**7TH ANNUAL CAASTRO RETREAT**

# ABSTRACT BOOKLET

**22-24 November 2017, Novotel Barossa Valley Resort, South Australia**

## Wednesday 22 November 2017

**Matthew Bailes**
Swinburne University of Technology
Theme: Dynamic

*The ARC Centre of Excellence for Gravitational Wave Discovery (OzGrav)*

A new window on the Universe was opened on the 15th of September 2015 when advance LIGO detected the merger of two black holes in the distant Universe. Since then two major observing runs have been completed and in this talk I will discuss the tremendous progress in this field and the work being undertaken by OzGrav.

---

**Dougal Dobie**
University of Sydney
Theme: Dynamic

*Radio Follow-up of GW170817*

On August 17 LIGO detected a gravitational wave signal consistent with a binary neutron star merger. Over the following days, detections of a counterpart to the event were made across the entire electromagnetic spectrum. Each of these detections gives insight into the physics behind the merger; in particular radio observations allow us to map the fast moving matter ejected from the event. The 16 delay in detecting the radio emission from the event also places tight constraints on possible neutron star merger models. We have performed multiple epochs of observation with the ATCA, coordinating our effort with the VLA and GMRT. In this talk I will present the results of our coordinated effort, our observations with ASKAP and the MWA and also discuss the vital role that radio observations will play in future gravitational wave events.

---

**Christian Wolf**
Australian National University
Theme: Evolving

*From the ashes to…15 years of SkyMapper Project*

SkyMapper was intended to be ready before the start of CAASTRO. I look back the numerous teething problems of the project and summarise what it has done for CAASTRO and look out to what it will do for science beyond CAASTRO

---

**Brad Tucker**
Australian National University
Theme: Dynamic

*The SkyMapper Search for Planet 9*

In order to explain the behavior of a group of Trans-Neptunian Objects, a new planet, Planet IX, has been proposed. Planet 9 is calculated to be between 4 and 10 Earth masses and between 200 and 800 AU away. However, based on previous all-sky searches, if it exists, it mostly exists in a narrow window towards the galactic plane. As part of BBC Stargazing Live, we ran a citizen science search to find this potential new planet. I will give an update on the search, from our novel strategy to results, which include the discoveries of new solar system bodies.

---

**Seo Won Chang**
Australian National University
Theme: Dynamic

*A First SkyMapper Variability Census and the Ongoing Search for Counterparts to High-energy Events*

SkyMapper searches for optical counterparts of high-energy events such as fast radio bursts and sources of gravitational waves. The latter involves follow-up observations of more than 100 square deg. per event so far. A large field of view is crucial to deal with the current uncertainties in localisation and incomplete galaxy catalogues, but there will be many diverse variable sources contaminating the counterpart candidate list. In this talk, we present a variability census of the SkyMapper Data Release 1 (DR1) to better understand characteristic timescales and amplitudes of potential contaminants. Several variability metrics are used to characterize large-amplitude variable sources whose signal can mimic that of possible counterpart, including Mira-type variables, dwarf novae or M-dwarf flares. We will also update the preliminary results related to follow-up observations of objects-of-interest, recently reported by our collaborators.

---

**Bradley Meyers**
Curtin University
Theme: Dynamic

*Spectral flattening of Crab giant pulses at low frequencies*

The Crab pulsar (PSR J0534+2200) sporadically emits extremely bright, intrinsically short-duration "giant pulses". The frequency dependence of normal pulsar radio emission is generally observed to be a power-law, with indications of a flattening or turnover at low frequencies (<100 MHz) in some pulsars. The spectrum of giant pulse emission, in general, has not been examined as closely. To study the spectral behaviour of Crab giant pulses, we conducted simultaneous wideband observations of the Crab pulsar with the CSIRO Parkes radio telescope and the Murchison Widefield Array (MWA). Our analysis shows that the mean spectral index of Crab giant pulses flattens at low frequencies, from -2.6±0.5 between the Parkes bands, to -0.7±1.4 between the lowest MWA subbands. There is currently no theoretical description that explicitly predicts this flattening. This may also have implications for certain Fast Radio Burst models, where they are thought to be ultra-luminous extragalactic giant pulses.

---

**Mengyao Xue**
Curtin University
Theme: Dynamic

*Low-frequency pulsar polarimetry across the MWA band*

The origin of pulsar radio emission has been a mystery for nearly 50 years. Pulsars are known to exhibit high degrees of polarisation, and the degree of linear polarisation generally tends to increase toward lower frequencies. At frequencies below 200 MHz, there is very limited amount of polarimetry work has been carried out in the past. Here we present a polarimetric study of for a few bright southern pulsars using the MWA's high time resolution mode. For each pulsar, observations were made simultaneo! usly across the full frequency range of the MWA, from 80 MHz to 310 MHz, sampling the frequency range at ~10 MHz separations. The frequency evolution of the profiles provides insights into the magnetospheric emission properties, as well as the scattering and depolarising effects caused by the inhomogeneous ISM.

---

**Steven Tremblay**
Curtin University
Theme: Dynamic

*Investigating the Magnetospheres of Pulsars with the MWA*

Studying the polarimetric properties of pulsars has been essential to understanding the configuration of magnetic field lines within any given pulsar’s magnetosphere. Investigating the low frequency polarimetry of these sources allows us to determine the geometric properties and any deviation from a magnetic dipolar field at higher altitudes above the star’s surface, while also sampling a large fraction of the magnetosphere. We’ve been studying a select number of pulsars

with the MWA that were previously studied at higher frequencies in order to get a better understanding of the magnetospheres over a large range of emission heights. One of the challenges of performing these low-frequency studies is the calibration and verification of the instrument's polarimetric response since there is little historical data to compare with. To address this, we're partnering with the German low frequency consortium (GLOW) to compare the polarimetric profiles from the MWA and the German LOFAR stations. The methodology used and our preliminary results will be presented.

---

**Sam McSweeny**
Curtin University
Theme: Dynamic

*Mapping emission regions in pulsar magnetospheres: simultaneous observations of subpulse drifting with the MWA and the GMRT*

Simultaneous observations of single pulses at multiple frequencies offer unique insights into the physical properties of a pulsar's magnetosphere. Here we present observational results of our simultaneously recorded data of PSR J0034-0721 (B0031-07) with the MWA (~185 MHz) and the GMRT (~610 MHz). The pulsar is known to switch between three distinct drift modes, interspersed with long duration nulling. The analysis reveals evidence for frequency-dependent behaviour of drift band! properties which are also "mode dependent". Our results confirm the known frequency dependence of a phase shift in pulse window that depends on the drift mode. We also find clear evidence for frequency dependent phase shifts of individual drift bands, which has not been reported previously. This enables us to measure the delay (~ms) between the times of emission at different frequencies. We interpret our results in terms of constraints on the pulsar's emission geometry and the structure of the magnetosphere.

---

**Andrew Zic**
University of Sydney
Theme: Dynamic

*Studies of bursty and quiescent emission of two ultra-cool dwarfs with the GMRT*

We report results from observations of two ultra-cool dwarfs, TVLM0513-46546 and 2MASS J1314203+132001A observed with the Giant Metrewave Radio Telescope. This is the first observing campaign searching for radio emission from these sources in the frequency range of 0.6 – 1 GHz. The results from these observations determine the existence of low-frequency radio bursts from ultra-cool dwarfs, and constrain the frequency at which the quiescent emission becomes optically thick. In turn, this can constrain the magnetic field strength and electron number density from within the emission region.

---

**Mathew Varidel**
University of Sydney
Theme: Evolving

*Deriving Gas Kinematics for Irregular Disk Galaxies using Trans-Dimensional Bayesian Gaussian Mixtures*

The relationship between gas turbulence and star-formation feedback processes within disk galaxies remains an open question. While previous studies have attempted to address this problem, inferring the resolved galaxy turbulence is difficult due to the effect of beam smearing acting to increase the observed velocity dispersion. In this talk, I will present a new 3D galaxy modelling approach which is designed to derive the underlying flux and velocity dispersion profiles by decomposing the galaxies into several gaussian blobs.

---

**Martin Bell**
University of Technology, Sydney
Theme: Dynamic

*Seven years of low frequency time-domain surveys: achievements and future prospects*

In this talk I will review the achievements made in the MWA Transients Survey - MWATS. Over seven years ago we started commissioning the Murchison Widefield Array for science operations. Since that time we have learnt a great a deal about the dynamic sky. In this talk I will review progress we have made with the MWATS survey, including what science goals have been achieved, what surprise discoveries were made, the status of our current research and future plans. One of the highlights will include presenting the prevalence of low-frequency variability in our latest and most state-of-the-art data reduction.

---

**Christene Lynch**
University of Sydney
Theme: Dynamic

*Chasing Low Frequency Radio Bursts from Magnetically Active Stars*

Flaring activity is a common characteristic of magnetically active stars. These events produce emission throughout the electromagnetic spectrum, implying a range of physical processes. A number of objects exhibit short-duration, narrow band, and highly circularly polarised (reaching 100%) radio bursts. The observed polarisation and frequency-time structure of these bursts points to a coherent emission mechanism such as the electron cyclotron maser. Due to the stochastic nature of these bursts and the sensitivity of current instruments, the number of stars where coherent emission has been detected is few, with numbers limited to a few tens of objects. Observations of a wider sample of active stars are necessary in order to establish the percentage that exhibit coherent radio bursts and to relate the observed emission characteristics to stellar magnetic properties. New wide-field, low frequency radio telescopes will probe a frequency regime that is mostly unexplored for many magnetically active stars and where coherent radio emissions are expected to be more

numerous. M dwarf stars are of particular interest as they are currently favoured as most likely to host habitable planets. Yet the extreme magnetic activity observed for some M dwarf stars places some doubt on the ability of orbiting planets to host life. This presentation reports the first results from a targeted Murchison Widefield Array survey of M dwarf stars that were previously detected at 100 - 200 MHz using single dish telescopes. We will discuss robust flare-rate measurements over a high dynamic range of flare properties, as well as investigate the physical mechanism(s) behind the flares.

---

**Fiona Helen Panther**
Australian National University
Theme: Dynamic

*Revealing the local stellar populations of SN1991bg-like supernova host galaxies*

SN1991bg-like supernovae are a distinctive subclass of thermonuclear Type Ia supernovae: sub-luminous, with distinctive red colours and spectra exhibiting strong Ti II in absorption. The majority of SN1991bg-like supernovae appear to occur in galaxies composed predominantly of old stars. With LEnsS (Local Environments of Subluminous Supernovae), we have observed host galaxies of past SN1991bg-like supernovae which have now faded, using integral field observations to reveal the properties of the stellar populations on <kpc scales around the apparent SN explosion site. We calculate the ages and metallicities of these stellar populations, and determine whether these are consistent with the peak of the delay time distribution that would make these objects a dominant contributor to the source of Galactic antimatter.

---

**Thursday 23 November 2017**

**Richard Scalzo**
University of Sydney
Theme: Evolving

*Datacube Construction for SAMI via Transformed Gaussian Process Priors*

The rise of multi-object integral field spectroscopy promises a wealth of data for galaxy surveys, but also presents a data analysis challenge in terms of both volume and complexity. For the SAMI instrument, the current method of building datacubes involves a drizzle-like weighted co-add of the data. This technique regains some of the on-sky detail lost to the instrument response, but cannot reconstruct detail finer than the atmospheric seeing, and suffers from some aliasing effects due to atmospheric differential refraction.

We present a new experimental method for datacube construction based on Gaussian process regression. Wavelength slices through the datacube are modelled as a Gaussian process, with the transformation from fibre fluxes to datacube spaxels handled by numerical integration of the instrument response. We discuss the method's performance on simulated data, including recovery of sub-seeing detail, removal of ADR aliasing, and correction to a wavelength-independent PSF, and suggest future directions for advanced galaxy modelling methods applied to entire datacubes.

---

**Nicholas Scott**
University of Sydney
Theme: Evolving

*Extragalactic Archaeology with SAMI*

The stellar population of a galaxy provides a fossil record of it's evolutionary history since the Big Bang. Using large integral field surveys like SAMI we can recover general aspects of this history and examine how it varies from galaxy to galaxy. Going further, we can study variations in the typical stellar population properties of a galaxy with galaxy mass, morphology, environment and dynamics, in an unbiased and significant way.

---

**Dilyar Barat**
Australian National University
Theme: Dark

*A unified galaxy scaling relation with SAMI*

We use data from the Sydney-AAO Multi-object Integral-field spectroscopy (SAMI) survey to study the dynamical scaling relation between galaxy stellar mass M* and the general kinematic parameter S_K =Vrot^2+sigma^2, combining rotation velocity (Vrot) and velocity dispersion (sigma). We show that the M*-S0.5 relation: (1) is linear above the spectral resolution limit of the SAMI survey; (2) has

smaller scatter than either the Tully-Fisher (M*-Vrot) or the Faber-Jackson (M*-sigma) relation; (3) gives consistent results whether the kinematics are measured from a galaxy's stars or its gas; (4) has an optimal value of K (i.e.\ minimal scatter) for K in the range 0.3 (optimal for gas measurements) to 0.7 (optimal for stellar measurements); and (5) these optimal values are the same for both early-type and late-type galaxies. These results are consistent with, but significantly extend, previous studies of this relation. We also show that sigma_aperture, the second moment of the stellar velocity distribution within a fixed aperture (as is typically measured from single-fibre surveys), is a good approximation to the optimal value of S_K for early-type galaxies, which contributes to minimising the scatter about the Fundamental Plane scaling relation.

---

**Matthew Colless**
Australian National University
Theme: Evolving

*Stellar populations and dynamics from resolved spectroscopy of galaxies*

The SAMI survey is obtaining integral field spectroscopy for more than 3000 nearby galaxies covering a wide range in mass and local environment. The spatially-resolved spectra of these galaxies recover both their stellar populations and their internal kinematics. I will report correlations revealed between key stellar population parameters and fundamental dynamical quantities such as mass, potential well depth, surface density, and angular momentum. I will discuss the implications of these results for the history of star formation and chemical evolution in galaxies.

---

**Katherine Harborne**
University of Western Australia
Theme Evolving

*A numerical investigation into λR*

The spin parameter, λR, gives us a quantitative way to distinguish galaxies according to how fast they rotate. This value is used quite frequently in many observational studies. However, observations are always a 2-dimensional projection of a 3-dimensional object – how well do the observed galaxy properties map to the true kinematic features?

I have been developing a code to analyse numerical simulations of galaxies as if observing them using an integral field spectrograph, such as SAMI. The aim of this work is to quantify the levels of uncertainty introduced by inclination projection effects, beam smearing and measurement radius. Here, I will present the results of this work and the code that has been developed.

---

**Dan Taranu**
University of Western Australia
Theme: Evolving

*Dissecting Disk Galaxies with Multiwavelength Data*

Massive galaxies show many strong correlations between physical and structural parameters like mass, size and angular momentum. However, galaxies also have complex structures with multiple distinct components, including stellar disks, bulges and dark matter halos. Accurately measuring these physical properties is therefore a challenging inference problem which requires careful modelling. I will describe the new tools we have built for Bayesian modelling of disk galaxies. Our codes can now process broadband images to perform source finding and segmentation (ProFound, Robotham+17), PSF modelling (AllStarFit, Taranu+17), photometric bulge/disk decomposition (ProFit, Robotham+17), and finally full 6D physical modelling using integral field kinematics (MagRite, Taranu+17). I will present results from modelling SAMI survey galaxies with deep imaging from KiDS/HSC and 21cm HI spectra. Finally, I will demonstrate how direct comparisons of these models with synthetic observations of galaxy simulations can provide strong constraints on theories of galaxy formation and evolution.

---

**Samuel Hinton**
University of Queensland
Theme: Dark

*Preserving your Project: Software Tooling and Resources*

Tools for preserving, sharing and collaborating on scientific software projects have improved vastly over the past five years. To try and reduce instances of code being lost, sharing old versions of code, and various hassles, I will present a brief overview of the current tools available and how to solve common issues found when specifically working with scientific code projects. For those that have solved common problems, or have useful code that can be used by other groups, I will present a quick summary of how to publish your code, get it distributed, archived and citable.

---

**Friday 24 November 2017**

**Chris Lidman**
AAO
Theme: Dark

*OzDES: Current status and first cosmological constraints*

OzDES is a six year program using the AAT to obtain thousands of redshifts in the 10 deep fields of the Dark Energy Survey (DES). OzDES and DES are now into their fifth years. The first cosmological results from the first year of the survey have just been published. In this talk, I will provide an update on both OzDES and DES and cast a look forward to some of the results that are likely to come from the full survey when it finishes at the end of 2018.

---

**Bonnie Zhang**
Australian National University
Theme: Dark

*Cosmology with Dark Energy Survey Supernovae*

Type Ia supernovae (SNe Ia) initially allowed the discovery of cosmic acceleration, and today remain an important cosmological probe. The Dark Energy Survey (DES) will use SNe Ia, along with three other independent probes, to measure cosmological parameters and investigate the nature of dark energy to unprecedented precision. By 2018 DES will have found thousands of SNe Ia. Most of these supernovae are classified with photometry only, with redshifts from host galaxy spectra obtained by OzDES using 2dF/AAOmega at the Anglo Australian Telescope. A smaller fraction, the 'spectroscopic sample', will have spectra of the supernovae itself. Several efforts are underway to produce parallel cosmology analyses of the DES 3-year supernova spectroscopic sample, including chi-squared minimising MCMC, approximate Bayesian computation, and hierarchical Bayesian methods. We present an overview of these techniques, with tests on simulated data and blinded DES results.

---

**Jacobo Asorey**
Swinburne University of Technology/University of Queensland
Theme: Dark

*Cosmology with Type Ia Supernova gravitational lensing*

In the last decades, the use of Type Ia Supernovae (SN) as standard candles has allowed us to understand the geometry of the Universe as they help to measure the expansion rate of the Universe, especially in combination with other cosmological probes such as the study of cosmic microwave background radiation anisotropies or the study of the imprint of baryonic acoustic oscillations on the galaxy clustering. Cosmological parameter constrains obtained with type Ia SN are mainly affected by intrinsic systematic errors. But there are other systematic effects related with the correlation of the observed brightness of Supernova and the large-scale structure of the Universe

such as the effect of peculiar velocities and gravitational lensing. The former is relevant for SN at low redshifts while the latter starts being relevant for SN at higher redshifts. Gravitational lensing depends on how much matter is along the trajectory of each SN light beam. In order to account for this effect, we consider a statistical approach by defining the probability distribution (PDF) that a given supernova brightness is magnified by a given amount, for a particular redshift . We will show that different theoretical approaches to define the matter density along the light trajectory hugely affect the shape and width of the PDF. This may have catastrophic effects on cosmology fits using Supernova lensing as planned for surveys such as the Dark Energy Survey or future surveys.

---

**Natalia Eiré Sommer**
Australian National University
Theme: Dark

*From time-lags to dark energy: Reverberation mapping with DES/OzDES*

The photometric Dark Energy Survey (DES) and its spectroscopic, Australian counterpart, OzDES, have for the past five years worked together to achieve competitive cosmological results. One of the projects has involved reverberation mapping, a technique which will allow for AGN to be used as standardisable candles. The AGN targeted in the DES/OzDES reverberation mapping project represent a unique sample due to the large number of targets, as well as their wide range in redshifts. With this AGN sample we will be able to provide luminosity distances at higher redshifts as ever before, while simultaneously using the same objects as low-redshift anchors. In this talk I will present the current state of the DES/OzDES reverberation mapping program, and the results we expect to see at the end of the surveys.

---

**Cullan Howlett**
University of Western Australia
Theme: Dark

*Cosmology with Peculiar Velocity Surveys*

Peculiar velocity surveys offer a unique way of understanding our cosmological model and testing the nature of gravity. In this talk I will give an overview of how these can be used, focussing on recent constraints from the 2MASS Tully Fisher Survey and plans for future surveys such as Taipan and LSST. In particular, I'll finish with predictions for how peculiar velocities measured with Type IA Supernovae from LSST could far surpass current measurements and offer an unparalleled test of gravity on large scales.

---

**Caitlin Adams**
Swinburne University of Technology
Theme: Dark

*Improved constraints on the growth rate of structure from modelling the density-velocity cross-correlation in the 6dF Galaxy Survey*

While the Universe's accelerating expansion is well established, its cause remains unknown. There are two promising explanations of the acceleration: dark energy (which assumes general relativity) and modified gravity. Changing the law of gravity on the largest scales will impact the formation of galaxies and galaxy clusters, resulting in a distribution of matter that differs from that predicted by general relativity. If we are to distinguish between these theories using observations, our measurements need to be incredibly precise. I will present a new maximum-likelihood approach that uses multiple observations at low redshift to better constrain the growth rate of structure, one of the key cosmological parameters for distinguishing between general relativity and modified gravity. Our approach takes advantage of the shared information between galaxy positions and velocities in the form of their cross-correlation. Applying this approach to the 6 degree Field Galaxy Survey, we find a 20% reduction in the uncertainty on the growth rate of structure when including the cross-correlation information.

---

**Anais Möller**
Australian National University
Theme: Dark

*SkyMapper Transient Survey towards the first data release*

The SkyMapper Transient (SMT) survey is performing a rolling search of the southern and equatorial sky utilizing the SkyMapper Telescope at Siding Spring Observatory. Its main goal is to obtain an untargeted sample of type Ia supernovae (SNe Ia) for cosmology. SkyMapper aims to have $>100$, well calibrated, low redshift ($z<0.1$) type Ia supernovae. The SkyMapper Transient Survey is in full operation and discovering a large number of transients. The SkyMapper supernovae data set will be valuable as a search and follow-up survey uniformly observed and reduced, and non-targeted sample of low-redshift SNe Ia.

In this talk we will give an update of the SMT survey, our work towards a first data release and the role of Supernova Sighting, a citizen science project where the general public can help classify possible transients discovered by SkyMapper, thus improving the processing time for the survey. To date SkyMapper has discovered over 60 supernovae including 40 type Ia and, in the last year, we have reported over 70 transients to the International Astronomical Union. I will discuss SNIa 2016hhd discovered within the first few days of explosion with possible evidence of a shock interaction.

---

**Claudia Lagos**
University of Western Australia
Theme: Evolving

*Angular Momentum in galaxies: lessons from the EAGLE simulations*

We use the EAGLE cosmological hydrodynamic simulation suite to study the specific angular momentum of galaxies, j, with the aims of (i) investigating the physical causes behind the wide range of j at fixed mass and (ii) examining whether simple, theoretical models can explain its seemingly complex and non-linear evolution. We find that j of the stars, jstars, and baryons, jbar, are strongly correlated with stellar and baryon mass, respectively, with the scatter being highly correlated with morphological proxies such as gas fraction, stellar concentration, (u-r) intrinsic colour, stellar age and the ratio of circular velocity to velocity dispersion. We compare with available observations at z=0 and find excellent agreement. I will show how galaxies follow generic tracks of stellar spin parameter evolution, with two channels producing galaxies of low spins: (i) galaxy mergers, and (ii) early star formation quenching. I will also show how dry and wet mergers affect the stellar spin parameters of galaxies, and how that gives rise to the dependence of slow rotators on stellar mass and environment.

---

**O. Ivy Wong**
University of Western Australia
Theme: Evolving

*Radio Galaxy Zoo*

Radio Galaxy Zoo is an international online citizen science project that asks its participants to identify the host galaxies of radio sources by comparing images of the radio sky to those from an infrared survey which map the stellar components of galaxies. Although a relatively simple task, it is predicted that 10% of all radio sources defy simple automated classification methods and require visual identification. This 10% translates to ~7 million sources from the upcoming ASKAP EMU survey. I will present the results and lessons learnt from the first 4 years of operation.

---

**Steven Murray**
Curtin University
Theme: Evolving

*Between Window and Wedge: A new statistical point-source model for the EoR*

Currently, a phenomenal level of effort is being directed at uncovering the elusive signature of the Epoch of Reionisation in the power spectrum of 21 cm temperature fluctuations. Several instruments, including the MWA, are lowering the upper limits of this signal using a wide range of techniques. For all, the primary outstanding obstacle is the presence of systematic noise -- from the instrument, the ionosphere, the Galaxy and extra-galactic sources -- and comprehensive modelling of each of these components is the only reliable avenue for removal or suppression of the overwhelming noise. In this talk, I focus on a hybrid foreground removal-suppression technique

named CHIPS, wherein bright foregrounds are individually modelled and subtracted, and fainter foregrounds are statistically characterised in order to optimally extract signal information. I significantly extend current modelling of extra-galactic point sources by generalising their source count distribution, and allowing them to exhibit angular clustering, and I provide expressions for the resulting covariance of power spectral modes.

I show that including source clustering induces excess power on large angular scales, which further constrains the EoR "window". I also provide an expression for the largest scale on which the contribution from clustering is dominant, and find that it critically depends on the relative abundance of faint sources. Finally, I demonstrate that ignoring source clustering may lead to false detections, due to a combination of unacknowledged bias and artificially reduced uncertainties.

I expect that these extensions will form a small but important component of the ongoing campaign to reveal the most mysterious epoch in history.

---

**Elizabeth Mahony**
University of Sydney
Theme: Evolving

*Searching for HI absorption in the brightest southern radio galaxies*

Detections of HI absorption in distant radio galaxies can provide a powerful tool in understanding the role that cold gas plays in the formation and evolution of radio-loud AGN. Using the ASKAP-BETA telescope we have searched for HI absorption against sources selected from the 2-Jansky sample; a sample of powerful radio galaxies at redshifts less than 0.7. In this talk I will present new detections of HI absorption and discuss the importance of obtaining complementary multi-wavelength data to aid in the scientific interpretation of these sources. Results obtained from this pilot study provide valuable insight into what we can expect to detect in the upcoming ASKAP-FLASH absorption line survey.

---

**Cathryn Trott**
Curtin University
Theme: Evolving

*Seven years of CAASTRO EoR - where are we now?*

I will review the work over the recent years within CAASTRO pursuing the goal of detection of the EoR signal, and provide some future directions as we look toward ASTRO 3D.

---

**Stephanie Bernard**
University of Melbourne
Theme: Evolving

*Chasing the bright end of the z > 8 galaxy luminosity function with the BoRG*

Using the Wide Field Camera 3 on the Hubble Space Telescope, the frontier of galaxy studies at z ~ 9-11, only 500 million years after the Big Bang, is currently being explored. While the WFC3 is a powerful instrument that has opened up a rich new area of discovery, including the most high-redshift galaxy currently known, its view is still limited. By adding in imaging and spectroscopic data from other space-based and ground-based sources, such as Spitzer's near-infrared IRAC camera, or the infrared MOSFIRE instrument on Keck, we can get a better view of the properties of these galaxies in the early Universe. I will present galaxy candidates and luminosity functions at z > 8 from our pure-parallel HST survey, the Brightest of Reionising Galaxies (BoRG) survey, and our Spitzer programme to follow-up over thirty of these candidates. I will also present results from our MOSFIRE programme to spectroscopically confirm reionisation-era candidates.

---

**Anthea King**
University of Melbourne
Theme: Evolving

*Investigating AGN structure using a joint reverberation mapping and microlensing analysis of lensed quasar HE0435-1223*

The bulk of an AGN's total emission is considered to arise from a compact region close to the central black hole (the accretion disk and BLR), and is then transferred into larger scale outflows that influence the regulation of galactic star formation, and may help drive the well observed galaxy–black-hole coevolution. However, even a basic understanding of the structure and kinematics of the compact region, and the connection between the compact regions and the large-scale outflows remain poorly understood. This region is unresolvable due to its small size, so alternative methods have been developed to explore this region. The two main methods used for this purpose are reverberation mapping and gravitational microlensing. This project will combine these two methods for the first time in a single object (HE0435-1223), giving us an opportunity to test both methods and help form a coherent picture of the inner regions of the AGN.

---

**Laura Wolz**
University of Melbourne
Theme: Evolving

*Testing Galaxy Evolution through HI Intensity Mapping Cross-Correlations*

Intensity mapping of the neutral hydrogen (HI) is a new technique designed to efficiently map the large-scale structure of the Universe. The flux of the redshifted HI emission is measured on low resolution without identifying individual galaxies such that the large-scale clustering is preserved and cosmological analysis is feasible. The cross-correlation of intensity maps with galaxy surveys is a

popular method to increase the detectability of the signal while minimising the impact of systematics. The cross-correlation signal is sensitive to the underlying density distribution, the biases of the probes, and the intrinsic correlation of the HI and the optical sample. Additionally, the sampling noise of the objects present in both samples is proportional to the average HI mass per galaxy in the optical sample. This implies this noise term allows to measure the average HI of the galaxy sample, commonly too distant and faint for direct HI detection by radio telescopes. The HI mass per galaxy sample as a function of optical selection criteria, such as star-formation activity, determines relations to understand the galaxy evolution processes over time. In this presentation, I will showcase how the cross noise can determine the evolution of HI-scaling relations using the latest cosmological simulations.

---

**Marcin Glowacki**
University of Sydney
Theme: Evolving

*WISE data as a photometric redshift indicator for radio AGN*

An understanding of the redshift distribution of radio sources is essential for the analysis of upcoming large-area radio surveys with SKA pathfinder telescopes, such as ASKAP and the MWA. We show that mid-infrared data from the all-sky WISE survey can be used as a robust photometric redshift indicator for powerful radio AGN, in the absence of other spectroscopic or multi-band photometric information. This work is motivated by a desire to extend the well-known K-z relation for radio galaxies to the wavelength range covered by the all-sky WISE mid-infrared survey. Using the LARGESS radio spectroscopic sample as a training set, and the mid-infrared colour information to classify radio sources, we generate a set of redshift probability distributions for the hosts of high-excitation and low-excitation radio AGN. We test the method using spectroscopic data from several other radio AGN studies, and find good agreement between our WISE-based redshift estimates and published spectroscopic redshifts out to $z < 1$ for galaxies and $z < 3$-4 for radio-loud QSOs. Our chosen method is also compared against other classification methods and found to perform reliably. Our code is publicly available.

---

Jean-Pierre Macquart
Curtin University
Theme: Dynamic

Fast Radio Burst Source Counts

I will present details of the latest CRAFT FRB detections, present an estimate of the source counts slope based on our statistics, and speculate on their origin based on our results.

---

**Dilpreet Kaur**
Curtin University
Theme: Dynamic

*Pulse profile and scintillation studies of PSR J2241−5236*

PSR J2241-5236, a millisecond pulsar with a spin period of 2.18 ms. It is in a 3.5 hour circular orbit with a very low mass (0.012 M⊙) white dwarf companion. The pulsar J2241-5236 was first discovered in Fermi-directed targeted searches with the Parkes telescope. PSR J2241-5236 is an important object for current and future timing array experiments with it's relative proximity (DM= 11.4 pc cm-3) and brightness (4.1 mJy at 1.4 Ghz). J2241-5236 is a promising timing array candidate so it's very important to study Interstellar medium behaviour in pulsar's line of sight. We will present the first low frequency studies of this interesting pulsar conducted using the MWA's high time resolution (100µ sec) mode, simultaneously sampling it's wide frequency range (80-300 MHz) in multiple sub-bands. These data are used to probe the nature of the ISM in the direction of the pulsar.

---

**Vivek Venkatraman Krishnan**
Swinburne University of Technology
Theme: Dynamic

*The UTMOST SMIRF survey*

Since the discovery of radio pulsars in the 1960s, there have been about a dozen all sky surveys conducted with premier radio telescopes in pursuit to find more. Such surveys have resulted in a population of pulsars that have highly periodic emissions but also a few whose emissions are rather sporadic. There have been estimates that the population of such sporadic emitters might be greater than the population of periodic emitters, and that have been missed in previous surveys due to selection biases. The UTMOST SMIRF survey is a multi-pass Galactic plane survey with the newly upgraded UTMOST telescope, that aims to understand and increase the population of such sporadic emitters, by doing fast and repeated survey of the Galactic plane and searching for new pulsars by performing real-time single-pulse and fold-mode searches. I will give an overview of the survey architecture and present the ongoing results and how implementing the search methodologies could help next generation telescopes such as MeerKAT, ASKAP and the SKA.

---

**Chris Curtin**
Swinburne University of Technology
Theme: Dynamic

*Three of the Highest Redshift Supernova Spectra Ever Collected from the First HSC-SSP Supernova Survey Keck Follow-up Campaign*

I will report on the first Hyper-SuprimeCam Subaru Strategic Program Supernova Survey Keck Spectroscopic Follow-up campaign. There will be at least two such campaigns, but the first campaign which operated from December 2016 to March 2017 successfully collected spectra of 3 superluminous supernovae at z>1.8, including the highest spectroscopically confirmed supernova ever seen. I will discuss the observations, the data reduction, and the spectra themselves along with strategies for the next campaign and implications on the SLSN field and other relevant fields for future applications.

---