



CAASTRO Newsletter Edition 16, April 2016



INTRODUCTION FROM CAASTRO DIRECTOR

I've just returned from Perth, where we held the inaugural ACAMAR Australia-China Workshop on Astrophysics on 5-7 April. This was an exciting and well-attended event, with sessions on Antarctic astronomy, gravitational waves, radio astronomy, instrumentation and big data challenges, and provided an excellent opportunity to meet with our Chinese colleagues to strengthen existing research collaborations and plan new ones. It was particularly interesting to me to see the rapid progress being

made on the Chinese 500m radio telescope, FAST, which will be opened later this year. A more detailed account of the ACAMAR workshop will appear in the next CAASTRO Newsletter.

I am happy to announce that Professor Robert Williamson AO FRS FAA will be the new Chair of the CAASTRO Advisory Board. He takes over from Dr Alan Finkel AO FTSE, who is now Australia's Chief Scientist. Bob Williamson is an eminent medical researcher and geneticist, and a former Director of the Murdoch Childrens Research Institute in Melbourne (an organisation with over 1500 researchers). He has a strong interest in national science policy and medical and scientific ethics, and has been an advisor to governments at both state and federal level. He has recently served as Secretary for Science Policy at the Australian Academy of Science, and is a strong advocate of gender equity.

The CAASTRO Executive met in Melbourne in March, where we also attended the launch of the planetarium show 'Capturing the Cosmos' at Scienceworks. It was an amazing experience to see the completed production and to meet many of the Museum Victoria staff who worked with us on this joint production. Wiebke Ebeling's article later in this Newsletter gives more detail about the show and its Melbourne and Perth launches. I hope all of you will have a chance to see this production if you haven't already done so.

The CAASTRO Annual Report for 2015 has now been completed and is available on our web page. Paper copies are now on their way to all our members and stakeholders. Many thanks to all those involved in producing this year's Report.

In a few days I'll be travelling to Germany, where CAASTRO is holding a joint workshop with the Max Planck Institute for Extraterrestrial Physics (MPE) on 'Follow-up of wide-area X-ray surveys'. The German eRosita instrument, to be carried on a Russian satellite, will perform a sensitive X-ray imaging survey of the whole sky and is expected to detect large numbers of galaxy clusters and millions of active galactic nuclei. Participants in the workshop will discuss scientific opportunities opened up by the synergy between eROSITA and existing or upcoming wide-area surveys, with an emphasis on multi-object spectroscopy and southern hemisphere programs. MPE is one of CAASTRO's international partner organisations, and I look forward to this opportunity to advance our collaborative research.

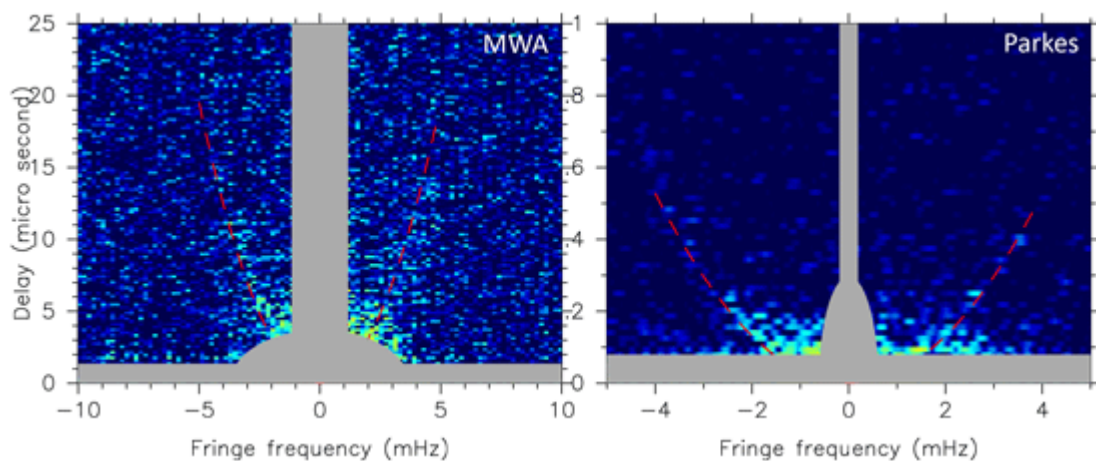
Finally, I hope to see many of you in person when I make a series of visits to CAASTRO nodes in Melbourne, Canberra, Brisbane and Perth in late May and June.

Elaine Sadler
Director, CAASTRO

RESEARCH UPDATE

Detection of parabolic arc helps locate pulsar scattering screen

Millisecond pulsars are precise clocks provided by nature. By measuring pulse arrival times of many such pulsars distributed over the sky – a pulsar timing array (PTA) – astronomers are hoping to detect long-period gravitational waves, as produced in super-massive black hole mergers. This requires extremely high timing precisions: every possible source of error must be accounted for, including those arising from propagation effects in the interstellar medium (ISM). The ISM effects are strongest at the low frequencies that the Murchison Widefield Array (MWA) operates at. [Read more here](#)



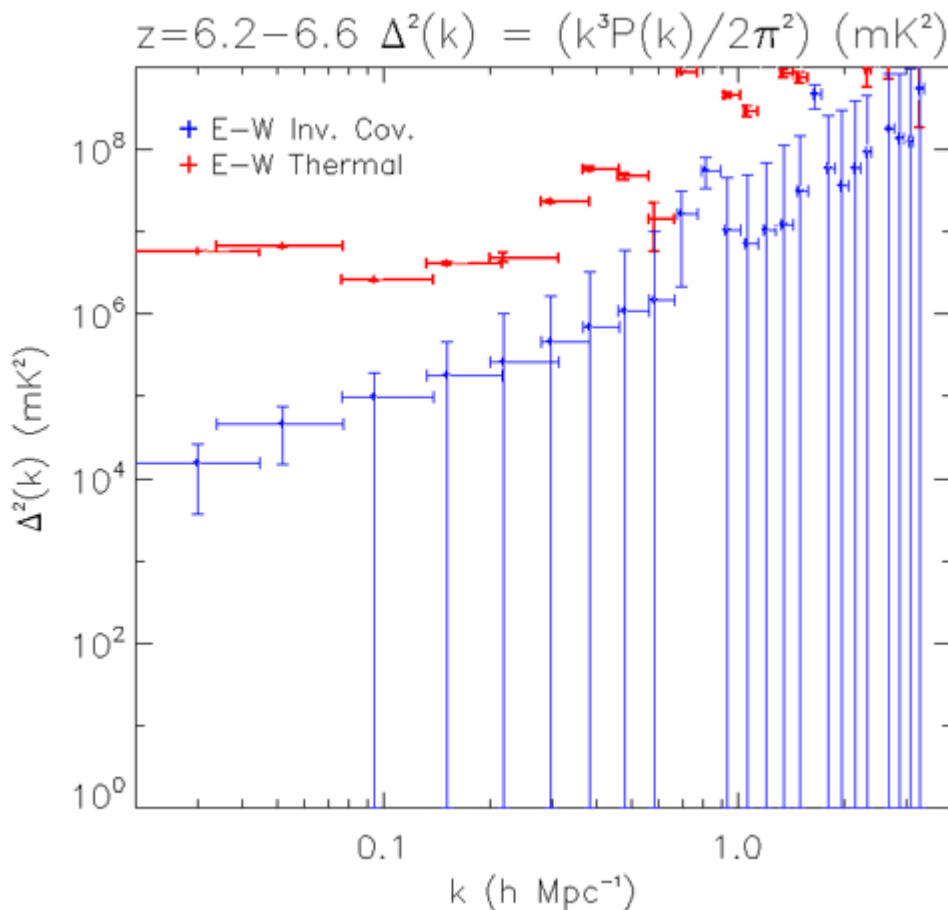
Secondary spectra of PSR J0437-4715 for MWA and Parkes data. Credit: Bhat et al. (fig. 4)

Publication details

Ramesh Bhat, Steve Ord, Steven Tremblay, Sammy McSweeney and Steven Tingay in ApJ (2016) "[Scintillation arcs in low-frequency observations of the timing-array millisecond pulsar PSR J0437-4715](#)"

CHIPS: The Cosmological HI Power Spectrum Estimator

Exploring the neutral hydrogen from the first billion years of the Universe provides a wealth of information about the ionisation state, spatial structure and temperature of the intergalactic medium and the growth of the first stars, galaxies and black holes in the Universe. Neutral hydrogen is probed through its radio frequency emission line, observable from the early Universe with low-frequency radio telescopes. We are using the Murchison Widefield Array (MWA) to detect 12 billion year-old hydrogen, in an attempt to provide a first glimpse into the evolution of the Universe at this early time — the Epoch of Reionisation (EoR). [Read more here](#)



Output signal power as a function of spatial scale on the sky. This quantity measures the amount of structure in the hydrogen in the early Universe as a function of size, and is a primary metric used to constrain different models for the growth of structure and properties of the intergalactic medium. These results are consistent with our expectations: dominated by noise, and residual contamination from bright foreground galaxies and black holes. Credit: Trott et al. (ApJ 2016)

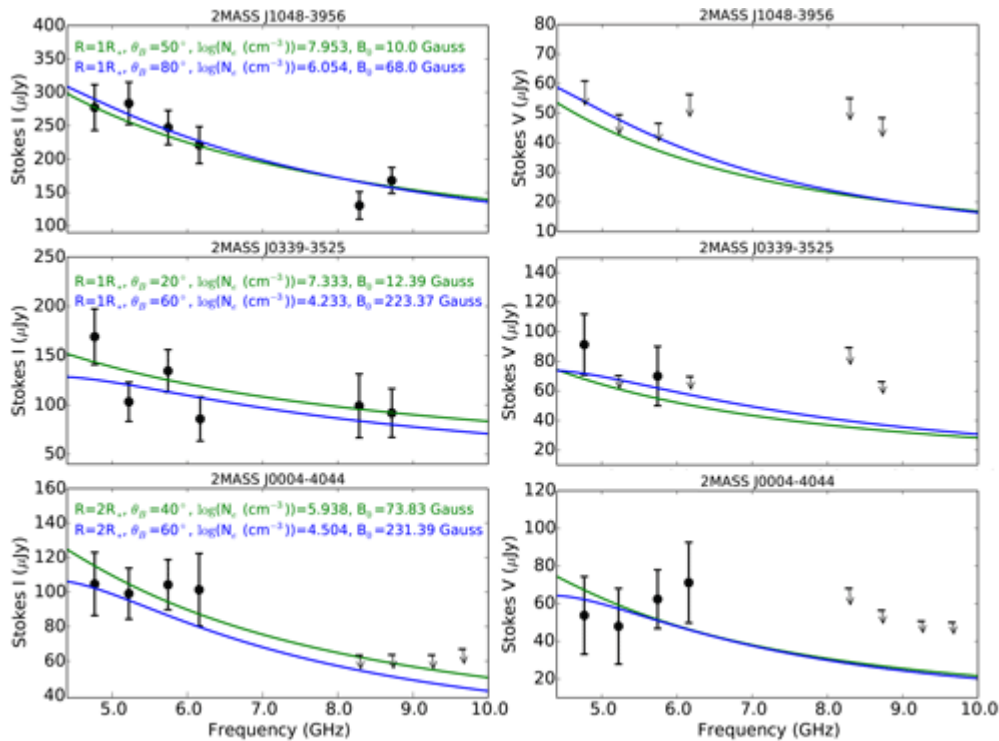
Publication details

Cathryn Trott, Bart Pindor, Pietro Procopio, Randall Wayth, Daniel Mitchell, Benjamin McKinley, Steven Tingay et al. in the *Astrophysical Journal* (2016)
["CHIPS: The Cosmological HI Power Spectrum Estimator"](#)

Radio-loud ultracool dwarfs allow analysis of magnetic fields

The group of lowest mass stars and brown dwarfs are collectively called ultracool dwarfs. A number of these objects are sources of both burst and quiescent radio emission. The radio bursts are sometimes found to occur periodically on the

timescale of the rotation of the ultracool dwarf or as isolated events. They are highly circularly polarised and occur over a timescale of a few minutes. Alternatively, the quiescent emission is observed to have very little variability and low circular polarisation. Both radio emission components are thought to be the result of magnetic processes and imply that ultracool dwarfs are able to generate and sustain strong magnetic fields. This is unexpected though, given their non-solar-like interior and the observed decline in the strength of magnetic activity tracers at other wavelengths. [Read more here](#)



Comparisons between two representative model curves and the measured Stokes I (left) and Stokes V (right) flux densities for 2MASS J1048-3956 (top), 2MASS J0339-3525 (middle), and 2MASS J0004-4044 (bottom). Fig.4 in Lynch et al. (MNRAS 2016)

Publication details

Christene Lynch, Tara Murphy et al. in MNRAS (2016): "[Radio detections of southern ultracool dwarfs](#)"

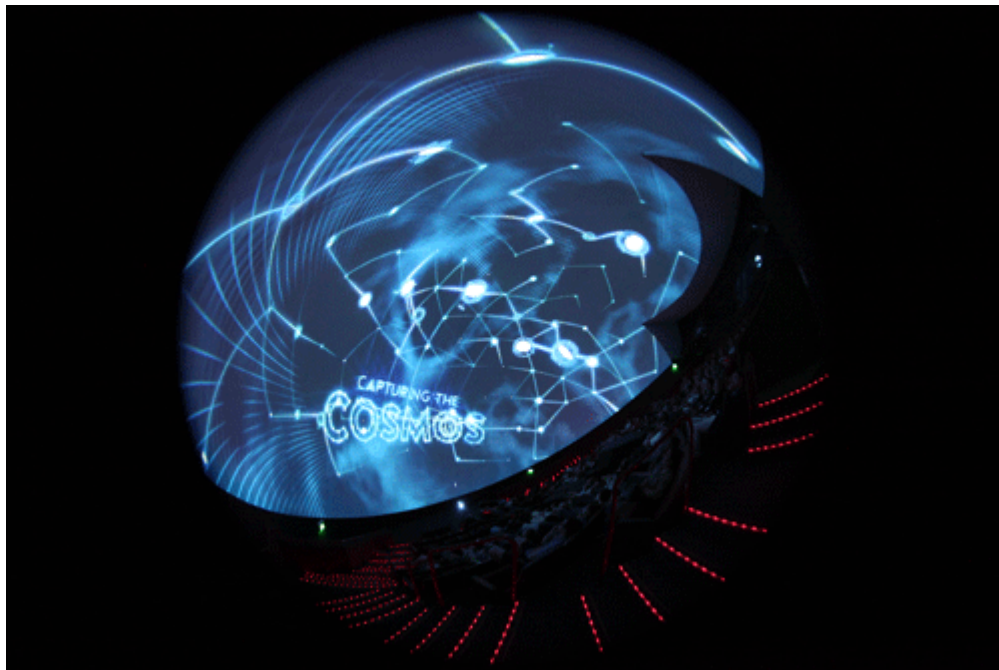
CAASTRO EDUCATION AND OUTREACH

We launched our planetarium show “Capturing the Cosmos” on Monday 21 March, three years after receiving the initial proposal from Museum Victoria. This show is the result of two years of collaboration and a major legacy project for CAASTRO Education & Outreach. The main launch event was hosted by Scienceworks in Melbourne where CAASTRO Director Elaine Sadler and CAASTRO Chief Investigator Brian Schmidt gave short speeches to highlight CAASTRO’s role in this project and our absolute delight to be sharing some of our science with the public. A satellite launch was held at [Scitech in Perth](#), where CAASTRO Education & Outreach Manager Wiebke Ebeling explained how the show is perfectly aligned with our science communication strategy. Sydney Observatory and Adelaide Planetarium also organised screenings on the night, and venues around Australia and New Zealand have commenced public screenings. “Capturing the Cosmos” will also be showcased at the Australasian Planetarium Society conference in Wellington (April), at the Jena FullDome Festival in Germany (May) and at the International

Planetarium Society conference in Poland (June). We will now be working towards producing the flat HD version of the show.

Living proof of our successful collaborations and excellent working relationships, the crew from Mount Burnett Observatory enriched the media's and our visitors' experience of the Melbourne launch event by assembling their [MWA tile display on the lawns of Scienceworks](#). They even got the tile wired up to receive ABC Classic radio. In preparation for the launch of the planetarium show, we also assisted Museum Victoria with creating educational resources including classroom activities, webinars, animations and video interviews. This collaboration will continue for another couple of weeks, as our very productive "[CAASTRO in the Classroom](#)" team creates more material.

We were involved in two major press releases about CAASTRO research: the "[Hidden Galaxies](#)" story, led by ICRAR, for our Deputy Director's paper "The Parkes HI Zone of Avoidance Survey", and the "[FRB Host Galaxy](#)" discovery, led by the SKA Organisation, for our former Swinburne post-doc and now SKA Affiliate Evan Keane. Both press releases got excellent media coverage, nationally and internationally.



Perth audience at the 'Capturing the Cosmos' launch. Credit: Dr John Goldsmith



Astrofest in Perth on 12 March attracted record numbers this year, more than 5,000 visitors. CAASTRO was once again present with an info stall, ably staffed by members from our Curtin and UWA nodes.

CAASTRO IN THE CLASSROOM

It's been a huge start to the year for CAASTRO in the Classroom, with 3 teachers joining the team to develop classroom resources. An intensive couple of weeks in the January school holidays resulted in outlines being completed for pre- and post-visit resources for our video conferencing topics and two set of notes were completed and published online in February. Teachers Neill Dorrington, Sandra Woodward and Silvia Choi have made a huge contribution to the program. Neill and Sandra have now left CAASTRO, but Silvia will stay working with CAASTRO for a few more months.

Thank you to the CAASTRO members who contributed to the set of '[Researcher Profiles](#)' on the Classroom Resources page. There are currently 5 profiles on the website and more will be added in the coming weeks. A set of classroom activities has been developed to help students engage with the profiles in a fun way, so they can learn more about what it is like to work in astrophysics and find out about some exciting science. Activities include designing business cards and a poster for a researcher and holding a mock science conference.

The first CAASTRO in the Classroom teacher workshop was held on 19 February at the Annual Conference of the Science Teachers Association of New South Wales. The teachers were fascinated by Aina Musaeva's presentation about her research on black holes and gave some excellent feedback on the resources and classroom activities presented by Jenny Lynch and Neill Dorrington.



Left: Ania Musaeva discussing black holes.



Right: Neil Dorrington

Astronomer in Residence

What is it like being the astronomer in residence for CAASTRO at Uluru? "Great" doesn't begin to cover it. It's so beautiful there, such great people working in the tiny, little astronomy department, so much passion, such an amazing night sky. As astrophysicists, we tend to spend way more time looking into a computer screen than into the night, and to us, stars and galaxies are represented by numbers, rather points and smears in the sky. During the stay at Uluru you get to right that wrong, even if only for a couple of weeks.

I have loved spending several hours each day talking to interested people. Let's face it; space is awesome, and everyone knows it! People have been keen to come to my public talks, to learn about how black holes work, and to let me explain to them how various stars end their lives. They have loved me pointing out the clusters of stars we are pointing our telescopes at, and having me explain what exactly they are seeing through the eyepiece. And as for me, I have loved helping them out, providing them with the knowledge they are looking for!

While the work aspect of being an astronomer in residence at Uluru is so nice, it can barely be called work, the time off has been great as well. I have thoroughly enjoyed exploring Uluru and Kata Tjuta, learning more about astrophotography, and trying out my picture taking skills. I am going to miss having such beautiful surroundings to satisfy my cravings for great photography!

Natalia Eire Sommer



MEMBERSHIP UPDATE

CAASTRO now has 176 members. We welcome most recent members:

- Anthea King, University of Melbourne
- Ben McKinley, University of Melbourne
- Merryn Taylor, University of Queensland
- Daniel Muthukrishna, University of Queensland
- Dilyar Barat, ANU
- Mia Walker, Curtin University
- Bradley Meyers, Curtin University
- Mengyao Xue, Curtin University
- Samuel McSweeney, Curtin University
- Chris Flynn, Swinburne
- Andrew Zic, University of Sydney
- Charlotte Ward, University of Sydney
- Dougal Dobie, University of Sydney
- Frank Briggs, ANU
- Minh Huynh, University of Western Australia
- Christopher Joran, Curtin University
- Sarah Brough, AAO
- Antonia Rowlinson, ASTRON
- Helen Keys, University of Sydney
- George Heald, CSIRO
- Tania Barone, ANU
- Balwinder Arora, Curtin University
- Rajan Chhetri, Curtin University

CAASTRO MEMBER PROFILES

Ms Kate Gunn (USYD) Chief Operating Officer

A start-up specialist with a wealth of business and University experience, Kate has been well placed to establish the necessary foundations for CAASTRO to grow and achieve its goals. She has 25 years of management experience, and has a background in the commercialisation of University intellectual property. In 2015, Kate won a scholarship to attend the Harvard Business School's Women's Leadership program.



Jarryd Rasti (UMEL) PhD Student

Jarryd Rasti joined CAASTRO this July. Jarryd is working with Ben



Dan Taranu (ICRAR/UWA) Research Staff

I have been a CAASTRO Research Associate at ICRAR/UWA since January 2015 and am the Theme Scientist for the Evolving theme. I joined CAASTRO after finishing my PhD at the University of Toronto, with John Dubinski and Howard Yee. My thesis used numerical simulations to show that elliptical

galaxies likely form through multiple merger in groups. I am now developing a new method for building realistic 3D models of spiral galaxies and applying it to data from the SAMI galaxy survey. I am also running more sophisticated hydrodynamical merger simulations and generating a catalog of synthetic observations for the new Romulus cosmological simulation (led by the N-Body Shop at the University of Washington). These projects will precisely measure the structural properties of thousands of galaxies and predict their evolution.



McKinley. Jarryd is measuring the beam patterns of MWA tiles, and using downlink transmissions from low-Earth-orbit satellites (the Orbcomm constellation in particular).

GENDER ACTION

Equity, Access and Diversity - Support and Advice

There are times when sometimes you need some informal advice on day to day issues. Feel free to contact us for this advice. While each University or organisation has their own support programs and specific policy responses to issues of diversity, harassment and gender issues, CAASTRO is happy to help you navigate through any challenges you may be facing. Please contact us now by clicking on the link on the CAASTRO intranet page <http://www.caastro.org/gender-action-committee> or you can contact any member of the Gender Committee directly.

If you would prefer to report an issue *anonymously*, you can describe it on “[I need support now](#)”

You are also welcome to discuss any matters related to the Gender Action Committee and its activities with the **co-chairs**, Brian Schmidt and Rachel Webster.

Also, the Director, Elaine Sadler is always open to any staff member or student with an issue to discuss.

POST DOCTORAL COMMITTEE REPORT

The CAASTRO Post-Doctoral Committee was formed to identify ways in which CAASTRO can support post-doctoral staff and PhD students in their final year in their training and career progression. [With representation by academics from most CAASTRO nodes](#), the inaugural CPDC met for the first time in February to discuss its scope and mission. Committee members felt that better communication between the CAASTRO Executive and post-docs would be desirable, to flag upcoming opportunities for staff and to explain strategic decisions, for instance with regard to new collaborations. The CPDC will act as a conduit of this communication by inviting Executive members and alumni to committee meetings and by maintaining resources for CAASTRO post-docs to learn more about training, jobs and travel funding opportunities. Organising local post-doc meetings and sending out newsletters will also be part of the CPDC's role. The chair of the CAASTRO Post-Doctoral Committee is Wiebke Ebeling from Curtin University. For more information please contact: Wiebke Ebeling (Wiebke.Ebeling@curtin.edu.au)

STUDENT COMMITTEE REPORT

The student committee has met once in 2016 and has set the ball rolling on organising a workshop on Interview technique in collaboration with Wiebke Ebeling. Once the resources are created, we'll hold it on a node by node basis so no one has to miss out if they can't travel. The student survival kit, full of useful tools and resources for students, is now on the CAASTRO intranet (found at <http://www.caastro.org/caastro-student-committee>). This will be updated with time so keep an eye on it! As always, if there is anything else you feel we could be doing for you as a student, please do get in touch. For more information please contact Jack Line (jline@student.unimelb.edu.au)

UPCOMING EVENTS

- [Follow-up of Wide-Area X-ray Surveys Workshop](#): 27-29 April 2016, Ringberg Castle, Bavaria
- [ASKAP 2016: The Future of Radio Astronomy Surveys](#): 6-10 June 2016, University of Sydney, Sydney, NSW, Australia
- [The 2016 ASA Annual Scientific Meeting](#): 3-8 July, The University of Sydney, Sydney, NSW, Australia
- [Diving into the Dark: Bridging Cosmological Theory & Observation](#): 2016 CAASTRO Scientific Conference, 17-22 July 2016, Pullman Cairns International Hotel, Cairns, QLD, Australia
- [The Changing Face of Galaxies: uncovering transformational physics](#): 2016 CAASTRO Scientific Conference, 18-23 September 2016, Wrest Point Hotel, Hobart, TAS, Australia

- [CAASTRO Annual Retreat](#): 28-30 November 2016, Abbey Beach Resort, Busselton, WA, Australia
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