ideas, I will highlight several collaborations that show how advances in data analysis have enabled scientific discovery. I will also illustrate the potential of machine learning for astronomers using several machine learning questions that have arisen in discussions with researchers working on the SkyMapper project. The talk will focus on the practical challenges of interdisciplinary projects and strategies for using machine learning in data-driven science.

SESSION 7
OUTREACH—WHY REACH OUT?

We all know that outreach is important, but do we actually know how valuable it is?

In this session, speakers will discuss the value that this activity brings to a group, a university, science nationwide and, finally, society at large.

Chair

Dr Alan Duffy
Swinburne University of Technology

Mentor

Ms Margaret Wertheim
The Institute For Figuring, Los Angeles, US

Presentations

Why does science communication matter?

Ms Margaret Wertheim
The Institute For Figuring

At the dawn of the scientific revolution, René Descartes wrote his famous book *Discourse on method*, a slim volume outlining his ideas about the emerging realm of natural science. His target audience was not his fellow scientists, to whom his more technical works were directed, but the ladies and gentlemen of the Parisian salons. Descartes realised that if the new science was going to take off it would have to be supported by patrons, which meant potential patrons had to be engaged and enthused. Four hundred years later, natural science has more than proved its worthiness. Across the spectrum, from cosmology to biology, science has changed the basic tenor of our lives and today provides the foundation of our conception of the real. Yet support for science remains a central issue in contemporary society. Although there is no lack of great scientific projects to pursue, funding for science is beginning to lag, and government support in many countries, including Australia, is waning. In this talk, internationally acclaimed science writer Margaret Wertheim will discuss why science communication remains as vital a project now as it was in the early seventeenth century. Bringing together historical, philosophical and sociological perspectives, Wertheim will advance the case that science communication is an essential part of the infrastructure of science itself.

Science can change lives

Miss Renae Sayers
SciTech

Renae Sayers will discuss the power of having scientists and researchers connected with the community and why this can change lives—all you need to start is a healthy dose of curiosity. Our science, technology, engineering and mathematics (STEM) world has it in spades.

Engaging policymakers through science

Dr Alexander Cooke
Australian Government Department of Industry

Dr Cooke will discuss how scientists and researchers can reach out to government and its policymakers. He will discuss some avenues for influencing public policy and some examples of how this has worked in the past.

Professional science communication: challenges and rewards

Mr Pete Wheeler
International Centre for Radio Astronomy Research

Professional science communicators, like scientists, are always 'work heavy' and 'time poor'. We seem to be constantly in motion. Before the dust has settled from the last public event, we are already working on a media release, developing a new education program for underprivileged students and simultaneously hammering out a gaggle of grant applications to make it all possible. So, how do we ensure that what we are doing is what we should be doing while maintaining this constant level of activity? The answer is, it is not easy. But nothing worthwhile ever is. Evaluation is essential for refining programs, assessing impact against the initial objectives and reporting outcomes to those we answer to. It is often difficult to assign time and resources to evaluation, but it is something we must do. In this short presentation, I will describe several key programs of the International Centre for Radio Astronomy Research and how we evaluate them efficiently and effectively. I will also attempt to summarise the benefits we generate for our researchers, the community and our key stakeholders. Finally, I will touch on how this translates into 'value' for the universities and the state government that fund this work.

SESSION 8
THE COMMUNITY OF ASTRONOMERS—INDIGENOUS ENGAGEMENT

In 2009 the Astronomical Society of Australia launched a Chapter on Women in Astronomy with the aim to raise the profile of women in astronomy. Each year the Chapter has hosted a two-day workshop with more than 60 astronomers (male and female) participating from across Australia. The topics of the workshop have expanded over time and now include the broader topics of diversity, inclusion, empowerment, mentoring and unconscious bias. In this session we take these important topics and focus on indigenous engagement and education.

We will hear from early- and mid-career researchers who are using their science knowledge to learn more about indigenous knowledge and engage with indigenous communities and students. We will also hear from leaders who have experience at the front line of closing the educational gap for Indigenous students.

The goal of this session is for the audience to learn how they as working scientists can engage, inspire and empower indigenous students to take up further studies in science.

Chair

Dr Kate Brooks
CSIRO Astronomy and Space Science

Mentors

Dr Marian Heard
CSIRO Education and Outreach

Ms Annette Cairnduff
University of Sydney

Presentations

Studies in Indigenous astronomy

Dr Duane Hamacher
University of New South Wales

Australia is home to several hundred distinct Aboriginal and Islander communities, each with a culture rich in astronomical knowledge. These cultures stretch back more than 50 000 years, making them the oldest continuous cultures on Earth, and the world's oldest astronomers. Woven into oral traditions and material culture, astronomical knowledge is used for navigation, calendars, food economics, sacred law, ceremony and social structure. Our knowledge of Indigenous astronomy is now greatly expanding, revealing a complexity and depth not before recognised or appreciated. Recent findings show that Aboriginal people built stone arrangements to mark the position of the setting sun at the solstices and equinoxes. Ceremonial sites are aligned to the position of the Milky Way. The breeding cycles of animals are closely linked with the rising and setting times of their celestial counterparts. Descriptions of ancient meteorite impacts remain in oral tradition. Torres Strait Islanders predict changing weather patterns using the degree of scintillation of stars. Our understanding of Indigenous astronomical knowledge is not only important for our cultural heritage, it is essential for appreciating the complexity and benefits of Indigenous Knowledge Systems that were developed over tens of thousands of years.

Working with Indigenous students and communities

Ms Emma Woodward
CSIRO Ecosystem Sciences

Emma is an experienced cross-cultural researcher who has worked in close partnership with Aboriginal communities on water resource, climate change and livelihoods projects in far northern Australia, and has been instrumental in developing community-scale research protocols and agreements directly with Aboriginal research participants. Through this award Emma seeks to build her knowledge and expertise in creating ethical Indigenous research partnerships and developing best practice frameworks for Indigenous research engagement. She has developed six seasonal calendars from six different language groups from the Northern Territory and Western Australia. The calendars provide early warning signs of environmental change, which will help scientists manage water use and monitor the impacts of climate change. In her talk, Emma will describe some of the projects she is currently involved in.

Mentoring program between CSIRO astronomers and the Pia Wadjarri remote community school

Dr Lisa Harvey-Smith
CSIRO Astronomy and Space Science

For the past two years, I have been taking part in a CSIRO mentoring program at the Pia Wadjarri remote community school in Western Australia. Pia Wadjarri is a small Aboriginal community, located within the Wadjarri Yamatji native title claim region in the mid-west of Western Australia. Pia Wadjarri is the closest community to the Murchison Radio-astronomy Observatory, which hosts CSIRO's Australian Square Kilometre Array Pathfinder telescope, as well as the Murchison Widefield Array telescope. The observatory will later become the Australian site of the Square Kilometre Array, the world's largest radio telescope. The mentoring program is one aspect of the Indigenous Land Use Agreement between CSIRO and the Wadjarri Yamatji people. In this talk, I will describe the aims and implementation of the mentoring program, as well as the broader Indigenous engagement strategy between CSIRO and the traditional owners.

Poster abstracts

(listed by alphabetical order of author)

EXPLORING 4 BILLION YEARS OF GALAXY EVOLUTION WITH ASKAP

Dr James Allison
CSIRO Astronomy and Space Science

Hydrogen is the most abundant element in the Universe and a vital ingredient in the formation of new stars and in feeding supermassive black holes at the centres of massive galaxies. However, until now, the hydrogen content of the distant Universe has remained largely unexplored for a vast period of cosmic history. At radio wavelengths we have been limited by the sensitivity of existing telescopes and contamination from terrestrial radio-frequency interference. Using a new radio telescope—the Australian Square Kilometre Array Pathfinder (ASKAP)—and its excellent radio-frequency environment, we can now survey the adolescent Universe. Here I present results from a hydrogen survey of distant galaxies using the six-antenna ASKAP prototype. By pointing the telescope towards a young radio galaxy, we have discovered clouds of cold atomic hydrogen, which are drifting in front of the active nucleus and absorbing the radio waves emitted from powerful jets of plasma. Furthermore, the radio spectrum is 304 MHz wide, allowing us to search over a range of lookback times from 4 to 8 billion years ago. This has allows us to place constraints on the cosmological hydrogen density during this period.

LIVE FAST AND DIE YOUNG

Dr Yanett Contreras
Australia Telescope National Facility

How stars form is a fundamental question in astrophysics, the answer to which has ramifications for the evolution of galaxies, the formation of planets, and ultimately life itself. Listed as one of the 10 big questions in the Australian astronomy Decadal Plan mid-term review, our understanding of how stars form has progressed considerably in recent years and will be revolutionized by the next generation of large telescopes. My current research involves an observational study of the earliest stages of star formation. By combining multi-wavelength data, using both ground-based and space-based observatories, single dishes and interferometers, I am studying how the most massive stars are born. With more than eight times the mass of our sun, these high-mass stars 'live fast and die young' and have a profound impact on the ecology of our Galaxy. Here I present some of the main scientific results of my research.

ASTRONOMY OUTREACH IN THE TOURISM SECTOR

Mr Mike Dalley
Ayers Rock Resort

Ayers Rock Resort and the ARC Centre of Excellence for All-sky Astrophysics (CAASTRO) bring professional astronomy to the public of Australia and the world. Free-choice learning areas are important for the public to outreach, learn and engage in astronomy outside a formal environment. Ayers Rock Resort, in partnership with CAASTRO, have created a new level of professional, free-choice astronomy outreach under the beautiful Central Australian sky. Located only 19 kilometres away from the iconic Ayers Rock, the resort offers high-level astronomy tours. This year, the resort has partnered with CAASTRO to ensure that the astronomy outreach continues to consist of the highest possible standard. Visiting resident astronomers sent by CAASTRO give support to resort staff. Together, they operate nightly tours, such as the famous Sounds of Silence dinner in the desert, and Outback Sky astronomy tours. During the day, the resident astronomers have the opportunity to interact with guests on a one-on-one basis and showcase themselves as they talk about their latest research and where they are based.

MAKING A SPLASH WITH THE DISH: SURVEYING STAR FORMATION AND HIDDEN GAS IN THE MILKY WAY

Dr Joanne Dawson
Macquarie University and
CSIRO Astronomy and Space Science

The Southern Parkes Large-Area Survey in Hydroxyl (SPLASH) is a new survey with the iconic Parkes 64 metre radio telescope, which tackles two aspects of the outstanding question 'How do galaxies convert their gas into stars?' By targeting the radio-frequency emission and absorption from OH molecules in our Milky Way Galaxy, SPLASH is embarking on a hunt for the 'dark interstellar medium'—a missing link in the evolutionary sequence linking diffuse interstellar

gas to dense, cold and dusty star-forming clouds. Further along the evolutionary timeline, SPLASH is also probing deeper than ever before into the Milky Way's disk to detect the sharp, bright radio spectral lines (masers) that are a signature of newly-forming high-mass stars. Now in the final stages of data processing, the project is beginning to provide new information on the physics and evolution of the interstellar medium, on the structure of our Milky Way, and on the star formation activity within it. This information promises to remain an important legacy dataset for the astronomical community.

A SODIUM LASER GUIDE STAR FACILITY FOR THE ANU/EOS SPACE DEBRIS TRACKING ADAPTIVE OPTICS DEMONSTRATOR

Ms Céline d'Orgeville
The Australian National University

Laser guide star adaptive optics (LGS AO) is a technique used to restore space-like imaging conditions for ground-based optical systems by correcting atmospheric turbulence disturbances in real-time. When applied to sharpening the infra-red laser beam used by space debris laser tracking stations, adaptive optics have the potential to enhance the tracking performance and overall station efficiency by enabling tracking of smaller and more distant debris. The Adaptive Optics group at The Australian National University (ANU) Research School of Astronomy and Astrophysics have teamed up with EOS Space Systems to equip the EOS laser space debris tracking station, located at the ANU Mount Stromlo Observatory, with an adaptive optics demonstrator. This project is a joint project whereby ANU provides LGS AO expertise and EOS provides space debris tracking and laser expertise. While the adaptive optics bench itself is developed mostly by the ANU, the laser guide star facility is a more collaborative effort that uses expertise from both the ANU and EOS teams.

AN ALGORITHM FOR BACKGROUND AND NOISE ESTIMATION

Dr Paul Hancock
Curtin University

In the era of big data we are no longer able to hand-curate all the catalogues and images that come from all-sky surveys. As such, we must rely on automated processes to produce high-quality (complete, reliable and accurate) descriptions of the sky. I have developed a source-finding algorithm, Aegean, which creates high-quality catalogues from radio images. In this poster, I demonstrate the need for an accurate measure of the background and noise properties of an image. I present an algorithm for background and noise estimation (BANE), that is able to generate accurate maps of the background and noise properties of an input image. It can generate these maps in a fraction of the time of more traditional methods.

COSMIC FOUNTAINS REVEAL THE BIRTH AND DEATH OF STARS

Dr Lisa Harvey-Smith
CSIRO Astronomy and Space Science

Water masers are very bright sources of cosmic radio emission that are generated when collisions occur in molecular gas. They are commonly found in regions surrounding young massive star formation and old stars that are rapidly turning into planetary nebulae. The study of water masers is extremely useful because the nature of the emission allows astronomers to measure the structure and motion of gas in these regions. Our team has used multi-frequency astronomical data to study ten Galactic water masers that have an extremely high (200 to 400 kilometres per second) spread in radial velocity, indicating the presence of very high-velocity outflows emanating from stars. These masers were selected from a large survey of molecular gas that was undertaken using the Mopra radio telescope. The masers discovered in this survey were later re-observed at higher resolution using the Australia Telescope Compact Array in order to pinpoint their exact positions on the sky. In this poster, I present images of these fascinating sources, discuss the impact of this study on our understanding of masers as signposts of stellar evolution, and suggest future work.

TERA-SCALE ASTRONOMICAL DATA ANALYSIS AND VISUALISATION

Dr Amr Hassan
Swinburne University of Technology

Upcoming and future astronomy research facilities are moving astronomy into a new era where large-scale all-sky surveys, massive numerical simulations, massive databases of astronomical objects, and large international collaborations are the key for future scientific discoveries. These resources will fundamentally change the way astronomers deal with their data and pose a serious challenge for current data analysis and visualisation tools. To address these challenges and to enable knowledge discovery in this new era, we designed and built the tera-scale interactive visualisation and data analysis framework, GraphTIVA. GraphTIVA is a framework to interactively

volume-render three-dimensional data cubes using distributed ray-casting and volume bricking over a cluster of workstations powered by one or more graphics processing units (GPUs) and a multi-core central processing unit (CPU). I will discuss the key technical aspects of GraphTIVA's design. I will also discuss a new rendering mode that enables GraphTIVA to be deployed on the CAVE2 at Monash University, Australia. This is a highly immersive environment of 84 million pixels combined with head-tracking, which provides a powerful platform that offers scientists more opportunities to achieve one-to-one mapping between their data and the output pixels, while still retaining context.

AUSTRALIAN ASTRONOMY DECADAL PLAN—WG3.3 INDUSTRY GROUP REVIEW

Professor Carole Jackson
Curtin University

In the new decadal planning round, WG3.3 was charged with reviewing industry engagement and providing a direction for the next decade (2016–2025). In this review we summarise the findings of this panel and how they may impact on our efforts in the coming 10 years.

GRAVITATIONAL WAVES FROM NEUTRON STARS

Dr Paul Lasky
Monash University

Advanced Laser Interferometer Gravitational-wave Observatory (LIGO) will begin listening to the Universe's gravitational waves in 2015, potentially opening a new window on the Universe as early as 2016–17. In this poster, I will present ongoing work to understand various gravitational wave emission mechanisms from neutron stars. This includes magnetic field instabilities, superfluid turbulence and hydrodynamical instabilities in newly born stars. I will also present ongoing data analysis efforts to detect these gravitational waves using LIGO.

DARK MATTER IN THE COSMIC CONTEXT

Dr Katie Mack
University of Melbourne

Dark matter forms the foundation for all cosmic structure. Its effects on ordinary matter are primarily gravitational, but most theories suggest that dark matter particle physics might influence the gas in its surroundings. In this poster, I show how dark matter's particle interactions might have altered the evolution of the first stars and galaxies.

ASTROPHYSICAL TRANSIENTS, AND WHY SHOULD WE CARE ABOUT THEM?

Dr Jean-Pierre Macquart
Curtin Institute of Radio Astronomy

Short-timescale transients are associated with the highest energy density events in the Universe, whose emission allows us to probe new physics well beyond that accessible here on Earth. In this poster, I will describe how recent discoveries in this field, particularly the discovery of fast radio bursts at cosmological distances, stand to transform our understanding of the matter and energy content of the Universe itself.

GALACTIC ARCHAEOLOGY WITH THE GALAH SURVEY

Dr Sarah Martell
University of New South Wales

The Galactic Archaeology with HERMES (GALAH) survey is the most ambitious Galactic archaeology project in progress. In a six-year observing program, our team will take high-resolution optical spectra of one million stars in the Milky Way—an order of magnitude more than competing projects. From these spectra we will determine stellar parameters and abundances for up to 29 elements per star. With this information, we will investigate the Galactic history of star formation, chemical enrichment, stellar migration and minor galaxy mergers.

A COMPREHENSIVE RADIO SURVEY FOR BLACK HOLES IN GLOBULAR CLUSTERS

Dr James Miller-Jones
Curtin University

Globular clusters are dense groupings of hundreds of thousands of stars within a volume of just a few cubic parsecs. Early in the lifetime of the cluster, hundreds of stellar-mass black holes are formed as the most massive stars exhaust their nuclear fuel and undergo catastrophic collapse. The high stellar densities in globular clusters imply frequent close interactions between the black holes and the stars of the cluster, allowing the black holes to acquire companion stars from which they can accrete matter. We can identify and study these black holes via the X-rays emitted by the infalling matter, and the radio waves from the jets launched close to the black hole. Since black holes have a higher ratio of radio to X-ray emission than other classes of accreting objects, deep radio surveys provide an efficient way to detect quiescent black holes. Our group has recently used this technique to great effect, identifying four new candidate black holes in

Galactic globular clusters. We are now conducting a comprehensive radio survey of all nearby globular clusters, aiming to determine the prevalence of black holes in globular clusters, and to measure their mass function.

WIDEFIELD IMAGING ALGORITHMS FOR THE AUSTRALIAN SQUARE KILOMETRE ARRAY PATHFINDER

Dr Daniel Mitchell
CSIRO Astronomy and Space Science

The Australian Square Kilometre Array Pathfinder (ASKAP) telescope is a radio array that is in the final stages of construction on the Australian Square Kilometre Array site, the Murchison Radio-astronomy Observatory. Each of the ASKAP antennas sees the sky through a phased array feed, an innovative CSIRO system that expands the natural field of view of the telescope from around one square degree to more than 30 square degrees. While ASKAP is a world-leading instrument for high-speed surveys of the radio sky, the wide field of view and enormous associated data rates present some significant computational challenges. This poster gives an overview of the imaging challenges, and solutions that have been developed to address them.

HYDROGEN IN THE UNIVERSE

Dr Vanessa Moss
University of Sydney

Hydrogen is the most fundamental and the most abundant element, comprising around 75% of the baryonic mass of the Universe. Its presence determines and drives the evolution of galaxies and the formation of stars, both in the nearby Universe and at distant cosmological times. My research in radio astronomy has revolved around hydrogen in its most basic form: atomic, neutral hydrogen. The spectral line produced by the spin-flip transition of hydrogen allows us to trace emission within our own Galaxy, the Milky Way, and absorption in galaxies that existed billions of years ago, shedding light on how this critical star-forming fuel shapes its host galaxies. Using the Galactic All-sky Survey from the 64-metre Parkes Radio Telescope to study gas in our Galaxy and the state-of-the-art Australian Square Kilometre Array Pathfinder to investigate absorbed hydrogen in far-away galaxies, we can bring together a new understanding of our Universe and its gas over billions of years.

LESSONS FROM BICEP2

Dr David Parkinson
The University of Queensland

The recent announcement of detection of large-angle primordial B-mode polarisation of the cosmic microwave background (CMB) by the BICEP2 experiment earlier this year caused considerable stir in the cosmology community, due to the possibility of the signal being generated by gravitational waves. Despite the fact that the significance of these results may have been overstated, especially in light of more realistic estimation of foreground contamination, the existence for the first time of a B-mode signal raises important questions about the correct way that a joint CMB temperature-polarisation analysis should be conducted. In particular, the tension between Planck and BICEP2 seems to drive a very blue-tilted tensor spectrum, which would be contrary to the inflation prediction. Here, I discuss the role, correct parameterisation, prior range and pivot scale play when considering a spectrum of primordial tensors, and the effect that increasing dust amplitude will have on the results.

SIMULATING STAR FORMATION

Dr Daniel Price
Monash University

This poster will present a brief overview of the star formation process, the techniques we use to simulate it on supercomputers, and the algorithms our team has developed at Monash in order to simulate the rich physics involved.

THE COSMIC MICROWAVE BACKGROUND

Dr Christian Reichardt
University of Melbourne

The cosmic microwave background (CMB) is revolutionizing our understanding of the Universe. The CMB is the strongest single piece of evidence that we live in a geometrically flat Universe, dominated by non-baryonic cold dark matter and dark energy. Many outstanding questions remain around this basic framework: Did inflation occur, and what physics was responsible for it? What are the neutrino masses? Are there new particle species that we can detect cosmologically? Remarkably, the CMB can shed light on all of these questions. I will discuss the planned Simons Array experiment, an array of three telescopes that will measure CMB polarisation at three frequencies across 80 per cent

of the sky. The first telescope will have first light in 2015, with all three telescopes taking data by mid-2016. In conjunction with measurements of the baryon acoustic oscillation feature or Hubble constant, the Simons Array should measure the sum of the neutrino to ~ 18 meV (1 sigma). The Simons Array will also dramatically improve constraints on the inflationary gravity wave background, reducing the uncertainties by a factor of ten compared to the Planck satellite.

INFERRING EXPLOSION PROPERTIES OF TYPE I SUPERNOVAE

Dr Richard Scalzo
The Australian National University

This poster outlines a flexible, economical Bayesian framework for inferring explosion properties (including ejected mass and explosion energy) of type I supernovae, which are powered by radioactive decay of nickel-56 at and after maximum light. The method uses a semi-analytic model of the bolometric light curve as the likelihood, and incorporates internal constraints on the explosion physics common to well-explored progenitor scenarios as priors. The method has been validated for Type Ia supernovae on synthetic light curves from contemporary numerical simulations of supernova explosions. Applications to real Type Ia supernova data show that the progenitors must span a range of masses at explosion, and that the ejecta mass correlates strongly with the light curve width used to standardize Type Ia supernova distance measurements in cosmology. Future work includes development of a set of priors and internal constraints appropriate to massive star explosions, and inclusion of other energy sources, such as shock interaction with circumstellar material or magnetic spin-down of a neutron star.

DATA-INTENSIVE QUASAR MICROLENSING IN THE SURVEY ERA OF ASTRONOMY

Mr Georgios Vernardos
Swinburne University of Technology

Quasar microlensing is a unique probe of quasar structure, from the broad emission line region down to the accretion disc and the supermassive black hole. Moreover, it can be used to study the mass distribution of the galaxy-lens and perform measurements of Hubble's constant. So far, only single, or small collections, of lensed quasars have been studied using microlensing techniques due to the observational and computational challenges involved. However, this is about to change due to the imminent discoveries by the upcoming all-sky survey facilities (e.g. LSST, the Large Synoptic Survey Telescope). I will present results, data, and tools from the GPU-Enabled High-Resolution MicroLensing parameter survey (GERLUMPH). In particular, how our e-research infrastructure, namely database and web interface to terabyte-sized microlensing simulations, complemented by advanced e-tools for an end-to-end online analysis of lensed systems, can accelerate the rate of scientific discovery. As regular monitoring of thousands of new microlensed quasars is expected, such an online resource would dramatically speed up the consistent and systematic study of large collections of these systems, using just a web browser at the user end.

THE SKYMAPPER SOUTHERN SURVEY

Dr Christian Wolf
The Australian National University

The Australian National University's SkyMapper Telescope started in 2014 to map the entire southern sky and will produce not only an image of the sky in six colours, but also a database with 50 million celestial objects. This huge resource allows the study of the structure and evolution of the Milky Way, as well as that of millions of other galaxies. Interpreting such large datasets relies on data mining and machine learning methods such as supervised classification, photometric distance estimation and search for rare and unusual objects. This project will identify millions of stars in the sky that belong to our Milky Way and facilitate follow-up studies of Galactic structure and archaeology. It will also create the largest-ever sample of galaxies—with high-quality photometric distance measurements with up to 10 million galaxies out to a few billion light years—and lay the groundwork for follow-up studies of their evolution with cosmic time. Possible follow-up includes studies of how stellar mass in galaxies builds up over time and how galaxies transform between different types. In addition, the TAIPAN project, which is Australia's largest detailed spectroscopic survey of galaxies and aims to commence in 2016, will build on this work.

THE RADIO GALAXY ZOO PROJECT

Dr Ivy Wong
International Centre for Radio Astronomy Research

Our team presents the early results from the Radio Galaxy Zoo project—an online citizen science project that asks its participants to help identify the host galaxy that is associated with the observed radio synchrotron emission from supernovas or

supermassive black holes (typically 10–100 million times the mass of the Sun). As the black hole radio emission can be spatially offset from the host galaxies, have unusual morphologies and be separated by quite some distance, visual identification of these sources is still the most effective method of identifying the host galaxies. Currently, Radio Galaxy Zoo hosts over 170 000 radio sources and provides the participant with the ability to transition between a radio image and the overlapping infra-red image that shows the stars in the galaxies. In its first nine months of operation, we have made reliable identifications of 12 489 host galaxies and we have found that these galaxies have a very high dust content.

Participants

DR JAMES ALLISON

Bolton Fellow, CSIRO Astronomy and Space Science

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- @theastrojim

James Allison is using the next-generation Australian Square Kilometre Array Pathfinder radio telescope to map out the reservoir of star fuel during a 4 billion-year period of galaxy evolution that has, until recently, remained largely unexplored. Making use of Bayesian model comparison, he specialises in detecting absorption of the radio signal emitted by supermassive black holes at the centre of distant galaxies. Before joining CSIRO as a Bolton Fellow, James was a Super Science Fellow at the University of Sydney, where he used the recently upgraded Australia Telescope Compact Array to probe the gaseous environments in which newly triggered radio galaxies are formed. In 2010, he completed his PhD in astrophysics at the University of Oxford.

DR JULIE BANFIELD

Postdoctoral Fellow, CSIRO Astronomy and Space Science

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Julie Banfield is a postdoctoral fellow at CSIRO Astronomy and Space Science, working on the evolution and formation of galaxies across cosmic time using magnetic fields. Julie is a member of the Evolutionary Map of the Universe and is the project leader of the citizen science project Radio Galaxy Zoo.

DR LUKE A BARNES

Speaker

Super Science Postdoctoral Fellow, Sydney Institute for Astronomy, University of Sydney

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Luke Barnes is a postdoctoral researcher at the Sydney Institute for Astronomy. Luke's university medal from the University of Sydney helped him earn a scholarship to complete a PhD at the University of Cambridge. He has published papers in the field of galaxy formation, and recently has taken an interest in the fine-tuning of the Universe for intelligent life. He blogs at letterstonature.wordpress.com

MR MAKSYM BERNYK

PhD student, Centre for Astrophysics and Supercomputing, Swinburne University of Technology

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Max Bernyk is working on e-research solutions for large astronomical datasets and galaxy formation models. Max is designing cloud systems for storing and processing synthetic galaxy catalogues and modelling the active galactic nucleus (AGN) feedback on galaxy star formation. He is also interested in high-performance computing and graphics processing units (GPU) – accelerated computations.

ASSOCIATE PROFESSOR CHRIS BLAKE

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James Allison


Julie Banfield


Luke Barnes


Max Bernyk


Chris Blake


Douglas Bock

Chris Blake is an astrophysicist based at Swinburne University. His current research uses the large-scale structure of the Universe to study the laws of gravity on cosmological scales. Chris is leading a new project using observations at the Anglo-Australian Telescope to perform new tests of General Relativity.

DR DOUGLAS BOCK

Organising Committee

Research Director, Australia Telescope National Facility Operations, CSIRO Astronomy and Space Science

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Douglas Bock has been with CSIRO since 2010 and leads operations for the Australia Telescope National Facility (ATNF), which includes the Australia Telescope Compact Array, Parkes Telescope, Mopra Telescope, and the Australian Square Kilometre Array Pathfinder (ASKAP). Douglas has made the focus of his career the design, construction and operation of radio telescopes. He was previously Assistant Director Operations and project manager for the Combined Array in Millimeter-wave Astronomy and system scientist for the Allen Telescope Array (both in California). His current activity is focused on evolving the ATNF to prepare for the SKA era, including transitioning ASKAP into its operational phase. He is also active in SKA operations planning.

DR BRIAN BOYLE

Mentor

SKA Project Director, Australian Government Department of Industry

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DR KATE BROOKS

Organising Committee

Deputy Head Operations, Australia Telescope National Facility Operations, CSIRO Astronomy and Space Science

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Kate Brooks is the deputy head of Operations of the Australia Telescope National Facility. Kate is responsible for the operations of CSIRO's three observatory sites: Parkes and Narrabri in country New South Wales and the Murchison Radio-astronomy Observatory (MRO) in Western Australia. Part of her work portfolio includes management of the MRO Indigenous Land Use Agreement. Kate joined the Council of the Astronomical Society of Australia in 2009 and was president of the society between July 2011 and July 2013. She was a member of the inaugural steering committee for the society's chapter on Women in Astronomy and has recently been appointment to the board for the National Foundation for Australian Women. Kate is committed to supporting young women scientists and promoting diversity and inclusion.

DR PAUL BROOKS

Speaker

General Manager—Networks and Technology, Trident Subsea Cables

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Paul Brooks leads Layer10 Advisory, an independent consultancy practice specialising in telecommunications strategy, internet architecture, policy and product design. Sometimes described as a 'Serial CTO', Paul provides technical expertise to service providers, regulators and enterprises in Australia, and elsewhere. Paul was actively involved in the early designs for the NBN, and is currently working to build a new subsea cable from Perth to Singapore and the Pilbara. Paul is an active participant within the Australian ISP community. He is a director of the Internet Society of Australia (a chapter of the global Internet Society),


Brian Boyle


Kate Brooks


Paul Brooks


Davide Burlon


Annette Cairnduff


Michael Childress

Interplanetary Networking chapter, and a co-founder and former director of Vocus Group Limited. He holds a BSc (Honours) in physics and computer science from the University of Adelaide, and a PhD in astrophysics from the University of New South Wales.

DR DAVIDE BURLON

Postdoctoral researcher, University of Sydney

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Davide Burlon graduated in the high-energy group at the Max Planck Institute for Extraterrestrial Physics before moving to the University of Sydney as research associate. Since completing a thesis on the high-energy emission that either precedes stellar explosions, known as gamma-ray bursts, or comes from nearby active galaxies, he has been interested in emission from black holes. He is now advising the transient working group of the multi-billion dollar Square Kilometre Array.

MS ANNETTE CAIRNDUFF

Mentor

Director, Social Inclusion, University of Sydney

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Annette Cairnduff leads the University of Sydney's social inclusion strategy. This includes managing the Compass program which works with schools and communities to encourage participation in higher education. Compass works to address the under-representation in higher education of students from low socio-economic backgrounds, Aboriginal and Torres Strait Islander students and regional students. Since it was started in 2009 Compass has had almost 100,000 engagements with students, teachers and parents. Annette has worked for 25 years in social justice and education programs across government and non-government organisations. She has undergraduate qualifications in both primary teaching and community development and a Masters in Adult Education.

DR MICHAEL CHILDRESS

Postdoctoral researcher, The Australian National University

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Michael Childress specialises in the study of Type Ia supernovae, particularly through observations of the supernovae and their environments. He received his PhD in physics from the University of California Berkeley in 2011. Michael is currently the leader of optical spectroscopy research for The Australian

National University supernova group, led by Professor Brian Schmidt.

DR KATE CHOW

CSIRO Square Kilometre Array Site & Infrastructure Executive Officer, CSIRO Astronomy and Space Science

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Kate Chow completed her PhD on the evolution of young radio galaxies in 2012, before beginning a Postdoctoral Fellowship on large radio surveys. Kate spent five months working on her postdoctoral research, before being appointed as the site and infrastructure executive officer at the CSIRO Square Kilometre Array (SKA). Kate now works with various teams on the world's largest radio telescope, the SKA. She is a member of the SKA pre-construction consortium, Infrastructure Australia, and is also involved in supporting CSIRO's work on the Australian Radio-Quiet Zone, Indigenous engagement, and site establishment for the SKA. She also remains engaged in research in her areas of expertise.

DR YANETT CONTRERAS

Office of the Chief Executive Postdoctoral Fellow, Australia Telescope National Facility

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Yanett Contreras is an expert in the field of star formation. She obtained her PhD from the University of Chile and is currently an OCE Postdoctoral Fellow at CSIRO Astronomy and Space Science. Her research aims to understand what drives the formation of massive stars in our Galaxy. She has used several of the world's largest telescopes, including the CSIRO's Mopra and Australia Telescope Compact Array as part of her research. She is also passionate about the need to educate children in science, being involved in an education program for Aboriginal school children in remote Western Australia.

DR ALEXANDER COOKE

Speaker

Manager, Science Policy, Science Policy and Governance Division, Australian Government Department of Industry

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Alexander Cooke is the manager of the Science Policy and Governance Division. He is responsible for the development and coordination of policies around science and research. This includes advising the Commonwealth Science Council and supporting the newly formed National Science, Technology and Research Committee. He is also responsible for astronomy policy in consultation with the Australian Square Kilometre Array Project Office and the Australian Astronomical Observatory. Alexander delivered the National Research Investment Plan and has sought to encourage the uptake of science into policy, including through the development of the report, *The Place of Science in Policy Development in the Public Service*.

ASSOCIATE PROFESSOR DARREN CROTON

Organising Committee

Queen Elizabeth II Research Fellow, Centre for Astrophysics and Supercomputing, Swinburne University of Technology

- dcroton@astro.swin.edu.au
- @darrencroton

Darren Croton is an associate professor and Queen Elizabeth II Research Fellow in the Centre for Astrophysics and Supercomputing at Swinburne University of Technology. He is a theorist who works on the formation and evolution of galaxies in the local and distant Universe, using both simulations and large observational data sets. He has recently moved to address the challenging problem of big data in astronomy, focusing on data access through


Kate Chow


Yanett Contreras


Alexander Cooke

innovative virtual laboratories and cloud-based technologies.

MR MIKE DALLEY

Astronomy Manager, Ayers Rock Resort

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During his time working at the iconic Ayers Rock Resort as the astronomy manager, Mike Dalley has been able to create a new area of free-choice learning for the public to engage in astronomy. The creation of dedicated astronomy tours and the building of a partnership between the ARC Centre of Excellence for All-sky Astrophysics (CAASTRO) and Ayers Rock Resort have only been a few of the steps he has taken to succeed in this newly growing area of professional resort astronomy. Mike is currently a member of CAASTRO and a chairperson for the International Astronomical Union. He is completing his postgraduate studies in astronomy, in addition to being dedicated to creating effective and efficient astronomy outreach to the public.

ASSOCIATE PROFESSOR TAMARA DAVIS

Organising Committee and Speaker

ARC Future Fellow, School of Mathematics and Physics, The University of Queensland

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Tamara Davis specialises in interpreting astrophysical observations in terms of their implications for fundamental physics. Using the cosmic-scale experiments that the Universe naturally provides, such as supernovae and the clustering of galaxies, she investigates dark energy and dark matter. Her current focus is the Australian Dark Energy Survey (OzDES), which will take spectra of thousands of supernovae, and monitor hundreds of active galaxies to test advanced theories of gravity. Tamara is currently an Associate Professor and Australian Research Council Future Fellow at The University of Queensland.

DR JOANNE DAWSON

Lecturer in Astronomy and Astrophysics, Department of Physics and Astronomy, Macquarie University and CSIRO Astronomy and Space Science

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Jo Dawson is a lecturer at Macquarie University and a researcher at CSIRO Astronomy and Space Science (CASS). Her research focuses on the evolution of the interstellar medium in the Milky Way and nearby galaxies and, in particular, on the mechanisms by which atomic gas is processed into star-forming clouds. She is joint Principal Investigator of SPLASH (the Southern Parkes Large-Area Survey in Hydroxyl), a large-scale, sensitive survey of OH in the Southern Galactic Plane. She gained her PhD in 2011 from Nagoya University, Japan, and was previously an Australian Research Council Super Science Fellow at the University of Tasmania, and a Bolton Fellow at CASS.

MS CÉLINE D'ORGEVILLE

Speaker

Instrument Scientist—Laser Physics, College of Physical and Mathematical Sciences, The Australian National University

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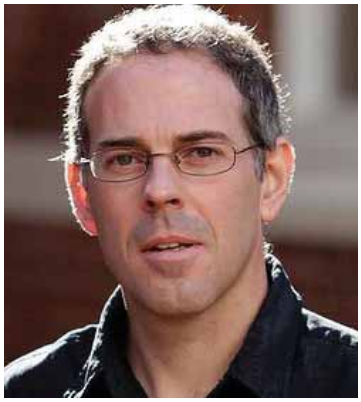
Céline d'Orgeville is a world-renowned expert in sodium laser guide star (LGS) adaptive optics applied to astronomy and laser tracking of space debris. From 1999 to 2011, Céline led the Gemini Observatory laser program to equip both Gemini 8 metre telescopes with state-of-the-art LGS facilities. In 2012, she joined The Australian National University Research School of Astronomy and Astrophysics, where she currently leads LGS activities undertaken at the Advanced Instrumentation and Research Centre (AITC). Céline is also the AITC student convener, and the chair of the school Access and


Darren Croton

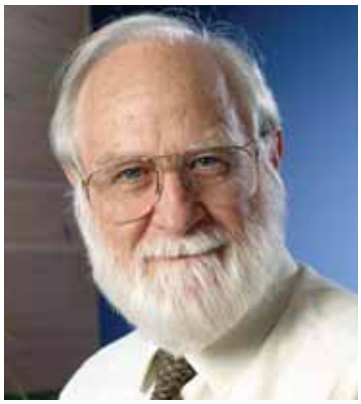

Mike Dalley


Tamara Davis


Jo Dawson


Céline d'Orgeville


Alan Duffy


Ron Ekers


Ilana Feain


Alessandro Fedrizzi

Equity Committee. She is passionate about science communication and a strong supporter of diversity in all forms.

DR ALAN DUFFY

Organising Committee

Research Fellow, Centre for Astrophysics and Supercomputing, Swinburne University of Technology

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Alan Duffy is a Research Fellow at Swinburne University of Technology. He has a joint position as a science communications expert, engaging in outreach activities while continuing his research on galaxy formation and dark matter through creating large-scale hydrodynamic simulations to model galaxies in cosmological volumes. In particular, he specialises in the growth of the first galaxies and their impact on reionisation. Previously, he has modelled (HI) gas in galaxies and dark matter properties at low redshifts. He has also published on constraining cosmological parameters with radio telescopes and optimising galaxy surveys using the Australian Square Kilometre Array Pathfinder facilities.

PROFESSOR RON EKERS FAA FRS

Oversight Committee (Chair)

Fellow, CSIRO

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Ron Ekers was appointed Foundation Director of CSIRO's Australia Telescope National Facility and returned to Australia in 1988. He was director of the VLA, the major national radio telescope in the US, from 1980 until 1987, chair of the Square Kilometre Array steering committee from 2000 to 2002, and president of the International Astronomical Union from 2003 to 2006. Ron's research interests include extragalactic astronomy, especially cosmology, galactic nuclei, ultra-high-energy particle physics and radio astronomical techniques. He is also involved in the history of the development of radio astronomical techniques, with particular focus on the nature of scientific discoveries.

DR ILANA FEAIN

Speaker

Senior Research Fellow, University of Sydney

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Ilana Feain obtained her PhD in astrophysics from the University of Sydney in 2006. In 2007, Ilana was awarded the Inaugural L'Oreal For Women in Science

Fellowship for her research and outreach work with Global Jet Watch, placing telescopes in girls schools across the world. From 2006 until 2012, Ilana was a research astronomer and project scientist on the Australian Square Kilometre Array Pathfinder (ASKAP) at CSIRO Astronomy and Space Science. In a research capacity, Ilana focused on radio galaxy evolution and black hole feedback, and as project scientist, she led the creation of the ASKAP Survey science teams and the early scientific, user and commissioning requirements for the ASKAP telescope. From 2012 to 2014, Ilana began focusing on the development of a cross-disciplinary research program to enable ASKAP's novel receiver technology for use beyond astronomy, including in health and defence. This led to a major career change in 2014, when Ilana moved into medical physics (radiotherapy), accepting a senior research fellowship in the Radiation Physics Laboratory at the School of Medicine of the University of Sydney. Now, Ilana is the project leader of Nano-X: a novel and cost-effective radiotherapy machine designed to level the playing field in global accessibility to equitable cancer treatment. This role involves X-ray instrumentation, real-time tomographic signal processing, and science and research project management. Ilana currently supervises PhD students in both medical physics and astrophysics, and is an affiliate of the ARC Centre of Excellence for All-sky Astrophysics (CAASTRO).

DR ALESSANDRO FEDRIZZI

Speaker

Australian Research Council Discovery Early Career Research Award Fellow, The University of Queensland

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Alessandro Fedrizzi is an expert in photonic quantum information processing and experimental quantum foundations. He completed his PhD in physics at the University of Vienna in 2008 and subsequently joined The University of Queensland as a Postdoctoral Research Fellow. His research interests cover topics ranging from foundational questions to photonic engineering and its application to problems in quantum computing, quantum communication and quantum simulation. In 2012, Alessandro was granted an Australian Research Council Discovery Early Career Research Award.

DR YESHE FENNER

Speaker

Executive Officer, Astronomy Australia Limited

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Yeshe Fenner has been the executive officer at Astronomy Australia Ltd since 2012. Her qualifications include a PhD in astrophysics from Swinburne University (2001–2005) and a project management professional (PMP®) certification. Yeshe held an Institute for Theory and Computation Postdoctoral Fellowship at Harvard-Smithsonian Center for Astrophysics before moving into project management roles in other areas of science and biomedicine, including project manager of a women's health study at Murdoch Childrens Research Institute/Royal Women's Hospital, and operations and project coordinator at the National Resource for Imaging Mass Spectrometry, Harvard Medical School.

MR ROGER FRANZEN

Mentor and Speaker

AGMT Technical Program Manager, Australian Giant Magellan Telescope, The Australian National University

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Roger Franzen is a chartered profession engineer with extensive experience in the management of organisations involved in the design development


Yeshe Fenner


Roger Franzen


Bob Frater

and construction of complex multi-discipline systems for space and astronomical applications.

PROFESSOR BOB FRATER AO FAA FTSE

Oversight Committee, Mentor and Speaker

Vice President for Innovation, ResMed

- Bob.Frater@resmed.com.au

Over more than 50 years, Bob Frater has researched electronics, telecommunications, electroacoustics, radioastronomy instrumentation, and electroacoustic and biomedical devices. In 1996, he was made an Officer of the Order of Australia for his contributions to science, including his work on the construction of the Australia Telescope at Narrabri in northern New South Wales. The telescope has just celebrated its 25th anniversary. Bob has been vice president for innovation with ResMed Ltd and chief technology officer for Innovation Capital since leaving CSIRO in 1999, where he had been deputy chief executive for 11 years. He serves on a number of advisory committees. He is a Fellow of the Australian Academy of Science and a Fellow of the Australian Academy of Technological Sciences and Engineering.

DR DUNCAN GALLOWAY

Speaker

Senior Lecturer, Monash University

- Duncan.Galloway@monash.edu
- @DuncanKGalloway

Duncan Galloway is an observational astrophysicist focusing on X-ray studies of accreting neutron stars. His research interests also encompass searches for previously unknown 'transient' sources across the electromagnetic spectrum, and even gravitational waves. He grew up in Tasmania, and studied at the University of Tasmania in Hobart. He worked as an oceanographer before completing a PhD in astrophysics, which led to postdoctoral work at the Massachusetts Institute of Technology in Boston, US. He returned to Australia in 2005 to take up fellowships at the University of Melbourne and then Monash University. Duncan is presently a senior lecturer at Monash University.

MS JENNY GORDON

Speaker

Principal Adviser Research, Productivity Commission

- jgordon@pc.gov.au

Jenny Gordon is the Principal Advisor Research at the Productivity Commission, where she oversees the Commission's research program and provides advice and quality assurance for research and inquiry work across both the Melbourne and Canberra Offices. She joined the Commission in March 2008, after 14 years at the Centre for International Economics, six as a Director and partner in the firm. Jenny completed a PhD in economics from Harvard University in 1993.

DR DUANE HAMACHER

Speaker

Lecturer and ARC Discovery Early Career Research Fellow, Nura Gili Indigenous Programs Unit, University of New South Wales

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- @AboriginalAstro

Duane Hamacher is a lecturer and an Australian Research Council (ARC) Discovery Early Career Research Fellow at the Nura Gili Indigenous Programs Unit at the University of New South Wales. His teaching and research focuses on cultural and historical astronomy, particularly Indigenous astronomical knowledge systems, with a focus on Australia and Oceania. His ARC-funded research


Duncan Galloway


Jenny Gordon


Duane Hamacher


Paul Hancock


Lisa Harvey-Smith


Amr Hassan

explores the various ways in which Torres Strait Islanders developed knowledge systems about the sun, moon and stars. This research involves working closely with Indigenous elders, studying and surveying material culture and archaeological sites, and analysing archival records. Duane is also an astronomy educator and consultant curator at Sydney Observatory.

DR PAUL HANCOCK

Curtin Early Career Research Fellow, Curtin University

- Paul.Hancock@curtin.edu.au
- @DrPaulHancock

Paul Hancock spent his PhD working on the Australia Telescope Compact Array 20 GHz Survey (AT20G) where he gained the skills required to conduct large surveys and process large amounts of data. In the years since his PhD, Paul has been working on a number of projects related to radio variability, including a search for radio emission from Type Ia supernovae, the discovery of two populations of GRB radio afterglows. Paul is now working on a survey to detect scintillation at low frequencies with the Murchison Widefield Array.

DR LISA HARVEY-SMITH

Speaker

Research Astronomer, CSIRO Astronomy and Space Science

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- @lisaharveysmith

Lisa Harvey-Smith is a research astronomer at CSIRO and the project scientist for the Australian Square Kilometre Array Pathfinder telescope, located in remote Western Australia. Her research focuses on the physical processes surrounding the birth and death of stars. Lisa is involved in the development of the world's largest telescope—the Square Kilometre Array—and has a science advisory role to the Australian Government. Passionate about communicating science to non-specialists, Lisa popularises astronomy on television, radio and the written press. She frequently gives lectures in Australia and around the world. Another of her passions is education and mentoring. Lisa maintains active partnerships with two schools, one in metropolitan Sydney and the other in a remote Aboriginal community in Western Australia. As chair of the Astronomical Society of Australia's Chapter for Women in Astronomy, she advocates for best practices in astronomy workplaces, and this year led the launch of a national gender equity scheme called the Pleiades Awards.

DR AMR HASSAN

gSTAR Projects and Engagement Support Leader, Centre for Astrophysics and Supercomputing, Swinburne University of Technology

- ahassan@astro.swin.edu.au
- @Amr_H_Hassan

Amr Hassan is the projects and engagement support leader for the Swinburne Supercomputer (gSTAR). Through his current role, he is leading and coordinating different activities to enhance the usage of high-performance computing (HPC) facilities by the Australian astronomy community in terms of impact and accessibility. Also, he assists in the development of strategies to meet the future HPC needs of the Australian astronomy community. Amr has a PhD in astrophysics and HPC from Swinburne University of Technology, Australia. His research focus includes scientific computing, ultra-scale visualisation and HPC. His current research concentrates on utilizing distributed graphics processing units to solve large-scale astronomical data analysis and visualisation problems.


Marian Heard


Andrew Hopkins


Minh Huynh

DR MARIAN HEARD

Mentor

Director, Indigenous STEM Education, CSIRO Education and Outreach

- Marian.Heard@csiro.au

For almost 20 years, Marian Heard has been developing and managing national science education programs in Australia. As education and public awareness manager at the Australian Academy of Science, she initiated the highly successful Primary Connections program and at CSIRO, established the Scientists and Mathematicians in Schools program. Following a significant investment of $28.8 million from the BHP Billiton Foundation to undertake a five-year project to improve the participation and achievement of Indigenous students in science, technology, engineering and mathematics, she has recently taken on the exciting new role of Director, Indigenous STEM Education, with CSIRO.

ASSOCIATE PROFESSOR ANDREW HOPKINS

Panellist

Head of Research and Outreach, Australian Astronomical Observatory

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- @evil_dr_hopkins

Andrew Hopkins has over 15 years experience in professional astronomy research, having held a Hubble Fellowship in the US and an Australian Research Council Queen Elizabeth II Fellowship at the University of Sydney before moving to the Australian Astronomical Observatory (AAO) in 2008. His research focuses on the evolution of star formation in galaxies over cosmic history. He is leading the development of the AAO data archive as a node in a national federated data archive program for astronomy. He also leads a major new 5-year observational project, TAIPAN, to begin in 2016, that capitalises on novel 'starbugs' technology, and which will make significant breakthroughs in cosmology and galaxy evolution. Andrew is leading the AAO's effort to promote links and develop new partnerships with industry and corporate groups.

ASSOCIATE PROFESSOR MINH HUYNH

Associate Research Professor, International Centre for Radio Astronomy Research, The University of Western Australia

- minh.huynh@icrar.org

Minh Huynh is an astronomer at the International Centre for Radio Astronomy Research at The University of Western Australia. She studies galaxy formation and evolution, using sensitive multi-wavelength data from ground-based and space-based observatories. From 2010 to 2013 she was the deputy international project scientist for the Square Kilometre Array, the next-generation radio observatory, which will be built in Western Australia and South Africa.

PROFESSOR CAROLE JACKSON

Organising Committee and Panellist

Western Australian Premier's Research Fellow, International Centre for Radio Astronomy Research, Curtin University

- Carole.Jackson@curtin.edu.au

Carole Jackson is a Western Australian Premier's Research Fellow and Professor of Radio Astronomy at the Curtin Institute of Radio Astronomy. Her research interests are centred on extragalactic radio source surveys, spanning population and evolutionary studies of the most powerful radio galaxies and quasars. She is a long-time contributor to the international Square Kilometre Array (SKA) project, having managed the design and delivery of the 36 dish antennas for the Australian SKA Pathfinder (ASKAP) telescope. Carole has deep


Carole Jackson


Paul Lasky


Ben Lewis

experience of industry collaborations, and through chairing the Australian astronomy Decadal Plan (2016–2025) industry review she is at the forefront of developing improved engagement strategies.

DR PAUL LASKY

Postdoctoral Research Fellow, Monash University

- paul.lasky@monash.edu

Paul Lasky is a Postdoctoral Fellow at Monash University. He is an expert on high-energy and gravitational wave astrophysics, with a particular focus on neutron star phenomenology and gravitational wave detection. Paul is a member of the Laser Interferometer Gravitational Wave Observatory (LIGO) Scientific Collaboration, contributing to the search for periodic gravitational waves from rapidly rotating neutron stars. He has recently started working at Monash University, where he is also contributing to the global effort to detect gravitational waves using pulsar timing arrays. Paul has recently become a member of the Parkes Pulsar Timing Array collaboration.

DR BENJAMIN LEWIS

Producer, Royal Institute of Australia

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- @BenSciGuy

Ben Lewis is a science communicator and producer with RiAus, where he conceptualises, organises and delivers public science events and digital content. He has been involved in public events around Australia and was producer and director of The Science of Doctor Who, which toured nationally in 2014 in association with the BBC. His digital content features on RiAus TV, ScienceAlert and News Limited websites, community radio and podcasts. Ben is also a regular guest on ABC radio around Australia, features in a fortnightly segment on commercial radio in Adelaide, and has been a guest speaker at universities around Australia on communicating science to the public. He is also producer of ECR Network, a program of events specifically for early-career researchers based in Adelaide, but live-streamed nationally and internationally.

DR HAIDA LIANG

Speaker

Reader in Physics, School of Science & Technology, Nottingham Trent University

- haida.liang@ntu.ac.uk

Haida Liang gained a PhD in astronomy and astrophysics from The Australian National University (in collaboration with the Australia Telescope National Facility) in 1996. Her thesis was on the distribution of matter in clusters of galaxies, focusing mainly on the detection of the Sunyaev-Zel'dovich effect using the Australian Telescope Compact Array. After her PhD, she joined the X-ray Astronomy group at Service d'Astrophysique of Commissariat à l'Energie Atomique in France and then continued her work on clusters of galaxies at the Physics Department of the University of Bristol. In 2002, she changed her career path and worked at the Scientific Department of the National Gallery (London) on the development of non-invasive imaging techniques for the examination of paintings. She is currently leading the Imaging Science for Archaeology and Art Conservation group at Nottingham Trent University in the UK. Her main research interests are the development and application of non-invasive imaging and spectroscopic techniques to art conservation and archaeology.

DR EDWARD MACAULAY

Postdoctoral researcher, The University of Queensland

- e.macaulay@uq.edu.au

Ed Macaulay's main research interest focuses on testing fundamental physics with cosmological


Haida Liang


Ed Macaulay


Katie Mack

surveys. He has previously worked on measuring the large-scale structure of the Universe with the peculiar velocities of galaxies, and on forecasting tests on the nature of dark matter with the next generation of cosmological surveys. Ed is currently working as a member of the OzDES survey to combine peculiar velocities with weak lensing, which should lead to unique new insights on gravity and dark matter.

DR KATIE MACK

DECRA Fellow, School of Physics, University of Melbourne

- kmack@unimelb.edu.au
- @AstroKatie

Katherine (Katie) Mack is a theoretical astrophysicist. Her work focuses on finding new ways to learn about the early Universe and fundamental physics using astronomical observations, probing the building blocks of nature by examining the cosmos on the largest scales. Throughout her career as a researcher at Caltech, Princeton University, the University of Cambridge, and now the University of Melbourne, she has studied dark matter, black holes, cosmic strings and the formation of the first galaxies in the Universe. Katie is also an active online science communicator and is passionate about science outreach. As a science writer, she has been published by Slate, Sky & Telescope, Time.com, the Economist tech blog 'Babbage', and other popular publications.

DR JEAN-PIERRE MACQUART

Senior Lecturer, Curtin Institute of Radio Astronomy

- jpmacquart@gmail.com

Jean-Pierre Macquart specialises in the study of transient astrophysical sources and in the interstellar and intergalactic medium through which their radiation propagates. He also studies black holes, particularly the massive black hole at the centre of our own Galaxy.

MR MALTE MARQUARDING

Research Project Officer, CSIRO

- Malte.Marquarding@csiro.au

Malte Marquarding is an expert in scientific computing in astronomy. After completing his MSc in astrophysics at the University of Melbourne in 2000, he took up a position in scientific computing at the Australia Telescope National Facility (CSIRO). He has been there ever since, creating single dish data reduction and analysis packages and astronomical data visualisation software, which is also used in a number of large international projects such as the Atacama Large Millimeter Array. Most recently, he has been designing and implementing software for the Australian Square Kilometre Array Pathfinder (ASKAP). Malte is also an active contributor to educating the astronomy community in programming techniques and has been chairing the Astronomical Society of Australia's Astroinformatics Schools.

DR LARRY R MARSHALL

Speaker

Managing Director, Southern Cross Ventures

- Larry.Marshall@csiro.au

Larry Marshall is the managing director of Southern Cross Ventures, a venture capital firm based in Silicon Valley, Shanghai and Sydney, specialising in growing Australian technology companies in Asia and the US. He has a longstanding partnership with SoftBank China, China's most successful venture capital firm, and co-manages the Renewable Energy Fund, founded in 2012, with them. He has lived in the US for 25 years and founded and/or was CEO of Light Solutions, Iridex (Nasdaq: IRIX), Iriderm, Lightbit, Translucent, AOC, Arasor (ASX: ARR), and the Renewable Energy Fund—driving two of these

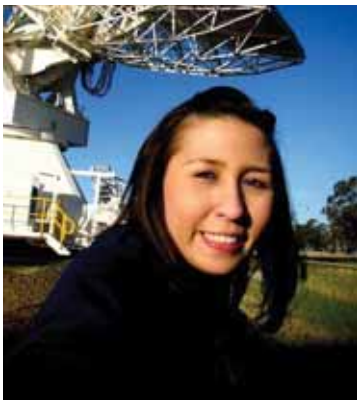

Jean-Pierre Macquart


Larry Marshall


Sarah Martell


James Miller-Jones


Daniel Mitchell


Vanessa Moss

companies to successful initial public offerings. Larry began his career as an engineer with a PhD in physics and has over 100 publications and presentations. He became an inventor, with 20 patents protecting numerous commercial products and generating over $200 million in revenue. He then became an entrepreneur, raising over $100 million in funding and creating companies with over $1 billion in market capital. Larry is now an investor with $400 million under management. He has served on 20 boards of high-tech companies operating in the US, Australia and China. He is a passionate supporter of Australian innovation and Australian entrepreneurs. Larry Marshall has been announced as the new Chief Executive of CSIRO. He will start in January 2015.

DR SARAH MARTELL

Australian Research Council Discovery Early Career Researcher Award Fellow/ Lecturer, University of New South Wales

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- @_sarahmartell

Sarah Martell is an Australian Research Council Discovery Early Career Researcher Award Fellow and a lecturer in the School of Physics at the University of New South Wales. Her research focuses on using the chemical compositions of stars to learn about their formation and internal processes. As the project manager for observations in the Galactic Archaeology with HERMES (GALAH) survey, she is driving the data collection that will make it possible to do these studies on a massive scale, determining the chemical compositions of one million stars in the Milky Way to explore its history of star formation and chemical evolution.

DR JAMES MILLER-JONES

Senior Lecturer, International Centre for Radio Astronomy Research, Curtin University

- James.Miller-Jones@curtin.edu.au

James Miller-Jones is an Australian Research Council Future Fellow and a senior lecturer at Curtin University. He is an expert in the field of jets from accreting stellar-mass black holes, aiming to understand the connection between relativistic jets and the accretion flow that powers them. His current work is focused on understanding the nature of accretion and jet ejection at the lowest luminosities, via studies of the quiescent state in which the majority of accreting black holes are found. James is leading a deep radio survey of nearby southern globular clusters to search for new quiescent black hole X-ray binaries, seeking to determine the

prevalence of black holes in clusters and estimate their mass function.

DR DANIEL MITCHELL

Research Scientist, CSIRO Astronomy and Space Science

- Daniel.Mitchell@csiro.au

Daniel Mitchell is a research scientist in the CSIRO division of Astronomy and Space Science. His research interests include solving imaging and deconvolution challenges of wide-field-of-view radioastronomy arrays, searching for the faint signatures of hydrogen gas fluctuations in the early Universe, and distributed, real-time data processing. Daniel is developing calibration and imaging software for the Australian Square Kilometre Array Pathfinder, the Murchison Widefield Array, and is a member of the Square Kilometre Array Science Data Processor consortium. He has published on real-time calibration and imaging algorithms, widefield polarised imaging, algorithm acceleration using graphics processing units, and strategies for mitigating radio-frequency interference.

DR VANESSA MOSS

Postdoctoral Researcher, ARC Centre of Excellence for All-sky Astrophysics, University of Sydney

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- @cosmicpudding

Dr Vanessa Moss is a postdoctoral researcher at the ARC Centre of Excellence for All-sky Astrophysics (CAASTRO), working as part of the FLASH team: the First Large Absorption Survey of HI. FLASH will probe the gas content of galaxies over billions of years in the Universe's evolution for the first time, seeking to understand how the hydrogen in our Universe has changed. As part of FLASH, she currently specialises in multi-wavelength characterisation, analysis and visualisation of galaxy targets. She has previously investigated disk-halo interaction in our Galaxy in order to determine how outflow and infall are shaping the evolution and fate of the Milky Way. She is keenly involved in science communication, education and outreach, is a guide at Sydney Observatory and currently co-runs the CAASTRO In The Classroom school education initiative. She is also an attendee of .Astronomy, which brings together researchers, educators, developers and communicators to share astronomy worldwide in an online context.

ASSOCIATE PROFESSOR MICHAEL MURPHY

Speaker

Centre for Astrophysics and Supercomputing, Swinburne University of Technology

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- @MTMurphy77

Michael Murphy is an observational astrophysicist researching aspects of cosmology—the Universe's properties on the largest scales. He specialises in studying the tenous gas within, and between, distant galaxies and also the fundamental laws of nature in the early Universe. Michael completed a BSc with Honours in physics in 1999, and a PhD in 2003, at the University of New South Wales. He was a Research Fellow at the University of Cambridge from 2003 to 2007 and an Australian Research Council Queen Elizabeth II Fellow at Swinburne University of Technology from 2008 to 2012.

DR TARA MURPHY

Organising Committee (Chair)

Senior Lecturer, School of Physics, University of Sydney

- tara.murphy@sydney.edu.au


Michael Murphy


Tara Murphy


Steve Negus

Tara Murphy completed her PhD in 2004 at the University of Edinburgh, and is currently an astrophysicist working in the School of Physics at the University of Sydney. She is a chief investigator at the ARC Centre of Excellence for All-sky Astrophysics (CAASTRO), leading an international team of researchers. Her research focuses on detecting and studying transient and highly variable astrophysical phenomena with next-generation radio telescopes. Tara is passionate about teaching and high school outreach and is a director of the National Computer Science School (NCSS) and the NCSS Challenge. This year Tara co-founded Grok Learning, a global start-up aiming to excite high school students about computational thinking.

MR STEPHEN NEGUS

Panellist

Industry Leader—Data and Telecommunications, Aurecon

- neguss@ap.aurecongroup.com
- @Steve_Negus

Steve Negus is the data and telecommunications industry leader for Aurecon. His responsibilities include industry strategy, growing mutually beneficial client relationships and providing targeted delivery strategies to assist teams in developing execution plans for client projects. As the board chair for the INFRA AUS Consortium, Stephen brings his extensive experience with the procurement and delivery of design and project management services associated with major telecommunications and multi-disciplinary facilities. Importantly, this has included his involvement with the Square Kilometre Array project since 2002 and his key strategic role on the Australian Square Kilometre Array Pathfinder project.

PROFESSOR RAY NORRIS

Speaker

Honorary Fellow, CSIRO Australia Telescope National Facility

- raypnorris@gmail.com
- @RayPNorris

Ray Norris is an astrophysicist studying the evolution of galaxies over cosmic time. Educated at Cambridge and Manchester, his career with CSIRO Astronomy and Space Science included positions such as head of Astrophysics, and deputy director, acting director and director of the Australian Astronomy Major National research Facility, before he returned to full-time research in 2006. He leads the Evolutionary Map of the Universe (EMU) project—one of the two key projects driving the construction of the $165 million Australian Square Kilometre Array Pathfinder telescope. The EMU project will transform our view of the radio sky, going 30 times deeper than any other large radio survey and discovering about 70 million galaxies.

DR CHENG SOON ONG

Speaker

Principal Researcher, Machine Learning Research Group, NICTA

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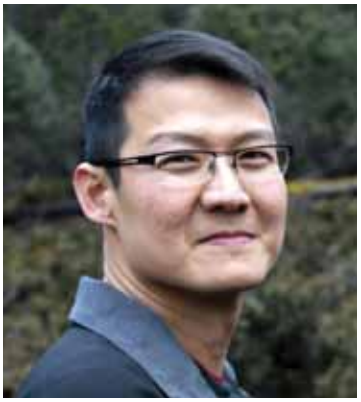
Cheng Soon Ong is interested in enabling scientific discovery by extending statistical machine learning methods. In recent years, he has developed new optimisation methods for solving problems such as ranking, feature selection and experimental design, with the aim of solving scientific questions in collaboration with experts in other fields. This has included diverse problems in genomics, systems biology and medical imaging. He is also an advocate of open source software and reproducible research in the context of machine learning. Cheng Soon Ong


Ray Norris


Cheng Soon Ong


John O'Sullivan

is a principal researcher at the Machine Learning Research Group, NICTA. He is also an adjunct associate professor at The Australian National University, and an honorary research fellow at the University of Melbourne.

DR JOHN O'SULLIVAN FAA FIEAUST FTSE

Mentor

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John O'Sullivan has had an extensive career in wireless, signal processing and radiophysics, in both research and commercial contexts. At CSIRO he led research projects in signal processing and wireless communications which, among other outcomes, led to key technologies underpinning the now wi-fi wireless networking. His career has extended to roles in various companies, ranging from large companies (News Corp and Cisco) to several technology startups (Radiata, G2, Taggle). He returned to technology research for radio astronomy with CSIRO on the Australian pathfinder for the next-generation international Square Kilometre Array radiotelescope. He is the winner of the 2013 MA Sargent award, the 2012 European Inventors Award, the 2010 Clunies-Ross Medal, the 2009 Australian Prime Ministers Prize for Science, the 2009 CSIRO Chairman's Medal and the 1992 CSIRO Medal. He is a Fellow of the Institution of Engineers Australia, the Australian Academy of Science and the Australian Academy of Technological Science and Engineering.

DR DAVID PARKINSON

Australian Research Council Future Fellow, School of Mathematics and Physics, The University of Queensland

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David Parkinson is an Australian Research Council (ARC) Future Fellow at The University of Queensland, Brisbane. He studies how the Universe was formed and has evolved using astronomical data to test Einstein's theory of gravity. David has a PhD from the Institute of Cosmology and Gravitation at the University of Portsmouth (2004) and worked at the Astronomy Centre at the University of Sussex before joining The University of Queensland. He is chair of the Early Career Researcher chapter of the Astronomical Society of Australia, and is an associate member of the ARC Centre of Excellence for All-sky Astrophysics (CAASTRO).

DR ROB PORTEOUS

Speaker

Head of Division, Science Policy and Governance Division, Australian Government Department of Industry

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Rob Porteous is head of the Science Policy and Governance Division in the Australian Government Department of Industry. His responsibilities include science and research policy, the governance arrangements for science agencies and infrastructure, the governance of trade controls on research, and international science engagement. Rob has extensive experience in industry, innovation, science, research and tertiary education policy development for the Australian Government. He has a particular interest in improving the linkage between industry and publicly funded research in institutions and universities. Rob has a PhD in plasma physics from The Australian National University and a BSc with first class honours from The University of Western Australia.

DR DANIEL PRICE

Senior Lecturer, Monash University

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Daniel Price is a senior lecturer and Australian Research Council Future Fellow at the Monash Centre for Astrophysics in the School of Physics and


David Parkinson


Rob Porteous


Daniel Price


Jill Rathborne


Christian Reichardt


Renae Sayers

Astronomy at Monash University in Melbourne, where he has been since 2008. Before this, he was a Royal Society University Research Fellow in the astrophysics group of the School of Physics at the University of Exeter (before which he also held a Particle Physics and Astronomy Research Council/ Science and Technology Facilities Council Postdoctoral Research Fellowship at Exeter). Daniel completed his PhD at the Institute of Astronomy at the University of Cambridge. His research interests are in computational astrophysics, with broad application across astronomy, but with a focus on star and planet formation as well as black hole accretion.

DR JILL RATHBORNE

Research Scientist, CSIRO Astronomy and Space Science

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Jill Rathborne is an expert in the field of high-mass star formation. By combining multi-wavelength data, using both ground-based and space-based observatories, single dishes and interferometers, Jill studies the very earliest stages in the formation of dense cores and the connection between these cores and the formation of individual stars and clusters. Using the unique capabilities of the new Atacama Large Millimeter/sub-millimeter Array (ALMA) located high in the Atacama desert in northern Chile, her research is uncovering the detailed physics that shapes a molecular cloud before star formation begins, which is important for understanding the process by which material is assembled to make a star and cluster.

DR CHRISTIAN REICHARDT

Lecturer, University of Melbourne

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Christian Reichardt is a cosmologist who observes the cosmic microwave background to study how the Universe began and what it is made of. Two of the big questions he seeks to address are 'Can we detect the gravity waves sourced by the rapid expansion of the Universe during inflation?' and 'What are the neutrino masses?' He currently works on the South Pole Telescope and Polarbear/Simons Array experiments. Christian did his PhD work at Caltech and was a postdoctoral scholar at the University of California, Berkeley, before coming to the University of Melbourne in 2014.

MISS RENAE SAYERS

Speaker

Theatre and Events Coordinator, SciTech

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- @lycrageek

Renae Sayers is an international science communicator who has dedicated her life to empowering people with the enlightenment that scientific literacy can provide. She strives to make the world a better place one light-bulb moment at a time. Based in Perth, Renae manages the Science Theatre and Events at Scitech—Western Australia's premier science centre. From producing and performing inspiring and engaging science shows to developing inventive programs, panels and projects, Renae connects the audience with the delight and wonder in the world through science themes, skills and understanding. From her time at Scitech, the Edinburgh International Science Festival and Questacon—The National Science and Technology Centre, she has collaborated and performed with communities across Australia, the UK, Japan, Abu Dhabi, Beijing and Singapore to achieve this goal.

DR RICHARD SCALZO

SkyMapper Postdoctoral Fellow, The Australian National University

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Richard Scalzo


Brian Schmidt


Helen Sim

Richard Scalzo is interested in how stars explode as supernovae, and how to improve their use in measurements of the mysterious 'dark energy' driving our Universe's accelerating expansion. He has led the development and operation of several large-scale software pipelines to search for variable objects in astronomical imaging surveys, including the SkyMapper supernova search. Richard's use of Bayesian probability to infer properties of Type Ia supernova progenitors bridges theory and observation, and has been featured in print and online science media such as *New Scientist*, *Astronomy Magazine* and *Physics Today*.

PROFESSOR BRIAN SCHMIDT AC FAA FRS

Oversight Committee and Mentor

Distinguished Professor, Research School of Astronomy and Astrophysics, The Australian National University

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Brian Schmidt is a Laureate Fellow and Distinguished Professor at The Australian National University. Brian received undergraduate degrees in astronomy and physics from the University of Arizona in 1989, and completed his astronomy Master's degree (1992) and PhD (1993) at Harvard University. Under his leadership, in 1998, the HighZ Supernova Search team made the startling discovery that the expansion rate of the Universe is accelerating, work that earned him the 2011 Nobel Prize in Physics. A Fellow of the Australian Academy of Science, the United States Academy of Science, and the Royal Society, he was made a Companion of the Order of Australia in 2013.

MS HELEN SIM

Public Relations Officer, ARC Centre of Excellence for All-sky Astrophysics, University of Sydney

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- @sky_pointer

Helen Sim publicises the research activities of the Australian astronomical community through outreach events, writing and liaising with the media. She works with scientists and technologists to translate complex information into plain language suitable for audiences beyond the astronomical community.

DR DENNIS STELLO

Senior Lecturer and Australian Research Council Future Fellow, University of Sydney

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Dennis Stello is an expert on asteroseismology—an exiting new field that infers the physical properties of stars from the in-print of internal standing sound waves arising from star quakes. Analogous to how earthquakes can reveal information about the Earth's interior, Dennis has used asteroseismology to measure intricate details of stars in the Milky Way, and is working closely with NASA to characterise planet-hosting stars found by the Kepler space telescope. With current and future space missions, Dennis will use his seismic information of tens of thousands of stars to probe the structure and evolution of our Galaxy. He received his PhD in 2007 and has since held a string of fellowship positions at the University of Sydney, including an Australian Research Council (ARC) Postdoctoral Fellowship, an ARC Discovery Early Career Research Award Fellowship, and now an ARC Future Fellowship. Dennis was awarded the New South Wales Young Tall Poppy of the Year in 2013.

DR ANDREW STEVENSON

Assistant Manager—Science Policy, Science Policy and Governance Division, Australian Government Department of Industry

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Andrew Stevenson works in the Science Policy and Governance Division of the Department of Industry,


Dennis Stello


Andrew Stevenson


Steven Tingay

with a particular focus on astronomy, and has consulted with the Australian astronomy community for over eight years on investment priorities, national research infrastructure, and broader policy issues. He has a research background in optical physics and photonics, as well as a background in teaching, postgraduate supervision and research in the academic and industry sectors.

PROFESSOR STEVEN TINGAY

Speaker

Director, International Centre for Radio Astronomy Research

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- @stingay

Steven Tingay is a Western Australian Premier's Research Fellow, director of the Curtin Institute of Radio Astronomy, director of the International Centre for Radio Astronomy Research, and director of the Murchison Widefield Array (MWA) project. Steven has authored or co-authored over 130 papers in international refereed journals and has attracted over $80 million of research funding over the past decade. His main interests are in radio astronomy and astrophysics. He has been responsible for the development of instrumentation and software that is now used around the world. Steven currently leads the MWA project—a $50 million international radio telescope recently completed and brought into its operational phase in the remote Murchison region of Western Australia—which is the low-frequency precursor for the multi-billion dollar Square Kilometre Array (SKA). He has been an active contributor to the international SKA project for the past decade. Steven is an alumnus of the University of Melbourne and The Australian National University.

PROFESSOR PETER TUTHILL

Professor, School of Physics, University of Sydney

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Peter Tuthill is an expert on high-resolution imaging techniques in the optical and near-infra-red. He has conducted imaging experiments, installing dedicated hardware on almost all of the world's 10 metre-class telescopes, as well as several space telescopes (including the James Webb Space Telescope).

MR GEORGIOS VERNARDOS

PhD student, Swinburne University of Technology

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Georgios Vernardos focuses on data-intensive scientific problems in physics and astrophysics. He is working with large-scale supercomputer simulations, data management, interactive e-tools, and visualisations. Georgios has been carrying out the GERLUMPH (gerlumph.swin.edu.au) parameter survey, preparing for the quasar microlensing survey era.

MR NOEL WAINWRIGHT

Panellist

Director, C4ISR Programs, Lockheed Martin Australia

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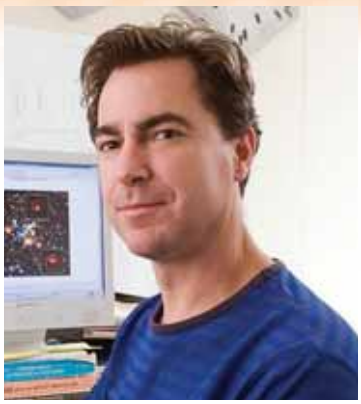
Noel Wainwright is a business person, representing (among others) in Australia the Lockheed Martin Corporation, US. His focus is on C4ISR Programs (including command, control, communications, computing, intelligence, surveillance and reconnaissance). Noel handles the promotion and business analysis of opportunities that arise for Lockheed Martin Corporation in the C4ISR arena.


Peter Tuthill


Georgios Vernardos


Noel Wainwright


Margaret Wertheim


Pete Wheeler


Christian Wolf

MS MARGARET WERTHEIM

Mentor and Speaker

Director, The Institute For Figuring

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- @margaretwerth

Margaret Wertheim is an internationally noted science writer and exhibition curator whose work focuses on the relations between science and the wider cultural landscape. She is the author of three books on the cultural history of physics, including *Pythagoras' trousers*, a history of the relationship between physics and religion, and *The pearly gates of cyberspace: a history of space from Dante to the internet*.

Margaret has a BSc in physics (The University of Queensland) and a BA in mathematics (University of Sydney). As a journalist, she has written for *The New York Times*, *Los Angeles Times*, *The Sciences*, *New Scientist*, *The Guardian* and many others. Her work has been included in *Best American science writing* and *Best Australian science writing*. In 2004, she was the US National Science Foundation's visiting journalist to Antarctica and in 2006 she won the excellence in journalism award from the American Institute of Biological Sciences. Margaret has lectured widely at universities internationally, including Harvard, Tufts, Oxford, Rutgers and Cornell.

In 2003, Margaret and her sister Christine founded the Institute For Figuring (IFF), a Los Angeles-based organisation devoted to public engagement with the aesthetic and poetic dimensions of science and mathematics (www.theiff.org). The IFF's Crochet Coral Reef project is now the largest participatory science-and-art endeavour in the world. Through an unlikely conjunction of geometry, art and handicraft, the Crochet Coral Reef addresses global warming by engaging people in participatory, hands-on, informal science education. The project has inspired communities throughout the US, Europe and Australia. Margaret's TED talk on the topic has been viewed more than a million times and translated into 20 languages.

MR PETE WHEELER

Speaker

Manager—Outreach, Education and Communications, International Centre for Radio Astronomy Research

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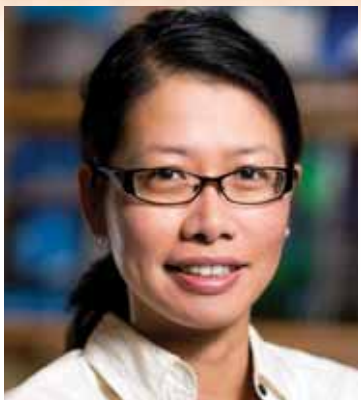
Pete Wheeler studied physics at Leeds University in the north of England, before graduating in 2001 and working for a company producing photomultipliers in north-west London. In 2003, Pete immigrated to Western Australia and began working for Scitech,


Ivy Wong


Emma Woodward


Stuart Wyithe

Perth's science discovery centre, as an outreach presenter.

After a series of roles developing educational resources for WA teachers, managing the largest planetarium in the Southern Hemisphere and coordinating large-scale education and outreach initiatives such as Astronomy WA, and the International Year of Astronomy for Western Australia, Pete now defines himself as a professional science communicator; a role that is becoming more and more recognised.

Pete is currently the outreach, education and communications manager for the International Centre for Radio Astronomy Research, a joint venture of Curtin University and The University of Western Australia.

DR CHRISTIAN WOLF

SkyMapper Survey Scientist, The Australian National University

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Christian Wolf is survey scientist for the SkyMapper Southern Survey, which is a project led by The Australian National University (ANU) to map all of the southern sky in six spectral passbands. He works on methods for object classification, machine learning and photometric redshift estimation. His science interests cover the evolution of galaxies and quasars over cosmic time, as well as the nature of stellar explosions. Christian obtained his PhD in 1999 from the Max Planck Institute of Astronomy in Germany. After a decade at Oxford University, he joined the ANU in 2013.

DR IVY WONG

Super Science Fellow, International Centre for Radio Astronomy Research

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Ivy Wong is an Australian astronomer whose work centres around understanding the physical processes that govern how galaxies accrete gas, form stars and evolve. One of the other questions she is investigating is how galaxies form supermassive black holes and how these black holes co-evolve with their host galaxies. As current pattern recognition algorithms are still inferior to the human eye–brain combination, Ivy also uses citizen science as an alternative data processing technique. She currently leads the radio.galaxyzoo.org project, which asks ordinary citizens to identify the host galaxies of supermassive black holes.

MS EMMA WOODWARD

Speaker

Research Scientist, CSIRO Ecosystem Sciences

- Emma.Woodward@csiro.au

Emma Woodward is a geographer with extensive experience in engaging northern Aboriginal communities in participatory ecological research to inform natural resources planning and management. She holds a strong interest in the development of ethical research protocols and community-scale (Indigenous) research agreements, and has employed diverse methods to facilitate community–science engagement and ensure mutually beneficial outcomes beyond a project's life. Emma has very recently returned from a Canadian study tour to identify novel and best-practice approaches to developing community-partnered research.

PROFESSOR STUART WYITHE

Organising Committee

Australian Laureate Fellow, School of Physics, University of Melbourne

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Stuart Wyithe is an Australian Laureate Fellow at the University of Melbourne. His research interests are

Fang Yuan

in cosmology and galaxy formation, with a focus on simulating the earliest galaxies in the Universe. He is the chair of the National Committee for Astronomy, which is currently undertaking the Decadal Plan for Australian astronomy 2016–2025.

DR FANG YUAN

Postdoctoral Research Fellow, The Australian National University

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Fang Yuan received an undergraduate degree in physics from Beijing University in 2003 and completed her PhD in physics at the University of Michigan in 2010. She is interested in a wide range of cosmic explosion phenomena. Fang Yuan is currently a research fellow at The Australian National University and the ARC Centre of Excellence for All-sky Astrophysics (CAASTRO). As a key member of the SkyMapper Transient Search team, she hopes to discover hundreds of supernovae each year to improve constraints on cosmology and to understand the nature of all types of supernova explosions. Fang Yuan is also involved in OzDES, a spectroscopy program that will enable the Dark Energy Survey to make the 'most detailed ever' measurement of the Universe's expansion history.

The aim of the Australian Frontiers of Science is to bring together the very best young Australian scientists to discuss emerging technologies, new opportunities and exciting, cutting-edge advances in their fields. Gifted young scientists explain what they do and why, and during this process discover how an idea can bridge disciplines. The symposia involve participants from universities, government and industry, and include both biological and physical sciences. Chairs of sessions, organisers, speakers and participants are selected from all states of Australia. More information is at: **www.science.org.au/events/frontiers**

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