Annual Scientific Meeting & Harley Wood School

Report of Contributions

https://indico.global/e/asm2025

Contribution ID: **2** Type: **Oral**

Unveiling the Nature of High-Redshift Galaxies with JWST: Challenges and Insights from Theory and Simulations

Friday, July 11, 2025 10:00 AM (15 minutes)

Recent JWST observations have revealed an unexpected abundance of bright galaxies at z ⊠ 12, both in the UV and as Lyman-α emitters, challenging standard galaxy formation models and our theoretical expectation of reionization in the early universe. Using a semi-analytic galaxy formation model, we find that while faint JWST galaxies align with predictions, bright galaxies require enhanced star formation efficiencies to be reconciled with theory. Some may instead be lower-redshift dusty or quiescent galaxies misclassified as high-z sources. We also explore the detectability of Lyman-alpha emission from these galaxies by integrating galaxy formation models with IGM reionization simulations. Our results indicate that intrinsic velocity offsets and reionization morphology significantly impact Lyman-alpha visibility, with low-mass galaxies driving reionization boosting detectability, as seen in JADES-GS-z13-1-LA (z = 13). Our findings underscore the need for spectroscopic follow-ups, improved reionization modeling, and refined simulations to accurately interpret JWST's high-redshift discoveries.

Author: QIN, Yuxiang (Australian National University)

Presenter: QIN, Yuxiang (Australian National University)

Session Classification: AGN

Contribution ID: **3** Type: **Oral**

WAVES: The Wide Area VISTA Extragalactic Survey

Thursday, July 10, 2025 12:00 PM (30 minutes)

The WAVES survey is a major galaxy redshift survey that will be conducted on 4MOST, scheduled to begin its scientific operations in early 2026. Expected to collect redshifts for 1.6 million galaxies, this survey will build a highly complete view of galaxy environment, over large areas of the sky, and also extending out to z=0.8. The backbone of this project is the wealth of multi-wavelength imaging data, which has been meticulously processed to produce an enormous photometric catalogue over ~1300 square degrees. This input catalogue will facilitate one of the first survey selections with a photometric redshift cut - a critical element of WAVES. I will present the WAVES sub-surveys, targeting strategy, and an overview of the wealth of science expected to be conducted with the data in the coming years.

Author: BELLSTEDT, Sabine (UWA)

Presenter: BELLSTEDT, Sabine (UWA)

Session Classification: Plenary

Contribution ID: **4** Type: **Poster**

Exploring the Assumptions and Limitations of Spectral Energy Distribution Fitting in Galaxies

Monday, July 7, 2025 12:54 PM (1 minute)

Spectral Energy Distribution fitting is a technique that forms the backbone for much of extragalactic analysis. From the vast samples of galaxies in modern galaxy redshift surveys, to the highest redshift galaxies from JWST, SED fitting is our best mechanism by which to derive properties like mass, star formation, and age of these galaxies.
The more we push these techniques, either in trying to derive more detailed properties like star formation histories and quenching timescales, or deriving properties for galaxies beyond cosmic noon, the more susceptible we are to falling prey to the assumptions and limitations that are baked into these techniques.
I will present a detailed analysis that compared the derived properties of low-redshift galaxies using a myriad of different stellar population libraries (and modifications to the ingredients that go into them) to characterise the consequences of our most common assumptions. This will include a discussion of the possible impacts of loosening these assumptions, such as allowing an evolution of metallicity, and even an evolution of the IMF.

Author: BELLSTEDT, Sabine (UWA)

Co-author: Prof. ROBOTHAM, Aaron

Presenter: BELLSTEDT, Sabine (UWA)

Session Classification: Poster

Contribution ID: **5** Type: **Oral**

The formation of merging compact binaries from massive binary stars

Monday, July 7, 2025 5:30 PM (15 minutes)

Several hundred compact binary mergers have now been observed in gravitational waves by LIGO, Virgo and KAGRA. Most of these are binary black hole mergers. The origin of these merging binaries is currently uncertain; they may originate from massive binary stars, be dynamically formed in star clusters or galactic nuclei, or may have contributions from multiple formation channels. We study the formation of merging compact binaries using the rapid population synthesis suite COMPAS. We present the current state of COMPAS, detailing recent updates in modelling physics relevant to compact binary formation, including the mass-loss rates of massive stars. We show that current population synthesis models are already in tension with (ruled out by) existing gravitational-wave observations. Using a simple mixture model, we show that while more than half of observed gravitational-wave events are not formed through massive binary evolution, the vast majority of compact binaries merging in the local universe originate from massive binary stars.

Author: STEVENSON, Simon (Swinburne University of Technology)

Presenter: STEVENSON, Simon (Swinburne University of Technology)

Session Classification: Compact / High-Energy Objects

Contribution ID: **6** Type: **Oral**

The formation of Magnetically Active Regions on the Sun

Tuesday, July 8, 2025 4:15 PM (15 minutes)

Magnetic active regions on the Sun's surface are the primary sources of significant solar activity. Understanding the physics behind the emergence of these active regions is essential for improving space weather forecasts, and understanding the underlying solar dynamo. Recent observational findings indicate that convection plays a crucial role in the emergence of active regions, challenging traditional models. To explore the relationship between convective flows and the formation of active regions, we aimed to identify where these regions emerge within the supergranulation flow pattern. We found that although active regions can emerge anywhere in the supergranulation pattern, they all have a net converging flow with speeds ranging from 10 to 20 m/s, occurring ~1 day prior to the active region emergence. This is followed by an increase in outflows leading up to the active region emergence.

Author: SCHUNKER, Hannah (University of Newcastle)

Presenter: SCHUNKER, Hannah (University of Newcastle)

Session Classification: Stars

Contribution ID: **7** Type: **Poster**

Using Kinematic Asymmetries to Understand Galaxy Dynamical Evolution

Monday, July 7, 2025 2:39 PM (1 minute)

Stellar and gas kinematics are sensitive to the underlying mass distribution within galaxies, hence they can be used to understand the mass assembly of massive galaxies. Due to gas being a fundamentally different fluid to stars, one can compare gas and stellar kinematics to disentangle the effects of internal and external physical processes as well as environment on galaxy evolution. Using a sample of star-forming and quiescent galaxies from the Middle Ages Galaxy Properties in IFS (MAGPI) and Sydney-Anglo Australian Multi Integral field (SAMI) Galaxy Surveys, I will discuss how we measured and compared kinematic disturbances in both the stars and gas to dissect individual drivers of galaxy evolution. I will show that, in both MAGPI and SAMI, massive galaxies with older stellar populations tend to have larger gas kinematics disturbances compared to their stars, whereas the opposite is true for galaxies with younger stellar populations. These results are consistent with massive galaxies with older stellar populations continuing to accrete gas and galaxies with younger stellar populations growing from gas-rich mergers. Focusing on galaxy environment, I will also present results of stellar and gas kinematic disturbances of SAMI cluster galaxies, showing how specifically the cluster, rather than just high-density environments can influence the dynamics and structure of galaxies.

Author: BAGGE, Ryan (UNSW)

Presenter: BAGGE, Ryan (UNSW)

Session Classification: Poster

Contribution ID: **8** Type: **Oral**

Binary Population Synthesis of Pulsars with COMPAS

Monday, July 7, 2025 5:00 PM (15 minutes)

Pulsars are fast rotating neutron stars (NSs) that are associated with high energy processes and gravitational wave emission. To date, over 3500 pulsars have been detected, with the majority of them seen in radio and around 300 pulsars detected in gamma-rays. In this work, we implement prescriptions for pulsar evolution within the binary population synthesis code COMPAS, enabling a comprehensive study of neutron star populations, including canonical pulsars, millisecond pulsars (MSPs), and magnetars. This work provides the unique opportunity to study the impact of binary interactions, including winds, stable mass transfer, common envelope and stellar mergers, on pulsar populations. Our models incorporate radio, X-ray, and gamma-ray emission mechanisms and selection effects to simulate the observed pulsar populations. By comparing the synthetic pulsar populations with observations, we constrain the birth distributions of pulsar spin period and magnetic field. Additionally, we will attempt to explain the MSP origin of the GeV emission excess from the Galactic Centre. This work also enables us to model gravitational wave (GW) sources such as Double NS and NS-white dwarf mergers, and interpret GW populations observed by LIGO, as well as predicting the detectability and detection rate for future missions such as LISA.

Author: SONG, Yuzhe (Swinburne University of Technology)

Presenter: SONG, Yuzhe (Swinburne University of Technology)

Session Classification: Compact / High-Energy Objects

Contribution ID: **9** Type: **Poster**

OzSDO: the first database for the Solar Dynamics Observatory in the Southern hemisphere

Monday, July 7, 2025 12:12 PM (1 minute)

NASA's Solar Dynamics Observatory (SDO), launched in 2010, is a monitoring mission capturing full disk images of the Sun at a number of wavelengths with unprecedented spatial and temporal resolution. The SDO has generated an enormous amount of data over its operational lifetime, making it necessary to store the data in a searchable database for efficient access. We have established the Australian Data Centre for SDO (OzSDO) a NetDRMS installation to archive and distribute data from the AIA and HMI instruments. The OzSDO primarily acts as a mirror for individual data series from the central SDO Joint Science Operations Center repository at Stanford. It currently contains the full meta-data for each of the HMI data series hmi.m_45s, hmi.v_45s, hmi.ic_45s, hmi.sharp_cea_720s, and aia.lev1, as well as the images for selected time periods under analysis. The hardware and infrastructure for the database is hosted at Australian Astronomical Optics Data Central at Macquarie University, and currently consists of a data server with 2 Intel Xeon Gold CPUs (32 cores), 128GB RAM, 20TB RAID5 HDD connected to a 216TB data array and a compute server with two 3.1GHz Intel Xeon Gold CPUs (32 cores total), 512GB memory, and an additional 3.8TB SSD local storage. Access to the OzSDO is available to researchers in the Centre for Solar and Space Physics group at the University of Newcastle (Australia), and externally upon request.

Authors: SCHUNKER, Hannah (University of Newcastle); Dr BURSTON, Raymond (University of Newcastle); Dr O'TOOLE, Simon (Australian Astronomical Optics, Macquarie University)

Presenter: SCHUNKER, Hannah (University of Newcastle)

Session Classification: Poster

Contribution ID: **10** Type: **Poster**

The Sun's open-closed magnetic flux boundary and the origin of slow solar wind

Monday, July 7, 2025 12:11 PM (1 minute)

The origin of the slow solar wind (SSW) remains an open question in solar physics, with significant implications for understanding space weather and its impact on Earth. A leading hypothesis for the SSW origin is interchange reconnection at the interface between open and closed magnetic flux in the corona, suggesting that the closed flux near coronal hole boundaries influences the composition of SSW plasma released into the heliosphere along open flux. To characterise this interface –which we term the open-closed boundary (or OCB) –we quantify the relative amount of open and closed magnetic flux within one supergranule-diameter (25 Mm) of the OCB using three coronal magnetic field models: a potential field source surface (PFSS) model, a static equilibrium magnetofrictional model, and a time-dependent magnetofrictional model. By comparing to interplanetary scintillation measurements of SSW speeds over one solar cycle, we argue that the fraction of open flux within this region is a good predictor of the amount of SSW in the heliosphere. Our findings have implications for understanding the origins of the SSW and the role of interchange reconnection at the OCB.

Author: Ms WILKINS, Chloe (University of Newcastle)

Co-authors: Prof. YEATES, Anthony (Durham University); Dr LAMICHHANE, Bishnu (University of Newcastle); Prof. PONTIN, David (University of Newcastle); SCHUNKER, Hannah (University of Newcastle); Dr ANTIOCHOS, Spiro (NASA/GSFC)

Presenter: SCHUNKER, Hannah (University of Newcastle)

Session Classification: Poster

Contribution ID: **11** Type: **Poster**

Deepest Upper Limits on the 21 cm Power Spectrum from the Murchison Widefield Array

Tuesday, July 8, 2025 11:30 AM (1 minute)

The 21 cm hydrogen line is a powerful probe of the intergalactic medium (IGM), enabling us to infer its thermal and ionisation history through statistical fluctuations measured via the power spectrum. In this talk, we present the deepest upper limits on the 21 cm power spectrum at redshifts z = 6.5, 6.8, and 7, derived from Murchison Widefield Array observations spanning 2013 to 2023. The total integration time amounts to approximately 657 hours, with the final analysis using a carefully selected 268-hour subset following a rigorous foreground mitigation strategy. These results provide the first evidence for a heated IGM at these redshifts. Furthermore, we show that improved separation of thermal noise and instrumental systematics from residual foregrounds, by analysing non-Gaussian features in the power spectrum distributions, can further enhance our sensitivity.

Author: NUNHOKEE, Ridhima (Curtin University)

Co-authors: Prof. TROTT, Cathryn M (Curtin University); Mr NULL, Dev (Curtin University)

Presenter: Prof. TROTT, Cathryn M (Curtin University)

Session Classification: Poster

Contribution ID: **12** Type: **Oral**

Hidden in plain sight: building towards finding rare, powerful radio galaxies at z>6 in the SKA era

Friday, July 11, 2025 10:15 AM (15 minutes)

High-redshift AGN are a key puzzle piece to understanding the full picture of galaxy evolution due to the co-evolution of supermassive black holes and host galaxies. Across cosmic time, radio-loud obscured AGN are beacons of massive black holes and host galaxies, but at z > 5 this population remains elusive (with fewer than five known). The most massive and powerful of these radio-loud AGN are high-redshift radio galaxies (HzRGs), which provide ideal targets for studying the evolution of the most massive objects. Should any be discovered within the Epoch of Reionisation (EoR) in the SKA era, they would enable 21-cm absorption experiments that directly probe the reionisation of the Universe. We have built and refined a sample of candidate z > 5 radio galaxies, cross-matching isolated young/compact radio sources turning over at low radio frequencies with non-detections in shallow NIR surveys. Deeper follow-up at optical/NIR wavelengths identifies the best candidates in a unique parameter space of extreme radio/NIR flux ratios, primarily limited by initial NIR survey coverage. So far this sample appears to span 1 < z < 5, but many of the best candidates still lack redshifts. We highlight some of the interesting environments these extreme HzRGs are found in, from optically dark protoclusters to jet-induced quenching, as well as current progress in characterising the sources and their host galaxy properties at more wavelengths. In future, LSST and the Euclid Wide Survey will provide redshift information for the millions of radio sources in all-sky SKA surveys and leave a manageable sample of sources that are z > 6 or remain undetected with extreme radio/NIR, in which HzRGs residing in the EoR may be found.

Author: HEDGE, Alexander (ICRAR/Curtin University)

Co-authors: Dr GUPTA, Anshu (ICRAR/Curtin University); Dr BRODERICK, Jess (SKAO); Dr COLLIER, Jordan (ICRAR/Curtin University); Dr SEYMOUR, Nicholas (ICRAR/Curtin University)

Presenter: HEDGE, Alexander (ICRAR/Curtin University)

Session Classification: AGN

Contribution ID: **13** Type: **Oral**

Novel, Independent Approach to VLBI Black Hole Imaging

Thursday, July 10, 2025 10:30 AM (15 minutes)

The Event Horizon Telescope (EHT) collaboration's iconic images of the supermassive black holes in M87 and the Milky Way delivered profound implications for our understanding of fundamental physics under strong gravitational fields. Producing these images required pushing radio interferometric imaging to its limits -—grappling with severely sparse data coverage, low signal-to-noise ratios, and calibration challenges from both the instrument and the propagation medium. These difficulties can introduce the risk of biases or artefacts unless handled with exceptional care. To provide independent verification of these scientifically critical results, we develop a novel approach using closure invariants—quantities that remain unaffected by calibration errors and therefore serve as robust observables of the true emission near the black hole's event horizon. By applying advanced generative deep learning techniques directly to closure invariants, we not only offer an independent method to cross-validate the EHT images, but also introduce a powerful new framework for Very Long Baseline Interferometry imaging under extreme observational conditions. In this talk, I will present our progress in developing and refining this approach.

Author: LAI, Samuel (CSIRO)

Co-authors: Dr DIAKOGIANNIS, Foivos (CSIRO); Dr WONG, Ivy (CSIRO); Dr THYAGARAJAN, Nithyanandan (CSIRO)

Presenter: LAI, Samuel (CSIRO)

Session Classification: Methods & Applications

Contribution ID: **14** Type: **Poster**

Assessing photometric redshift accuracy and parameter estimation with limited photometric coverage using CIGALE

Monday, July 7, 2025 2:43 PM (1 minute)

Redshifts are crucial for nearly all extragalactic and cosmological studies. Upcoming wide-field surveys, such as the Evolutionary Map of the Universe (EMU), will catalogue millions of sources, making spectroscopic follow-ups unfeasible at scale. Though sensitive to band selection and availability, photometry yields redshifts (photo-*z*s) for fainter sources while optimising telescope time. Using the extensive FourStar Galaxy Evolution Survey and spectroscopic redshifts (z_{spec}) for calibration, we employ the Bayesian SED-fitting tool CIGALE to derive photo-*z*s up to z ~ 3 and assess their accuracy with limited data. By systematically reducing bands, we compare NMAD values between full and reduced-band fits to identify the minimal bandset for reliable estimates. We then examine the impact on stellar mass and star formation history derivation by analysing deviations from best-fit mock analyses and apply our findings to crossmatched EMU datasets. We find that photo-*z*s from 6 well-spaced optical to mid-IR bands remain robust compared to full-band (> 27 bands) estimates, reaching accuracies of NMAD_{full} = 0.013 with η = 1.46% catastrophic errors and NMAD_{6bands} = 0.038, η = 2.55%. We derive reliable parameters using our minimal bandset, though our reduced framework performs best in a redshift range 0 < z < 1.5. Here, we discuss how these results optimise scientific return for single-point EMU radio sources with sparse overlapping data and outline the broader potential of minimal-band SED fitting.

Author: PORCHET, Vanessa (Queensland University of Technology)

Presenter: PORCHET, Vanessa (Queensland University of Technology)

Session Classification: Poster

Contribution ID: **15** Type: **Poster**

Determining Ideal Fields For Epoch of Reionisation Science Using the 21 cm Line

Monday, July 7, 2025 2:31 PM (1 minute)

The 21 cm line, produced by the hyperfine transition in the ground state of neutral hydrogen, makes an ideal tracer of the Epoch of Reionisation (EoR). Detecting this signal comes with many challenges, notably, strong foreground emissions and RFI, which are orders of magnitude brighter than the 21 cm signal.
Much of the work in EoR science involves methods to address these challenges. In this work, we investigate the effects of different parts of the sky on the data calibration, in particular for the upcoming SKA-Low experiments. Spectral structure in the calibration can propagate into our final results and hinder our ability to make a measurement. We derive a set of metrics from archival Murchison Widefield Array data and investigate their usefulness. We also present a theoretical approach to calculating calibration uncertainties to investigate the impact of the selected fields on the final brightness temperature power spectrum. We show that two fields in particular are promising candidates for the SKA-Low experiments

Author: JONG, Eric (ICRAR - Curtin)

Co-authors: TROTT, Cathryn M (Curtin University); Dr ZHENG, Qian (Shanghai Astronomical Observatory); NUNHOKEE, Ridhima (Curtin University)

Presenter: JONG, Eric (ICRAR - Curtin)

Session Classification: Poster

Contribution ID: **16** Type: **Poster**

Follow the Dust: Modelling Grain Dynamics in Dusty Discs

Monday, July 7, 2025 12:46 PM (1 minute)

Debris discs are composed of planetesimal belts containing asteroids and comets that produce dust grains in mutual collisions. Radiation pressure forces acting upon the smallest of these grains can drive them onto eccentric orbits, spreading them far from the point of original production site of the planetesimal belt. Non-conservative forces, such as the P-R effect, can pull grains inwards towards the host star. Radiative transfer models typically assume a fixed number density of dust grains at any location in the belt, irrespective of their size. Here, I present 'Stardust', a 1-dimensional quasi-static dynamics and radiative transfer code designed for bound non-rotating spherical dust grains in debris discs. Stardust can predict the radial distribution of dust grains due to stellar forces, including non-conservative forces, that act on them according to their size and composition. It then models the thermal emission of the dust grains. A key feature of Stardust is its adaptability—it can simulate two distinct rings of sources of dust production, i.e. creating separate analogues of the Asteroid and the Edgeworth-Kuiper belt. The resultant thermal emission is then compared to the spectral energy distribution (SED) of known debris systems for confirmation. Although it operates under certain conditions and limitations, we can leverage Stardust, with targeted modifications, to tackle key questions regarding the nature of debris discs, such as what they are composed of, extended halos structures, and cometary dust.

Author: HENGST, Shane (Centre for Astrophysics, University of Southern Queensland)

Presenter: HENGST, Shane (Centre for Astrophysics, University of Southern Queensland)

Session Classification: Poster

Contribution ID: **17** Type: **Poster**

Interquadrant Cross-talk Correction from Veloce Data.

Tuesday, July 8, 2025 12:54 PM (1 minute)

Veloce is a high-resolution (λ/Δλ = 80,000), stabilized, echelle spectrograph at the 3.9m Anglo-Australian Telescope, optimized for bright star observations. It covers 396–940 nm across three spectral arms. A persistent issue has been electronic cross-talk in the red "Rosso"arm, where electronic ghost images appear in one quadrant due to bright pixels in another quadrant. This cross-talk is not uncommon amongst large-format detectors read out using multiple amplifiers. However, documentation of a treatment for this effect is sparse in the literature. In Veloce data obtained with SDSU2 controllers (prior to their replacement in June 2023), pixels close to digital saturation produce electronic ghosts at levels of 50–100 adu. While this effect is unlikely to significantly impact radial velocity precision, it does obscure potentially useful data, making correction highly desirable. We have developed a correction pipeline that uses binary dilation to generate a source mask, maps cross-talk pixels, estimates background; and finally applies a linear correction. We find that separate corrections are required for pixels that are bright but unsaturated, just saturated, and highly saturated. Given the shortage of published solutions, our approach may be useful for mitigating these effects in other multi-channel detectors.

Author: MISTRY, Priyashkumar Bhupendrabhai (University of New South Wales, Sydney)

Co-authors: Dr MONTET, Ben (University of New South Wales, Sydney); TINNEY, Chris (UNSW Sydney)

Presenter: MISTRY, Priyashkumar Bhupendrabhai (University of New South Wales, Sydney)

Session Classification: Poster

Contribution ID: **18** Type: **Oral**

Unveiling Massive Quiescent Galaxies: Halo mass evolution with simulations and JWST

Monday, July 7, 2025 4:15 PM (15 minutes)

Massive quiescent galaxies (MQGs) at high redshift present an intriguing puzzle: what are their host halo masses, and how do their halo mass functions evolve from reionization (z~6) to cosmic noon (z~2)? Recent JWST observations have revealed a surprisingly large population of MQGs at these early epochs, challenging existing formation models. In this talk, I will address these questions using one of the largest and highest-resolution cosmological simulations, "Uchuu", coupled with an updated version of Swinburne's Semi-Analytical Galaxy Model (SAGE). By calculating halo masses through autocorrelation and cross-correlation functions and analyzing the evolving halo mass function, we aim to uncover the physical processes governing MQG's formation and quenching. These predictions will be rigorously compared with the latest observations from the JWST "OutThere"legacy survey. This work highlights the interplay between baryons and dark matter in the rapid assembly of MQGs, offering a deeper understanding of their emergence and early evolution in the Universe.

Author: Ms BANERJEE, Amrita (Swinburne University of Technology)

Presenter: Ms BANERJEE, Amrita (Swinburne University of Technology)

Session Classification: Cosmology & Dark Universe

Contribution ID: **20** Type: **Oral**

Jet Outbursts, Non-thermal Pressure and the AGN Duty Cycle

Monday, July 7, 2025 10:45 AM (15 minutes)

The hot intracluster gas within galaxy clusters experiences shocks, mergers, and active galactic nucleus (AGN)-driven feedback, all of which drive its overall pressure distribution, which is crucial for understanding the mass and composition of these systems. 'Non-thermal pressure' (NTP) - gas pressure not attributed to random motion - is generated during these processes, but is challenging to observe. Evidence exists for NTP toward the cluster outskirts - primarily driven by shocks and mergers - whereas inside the core, where AGN-driven feedback is most significant, its contribution is only beginning to be unveiled. *Hitomi* measured a fractional NTP contribution of $\sim 2-7\%$ in the core of the Perseus Cluster; XRISM (X-ray Imaging and Spectroscopy Mission) is currently revealing the NTP contribution in the cores of many more systems. These observations highlight the need for theoretical models to determine the degree by which AGN feedback - in particular that generated by its relativistic jets - can stir up gas turbulence and NTP; this will enable evolutionary histories to be suggested for given observations.

In this work, we present analytical model predictions for the NTP produced by AGN outbursts, and its dependence on properties of the AGN and its environment. We simulate jet outbursts with physically-motivated jet power and active age distributions, and evolve these in time, coupling the injected energy to the surrounding gas. We find that the NTP fraction is $lesssim 8-12\%$ when the AGN jets are active for $\sim 10-30\%$ of the total AGN life-cycle, over a range of environments. We predict the AGN duty cycle of Perseus by applying our model to the *Hitomi* observations; we find excellent agreement with independent measurements of Perseus' AGN activity.

We will investigate the relationship between NTP and AGN activity further by using galaxy formation models. When applied in conjunction with measurements of the current state of the ambient medium and AGN activity, these models will help us infer the past AGN activity of real clusters from their observed NTP, as measured by XRISM.

Author: SULLIVAN, Andrew (The International Centre for Radio Astronomy Research (UWA))

Co-authors: Prof. POWER, Chris; Dr BOTTRELL, Connor; Dr THOMAS, Nicole; Dr TURNER, Ross; Ms YOUNG, Sophie; Dr SHABALA, Stas

Presenter: SULLIVAN, Andrew (The International Centre for Radio Astronomy Research (UWA))

Session Classification: AGN

Contribution ID: **21** Type: **Poster**

Continuum Reverberation Mapping in ATLAS Quasars: A Precursor to LSST

Monday, July 7, 2025 12:09 PM (1 minute)

The variable continuum emission from AGN can be used to probe the structure of their accretion disks via reverberation mapping analysis. Assuming a hot inner light source irradiating the outer accretion disk, time lags between light curves in different passbands reveal light-travel times between their emission regions. Previous work on several low-luminosity AGN found 3x longer lag times than expected in standard disk theory. As a precursor study to LSST, we have analysed high-cadence light curves of 10,000+ bright quasars between redshift 0.3-2.5 in the largest study to date. Given the large sample, we stack inference across the parameter space to improve lag detections. We find that the size discrepancy persists in our high-luminosity sample with some dependence on wavelength, possibly due to contamination from diffuse Broad Line Region and disk wind emission. In particular, we observe an inversion of the lag-luminosity relation at redshifts where our two filters straddle the Balmer jump. We also present tentative evidence that quasars with fast outflows, as evident in high CIV blueshift, have longer lags than normal quasars.

Author: Mr STEYN, Zachary (Australian National University)

Presenter: Mr STEYN, Zachary (Australian National University)

Session Classification: Poster

Contribution ID: **22** Type: **Poster**

Correcting Black Hole Masses Biased by Size Inertia in Broad Line Regions

Monday, July 7, 2025 2:42 PM (1 minute)

Estimating supermassive black hole masses in AGN mostly relies on the virial method, which uses the radius-luminosity (R-L) relation to determine the radius of the broad line region (BLR). The R-L relation heavily depends on the assumption that the BLR is virialised. A volume-complete two-epoch Southern Sky AGN sample at $z < 0.1$ and high-cadence monitoring of NGC 5548 have revealed significant optical luminosity changes over 15-20 years but did not show the expected virial anti-correlated change in the broad Hβ line width, indicating the BLR is not virially breathing on decadal timescales. Single-epoch masses from L_{5100} and broad Hβ R-L relations exhibit time-variations with a scatter of ~0.5 dex over 20 years. The deviation from the mean depends on the broad Hβ to narrow [OIII] luminosity ratio. Comparing reverberation mapping and single-epoch mass estimates from different luminosity proxies using the R-L relation showed that mass estimates derived from the [OIII] luminosity and the broad Hβ FWHM have the lowest scatter. The absence of virial breathing implies that BLR sizes do not correlate with short-term luminosity variations. Instead, narrow-line AGN emission, which conveys accretion rates averaged over centuries, serves as a more reliable proxy for the instantaneous BLR radius.

Authors: AMRUTHA, Neelesh (The Australian National University); WOLF, Christian (Australian National University); ONKEN, Christopher (Australian National University); TAN, Ashley Hai Tung (Australian National University)

Presenter: AMRUTHA, Neelesh (The Australian National University)

Session Classification: Poster

Contribution ID: **23** Type: **Oral**

ESO Update and Progress towards Full Membership

Tuesday, July 8, 2025 2:50 PM (10 minutes)

I will provide an update on Australia's strategic partnership with ESO and a progress report on the case for full Australian membership. I will also update usage of ESO facilities by Australian astronomers, new instrumentation programs (especially those with Australian involvement), and other new opportunities including the Widefield Spectroscopic Telescope (WST) and Australia's involvement in a proposed concept study for this potential post-ELT ESO facility.

Author: BROUGH, Sarah (UNSW)

Presenter: BROUGH, Sarah (UNSW)

Session Classification: Mini-Session

Contribution ID: **24** Type: **Oral**

When did the initial mass function become bottom heavy?

Monday, July 7, 2025 5:45 PM (15 minutes)

The first billion years of cosmic history set the stage for the galaxies we observe today, yet key uncertainties remain in how the earliest stellar populations shaped galaxy evolution across time. A critical missing piece is the stellar initial mass function (IMF), which governs star formation and impacts derived galaxy properties —from stellar masses to chemical enrichments. While nearby massive galaxies show evidence for "bottom-heavy" IMFs, indicating an excess of low-mass stars, we do not yet know when or how this bottom-heavy IMF emerged. Pre-JWST, the low-mass end of the IMF could only be studied in the local (z~0) Universe. In this talk, I will present JWST/NIRSpec IFU observations of two gravitationally lensed, massive quiescent galaxies at z ~ 1. By targeting multiple gravity-sensitive absorption features and combining with deep rest-frame optical spectroscopy, we obtain one of the first direct measurements of the low-mass IMF beyond the local Universe. These results will provide constraints on the timing and drivers of IMF evolution, tying together the evolution of massive quiescent galaxies from high to low redshifts.

Author: BARONE, Tania (Swinburne University of Technology)

Presenter: BARONE, Tania (Swinburne University of Technology)

Session Classification: Cosmology & Dark Universe

Contribution ID: **25** Type: **Oral**

More Precise Galaxy Distances using Machine Learning

Thursday, July 10, 2025 10:15 AM (15 minutes)

Galaxy distances measured using standard methods like the Tully-Fisher relation and the Fundamental Plane have relative errors of 20-30%. Beyond a few tens of Mpc, this means that the errors in galaxy peculiar velocities are generally much larger than the peculiar velocities themselves. It is therefore highly desirable to find ways to reduce the uncertainties in such distance estimates. We have therefore investigated the use of machine learning together with measurements of a wide range of galaxy properties to obtain more precise distances. Applying a relatively simple neural network to early-type galaxies in the SDSS peculiar velocity catalogue, we are able to reduce the errors in Fundamental Plane distances by 30-40%. We identify the galaxy properties that are most important to achieving this improvement and suggest possible physical mechanisms leading to the reduced scatter. If this result is confirmed and can be extended to other datasets and other distance estimators, it will proportionally increase the precision and power of major new peculiar velocity surveys such as the 4MOST Hemisphere Survey and the WALLABY HI survey. In turn, this will lead to more precise estimates of the growth rate of large-scale structure and improved measurements of the Hubble constant in the local Universe.

Authors: COLLESS, Matthew (Australian National University); CAMPBELL, Melissa (Australian National University)

Presenter: CAMPBELL, Melissa (Australian National University)

Session Classification: Methods & Applications

Contribution ID: **26** Type: **Oral**

The Dynamic Radio Sky: Wide-field Transient Surveys on the Path to the Square Kilometre Array

Wednesday, July 9, 2025 12:30 PM (30 minutes)

Time domain radio astronomy will be revolutionised by the Square Kilometre Array. The capability to image the sky repeatedly, over many frequencies and timescales, will allow us to explore and understand dynamic phenomena in a way that has not been previously possible. These phenomena range from events at cosmological distances, such as gamma-ray bursts and fast radio bursts, to much more local events, such as massive flares from stars in our Galactic neighbourhood. In each case, rapidly varying emission gives us insights into physics of extreme environments.

In the past decade, there have been great strides forward as we prepare for the SKA. We have seen the field of radio transients evolve from targeted observations of individual objects; to archival searches; to dedicated wide-field surveys on SKA pathfinder and precursor instruments. We have already seen new discoveries, such as the emerging class of long-period transients.

In this talk I will review the history of radio transient surveys, and the evolution of the field to the current time. I will discuss what we have learned from the major widefield surveys that have been conducted on pathfinder and precursor instruments. In particular I will share some of the highlights from the ASKAP Variables and Slow Transients Survey. I will also identify some of the lessons learned from these surveys (both scientific and technical), and some of the challenges we face in scaling up our current approaches for the Square Kilometre Array.

Author: Prof. MURPHY, Tara (University of Sydney)

Presenter: Prof. MURPHY, Tara (University of Sydney)

Session Classification: Plenary

Contribution ID: **27** Type: **Oral**

The Dynamical and Morphological Transformation of Galaxies through Cosmic Time

Wednesday, July 9, 2025 4:30 PM (15 minutes)

In this talk, I will briefly discuss some of the existing evidence for the morphological and dynamical transformation of galaxies through cosmic time. This transformation is thought to result from the complex interplay between the hierarchical merging of dark matter halos and baryonic processes. I will introduce the Middle-Ages Galaxy Properties with Integral field spectroscopy (MAGPI) Survey, a VLT/MUSE large programme designed to replicate the depth and spatial resolution of local integral field spectroscopy surveys at intermediate redshift (z~0.3). MAGPI provides a 3D snapshot of the dynamical state of both the ionised gas and stars in galaxies at the highest feasible lookback time. I will discuss and contrast visually identified kinematic morphologies of MAGPI galaxies with local comparable surveys, using MUSE-derived gas and stellar kinematic maps.
Presented results will focus on the dynamical state of galaxies in MAGPI in light of predictions from cosmological simulations.

Author: FOSTER, Caroline (University of New South Wales, Sydney)

Presenter: FOSTER, Caroline (University of New South Wales, Sydney)

Session Classification: Galaxies

Contribution ID: **28** Type: **Oral**

The K2 & TESS Synergy: Uniting NASA's Planet Hunters

Wednesday, July 9, 2025 4:45 PM (15 minutes)

The early success of JWST provides an exceptional opportunity to study the atmospheres of exoplanets with unprecedented detail. However, most (>65%) confirmed transiting exoplanets will not be accessible to JWST during the mission's lifetime. This widespread problem is due mostly to ephemeris degradation: uncertainties on transit time and period compound over time, which can culminate in predicted future transits being off by hours to days when targeting planets years later. With this in mind, I am leading the K2 & TESS Synergy, a large-scale effort to reanalyse all ~300 systems originally discovered by NASA's K2 mission with new observations from TESS. We combine light curves from both missions along with archival radial velocities, Gaia parallaxes, and spectral energy distributions in global fits which not only updates the ephemerides, but also allows us to build a self-consistent homogeneous catalogue of system parameters for future population studies. We have now made ~70 K2 planetary systems accessible to JWST (including the top 50 transmission spectroscopy targets), and identified multiple systems with incorrect transit ephemerides due to systematics in the discovery observations. I will discuss the impact of these results for future characterisation efforts, our effort to recover the lost ephemeris of K2's first exoplanet discovery, and our plans to complete the full K2 catalogue. Efforts like the K2 & TESS Synergy will ensure the accessibility of transiting planets for future characterisation while leading to a self-consistent catalogue of stellar and planetary parameters for future population work.

Author: THYGESEN, Erica (University of Tasmania, Michigan State University)

Co-author: Prof. RODRIGUEZ, Joey (Michigan State University)

Presenter: THYGESEN, Erica (University of Tasmania, Michigan State University)

Session Classification: Planets

Contribution ID: **29** Type: **Oral**

Exploring the Spatially Resolved Initial Mass Function in SAMI Star-Forming Galaxies

Wednesday, July 9, 2025 5:00 PM (15 minutes)

The initial mass function (IMF) describes the distribution of stellar masses in a newly formed stellar population and is fundamental to the study of star and galaxy formation. Over the past decades, a growing body of evidence has supported the need for a variable IMF. Understanding the IMF's characteristics across spatial scales and the factors driving its variability remains a key objective in astrophysics. In this work, spatially resolved spectroscopy is used to examine the high-mass IMF slope of star-forming galaxies from the SAMI survey. The Kennicutt method and stellar population synthesis models are applied to estimate both the spaxel-resolved (α_{res}) and galaxy-integrated (α_{int}) high-mass IMF slopes. A near 1:1 relationship is observed between α_{res} and α_{int} for α_{int} $gtrsim -2.7$, alongside significant internal variation in α_{res} distributions. To investigate the drivers of this variability, correlations between IMF slope and both star formation rate (SFR) and SFR surface density ($\Sigma_{\rm SFR}$) are analysed. Results show a strong trend, with flatter/steeper slopes linked to higher/lower SFR and $\Sigma_{\rm SFR}$, consistent across resolved and integrated scales. These findings support a scenario in which high-mass star formation is enhanced in regions of concentrated star formation, possibly due to reduced molecular cloud fragmentation and more efficient accretion. Building on these results, a follow-up project will focus on the low-mass end of the IMF in star-forming galaxies using an approach based on stellar population synthesis.

Author: SALVADOR CAMPE, Diego (Macquarie University)

Presenter: SALVADOR CAMPE, Diego (Macquarie University)

Session Classification: Galaxies

Contribution ID: **30** Type: **Poster**

Advancing Halo Mass Estimation for Galaxy Groups: Group Therapy for Halos

Monday, July 7, 2025 2:44 PM (1 minute)

Accurate measurements of halo masses for galaxy groups are essential for understanding the connection between dark matter and baryons. We present two newly developed methods for improving halo mass estimates, calibrated using semi-analytical simulations. Relations are first calibrated against SHARK v2.0, and cross-validated with the independent SAGE model to assess sensitivity to underlying physical prescriptions. The first method establishes a baryon–halo mass relation, closely anchored to the cosmological framework of the simulations. Although residual model-to-model variation remains, it is significantly reduced compared to current observational techniques, providing robust mass estimates for a wide range of applications, excluding those requiring unbiased halo mass functions. The second method adopts a minimally model-informed approach, treating galaxies as test particles within their groups. It leverages the velocity dispersion and maximum projected separation of member galaxies, introducing a calibrated scale factor that evolves with the reliability of these measurements. This approach is particularly suited for low-multiplicity groups where traditional estimates are less stable. While the first method achieves higher precision, the second offers a pathway to recover statistical halo mass distributions independently of specific simulation outputs. Together, these techniques open new avenues for tracing the dark matter–baryon interplay in the group regime with greater fidelity, particularly targeting the low-mass, low-multiplicity halos where mass estimates remain challenging, and enabling robust measurements to extend into a lower halo mass range than previously accessible.

Author: VAN KEMPEN, Wesley (Swinburne University of Technology)

Presenter: VAN KEMPEN, Wesley (Swinburne University of Technology)

Session Classification: Poster

Contribution ID: **31** Type: **Oral**

Relativistic Electron Cyclotron Maser as an Engine for Long Period Transients Associated with White Dwarfs

Tuesday, July 8, 2025 5:45 PM (15 minutes)

We present the discovery and characterisation of a novel white dwarf binary system, identified through optical spectroscopy and radio-wavelength observations. This system displays a short orbital period of ~1.3 hours, determined from Doppler shifts in Balmer emission lines, and exhibits unique radio emission characteristics.

We observed periodic bursts of elliptically polarised radio emission – displaying frequency drift and intermittency – aligned with the orbital period. As well as coincident X-ray and UV emission, which may indicate potential accretion.

This system occupies a crucial evolutionary space, bridging cataclysmic variables and long-period transients, with an orbital period shorter than other known long-period transient associated with white dwarfs. The radio emission's high brightness temperature and elliptical polarisation necessitates a coherent mechanism. We find the observations can be explained by a relativistic electron cyclotron maser operating within the magnetic field lines connecting the white dwarf and its companion.

Our analysis allows us to probe the system's magnetic field structure and plasma transfer dynamics. We will discuss the implications of these findings for understanding the emission mechanisms of long-period transients and the evolutionary pathways of close white dwarf binaries.

Author: ROSE, Kovi (University of Sydney)

Presenter: ROSE, Kovi (University of Sydney)

Session Classification: Transients

Contribution ID: **33** Type: **Oral**

Probing AGN Accretion Discs through their Variability

Monday, July 7, 2025 10:00 AM (15 minutes)

AGN accretion discs cannot be directly resolved, making flux variability a powerful probe of their internal structure and accretion processes. However, host galaxy contamination complicates variability studies of low-luminosity AGN. To address this gap, we characterise the optical variability of a sample of ~250 low-luminosity AGN at z < 0.1 through the ensemble variability structure function using difference photometry. We find that the variability behaviour deviates from predictions extrapolated from the high-luminosity end. Our results suggest that there may be two distinct mechanisms behind the variability, one dominating in the low-luminosity regime and the other in the well-studied high-luminosity regime. We also find differences between the behaviour in the cooler outer disc we probe and the well-studied hotter inner disc, indicating that a more complex accretion disc model may be needed to explain the variability.

Author: TAN, Ashley Hai Tung (Australian National University)

Co-authors: WOLF, Christian (Australian National University); ONKEN, Christopher (Australian National University); AMRUTHA, Neelesh (The Australian National University)

Presenter: TAN, Ashley Hai Tung (Australian National University)

Session Classification: AGN

Contribution ID: **34** Type: **Poster**

GALAH in Concert: An observational and theoretical mixtape

Tuesday, July 8, 2025 10:45 AM (15 minutes)

By now, most Australian astronomers have heard of the ever-evolving group known as GALAH*. With the recent drop of their fourth data release, it's the perfect time to revisit some of the standout tracks —and preview what's next in this growing catalogue of Galactic hits.

Tracklist:
1. The Galactic Mashup: Decoding the Milky Way's merger history with GALAH observations and NIHAO-UHD simulations
2. Double Trouble: How spectroscopic binaries can throw you off-key
3. GALAH (remastered): Introducing GALAH-2, a new large AAT program with higher quality (including Veloce for more elements and even isotopes)
4. Radio GAGA: Mapping interstellar absorption with GALAH and GASKAP in optical and radio wavelenghts

*GALAH: The Galactic Archaeology with HERMES Survey, Australia's high-resolution million-star spectroscopic survey

Author: BUDER, Sven (Australian National University)

Presenter: BUDER, Sven (Australian National University)

Session Classification: Stars

Contribution ID: **35** Type: **Oral**

TASSIE: a TASmanian Search for Inclined Exoplanets

Wednesday, July 9, 2025 5:15 PM (15 minutes)

The Transiting Exoplanet Survey Satellite (TESS) is a nearly all-sky survey taking precise photometric measurements of millions of stars in our galaxy. It has become a powerful tool in the search for exoplanets, along with contributing to studies of stellar evolution through asteroseismology. By targeting bright stars amenable to radial velocity follow-up, the TESS mission aims to increase our statistical sample of exoplanets with accurate radius and mass measurements. It will also provide excellent targets for future atmospheric characterization through transmission spectroscopy. This will help to address outstanding issues in planet formation and evolution, such as testing classic core accretion and migration scenarios.

At the UTAS Greenhill Observatory, we have commenced a photometric follow-up program for southern transiting planets with the new Harlingten 50 cm telescope. We specifically focus on candidates residing in the sub-Jovian desert, a region of the period-radius parameter space where it is rare to find planets. The boundaries of the desert are shaped by evolutionary processes, such as photoevaporation and migration. In this talk, I will present our first results with the observations and analysis of five short-period TESS candidates. We show that three of these targets are false positives from grazing eclipsing binaries or stellar activity. More excitingly, we identify an interesting system with a potential desert planet in a wide binary system. I will also present preliminary modelling of a new two-planet system currently under investigation.

Author: PLUNKETT, Thomas (University of Tasmania)

Presenter: PLUNKETT, Thomas (University of Tasmania)

Session Classification: Planets

Contribution ID: **36** Type: **Poster**

Identification methods for poor-quality radio images

Tuesday, July 8, 2025 11:37 AM (1 minute)

The VAST Survey has been collecting data over the last four years using ASKAP to study radio transients. It has provided us with the most comprehensive radio time domain survey ever conducted, which gives us an invaluable opportunity to study radio transients, particularly Gamma-ray Burst (GRB) orphan afterglows, an area yet to be investigated using this dataset. GRBs are relativistic transients associated with the gravitational collapse of massive stars or coalescing compact objects. These events are accompanied by lower energy long-lasting afterglow emission at x-ray, optical, and radio wavelengths. Orphan afterglows resemble the long-wavelength afterglow of a GRB but are observed without a prompt emission trigger.

Prior to systematically searching for and identifying orphan afterglows using the VAST pipeline, a challenge will be to remove the artefacts in the data. In this project, we plan to evaluate different techniques and develop robust artefact detection methods, enabling us to identify not only afterglows, but also other classes of transients in the broader VAST survey. We aim to develop an image quality assessment algorithm for systematic implementation and potential upstream integration across the entire VAST pipeline. Eliminating non-informative artefacts at an initial stage will ensure that our computed measurements are derived solely from legitimate images, thereby improving the precision and accuracy of our subsequent analyses.

As a next step, our goal will be to study orphan afterglows, providing us with insights to help constrain existing afterglow models, ultimately revealing the nature of the central engines that drive them, and their progenitors.

Author: Ms CHANDRA, Surabhi (The University of Sydney)

Co-authors: DOBIE, Dougal (University of Sydney); Prof. MURPHY, Tara (University of Sydney)

Presenter: Ms CHANDRA, Surabhi (The University of Sydney)

Session Classification: Poster

Contribution ID: **37** Type: **Poster**

Fully automated near-infrared spectrophotometry with the robotic ANU 2.3m telescope

Tuesday, July 8, 2025 11:42 AM (1 minute)

The successful automation of the ANU 2.3m telescope has unlocked the potential for extensive spectroscopic campaigns with the existing WiFeS integral field spectrograph. In this poster we describe a complementary near-infrared spectrograph concept to be located at the second Nasmyth focus. We present two conceptual designs for NIR spectrographs covering the J and H band, as well as highlight the importance of automated follow-up in the context of DREAMS, LSST, and other forthcoming surveys.

Author: Prof. SHARP, Rob (Australian National University)

Co-authors: Dr VAUGHN, Israel (Australian National University); Dr TRAVOUILLON, Tony (Australian National University); MENDEL, Trevor (Australian National University)

Presenter: Prof. SHARP, Rob (Australian National University)

Session Classification: Poster

Contribution ID: **38** Type: **Oral**

Gravitational Instability in Post-AGB Disks: Limits on Second-Generation Planet Formation

Wednesday, July 9, 2025 5:30 PM (15 minutes)

Disks around evolved binaries such as post-AGB binaries share many similarities with protoplanetary disks (PPDs) around young stellar objects, which has led some to believe that planet formation may occur in these systems. Here we investigate the possibility of planet formation via gravitational instabilities in post-AGB disks. We first apply the Toomre criterion of gravitational instability to several PPDs suspected of being gravitationally unstable, and then use the same criterion to investigate possible disk instabilities in post-AGB disks. We find that gravitational instabilities are not a probable scenario for the formation of planets in post-AGB disks due these disks having generally too low a mass. Even accounting for a likely larger disk mass in the recent past does not enable us to conclude that planet formation by instability took place in these systems. We also find that in the hypothetical case of planet formation with this method, the rapid mass growth of these newly born planets would result in rapid orbital decays. We conclude by discussing alternative planet formation mechanisms that may better explain the presence of planets in these evolved systems.

Author: POURMAND, Ali (Macquarie University)

Co-authors: Dr KAMATH, Devika (Macquarie University); Prof. DE MARCO, Orsola (Macquarie University)

Presenter: POURMAND, Ali (Macquarie University)

Session Classification: Planets

Contribution ID: **39** Type: **Oral**

The intracluster light fraction across redshift and cluster environment

Wednesday, July 9, 2025 4:45 PM (15 minutes)

The intracluster light (ICL) is an important tracer of galaxy cluster assembly, comprising a significant fraction of the total luminous mass of galaxy clusters, and being formed primarily due to galaxy interactions and mergers. Up to now, only small samples of clusters have been studied due to the ICL's very low surface brightness and the challenges involved in carrying out measurements on a large scale. Using a novel machine learning method, we have measured the ICL fraction in the current largest sample of 176 galaxy groups and clusters using images from the Hyper Suprime-Cam Subaru Strategic Program. In this talk, I will present the results of our analysis of this large sample, studying observational trends in redshift, halo mass, and cluster dynamical state. I will highlight the importance of accounting for observational effects when drawing our conclusions, and discuss what these trends reveal about the formation and evolution of the ICL and the galaxies within.

Author: CANEPA, Louisa

Presenter: CANEPA, Louisa

Session Classification: Galaxies

Contribution ID: **40** Type: **Poster**

Radio GAGA?! Complementing Radio Data from GASKAP with Optical Data from GALAH to study the Interstellar Medium (ISM)

Monday, July 7, 2025 12:45 PM (1 minute)

This poster showcases how interstellar absorption features in high-resolution optical spectra from the GALAH survey —including neutral potassium (KI) and diffuse interstellar bands (DIBs) —can be used to trace the cold ISM across our Galaxy.
To highlight this amazing potential, we present first results by Nguyen, Buder et al. (in prep.), where we combine GALAH KI absorption with GASKAP HI absorption toward the Magellanic Cloud foreground. The study reveals a strong kinematic correlation between the optical and radio tracers, providing a powerful example of how optical and radio observations can be used in concert to probe the structure, kinematics, and composition of the neutral ISM.

Authors: Dr NGUYEN, Hiep (ANU); Prof. MCCLURE-GRIFFITHS, Naomi (ANU); BUDER, Sven (Australian National University)

Presenter: BUDER, Sven (Australian National University)

Session Classification: Poster

Contribution ID: **41** Type: **Oral**

Breaking the assumption of action conservation: Limits on stellar orbit reconstruction in Milky Way disk

Tuesday, July 8, 2025 5:30 PM (15 minutes)

Stellar actions are widely assumed to be conserved for use of orbit reconstruction techniques in Galactic studies. However, the Milky Way disk is highly dynamic, with time-dependent, non-axisymmetric features such as transient spiral arms and giant molecular clouds (GMCs) driving fluctuations in the gravitational potential constantly perturbing stellar orbits. Using high-resolution magnetohydrodynamic simulations that self-consistently model gas dynamics, star formation and gravitational interactions, we investigate the evolution of stellar actions over Myr to Gyr timescales. We find that actions undergo a random walk in logarithmic space, with vertical actions evolving faster than radial actions. A diffusion model fitted to the data yields characteristic timescales of ~100 Myr beyond which actions lose memory of their initial conditions, placing a fundamental limit on the reliability of orbit reconstruction methods. The diffusion rate associated with the random walk is found to be weakly dependent on the stellar birth environment and scales approximately linearly with the galactic orbital frequency at the star's position. Comparison with older stars initially present in the simulation reveals that vertical and radial action evolution are driven by distinct mechanisms, with GMCs being responsible for vertical action change and transient spiral arms altering radial actions. Our study challenges the core assumption of stellar action conservation in Galactic dynamics studies even over short dynamical timescales. However, because stars born clustered in action space remain relatively clustered despite diffusion, action-space clustering remains a promising tool for reconstructing disrupted star clusters.

Author: ARUNIMA, Arunima (RSAA)

Co-authors: KRUMHOLZ, Mark; IRELAND, Michael; ZHANG, Chuhan; HU, Zipeng

Presenter: ARUNIMA, Arunima (RSAA)

Session Classification: Stars

Contribution ID: **42** Type: **Oral**

Seeing the full picture: measuring AGN feedback with next-generation radio jet models

Monday, July 7, 2025 10:15 AM (15 minutes)

Active Galactic Nuclei (AGN) jets are the brightest objects in the radio sky. Their feedback is an essential ingredient in all galaxy formation models. Tens of millions of AGN jets have been discovered over the past decade with more promised by the SKA. Measuring the energy output of these jets is a notoriously challenging, requiring either analytical or numerical jet models. In this work, for the first time, we fully utilise the information contained in images of radio AGN at multiple frequencies –instead of just a single frequency measurement of size and luminosity.
I will present the first fast (millisecond run time) analytical model which generates synthetic radio images with comparable accuracy to full hydrodynamical simulations. We perform a novel MCMC parameter inversion which compares observed radio images at multiple frequencies to a large suite of analytic model predictions. This new method allows us to simultaneously recover both AGN energetics and environments into which the jets are expanding –another historically challenging task –using only radio observations. Application of this technique to large survey data sets will measure intrinsic properties of AGN jet populations, and their feedback, across cosmic time.
We are making this python code publicly available for use by the astronomy community for application to large radio surveys.

Authors: TURNER, Ross; HANSEN, Samuel

Presenter: HANSEN, Samuel

Session Classification: AGN

Contribution ID: **43** Type: **Poster**

Galaxy spin and the bar

Tuesday, July 8, 2025 12:46 PM (1 minute)

Motivated by the need to explain why galaxy spin is more strongly correlated to internal properties of galaxies such as star formation rate and stellar population age, rather than mass or environment, we look at how bar formation can change the observed galaxy spin measurement within one effective radius. Using a suite of galaxy simulations, we find when bar formation occurs and identify the associated heating of the disk. By making mock observables of these galaxy simulations using SimSpin, we find that bar formation causes a significant drop in the measured galaxy spin within one effective radius. Comparisons to observations from the SAMI galaxy survey are also made.

Author: JOSHI, Robin (University of Sydney)

Co-authors: Dr ILES, Elizabeth (University of Sydney); CROOM, Scott (University of Sydney); Dr BARSANTI, Stefania (University of Sydney)

Presenter: JOSHI, Robin (University of Sydney)

Session Classification: Poster

Contribution ID: **44** Type: **Oral**

Quantifying Radio Source Morphology

Thursday, July 10, 2025 10:00 AM (15 minutes)

The advent of next-generation telescope facilities brings with it an unprecedented amount of data, and the demand for effective tools to process and classify this information has become increasingly important. There have been many applications of machine learning (ML) in this context, however ML can be computationally expensive and often requires manually curated training sets. This work proposes a novel approach to quantify the radio galaxy morphology, through the development of a series of algorithmic metrics that can be applied to images in an automatic way. We introduce a series of unique metrics that quantitatively describe the structure of a single radio galaxy lobe. These metrics are intuitive in nature and are inspired by the intrinsic structural differences observed between the existing Fanaroff-Riley (FR) morphology classification system. The metrics are defined in categories of asymmetry, blurriness, concentration, disorder, and elongation ($ABCDE$/single-lobe metrics), as well as the asymmetry and angle between lobes (source metrics). We apply these metrics to a sample of 483 sources from the Evolutionary Map of the Universe Pilot Survey (EMU-PS) and 72 well resolved extensively studied sources from An Atlas of DRAGNs, a subset of the revised Third Cambridge Catalogue of Radio Sources (3CRR). We find that these metrics are relatively robust to resolution changes, independent of each other, and measure fundamentally different structural components of radio galaxy lobes. We also find that we can recover the original FR classification using probabilistic combinations of our metrics, highlighting the usefulness of our approach for future large data sets from radio sky surveys.

Author: BARNES, Lachlan (Macquarie University)

Presenter: BARNES, Lachlan (Macquarie University)

Session Classification: Methods & Applications

Contribution ID: **45** Type: **Oral**

Post-AGB postcards: Revealing evolved star disc substructure through optical interferometry.

Tuesday, July 8, 2025 10:30 AM (15 minutes)

Protoplanetary discs (PPDs) of dust and gas around young stellar objects are now routinely imaged using high angular resolution facilities. Various substructures detected in these images serve as critical signposts of fundamental disc physics and inter-component interactions with the central star(s) or embedded sub-stellar companions. However, a certain class of evolved stars, called post-asymptotic giant branch (post-AGB) binaries, are also surrounded by similar discs. With almost 100 Galactic candidates detected, these evolved circumbinary-disc-bearing systems are now understood to be a common product created at the end of low- to intermediate-mass stellar evolution.

Post-AGB discs are formed differently than PPDs, namely through material stripped from the primary during binary interaction in the preceding AGB phase. Nevertheless, various studies have shown similarities in terms of dust mass and grain properties, bulk disc structure and Keplerian rotation. These findings raise the question of whether post-AGB discs possess substructures similar to those found in PPDs. If detected, such substructures could provide direct evidence for ongoing physical disc processes and interactions with both the central stars and possible embedded sub-stellar companions. Due to the relatively large distances of post-AGB binaries (~ 1kpc), milli-arcsecond-scale imaging via optical interferometry provides the ideal tool to tackle this science question.

In this contribution, I cover the latest progress on imaging of the inner rims of 8 post-AGB discs, using VLTI/PIONIER data and neural network based image reconstruction algorithms. I also offer a brief discussion of the potential provided by both current and future facilities when it comes to studying these intriguing circumstellar environments.

Author: DE PRINS, Toon (Macquarie University)

Presenter: DE PRINS, Toon (Macquarie University)

Session Classification: Stars

Contribution ID: **46** Type: **Poster**

Twinkle twinkle compact AGN: modelling interplanetary scintillation of young radio galaxies

Monday, July 7, 2025 12:04 PM (1 minute)

Astrophysical jets powered by accretion onto supermassive black holes at the centre of galaxies are among the most energetic phenomena in our universe. Charged particles are accelerated along the jets to relativistic speeds, emitting synchrotron radiation observable at radio frequencies. Jets provide feedback and regulate star formation by interacting with the dense clumps of gas in their host galaxy and, on larger scales, the smoother and lower density circumgalactic medium. Sources confined to their host galaxy have characteristic peaked radio spectra, which can be observed with a combination of mid- and low-frequency instruments (e.g. ASKAP + MWA).

Interplanetary scintillation (IPS) is the variability of flux from a radio source on timescales of seconds due to fluctuations in the solar wind. IPS scales with the angular size of the source, and is therefore an excellent method for identifying large samples of compact radio sources without the need for much more resource-intensive techniques such as VLBI. Recent observations have shown that these two seemingly distinct phenomena - that is, strong scintillation and peaked radio spectra - are closely linked. In this talk, I will explain this connection from a theoretical point of view, using jet simulations with calculations of radio emission and scintillation performed in post-processing. I will discuss the relationship between the low-frequency spectral slope and the strength of scintillation for young radio sources, and predict new populations of sources observable with SKA-era telescopes.

Author: YOUNG, Sophie (University of Tasmania)

Presenter: YOUNG, Sophie (University of Tasmania)

Session Classification: Poster

Contribution ID: **47** Type: **Poster**

xenomorph: the fastest way to model the colliding winds of massive binary stars

Monday, July 7, 2025 12:10 PM (1 minute)

When Wolf-Rayet stars are together with a massive companion in a close binary, their winds may collide to copiously form dust. This occurs at the shock of the wind-wind collision, and the orbital motion wraps this dust cone into a highly structure spiral nebula that expands away from the inner binary. State of the art ground-based and space telescopes (such as the VLT and JWST) are observing these colliding wind nebulae more and more often, and so there is a need for an advanced – and importantly fast – way to model the observed geometric structures. We introduce 'xenomorph', a geometric modelling code that can reproduce these astrophysical fingerprint structures and in-turn uniquely reveal the orbital mechanics and wind physics hidden from view at the heart of the stellar binary. Our code is ~100x times faster than previous implementations, features more physics, and is natively differentiable through our use of the JAX framework. In fitting these nebula structures, we better understand the binary evolution of the most massive stars and their conditions immediately before going supernova – and we get to look at pretty pictures along the way.

Author: WHITE, Ryan (Macquarie University)

Presenter: WHITE, Ryan (Macquarie University)

Session Classification: Poster

Contribution ID: **48** Type: **Oral**

Putting on Spectroscopic Lenses: How to Constrain Dark Matter Haloes

Monday, July 7, 2025 4:00 PM (15 minutes)

Despite the essential driving role dark matter (DM) plays in galaxy evolution, it is still unclear what the DM halo of an individual galaxy looks like. In this talk I will present two approaches to studying DM haloes in terms of their total mass and density distribution.
First, we used data from the integral field spectrograph KCWI to investigate the DM halo of a faint dwarf elliptical using globular clusters (GCs) as discrete dynamical tracers. While imaging data alone can give an estimate of the GC number, spectroscopy is required to confirm the members of the GC system, hence allowing constraints on the total halo mass.
Second, we used data from the GECKOS survey with MUSE. Two conveniently located background sources behind a giant spiral allow the application of kinematic lensing techniques, where spectroscopy makes it possible to measure the lensing effect of individual galaxies. Rather than just constraining the total DM mass, we are able to present preliminary measurements of the halo density profile and how it can be disentangled from the stellar component.
Combining the two scenarios, there is a clear picture emerging of how spectroscopic data can help unveil the properties of DM haloes across different galaxy types. With this, next generations of spectroscopic facilities such as SKA and WST can transform our ability to measure and map DM around galaxies.

Author: HAACKE, Lydia (Swinburne University of Technology)

Presenter: HAACKE, Lydia (Swinburne University of Technology)

Session Classification: Cosmology & Dark Universe

Contribution ID: **49** Type: **Poster**

Photometric core-collapse supernova classification: first results and opportunities.

Monday, July 7, 2025 12:59 PM (1 minute)

The continuous increase of astronomical surveys in scale yields the need for efficient solutions to analyze the data. The Vera C. Rubin LSST as a prime example will produce millions of alerts, notifications of potentially novel objects, per night. Within the entire set will be millions of supernovae (SNe), which makes spectroscopic classification of all of them infeasible.

We present first results of a data-driven machine learning approach for the photometric classification of core-collapse supernovae (CC SNe) into SN Ib/c and SN II, two of their subclasses. Our study uses LSST-like precursor datasets and simulations to uncover advantages and pitfalls of existing architectures and presents a new architecture based on transformers. This alternative to spectroscopy is scalable while achieving good accuracy (87% on simulations). Our photometric classifier will elevate our understanding of CC SN by improving rate measurements, and significantly increasing the size of available datasets for population properties studies.

Author: STEINWENDER, Lukas

Co-authors: MÖLLER, Anais; FLUKE, Christopher

Presenter: STEINWENDER, Lukas

Session Classification: Poster

Contribution ID: **50** Type: **Poster**

Searching for New Physics with the Cherenkov Telescope Array Observatory

Monday, July 7, 2025 2:30 PM (1 minute)

Since its discovery by the *Fermi*-LAT space telescope, the galactic centre gamma-ray excess (GCE) has been the subject of intensive investigation in high-energy astrophysics. In this presentation, I will share progress on a current effort to model the GCE and determine if the Cherenkov Telescope Array Observatory (CTAO) will be able to distinguish between two prevalent hypotheses of the GCE emission: dark matter, or millisecond pulsars (MSPs). Our preliminary results of this investigation seem to suggest that CTAO may have sufficient performance to reveal features in the spatial distribution of gamma-ray emission that can strongly test a MSP scenario vs. dark matter. Hence, the CTAO could be the key to improving our current understanding of dark matter.

Author: JAMES, Hayden (The University of Adelaide)

Co-authors: Prof. ROWELL, Gavin (University of Adelaide); WHITE, Martin John (University of Adelaide (AU)); EINECKE, Sabrina (University of Adelaide)

Presenter: JAMES, Hayden (The University of Adelaide)

Session Classification: Poster

Contribution ID: **51** Type: **Oral**

Ultraviolet Extinction Sky Survey (UVESS): A mission concept to study the interstellar medium in the Milky Way and Local Group galaxies

Wednesday, July 9, 2025 10:00 AM (15 minutes)

Corrections for the absorption of light by interstellar dust (referred to as dust extinction) represent one of the largest sources of uncertainty for deriving properties of stars and galaxies in astronomical studies, particularly those that rely on ultraviolet (UV) wavelengths where dust extinction is strongest. The origin of the 2175Å absorption feature (the most prominent UV dust extinction feature) is still a mystery and this lack of understanding directly limits the accuracy to which dust extinction corrections can currently be made. The reason for this limited knowledge is due to the sparsity of UV extinction measurement to date, with only a few hundred sightlines being measured from all past/current facilities. Recent advancements in UV instrumentation and technologies have paved the way for the development of high-throughput UV instruments in compact form factors. The Ultraviolet Extinction Sky Survey (UVESS) is a UV spectroscopic SmallSat mission concept being developed by the Australian National University, in collaboration with the Indian Institute for Astrophysics. We are also seeking further engagement with the wider space- and scientific-communities. UVESS would map the variability in dust extinction curves and 2175Å dust absorption feature by acquiring UV spectroscopy (1400-2700Å; R~200) for thousands of sightlines across most of the sky, probing the interstellar medium in the Milky Way and Local Group galaxies. These characterisations will offer valuable insights into the composition, size distribution, and processing of interstellar dust grains. Understanding these factors are critical to developing more accurate prescriptions for dust extinction corrections in astronomical observations. In this presentation, I will outline the UVESS instrument concept and mission science goals.

Authors: BATTISTI, Andrew (International Centre for Radio Astronomy Research, University of Western Australia); Dr MATHEW, Joice (Advanced Instrumentation and Technology Centre, Research School of Astronomy and Astrophysics, Australian National University)

Presenter: BATTISTI, Andrew (International Centre for Radio Astronomy Research, University of Western Australia)

Session Classification: Gas

Contribution ID: **52** Type: **Oral**

Ramping Up the Search for Fast Transients with JWST

Tuesday, July 8, 2025 4:30 PM (15 minutes)

Fast infrared transients have not been well explored; however, we now have chance to search this parameter space. With creative analysis techniques, we are using the James Webb Space Telescope (JWST) to search for transients with lifetimes from seconds to minutes. A single exposure from JWST is made up of integrations that are combination of numerous non-destructive reads. This means that a single image can be split into a time-series of images with cadences ranging from about 3 seconds to 50 seconds depending on the specified readout pattern. In principle, JWST can then be turned into a fast transient infrared telescope just by looking at its diagnostic images. This method is applicable to all NIRCam and MIRI observations, however, detection capability increases with the length of integration time. I will present the pipeline and report our search's initial findings.

Author: LUISI, Jaime (University of Canterbury)

Co-authors: Dr REST, Armin (Space Telescope Science Institute); Prof. COOKE, Jeffrey (Swinburne University of Technology); Dr WANG, Qinan (Massachusetts Institute of Technology); Dr RIDDEN, Ryan (University of Canterbury)

Presenter: LUISI, Jaime (University of Canterbury)

Session Classification: Transients

Contribution ID: **53** Type: **Oral**

The many ways to assemble low-mass stellar systems

Tuesday, July 8, 2025 4:45 PM (15 minutes)

As observational studies of the Local Group and other environments have expanded to include smaller, fainter and more distant objects, it has become clear that the family of low-mass stellar systems is very diverse, encompassing normal and metal-complex globular clusters, ultra-faint dwarfs with extremely high mass-to-light ratios, and ultra-compact dwarf galaxies. This raises questions about the formation pathways that produce these different systems: Is there more than one way to make a globular cluster? Do similar initial conditions always result in the same present-day properties? I will discuss the observational results that complicate the bottom end of the (galaxy?) mass function and the possible connections to very high redshift stellar populations being observed by JWST, and present a schematic model for inferring the origins of low-mass stellar systems based on their present-day properties and environments.

Author: Prof. MARTELL, Sarah (University of New South Wales)

Presenter: Prof. MARTELL, Sarah (University of New South Wales)

Session Classification: Stars

Contribution ID: **54** Type: **Oral**

Using SOFIA ionised carbon data as a probe for sub-GeV cosmic rays in young Supernova Remnants

Monday, July 7, 2025 4:30 PM (15 minutes)

Supernova remnants (SNRs) have long been proposed as potential sources of galactic cosmic rays. However, current gamma-ray observations at GeV energies lack the angular resolution required to effectively trace low-energy cosmic rays. Ionised gas tracers such as the 1.9 THz fine-structure line of carbon ([C II]) offer arc-minute resolution and thus a promising probe of cosmic rays in the GeV range.
In this contribution, we present analysis of SOFIA [C II] observations of several SNRs—including RXJ1713.7−3946, RCW86, and Vela Jr.—focusing on the gas associated with and surrounding the remnants. Data from the SOFIA, Nanten, and Parkes+ATCA telescopes were used to measure the ratios of [C II] intensity to H_2 and HI emission toward each remnant, in an attempt to discern the origin of the [C II] emission. However, the contribution of UV photons to [C II] emission was also modelled using the photoionisation code CLOUDY. Model results suggest that UV photons can be an important source of [C II] emission in the SNRs we studied, providing challenges to use [C II] emission as a tracer of GeV cosmic rays.

Author: THAKUR, Adnaan (The University of Adelaide)

Co-author: Prof. ROWELL, Gavin (University of Adelaide)

Presenter: THAKUR, Adnaan (The University of Adelaide)

Session Classification: Compact / High-Energy Objects

Contribution ID: **55** Type: **Oral**

Preparing for science with the SKAO

Tuesday, July 8, 2025 12:15 PM (30 minutes)

As the SKA timeline towards science progresses, the SKAO aims to engage with the user community to define early access to the SKA telescopes through Science Verification planning. This talk will be a distillation of multiple presentations at the SKAO Science meeting in Görlitz earlier this year, focusing on SKAO's work in preparation for full science operations. Furthermore, I will present SKA's evolving science potential and highlight how community access to data and support services will scale at each key operational milestone. By linking scientific capabilities with operational planning, the SKAO hopes to empower the global astronomy community with the tools to explore the full potential of SKA-era science.

Author: KACZMAREK, Jane (SKAO)

Presenter: KACZMAREK, Jane (SKAO)

Session Classification: Plenary

Contribution ID: **56** Type: **Oral**

The Disk Strikes Back: Accretion and Depletion in Evolving Post-giant Binaries

Tuesday, July 8, 2025 10:15 AM (15 minutes)

Post-giant binaries are unique systems that host stable circumbinary disks, formed from previously ejected stellar material, and exhibit unusual orbital characteristics resulting from complex binary interactions. Gas from the disk, which is deficient in heavy elements, is re-accreted onto the central stars, producing metal-poor surface abundances — a phenomenon known as chemical depletion. This study investigates how re-accreted gas from the circumbinary disk drives chemical depletion in a sample of six post-giant binary stars, and how this process influences post-giant stellar evolution. Additionally, we assess whether re-accretion can account for the observed absence of ionised planetary nebulae (PNe) in many post-giant systems. We find that high accretion rates ($> 10^{-7}\,\mathrm{M_\odot\,yr^{-1}}$) and substantial disk masses ($gtrsim10^{-2}\,\mathrm{M_\odot}$) are required to reproduce the observed chemical depletion, particularly in hotter post-giant stars (T_{eff} $gtrsim6000\,\mathrm{K}$). While such rapid accretion significantly prolongs post-giant lifetimes by factors of 3 to 10, the resulting evolutionary timescales remain within the PN visibility window. This suggests that accretion alone is insufficient to explain the lack of ionised PNe in post-giant systems. Our results constrain accretion-flow parameters and offer valuable insights into disk-mediated binary evolution during the post-giant phase.

Author: MARTIN, Kayla (Macquarie University)

Presenter: MARTIN, Kayla (Macquarie University)

Session Classification: Stars

Contribution ID: **58** Type: **Oral**

Colouring High Cadence Lightcurves of Fast Transients

Thursday, July 10, 2025 10:00 AM (15 minutes)

For the first time ever, it is possible to obtain well sampled lightcurves of fast transients, with a plethora of data provided by a range of telescopes. In particular, TESS has a unique fast cadence that allows us to observe transients during the rise, and decay after peak brightness. With TESS alone our understanding of these fast transients is limited due to the lack of colour information. However, by incorporating slower and deeper multi-band observations from ground based telescopes, such as ZTF and LSST, we can more easily identify the transient type and constrain their physical properties. We present two examples of the synergy between TESS and ground-based telescopes in the analysis of two gamma ray burst afterglows, 2021buv and 2024zuk. We will also present the framework for a joint fast transient search and analysis with TESS and LSST following LSST first light later this year.

Author: MONTILLA, Clarinda (University of Canterbury)

Co-authors: Dr MOLLER, Anais (Swinburne University of Technology); REST, Armin (Space Telescope Science Institute); ROXBURGH, Hugh (Curtin University); FREEBURN, James (Swinburne University of Technology); COOKE, Jeffrey (Swinburne University of Technology); WANG, Qinan (Massachusetts Institute of Technology); RIDDEN, Ryan (University of Canterbury)

Presenter: MONTILLA, Clarinda (University of Canterbury)

Session Classification: Surveys & Facilities

Contribution ID: **59** Type: **Poster**

Kinematic analysis of a large sample of interacting galaxies at cosmic noon

Monday, July 7, 2025 2:35 PM (1 minute)

Studies of resolved kinematics can provide key insights into the impact of mergers on galaxy dynamical stability and gas turbulence. Studies of low redshift and simulated galaxies have found that merging events can cause enhanced star formation, complex, non-disc-like rotation and increased turbulence. Work has also been done to study the impact of mergers at higher redshift (z > 1), however detailed kinematic analysis has primarily been restricted to a small number of deep observations of massive systems. One reason for this is the observational effect of beam smearing which impacts observed kinematics by smoothing over signatures of gas motions and artificially increasing the inferred disk-scale turbulence. Most methods used to account for beam smearing have been optimised for disk-like galaxies at higher redshift and therefore have not been designed for merging galaxies.

Aiming to overcome this, we have adapted the existing HI-line fitting code *ROHSA* with regularisation to create a spatially non-parametric kinematic analysis tool *ROHSA-SNAPD*, which allows beam smearing to be accounted for without assuming an intrinsic rotation model. This makes it now possible to study the kinematics of larger samples of disrupted and merging galaxies at z > 1. We will introduce *ROHSA-SNAPD* and demonstrate its ability to recover the intrinsic kinematics of simulated galaxies, from pre- to post-merger states. We will then present results from applying *ROHSA-SNAPD* to integral field spectroscopy surveys at cosmic noon (z ~ 1 −3), quantifying differences in star formation and velocity dispersion between interacting vs. isolated galaxies.

Author: KANOWSKI, Isaac (Australian National University)

Co-authors: Dr MARCHAL, Antoine; WISNIOSKI, Emily (Australian National University); TSUKUI, Takafumi; MENDEL, Trevor (Australian National University)

Presenter: KANOWSKI, Isaac (Australian National University)

Session Classification: Poster

Contribution ID: **60** Type: **Oral**

First Results from DEBASS and the Importance of Low-z Supernova Samples in Validating Thawing Dark Energy

Thursday, July 10, 2025 12:30 PM (30 minutes)

Recent results from DES and DESI find evidence for a thawing model of dark energy at the ~4 sigma level. However, this evidence largely depends on a heterogenous collection of low redshift supernovae that were obtained over several decades. Using DECam on the 4m Blanco telescope in Chile, and WiFeS on the ANU 2.3m telescope, we are assembling a sample of 500 low redshift supernovae that will replace this historic anchor to the Hubble diagram. This will allow us to test whether the recent results about the time-varying nature of dark energy are real, or whether they are driven by systematics in current low-redshift SN Ia samples. We present the initial findings of DEBASS, and the concurrent host galaxy follow-up program with WiFeS, which aims to investigate the impact of host galaxy properties in estimating distances.

Author: MARTIN, Bailey (Research School of Astronomy and Astrophysics, The Australian National University)

Presenter: MARTIN, Bailey (Research School of Astronomy and Astrophysics, The Australian National University)

Session Classification: Plenary

Contribution ID: **61** Type: **Poster**

Characterising Stellar Streams and Shells using AstroLink

Tuesday, July 8, 2025 12:50 PM (1 minute)

I present a novel approach to classify stellar streams and shells using the clustering algorithm AstroLink. This density-driven approach is applied to tidally disrupted stellar shells and streams formed in mock MW static haloes. AstroLink can identify the structures formed from the N-body simulations and provide clues to identifying streams and shells based on the ordered density distribution. This work is currently submitted to PASA for publication.

Author: GIREESH, Smrithi (University of Sydney)

Presenter: GIREESH, Smrithi (University of Sydney)

Session Classification: Poster

Contribution ID: **62** Type: **Oral**

Abundance Differences of Dwarf Galaxy Streams and Fully Accreted Systems

Wednesday, July 9, 2025 5:15 PM (15 minutes)

I will present a comparison between the abundance patterns in accreted dwarf galaxies and dwarf galaxy streams using data from Gaia, APOGEE, GALAH, as well as specific stream targeting surveys. Dwarf galaxy streams merged with the Milky Way at a much later time then phased mixed, fully accreted, systems. Understanding the differences in properties and evolution between these two groups is crucial to reconstruct the evolutionary history of both dwarf galaxies, and the whole Milky Way. Preliminary results have indicated that there is correlation between infall time of our fully accreted progenitors and their chemical composition, as well as a clear separation between our dwarf galaxy streams and their equivalent mass fully accreted systems. I will discuss the significance of these results as well as the challenges in using them to model the evolutionary history of these dwarf galaxies.

Author: PEARSON, Miles (University of New South Wales)

Presenter: PEARSON, Miles (University of New South Wales)

Session Classification: Galaxies

Contribution ID: **63** Type: **Oral**

Host galaxy influence on Type Ia Supernovae: First insights into the mass step with ZTF DR2

Monday, July 7, 2025 4:30 PM (15 minutes)

Type Ia supernovae (SNe Ia) are essential tools for measuring cosmic distances, yet their standardisation remains imperfect. Even after correcting for light-curve properties, residual correlations with host galaxy properties such as mass persist. Correcting for the so-called mass step is crucial for precise measurements in cosmological analysis, and its origin remains poorly understood.

In this work, we present first results of the mass step using a volume-limited sample of SNe Ia from ZTF. Host galaxy properties are obtained from GAMA's spectroscopic measurements. We apply a new regression model based on GAMA galaxies to expand the sample beyond the GAMA footprint to estimate host properties from Legacy Survey fluxes. We also incorporate infrared data from the WISE catalogue to account for dust, which has been proposed as a possible physical origin of the mass step. Using this approach, we present correlations between host-galaxy properties and SNe Ia light-curve parameters. This work aims to better characterise the mass step and serves as a precursor for upcoming surveys like LSST, which will discover millions of SNe Ia.

Author: VIDAL VELAZQUEZ, Olivia (Swinburne University of Technology)

Co-authors: MOLLER, Anais (Swinburne University of Technology); Prof. TAYLOR, Edward (Swinburne University of Technology); Prof. CLUVER, Michelle (Swinburne University of Technology)

Presenter: VIDAL VELAZQUEZ, Olivia (Swinburne University of Technology)

Session Classification: Cosmology & Dark Universe

Contribution ID: **64** Type: **Oral**

Unveiling Gravitational Lenses in Colour: Multi-band Reconstruction of Sixteen Lensed Systems with PISCO

Wednesday, July 9, 2025 10:45 AM (15 minutes)

The growing flood of gravitational lensing data in the era of big-data astronomy brings both opportunities and challenges—particularly in modeling efficiency and the reliability of inferences from a given dataset.
In this work, we reconstruct 16 strong lens candidates using multi-band PISCO data from the Magellan Telescope, employing a scalable pipeline that jointly models all four bands (z, i, r, g) while correcting for image misalignments. This approach significantly reduces parameter uncertainties and uncovers lens systems with complex mass distributions, substructures, and potential exotic configurations. A further comparison with HST-based reconstructions will help clarify the strengths and limitations of PISCO's resolution in constraining lens models.

Author: QU, Huimin (The University of Sydney)

Co-authors: BALLARD, Daniel (The University of Sydney); LEWIS, Geraint

Presenter: QU, Huimin (The University of Sydney)

Session Classification: Methods & Applications

Contribution ID: **65** Type: **Poster**

The identification of ram-pressure-affected galaxies with SAMI/Hector

Tuesday, July 8, 2025 12:55 PM (1 minute)

Cluster environments influence galaxy evolution by regulating star formation activity, notably through ram-pressure stripping (RPS), where the intracluster medium removes cold gas available for star formation as galaxies move through it. This may leave observable signatures, such as gas tails, truncated gas disks, and regions exhibiting intense star formation triggered by compression. Using spatially resolved data from the SAMI and Hector Galaxy Surveys, we identify galaxies undergoing or recently affected by RPS through two different methods: visually classifying the ionized gas distribution into unperturbed, asymmetric, and truncated galaxies, and a quantitative analysis of shape parameters like concentration and asymmetry. The projected phase-space analysis suggests that asymmetric galaxies are likely recent infallers—having crossed $0.5\,R_{200}$ in the past 1 Gyr—whereas truncated and unperturbed galaxies are more broadly distributed, predominantly located at larger clustercentric distances. Central (i.e. $R < 0.5R_{eff}$) star formation activity appears to be comparable across all visual classes, while the outskirts exhibit differences. Unperturbed galaxies maintain relatively constant sSFR values with increasing radius, truncated galaxies exhibit a sharply declining profile, and asymmetric ones indicate an intermediate stage with a gradual decline. This might be attributed to an evolutionary trend linked to the RPS stage, where unperturbed galaxies likely represent recently accreted systems (pre-RPS), while asymmetric and truncated galaxies may correspond to populations undergoing RPS and post-RPS phases, respectively.

Author: CAKIR, OGUZHAN (Macquarie University)

Co-authors: CORTESE, Luca (ICRAR - UWA); OWERS, Matt (Macquarie University)

Presenter: CAKIR, OGUZHAN (Macquarie University)

Session Classification: Poster

Contribution ID: **66** Type: **Poster**

SN2019vxm: A Shocking Coincidence between Fermi and TESS

Monday, July 7, 2025 12:05 PM (1 minute)

We present photometric observations of SN2019vxm, a long-lasting, highly luminous Type IIn supernova, including a high-cadence rise captured by *TESS*. SN2019vxm has a broad range of electromagnetic detections ranging from *Swift* x-rays and ultraviolet through to near-infrared ground based surveys. By fitting a broken power-law model to the *TESS* light curve, we constrain the explosion time with an uncertainty of 7.2 hours. Additionally, we analyze the spatially and temporally coincident x-ray burst GRB191117A as a likely shock breakout associated with the supernova at the time of the explosion. Our analysis finds a coincidence confidence of 2.5σ that the two events are correlated. We infer that the progenitor star is likely to be a Blue Supergiant or a Luminous Blue Variable, based on the x-ray properties and the model-fitting to our extensive multi-band photometry.

Author: LANE, Zachary (University of Canterbury)

Co-authors: Dr REST, Armin (Space Telescope Science Institute); Ms MONTILLA, Clarinda (University of Canterbury); Ms STEED, Micaela (University of Canterbury); Dr WANG, Qinan (Massachussetts Institute of Technology); Dr RIDDEN-HARPER, Ryan (University of Canterbury); Ms REST, Sofia (Johns Hopkins University); Mx COLLABORATION, and (Various)

Presenter: LANE, Zachary (University of Canterbury)

Session Classification: Poster

Contribution ID: **67** Type: **Poster**

KAKAPO: A Kepler and K2 Transient detection Pipeline

Monday, July 7, 2025 12:06 PM (1 minute)

We present *KAKAPO*, the *Kepler and K2 Analysis of Phast-evolving Objects* pipeline for detecting transients in the *Kepler/K2* space telescope. *KAKAPO* reliably recovers known transient events using effective Point-Spread Function Correlation matching and is currently searching for new events. In this poster we present the pipeline and the initial results.

Author: LANE, Zachary (University of Canterbury)

Co-authors: REST, Armin (Space Telescope Science Institute); Mr SHUKAWA, Koji (Johns Hopkins University); Dr WANG, Qinan (Massachussetts Institute of Technology); Dr RIDDEN-HARPER, Ryan (University of Canterbury); Ms REST, Sofia (Johns Hopkins University)

Presenter: LANE, Zachary (University of Canterbury)

Session Classification: Poster

Contribution ID: **68** Type: **Oral**

Searching for escaped cosmic rays from supernova remnants using Fermi-LAT data

Monday, July 7, 2025 4:15 PM (15 minutes)

The origin of cosmic rays has been an active area of research since their discovery over a century ago. Supernova remnants (SNRs) are believed to be able to accelerate cosmic rays up to the 'knee' of the observed cosmic-ray spectrum via diffusive shock acceleration, a feature likely indicating the maximum cosmic-ray energy achieved in our Galaxy. Although the acceleration at SNR shocks has been extensively modelled, it is still not observationally clear that cosmic rays are able to escape these sources. After acceleration, cosmic rays may escape the shock front and diffuse into the surrounding environment where they could interact with ambient gas to produce gamma rays. Detection of gamma-ray emission outside the observed shell of an SNR will provide evidence for cosmic-ray escape from SNRs. We outline here an approach to search for escaped cosmic rays from SNRs using Fermi-LAT data. We will discuss our methods to perform both a morphological and spectral analysis for a SNR, and present preliminary results for a selection of Galactic SNRs, including W28. We aim to use these results to perform multi-wavelength spectral modelling for the SNRs.

Author: PILOSSOF, Jemma (University of Adelaide)

Co-authors: Prof. ROWELL, Gavin (University of Adelaide); EINECKE, Sabrina (University of Adelaide)

Presenter: PILOSSOF, Jemma (University of Adelaide)

Session Classification: Compact / High-Energy Objects

Contribution ID: **69** Type: **Poster**

Dependence of stellar populations on local and global galaxy structure

Tuesday, July 8, 2025 12:45 PM (1 minute)

The stellar populations and their distributions in and around galaxies record the evolutionary history of a galaxy. The gas from which stars form may have experienced dilution from pristine gas or enrichment from previous generations of stars. Alternatively, enriched gas may escape through stellar winds or AGN feedback in a shallow potential well. The structure and depth of the local gravitational potential are thus thought to play a crucial role in a galaxy's ability to retain gas and continue to form stars. Signatures of these processes may therefore be reflected in the spatial distribution of the stellar population parameters (ages, metallicities, and alpha-element abundances).

In my poster, I will present how stellar population gradients vary with global galaxy structure parameters (such as Sérsic index, effective radius, visual morphology, etc.) in MAGPI (z = 0.3) galaxies. I will also present the impact of the local gravitational potential (probed via the enclosed dynamics and galactocentric distance) and local angular momentum (local j_s and/or λ) on local stellar populations.

To determine the stellar population radial metallicity and alpha-abundance gradients, I have radially binned the MAGPI galaxies and employed pPXF (Cappellari et al. 2023) to fit the stellar continuum and thus obtain metallicity and alpha-abundance values across different radial bins. Following this, I calculated the slopes of these gradients and analysed the correlations with structural parameters such as Sérsic index, size, and visual morphology.

Author: TYAGI, Udit Kumar (UNSW Sydney)

Co-author: Dr FOSTER, Caroline (UNSW Sydney)

Presenter: TYAGI, Udit Kumar (UNSW Sydney)

Session Classification: Poster

Contribution ID: **70** Type: **Oral**

The Fate of Globular Cluster Substructure: From Accretion to Diffusion in Galaxy Halos

Wednesday, July 9, 2025 4:15 PM (15 minutes)

Globular clusters (GCs) are key tracers of galaxy assembly, providing crucial insights into stellar halo formation. Using the Feedback in Realistic Environments (FIRE) simulations with a post-processing GC formation model, we investigate the accretion of GCs from dwarf galaxies into Milky Way-mass hosts and the processes that shape their kinematic evolution. We explore how changes in the gravitational field in conjunction with the destruction of GCs drives the diffusion of substructure. By quantifying diffusion timescales and measuring GC migration distances in kinematic space, we evaluate how effectively GC kinematics can be used to reconstruct past merger events.

Author: PAL, Finn (University Of New South Wales)

Presenter: PAL, Finn (University Of New South Wales)

Session Classification: Galaxies

Contribution ID: **71** Type: **Oral**

Revised Open Cluster Membership Probabilities in GALAH DR4 and their Abundances and Kinematics

Monday, July 7, 2025 10:00 AM (15 minutes)

The radial migration and chemical evolution of the stars in the Milky Way disc can be studied through the dynamics, distribution and chemical abundances of open clusters. With the latest GALAH DR4 catalogue, we are now able to work with refined stellar parameters and up to 30 elemental abundances per star. I will present my work on obtaining a revised catalogue of open cluster stars, with 76 clusters with a total of 29097 stars with membership probabilities above 50%. This work uses the DBSCAN clustering algorithm to cluster the stars using Gaia astrometry and GALAH radial velocity. I will present the resulting cluster orbits in the Galaxy, the internal light-element abundance dispersions, and radial gradients of metallicity and alpha elements across the disc.

Author: MUKHERJEE, Shourya (University of New South Wales)

Co-author: Prof. MARTELL, Sarah (University of New South Wales)

Presenter: MUKHERJEE, Shourya (University of New South Wales)

Session Classification: Methods & Applications

Contribution ID: **72** Type: **Oral**

Image Reconstruction with the James Webb Interferometer

Thursday, July 10, 2025 10:45 AM (15 minutes)

Flying on board the James Webb Space Telescope (JWST) above Earth's turbulent atmosphere, the Aperture Masking Interferometer (AMI) stands as the highest resolution optical interferometer ever placed in space.
However, imaging is severely limited by non-linear detector systematics, particularly charge migration known as the brighter-fatter effect (BFE).
Conventional interferometric Fourier observables are seriously distorted by non-linear transformations in the image plane.
To combat this, I have developed a regularized maximum-likelihood image reconstruction algorithm operating entirely in the image plane.
This is made possible by a differentiable forward-modeling approach, and facilitates the recovery of astrophysical structure at unprecedented resolution.
In this talk, I will walk through this method and present imaging results from multiple AMI datasets: volcanic activity on Io, protoplanetary disk systems, and AGN cores.
I will discuss the advantages of this methodology and the importance to mitigate non-linear effects in space and ground-based optical imaging.

Author: CHARLES, Max (University of Sydney)

Co-authors: Prof. POPE, Benjamin (Macquarie University); Mr DESDOIGTS, Louis (University of Sydney); Prof. TUTHILL, Peter (University of Sydney)

Presenter: CHARLES, Max (University of Sydney)

Session Classification: Methods & Applications

Contribution ID: **73** Type: **Oral**

Gamma-ray View of the Transient Sky

Tuesday, July 8, 2025 4:00 PM (15 minutes)

The gamma-ray emissions of transient phenomena provide critical insight into the nature of the most extreme environments in the Universe. Observing the energetic outbursts of active galactic nuclei, supernovae, neutron star mergers, tidal disruption events, and a variety of Galactic sources at GeV to TeV energies is a crucial component of modern multi-wavelength and multi-messenger studies. Transient astronomy is thus expected to rapidly expand as next-generation gamma-ray facilities come online, such as the Cherenkov Telescope Array Observatory (CTAO) and the Southern Wide-field Gamma-ray Observatory. Quickly following up on the triggers of radio and optical telescopes, such as from the upcoming Vera C. Rubin Observatory, will be essential for comprehensive multi-wavelength studies. Probing the nature of gamma-ray transients could be assisted by establishing a transient-focused worldwide network of Cherenkov telescopes, particularly in the Southern Hemisphere. In this talk, I will introduce the different classes of transients in the gamma-ray sky and provide an overview of the related CTAO key science projects. In addition, I will present the prospects of re-establishing gamma-ray telescopes in Australia.

Author: LEE, Simon

Presenter: LEE, Simon

Session Classification: Transients

Contribution ID: **74** Type: **Oral**

Long-period radio transients and where to find them

Tuesday, July 8, 2025 5:15 PM (15 minutes)

Long-period radio transients represent a newly identified class of astronomical objects with emission periods lasting minutes to hours. Their origins remain uncertain, with highly magnetised white dwarfs and neutron stars as leading candidates. These objects emit polarised, coherent, and beamed radio signals, resembling pulsars. Standard models suggest pulsars cease emitting as they slow down, yet these transients defy that expectation, challenging existing theories of compact stellar objects and radio emission mechanisms.

In the first part of my talk, I will present the discovery of ASKAP J1839−0756, the longest-period known radio transient, with a 6.45-hour period. Its emission pattern suggests an ordered dipolar magnetic field, featuring bright pulsar-like main pulses and weaker inter-pulses offset by half a period—indicative of an oblique or orthogonal rotator. This phenomenon, observed for the first time in a long-period radio transient, confirms that the emission originates from both magnetic poles and directly links the observed period to its rotation. Spectroscopic and polarimetric properties of ASKAP J1839−0756 support a neutron star origin, providing key insights into long-period radio sources.

In the second part, I will present results from a recent radio survey at low Galactic latitude, attempting to identify additional long-period transients. Using the VASTER pipeline, which generates continuum-subtracted 10-second images from ASKAP EMU data, we searched for minute-timescale transients near the Galactic plane. Although no long-period transients were found, we discovered six radio transients from main-sequence or dwarf stars, including three previously unknown sources. This study places more stringent limit on the surface density of radio transients and offers insights for future transient survey strategies.

Author: LEE, Yu Wing Joshua (University of Sydney)

Presenter: LEE, Yu Wing Joshua (University of Sydney)

Session Classification: Transients

Contribution ID: **75** Type: **Oral**

Tracing Globular Cluster Escapees in the Galactic Halo with GALAH DR4

Tuesday, July 8, 2025 5:45 PM (15 minutes)

We are expanding on previous work on globular cluster stars that have escaped into the halo field using the fourth data release from the Galactic Archaeology with HERMES (GALAH) survey. We use a purely kinematic selection to identify both red giant and dwarf stars on halo orbits and investigate the utility of GALAH light element abundances for identifying second-population GC stars in that catalog. We identify GC-like candidate members via Na-Al abundance kernel density estimation (KDE) contours based on enriched GC populations obtained from previous works. Past studies estimate that 2–3% of field stars originate from GCs and exhibit second-population abundance signatures, and our preliminary analysis finds that a similar fraction in GALAH DR4 are notable outliers in oxygen, sodium, and aluminium. We compare their metallicities and orbital properties to the halo GC population and major accreted substructures like Gaia-Enceladus and Sequoia to trace their origins. In the future, we will use Feedback in Realistic Environments (FIRE) simulations to assess the contribution of such dissolved GC stars to the halo field and compare to other theoretical predictions for the fraction of halo stars originating in globular clusters. Overall, this project aims to illuminate the connections between accretion, mass loss, and cluster destruction in the assembly of stellar halos.

Author: SAIKIA, Siddhartha (UNSW Sydney)

Co-author: Prof. MARTELL, Sarah (UNSW Sydney)

Presenter: SAIKIA, Siddhartha (UNSW Sydney)

Session Classification: Stars

Contribution ID: **76** Type: **Oral**

Milliseconds, Minutes, and Mysteries: The New Era of Radio Transients

Tuesday, July 8, 2025 4:15 PM (15 minutes)

The quest for radio transients has evolved into a thriving field, driven by the rise of wide field-of-view telescopes. In recent years, two remarkable classes of extreme coherent radio transients have emerged: long-period transients, with pulse durations from minutes to hours, and fast radio bursts, with pulse durations from microseconds to tens of milliseconds. Intriguingly, the long-period transients are lighting up from the compact object "graveyard," where traditional models predict they should no longer be detectable in the radio. Zombie stars, anyone? Emerging theories, coupled with observational data, reveal striking similarities in the spectral, temporal, and polarimetric properties of long-period transients and fast radio bursts. While the exact origins of FRBs remain unclear, the 2020 detection of a fast radio bursts-like pulse from the Galactic magnetar SGR 1935+2154 confirmed that magnetars can produce such bursts, at least in some cases. But many questions remain: Are all fast radio bursts from magnetars? What powers their extreme emission? And could long-period transients be their evolutionary cousins?

In this talk, I will highlight recent discoveries from the ASKAP and MeerKAT telescopes that are reshaping our understanding of fast radio bursts and long-period transients. Early JWST follow-up has begun to uncover fast radio bursts in distant, high-redshift environments, offering new clues about their origins and strengthening their potential as cosmological probes. I will also discuss how next-generation facilities like the SKA will revolutionise the field through population studies and new tests of fundamental physics.

Author: CALEB, Manisha (The University of Sydney)

Presenter: CALEB, Manisha (The University of Sydney)

Session Classification: Transients

Contribution ID: **77** Type: **Oral**

Tessellating the Stars with Jewel Aperture Masking

Monday, July 7, 2025 10:30 AM (15 minutes)

Now more than 150 years old, the technique of aperture masking interferometry has played a crucial role in high angular resolution astronomy, allowing ground-based observatories to achieve sub-seeing-limited precision. Today, when complemented with adaptive optics, aperture masking continues to provide high-resolution observations, pushing beyond the classical diffraction limit. However, traditional masking methods are heavily restricted both in sensitivity and spatial information in order to meet the requirement of non-redundancy. In order for a mask to be considered non-redundant, the number of holes, or sub-apertures, across which the science signal is sampled, is severely limited, usually resulting in a throughput of 10% or less. Jewel Masks, a novel optic developed at the University of Sydney, enable high-sensitivity aperture masking and preserves the information of the full pupil. Through the use of perforated wedged windows, Jewel masks combine multiple non-redundant patterns onto a single mask, tessellating the entire pupil with sub-aperture holes. In my talk I will cover the design and optical forwards modelling empowering Jewel masks along with the expected science and metrology applications, with first use on the Subaru Telescope.

Authors: Mr TARAS, Adam (University of Sydney); PIROSCIA, Grace (University of Sydney); TUTHILL, Peter (University of Sydney)

Presenter: PIROSCIA, Grace (University of Sydney)

Session Classification: Methods & Applications

Contribution ID: **80** Type: **Oral**

From Reionization to Cosmic Noon: Tracing galaxy evolution and gas kinematics with Lyman Alpha Emitters

Monday, July 7, 2025 5:00 PM (15 minutes)

Hydrogen Lyman-alpha (Lyα) emission is a powerful tool for probing the high-redshift Universe. The emergent Lyα spectra provide insights into the kinematics of the circumgalactic medium (CGM) and the structure of the interstellar medium (ISM) in Lyα emitters (LAEs). Additionally, determining the timing of reionization and identifying sources capable of emitting sufficient ionizing photons (Lyman-continuum or LyC) remain key open questions in astrophysics. Direct detection of LyC photons beyond z>4 is challenging due to strong intergalactic medium (IGM) attenuation. However, Lyα emission serves as a crucial indirect tracer of LyC leakage. We use VLT/MUSE data to study spatially resolved LAEs from cosmic noon to the epoch of reionization. We develop an automated method that classifies Lyman-alpha spectra as single, double, or triple-peaked. We discover that only 3% of double-peaked emitters show a dominant blueshifted peak, suggesting strong gas inflows. We perform global and spatially resolved radiative transfer modeling of double-peaked profiles to investigate gas kinematics, ISM properties, and the conditions that enable Lyα and LyC photon escape. We also explore the survival of Lyα photons in luminous LAEs exhibiting broad Lyα line profiles during the reionization era. Our findings reveal that high-luminosity LAEs at z>6 is more likely to reside in highly ionized regions, reducing the impact of IGM scattering. This work deepens our understanding of the patchy reionization process and the evolution of the early Universe.

Author: MUKHERJEE, Tamal (Macquarie University)

Presenter: MUKHERJEE, Tamal (Macquarie University)

Session Classification: Cosmology & Dark Universe

Contribution ID: **81** Type: **Poster**

A star formation-driven outflow caught in the act of quenching a satellite galaxy

Monday, July 7, 2025 12:47 PM (1 minute)

Stellar feedback is thought to play a key role in regulating the gas-star formation cycle in galaxies, disrupting star-forming regions and driving outflows that can suppress star formation. However, most insights into these mechanisms come from starburst galaxies, limiting our broader understanding of their impact on galaxy evolution. In this talk, I will present the discovery of an ionized gas outflow in NGC 4064, a Virgo cluster satellite that has been almost completely stripped of its cold gas reservoir after pericenter passage. The ongoing MAUVE (Multiphase Astrophysics to Unveil the Virgo Environment) survey, using MUSE's exquisite spatial resolution, has allowed us to characterise an outflow in a galaxy with a star formation rate ~0.6 dex below the star-forming main sequence. Remarkably, we find a mass loading factor comparable to that of starburst galaxies, demonstrating the significant impact it has on the remaining gas reservoir. This discovery reinforces our understanding of the role of outflows in quenching star formation, even in low-activity galaxies, and provides new insights into stellar feedback physics across the galaxy population.

Author: ATTWATER, Amy (University of Western Australia)

Presenter: ATTWATER, Amy (University of Western Australia)

Session Classification: Poster

Contribution ID: **82** Type: **Oral**

MAVIS - A new facility instrument for the ESO VLT Adaptive Optics Facility

Tuesday, July 8, 2025 3:10 PM (10 minutes)

MAVIS (MCAO Assisted Visible Imager and Spectrograph) is a new facility instrument for the ESO VLT being built by an Australian (Astralis - lead), Italian (INAF) and French (LAM) consortium. MAVIS pushes the frontier of new instrument technologies to provide, for the first time, wide-field, diffraction-limited angular resolution at visible wavelengths. Enhancing the VLT Adaptive Optics Facility, MAVIS will use multi-conjugate adaptive optics (MCAO) to feed a 4k × 4k imager covering 30 × 30 arcseconds, as well as a powerful Integral Field Spectrograph (IFS). Angular resolution down to 18 milliarcseconds will be achieved at 550 nm (V band), making MAVIS a powerful complement to infrared-optimised facilities like JWST and ELT. The IFS will provide four spectral modes, with resolutions from 4,000 to 15,000 between 370-935 nm. This enables a wide variety of science cases, spanning themes that include the emergence of the Hubble sequence; resolving the contents of nearby galaxies; star clusters over cosmic time; and the birth, life, and death of stars and their planets. MAVIS builds on the success of MUSE Narrow Field Mode at the VLT, extending to bluer wavelengths and higher spectral resolution (complementing BlueMUSE), larger field size and angular resolution for imaging capabilities, and dramatically higher AO-corrected sky coverage, including most of the sky. I will present an update on the MAVIS project and science, highlighting its complementarity to the suite of ESO capabilities in the coming decade.

Author: MCDERMID, Richard (Macquarie University)

Presenter: MCDERMID, Richard (Macquarie University)

Session Classification: Mini-Session

Contribution ID: **83** Type: **Oral**

Disentangling AGNs from Stellar contributions to the Cosmic Spectral Energy Distribution

Monday, July 7, 2025 10:30 AM (15 minutes)

A galaxy's total radiation arises from a combination of processes including star formation, dust and gas reprocessing, accretion, and magnetic interactions. While star formation typically dominates the optical and infrared emission of galaxies, AGNs contribute significantly at X-ray, mid-infrared, and radio wavelengths. Even a modest AGN contribution can bias key derived quantities such as stellar mass, star formation rate, and dust properties. To improve the accuracy of these measurements, it is essential to move beyond simple galaxy/AGN classifications and systematically disentangle their respective contributions. As a step toward this, we extend the GAMA catalog by incorporating new radio data from the SWAG-X survey and X-ray data from eROSITA for 5,258 sources within redshift $z < 0.1$ in the G09 region. We perform multiwavelength Spectral Energy Distribution (SED) fitting from ultraviolet to radio using ProSpect to derive stellar masses and star formation rates for these sources. For the first time, we present a Cosmic Spectral Energy Distribution (CSED) spanning X-ray to radio wavelengths, constructed by stacking the SEDs of individual galaxies, providing a more complete view of the integrated energy output of the nearby Universe.

Author: NAGARAJAN RAJKUMAR, Kavin Kumar (International Centre for Radio Astronomy Research - University of Western Australia)

Presenter: NAGARAJAN RAJKUMAR, Kavin Kumar (International Centre for Radio Astronomy Research - University of Western Australia)

Session Classification: AGN

Contribution ID: **86** Type: **Oral**

The hidden population of pulsars in Terzan 5

Monday, July 7, 2025 4:45 PM (15 minutes)

We present the deepest radio continuum observations of the Galactic globular cluster Terzan 5. While past timing surveys of Terzan 5 have been highly successful, discovering nearly 50 pulsars, continuum imaging offers a complementary approach to identifying and characterising these sources. Imaging is especially useful for finding eclipsing pulsars, which are often difficult to identify in timing searches. We find a small number of new candidate pulsars, though many more likely remain undiscovered. To this end, we have developed a novel method for constraining the total pulsar population by studying the shot noise characteristics and residual emission produced by faint unresolved pulsars.

Author: URQUHART, Ryan (Michigan State University)

Presenter: URQUHART, Ryan (Michigan State University)

Session Classification: Compact / High-Energy Objects

Contribution ID: **87** Type: **Poster**

Analysing feedback in low redshift galaxies via emission line kinematics with GAMA and KOALA

Monday, July 7, 2025 2:33 PM (1 minute)

The problem of resolving both AGN and star formation feedback, operating through galactic-scale outflows, remains constrained by the limited spectral resolution of many ongoing galaxy surveys. Detecting outflows (as well as inflows) via emission-line kinematics from ionised species depends on multi-component fitting, which is highly sensitive to goodness-of-fit, overfitting criteria and statistical biases, especially in low signal-to-noise regimes. This often skews the characterisation of such phenomena to the detriment of weak and low-luminosity cases in the optical range of low-redshift galaxy spectra. We present a study in which we use a model based on the peak virial equilibrium velocity, $V_{\rm peak}$—which accounts for the dark matter mass content in the galaxy-halo system—to investigate the relationship between gas kinematic distortion in both star-forming and AGN galaxies (classified using classical techniques) and star formation quenching, as an alternative continuum-like approach. We use data from the GAMA survey for broad statistical analysis, as well as IFS data from the KOALA + AAOmega instrument in the AAT for a spatially resolved, case-by-case study. Our method involves using the ratios of the velocity dispersions of the four emission lines most commonly employed in BPT classification (Hβ, Hα, [OIII], [NII]) over $V_{\rm peak}$, interpreting this ratio as a proxy for kinematic disturbance—quantifying interplay between feedback-driven turbulence and gravitational support—and analysing its behaviour in relation to star formation parameters. Our results indicate that galaxies appropriately segregated by these ratio values follow distinct sequences in star formation-related scaling relations. In particular, we find that galaxies in the high-disturbance group exhibit a truncated power-law behaviour in their $L_{\rm line}/M_\star$ vs. ΔMS and $\log$ sSFR planes, while those in the low-disturbance group follow a linear trend.

Author: CARRILLO MARTINEZ, José Luis (Macquarie University)

Co-authors: Dr LOPEZ SANCHEZ, Angel Rafael (Macquarie University); Ms WEBB, Jacinda (Macquarie University); Dr ZAFAR, Tayyaba (Macquarie University)

Presenter: CARRILLO MARTINEZ, José Luis (Macquarie University)

Session Classification: Poster

Contribution ID: **89** Type: **Oral**

From AAVSs to AA0.5: observational highlights on the path to SKA-Low science commissioning

Thursday, July 10, 2025 10:45 AM (15 minutes)

The Aperture Array Verification Systems (AAVS), developed between 2014 and 2024 by a large international collaboration between the SKA Organization/SKAO and partner institutes and Universities, were a critical steppingstone in the path to SKA-Low. Originating from the need to validate novel antenna designs, signal processing systems, and station-level infrastructure for SKA-Low, they significantly improved the performance and operational readiness of Low telescope stations. With SKA-Low now entering its science commissioning phase, their value is evident.
In this talk, I will provide a high level review of the AAVS's history, focusing on the major results obtained through full single station astronomical observations. Particularly, those achieved during AAVS2 and AAVS3 phases, that led to deep insights into station sensitivity, stability, and polarisation performance were achieved through dedicated calibration and all-sky imaging techniques.
The outputs of the AAVSs retired risk, proved subsystems, and made a major contribution to allow SKA-Low to pass the final Design Review.
The observational experience from AAVS campaigns now underpin the early science commissioning results of SKA-Low's Array Assembly 0.5 (AA0.5) phase.

Author: Dr MACARIO, Giulia (SKAO/INAF)

Presenter: Dr MACARIO, Giulia (SKAO/INAF)

Session Classification: Surveys & Facilities

Contribution ID: **90** Type: **Oral**

The Driving Mode of Turbulence in Extragalactic Sources

Friday, July 11, 2025 10:45 AM (15 minutes)

Turbulence fundamentally shapes the density structure and star-formation activity of the interstellar medium, yet almost all evaluations of extragalactic star formation models assume a spatially uniform driving mode. In reality, the balance between solenoidal (divergence-free) and compressive (curl-free) forcing can vary on scales as small as individual molecular clouds, with profound consequences for gas fragmentation and star formation efficiency. With the precise, spatially resolved measurements of the driving mode of turbulence within a galaxy, we can now begin to refine star formation modelling further. In this talk I will present spatially resolved measurements of the turbulence driving parameter across the face of the large spiral galaxies NGC 7793 and NGC 1313. Using high-resolution CO ($J = 2 - 2$) maps from the Atacama Large Millimeter/submillimeter Array, I present the first full-galaxy measurements of the turbulence driving parameter in NGC 7793 and NGC 1313 complimenting the results from simulations, the Milky Way and its satellites. We find that arms, interarms, rings, and outskirts each exhibit distinct driving modes and turbulent conditions, implying that any realistic star-formation model must ingest spatially varying turbulence inputs. Going forward, incorporating the spatial variance of turbulent driving is essential to develop star formation models with unprecedented fidelity.

Author: MILLER, Lewis

Co-authors: Prof. FEDERRATH, Christoph; Dr GRASHA, Kathryn

Presenter: MILLER, Lewis

Session Classification: Stars

Contribution ID: **91** Type: **Oral**

From PhD to Profession: Understanding the experiences and career outcomes of observational astronomy PhD graduates

Thursday, July 10, 2025 3:10 PM (10 minutes)

Astronomy is one of the fastest-growing areas of research in Australia. In general, enrolment in postgraduate study in Australia has grown by 45% over the last two decades; in contrast, in astronomy, the number of PhD graduates has grown by 250%. As documented in the 2026-2035 decadal plan, the number of PhD graduates far exceeds the availability of Postdoctoral positions. In addition, the current geopolitical instability has meant that many Astronomy PhD graduates are being driven to seek employment in industry and government. In 2025, we conducted a series of 30 interviews with astronomy PhD graduates. Themes in these interviews included motivations towards embarking on a PhD, the PhD experience, the skills developed during a PhD, and, critically, the considerations and choices associated with transitioning from an astronomy career. Participants were selected to reflect a vertical slice of the observational astronomy community, including individuals who completed their PhD between 2003 and 2023, as well as other key demographics, including gender and whether they were a domestic or international student. The insights from these interviews offer a timely reflection on the evolving role of the astronomy PhD and a critical reference to consider how we best prepare researchers for diverse futures beyond academia.

Author: WALSH, Hugo (Swinburne University of Technology)

Presenter: WALSH, Hugo (Swinburne University of Technology)

Session Classification: Town Hall

Contribution ID: **92** Type: **Poster**

Scale Up of SKAO Science Operations

Tuesday, July 8, 2025 11:33 AM (1 minute)

As operations for the SKA-Low telescope ramp up, scaling the operator team to support 24/7 observations presents both logistical and technical challenges. This talk outlines our implementation of a 'follow-the-sun'style model between teams in Australia, South Africa and the UK, and the training strategy developed to ensure consistent knowledge transfer and operational readiness across sites. Common challenges encountered during observations will be examined, along with the interim, creative solutions developed in the absence of fully deployed operational tools. The session will provide insight into the collaborative practices enabling continuous observations and the opportunities arising in this transitional phase of operations.

Author: GRIGOROFF, Lucy (CSIRO/SKA)

Presenter: GRIGOROFF, Lucy (CSIRO/SKA)

Session Classification: Poster

Contribution ID: **93** Type: **Poster**

Opportunities with the SKAO

Tuesday, July 8, 2025 11:31 AM (1 minute)

The Square Kilometre Array Observatory (SKAO) will be the world's largest radio telescope and is currently well into construction in both South Africa and Western Australia. As an organisation it has also grown rapidly in the last few years with more than 330 staff now worldwide, including more than 100 based in Australia. This poster will outline the current and future opportunities that might be of interest to the ASA community, including in particular the Operator / Data Analyst role and Operations Scientist role within Science Operations, roles within Science Commissioning, as well as other roles within the Organisation that have parallels with the skills of the community.

Author: GREEN, Jimi (SKAO)

Presenter: GREEN, Jimi (SKAO)

Session Classification: Poster

Contribution ID: **94** Type: **Poster**

Imaging with SKA-Low: current and future capability

Tuesday, July 8, 2025 11:32 AM (1 minute)

SKA-Low construction is fully underway and making rapid progress. At this early stage, four stations are available for use as an integrated interferometric array. The SKA-Low Science Commissioning team has been able to demonstrate basic array calibration and has produced a first image from this initial test array. In this poster we will demonstrate imaging outcomes from the first four SKA-Low stations and highlight expected imaging performance through the staged deployment process leading eventually to transformational capability of the full array.

Author: HEALD, George (SKA Observatory)

Presenter: HEALD, George (SKA Observatory)

Session Classification: Poster

Contribution ID: **95** Type: **Oral**

Cataloging the dynamic sky with the TESSELLATE Sky Survey

Tuesday, July 8, 2025 4:45 PM (15 minutes)

In the last seven years the *TESS* space telescope has observed thousands of fast transients that have gone undetected, until now. With the TESSELLATE pipeline we are now searching all of the high-cadence Full Frame Images (FFIs) recorded by *TESS* for transient and variable phenomena. From processing less than 10% of the data from *TESS*, we have generated millions of detections which include asteroids, stellar flares, variable stars, novae, dwarf novae, gamma-ray bursts and other fast transients. Light curves generated by TESSELLATE are vetted and sorted both algorithmically and by citizen scientists with the Cosmic Cataclysms Zooniverse project. Through the work of citizen scientists we have now identified over 5000 transients observed at a 10-minute cadence. In this talk I will present the first release of the open-source TESSELLATE Sky Survey, and highlight key transients discovered by the survey.

Author: RIDDEN, Ryan (University of Canterbury)

Co-authors: Mr MOORE, Andrew (University of Canterbury); LEICESTER, Brayden (University of Canterbury); MONTILLA, Clarinda (University of Canterbury); Mx COSMIC CATACLYSMS COLLABORATION; ROXBURGH, Hugh (Curtin University); LANE, Zachary (University of Canterbury)

Presenter: RIDDEN, Ryan (University of Canterbury)

Session Classification: Transients

Contribution ID: **96** Type: **Oral**

Non-equilibrium chemistry in the Milky Way's nuclear wind

Friday, July 11, 2025 10:30 AM (15 minutes)

Galactic outflows play a crucial role in star formation regulation and the redistribution of gas and metals throughout galaxies. The recent discovery of high-velocity atomic and molecular clouds entrained in the Milky Way's nuclear wind provides a unique opportunity to study these processes at sub-parsec resolution. Although cold clouds are commonly observed in galactic nuclear winds, their survival is surprising, as theoretical models predict their rapid destruction through hydrodynamic instabilities and thermal evaporation

In this talk, I will present new observational and theoretical results indicating that these clouds must be in a state of chemical non-equilibrium and have likely undergone a transition from the disc to their observed positions. Using radiative transfer and thermochemical modelling, I constrain the CO-H_2 conversion factor in the nuclear wind and show that a significant fraction of the molecular gas is dark. These findings provide critical constraints on the survival of cold gas in feedback-driven environments and properties of the galaxy's nuclear wind, but also underscore the need for time-dependent, photochemistry in simulations of galactic evolution.

Author: Ms NOON, Karlie (Australian National University)

Presenter: Ms NOON, Karlie (Australian National University)

Session Classification: Stars

Contribution ID: **97** Type: **Oral**

MAUVE: Tracking the influence of the environment on the gas-star formation cycle of cluster galaxies during infall.

Wednesday, July 9, 2025 10:15 AM (15 minutes)

I will present recent results from the MAUVE (Multiphase Astrophysics to Unveil the Virgo Environment) survey—a multi-wavelength campaign combining VLT/MUSE, ALMA, and HI data for 40 Virgo Cluster galaxies, including an Australian-led MUSE Large Program. MAUVE is designed to investigate how the cluster environment impacts the gas–star formation cycle during galaxy infall.

These observations trace the distribution and kinematics of stars, ionized, and molecular gas down to a few hundred parsecs, enabling detailed studies of how environmental processes affect star formation. Among our key findings are signatures of star formation-driven outflows even in HI-deficient, ram-pressure stripped galaxies, suggesting feedback may play a critical role in quenching. We also find that the warm ionized medium is often ionized by mechanisms other than star formation—unlike in field galaxies—and uncover early evidence for ISM disc reformation and a surprising prevalence of nuclear stellar discs with varied evolutionary paths.

Finally, MAUVE's rich, high-dimensional dataset offers a valuable platform for developing new methods to integrate panchromatic data. I will highlight both the scientific insights and technical challenges arising from this approach. Though still in its early stages, MAUVE is already providing transformative insights into the gas cycle of cluster galaxies and offering key constraints for theoretical models.

Author: Prof. CORTESE, Luca (ICRAR-UWA)

Co-author: Prof. CATINELLA, Barbara (ICRAR-UWA)

Presenter: Prof. CORTESE, Luca (ICRAR-UWA)

Session Classification: Gas

Contribution ID: **98** Type: **Poster**

The search for cold outflows in nearby galaxies: challenges and promises from high-resolution panchromatic studies

Monday, July 7, 2025 12:48 PM (1 minute)

Gas outflows are a key component of our framework for galaxy formation and evolution. They are invoked to regulate star formation, shape the mass–metallicity relation, and drive the transformation of galaxies across cosmic time. While ionized gas outflows are now routinely observed, detecting and characterizing cold gas outflows—particularly in the molecular and atomic phases—remains observationally challenging but critically important. Cold outflows are thought to carry the bulk of the mass ejected from galactic disks and are more directly connected to the star formation reservoir, making them a potentially dominant agent in feedback and quenching processes.

In this talk, I will present an in-depth analysis of the ionized, atomic, and molecular outflows in NGC 4383, observed as part of the MAUVE (Multiphase Astrophysics to Unveil the Virgo Environment) survey. I will discuss the observational and methodological challenges in isolating the cold gas component and show how high-resolution 3D analyses are essential to avoid significant overestimates of the cold gas entrained in the outflow. Our results reveal that atomic hydrogen dominates the mass outflow rate near the disk, but the expelled gas does not escape the galaxy' s potential well and likely falls back after reaching scale heights of only a few kiloparsecs. The molecular gas, while clearly affected by the outflow, appears to be rapidly dissociated after leaving the disk, contributing minimally to mass loss.
Together, these findings demonstrate both the power and limitations of combining VLT, ALMA, and SKA-pathfinder data to study feedback processes. They also underscore the importance of carefully integrating diverse observational constraints to avoid mischaracterizing outflow properties and misinforming theoretical models.

Author: CORTESE, Luca

Co-authors: Dr WATTS, Adam (ICRAR-UWA); Prof. CATINELLA, Barbara (ICRAR-UWA)

Presenter: CORTESE, Luca

Session Classification: Poster

Contribution ID: **99** Type: **Poster**

TESSreduce: Extracting high quality calibrated PSF photometry from TESS

Monday, July 7, 2025 12:57PM (1 minute)

Extracting high quality calibrated lightcurves from TESS Full Frame Images can often be challenging due to high levels of scattered light, low spatial resolution, and broad bandpass. These challenges limit what phenomena that TESS can be used to study. The TESSreduce pipeline solves these challenges by providing flux calibrated PSF photometry for any TESS target with a single line of python code. Through TESSreduce we are able to correct for even the most extreme cases of scattered light backgrounds, and calibrate the photometry to ~0.01mag precision using the well calibrated Pan-STARRS and SkyMapper source catalogs. We will present the current version of TESSreduce and how it can be used to enable open science with TESS.

Author: RIDDEN, Ryan (University of Canterbury)

Co-authors: REST, Armin (Space Telescope Science Institute); Mx COSMIC CATACLYSMS COLLABORATION; WANG, Qinan (Massachusetts Institute of Technology); Dr HOUNSELL, Rebekah (NASA Goddard)

Presenter: RIDDEN, Ryan (University of Canterbury)

Session Classification: Poster

Contribution ID: **100** Type: **Oral**

Hot Gas, Cold Gas, and Stars: Mapping the Halo Baryon Budget in the Local Universe

Wednesday, July 9, 2025 10:30 AM (15 minutes)

Feedback processes, particularly from active galactic nuclei (AGN), play a crucial role in redistributing baryons within dark matter halos. These mechanisms can displace gas to halo outskirts or eject it entirely, resulting in baryon fractions significantly below the cosmic mean—especially in low-mass systems where feedback energy can rival halo binding energy. While simulations such as TNG, SIMBA, and EAGLE predict strong mass-dependent baryon loss, observational constraints remain limited, particularly for low-mass halos.

In this talk, I present a systematic empirical analysis of the baryon content of halos in the local universe across a wide mass range ($10^{10} - 10^{15} M_{\odot}$). Using a compilation of literature measurements and new stacking analyses with eROSITA and ASKAP, we quantify the contributions of hot gas, stars, and cold gas to the total baryon budget. These data enable construction of baryonic mass-to-halo mass scaling relations across all phases, extending down to $10^{10} M_{\odot}$ via individual galaxy measurements.

By combining these relations with the halo mass function, we derive the baryon mass distribution and the cosmic mass densities of stars, HI, and hot gas in bound halos. These results provide new observational constraints on the efficiency of feedback mechanisms across mass scales and inform models of baryon retention, redistribution, and depletion in both group and galaxy-scale systems.

Author: DEV, Ajay (ICRAR - UWA)

Presenter: DEV, Ajay (ICRAR - UWA)

Session Classification: Gas

Contribution ID: **101** Type: **Oral**

First monitoring campaign of a Main-sequence Radio Pulse emitter

Friday, July 11, 2025 10:00 AM (15 minutes)

In my talk, I will present the results from the first monitoring campaign of a Main-sequence Radio Pulse emitter, or MRP. MRPs are main-sequence OBA type stars that emit periodic radio pulses by the electron cyclotron maser emission mechanism. The extra-ordinary stability and simplicity of their magnetic fields set them apart from other magnetic stars on the stellar main-sequence, and also make the MRPs celestial laboratories to understand magnetospheric physics. While spectral properties of the radio pulses from MRPs have been investigated (leading to a wealth of information about how their magnetospheres could operate), the temporal properties remain largely unknown. The key challenge here is the timescale of these pulses. The MRP rotation periods are ~days, so that any monitoring campaign aiming to conduct statistical analysis (e.g. average pulse-profile, drift rates etc.) would be extremely expensive in terms of telescope time. We partially overcame this challenge taking advantage of the stable magnetic properties of MRPs that allows us to reliably predict the pulse arrival times. Under this pilot study, we observed an MRP at 37 epochs using the 16-cm band of the Australia Telescope Compact Array. I will present our initial results that already challenge the current understanding of MRPs, and the potential ways forward.

Author: DAS, Barnali (CSIRO, Space and Astronomy)

Presenter: DAS, Barnali (CSIRO, Space and Astronomy)

Session Classification: Stars

Contribution ID: **102** Type: **Oral**

Disentangling the effects of ram pressure on cluster galaxies using multi-component Gaussian fitting.

Wednesday, July 9, 2025 5:30 PM (15 minutes)

Ram pressure stripping (RPS) is a hydrodynamical mechanism that can strip ISM material from galaxies as they move through the hot intracluster medium (ICM) permeating galaxy clusters. This is a key process in the quenching of star formation as star forming material is effectively removed from the galaxy. Signatures of RPS can be seen in ionised gas emission by studying the kinematics as well as emission line ratios. Evidence of RPS often manifests itself as a truncated gas disk compared to the stellar disk as well as asymmetric gas distributions, often in the form of an ionised gas tail. RPS can also produce shocks in the ISM, which are more rarely observed, and manifest as broad emission lines with different kinematics and emission line ratios compared to star forming regions. These signatures can often be spatially coincident along the line of sight with other ionising sources so similar studies utilising 1-component Gaussian fits are only able to identify the dominant ionising mechanism. To enable the disentanglement of the multiple ionisation sources we implement a multi-component Gaussian fitting routine. This takes advantage of the different kinematic signatures (in terms of velocity and velocity dispersion) and emission line flux ratios associated with different ionising mechanisms. Two SAMI galaxies were identified as RPS candidates and were followed up with the larger FOV KOALA instrument. Utilising the multi-component Gaussian fitting we revealed shock regions at the interface of the ICM and ISM on the leading edge of the galaxy as well as a distinct lack of photoionisation in the ionised gas tails. The lack of star formation in the tails indicates that these galaxies are distinct from so called 'jellyfish'galaxies that have star forming knots in their tails. We are now expanding our sample with other RPS candidates identified in both SAMI and Hector to answer the following questions: (1) do we see shock-like structures in all RP affected galaxies at the ICM-ISM interface? (2) If not photoionisation, what excitation mechanism is ionising the tails? (3) What causes the different manifestations of tails in RP affected galaxies?

Author: QUATTROPANI, Gabriella

Co-author: OWERS, Matt (Macquarie University)

Presenter: QUATTROPANI, Gabriella

Session Classification: Galaxies

Contribution ID: **103** Type: **Oral**

Preparing SKA-Low for Science: Commissioning a Next-Generation Low-Frequency Array

Thursday, July 10, 2025 10:30 AM (15 minutes)

SKA-Low is entering a critical phase as commissioning advances across its growing array of stations in Western Australia. This talk will give an overview of the commissioning work underway, share key milestones—such as the first image and pulsar detections—outlining the early performance. The talk will also describe assessment of current operational success based on a working definition that highlights the volume of successful observations versus those requiring troubleshooting, with visual representation capturing the added complexity of operating during the construction phase. These efforts are laying the foundation for SKA-Low's transformative role in exploring the low-frequency radio Universe.

Authors: SCOTT, Danica (SKAO); HEALD, George (SKA Observatory); MACARIO, Giulia (SKAO/INAF); WAYTH, Randall (SKAO); BHANDARI, Shivani

Presenter: BHANDARI, Shivani

Session Classification: Surveys & Facilities

Contribution ID: **105** Type: **Oral**

Neutrino Astronomy with IceCube at the South Pole

Monday, July 7, 2025 4:00 PM (15 minutes)

The IceCube Neutrino Observatory at the South Pole has been fully operational for over a decade. With a cubic kilometre of deep ice as the detection volume, the detector has seen thousands of astrophysical neutrinos from across the sky. Initially, these were observed as an unresolved diffuse flux, but with recent improvements in event selection and reconstruction the first distinct sources are starting to emerge - the nearby AGN NGC1068 has been revealed as the first steady emitter of high-energy neutrinos. In this talk we will learn how IceCube was constructed in the deep ice, how neutrinos are detected and data analysed to reveal the sources. In addition to the steady source NGC1068, IceCube has revealed that our own galaxy is a source of high energy neutrinos, likely from populations of as-yet unresolved particle acceleration environments in the galactic plane. We will also discuss plans for the future expansion of the detector into IceCube-Gen2 –which would more than double the number of strings in the ice, and vastly expand the detection volume.

Author: HILL, Gary (University of Adelaide)

Presenter: HILL, Gary (University of Adelaide)

Session Classification: Compact / High-Energy Objects

Contribution ID: **106** Type: **Oral**

SPICE: Differentiable Synthetic Spectra Modeling for Stars with Surface Inhomogeneities

Monday, July 7, 2025 10:45 AM (15 minutes)

I present SPICE, a framework designed to efficiently generate time-series synthetic spectra for stars with surface inhomogeneities such as spots, binary occultation, abundance anomalies, radial pulsations, and non-spherical symmetry. These effects have been studied in photometry, interferometry, and spectroscopy before, but there's an unfilled niche for tools capable of processing and fitting large volumes of data.

SPICE incorporates a transformer-based machine learning model for synthesizing spectra across arbitrary wavelength ranges and parameter spaces, significantly reducing computational costs while preserving physical accuracy. I demonstrate several tests and applications of this tool, exploring its impact on both spectroscopic and photometric studies, highlighting the yet untapped potential it will unlock in the era of multi-epoch surveys.

The framework will be released open-source, remaining accessible to a wide audience of researchers. It's implemented in Python and JAX and utilizes state-of-the-art features such as compilation and automatic differentiation, paving the way towards gradient-based optimization of spectra and light curves

Author: JABLONSKA, Maja (Research School of Astronomy & Astrophysics, Australian National University)

Presenter: JABLONSKA, Maja (Research School of Astronomy & Astrophysics, Australian National University)

Session Classification: Methods & Applications

Contribution ID: **107** Type: **Oral**

An Unbroken View of the Milky Way: Continuous Maps of Faint Emission Lines at Sub-Parsec Scales with the SDSS-V Local Volume Mapper

Monday, July 7, 2025 10:15 AM (15 minutes)

The SDSS-V Local Volume Mapper (LVM) survey is delivering unprecedented spectroscopic information about our galaxy, enabling detailed studies of star formation and galaxy evolution across a wide range of spatial scales. LVM is uniquely positioned to map energy and momentum transport, chemical abundances, and the thermal structure of the interstellar medium, down to 0.05 parsecs. Weak emission lines, particularly recombination lines, are essential for robust measurements and for resolving the longstanding "abundance discrepancy problem": the systematic disagreement between methods. But the low signal-to-noise of recombination lines, combined with the sheer scale of LVM's >55 million spectra, makes reliable measurements challenging. To tackle this, we developed a spatially coherent model that infers emission line properties continuously across the sky, fitting hundreds of thousands of spectra at once. It exploits the fact that nearby spectra tend to be similar, making it especially effective for recovering weak recombination lines. We demonstrate the power of this approach through its first application to the LVM Rosette Nebula dataset, recovering spatially resolved maps of faint line emission. This work also led to the development of a state-of-the-art Gaussian Process framework for scalable inference in multi-dimensional problems.

Author: HILDER, Thomas (School of Physics and Astronomy, Monash University)

Presenter: HILDER, Thomas (School of Physics and Astronomy, Monash University)

Session Classification: Methods & Applications

Contribution ID: **108** Type: **Poster**

Uncovering Mass Distributions through Gravitational Time Delays

Monday, July 7, 2025 2:34 PM (1 minute)

Changes in the brightness of fast transients, observed over hours to months, can reveal the mass distribution of galaxies that lie along the line of sight. These galaxies deflect light from the source via gravitational microlensing. The difference in path length of individual rays, paired with variations in gravitational potential, change the arrival time of lensed light. These microlensing time-delays are imprinted in the lightcurves of the source and reflect the internal structure of the intermediate galaxy. These patterns can be recovered by simulating how light rays travel through the lensing galaxies. However, such a process is computationally expensive. We use the Python library JAX to enable fast, efficient computation through just-in-time compilation and GPU acceleration. In light of upcoming observations, the accelerated microlensing computation that we present here will be key in unveiling the large-scale structure of the Universe.

Author: SALAMA, nada (The University of Sydney)

Presenter: SALAMA, nada (The University of Sydney)

Session Classification: Poster

Contribution ID: **109** Type: **Oral**

WD40: a highly elliptically polarised radio white dwarf

Friday, July 11, 2025 10:15 AM (15 minutes)

I will present WD40, a white dwarf first identified as a radio source using circular polarisation searches with ASKAP. WD40 has been observed over 40 times with ASKAP and is highly variable, with flux densities ranging from 1 mJy to 65 mJy. It has been detected 40 times in 15 minute, 888.5 MHz and 943 MHz ASKAP observations but has not been detected in ASKAP observations at higher frequencies or in VLASS at 3 GHz. Follow-up using ATCA revealed highly elliptically polarised, up to 100% linearly and circulatory polarised, bursts. These bursts have a period of ~1.6 hours and are half an hour long or longer, resulting in a duty cycle of >30%. Bursts were detected persistently in two, 9 hour ATCA observations. But only one burst was detected in a subsequent ATCA observation. As well as the time variability, the radio emission from WD40 sharply cuts off at ~1300 MHz, with no emission detected at higher frequencies. The radio emission is coincident with a Gaia source. We confirmed that the source is a white dwarf using optical spectroscopy. The source is 177 pc away and is detected as a variable source in the infrared, optical, and X-ray. The multi-wavelength properties indicate that it may be a new "period-bouncer"white-dwarf-brown dwarf binary, of which there are only 19 known and none have been detected in the radio. I will present this enigmatic source and what we think may be causing its interesting properties.

Author: Dr DRIESSEN, Laura (University of Sydney)

Presenter: Dr DRIESSEN, Laura (University of Sydney)

Session Classification: Stars

Contribution ID: **110** Type: **Oral**

DESI Peculiar Velocity Survey - DR1 Fundamental Plane

Monday, July 7, 2025 4:45 PM (15 minutes)

In this talk I will present the some of the peculiar velocity measurements from the first year of observations from the Dark Energy Spectroscopic Instrument (DESI) which will be used alongside redshift space distortion measurements to constrain the growth rate of structure. Over five years DESI is using a 5000 fibre spectrograph to map 3D positions of tens of millions of galaxies. At the same time we are using the "Fundamental Plane" technique to measure peculiar velocities for about 375,000 early-type galaxies. This sample will be the largest peculiar velocity sample to date, dwarfing the state-of-the-art SDSS catalogue of ˜30,000 peculiar velocities. I will describe the data collection and analysis pipelines, as well as presenting our peculiar velocity measurements for ˜98,000 galaxies in Data Release 1, including analysis of the robustness of our results to selection criteria and our choices for correction parameters.

Author: ROSS, Caitlin (The University of Queensland)

Presenter: ROSS, Caitlin (The University of Queensland)

Session Classification: Cosmology & Dark Universe

Contribution ID: **111** Type: **Poster**

Beaming in Fast Radio Bursts

Monday, July 7, 2025 12:08 PM (1 minute)

Among the mysteries of Fast Radio Bursts (FRBs) is how they direct, or 'beam' their energy. Despite observations of over 1000 FRBs from unique sources, the majority of the leading theories for emission mechanisms include some form of beaming, but this is often ignored for simplicity. Interpretations of features in the energy distribution, such as bimodality and broken power-laws implicitly assume an isotropic or unphysical top hat emission cone. In this work, we approach the FRB beaming problem by simulating FRB bursts with a variety of beam shapes and their effects on different underlying intrinsic energy distributions. Under the most realistic beaming models (e.g. a Gaussian, pulsar-like beam), it is challenging to preserve bimodality and even a break in the power-law of the intrinsic energy function. We find that a large beam area with small intensity variation is the only way to reproduce bimodality. With our new approach, we are able to reproduce bimodality in simulated energy distributions, resembling that of FRB 20201124A and FRB 20121102.

We are also able to simulate a broken power-law energy distribution from a combination of one Gaussian and one relativistic beam, affected by the same intrinsic power-law distribution, energy distribution, showing that the effects of beaming play a significant role in interpreting the intrinsic energy distribution.

Author: MONTILLA, Clarinda (University of Canterbury)

Co-author: Dr JAHNS-SCHINDLER, Joscha

Presenter: MONTILLA, Clarinda (University of Canterbury)

Session Classification: Poster

Contribution ID: **114** Type: **Poster**

Detection of Circular Features using the Hough Transform

Monday, July 7, 2025 12:51 PM (1 minute)

Astronomical images can reveal circular structures arising from various phenomena. For instance, a shock propagating through the interstellar medium can sweep up material, creating voids, while relativistic electrons within shock and magnetic fields generate synchrotron radiation across the radio to X-ray bands. Commonly, these circular features are identified through a mostly manual inspection process; however, the high resolution of modern telescopes and large coverage of state-of-the-art surveys have rendered this approach unviable and impractical. The Hough Transform has previously demonstrated success at detecting circular features in radio images of supernova remnants. However, this application has been limited to individual images of these objects, requiring only a very simplified approach. Here, we explore the application to survey data containing a multitude of potential circular features and an extension of the method to three-dimensional data cubes.
In this contribution, we will introduce a method to identify circular features based on the Hough transform, discuss its challenges and present our extension of the method to apply it to data cubes. We will also present results obtained from applying it to different observations, such as from the Mopra Southern Galactic Plane Carbon Monoxide Survey.

Author: MCLEOD, Georgia (The University of Adelaide)

Presenter: MCLEOD, Georgia (The University of Adelaide)

Session Classification: Poster

Contribution ID: **116** Type: **Oral**

Stellar Cartography: High-Precision Astrometry for Surface Mapping of Nearby Stars

Tuesday, July 8, 2025 4:30 PM (15 minutes)

Observations of the surface of our Sun is one of the key ways to understand solar physics. The tracking of large-scale magnetic surface features, such as sunspots and plages, has provided insights into the solar dynamo, differential rotation, and other phenomena. Yet for most other stars, our knowledge of surface features—and consequently the stars themselves—remains severely limited, especially at the individual rather than population level. Traditionally, stellar surface mapping has relied on interferometry or light curve inversion techniques. However, recent work has demonstrated fundamental limitations in light curve inversion methods, revealing that virtually any light curve can be modelled with just two-star spots, and that these techniques recover at most 50% of the surface information—often significantly less. This work demonstrates that high-precision astrometry offers a superior alternative for stellar surface mapping of nearby stars. Our approach not only yields more comprehensive information about stellar surfaces but also achieves finer "resolution"compared to traditional methods. This new mapping technique can improve our understanding of stellar activity and evolution, paving the way for more accurate models of stellar behaviour and structure.

Author: DEAGAN, Conaire (University of New South Wales)

Presenter: DEAGAN, Conaire (University of New South Wales)

Session Classification: Stars

Contribution ID: **117** Type: **Oral**

A Metal- and Volatile-Rich Comet-Like Tail from the Ultra-Hot Jupiter KELT-9b

Wednesday, July 9, 2025 4:30 PM (15 minutes)

Planets orbiting close to their stars face an intense environment that can dramatically reshape their atmospheres. Among these extreme worlds, the ultra-hot Jupiter KELT-9b stands out as one of the most intensely irradiated planets known, orbiting so close to its star that its atmosphere is actively evaporating into space. Using high-resolution optical observations during the planet's transit, we have detected—for the first time—metals such as sodium and iron escaping into a comet-like tail behind the planet. This groundbreaking observation reveals that powerful stellar radiation can drive not only hydrogen but also heavier, rocky elements out of planetary atmospheres. By modelling the properties of the escaping material, our methods allow us to directly probe the physical properties of the outflow and constrain key parameters such as mass-loss rates and outflow speeds. These escaping metals suggest that the current chemical makeup of hot planets may differ significantly from their primordial compositions. Studying these extreme cases provides a unique opportunity to trace the long-term chemical and dynamical evolution of planetary systems, offering new insights into the evolution of planets across the galaxy.

Author: BORSATO, Nicholas (Macquarie University)

Presenter: BORSATO, Nicholas (Macquarie University)

Session Classification: Planets

Contribution ID: **118** Type: **Oral**

Probing Omega Centauri for an Accreting IMBH: Stringent constraints from radio observations

Monday, July 7, 2025 5:15 PM (15 minutes)

Omega Centauri is the largest and most massive globular cluster in the Milky Way. Due to its size and complex evolution, it has long been considered a promising candidate for hosting an intermediate-mass black hole (IMBH). Recent findings from fast-moving stars in the central region of Omega Cen indicate the presence of a large amount of unseen mass at the core of this cluster. We present results from 172 hours of deep radio observations with the Australia Telescope Compact Array (ATCA) to search for signatures of accretion from a putative IMBH. Our data reaches an unprecedented radio luminosity level of ~10^26 erg/s, making this the most sensitive radio image of Omega Centauri. Despite this depth, we do not detect radio emissions from a suspected IMBH at any of the photometric centers proposed in previous studies. Our finding indicates that either Omega Centauri is unlikely to host an IMBH with mass > 1000 solar mass or that any existing black hole is accreting at an extremely low rate.

Author: MAHIDA, Angiraben (PhD candidate)

Presenter: MAHIDA, Angiraben (PhD candidate)

Session Classification: Cosmology & Dark Universe

Contribution ID: **119** Type: **Oral**

ASKAP Discovery of a Long-Lived Synchrotron Transient: Intermediate-Mass TDE or Orphan Afterglow?

Tuesday, July 8, 2025 10:30 AM (15 minutes)

In synchrotron transients, relativistic or sub-relativistic outflows interact with the surrounding medium, producing shocks that accelerate electrons and amplify magnetic fields. This generates synchrotron radiation observable at radio wavelengths. While the emission mechanism is broadly similar across events, variations in progenitor systems lead to a wide range of outflow velocities, energies, and light curve morphologies. Radio observations are therefore powerful tools for probing the physics of these extreme astrophysical events, from compact object interactions to stellar explosions.

In this talk, I will present the discovery and follow-up of a highly energetic and unusual radio transient identified in the Rapid ASKAP Continuum Survey (RACS), located offset from an actively star-forming galaxy. The source exhibits a 20-fold increase in flux density over 200 days and remains detectable in a declining state more than 1000 days after the initial detection. Follow-up observations with the Australia Telescope Compact Array (ATCA) at 2, 5, and 9 GHz, the Giant Metrewave Radio Telescope (GMRT) at 300–1300 MHz, and MeerKAT in L-band reveal an evolving spectral energy distribution consistent with a synchrotron origin. Plausible interpretations include a relativistic tidal disruption event involving an intermediate-mass black hole or an orphan gamma-ray burst afterglow—both of which are exceptionally rare, with few confirmed examples to date.

Author: GULATI, Ashna (The University of Sydney)

Co-author: Prof. MURPHY, Tara (The University of Sydney)

Presenter: GULATI, Ashna (The University of Sydney)

Session Classification: Transients

Contribution ID: **122** Type: **Oral**

Hints of binary-enhanced dust production for AGB stars

Tuesday, July 8, 2025 10:00 AM (15 minutes)

Asymptotic Giant Branch (AGB) stars are known as key sites of dust production in the Galaxy. Most Sun-like stars with masses in the range 0.8 to 8 $M_{\odot}$ will pass through the AGB phase, during which they will lose a substantial amount of material. This mass loss is powered by radiation pressure through a pulsation-enhanced dust-driven wind. I will present new high angular resolution observations of continuum emission taken with the ALMA telescope. These data show that binary companions to AGB stars also drive dust formation and, in some circumstances, could even increase mass-loss rates and hence alter the duration of the AGB phase. A shorter or longer AGB phase has ramifications for nucleosynthetic yields and the chemical enrichment these stars contribute to the interstellar medium

Author: DANILOVICH, Taissa (Monash University)

Presenter: DANILOVICH, Taissa (Monash University)

Session Classification: Stars

Contribution ID: **123** Type: **Poster**

How atomic hydrogen fuels star formation: new results from the WALLABY survey

Tuesday, July 8, 2025 12:51 PM (1 minute)

Neutral atomic hydrogen (HI) is a key component of the cold gas reservoir that fuels star formation in galaxies. However, global HI scaling relations often show significant scatter, partly because HI typically extends well beyond the stellar discs where most star formation occurs. A major limitation in resolving this connection has been the lack of spatially resolved HI data for large galaxy samples—until now. The WALLABY survey, conducted with the Australian SKA Pathfinder, is addressing this gap by delivering (at least marginally-) resolved HI observations for thousands of nearby galaxies. In this talk, I will present the first measurements of HI mass enclosed within the stellar-dominated regions of ~1000 gas-rich galaxies from WALLABY. I will discuss how constraining HI to the stellar disc affects key scaling relations, focusing on the fraction of HI mass within the disc, average HI surface density, and HI depletion time. The inner HI mass fraction varies widely among galaxies, and this variation is strongly correlated with star formation-related properties. In particular, the average HI surface density within the stellar disc emerges as a key predictor of star formation activity. These results demonstrate the critical role of resolved HI data in uncovering the physical drivers of galaxy evolution.

Authors: CATINELLA, Barbara (ICRAR/UWA); Ms LEE, Seona (ICRAR/UWA)

Presenter: CATINELLA, Barbara (ICRAR/UWA)

Session Classification: Poster

Contribution ID: **124** Type: **Oral**

Fast radio bursts: ASKAP and beyond

Tuesday, July 8, 2025 10:00 AM (15 minutes)

Fast radio bursts (FRBs) are intense pulses of radio emission now known to originate in distant galaxies. They are showing their promise as tools to understand extreme physical processes and environments, and as powerful probes of the diffuse cosmic web of baryons, nearly impossible to study otherwise. One of the key instruments for detecting and studying FRBs has been the Australian SKA Pathfinder, owing to its wide field of view and bespoke FRB detection systems. In this presentation, I will highlight recent discoveries made using ASKAP's latest fast transient detection system, an image based system capable of searching 24 trillion pixels per second. This includes the first repeating FRB source detected with ASKAP, and one of the rare class of FRB originating from an elliptical galaxy. I will discuss how these discoveries are enabling us to use FRBs as cosmological probes and unlock the cause and source of FRB emission. I will conclude by motivating future image plane FRB detection systems, both with the SKA and an all-sky Southern hemisphere aperture array.

Author: SHANNON, Ryan (Swinburne University of Technology)

Presenter: SHANNON, Ryan (Swinburne University of Technology)

Session Classification: Transients

Contribution ID: **125** Type: **Poster**

Mt Kent Observatory: Astronomy meets Space in regjonal Queensland

Tuesday, July 8, 2025 11:36 AM (1 minute)

The University of Southern Queensland operates Mt Kent Observatory as a robotic and remote-access astronomical and space research facility on behalf of Australian and international partners. The site hosts robotic telescopes for MINERVA-Australis exoplanet characterisation, for Stellar Observations Network Group asteroseismology, and for Shared Skies partnership remote-access astronomy. The site also hosts a Small Aperture Robotic Telescope Network station for studies of resident space objects.

Author: Prof. CARTER, Brad (University of Southern Queensland)

Presenter: Prof. CARTER, Brad (University of Southern Queensland)

Session Classification: Poster

Contribution ID: **126** Type: **Oral**

Understanding the origins and properties of the solar wind

Tuesday, July 8, 2025 4:00 PM (15 minutes)

The Sun —like many stars —possesses a wind that streams outwards to fill the heliosphere. Observations of the solar wind show that it is divided into "fast"and "slow"wind streams, whose variabilities, compositions and apparent origins are different. The origin of the slow solar wind remains enigmatic, hampering efforts to predict conditions in near-Earth space. Here we describe ongoing modelling efforts to understand the origin of the slow component of the wind, and the mechanisms responsible for its properties. These involve global modelling of the Sun's magnetic field as well as local models large-scale, adaptive-mesh, magnetohydrodynamic simulations of the solar atmosphere.

Authors: Ms WILKINS, Chloe (University of Newcastle); PONTIN, David (University of Newcastle); Dr DEY, Sahel (University of Newcastle)

Co-authors: YEATES, Anthony (Durham University); ANTIOCHOS, Spiro (NASA/GSFC)

Presenter: PONTIN, David (University of Newcastle)

Session Classification: Stars

Contribution ID: **127** Type: **Poster**

The study of diffuse radio emissions in galaxy groups

Monday, July 7, 2025 12:53 PM (1 minute)

The discovery of diffuse radio emission in galaxy clusters has been key to understanding the physical non-thermal processes shaping large-scale structures. For many years, galaxy groups were not contemplated as distinct astrophysical systems but rather as low-mass extensions of galaxy clusters. In reality, galaxy groups are common yet critical environments for studying galaxy evolution, the nature Intra-group Medium (IGrM), and structure formation. Using Australian Square Kilometre Array Pathfinder's (ASKAP's) deep radio continuum data from the Evolutionary Map of the Universe (EMU) and Deep Investigations of Neutral Gas Origins (DINGO) surveys, we map faint diffuse radio emissions associated with the IGrM —such as halos, relics. These features may originate from Active Galactic Nuclei (AGN) activity, shock fronts, or turbulence within the group environment. Our goal is to identify and characterise these emissions across a statistically significant sample, and to study potential scaling relations between diffuse radio emission and group properties. This work provides critical insights into the role of non-thermal processes in low-mass systems and assess whether the scaling relations observed in galaxy clusters extend into the group regime or not, contributing to a more unified understanding of structure formation across mass scales.

Author: WAGH, Sai (International Centre for Radio Astronomy and Research)

Co-authors: Dr DAVIES, Luke (ICRAR-UWA); Prof. STAVELEY-SMITH, Lister (ICRAR-UWA); Dr VERNSTROM, Tessa (CSIRO)

Presenter: WAGH, Sai (International Centre for Radio Astronomy and Research)

Session Classification: Poster

Contribution ID: **128** Type: **Oral**

Anisotropy and Inhomogeneity of the luminosity function in the local universe

Monday, July 7, 2025 5:30 PM (15 minutes)

The cosmological principle —the foundational axiom that defines modern cosmology —states that the universe is homogeneous and isotropic on large scales. But this assumption, while elegant, must be tested. Recent observations —including the Hubble tension and our unexplained local bulk motion relative to the Cosmic Microwave Background —suggest that the nearby universe may contain structure significant enough to challenge this principle. While these questions have traditionally been approached using high-redshift data, the local universe ($z < 0.1$) may hold equally important clues.

In this project, we use the galaxy luminosity function as a tool to study the distribution of starlight —or luminosity density —across the sky. This provides insight into the underlying mass distribution and whether it aligns with the predictions of a homogeneous universe. Using data from the 6dF Galaxy Survey, 2MASS Redshift Survey, and GAMA, we divide the sky into hundreds of distinct regions and apply a Bayesian hierarchical model to estimate the luminosity function parameters in each region. This approach allows us to capture both local variations and their relation to a global cosmic average.

From this, we construct a 3D map of the stellar luminosity density across the Local Volume (out to ~ 400 Mpc), and measure the statistical variations around the cosmological mean density as a function of redshift and direction on the sky. We also compute the dipole moment of the luminosity density field to constrain the motion of the Milky Way relative to its surroundings, by averaging over scales from 40 to 400 Mpc. This work serves as a foundational step toward the upcoming 4HS survey, where high-completeness, full-sky southern hemisphere data will enable us to refine and extend these analyses with greater depth and precision.

Author: BANSAL, Aryan (Swinburne University of Technology)

Co-authors: TAYLOR, Edward (Swinburne University of Technology); CLUVER, Michelle (Swinburne University of Technology)

Presenter: BANSAL, Aryan (Swinburne University of Technology)

Session Classification: Cosmology & Dark Universe

Contribution ID: **129** Type: **Oral**

The CosmoDRAGoN simulations: radio jet feedback and spectral signatures in cosmological environments

Friday, July 11, 2025 10:45 AM (15 minutes)

Galaxy formation and evolution over cosmic timescales are driven by active galactic nuclei (AGN) feedback. The kinetic-mode feedback of powerful radio jets launched from AGN shock-heat the intra-cluster medium, influence star formation through driven turbulence, and uplift rapidly cooling gas to large cluster radii. There is a clear need to understand and quantify the effects of this feedback for both the interpretation of observational data from present and upcoming radio surveys and the development of accurate cosmological galaxy formation models. Hydrodynamic simulations of (magnetised and relativistic) radio jets in observationally-motivated environments are the key to a detailed understanding of AGN kinetic-mode feedback.

In this talk, I will present new results from the largest suite to date of simulated radio jets in cosmological environments—the Cosmological Double Radio AGN (CosmoDRAGoN) project—which simulates realistic jets in galaxy cluster and group environments drawn from cosmological simulations. These state-of-the-art grid-based magnetohydrodynamic simulations fully capture the pressure-driven collimation and evolution of the initially conical jets out to hundreds of kiloparsecs. By embedding tracer particles in the jet plasma, we calculate synthetic radio spectra for a wide range of jet and environment parameters, observing configurations, and redshifts across both the active and remnant jet phases. Our simulations reproduce key observed features of real radio galaxies. Through controlled comparisons of key jet parameters, including initial jet velocities (non-relativistic and relativistic), magnetised and hydrodynamic jets, and different jet powers and opening angles, we quantify the requirements for accurately representing jet feedback and observable signatures in cosmological galaxy formation models. Both the overall efficiency of jet feedback and the feedback mechanisms (gas heating, uplifting, or jet-driven turbulence) depend strongly on both jet and environment parameters.

Author: YATES-JONES, Patrick

Presenter: YATES-JONES, Patrick

Session Classification: AGN

Contribution ID: **130** Type: **Oral**

A Tale of Two streams

Tuesday, July 8, 2025 5:00 PM (15 minutes)

Stellar streams –formed through the tidal disruption of dwarf galaxies and star clusters –can tell us about the nature of their progenitors as well as the distribution of mass inside their orbits. The Southern Stream Stellar Spectroscopic Survey (S5) employs the Anglo-Australian Telescope (AAT) to study stellar streams, using photometric and proper-motion data to identify candidate member stars, while also using low-resolution and high resolution spectroscopy to obtain radial velocities and abundance information. To date, S5 has explored stream membership, orbit models and progenitors of over a dozen streams in detail. I will present an in-depth study and comparison of two metal-poor, distant dwarf galaxy stellar streams originally identified in the Dark Energy Survey: Elqui and Turranburra. Both streams are rather distant, with Elqui at a Galactocentric distance of 52 kpc and Turranburra at 28 kpc. In previous work, both streams have been found to have moderately high velocity dispersions and low mean metallicities, implying that their progenitors were relatively low-mass –potentially ultra-faint –dwarf galaxies. I will discuss the stellar populations and orbital modelling of these streams and how they relate to the previously studied streams in the Galactic halo. By studying the orbits, chemical compositions, and stellar populations of these streams, we refine our understanding of how the Milky Way has grown through the accretion of dwarf galaxies. This research also sheds light on the mechanisms driving galaxy formation, such as hierarchical mergers, tidal stripping, and the role of dark matter in structuring the cosmic web.

Author: GUDALUR BALASUBRAMANIAM, Adithya (Macquarie University)

Co-authors: Prof. ZUCKER, Daniel (Macquarie University); Prof. MARTELL, Sarah (University of New South Wales)

Presenter: GUDALUR BALASUBRAMANIAM, Adithya (Macquarie University)

Session Classification: Stars

Contribution ID: **131** Type: **Oral**

The WALLABY view of the gas cycle in galaxies

Wednesday, July 9, 2025 10:45 AM (15 minutes)

Extragalactic HI-line surveys are crucial for understanding how cold atomic hydrogen (HI) flows into and out of galaxies and how this process is influenced by the environment. While past HI surveys in the local Universe were limited by the low spatial resolution of single-dish radio telescopes, next-generation instruments such as the Australian SKA Pathfinder (ASKAP) are now transforming the field. In this talk, I will present early results from WALLABY—the Widefield ASKAP L-band Legacy All-sky Blind surveY—which is delivering the most detailed census of HI to date, improving spatial resolution nearly tenfold over ALFALFA, the benchmark single-dish HI survey.
I will highlight new measurements of HI structural parameters across a diverse galaxy sample, including scaling relations between HI size, surface density, and galaxy properties. These reveal unexpected variations in HI distributions, challenging assumptions of uniform disk profiles. I will also discuss how these trends relate to star formation efficiency and the physical processes governing gas regulation in galaxy disks. Finally, I will outline how WALLABY sets the stage for the transformative capabilities of the full Square Kilometre Array in the coming decade.

Author: CATINELLA, Barbara (ICRAR/UWA)

Presenter: CATINELLA, Barbara (ICRAR/UWA)

Session Classification: Gas

Contribution ID: **132** Type: **Poster**

Utilizing Photonic Lanterns for Pre-Compensation Adaptive Optics

Tuesday, July 8, 2025 11:44 AM (1 minute)

Optical communication is an alternative to radio for ground-to-space communication, providing more flexibility, larger bandwidth, and higher security. However, optical links are much more sensitive to the atmospheric turbulence. While downlinks can be corrected with adaptive optics (AO) at the ground terminal, uplinks present a more significant challenge due to power and space constraints. We present a novel method for atmospheric pre-compensation using photonic lanterns as the AO instrument. By altering the intensities and phases of the single-mode end of the photonic lantern, we can tailor the output electric field of the multimode end. A proof-of-concept experiment confirms the pre-compensation correction possibilities of a 3-port photonic lantern for simulated atmospheric turbulence in C-band. Intensity and phase modulators are used to adaptively inject the appropriate superposition of input modes in a three-mode fiber to achieve the desired output. A Stochastic Parallel Gradient Descent (SPGD) algorithm drives the modulation of the single-mode fiber array. We also present a novel simulation framework for photonic lantern pre-compensated AO uplinks, extending results to 7-port and 19-port lanterns.

Author: MALENDEVYCH, Teodor (University of Sydney)

Co-authors: Dr ROSS-ADAMS, Andrew (University of Sydney); Dr BETTERS, Christopher (University of Sydney); Dr LEON-SAVAL, Sergio

Presenter: MALENDEVYCH, Teodor (University of Sydney)

Session Classification: Poster

Contribution ID: **133** Type: **Poster**

Clustering the Interstellar Medium for Gamma-ray Modelling of Galactic Objects

Monday, July 7, 2025 12:50 PM (1 minute)

To reveal the nature of high-energy gamma-ray sources and to understand the associated emission and acceleration mechanisms, we need detailed models capable of reproducing the observed energy spectra and morphologies. Gamma rays can be produced in non-thermal radiation processes involving protons and electrons interacting with the interstellar medium (ISM). These protons and electrons originate from cosmic-ray accelerators, such as supernova remnants or pulsar wind nebulae. The model of the gamma-ray morphology is very sensitive to changes in the distance between the accelerator and ISM gas clouds. However, the estimates of these distances come with large uncertainties, which cannot determine the location of the gas clouds with the precision we require.

In this contribution, we will present preliminary results from our novel method for clustering the ISM. Our clustering determines the 3D pixels belonging to a specific ISM gas cloud, allowing us to individually move clouds and iterate over their physical distances relative to the accelerator. Using the Mopra Southern Galactic Plane Carbon Monoxide Survey, we will analyse the properties of identified interstellar gas clouds, demonstrating the importance of accurate gas locations in 3D modelling.

Author: BARNSLEY, Imogen (University of Adelaide)

Co-authors: Prof. ROWELL, Gavin (University of Adelaide); EINECKE, Sabrina (University of Adelaide)

Presenter: BARNSLEY, Imogen (University of Adelaide)

Session Classification: Poster

Contribution ID: **134** Type: **Oral**

Point source inference using Parametric Cataloguing

Wednesday, July 9, 2025 10:00 AM (15 minutes)

The identification and description of point sources is one of the oldest problems in astronomy; yet, even today an efficient and comprehensive statistical treatment for point sources remains one of the field's hardest problems. For dim or crowded populations, likelihood based inference methods are needed to estimate the uncertainty of the population characteristics. Probabilistic cataloguing is a leading method for this task, and solves the exact problem with Monte Carlo sampling. However, it requires a mathematical formulation that prevents efficient sampling techniques and so is limited to small populations. I present a new formulation of the method that allows the most efficient sampling techniques to be used, enabling the application to an order of magnitude more sources.

Author: COLLIN, Gabriel

Presenter: COLLIN, Gabriel

Session Classification: Methods & Applications

Contribution ID: **135** Type: **Oral**

Detecting and analyzing LEO satellite streaks with MUSE

Wednesday, July 9, 2025 10:15 AM (15 minutes)

The number of low Earth orbit (LEO) satellites is increasing, and they are having a noticeable impact on the quality of a large range of astronomical data. We use archival data from the Multi Unit Spectrographic Explorer (MUSE) to quantify the effects of satellites on the datacubes. MUSE is an integral field unit (IFU) so it captures a spectrum at every pixel in the field of view. Using the *starkiller* package we have searched all MUSE quicklook images for spatially resolved satellite streaks and have extracted many satellite spectra from the impacted observations. We find that LEO satellite spectra are diverse and can be modeled as a solar spectrum with variable levels of atmospheric extinction. Through this process we are able to recover the science targets and build a spectral library for LEO satellites which can be used to inform other spectroscopic surveys.

Author: LEICESTER, Brayden (University of Canterbury)

Co-authors: Dr BANNISTER, Michele (University of Canterbury); RIDDEN, Ryan (University of Canterbury)

Presenter: LEICESTER, Brayden (University of Canterbury)

Session Classification: Methods & Applications

Contribution ID: **136** Type: **Poster**

A Complete Polarization Survey of Southern Bright Stars

Tuesday, July 8, 2025 12:58 PM (1 minute)

We have made the first complete survey of the linear polarization of all southern stars brighter than V=4. The 391 stars have been observed in the g' band to a median precision of 11 parts-per-million, more than 30 times better than previous incomplete surveys. Stars with significant polarization have been studied for variability. The observations allow mapping of the distribution of interstellar dust in the local region. They also allow us to determine which types of stars most commonly show variable (and hence intrinsic) polarization. Among new polarization variables we have discovered and studied in the course of the survey are the O4 supergiant ζ Puppis and the outbursting Be star η Centauri.

Authors: BAILEY, Jeremy (UNSW); COTTON, Daniel V (MIRA); KEDZIORA-CHUDCZER, Lucyna (UniSQ); DE HORTA, Ain (WSU); MELVILLE, Graeme (Uni Wollongong)

Presenter: BAILEY, Jeremy (UNSW)

Session Classification: Poster

Contribution ID: **137** Type: **Poster**

Rotation properties of asteroids as seen by TESS

Monday, July 7, 2025 12:58 PM (1 minute)

The Transiting Exoplanet Survey Satellite (TESS) contains a wealth of information on asteroids. As irregularly shaped asteroids tumble across the TESS field their brightness changes periodically. To date TESS has observed thousands of asteroids at high cadence. With the *TESSELLATE* transient pipeline we have identified and extracted 10 minute cadence lightcurves of all asteroids brighter than ~17 mag observed by TESS in sectors 28-39. With these lightcurves we can calculate the rotation periods of the asteroids observed by TESS. We recover known asteroid rotation periods, and expand the population with rotation properties for new asteroids.

Author: LEICESTER, Brayden (University of Canterbury)

Co-authors: BANNISTER, Michele (University of Canterbury); RIDDEN, Ryan (University of Canterbury)

Presenter: LEICESTER, Brayden (University of Canterbury)

Session Classification: Poster

Contribution ID: **138** Type: **Oral**

GaLactic and Extragalactic All-sky Murchison Widefield Array survey eXtended (GLEAM-X) III: Galactic Plane

Wednesday, July 9, 2025 12:00 PM (30 minutes)

Radio surveys of the Galactic Plane are essential for understanding how the Milky Way evolves, what it is composed of, and what emission processes take place. Low radio frequencies are particularly useful for constraining the distribution of cosmic rays and magnetic fields, as well as studying the spectral properties of pulsars and the diffuse emission of supernova remnants.
The GLEAM-X survey is incrementally made available to the community as portions are completed. The first two data releases covered 14892 deg^2 of the extragalactic sky. We present here the third data release for the GLEAM-X survey, covering ≈3800 deg^2 of the southern Galactic Plane (GP) with 233◦ < l < 44◦ and |b| < 11◦ over a frequency range of 72–300 MHz. However, GLEAM-X alone is not sensitive to the large-scale diffuse emission, abundant along the GP. To address this, we jointly deconvolved GLEAM-X data with the original GLEAM survey to recover spatial scales 45′′– 15◦ - a capability unmatched by other low-frequency surveys - using a GPU-based Image Domain Gridding (IDG) extension of WSCLEAN. This release represents the most detailed low-frequency survey of the GP to date, with only the SKA expected to produce deeper and broader coverage.
The GP release has an RMS noise level of 10–2 mJy/beam across the observing band, and almost 90000 sources with spectral fitting. In this talk, we will present the new images and catalogues, and showcase some early science results including spectral studies of SNRs, HII regions classification and pulsar detections at low frequencies.

Author: MANTOVANINI, Silvia (Curtin University)

Co-author: Dr HURLEY-WALKER, Natasha

Presenter: MANTOVANINI, Silvia (Curtin University)

Session Classification: Plenary

Contribution ID: **139** Type: **Poster**

PICSARR - High-Perfomance Low-Cost Astronomical Polarimeters

Tuesday, July 8, 2025 12:57 PM (1 minute)

The PICSARR (Polarimeter using Imaging CMOS Sensor and Rotating Retarder) design was first tested in 2021. Several of these instruments have now been built and are used at several sites in Australia and the USA. Improvements in the latest versions enable observations of much fainter stars while still providing high-precision and wide wavelength coverage. These instruments allow small telescopes (20cm –1m aperture) to undertake studies that would have previously needed much larger telescopes. We will present examples of the observations that these instrument have made possible in fields ranging from stellar polarization variability (Supergiants, Be stars, Binary stars, Wolf-Rayet stars) to Solar System studies (Planets, Satellites, Asteroids) to observations of artificial satellites.

Authors: BAILEY, Jeremy (UNSW); COTTON, Daniel V (MIRA)

Presenter: BAILEY, Jeremy (UNSW)

Session Classification: Poster

Contribution ID: **141** Type: **Oral**

Ten things you didn't know about astronomy in South Australia

Monday, July 7, 2025 11:45 AM (15 minutes)

NSW has Siding Spring, Murriyang, and the Australia Telescope Compact Array, WA has the MWA, ASKAP, and SKA-Low, Queensland has the Mount Kent Observatory, Victoria has the Stawell Underground Physics Lab, Tasmania had Grote Reber's Square Kilometer Array and has several other radio-telescopes, and the NT has the Katherine AuScope antenna – can SA offer anything astronomical? Yes it can! This presentation will describe ten things you didn't know about astronomy in SA – including events, achievements, and people.

Author: EDWARDS, Philip (CSIRO Space and Astronomy)

Presenter: EDWARDS, Philip (CSIRO Space and Astronomy)

Session Classification: Plenary

Contribution ID: **142** Type: **Poster**

Numerical Solutions for Cosmic Ray Transport

Monday, July 7, 2025 12:01 PM (1 minute)

Since their discovery in 1912, the origin of cosmic rays remains a mystery. The energy spectrum of cosmic rays suggests that these charged particles can be accelerated up to PeV energies within our Galaxy by so-called PeVatrons. As these charged particles propagate through the Galaxy, they are deflected by interstellar magnetic fields, as such we cannot trace them back. Instead, alternative messengers from cosmic-ray interactions (e.g., gamma rays and neutrinos) can be used to obtained information about these accelerators. Gamma-ray observatories such as LHAASO and H.E.S.S. provide the first glimpse of where to find PeVatrons within our Galaxy.

To understand and accurately model gamma-ray emissions, it is crucial to understand the transport of cosmic rays as they propagate within our Galaxy. Realistically modelling the transport of cosmic rays as they interact with magnetic fields, interstellar medium, photon fields and undergo losses lends itself to numerical solutions. This talk will give an overview of particle transport and solution methods and cover early development of a numerical model for cosmic ray diffusion and energy losses.

Author: MCKENNALL, Edmund (University of Adelaide)

Presenter: MCKENNALL, Edmund (University of Adelaide)

Session Classification: Poster

Contribution ID: **144** Type: **Oral**

The Long-term Evolution of a Rare Nuclear Transient - ASASSN-14ko

Tuesday, July 8, 2025 10:45 AM (15 minutes)

Active Galactic Nuclei (AGN) typically vary stochastically in brightness across all wavelengths on the electromagnetic spectrum. However, observations of consistent periodic variability in AGN are desirable because they are signatures of a binary supermassive black hole (SMBH) system. A rare periodically flaring nuclear transient, ASASSN-14ko, was discovered in a Type 2 Seyfert galaxy with a binary SMBH system. This is the first discovery of a nuclear transient with a period of ~115 days. From previous observations in the optical and UV bands, the origin of the flares was concluded to be a partial Tidal Disruption Event (pTDE) with an evolved star progenitor. However, only a handful of spectra have been taken of ASASSN-14ko and the last published photometric analysis was conducted on flares occurring in 2022. The question of how ASASSN-14ko has evolved since 2022 remains unknown until now. By performing high-cadence spectroscopy using the WiFeS 2.3m Telescope, we find that the spectral evolution remain consistent amongst all epochs but photometric observations show a decrease in period.

Author: SHI, Jennifer

Presenter: SHI, Jennifer

Session Classification: Transients

Contribution ID: **145** Type: **Poster**

Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory, Australia's radio quiet site: enabling world-class radio astronomy

Tuesday, July 8, 2025 11:34 AM (1 minute)

Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory, is located in an extremely radio quiet region of the planet, approximately 800 kilometres north of Perth. This unique observatory is the most well protected radio astronomy site in the world. Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory, is the site of the Australian Square Kilometre Array Pathfinder (ASKAP), the Murchison Widefield Array, and EDGES. The Australian component of the international SKA is also currently being constructed on the site. The remote nature of this location makes it an ideal site for radio astronomy.

Since 2005, a number of regulatory measures have been introduced by the Commonwealth and Western Australian governments to prevent or control radio frequency interference (RFI) to radio astronomy on the site. In total, these measures provide unprecedented radio quiet protection – in frequency coverage, geographic extent, and the range of potential interference sources. The protections cover the frequency range 70 MHz to 25.25 GHz, an area 260 km in radius, and address intentional radiocommunication transmitters and incidental emissions from electrical equipment. A brief description of the radio quiet protections will be presented.

The best way to demonstrate the success (or failure) of these radio quiet measures is to use the radio telescopes themselves. Data from ASKAP and MWA has shown that tropospheric ducting causes strong RFI, which is regularly detected by the RFI monitoring equipment at the Observatory. We have worked on a numerical weather prediction model to predict the presence of RFI from ducting to assist with scheduling sensitive observations where ducting is problematic (particularly for ASKAP Science Survey FLASH) and will show some results from this work. We also show preliminary results of the impact of SKA-Low construction on RFI at the Observatory and RFI detections from other activities in the vicinity.

Author: CHOW, Kate (CSIRO)

Co-authors: INDERMUEHLE, Balthasar (CSIRO); BRAYTON, Chris (CSIRO); ALLEN, Graham (CSIRO); SUZUKI, Hajime (CSIRO); MANOUFALI, Mohamed (CSIRO); COX, Tom (CSIRO)

Presenter: CHOW, Kate (CSIRO)

Session Classification: Poster

Contribution ID: **146** Type: **Poster**

The baryonic Tully-Fisher relation from WALLABY

Monday, July 7, 2025 2:32 PM (1 minute)

We investigate the baryonic Tully-Fisher relation using data from the WALLABY pilot survey, which includes a total sample of 2,352 galaxies. To accurately measure line widths of HI global profiles, we develop and apply a spectral profile fitting technique based on the Busy Function (Westmeier+2014), which effectively reduces systematic biases caused by noise peaks in low S/N spectra. This method allows us to automatically and robustly measure line widths for large samples of galaxies. By comparing our measurements with those obtained from SoFiA (Westmeier+2021), we identify a systematic offset in the SoFiA-derived line width measurements. Using a Monte Carlo-bootstrap method, we estimate line width measurement uncertainties as well as validate the robustness of our spectral profile fitting technique. After correcting for peculiar velocities and deriving stellar masses using WISE band 1 magnitudes, we construct both the stellar mass and baryonic Tully-Fisher relations. These are based on a representative sample of ~430 galaxies covering a broad mass range, from low-mass to high-mass systems, which were previously underrepresented. We quantify the statistical properties of the relations (such as slope, zero-point, and scatter) and particularly examine how the intrinsic scatter varies as a function of rotational velocity. Additionally, we investigate environmental effects by examining how the relation differs between galaxies in high- and low-density regions. Our results provide further insights into the fundamental drivers of variance in the baryonic Tully-Fisher relation and contribute to a deeper understanding of galaxy formation and evolution within the ΛCDM framework.

Author: KIM, Shinna (ICRAR / UWA)

Presenter: KIM, Shinna (ICRAR / UWA)

Session Classification: Poster

Contribution ID: **147** Type: **Oral**

Beyond kicks: Revisiting rocket-like neutron star acceleration in binaries

Monday, July 7, 2025 5:15 PM (15 minutes)

Neutron stars are born with high proper motions, known as neutron star kicks. It is widely accepted that the kicks are a result of asymmetries in the core-collapse supernova mechanism, which accelerate the neutron star on the dynamical timescale of the core (~10s). In the 1970s, alternate models proposed that asymmetries in the magnetic field could slowly accelerate neutron stars by converting rotational energy into thrust on the spin-down timescale (~months-years). However, these rocket-like models quickly became disfavored as they required unrealistically rapid birth spins to explain the observed kick magnitudes.
In this talk, I will revisit the rocket mechanism in the context of binary systems. When the acceleration timescale is longer than the orbital period, there is a fundamental difference in the way orbits are altered compared to instantaneous kicks. We find that even a small contribution of rocket-like kicks combined with strong instantaneous natal kicks can allow binaries to reach period–eccentricity combinations unattainable in standard binary evolution models. This hybrid mechanism provides a natural explanation for otherwise puzzling systems, such as the wide, low-eccentricity neutron star binary Gaia NS1 and certain symbiotic X-ray binaries. Moreover, it offers a pathway to post-supernova stellar mergers on months- to years-long timescales, potentially powering peculiar high-energy transients like SN2022mop.

Author: Dr HIRAI, Ryosuke (RIKEN / Monash University)

Presenter: Dr HIRAI, Ryosuke (RIKEN / Monash University)

Session Classification: Compact / High-Energy Objects

Contribution ID: **148** Type: **Oral**

The enigmatic long-period radio transients

Tuesday, July 8, 2025 5:00 PM (15 minutes)

The long-period radio transients are a newly-discovered class of Galactic radio sources that produce pulsed emission lasting tens of seconds to several minutes, repeating on timescales of tens of minutes to hours. Such cadence is unprecedented, and there is currently no clear emission mechanism or progenitor that can explain the observations, which include complex polarisation behaviour, pulse microstructure, and activity windows that range from hours to decades.

Could they be ultra-long period magnetars, and connected to the phenomenon of Fast Radio Bursts? Could they be white dwarf pulsars, defying the expectations of the magnetic field evolution of these stellar remnants? In this talk I will review the ten discoveries made so far, informative simulations of their evolution, the potential physical explanations, and the prospects for detecting more of these sources in ongoing and upcoming Australian and international radio surveys, that will help uncover their true nature.

Author: HURLEY-WALKER, Natasha (Curtin University / International Centre for Radio Astronomy Research)

Presenter: HURLEY-WALKER, Natasha (Curtin University / International Centre for Radio Astronomy Research)

Session Classification: Transients

Contribution ID: **151** Type: **Poster**

N-body models of the old open cluster M67

Tuesday, July 8, 2025 12:47 PM (1 minute)

M67 is a dynamically evolved open cluster in the Milky Way, making it an ideal testbed for stellar and binary evolution theory. Due to its nearness and relatively low levels of dust in the line-of-sight, it has been extensively observed. We create N-body models of the old open cluster M67 (NGC 2682), taking into account its dynamical evolution as well as stellar and binary evolution of its member stars, and compare these models to the latest Gaia survey data.

Author: ANDERSON-BALDWIN, Jasmine (Swinburne University of Technology)

Co-authors: Dr FLYNN, Chris (Swinburne University of Technology); Prof. HURLEY, Jarrod (Swinburne University of Technology)

Presenter: ANDERSON-BALDWIN, Jasmine (Swinburne University of Technology)

Session Classification: Poster

Contribution ID: **152** Type: **Oral**

We Can See Your Halo: Deciphering the Milky Way's Accretion History with the S5 and OzArch Surveys

Tuesday, July 8, 2025 5:15 PM (15 minutes)

Small stellar systems merge and are accreted hierarchically to form large galaxies like the Milky Way. We see the evidence for this process all around us: dynamically, as stellar overdensities in phase space in the nearby Galaxy; chemically, in abundance patterns distinct from those of stars formed in situ within the Milky Way; and spatially, as stellar streams and tidally disrupting satellites in the Galactic halo. This last source of evidence –a halo threaded through with a multitude of stellar substructures –has been the target of the Southern Stellar Stream Spectroscopic Survey (S5), an Australian-led international collaboration using the AAT + AAOmega to study the streams and disrupting satellites surrounding the Milky Way. S5's science goals included characterising the Galaxy's accretion history and constraining the distribution of matter interior to stream orbits. I will present highlights from S5, including evidence for the influence of Magellanic Clouds on halo stream orbits (and the Milky Way itself), the orbital properties of the stellar streams observed, and comparisons with simulation predictions for detectable streams and satellites. As the AAT enters a new phase of operation, we are launching a new, expanded survey of the Galactic halo: OzArch. I will give an overview of OzArch's scientific objectives, and conclude with a look at the complementary capabilities of new facilities such as LSST and 4MOST for driving further major advances in our understanding of how galaxies like the Milky Way grow.

Author: Prof. ZUCKER, Daniel (Macquarie University)

Co-authors: Prof. LEWIS, Geraint (University of Sydney); Prof. MARTELL, Sarah (University of New South Wales); THE S5 COLLABORATION

Presenter: Prof. ZUCKER, Daniel (Macquarie University)

Session Classification: Stars

Contribution ID: **153** Type: **Poster**

Powering your science with Data Central

Tuesday, July 8, 2025 11:43 AM (1 minute)

Data Central now provides multiple ways to access and use data hosted with us, whether via the web UI, the VO services or our science platform. In this talk, we will outline what your options are and which parts of your workflow would most benefit from which tools.

Author: TOCKNELL, James (AAO, Macquarie University)

Presenter: TOCKNELL, James (AAO, Macquarie University)

Session Classification: Poster

Contribution ID: **154** Type: **Poster**

Lens 3.0: A flexible modern telescope time scheduling and proposal management system built using modern web frameworks

Tuesday, July 8, 2025 11:40 AM (1 minute)

With the deprecation of Drupal 7 in January 2025, Data Central has fully transitioned the Lens platform to Django, a robust Python-based web framework. Originally developed in PHP and Drupal in 2015, Lens has long supported Time Allocation Committees (TAC) across major facilities such as the Anglo-Australian Telescope (AAT). Since being used for the 2024B semester on the ANU 2.3m Telescope, Lens 3.0 has now been upgraded improving the proposal preparation workflow and integrating more closely with the Data Central ecosystem. Lens' integration with the 2.3m Telescope offers a streamlined observer preparation workflow by managing observer assignments through a direct interface with the 2.3m Observing System, enabling the efficient coordination of observations and easy access to your data. Meanwhile, recent changes to the AAT submission process have improved performance whilst also aligning the system more closely with Data Central' s account system, eliminating the need to update investigator information in multiple locations. Lens has also improved Time Allocation Committee (TAC) workflows by providing streamlined reporting capabilities.

Author: COULSON, James (Australian Astronomical Optics, Macquarie University)

Co-author: O'TOOLE, Simon (Australian Astronomical Optics, Macquarie University)

Presenter: COULSON, James (Australian Astronomical Optics, Macquarie University)

Session Classification: Poster

Contribution ID: **155** Type: **Poster**

Type 1 and Type 2 AGN Catalogue from 6dFGS in the Southern Sky

Monday, July 7, 2025 12:07 PM (1 minute)

An Active Galactic Nucleus (AGN) is the compact central region of a galaxy hosting a supermassive black hole that accretes gas and dust from its surroundings, often producing powerful outflows. Studying AGN provides critical insights into galaxy evolution and AGN-host interactions. Unlike the Northern Hemisphere, the Southern Sky remains underexplored in terms of AGN catalogues. We present two comprehensive catalogues of Type 1 (Hon et al. 2025) and Type 2 AGN (Suresh et al., submitted) identified in the Six-degree Field Galaxy Survey (6dFGS), a spectroscopic redshift survey of the Southern hemisphere completed in 2006. AGN are recognised by the presence of strong emission features—either broad or narrow—in their optical spectra. Narrow emission-line galaxies were selected using a Median Absolute Deviation cut on the continuum-subtracted spectra. Spectral fitting was performed using PyQSOFit, a Python-based tool that was optimised to fit 6dFGS data in the rest frame, yielding robust measurements of key emission-line parameters. Each spectrum was visually inspected to confirm the AGN classification and to eliminate contamination from fibre cross-talk.
Our Type 1 AGN catalogue comprises 2,515 sources, while our Type 2 catalogue includes 2,744 AGN and 2,327 composite galaxies. This combined catalogue approach provides a valuable resource for future studies of AGN demographics in the Southern Sky. In particular, we aim to use this combined dataset to identify Changing-Look AGN through photometric variability detected by the upcoming Legacy Survey of Space and Time (LSST), enabling targeted follow-up spectroscopy.

Keywords - catalogues –galaxies: active –galaxies: Seyfert –galaxies: emission lines –galaxies: nuclei –techniques: spectroscopic

Author: SURESH, Sruthi (University of Melbourne)

Co-authors: Mr HON, Wei Jeat (University of Melbourne); Ms WEBSTER, Rachel (University of Melbourne); WOLF, Christian (Australian National University); ONKEN, Christopher (Australian National University)

Presenter: SURESH, Sruthi (University of Melbourne)

Session Classification: Poster

Contribution ID: **156** Type: **Poster**

Alpha-rich dSph galaxy stellar streams

Tuesday, July 8, 2025 12:48 PM (1 minute)

In Galactic archaeology, the "alpha-knee"–where the slope of the [α/Fe]–[Fe/H] relation changes –is a chemical feature that serves as a powerful diagnostic of star formation histories in galaxies. The characteristics of this knee depend on the nucleosynthetic sources of the α-elements (O, Mg, Si, S, and Ca) and their evolution relative to [Fe/H] enrichment, providing us with information on the fundamental properties of a galaxy, such as its initial mass and its star formation timescales and intensities. In this work, we compare α-element abundances in 6 disrupted dwarf galaxies, obtained using high-resolution spectra from the Southern Stellar Stream Spectroscopic Survey (S5), to literature values for surviving (i.e., undisrupted) dSph galaxies. Our findings show significant enhancements in α-elements in stars from stellar streams compared to those found in intact dwarfs. These differences in alpha abundances –indicative of different star formation history – point to differences in the initial properties of these two categories of dwarfs, and/or the impact of environmental factors on their evolution. We discuss and evaluate a number of possible scenarios which could be responsible for the observed distinct abundance patterns.

Author: MURA GUZMAN, Aldo Andres (Macquarie University)

Co-authors: ZUCKER, Daniel (Macquarie University); Prof. MARTELL, Sarah (University of New South Wales); GUDALUR BALASUBRAMANIAM, Adithya (Macquarie University); LEWIS, Geraint; S5 COLLABORATION

Presenter: MURA GUZMAN, Aldo Andres (Macquarie University)

Session Classification: Poster

Contribution ID: **157** Type: **Poster**

PyKOALA: A Multi-Instrument Data Reduction Pipeline for IFS Data

Tuesday, July 8, 2025 11:38 AM (1 minute)

We present PyKOALA, an open-source Python package developed to streamline the reduction of integral field spectroscopy (IFS) data. Initially conceived as a specialist pipeline to complement the outputs of 2dfdr and enhance data reduction for the Kilofibre Optical AAT Lenslet Array (KOALA) Integral Field Unit (IFU), PyKOALA has evolved into a versatile, multi-instrument framework. It now offers a modular and flexible architecture that enables astronomers to tailor their reduction workflows and apply a wide range of corrections across various IFS instruments. PyKOALA provides a unified interface for ingesting data from different IFUs, standardizing core IFS properties to ensure consistent and efficient processing.

The PyKOALA source code is openly available at github.com/pykoala/pykoala and can also be easily installed via pip. The repository includes comprehensive documentation, unit tests, and a continuous integration (CI) workflow. This CI workflow automatically runs tests on each update, including both standard unit tests and more elaborate validation routines implemented as Jupyter notebooks. These features support reproducibility, transparency, and ease of contribution, making PyKOALA a robust and sustainable tool for the IFS community.

Authors: GONZALEZ BOLIVAR, Miguel (Australian Astronomical Optics - Macquarie University); Dr CORCHO-CABALLERO, Pablo (Kapteyn Astronomical Institute, University of Groningen, Netherlands); OWERS, Matt (Macquarie University); QUATTROPANI, Gabriella; Prof. ASCASIBAR SEQUEIROS, Yago (Universidad Autonoma de Madrid); LORENTE, Nuria (AAO, Macquarie University)

Presenter: GONZALEZ BOLIVAR, Miguel (Australian Astronomical Optics - Macquarie University)

Session Classification: Poster

Contribution ID: **158** Type: **Oral**

The role of triple evolution and dynamics in massive stellar and gravitational wave mergers

Monday, July 7, 2025 5:45 PM (15 minutes)

Most massive stars reside in triple or higher-order gravitationally bound systems. The coupled stellar and dynamical evolution in these systems makes predictions for stellar interactions and mergers particularly challenging. I will present a novel semi-analytical model that traces the evolution of an inner chemically homogeneous binary within a hierarchical triple and predicts its final fate across a wide range of initial conditions. Using this framework, I estimate the rates of both stellar and gravitational-wave mergers in the universe from this channel. I will also compare merger rates in triple systems to those in dense environments such as stellar clusters and galactic nuclei, highlighting the significant contribution of field triples to the population of stellar mergers and eccentric gravitational-wave sources. Looking ahead, observations from the Rubin Observatory, the LIGO–Virgo–KAGRA (LVK) network, and the upcoming LISA mission will provide key constraints on these channels, enabling us to test these theoretical predictions in unprecedented detail.

Author: Dr GRISHIN, Evgeni (Monash University)

Presenter: Dr GRISHIN, Evgeni (Monash University)

Session Classification: Compact / High-Energy Objects

Contribution ID: **159** Type: **Oral**

Finding High Redshift FRBs with Galaxy Clusters

Tuesday, July 8, 2025 10:15 AM (15 minutes)

Due to their short timescales and sensitivity to radio propagation effects over cosmological volumes, high redshift Fast Radio Bursts (FRBs) are expected to be extremely powerful probes of our Universe. However, while a significant number of FRBs are expected to exist at high redshifts, detecting them has been difficult, with few confirmed at redshifts greater than one. In many other fields, gravitational lensing from galaxy clusters has enabled high redshift detections by magnifying background sources. In this talk I demonstrate how cluster lensing can also be used to find the highest redshift FRBs. Using observationally driven models of existing galaxy clusters, I predict the population of lensed FRBs that will be observed by FRB detectors such as CHIME, CHORD, ASKAP and SKA. I show that in each case the rate of lensed FRBs is strongly sensitive to density of FRBs at high redshifts, allowing cluster lines of sight to strongly constrain FRB progenitor models. For a realistic FRB redshift distribution that traces star formation, I show that typical cluster lensing can potentially double the rate and range of high redshift FRB detections along a given line of sight. Contextualising this advantage, I recommend survey strategies that would yield multiple lensed FRBs per year from redshifts $z > 1$ for CHIME and $z > 2$ for CHORD by searching only a few lines of sights on each instrument to lower signal to noise ratios.

Author: SAMMONS, Mawson (Trottier Space Institute, McGill University)

Presenter: SAMMONS, Mawson (Trottier Space Institute, McGill University)

Session Classification: Transients

Contribution ID: **161** Type: **Oral**

Enhanced astrometry of the rapid ASKAP continuum survey for precise localisation of fast radio bursts

Wednesday, July 9, 2025 10:30 AM (15 minutes)

Accurate localisation of Fast Radio Bursts (FRBs) is essential for identifying their host galaxies, constraining progenitor models, and employing FRBs as precise cosmological probes. For extragalactic FRBs, particularly those at higher redshifts ($z > 1$), sub-arcsecond astrometry is required to robustly associate them with host galaxies and disentangle contributions to dispersion and scattering along the line of sight. The localisation of FRBs detected with the Australian Square Kilometre Array Pathfinder (ASKAP) relies on reference positions from the Rapid ASKAP Continuum Survey (RACS), whose astrometric fidelity has previously been limited by systematic positional errors. We present a comprehensive correction of astrometric offsets across all RACS epochs—RACS-Low, RACS-Mid, and RACS-High—using crossmatching with the Wide-field Infrared Survey Explorer (WISE) catalogue to improve positional accuracy across the entire southern sky (Dec. $< +45°$). These corrections reduce residual uncertainties to approximately 0.3 arcseconds (1-σ) or better, and are independently validated through comparisons with the Very Large Array FIRST Survey (FIRST), the Very Large Array Sky Survey (VLASS), the Radio Fundamental Catalogue (RFC), as well as the corrected RACS catalogues. The improved astrometry has been incorporated into ASKAP's FRB localisation pipeline, enabling more precise identification of host galaxies, tighter constraints on host-frame dispersion measures (DMs), and reduced uncertainties in scattering analyses. This work establishes a robust new reference standard for radio transient localisation with ASKAP and significantly enhances the utility of FRBs as astrophysical and cosmological probes.

Author: JAINI, Akhil (Swinburne University of Technology)

Co-authors: Prof. DELLER, Adam (Swinburne University of Technology); Dr WANG, Yuanming (Swinburne University of Technology)

Presenter: JAINI, Akhil (Swinburne University of Technology)

Session Classification: Methods & Applications

Contribution ID: **162** Type: **Poster**

Studying lithium-rich stars through population synthesis

Tuesday, July 8, 2025 12:53 PM (1 minute)

The study of how elements form and evolve in stars is a critical question in modern astrophysics. Lithium (Li) was produced in big bang nucleosynthesis (BBN) and is easily destroyed in the first dredge-up (FDU), which leads to a dramatic drop in Li abundance on the stellar surface. However, a small fraction of giant stars still maintain a substantial quantity of lithium in their atmospheres after the FDU. Although several mechanisms have been proposed to explain this phenomenon, the truth remains unrevealed. In this talk, I will present the use of two neural networks to separately predict the Li normal behaviour as a function of asteroseismic information and observational parameters in red giants. The next step will be developing a comprehensive and complete population synthesis model to predict normal lithium production in giants and explore how different physical processes individually contribute to Li enrichment across stellar populations. By incorporating multiple enrichment pathways into our simulations, I aim to quantify their relative importance and improve our understanding of the conditions that lead to Li-rich giants. Leveraging data from large-scale spectroscopic surveys and asteroseismic surveys, this model will be robust for the identification and further studies of Li-rich stars in the future.

Author: SHEN, Han (UNSW)

Co-author: Prof. MARTELL, Sarah (University of New South Wales)

Presenter: SHEN, Han (UNSW)

Session Classification: Poster

Contribution ID: **163** Type: **Poster**

Follow up of ASKAP-discovered fast scintillating quasars

Monday, July 7, 2025 12:02 PM (1 minute)

The remarkable discovery by Y. Wang et al. (2021, MNRAS 502, 3294) of multiple scintillating AGN behind a nearby (within 20pc), long and narrow interstellar plasma filament (1.7 degrees by 4 arcmin on the sky) heralded a new era in studies of scintillating radio sources, made possible by widefield radio telescopes such as ASKAP. The finding has important implications for understanding the physics and origin of the still-mysterious, yet ubiquitous, interstellar scattering "screens" that cause very compact (mas-scale or smaller) sources to scintillate. However, from the ASKAP data alone, the strength of scattering is not well constrained, leading to ambiguity in modelling the screen properties. Data across a broader frequency range can constrain the scattering strength as a function of frequency. We present new analysis of follow-up data for two of the fast scintillators, observed with the VLA across the frequency range 4-8 GHz, and discuss implications for the scattering plasma.

Author: BIGNALL, Hayley (Manly Astrophysics)

Co-authors: TUNTSOV, Artem (Manly Astrophysics); WANG, Yuanming (Swinburne University of Technology)

Presenter: BIGNALL, Hayley (Manly Astrophysics)

Session Classification: Poster

Contribution ID: **164** Type: **Poster**

Spectropolarimetry in the Southern skies with VelocePol

Tuesday, July 8, 2025 12:56 PM (1 minute)

We present an overview of the science program and instrument design for VelocePol - a polarimetric module for the Veloce spectrograph on the Anglo-Australian Telescope. This will provide much needed spectropolarimetric capabilities in the Southern sky for studies of stellar magnetism in the coming era of SKA-low and PLATO.

Author: NICHOLSON, Belinda (University of Southern Queensland)

Presenter: NICHOLSON, Belinda (University of Southern Queensland)

Session Classification: Poster

Contribution ID: **165** Type: **Poster**

Towards a catalogue of southern hemisphere Compact Symmetric Objects

Monday, July 7, 2025 12:03 PM (1 minute)

Compact Symmetric Objects, CSOs, are very compact, double-lobed radio galaxies, < 1 kiloparsec in extent. Understanding the population of CSOs has important implications for radio galaxy formation and evolution, but CSOs represent only a very small fraction (~5%) of bright, compact radio sources found in flux density limited surveys. The vast majority of sources are dominated by asymmetric emission due to relativistic beaming from jets aligned close to the line of sight, often dubbed "blazars". Blazars may also exhibit a gigahertz-peaked spectrum that is characteristic of CSOs, and so CSO candidate samples defined by radio compactness and spectral characteristics are generally contaminated by blazars. This has presented a problem for understanding the population of bona fide CSOs. As a result of their orientation and relativistic beaming, blazars tend to exhibit large variations in flux density on timescales of months to years. CSOs, however, are relatively stable on typically observable timescales of years or even decades. With a view to significantly expanding the very small number of confirmed CSOs in the southern hemisphere, we used the Australia Telescope Compact Array calibrator database, which has multi-frequency flux density measurements for more than 1000 compact sources spanning years to decades, to extract sources with low variability on timescales of years. The next step will be to verify or rule out the new CSO candidates with VLBI observations.

Author: BUTTON, Macey (University of Western Australia)

Co-authors: Dr REYNOLDS, Cormac (CSIRO); BIGNALL, Hayley (Manly Astrophysics); Dr CHHETRI, Rajan (CSIRO)

Presenter: BIGNALL, Hayley (Manly Astrophysics)

Session Classification: Poster

Contribution ID: **166** Type: **Poster**

Testing general relativity with EMU: Simulation and analysis pipeline

Monday, July 7, 2025 2:36 PM (1 minute)

The Evolutionary Map of the Universe (EMU) is currently conducting a radio-continuum survey with the Australian Square Kilometre Array Pathfinder (ASKAP) radio telescope. We can use the radio continuum galaxies from EMU to perform an observational test of General Relativity (GR) via cosmic magnification in the weak gravitational lensing regime; a key science goal of the cosmology project inside EMU. We will test GR via the cross-correlation of high-redshift radio galaxies ($z > 1.0$), which do not have counterparts, and low-redshift radio galaxies ($z \leq 1.0$) with optical/NIR counterparts. The simulation of galaxy clustering statistics is crucial for an accurate test. Accordingly, we have established the requisite simulation and analysis pipeline to generate theoretical predictions of the two-point angular correlation function,
, with and without a predicted lensing effect, in addition to generating the respective covariance matrices. In my talk, I will detail the finalised simulation and analysis pipeline, as well as outline the upcoming analysis of EMU galaxies in the south polar orbital zone, located between approx. -45 and -75 degrees in declination. By cross-correlating the two EMU radio galaxy populations, we can determine the statistical significance of the cosmic magnification effect, and look for potential deviations from the standard LCDM model.

Author: ASHER, Albany (Western Sydney University / CSIRO Space & Astronomy)

Presenter: ASHER, Albany (Western Sydney University / CSIRO Space & Astronomy)

Session Classification: Poster

Contribution ID: **167** Type: **Oral**

A Geometric Model for LPTs

Tuesday, July 8, 2025 5:30 PM (15 minutes)

The Galactic long period transients (LPTs) discovered in recent years are a mysterious new class of object. They have periods of tens of minutes to hours, and produce strongly polarised pulses lasting seconds to minutes. Their characteristics are phenomenologically analogous to neutron star pulsars albeit at much longer timescales, but the underlying emission mechanism is unclear.

The 2.1 and 2.9 hour LPTs ILT J1101+5521 and GLEAM-X J 0704–37 are the only LPTs with multi-wavelength confirmed counterparts to date, and they are white dwarf (WD) - M dwarf (MD) binaries with equal WD spin and orbital periods, making them polars. Two other WD - MD binaries, AR Scorpii and J1912-44, are known to emit in the radio. They pulse every 1.97 and 5.3 min respectively at the beat periods between the WD spin and the longer orbital period, making them intermediate polars (IP)s.

In this talk I will demonstrate a new, unified model for LPTs, and apply it to the longest-active LPT, GPMJ1839-10, using its 33-year timing baseline to fit its orbital geometry purely from radio data. With this model, we can interpret the shortest to longest period sources as lying between IPs and polars, including those now being found by the SKA precursors. Understanding LPTs will be invaluable to the study of WD binary evolution.

Author: HORVATH, Csanad (Curtin University)

Co-authors: REA, Nanda (CSIC); HURLEY-WALKER, Natasha (Curtin University / International Centre for Radio Astronomy Research); Dr MCSWEENEY, Sam (Curtin University)

Presenter: HORVATH, Csanad (Curtin University)

Session Classification: Transients

Contribution ID: **168** Type: **Oral**

Stellar parameters and abundances for 800,000 Gaia RVS spectra using GALAH DR4 and The Cannon

Thursday, July 10, 2025 10:15 AM (15 minutes)

The enormous spectroscopic datasets from current astronomical surveys provide an unprecedented opportunity to explore the stellar populations of the Milky Way and its surroundings. The largest surveys range from several million stars (e.g., LAMOST) to the roughly quarter-billion stars observed with *Gaia* XP spectra. These survey data are generally at low or moderate spectroscopic resolutions, yet the "gold standard"for determining stellar parameters and elemental abundances remains high-resolution spectroscopic data. We have used *The Cannon*, a data-driven machine-learning technique to transfer stellar labels (collectively referring to stellar parameters and abundances) from high-resolution GALAH DR4 data to lower-resolution *Gaia* DR3 RVS spectra. We trained our data model on ~14000 selected targets common to both surveys, utilising the stellar labels from GALAH. Our model determines effective temperature (Teff), surface gravity (log *g*), metallicity ([Fe/H]), and α-element abundances for nearly 800,000 RVS spectra (Das et al. 2025). We recover a bimodal distribution in [Ti/Fe] vs. [Fe/H], corresponding to the high-α and low-α populations in the Milky Way disc, marking one of the first demonstrations of this α-element dichotomy in RVS data. Using stars from several open and globular clusters present in the *Gaia* RVS catalogue, we have validated our metallicity estimates within a precision of ~0.02–0.10 dex. Finally, for a subset of this sample with predicted log g < 3.5 (i.e., giants) we are able to measure the abundances of several neutron-capture elements, illustrating the exciting potential of this method for reliably determining stellar parameters and abundances from medium-resolution *Gaia* RVS spectra –a dataset which will comprise spectra of over 200 million stars by the end of final data release.

Author: Mr DAS, Pradosh Barun (Macquarie University)

Co-authors: ZUCKER, Daniel (Macquarie University); DE SILVA, Gayandhi (Macquarie University)

Presenter: Mr DAS, Pradosh Barun (Macquarie University)

Session Classification: Surveys & Facilities

Contribution ID: **169** Type: **Poster**

ASKAP Pipeline processing

Tuesday, July 8, 2025 11:35 AM (1 minute)

The ASKAP Telescope is a cm-band synthesis imaging telescope operated by CSIRO at Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory in Western Australia. Its innovative phased-array-feed (PAF) receivers give ASKAP the wide field-of-view that makes it excellent at conducting large-scale surveys of the sky. This comes, however, at the cost of high data rates. High-performance computing is required to create the calibrated images and catalogues quickly enough to keep up with the incoming data rate, and allow the data products to be deposited in the CSIRO ASKAP Science Data Archive (CASDA) for use by astronomers.

The data processing that creates the science products is orchestrated by the ASKAP Pipeline, a highly-parallelised, scripted workflow that leverages the Slurm workload manager to execute all the required calibration, imaging and source-finding tasks. These tasks are realised through the custom-written calibration & imaging package ASKAPsoft, which has been designed to address challenges presented by the scale of data ASKAP produces. This Pipeline is in near constant use, with regular survey observing resulting in large amounts of data being deposited into the CASDA archive and made publicly available. Data rates into the archive can be around 70 TB per week. The Pipeline is nearly autonomous - most observations are processed in a completely hands-off fashion, with only a small fraction requiring manual attention (perhaps due to data quality issues).

This talk will describe the Pipeline and key design decisions that have shaped its workflow, demonstrating its capabilities as a large & complex supercomputing workflow. Building on the experience of many years of operations through pilot and full-scale surveys, this talk will detail the current performance and describe recent additions to the processing that enhance the data quality, while reflecting on lessons learned from managing the large data rates and I/O loads, looking ahead to future large-scale processing for facilities such as the SKA.

Author: WHITING, Matthew (CSIRO)

Presenter: WHITING, Matthew (CSIRO)

Session Classification: Poster

Contribution ID: **170** Type: **Poster**

Unveiling 3-D HI Structures in M31 and local dwarfs Using FMG

Monday, July 7, 2025 12:52 PM (1 minute)

In this talk, I will present a series of my recent work on HI kinematics, focusing on the Andromeda galaxy (M31), as one of the major key science projects of the Five-hundred-meter Aperture Spherical Radio Telescope (FAST). FAST's unparalleled sensitivity delivers high-dynamic-range HI data that reveal remarkably complex kinematic structures, while simultaneously posing challenges for data processing, Milky Way foreground subtraction, and subsequent dynamical analyses. Using our FMG toolkit (Lyu et al. 2023) to perform multi-Gaussian decomposition of the data cube, we successfully isolate distinct 3-D kinematic components (K. Zhang et al. 2025, in preparation), precisely remove Galactic contamination, clearly unveil the extended structure of M 31's northern disk, and derive a refined rotation curve. Meanwhile, by applying FMG to the combined VLA + FAST data set, we further identify and disentangle a quasi-ring kinematic feature within the ~1 kpc nuclear region of M31 (Li et al. 2025)—a structure previously only hinted at in infrared observations.

In the future, we plan to deploy FMG on the integral-field unit (IFU) and interferometric HI data from The HI-KOALA IFS Dwarf Galaxy Survey (Hi-KIDS; López-Sanchez et al. in prep) to conduct a comparative kinematic analysis of the stellar disk (absorption lines), ionised gas (emission lines), and atomic gas (21 cm HI emission) in nearby dwarf galaxies. At the spatial scale of individual H II regions, this approach will allow us to investigate the star-formation feedback onto galactic dynamics and thereby offer insights into the galaxy evolution of local dwarfs.

Author: LYU, xuanyi (macquarie university)

Presenter: LYU, xuanyi (macquarie university)

Session Classification: Poster

Contribution ID: **172** Type: **Oral**

Orbital Decay of the Shortest-Period Hot Jupiter, TOI-2109b: Tidal Constraints and Transit-Timing Analysis

Wednesday, July 9, 2025 4:15 PM (15 minutes)

TOI-2109b is the hot Jupiter with the shortest orbital period ($\sim$16 hr). At this close distance, strong tidal interactions can produce a significant exchange of angular momentum with the star. Since the orbital period of this planet is shorter than the stellar rotation period, TOI-2109b may be an optimal candidate for studying orbital decay. This process depends on how efficiently the star and the planet dissipate energy, due mainly to interior mechanisms that are poorly constrained in exoplanet systems. In this work, we study for the first time the tidal evolution of TOI-2109b under a formalism of inertial waves (IWs) in convective envelopes and internal gravity waves (IGWs) in stellar radiative regions. We find that uncertainties in the age of TOI-2109 ($t_{\star,\mathrm{age}}$) significantly affect the rate of orbital evolution, as IWs and IGWs interact differently depending on $t_{\star,\mathrm{age}}$. For an 'old' host star, we find that TOI-2109b would undergo fast orbital decay. Conversely, if TOI-2109b orbits a 'young' host star, a rather slow decay rate would suggest a constant-period orbit. Our calculated mid-transit times and transit-timing variations (TTVs) support a younger host star with $Q'_\star > 3.7 \times 10^7$, suggesting a decay rate of $\dot{P} \sim 4\,\mathrm{ms\,yr^{-1}}$ that could lead to mid-transit-time shifts of
$lesssim10$ s over three years. Orbital decay and other TTV-inducing effects will be confirmed or ruled out with future higher-quality timing data. The results presented here aim at constraining the current modeling of tides and TTVs for TOI-2109b, helping us further understand those light-curve changes associated to the long-term evolution of ultra-short-period planets.

Author: ALVARADO MONTES, Jaime A. (Australian Astronomical Optics (AAO), Macquarie University)

Presenter: ALVARADO MONTES, Jaime A. (Australian Astronomical Optics (AAO), Macquarie University)

Session Classification: Planets

Contribution ID: **173** Type: **Oral**

How biased are JWST high-z quasar host galaxy detections?

Friday, July 11, 2025 10:30 AM (15 minutes)

The James Webb Space Telescope (JWST) has revolutionized the study of quasars in the high-z Universe. For the first time, astronomers have detected and characterized nearly 10 galaxies that host bright quasars at z > 6, a fundamental step in understanding the co-evolution of galaxies and their supermassive black holes (SMBHs) across cosmic time. Initial stellar mass measurements of these quasar hosts result in black hole-stellar mass ratios that are much larger than those in the local Universe, implying that these early black holes are significantly overmassive. The accuracy of these measurements remains limited by a subtraction of the extremely bright quasar point source. To constrain the bias from the subtraction, I use the BlueTides simulation to develop a Bayesian framework to estimate the error on the measured stellar mass of high-z quasar hosts. I find that quasar host galaxy masses are often underestimated, sometimes even falling below the observational uncertainties. Understanding this observational bias in the black hole to stellar mass relationship is critical for constraining the evolution of high-z quasars with their hosts. I'll also briefly discuss how radio observations can shed light on the interaction between high-z galaxies and their central SMBHs, offering clues to the mechanisms behind their large black hole–stellar mass ratios.

Author: BERGER, Sabrina (University of Melbourne)

Presenter: BERGER, Sabrina (University of Melbourne)

Session Classification: AGN

Contribution ID: **174** Type: **Oral**

The GLINT Instrument: Finding the glimmer of alien worlds

Wednesday, July 9, 2025 5:00 PM (15 minutes)

Directly imaging habitable-zone exoplanets and analysing their spectra can reveal atmospheric compositions and potential biosignatures, making this endeavour a central goal in exoplanet science. However, separating the faint planetary light from its host star is extremely challenging, requiring high contrasts and tight angular separations. Nulling Interferometry offers a solution by destructively interfering light from an on-axis host star, while constructively interfering light from its companion, effectively 'nulling out' the starlight. The Guided Light Interferometric Nulling Technology (GLINT) instrument, downstream of the SCExAO system on the 8.2-meter Subaru Telescope (Hawai'i, USA), performs nulling interferometry in the H-band. GLINT uses photonic technology with laser-inscribed waveguides to couple light within a glass chip and has previously resolved angular separations 2.5 times smaller than the telescope's diffraction limit. Here, we present an overview of the GLINT instrument, current achievements, and future endeavours.

Author: ROSSINI-BRYSON, Stephanie (University of Sydney)

Presenter: ROSSINI-BRYSON, Stephanie (University of Sydney)

Session Classification: Planets

Contribution ID: **176** Type: **Oral**

Extreme Astrophysics with the Cherenkov Telescope Array Observatory

Tuesday, July 8, 2025 11:45 AM (30 minutes)

The Cherenkov Telescope Array is the next-generation observatory (CTAO) for ground-based gamma- ray astronomy. With more than 100 telescopes equipped with state-of-the-art technologies, it will provide a new view of the sky at energies from 20 GeV to 300 TeV at unprecedented sensitivity and angular resolution. CTAO will be a key contributor to multi-wavelength and multi-messenger astronomy, and its unique capabilities will allow us to explore the most extreme phenomena in the Universe. For example, the telescopes' very large collection area and rapid slewing are crucial to capture and probe transient phenomena, such as gamma-ray bursts and last radio bursts.
In this contribution, I will present the status of the observatory, introduce its key science projects, and highlight synergies between CTO and Australian facilities and research interests. In particular, I will discuss the importance of combining gamma-ray and radio observations, motivating the partnership to the Square Kilometre Array Observatory - the world's largest radio telescopes in the near future.

Author: EINECKE, Sabrina (University of Adelaide)

Presenter: EINECKE, Sabrina (University of Adelaide)

Session Classification: Plenary

Contribution ID: **177** Type: **Oral**

The Wide Field Spectroscopic Telescope: ESO's next big telescope?

Tuesday, July 8, 2025 3:00 PM (10 minutes)

While the construction of the ELT is well underway, the ESO community is already preparing for its next telescope project. A down selection is in fact already scheduled for the end of 2026. The leading contender, the Wide Field Spectroscopic Telescope (WST) is progressing its design with several contributing institutions across Europe and Australia. We will report on the telescope design progress and stress the activities taking place in Australia and its implication for ESO membership.

Author: TRAVOUILLON, Tony (Australian National University)

Presenter: TRAVOUILLON, Tony (Australian National University)

Session Classification: Mini-Session

Contribution ID: **179** Type: **Poster**

Modelling Joy's Law: Coriolis Effects on Rising Magnetic Flux Tubes in the Sun

Monday, July 7, 2025 12:13 PM (1 minute)

Joy's Law describes the systematic tilt of bipolar active regions on the Sun: the leading (prograde) magnetic polarity tends to emerge closer to the equator than the trailing (retrograde) polarity. This tilt increases with latitude and is attributed to the Coriolis force. In this study, we model the effect of the Coriolis force on a rising magnetic flux tube using a 3D Cartesian magnetohydrodynamic simulation. The flux tube originates at a depth of 11 Mm within the Sun's near-surface convection zone. To isolate the influence of the Coriolis effect on horizontal flows we approximated the Coriolis force in the f-plane approximation. Because Joy's Law is weak and only apparent in statistical averages over many active regions, we simulate a rotation rate 110× faster than the Sun's to amplify measurable effects in a single run. The simulated flux tube emerges with a tilt angle consistent with Joy's Law, and this tilt remains stable after emergence. When scaled to solar rotation, our results support the interpretation that horizontal Coriolis forces in the near-surface convection zone can explain the observed tilt.

Author: Mr ROLAND-BATTY, William (University of Newcastle)

Co-authors: Prof. PONTIN, David (University of Newcastle); SCHUNKER, Hannah (University of Newcastle)

Presenter: SCHUNKER, Hannah (University of Newcastle)

Session Classification: Poster

Contribution ID: **180** Type: **Oral**

LSST: first data release

Monday, July 7, 2025 3:15 PM (15 minutes)

On 23 June 2025, the Rubin Observatory released its first on-sky images after several months of testing and calibration. Six-filter images in the COSMOS field have been successfully obtained and reduced through the full automated pipeline. Distortion and illumination corrections have been refined. It is now 'all systems go'. This talk is presented on behalf of the Australian LSST collaboration and will show some of the data from the Rubin First Look and provide an up-to-date summary of the opportunities available to Australian astronomers as we move into the LSST era.

Author: WEBSTER, Rachel (University of Melbourne)

Co-authors: Prof. WOLF, Christian (ANU); Dr RYDER, Stuart

Presenter: WEBSTER, Rachel (University of Melbourne)

Session Classification: Plenary

Contribution ID: **181** Type: **Poster**

Tuning in to black holes: is it a bird, is it a plane, or is it just a calibration error?

Monday, July 7, 2025 2:38 PM (1 minute)

Colliding black holes send ripples through space-time in the form of gravitational waves. The waves from the final ringing created by the disturbed remnant black hole settling into a stable state after the collision are encoded with clues about the nature of gravity. By analysing these waves in a method called black hole spectroscopy, we can test Einstein's theory of general relativity in extreme conditions. But there's a catch: small calibration errors in our gravitational wave detector' s output can mimic signals that look like "new physics,"leading us to wonder —is it just me, or have we killed general relativity? So, let's talk about the impacts of calibration accuracy on our ability to truly test the nature of gravity. Using simulated black hole merger waveforms, we model how different levels of calibration errors affect the results of our tests. While we're pretty confident the observations from the current-generation observatories with their state-of-the-art calibration will be unaffected, the same cannot be said for our incredibly sensitive future observatories. In the end we find that calibration is a key factor to consider in order to ensure that if general relativity were ever to "die,"we'd know it was a real discovery and not just a glitch in calibration.

Author: SINHA, Mallika (Monash University)

Co-authors: SUN, Ling; MA, Sizheng (Perimeter Institute)

Presenter: SINHA, Mallika (Monash University)

Session Classification: Poster

Contribution ID: **182** Type: **Poster**

Evolutionary Map of the Universe: Detections of the well-known Wolf-Rayet stars WR16 and WR40 and their shells

Tuesday, July 8, 2025 12:52 PM (1 minute)

We present radio–continuum detections of the shells surrounding the well-known WN8 type Wolf-Rayet stars WR16 and WR40 at 943.5 MHz using the ASKAP EMU survey. These stars are easily identifiable by their surrounding outbursts of stellar material. WR16 is well known for its ring-like shell, whereas WR40's shell is elongated with non-uniform expansion. We analyse both stars and their shells as seen by EMU, and use the latest *Gaia* astrometry to determine the emission's sizes and distances. Due to WR16's symmetrical symmetry, we are also able to make estimates of the shell's age by tracing the proper motions of the star back to its geometric centre .

Author: BRADLEY, Aaron (Western Sydney University)

Presenter: BRADLEY, Aaron (Western Sydney University)

Session Classification: Poster

Contribution ID: **183** Type: **Poster**

Identifying muons with IACTs

Monday, July 7, 2025 12:00 PM (1 minute)

At very high energies, there is a deficiency in the number of muons produced in hadronic extensive air showers (EAS) in simulated interaction models compared to experimental measurements. Imaging atmospheric Cherenkov telescopes (IACTs) can be used to study this 'muon puzzle'. These telescopes detect the resultant Cherenkov light emitted from the interaction of cosmic rays with atmospheric nuclei. To study this discrepancy, muons must be efficiently identified with sufficient statistics to be able to distinguish different shower models.

This can be achieved through understanding properties of air showers and the muon characteristics that result with simulation software. These characteristics will be used to develop models that can identify muons. Examples include statistical likelihood template fitting or machine learning such as deep learning. Presented in this poster is an introduction to how muons are measured with IACTs and the relevant characteristics that will be used to build an effective identification model.

Author: CASTELLUCCI, Lydia

Co-authors: DAWSON, Bruce (University of Adelaide); EINECKE, Sabrina (University of Adelaide)

Presenter: CASTELLUCCI, Lydia

Session Classification: Poster

Contribution ID: **184** Type: **Poster**

EMUSE: Evolutionary Map of the Universe Search Engine

Tuesday, July 8, 2025 11:39 AM (1 minute)

The Evolutionary Map of the Universe (EMU) survey, conducted using the Australian Square Kilometre Array Pathfinder (ASKAP), aims to detect approximately 20 million radio galaxies, providing an unparalleled opportunity to explore galaxy evolution and uncover previously unknown astrophysical phenomena. However, the scale and complexity of this dataset go beyond the capabilities of traditional data mining methods. To tackle this, we are developing machine learning-based architectures tailored to the challenges of Big Radio Data. In this talk, I will introduce EMUSE (Evolutionary Map of the Universe Search Engine), a multimodal (image-text) search tool designed to efficiently query approximately 4,500 square degrees of EMU first-year survey images, delivering results within sub-seconds. I will demonstrate how EMUSE can effectively retrieve and classify radio sources based on their morphological characteristics. The EMUSE search engine is publicly available at: https://askap-emuse.streamlit.app/.

Author: GUPTA, Nikhel (CSIRO Space & Astronomy)

Presenter: GUPTA, Nikhel (CSIRO Space & Astronomy)

Session Classification: Poster

Contribution ID: **185** Type: **Poster**

New robust merger rates at intermediate redshifts using DEVILS

Monday, July 7, 2025 2:37 PM (1 minute)

Mergers are fundamental to our understanding of the processes that drive the evolution of the structure and morphology of galaxies, star formation, AGN activity, and the redistribution of stellar mass in the Universe. Therefore, determining the fraction and properties of mergers across cosmic time is crucial for understanding the formation of the Universe we observe today. There are multiple techniques for identifying mergers at different stages of their interaction, each providing its insights and challenges. One such technique identifies pre-merger galaxies by selecting galaxy pairs that are close in both projected spatial separation and radial velocity. While robust, this method requires spectroscopic samples to be highly complete and has so far been limited to the relatively local Universe ($z < 0.2$, e.g., from GAMA). In this work, I will present new, robust estimations of major close-pair fractions and rates at $0.2 < z < 0.9$, derived from the highly complete Deep Extragalactic VIsible Legacy Survey (DEVILS), and I will compare our estimates to predictions from hydrodynamical simulations. I will discuss how these findings contribute to our understanding of galaxy evolution during this critical epoch and how they help bridge our knowledge of merger rates at $z < 1$ with future studies using the next generation of galaxy redshift surveys.

Author: FUENTEALBA FUENTES, Melissa (The University of Western Australia)

Co-authors: DAVIES, Luke (ICRAR-UWA); ROBOTHAM, Aaron; BELLSTEDT, Sabine (UWA)

Presenter: FUENTEALBA FUENTES, Melissa (The University of Western Australia)

Session Classification: Poster

Contribution ID: **186** Type: **Oral**

On the chemical and orbital origin of Hercules

Thursday, July 10, 2025 4:00 PM (25 minutes)

The Hercules kinematic group is an anomaly overdensity structure of stars in the L_Z-V_R kinematics plane in the solar neighbourhood, characterised by lower galactocentric cylindrical L_Z and an asymmetric bias towards positive V_R. The chemical data from GALAH DR4 show enhancement in Fe-peak elements (Fe, Mn, Ni), deficiency in alpha elements (O, Ti), and enhancement in Odd-Z elements (Na, Al) in the thin disc ([Mg/Fe]<0.1) population of the low Lz Hercules subgroups. These chemical features indicate an inner Galactic origin of Hercules stars. We then consider orbits in a slow-long bar model of the Galaxy to seek the mechanism that transports stars born in the inner Galaxy out to the solar neighbourhood and form the Hercules group. We found that the extended quasi-periodic Trojan orbits surrounding the L4 Lagrange point of the bar are the few that can transport orbits from the inner Galaxy into the solar neighbourhood and include the kinematics of Hercules. We therefore support these orbits as the dynamical origin of Hercules.

Authors: Mr LI, Yusen (Australian National University); Prof. FREEMAN, Kenneth; Prof. JERJEN, Helmut

Presenter: Mr LI, Yusen (Australian National University)

Session Classification: Plenary

Contribution ID: **187** Type: **not specified**

Q&A

Tuesday, July 8, 2025 3:20 PM (10 minutes)

Session Classification: Mini-Session

Contribution ID: **188** Type: **Oral**

A new probe of cool gas outflows from distant galaxies

Monday, July 7, 2025 12:15 PM (30 minutes)

Outflows have long been considered a key mechanism for quenching star formation in galaxies, yet direct evidence linking outflows to quenching has remained elusive for decades. With the advent of JWST, our ability to study outflows in the early Universe has been transformed - particularly through the widespread detection of neutral gas being expelled from massive galaxies. This neutral phase likely carries the bulk of the outflow mass and directly reflects the depletion of the star-forming gas reservoir. In this talk, I will present new insights from JWST on the prevalence and energetics of neutral outflows, their dependence on galaxy properties, and their role in quenching star formation. I will also discuss some of the puzzles arising from the JWST results and introduce ongoing observational programs aimed at establishing neutral sodium absorption as a robust, widely applicable tracer of outflows across cosmic time.

Author: DAVIES, Rebecca (Swinburne University of Technology)

Presenter: DAVIES, Rebecca (Swinburne University of Technology)

Session Classification: Plenary

Contribution ID: **189** Type: **Poster**

Giant of the LMC: A multi-frequency view of the largest LMC SNR, J0450-7050

Monday, July 7, 2025 12:55 PM (1 minute)

This poster presents a multi-frequency view of one of the largest and most evolved supernova remnants (SNRs) in the Large Magellanic Cloud (LMC), J0450-7050. As one of the Milky Way's closest galactic neighbours, the LMC provides a clear view of the entire SNR population in the galaxy, allowing us to analyse their properties, evolution, and impact on the surrounding galaxy environment. J0450-7050 is an unusual SNR, displaying an extremely large size, high radio surface-brightness, and a flat radio spectral index, indicating unusual particle acceleration processes or environmental interaction. This poster presents new high-resolution radio images from the MeerKAT radio telescope, providing new insight into the radio-continuum morphology and particle acceleration properties. Optical data is also presented, which shows predominantly radiative shocks over the SNR, along with X-ray data which shows the interior thermal plasma. The multi-frequency view of this SNR demonstrates a complete view of the SNR properties, particle acceleration processes, shock processes, and overall evolution of this unusual SNR.

Author: SMEATON, Zachary (Western Sydney University)

Co-author: Prof. FILIPOVIC, Miroslav

Presenter: SMEATON, Zachary (Western Sydney University)

Session Classification: Poster

Contribution ID: **190** Type: **Oral**

A Journey Through Cosmic Time: Advancing Galaxy Evolution with the Shark Semi-Analytic Model

Friday, July 11, 2025 12:00 PM (30 minutes)

Cosmological galaxy formation simulations are essential tools for interpreting observations, designing surveys, and exploring uncharted regions of galaxy parameter space. Yet, these models face long-standing challenges—such as reproducing galaxy emission consistently from the UV to the FIR—as well as new ones, including explaining the presence of massive quenched galaxies in the early Universe revealed by recent observations. In this talk, I will present how we are addressing these challenges with *Shark*, a highly flexible, open-source semi-analytic model of galaxy formation. I will highlight recent advances in Shark's physical modelling, including the implementation of more realistic dust attenuation curves and improved treatments of Active Galactic Nuclei feedback, which together enable a more accurate and predictive framework for galaxy evolution across cosmic time.

Author: LAGOS, Claudia (University of Western Australia)

Presenter: LAGOS, Claudia (University of Western Australia)

Session Classification: Plenary

Contribution ID: **191** Type: **Poster**

CTA-Pol: An optical polarimeter to support gamma-ray transient science

Tuesday, July 8, 2025 12:59 PM (1 minute)

CTA-Pol is an optical polarimeter to deliver ancillary data for the Cherenkov Telescope Array Observatory (CTAO), the next-generation very high-energy gamma-ray observatory. Blazar flares combine increases in gamma-ray flux with changes in the fraction and orientation of visible-light polarisation. Other variable and transient sources to be targeted include gamma-ray bursts and tidal disruption events. CTA-pol will be used on small- to medium-sized telescopes in Australia to follow up gamma-ray flares and to monitor blazars directly. An emphasis will be an installation on the ANU 2.3m telescope which was recently automated. The instrument, currently under construction, is part of Australia's engagement with the CTA Observatory.

Authors: Prof. ROWELL, Gavin (University of Adelaide); BAILEY, Jeremy (UNSW); Prof. FILIPOVIC, Miroslav; TOTHILL, Nick (Western Sydney University); EINECKE, Sabrina (University of Adelaide)

Presenter: Prof. ROWELL, Gavin (University of Adelaide)

Session Classification: Poster

Contribution ID: **192** Type: **Oral**

PUBLIC HARLEY WOOD LECTURE - Per Aspera Ad Astra: The future of astronomy is here! Discovering ORC's and many other new wonders of the Universe

Tuesday, July 8, 2025 7:00 PM (1 hour)

This is an exciting time for the discovery of new astronomical objects through various multi-messengers. New-generation surveys across the entire waveband present a significant opportunity to study different objects and processes in the elemental enrichment of the interstellar medium (ISM). We reflect on our cosmic past, present, and future.

SKA pathfinders' observations in the radio spectrum, with high sensitivity, detect new objects in our Galaxy and other galaxies. Neutrino and gamma-ray studies provide answers to the long-standing question in high-energy astrophysics: Where do cosmic rays and ultra-high-energy particles come from? The gamma-ray emission observed from some middle-aged supernova remnants (SNRs) is now understood to originate from distant populations of cosmic rays (likely accelerated locally) interacting with gas, but there is still much work to be done to account for the Galactic cosmic-ray flux. Young PeV gamma-ray supernova remnants require different techniques to address the question of cosmic-ray acceleration. Among others, the Cherenkov Telescope Array will enable us to achieve this.

I will review the latest scientific outcomes from various new and sensitive surveys, such as ASKA and MeerKAT (radio). This is in addition to large multi-messenger surveys from XMM-Newton and eROSITA (X-rays), Herschel and Spitzer (IR), MCELS (optical), KM3NeT and HESS (gamma rays).

These are the golden days for Astronomy. ⋯and, maybe, the Earth deserves to be called a Galactic National Park?

Author: Prof. FILIPOVIC, Miroslav

Presenter: Prof. FILIPOVIC, Miroslav

Contribution ID: **193** Type: **Oral**

Astronomy Australia Ltd - an update on our strategy and funded projects

Thursday, July 10, 2025 2:40 PM (30 minutes)

This session will provide an overview of the portfolio of projects supported by Astronomy Australia Ltd (AAL), AAL's plans for seeking funding under the next round of NCRIS, and forward strategy to enable access to world-class facilities, strengthen national astronomy capability, integrate astronomy into industry and society, and serve as a trusted partner to government.

Author: COOKE, Alexander (Astronomy Australia)

Presenter: COOKE, Alexander (Astronomy Australia)

Session Classification: Town Hall

Contribution ID: **194** Type: **Poster**

Unveiling Unidentified Gamma-ray Sources using Supernova Remnants and Molecular Clouds

Monday, July 7, 2025 12:49 PM (1 minute)

The origin of high-energy cosmic rays remains one of the most investigated open questions in astroparticle physics. The presence of the knee in the cosmic-ray energy spectrum is particularly interesting, as it indicates the maximum energy that cosmic rays within our Galaxy can be accelerated to. To search for possible sites of Galactic cosmic-ray acceleration, we can look for gamma rays that high-energy cosmic rays produce when interacting with molecular gas close to their production site. Supernova remnants (SNRs) have long been considered as contenders for sources that can accelerate up to this threshold.

In this contribution, we describe our search for SNRs that may be capable of accelerating high-energy cosmic rays. We perform three-dimensional particle diffusion and time-dependent SNR evolution modelling to simulate the gamma-ray flux expected from an extensive list of SNR and molecular cloud (MC) combinations in our Galaxy. These combinations have been compared with unidentified sources from the H.E.S.S. Galactic plane survey (HGPS) to identify possible origins of these sources. We additionally investigate the model parameters that allow SNR-MC combinations to produce gamma-ray fluxes that have evaded current gamma-ray telescopes, but would be observable with the upcoming Cherenkov Telescope Array Observatory (CTAO).

Author: BURLEY, Ryan (University of Adelaide)

Co-authors: Prof. ROWELL, Gavin (University of Adelaide); EINECKE, Sabrina (University of Adelaide)

Presenter: BURLEY, Ryan (University of Adelaide)

Session Classification: Poster

Contribution ID: **195** Type: **Poster**

Investigations in continuum-removed nebular imaging

Monday, July 7, 2025 12:56 PM (1 minute)

Narrowband optical imaging is a useful tool for helping to characterise some high-energy sources, such as SNR and other sources producing gaseous emission lines. In particular, removal of continuum light from such narrowband images greatly improves the visibility of the emission line sources. Initial experiments in this regard, at Adelaide, will be described.

Author: MCGEE, Padric (University of Adelaide)

Co-authors: Prof. ROWELL, Gavin (University of Adelaide); EINECKE, Sabrina (University of Adelaide)

Presenter: MCGEE, Padric (University of Adelaide)

Session Classification: Poster

Contribution ID: **196** Type: **Poster**

How many neutrino sources are there in the Universe?

Monday, July 7, 2025 12:14 PM (1 minute)

With the current upgrade of IceCube undergoing and IceCube Gen 2 on the way, along with KM3NeT in the Mediterranean Sea observing the most energetic neutrino event ever before even being finished, multi-messenger astronomy is becoming more and more prevalent than ever. However, one question remains unanswered: How many neutrino sources are there in the Universe? IceCube has provided evidence for the emission of neutrinos from the active galaxy NGC 1068, the blazar TXS 0506+056 and the galactic plane, but the sky remains vastly diffuse in astrophysical neutrinos. To assess how well a number of sources may have been responsible to produce the neutrino sky, one needs to calculate the integrated likelihood with respect to all the positions of the sources, a highly dimensional integral that even a computer could not hope to do. Our findings suggest, however, that many of the Universe's sources may be too dim to see, and applying Markov chain Monte Carlo techniques to perform the related integral allows us to test how well a number of sources are at describing the neutrino sky. Hopefully, this will allow us to distinguish between a completely diffuse universe, or a universe with a few but bright point sources, for which we can then perform multi-messenger astronomy through other instruments such as gamma-ray astronomy and gravitational wave astronomy.

Author: LOTSTRA, Caleb (The University of Adelaide)

Co-authors: COLLIN, Gabriel; HILL, Gary (University of Adelaide); Dr BOLOGNINO, Irene (The University of Adelaide)

Presenter: LOTSTRA, Caleb (The University of Adelaide)

Session Classification: Poster

Contribution ID: **197** Type: **Poster**

Bringing Observational Archives and Data Reduction Pipelines Together: Automating the pyWiFeS pipeline inside Data Central

Tuesday, July 8, 2025 11:41 AM (1 minute)

With ANU 2.3m Telescope observational data now being archived in the Data Central Archives system, observers can now receive their reduced data quicker than ever. As new observations come off the telescope, they are transferred into the Data Central Archives system where the data then gets reduced as part of the archival workflow. The implementation of the pyWiFeS pipeline automatically detects any calibration frames related to the new observation and then produces the cubes and other data products. This workflow also includes the feature of running a re-reduction automatically as new calibrations or exposures become available and updating the archive database as required. Once the reductions have completed, they then get ingested into the database where astronomers can query and download both raw and reduced files via a web interface or interact directly through the Archives API with support in Data Central's Jupyterhub service upcoming.

Authors: Dr MISZALSKI, Brent (Australian Astronomical Optics - Macquarie University); Prof. LIDMAN, Christopher (The Australian National University); ONKEN, Christopher (Australian National University); COULSON, James (Australian Astronomical Optics - Macquarie University); O'TOOLE, Simon (Australian Astronomical Optics, Macquarie University)

Presenter: COULSON, James (Australian Astronomical Optics - Macquarie University)

Session Classification: Poster

Contribution ID: **198** Type: **Poster**

SN2024iss: the nearby Type IIb SN with high velocity H-alpha and shock break out features

Monday, July 7, 2025 1:00 PM (1 minute)

Core Collapse Supernovae are powerful explosions marking the death of
massive stars. One of the most uncertain aspects of our understanding of the final stages of stellar evolution is the connection between the progenitor star, the type of explosion, and the resulting outcome, such as the formation of a compact object and/or an observable supernova. With the advent of ground-based optical surveys, more supernovae, especially nearby ones and those discovered a few hours after the explosion, are being detected. Data from both early and later observations provide a unique opportunity to study the explosion mechanism and the progenitor system.
Here we present a detailed analysis of the first ~100 days of evolution of nearby (z=0.003) Type IIb Supernova, SN2024iss, using high cadence optical to X-ray photometry and optical and near-infrared spectroscopy. Our spectra initially reveal strong lines consistent with other Type IIb supernova, but whose H-alpha profile shows an unusual high velocity (v~18000 km/s), indicating fast shock velocities. Its early light curve shows a characteristic double peak consistent with shock-break out indicating shock cooling or CSM interaction, before exhibiting re-brightening to a second peak which transitions quickly to radioactive powered and long-last decline. As strong shock-break out features seen in SN2024iss have been observed in only a small number of supernovae, this provides us with the opportunity to independently constrain the properties of the progenitor star. Here we place not only the spectroscopic properties but also the progenitor star properties into the context of other Type IIb and those that exhibit shock-break out features.

Author: ROMAGNOLI, Sara (University of Melbourne)

Presenter: ROMAGNOLI, Sara (University of Melbourne)

Session Classification: Poster

Contribution ID: **199** Type: **Oral**

Exoplanets in the Era of JWST

Monday, July 7, 2025 2:45 PM (30 minutes)

The James Webb Space Telescope has exceeded the expectations of the exoplanet community: revealing the first high quality transmission spectra of exoplanet atmospheres, including numerous (and sometimes controversial) detections of molecular features; revealing the dusty nebulae where planets are born, both in spectra and imaging; and direct imaging of young planets on distant orbits. I will review some of the highlights of recent discoveries, the current limitations and highlights of the work to overcome them, and situate these in the context of other observations & theory.

Author: Prof. POPE, Benjamin (Macquarie University)

Presenter: Prof. POPE, Benjamin (Macquarie University)

Session Classification: Plenary

Contribution ID: **200** Type: **Poster**

Data Central: Australian Astronomy's Science Platform

Data Central is the Science Platform for Australian Astronomy, providing multi-wavelength tools and services for both individual researchers and teams. This poster outlines what a Science Platform is, and how and why you can benefit from using our Science Platform.

Author: TOCKNELL, James (AAO, Macquarie University)

Presenter: TOCKNELL, James (AAO, Macquarie University)

Session Classification: Poster

Contribution ID: **201** Type: **not specified**

The MeerKAT Pulsar Timing Array: A Southern Hemisphere Gravitational Wave Detector

Friday, July 11, 2025 12:30 PM (30 minutes)

The signal that is most sought after in pulsar timing array experiments is that of a stochastic gravitational wave background: the superposition of all nanohertz-frequency gravitational waves emitted in the observable Universe. Recently, a number of pulsar timing arrays have unveiled modest evidence of a spatially correlated signal. This signal, if correct, is thought to be representative of a background of gravitational waves from inspiralling supermassive black hole binaries. However, in order to make a definitive detection, it is necessary to observe pulsars over a longer timing baseline, monitor a larger ensemble of pulsars, time pulsars to higher precision, or all. Here, we introduce The MeerKAT Pulsar Timing Array. The array monitors a large number of pulsars (83), to high precision, and at the highest cadence of any extant pulsar timing array. While amongst the youngest of these experiments, the pulsar timing array has now completed its first two public data releases, and its first search for gravitational wave signals.

In this presentation, I provide an overview of pulsar timing array science, describe the process of analysing the highly sensitive data of the array, present the results of these initial searches, and speak to the future goals of the experiment as we approach the era of Square Kilometer Array Science.

Author: MILES, Matthew (Vanderbilt University)

Presenter: MILES, Matthew (Vanderbilt University)

Session Classification: Plenary

Contribution ID: **203** Type: **Oral**

Welcome

Monday, July 7, 2025 11:30 AM (15 minutes)

Presenter: Prof. ROWELL, Gavin (University of Adelaide)

Session Classification: Plenary

Contribution ID: **204** Type: **Oral**

Harley Wood School Debrief

Friday, July 11, 2025 2:30 PM (15 minutes)

Authors: BARNSLEY, Imogen (University of Adelaide); PILOSSOF, Jemma (University of Adelaide)

Presenters: BARNSLEY, Imogen (University of Adelaide); PILOSSOF, Jemma (University of Adelaide)

Session Classification: Plenary