



## CAASTRO Newsletter Edition 13, April 2015



### INTRODUCTION FROM CAASTRO DIRECTOR

The [CAASTRO Annual Report for 2014](#) has just been completed, and paper copies will be soon be sent out to all our CAASTRO members and stakeholders. As usual, an electronic copy has been posted on the [CAASTRO web page](#). This is our fourth annual report, and it is really impressive to see so many of our projects coming to fruition and producing great scientific results. Many thanks all those involved in producing this year's report.

Last week Steven Tingay, Kate Gunn and I visited the Melbourne Planetarium and met with Dr Tanya Hill and her colleagues, who are working on the Museum Victoria planetarium highlighting CAASTRO's research and discoveries. Plans for this show are advancing well - the script is now almost complete, and we were able to see some of the first visuals projected onto the planetarium dome. These looked fantastic, and it's clear that the final show promises to be spectacular. It was also fascinating to have a 'behind the scenes' glimpse at some of the technology used in a modern planetarium.

We have a full program of meetings and workshops taking place over the next few months. First up is the CAASTRO co-sponsored workshop on "[OzSKA: Radio astronomy in the next decade](#)" in Melbourne, exploring some of the new science opportunities which will be opened up by the Square Kilometre Array (SKA). Registration is now open for the fifth annual [Women in Astronomy Workshop](#), which will be held in Brisbane this year and hosted by the University of Queensland. This workshop is open to all, and both men and women are encouraged to attend. Last year's Women in Astronomy workshop in Canberra was both informative and inspirational, and I hope many of you will join us in Brisbane for this year's event.

Registration is also open for CAASTRO's major conference for 2014, and this year we are hosting the [25th Annual Astronomical Data Analysis Software and Systems \(ADASS\)](#) Conference in Sydney. ADASS is the main international forum for scientists and programmers working on algorithms and software for the acquisition, reduction, analysis and dissemination of astronomical data - so is relevant to a wide

range of projects both within CAASTRO and across Australian astronomy. The ADASS conference takes from 25-30 October, and the abstract deadline for talks is 1 July.

I have enjoyed meeting and talking with many people from CAASTRO during my recent visits to Perth and Melbourne, and am looking forward to visiting the ANU and UQ nodes in the near future.

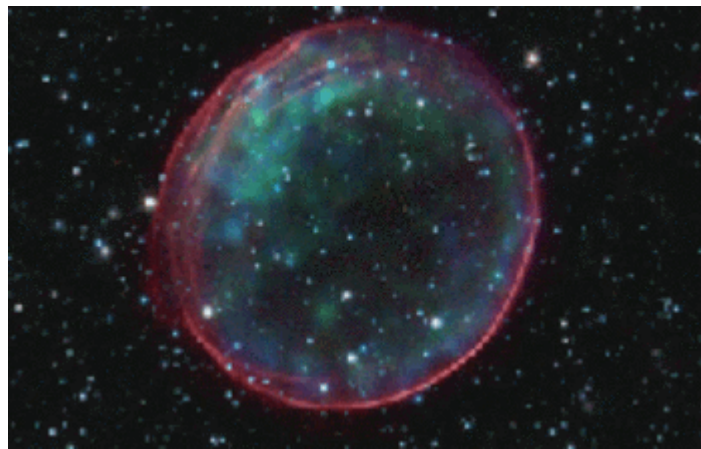
**Elaine Sadler**  
CAASTRO Director

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## RESEARCH UPDATE

### [Clues to origin of luminous supernovae may lie in ultraviolet](#)

The widespread use of type Ia supernovae (SNe Ia) in cosmology, as one of the farthest runs in the extragalactic distance ladder and as tools to study dark energy, depends on the accuracy with which their luminosity can be measured. The classic luminosity calibration relations used in cosmological studies apply only to SNe Ia with normal spectra. However, wide-field supernova searches (including CAASTRO's SkyMapper survey) are now revealing the true observational diversity of SNe Ia uncovering a rare, ultraluminous subclass of SNe Ia which do not obey the calibration relations. [Read more here](#)



*Illustration of Type Ia Supernova; credit: NASA, ESA, CXC, SAO, the Hubble Heritage Team (STScI/AURA), J. Hughes (Rutgers University)*

#### **Publication details:**

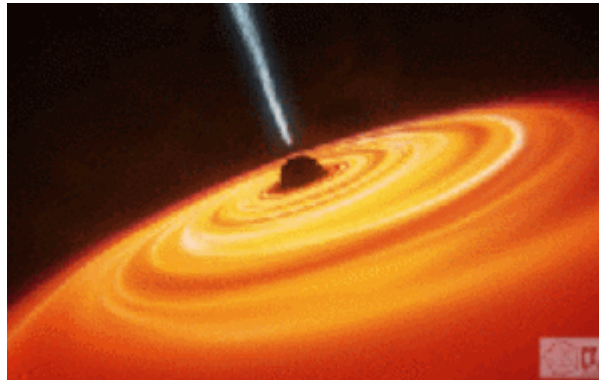
R. A. Scalzo, M. Childress, B. Tucker, F. Yuan, B. Schmidt, P. J. Brown, C. Contreras, N. Morrell, E. Hsiao, C. Burns, M. M. Phillips, A. Campillay, C. Gonzalez, K. Krisciunas, M. Stritzinger, M. L. Graham, J. Parrent, S. Valenti, C. Lidman, B. Schaefer, N. Scott, M. Fraser, A. Gal-Yam, C. Inserra, K. Maguire, S. J. Smartt, J. Sollerman, M. Sullivan, F. Taddia, O. Yaron, D. R. Young, S. Taubenberger, C. Baltay, N. Ellman, U. Feindt, E. Hadjiyska, R. McKinnon, P. E. Nugent, D. Rabinowitz, E. S. Walker in MNRAS 445 (2014) "[Early ultraviolet emission in the Type Ia supernova LSQ12gdj: No evidence for ongoing shock interaction](#)"

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### [Bright Active Galactic Nuclei cause high velocity ionised wind](#)

At the centre of most (if not all) galaxies lies a supermassive black hole. In in most

cases, as in our own galaxy, it is dormant. This means that it is not currently accreting matter. However, in some galaxies it is active: it is accreting matter and, as a result, radiating an enormous amount of energy across the electromagnetic spectrum. These so-called active galactic nuclei (AGN) likely play an important role in the lifetime of galaxies due to the close observed correlations between the mass of supermassive black holes and their galaxy's central bulge of stars. Such correlations suggest that they evolve and grow together. [Read more here](#)



*Artist's impression of an accreting Black Hole; credit: Swinburne Astronomy Productions*

**Publication details:**

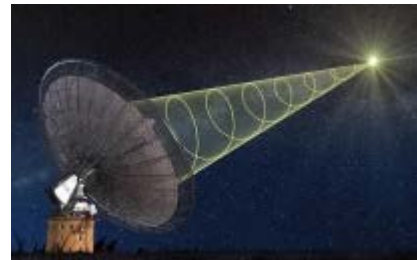
Rebecca McElroy, Scott M. Croom, Michael Pracy, Rob Sharp, I-Ting Ho, Anne M. Medling in MNRAS 446 (2015): "[IFU observations of luminous type II AGN - I. Evidence for ubiquitous winds](#)"

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## [Cosmic radio burst caught red-handed](#)

Snap! Astronomers using CSIRO's 64-m Parkes radio telescope in eastern Australia have for the first time seen a 'fast radio burst' — a short, sharp flash of radio waves from an unknown source — happening live. [Read more here](#)

*A schematic illustration of CSIRO's Parkes radio telescope receiving the polarised signal from the new 'fast radio burst'. Credit: Swinburne Astronomy Productions*



**Publication details:**

E. Petroff and 34 co-authors [12 CAASTRO authors] "A real-time fast radio burst: Polarization detection and multi-wavelength follow-up". Monthly Notices of the Royal Astronomical Society 2015 447 (1): 246-255. doi: 10.1093/mnras/stu2419<http://arxiv.org/abs/1412.0342>This is a Text Block. Use this to provide text...

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## **Interdisciplinary Research Case Study: Colour vision in marsupials**

**Dr Wiebke Ebeling (Curtin University)**

Neglected by colour vision research for a long time, and generally assumed to have poor colour vision just as most mammalian (non-primate) species, Australian marsupials suddenly emerged as a particularly interesting experimental subject in

the 2000s. According to a research group based at the University of Western Australia, at least four marsupial species were found to have ‘trichromatic’ colour vision, that is, based on the spectral responses of three cone photoreceptor types in the retina. This had been thought strictly limited to primates, such as ourselves, where the gene of the middle-to-long wavelength sensitive cone type had duplicated and shifted towards the longer wavelengths, enabling us to perceive hue independently to the brightness and saturation of a stimulus. [Read more here](#)



Photo caption: Australian tammar wallaby in a two-alternative forced-choice experiment to discriminate between two monochromatic wavelengths. *Credit: Wiebke Ebeling*

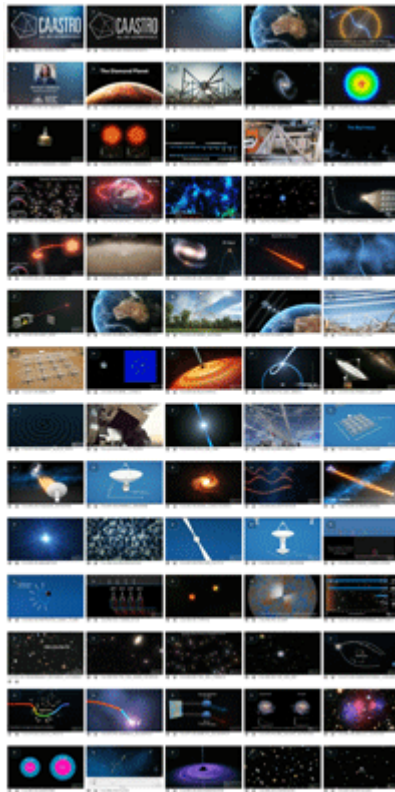
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## CAASTRO EDUCATION AND OUTREACH PROGRAM

### Activity Plan 2015

With the breadth and depth of [CAASTRO's Education & Outreach](#) program having received very positive feedback at the mid-term review in late 2014, the coming year will see more of our successful projects – but also a number of major novelties. The continuing CAASTRO classics are our High School support through “[CAASTRO in the Classroom](#)” and “[Telescopes in Schools](#)”, our public outreach efforts at Perth Astrofest and Mount Burnett Observatory and our partnership with Voyages Indigenous Tourism Australia for the “[Astronomer in Residence](#)” and “[Astronomy Weekend](#)” activities.

In 2015, our collaboration with Museum Victoria for the production of a planetarium show will intensify as visuals are being created to tell the story of the new golden age of astronomy. This show is an exciting project for CAASTRO Education & Outreach to complete in the second half of our funding period, with the prospect of national and international distribution of the show. We will also be deploying more antenna tile displays of the Murchison Widefield Array (MWA) at various Australian locations, along with new signage. Further plans for activities in 2015 include an even stronger engagement in schools through fine-tuning and distributing the MWA classroom tool and through curriculum-specific research stories and career advice.



## CAASTRO Media Library Now Available

The new CAASTRO media library, thanks to Swinburne Astronomy Productions, is now available for use.

The animations have been put together to cover a significant number of concepts and experimental approaches that are relevant to CAASTRO research across all three themes. We would therefore like to encourage you to make good use of this resource in your presentations. The library also contains previous productions that accompanied the CAASTRO launch and several press releases.

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## MEMBERSHIP UPDATE

CAASTRO now has 178 members. We welcome our latest team members:

**Dr Christene Lynch**, University of Sydney

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## CAASTRO MEMBERS PROFILES

### **Wiebke Ebling (CURTIN) Education and Outreach**

I have been the national coordinator of CAASTRO's Education & Outreach program since mid 2011. Prior to this role, I completed a PhD in neuroscience at the ANU and worked as Outreach Officer of the Australian Ocean Data Network at the University





### **Alex Codroneanu (SWIN) PhD Student**

I'm originally from Romania and received my honors equivalence in Physics and Astrophysics from the University of Minnesota, Twin Cities. For my Physics degree I worked with the Super Cryogenic Dark Matter Search Program on cold hardware manufacture and design as well new detector design testing. I also worked with Prof. Claudia Scarlata on simulating grism observations for the upcoming Euclid Space Telescope with the goal of understanding the impact of this exciting new tool on breaking down the age/dust/metallicity degeneracy in the identification of stellar population parameters. [Read more here](#)

of Tasmania. My focus in designing and implementing our program is a smart use of (human) resources by adapting activities to the highly distributed nature of CAASTRO, maximising re-use and longevity of materials and efforts, and fostering collaborations. [Read more here](#)



### **Anna Kapinska (UWA) Research Associate, Evolving Theme**

Anna joined ICRAR and CAASTRO as a postdoctoral researcher in August 2013. Anna completed her Ph.D. in 2012 at the University of Southampton, UK, and was a senior research associate at the Institute of Cosmology & Gravitation, University of Portsmouth, UK, before joining CAASTRO.



Anna's research focuses on supermassive black holes studied via analyses of radio galaxies and quasars. She uses both continuum observations from the SKA precursors and pathfinders, and numerical simulations of semi-analytical models, to investigate the physical (time) evolution of these powerful radio sources and possible links to their hosts' evolution (AGN feedback). [Read more here](#)

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## RECENT WORKSHOPS

### Perth Simulated Galaxy Cluster Comparison Workshop ICRAR/UWA between March 23rd and 27th, 2015.

SOC/LOC : Weiguang Cui (ICRAR/UWA), Madhura Killedar (Ludwig Maximilians Universitat, Munich), Lyndsay Old (U Nottingham), Chris Power (ICRAR/UWA), 2 female, 2 male

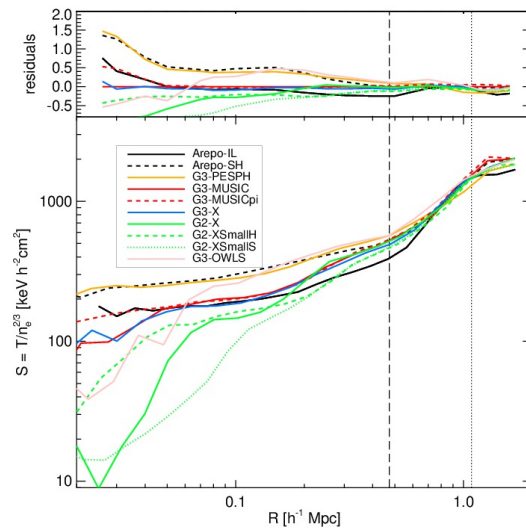
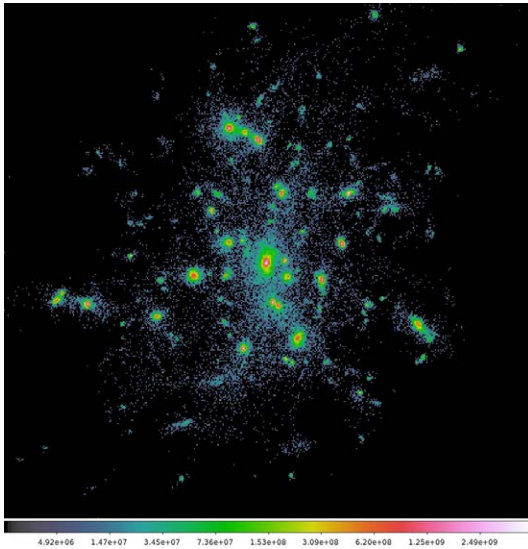
Speakers: 10 in total, 3 female, 7 male

The Perth Simulated Galaxy Cluster Comparison workshop built on the foundations set down in the nIFTy cosmology workshop held in Madrid in June/July 2014. The aim of the workshop was two-fold;

1. To continue working on our astrophysical code comparison, in which we study the properties of the same cosmologically simulated galaxy cluster using 12 state-of-the-art codes. By comparing results with different codes, we can better understand how predictions vary depending on the code used and the galaxy formation model assumed. This is important when we want to compare predictions against observations and to understand how degenerate the results of models are (i.e. two models can predict similar galaxy cluster properties by invoking fundamentally different physical processes)

2. To compare the results of these state-of-the-art codes with observed galaxy clusters, including direct measurement of physical quantities (such as stellar mass and metallicity) in the simulations as well as the creation of codes to create synthetic observations of the simulations.

[Read more here](#)



Left: Weiguang Cui and Chris Lidman worked together to produce synthetic optical images of stars within the cluster, useful for the study of the BCG and ICL. Here is an example of the stellar light distribution within the cluster created by Weiguang, where stellar spectra have modelled to produce realistic colours; Chris' code takes such synthetic images and can model realistic synthetic observations at arbitrary redshifts

Right: Federico showed that, once the physics of galaxy formation is modelled in simulations, modern astrophysical codes predict broadly similar entropy profiles, even if there are stark differences in predictions from modelling only gravity and non-radiative hydrodynamics — a quite striking result that forms the basis of a new paper.

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## UPCOMING EVENTS

[Women in Astronomy Workshop](#): 22-23 July 2015, Women's College, University of Queensland

[ADASS XXV](#): The 25th Annual Astronomical Data Analysis Software and Systems Conference: 25-30 October 2015, Sydney, NSW, Australia

[CAASTRO Annual Retreat](#), 16-18 November 2015, Leura, NSW, Australia

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