Modelling the Energy and Redshift distribution of FRBs using the Second CHIME/FRB catalog

Naman Jain[1,2]

[1]McGill University; [2]Trottier Space Institute; naman.jain@mail.mcgill.ca

Fast radio bursts (FRBs) are energetic millisecond-duration bursts with extragalactic origins. Roughly 4000 unique sources have been observed to date, about 3% of which have been seen to repeat, though it remains unclear whether all FRBs repeat.
An FRB population study addresses several key questions: How often do FRBs occur in the universe? What energy and redshift distributions do they follow? Is their occurrence correlated with the cosmic star formation history (SFH)? Answering these questions helps contextualize the origins of FRBs with potential astrophysical sources such as magnetars and supernovae.
Previous population studies, based on samples of a few hundred sources, have provided important constraints on FRB rates and energetics. However, these analyses were limited by smaller sample sizes, less well-characterized selection effects, and uncertain treatment of repeat bursts.
The recently released Second CHIME/FRB Catalog contains more than 90% of all known FRB sources (≈3600) and provides well-calibrated selection effects. We leverage this sample to infer key FRB properties, including the volumetric rate, energy function, redshift distribution, and correlation with the cosmic SFH. We then compare the predicted energetics and abundances with proposed FRB models and contrast the inferred redshift distributions with those of FRBs with known host galaxies.

Evolutionary Map of the Universe: A pilot survey to detect high Galactic latitude pulsars in variance images with ASKAP

Adeel Ahmad[1], Shi Dai[2], Emil Lence[2], Miroslav Filipović[1], Bärbel Koribalski[2,1], Simon Johnston[2], George Hobbs[2], Stefan W Duchesne[2], Sanja Lazarević[1,2], Lawrence Toomey[2], N. D. R Bhat[4], Denis Leahy[5], Andrew Hopkins[3], Tayyaba Zafar[3], S. F Rahman[6]

[1]Western Sydney University, Australia; [2]Australia Telescope National Facility, CSIRO, Space and Astronomy; [3]School of Mathematical and Physical Sciences, 12 Wally's Walk, Macquarie University, NSW 2109, Australia; [4]International Centre for Radio Astronomy Research, Curtin University, Bentley, WA 6102, Australia; [5]Department of Physics and Astronomy, University of Calgary, 2500 University Drive NW, Calgary, AB T2N 1N4, Canada; [6]Syed Babar Ali School of Science and Engineering, Lahore University of Management Sciences, Lahore, Pakistan; 22031320@student.westernsydney.edu.au

It has been proposed that radio pulsars can be distinguished from other point-like radio sources in continuum images by their unique interstellar scintillation signatures. Using data from ASKAP Evolutionary Map of the Universe (EMU) survey, we conducted a pilot survey of radio pulsars at high Galactic latitude regions via the variance imaging method. Out of approximately 59,800 compact radio sources detected in a ~ 480 square degree survey area, we identified 21 highly variable sources. Among them, 10 are known pulsars, 2 are known radio stars, 1 is a known long period transient, 3 are radio star candidates, and the remaining 5 are pulsar candidates. Notably, we discovered two strongly scintillating pulsars: one with a period of 85.707 ms and a dispersion measure (DM) of 19.4 cm^{-3}pc, and another with a period of 5.492 ms and a DM of 29.5 cm^{-3}pc. In addition, a third pulsar was discovered in the variance images, with a period of 14.828 ms and a DM of 39.0 cm^{-3}pc. This source shows a steep radio spectrum and a high degree of circular polarisation. These results underscore the strong potential of variance imaging for pulsar detection in full EMU and future radio continuum surveys planned with Square Kilometre Array (SKA).

Ayush Pandhi[1,2]

[1]McGill University, Quebec, Canada; [2]Trottier Space Institute, Quebec, Canada; ayush.pandhi@mcgill.ca

Fast radio bursts (FRBs) are energetic, micro- to millisecond duration radio transients originating from cosmological distances. However, even two decades after their discovery, the specific origins of FRBs remain elusive. In this talk, I will present 3.2 years of observations with the Canadian Hydrogen Intensity Mapping Experiment FRB backend (CHIME/FRB) tracing the evolution of the dynamic local environment around repeating FRB 20220529A by measuring propagation effects imprinted upon its radio signals. We find that the integrated electron column in the FRB environment decreases linearly over multiple years, closely matching theoretical predictions for a FRB source embedded within a young (~years to a few centuries old), expanding supernova remnant. This scenario is also consistent with the scattering timescale variations and depolarization we observe in FRB 20220529A bursts. This FRB source also undergoes a month-long period in which the local plasma density and magnetic field strength precipitously rise before declining to their original state. I will explore physical scenarios that can explain such extreme, transient changes in the FRB environment, for example magnetized plasma overdensities in the supernova remnant, intervening ejecta or wind from a binary companion, or a magnetar ejecta interactions with a supernova remnant.

A deep 43-epoch search for radio transients and variables in the globular cluster 47Tuc

Angiraben Mahida, Arash Bahramian, James Miller-Jones, Susmita Sett

Curtin University, Australia; angiraben.mahida@postgrad.curtin.edu.au

Globular cluster 47 Tuc (NGC104) is one of the brightest clusters of the Milky Way. Due to its proximity, 47 Tuc has been extensively observed across the entire electromagnetic spectrum from radio to gamma rays. 47 Tuc is known to harbour not only 42 known millisecond pulsars but also exotic binary systems.

We have observed 47 Tuc for nearly 480 hours across 43 epochs using the Australia Telescope Compact Array (ATCA). The stacked image reaches an unprecedented radio sensitivity of 790 nJy, revealing 400 unclassified sources. We investigated individual epochs, identifying nearly 1000 variables and transient candidates, including a few classified as X-ray sources and pulsars. In this talk, I will discuss the results and analysis of this work, highlighting some of the most interesting detections, and conclude by discussing prospects for future facilities such as SKA.

Constraining the NE2025 Galactic Electron Density Model with High-Time-Resolution CHIME/FRB Scattering Measurements

Daniel Amouyal
McGill University, Canada; daniel.amouyal@mail.mcgill.ca

Models of the Galactic electron density are widely used to predict distances and scattering of compact radio sources, and to account for interstellar medium foregrounds in extragalactic studies. The recently updated NE2025 model (Ocker & Cordes 2026) offers order-of-magnitude improvements over its predecessor, the commonly referenced NE2001. However, its scattering predictions have yet to be tested by extra-galactic sources. This work presents a direct verification using fast radio bursts (FRBs) detected by CHIME/FRB. Since FRB signals propagate through the full Galactic interstellar medium, their observed scattering must equal or exceed the Milky Way contribution, making them natural constraints on Galactic scattering models. Using CHIME/FRB baseband data, we measure scattering timescales at microsecond-to-millisecond precision and compare them to the NE2025 prediction along each line of sight. I will show that while most FRBs are scattered well beyond the Galactic prediction, a subset of minimally scattered FRBs place hard upper limits on the true Galactic scattering, revealing Galactic directions where NE2025 overpredicts. These sightlines offer insight into specific model components, and point to the potential of FRBs as systematic constraints on future Galactic electron density models.

Extreme fast radio variability in early-stage active galactic nuclei

Emilia Järvelä
Texas Tech University, United States of America; ejarvela@ttu.edu

I report on the discovery of extreme 37 GHz radio variability originating from early-stage active galactic nuclei (AGN). Most of these AGN are narrow-line Seyfert 1 (NLS1) galaxies, harbouring fast-growing, low-mass supermassive black holes, accreting at high Eddington ratios. These AGN exhibit amplitude variability of three to four orders of magnitude over timescales of a few days. However, despite our relentless attempts, we have not detected relativistic jets in these sources, and thus, they might be displaying a new kind of variability phenomenon in AGN. Recently, one of these sources exhibited a series of 37 GHz flares and was followed up by several radio and X-ray facilities. Based on these observations, we estimated a timescale of some hours, leading to variability brightness temperatures and variability Doppler factors that are extremely hard to explain by an incoherent emitter, suggesting a possible detection of coherent emission from an AGN or, alternatively, brightness temperatures far exceeding the inverse Compton catastrophe limit. In this talk, I will present our multiwavelength investigation, including future plans, into this subset of AGN, and discuss the importance of the next-generation astronomical facilities for our efforts to unveil the nature of these extraordinary sources.

Radio Properties of Ultra-compact White Dwarfs

Anwesha Sahu
University of Warwick, United Kingdom; anwesha.sahu@warwick.ac.uk

Recent discoveries of long-period radio transients (LPTs) confirmed to host white dwarfs have increased the number of classes of radio-emitting white dwarf binaries, including cataclysmic variables (CVs), white dwarf pulsars, and AM CVn systems. However, key questions remain about accretion and outflow processes in these, particularly in AM CVns, where a white dwarf accretes from a white dwarf or evolved helium star. To date, only one radio detection of an AM CVn exists, and both its validity and emission mechanism remain uncertain. Using observations from the Karl G. Jansky Very Large Array (VLA) and MeerKAT, this study presents the deepest radio luminosity constraints for three AM CVns: AM CVn, HP Lib, and ASASSN-14mv. These data are combined with large survey catalogues, including LOFAR, RACS, and VLASS, to constrain the AM CVn population for the first time. By comparing radio and optical luminosities alongside orbital periods, we explore potential emission mechanisms. Statistical analysis of detected systems allows us to investigate how binary configuration influences radio luminosity. In this talk, I will discuss how this work contributes to our understanding of radio emission processes in compact binaries.

Astro-COLIBRI

Fabian Schüssler, Bernardo Cornejo, Sofia Bisero, Ilja Jaroschewski, Weizmann Kiendrebeogo
CEA Paris-Saclay, France; fabian.schussler@cea.fr

Next-generation radio astronomy, led by infrastructures like the SKAO, requires coordinated real-time responses to transient phenomena. We present Astro-COLIBRI, a platform designed to streamline time-domain and multi-messenger (TDAMM) workflows. Astro-COLIBRI evaluates alerts from global streams (GCN, TNS, LSST brokers) in real-time, placing them in a multi-wavelength context to enable rapid follow-up decisions.

For the radio community, it facilitates the study of FRBs, stellar flares, and radio counterparts to GRBs and gravitational waves.

Key features we will highlight in this contribution include:
- Observability Assessments: Instant visibility calculations for all major observatories.
- Advanced Tiling: Integration of tilepy for optimized tiling and galaxy targeting of poorly localized events, such as neutrinos or gravitational waves.
- Real-Time Access: User-friendly web and mobile apps providing event summaries and automated lightcurves.

SN 2012au: A compact radio source emerging a decade after a peculiar stripped envelope supernova

Mattias Lazda
University of Toronto, Canada; mattias.lazda@mail.utoronto.ca

A growing sample of stripped-envelope supernovae (SESNe) have been observed to re-brighten at radio frequencies years post collapse. Three leading models have been put forth to justify the observed radio re-brightening associated with these SESNe: radiation from an emerging pulsar wind nebula (PWN), shock interaction with a dense circumstellar medium, or emission from an off-axis, relativistic jet. SN 2012au is a particularly intriguing SESN in this regard as observations >6 years post-explosion have shown both (i) optical emission features consistent with a young PWN and (ii) a radio re-brightening. In this talk, I will present the results of an observational campaign to image SN 2012au using very-long-baseline-interferometry (VLBI) 8 to 13 years post-explosion. We find that our VLBI measurements can be readily explained by a ~decade-old PWN, consistent with independent inferences based on late-time optical spectroscopy of SN 2012au. I will close by discussing the implications of our observations on the properties of the central neutron star, as well as how future observations can be leveraged to gain novel insight into the formation properties of, what is likely, a decade-old extragalactic pulsar.

Probing the GRB Orphan Afterglow population with the VAST-ASKAP survey

Surabhi Chandra, Dougal Dobie, Tara Murphy

The University of Sydney, Australia; sura0296@uni.sydney.edu.au

Gamma-ray Bursts (GRBs) are relativistic transients associated with the gravitational collapse of massive stars or coalescing compact objects, the latter of which are also associated with gravitational waves. 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, offering an opportunity to study jet structure and their environment. Wide-field radio surveys enable us to detect such events. The VAST Survey conducted with ASKAP has been collecting data over the last four years, providing the most comprehensive radio time-domain survey ever conducted. This will allow the systematic search and identification of radio transients, particularly GRB orphan afterglows, an area yet to be investigated using this dataset.
We have developed a novel framework to assess measurements quality and remove imaging artefacts, which combined with a matched-filter approach driven by canonical GRB afterglow models, will help us identify orphan afterglows and potentially other classes of transients in the VAST survey as well. Leveraging the unexplored VAST dataset to study orphan afterglows will provide new insights to help constrain existing afterglow models, revealing the nature of their central engines and progenitors.

Evolving faraday complexity from an accreting galactic black hole

Andrew Kenneth Hughes

University of Oxford, United Kingdom; andrew.hughes@physics.ox.ac.uk

X-ray binaries are canonical laboratories for studying accretion and accretion-driven outflows (i.e., jets). As small-scale analogues of AGN, they undergo outbursts that evolve on human timescales, making them well suited to probing time-variable jet behaviour. Their jets are primarily studied at radio wavelengths because they are radio-bright, polarised synchrotron emitters. However, since polarised flux densities are, by definition, no brighter than the total intensity (and often much fainter), work on X-ray binaries has largely been dominated by total-intensity measurements.

Recently, the MeerKAT Large Survey Programme ThunderKAT (and its ongoing spiritual successor, X-KAT) has delivered years of high-sensitivity, weekly-cadence 1 GHz observations of outbursting X-ray binaries. Compared to the historic focus on >5 GHz, these lower-frequency data provide a new time-resolved spectropolarimetric window on jets and their Faraday-rotating plasmas. In this talk, I will present results from the X-ray binary Swift J1727 consistent with the transient emergence of local, complex Faraday components; discuss how these may map onto distinct elements of multi-component jet emission and their intrinsic properties; and outline how similar techniques can be applied across the remaining 7 years of data and to the brightest sources in the sample.

Righting the Radio Light Curve of the BOAT (GRB 221009A)

Helena-Margaret Grabham, Gavin Lamb

Liverpool John Moores University, United Kingdom; H.M.Grabham@2025.ljmu.ac.uk

The Brightest-of-All-Time GRB 221009A, aka. the 'BOAT' remains the most energetic gamma-ray burst (GRB) ever recorded. Spanning over 15 orders of magnitude, the BOAT released an isotropic energy on the order of ~55 ergs, causing disturbances in the Earth's ionosphere and drawing the attention of astronomers globally. This unique 1 in 10,000 year event puzzled astronomers due to its incredible luminosity and excess radio flux contribution within the long-lasting afterglow emission. Classical afterglow models only predict the optical and X-ray radiation and not the complex radio signature. This triggered deep searches for a supernova association, however, after no evidence was found, the shallow decline from the radio emission remained unsolved. We show how the multi-band afterglow can be reproduced using a nested tophat model, a combination of two GRB jet models with simple modifications applied to the micro-physics of the jet parameters. This provides better knowledge of where energy release occurs inside jets and allows us to build a quasi-universal model for all GRBs to fit. I will present the jet dynamics governing the nested tophat and explain how this accurately matches the BOAT's observational data, providing an advanced structural analysis applicable to the next generation of GRBs.

Extreme Scintillators and Serendipitous Transients

Raghav Girgaonkar[1], David Kaplan[1], Yuanming Wang[2], Hayley Bignall[3], Artem Tuntsov[3]

[1]Department of Physics & Astronomy, University of Wisconsin-Milwaukee, P.O. Box 413, Milwaukee, WI 53201, USA; [2]Centre for Astrophysics and Supercomputing, Swinburne University of Technology, Hawthorn, VIC 3122, Australia; [3]Manly Astrophysics, 15/41-42 East Esplanade, Manly 2095, Australia; raghav@uwm.edu

Compact radio sources are highly susceptible to propagation effects, such as scintillation, caused by irregularities in the ionized interstellar medium (ISM), which alter their apparent brightness on different timescales. In rare cases, sources may scintillate on very short (~hours to ~days) timescales, a phenomenon known as intra-day variability, suggesting the presence of highly structured, nearby scattering media. We present preliminary results of a long-term (4–6 year), first-of-its-kind monitoring campaign of previously detected extreme scintillators with ASKAP. This campaign aims to characterize the nature, evolution, and dynamics of plasma filaments in the local ISM by simultaneously probing the presence (or absence) of multi-epoch variability and extending the search to new scintillators and transients. We also present an analysis of a serendipitously discovered transient, ASKAP J2024, in the scintillator fields. The transient exhibits peculiar properties: simultaneous narrowband flare emission in different bands, long-term changes in its quiescent flux, and a lack of an optical/near-infrared counterpart. These observed properties together do not match ASKAP J2024 to any particular class of radio transients. We explore a range of possible models, focusing on the two most likely explanations: an extremely radio-loud ultracool dwarf or a hitherto uncharacterized class of radio transients.

The Rapid ASKAP Continuum Survey (RACS)

Stefan Duchesne

Commonwealth Scientific and Industrial Research Organisation, Australia; stefan.duchesne@csiro.au

Surveys of the sky within myriad wavelength regimes provide a complete view into the large-scale properties of the Universe while also allowing studies of unique and heretofore unknown astrophysical objects and processes. The Australian SKA Pathfinder (ASKAP) has completed a series of shallow radio-frequency surveys as part of the Rapid ASKAP Continuum Survey (RACS) to add to this collection of sky surveys. RACS covers three radio-frequency bands centred on ~900, 1367, and 1656 MHz and covers the whole southern sky and up to declination ~+49 degrees. RACS provides a combination of frequency, sensitivity (~ 150-300 micro Jy/beam), angular resolution (~8-15 arcsec), and polarization information that fills a niche in the existing ecosystem of all-sky surveys. Imaging and cataloguing of the multiple epochs covering 888 to 1656 MHz has been completed, with data released to the astronomical community. I will present on RACS and provide an update on the project, highlighting the various datasets and recent improvements to the images and catalogues.

First results from the PanRadio GRB collaboration: radio follow-up of all Southern GRBs from <1 day to >1 year post-burst

James Leung[1], Gemma Anderson[2], Alexander van der Horst[3]

[1]University of Toronto, Canada; [2]CSIRO Space and Astronomy, Australia; [3]George Washington University, USA; jamesk.leung@utoronto.ca

Gamma-ray bursts are the most extreme cosmic explosions and emitting across the entire electromagnetic spectrum, detected from TeV gamma rays down to sub-GHz radio frequencies. Their multi-wavelength emission allows for studies of ultra-relativistic jets, extreme particle acceleration, the final stages of life for the most massive stars, and the counterparts to gravitational wave events. Radio observations play a crucial role in probing gamma-ray burst physics, tracking the evolution of the broadband spectrum for much longer than at any other wavelengths and catching early-time phenomena such as the reverse shock that often go undetected in other wavelength regimes. In recent years, there has been a paradigm shift in radio observations of gamma-ray bursts, due to significant sensitivity improvements and the implementation of automated triggering capabilities, which were developed as part of pathfinder projects for the next generation of radio astronomy. We will present highlights of these recent results, such as the earliest detections of radio emission from gamma-ray bursts with the Australian Telescope Compact Array within an hour of gamma-ray trigger, revealing temporal behavior never before observed in the radio regime. We will discuss how the capabilities developed in our pathfinder projects can be adopted in the DSA/ngVLA/SKA-era of radio telescopes.

The first blind detection of a low-frequency fast radio burst with the Murchison Widefield Array

Cristian Di Pietrantonio[1,2], Marcin Sokolowski[3,1], Randall Wayth[4,2], Ramesh Bhat[2], Clancy W. James[2], Chia Min Tan[2], Christopher P. Lee[2], Christoher Harris[1], Bradley W. Meyers[3,2], Danny C. Price[4,2]

[1]Pawsey Supercomputing Research Centre; [2]Curtin Institute for Radio Astronomy; [3]Australian SKA Regional Centre (AusSRC); [4]Square Kilometre Array Observatory (SKAO); cristian.dipietrantonio@postgrad.curtin.edu.au

Radio telescopes observing at frequencies above 400 MHz have been routinely detecting fast radio bursts (FRBs) over the past seven years, with the second CHIME catalogue presenting more than 4000 FRBs. In contrast, detections below 300 MHz are still extremely rare, with only one confirmed detection known in the literature. In this talk I will present the first-ever low-frequency (< 300 MHz) FRB detected in a non-targeted search with the Murchison Widefield Array (MWA), as opposed to LOFAR's targeted detections of FRB 20180916B. Only one burst of the MWA FRB has been detected at the time of writing, possibly making it the first non-repeating FRB at frequencies below 300 MHz. In addition to describing its properties, I will also briefly describe the strategies and technologies that led to find the first MWA FRB after 10 years of past attempts. I will discuss the inferred low-frequency FRB rates and compare with the extrapolations from higher frequencies. Finally, I will discuss the physical interpretation and implications of these results for FRB research with low-frequency telescopes such as the upcoming SKA-Low.

BLINK and you'll miss it: a high time resolution imaging pipeline for fast radio burst searches with the Murchison Widefield Array

Marcin Sokolowski[1], Cristian Di Pietrantonio[2,3], Christopher P. Harris[2], Danny C. Price[3,4], Randall B. Wayth[3,4]

[1]Australian SKA Regional Centre, Australia; [2]Pawsey Supercomputing Research Centre, Kensington, 6151, Western Australia, Australia; [3]International Centre for Radio Astronomy Research, Curtin University, Bentley, 6102, Western Australia, Australia; [4]Square Kilometre Array Observatory (SKAO), Kensington, 6151, Western Australia, Australia; marcin.sokolowski@uwa.edu.au

The Murchison Widefield Array (MWA) offers a unique insight into the population of low-frequency radio transients in the southern sky due to its wide field of view (FoV) and high-time resolution capabilities. The petabyte-sized MWA archive contains raw-voltage observations spanning over 7 years. However, its discovery potential has been hindered by the lack of efficient software addressing computational challenges of low-frequency searches over wide FoVs. I will present the BLINK high time resolution imaging pipeline designed and developed from the ground up to perform image-based fast transient searches at even exaFLOPS scales on modern supercomputers with Graphical Processing Units (GPUs). Minimisation of I/O and efficient use of GPUs enabled processing of MWA high-time resolution data at an unprecedented pace (days instead of months). The pipeline also features a new image-based dedispersion algorithm called Streaming high-Time Resolution Imaging DEdispersion (STRIDE). The imaging pipeline achieves a 3700x speedup compared to its WSCLEAN-based predecessor, while the new dedispersion algorithm reduces memory requirements by more than 97%. I will also discuss potential applications of this new software to other science cases and telescopes. Especially, how these novel techniques will enable SKA-Low to explore the low-frequency dynamic radio sky in previously impossible ways.

Time-Domain Exploration of a LOFAR Calibrator Field

Jaiverdhan Chauhan[1], Rhaana Starling[1], Antonia Rowlinson[2]
[1]University of Leicester, United Kingdom; [2]Anton Pannekoek Institute, University of Amsterdam; jc999@leicester.ac.uk

We present a systematic time-domain study of a LOFAR calibrator field using 53 snapshot observations at 144 MHz spanning 344 days. Combining 50 epochs, we construct a deep image (≈0.4 mJy beam^{-1} over ≈29 deg^2) and identify 3933 compact sources. Cross-matching with LoTSS DR3 reveals 20 source not detected in LoTSS, including steep-spectrum sources, stellar counterparts, and a potential infrared AGN. A complementary time-domain analysis using per-epoch photometry and a blind transient search identifies four plausible transient events—three stellar flares and one galaxy detected across epochs—corresponding to a surface density of ≈0.14 deg^{-2} at ≈15 mJy. Variability analysis of 1394 sources yields no significant variables, placing a 95% confidence upper limit of <0.22% on strong variability at 144 MHz. These results demonstrate the power of mining calibrator archives for uncovering rare transients and constraining low-frequency variability.

FRB 20250316A: A Brilliant and Nearby One-Off Fast Radio Burst Localized to 13 parsec Precision

Amanda Cook
McGill University, Canada; amanda.cook@mail.mcgill.ca

FRB 20250316A is the highest S/N FRB ever detected by CHIME/FRB and the first to be localized with the newly operational, full CHIME Outriggers array. While energetically representative of an average FRB luminosity, this one-off burst was localized to host galaxy NGC 4141 at a distance of ~40 Mpc. Our sensitivity towards this line of sight, paired with the steep power-law burst energy distributions of other repeaters, suggest that this source is inconsistent with other repeating FRBs. In this talk, we leverage the precise localization, brilliance and proximity of the source to explore the 13 pc environment of a one-off FRB with a rich multiwavelength dataset. We also place deep constraints on transient FRB counterparts using more than 20 years of monitoring.

ASKAP monitoring of the Rubin Deep Drilling Fields

Dougal Dobie
University of Sydney, Australia; d.dobie@sydney.edu.au

The Vera C. Rubin Observatory has now started releasing alerts. It will carry out a paradigm shifting survey of the sky and detect time-variable objects such as Active Galactic Nuclei, Tidal Disruption Events and kilonovae at an unprecedented rate.
Studying the objects discovered by Rubin will require comprehensive multi-wavelength observations, but the sheer number of sources to observe makes dedicated follow-up infeasible. I have recently been allocated a large Guest Science Programme on the Australian Square Kilometre Array Pathfinder (ASKAP) to carry out regular monitoring of the five Rubin "Deep Drilling Fields" (DDFs) across the first year of Rubin operations. These observations will provide radio light curves for every transient detected in the DDFs which would take thousands of hours of telescope time to obtain under a traditional targeted approach. The raw data products will be made publicly available immediately and we plan to release value-added data products regularly throughout the survey.
In this talk I will outline the project status and highlight early results from the survey.

A New Era of Afterglow Discovery with the Eric and Wendy Schmidt Observatory System

James Freeburn
University of North Carolina at Chapel Hill; jamesfreeburn54@gmail.com

Gamma-ray burst (GRB) afterglows have traditionally been discovered via triggered follow-up of high-energy triggers. As part of the Eric and Wendy Schmidt Observatory System, the Argus Array in the optical and the Deep Synoptic Array (DSA) in the radio, will change this paradigm by enabling serendipitous afterglow detections at an unprecedented rate. We simulate DSA and Argus observations of a population of long-duration GRBs and their afterglows. We predict Argus and DSA will serendipitously detect the afterglows from GRBs detected by Fermi's Gamma-ray Burst Monitor on a weekly basis, at a rate of 41 ± 4 and 64 ± 7 per year respectively. These surveys will also routinely detect afterglows independently of GRB triggers with hundreds per year. The Argus array's second–minute cadence, detecting afterglows before they peak, will enable a large sample of Lorentz factor measurements, reverse shock emission and prompt optical emission. Joint detections with Argus and DSA, will yield multi-wavelength light curves with post-burst timescales spanning more than six orders of magnitude, providing robust constraints on jet geometries and circumburst environments. We highlight the continued need for multi-wavelength follow-up of afterglows detected with Argus and DSA and their promise for unveiling the orphan afterglow population.

The VAST Extragalactic survey data release 1

Iris de Ruiter
University of Sydney, Australia; iris.deruiter@sydney.edu.au

The Variables and Slow Transients (VAST) Survey on the Australian SKA Pathfinder (ASKAP) is designed to systematically monitor the radio sky. I will present Data Release 1 of the VAST Extragalactic Survey, a survey designed to identify slowly evolving synchrotron transients across ~12,300 deg^2 of the southern sky. Between June 2023 and May 2025, the survey produced 2,945 images of 276 fields at 888 MHz, achieving a typical rms of 0.24 mJy $beam^{-1}$ and 12–20 arcsec resolution, with each field revisited roughly every two months. DR1 provides light curves for 0.5 million sources and 6.4 million measurements, all publicly accessible through the CSIRO data access portal.

I will focus on the key scientific results from an untargeted variability search, which identifies 117 astrophysical variables, including pulsars, radio stars, active galactic nuclei, supernovae, and unidentified objects lacking multi-wavelength counterparts. I will also highlight how to access and work with the various data products that are part of this work. Finally, I will showcase ongoing projects already leveraging this dataset. This work presents the first uniform, long-term view of extragalactic radio variability with ASKAP and establishes a foundation for future radio transient surveys.

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Talk Abstract Submissions
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Exploring the low-frequency transient sky with NenuFAR: pulsars, fast radio bursts, and beyond

Cherry Ng
CNRS, France; cherry.ng-guiheneuf@cnrs-orleans.fr

The dynamic Universe is rich in transient phenomena spanning a wide range of timescales and energies, yet the very-low-frequency radio window remains largely unexplored. The newly commissioned NenuFAR (New Extension in Nançay Upgrading LOFAR) telescope in France is opening this regime, providing unprecedented sensitivity between 10–85 MHz and serving as a pathfinder for the Square Kilometre Array (SKA). NenuFAR enables systematic searches for coherent radio transients, offering new insight into emission mechanisms, source environments, and propagation effects such as scattering and absorption in dense plasma. Early science efforts include large-scale pulsar surveys and dedicated searches for fast radio bursts (FRBs), alongside monitoring campaigns of known repeating sources. In this talk, we present the current status and first results from these surveys, highlighting the potential of low-frequency observations to uncover new populations and constrain the physics of transient sources. We conclude with a broader perspective on the role of low-frequency facilities in multi-wavelength transient studies and their synergy with upcoming instruments such as the SKA.

The sharpest view on GRBs: measuring their expansion through very long baseline interferometry

Stefano Giarratana
INAF - OAB, Italy; stefano.giarratana@inaf.it

Radio observations employing the very long baseline interferometry (VLBI) technique offer a crucial insight into the structure and dynamics of Gamma-Ray Burst (GRB) jets. Specifically, VLBI serves as a fundamental tool for measuring the apparent super-luminal expansion (in on-axis GRBs) and proper motion (in off-axis GRBs) of the GRB blast wave. These measurements enable constraints on the outflow geometry and dynamics, complementary to light curve and spectral modelling. In this talk, I will highlight the significant contribution of VLBI to GRB science, with a particular focus on recent results concerning GRB 221009A, the brightest GRB recorded to date. For the latter, the observed size evolution probed by VLBI measurements suggests that the reverse shock and the forward shock dominate the afterglow emission at different frequencies and times. Lastly, prospects for GRB research in the era of the Square Kilometre Array (SKA) will be discussed.

Searching for Spider Pulsars in the Image Domain

Flora Petrou
Curtin University, Perth; flora.petrou@student.curtin.edu.au

The launch of the Fermi γ-ray telescope revealed numerous sources without multiwavelength counterparts and discovered an excess of γ-ray emission arising from the Galactic Centre (GCE). Millisecond pulsars (MSPs) have emerged as a promising explanation for both phenomena. Spider pulsars are a subclass of binary MSPs in compact orbits with low-mass companions ablated by the pulsar wind, producing eclipses observable across the electromagnetic spectrum. Their short orbital periods ($\lesssim$24 hours) and long-duration radio eclipses make them challenging to detect with traditional beamforming searches.

Recent advances in wide-field radio interferometry, particularly with SKA precursor telescopes, enable sensitive time-domain imaging searches, offering a complementary route to discovery. I present a novel imaging-based approach to identifying spider pulsars, reporting multiple candidates, including two confirmed systems. These sources show characteristic eclipsing variability, short orbital periods, steep spectral indices, and potential optical and γ-ray counterparts. I will also describe a pipeline applied to the VAST Galactic survey, carried out by ASKAP, which identifies eclipsing behaviour via bimodal flux density distributions and periodicity searches.

This method has strong potential to reveal a previously hidden population of spider pulsars missed by conventional searches, providing critical insight into the nature of Fermi's unassociated sources and the unresolved GCE.

Detection of Millimeter-Wavelength Flares from Two Accreting White Dwarf Systems in the SPT-3G Galactic Plane Survey

Yujie Wan
UIUC, United States of America; yujiew2@illinois.edu

Discoveries of millimeter-wave transient events in non-targeted surveys have only become possible in the past decade using cosmic microwave background surveys. To date, the SPT-3G collaboration has reported over a hundred transient events, with the majority being stellar flares. In this talk, we will present the first results from the SPT-3G Galactic Plane Survey-the first dedicated high-sensitivity, wide-field, time-domain, mm-wave survey of the Galactic Plane, conducted with the South Pole Telescope using the SPT-3G camera. The survey started in 2023, covering 100 deg^2 near the Galactic center for one month each year. The first two years of data, comprising ~1,500 individual 20-minute observations, resulted in the detection of two transient events exceeding the 5σ threshold. Both events exhibit durations of ~one day, with peak flux densities at 150 GHz of at least 50 mJy, and are not linearly polarized. Each event is associated with a previously identified accreting white dwarf, and magnetic reconnection in the accretion disk is a likely explanation for the observed millimeter flares. We are currently extending our search to the full four-year dataset, with the goal of lowering the detection threshold. We are also exploring variability across different timescales, from single-scan (minute-scale) to yearly difference maps.

The Nature of Hostless Radio Transients in the VLA Sky Survey

Delina Levine, Gregg Hallinan
Caltech, United States of America; dlevine2@caltech.edu

Of the thousands of transients identified in the VLA Sky Survey (VLASS) to date, ~1/3 are ` `hostless'', i.e. do not have a detected counterpart in any existing multi-wavelength survey. The brightest of these are luminous, likely jetted transients, representing the most extreme examples of existing transient classes or, in some cases, entirely new classes. To understand the origin of these transients, the 20 most radio-luminous of this sample were selected for targeted multi-wavelength follow-up and classification. This effort has already yielded a spectacular tidal disruption event (TDE) candidate, likely from an intermediate-mass black hole (IMBH) progenitor, that is among the most radio-luminous transients ever detected. The remainder of the sample is likely comprised of further rare examples of jetted events, objects in dusty and/or high-redshift galaxies, and objects of galactic origin. I present an overview of the complete sample, with additions from the most recent VLASS Epoch 4.1, and updates on the ongoing analysis and characterization of these transients.

Evaluating magnetars as the progenitors of fast radio bursts

Vishwangi Shah
McGill University, Canada; vishwangi.shah@mail.mcgill.ca

Fast radio bursts (FRBs) are millisecond-duration radio transients originating from extragalactic distances. While thousands of FRBs have been detected, their origins remain unknown. Many FRB theories invoke highly magnetised neutron stars, called magnetars, as progenitors. In this talk, I will evaluate the magnetar progenitor scenario using recent results from the CHIME/FRB telescope.

The most energetic FRBs provide crucial insights into their progenitor models. I will present constraints on the maximum energy of FRBs derived from the largest sample of ~3,000 FRBs in the second CHIME/FRB catalog. Our results indicate that the most energetic bursts have isotropic energies collectively limited to ~10^{42} erg, thereby constraining the energy reservoir of their sources. Assuming standard radio-to-high-energy emission efficiency ratio, this energy limit is consistent with that of the most powerful magnetar giant flares.

Furthermore, the occurrence of most FRB sources inside star-forming galaxies supports an origin in magnetars formed via core-collapse supernovae. However, I will present the first ever localization of a repeating FRB far outside a quiescent galaxy, which challenges this theory. We propose that this source resides in a globular cluster, where the magnetar progenitor scenario is only viable if the magnetar formed via exotic formation channels such as compact-object mergers.

Investigating mechanisms of extreme radio variability in AGN

Chloe Klare, Charlotte Ward
The Pennsylvania State University, United States of America; chloe.klare@psu.edu

Radio-bright AGN are known to exhibit intrinsic radio variability due to properties of their synchrotron jets, but understanding the formation and evolution of these jets remains a challenge. Recent work has shown that previously radio-quiet AGN can transition to radio-bright over the span of decades, contrary to the idea that the radio properties of AGN remain fixed on these timescales. We have identified 101 AGN which have brightened by 80%-1800% at 888MHz across 8-30 epochs spread over 1-6 years in the ASKAP Variables and Slow Transients survey. To characterize our sources, we obtained multi-epoch radio SEDs by combining new ATCA observations with archival radio survey data. We will present on whether our sources are young, compact AGN with off-axis jets or previously undiscovered blazars. For sources with off-axis jets, we will present our conclusions on whether the increasing radio emission is due to the formation of new jets, interactions between the jets and the ISM, plasma propagation effects, or radio flares from transient phenomena, such as tidal disruption events. Our results will lead to a better understanding of the physical conditions that lead to the formation of jets in AGN and the duty cycle of AGN accretion episodes.

Off-axis GRBs and Where to Find Them

Genevieve Schroeder
Cornell University, United States of America; gms279@cornell.edu

Long-duration gamma-ray bursts (GRBs) are the most luminous explosions in the Universe, visible out to cosmological redshifts. Almost every spectroscopically confirmed supernova (SN) associated with a long GRB has been hydrogen and helium poor with broad lines (Ic-bl), indicating a stripped massive star progenitor with fast winds that produced a highly-collimated jet viewed on-axis. A critical prediction of this progenitor model is that there should be a large number of off-axis jets accompanying SNe Ic-bl - however, this has yet to be observationally confirmed. Additionally, if a GRB is observed moderately off-axis, it may result in a spectrally softer X-ray flash (XRFs), detectable with X-ray observatories such as Einstein Probe and SVOM. Radio observations of XRFs and SNe Ic-bl can reveal late rising afterglows as the jet spreads into the field of view, providing one of the best pieces of evidence for the off-axis GRB scenario. Here, I will present recent results following up several candidate off-axis GRBs, including an XRF and a sample of radio loud SNe Ic-bl. Additionally, I will lay the path forward to detecting off-axis GRBs in the era of large transient surveys.

Insights from a Systematic VLA Monitoring Program of Tidal Disruption Events

Collin Christy
University of Arizona, United States of America; collinchristy@arizona.edu

Transient accretion onto a supermassive black hole through the tidal disruption of a star offers a unique opportunity to probe the environment around quiescent galactic nuclei and to map the lifecycle of jets and outflows. Until recently, the radio properties of tidal disruption events (TDEs) have remained poorly understood. Here, we present results from four years of systematic Karl G. Jansky Very Large Array monitoring of a uniformly-selected sample of optical TDEs, which represent the most comprehensive radio follow-up effort for TDEs to date. Our dataset consists of sensitive, multi-frequency observations over timescales of weeks to years, enabling consistent analysis across the population for the first time. By systematically modeling the radio light curves and broadband spectra of each event, we infer the physical properties of their outflows and place new constraints on the diversity and prevalence of radio-emitting ejecta in TDEs. Additionally, we place the first statistical constraints on the fraction of TDEs producing detectable radio emission, finding that radio outflows are a common but not ubiquitous feature of the population. Together, these results demonstrate that uniform, long-term monitoring is essential for understanding the diversity of TDE outflow properties and connecting late-time radio behavior to the underlying accretion physics.

Exoplanets in Radio - A Statistical Approach

Tiasha Biswas
UNSW Sydney, Australia; z5628863@ad.unsw.edu.au

The search for habitable exoplanets requires understanding planetary magnetic fields, which protect atmospheres from stellar winds and radiation. Radio observations probe these magnetospheres through electron cyclotron maser emission (ECM) generated by star-planet interactions (SPIs), but such emissions are extremely faint. In radio interferometry, visibilities are the measurable quantity, and image reconstruction from it requires accurate calibration to account for ionospheric and instrumental effects. If these are not properly modeled, they can introduce biases and obscure faint signals. Moreover, the limited sensitivity of current radio interferometers makes direct imaging of such emissions very challenging. Instead, statistical techniques can be used to identify ECM signatures directly in visibilities. Visibilities consist of astrophysical sky emission, thermal noise, radio-frequency interference, and periodic signals potentially associated with SPIs. In this work, we apply the sky-subtracted incoherent noise spectra algorithm to isolate these components. Using simulations generated with WODEN, matched to the observing capabilities of the Murchison Widefield Array, we investigate the detectability of circularly polarized exoplanetary radio emission in the 73–105 MHz band through noise spectra. We present initial results from noise spectra diagnostics, demonstrating the potential of statistical techniques for exoplanetary studies and outlining a framework for future searches with more sensitive instruments.

Untwisting the magnetospheric dynamics of PSR J1622-4950

Marcus Lower
Swinburne University of Technology, Australia; mlower@swin.edu.au

Radio-loud magnetars offer unique insights into how the magnetospheres of neutron stars respond to explosive outbursts. Phase-coherent timing of their radio pulses allows us to track dramatic changes in their rotational and radiative properties over time. These time-variable behaviours are thought to be driven by twists in the magnetosphere that propagate outward from the crust, altering both the magnetic geometry and plasma content. However, such models may do tell the complete story. In this talk, I will describe a comprehensive analysis of the 2017-2022 outburst PSR J1622-4950. High-cadence monitoring by the Murriyang, MeerKAT and Molonglo telescopes enabled a fully phase-coherent timing solution to be obtained for the full duration of the outburst. Combined with measurements of the radio profile width, spectral index, polarisation and single-pulse behaviour, we are able to test the predictions of the twisted magnetosphere model in unprecedented detail. The sequence in which emissive features emerge, fade and disappear also provides us with a clear picture of how radio-magnetar outbursts progress, and are indicative of a shared, universal model for their magnetospheric response.

A real-time LOFAR image plane transient detection pipeline

Lars Zwaan
University of Amsterdam, Netherlands, The; l.p.zwaan@uva.nl

We present a real-time transient detection pipeline operating in the image plane for LOFAR data. The pipeline generates short-duration snapshot images (seconds to a minute) and searches for transient sources in the differences between consecutive images. By restricting processing to the LOFAR core stations and using short integration times, we bypass computationally expensive calibration, enabling imaging on seconds timescales. When a candidate transient passes automated filtering, buffered station data are stored for detailed offline analysis.

The pipeline will run on the EuroFlash cluster, which receives a commensal multicast of all LOFAR observations, enabling low-latency searches across large data volumes. This approach is sensitive to transients on timescales of seconds to minutes, probing a relatively unexplored regime where Long Period Transients (LPTs) have recently emerged. Some LPTs are associated with white dwarf binaries, while others exhibit properties consistent with neutron star progenitors.

We demonstrate the pipeline's capabilities using LOFAR Two-metre Sky Survey data, successfully re-detecting the two known LPTs observed by LOFAR (ILT J1101+5521 and ILT J1634+44). Real-time commensal processing is expected by summer 2026, following the LOFAR2.0 upgrade.

Monitoring the low frequency radio transient sky with AARTFAAC

Antonia Rowlinson[1,2], Kate Kelley[1,2]
[1]University of Amsterdam, Netherlands, The; [2]ASTRON; b.a.rowlinson@uva.nl

With the discovery of long period radio transients and slow spinning pulsars, the radio transient sky on seconds to minutes timescales is proving to be an exciting regime for studying coherent emission mechanisms in compact object systems. Identifying more of these sources, and the most extreme examples, will give deep insights into the population of radio transients on these timescales. A whole sky radio transient monitor will play an important role in this field.

AARTFAAC was a whole visible sky radio transient monitor operational on LOFAR at ~60 MHz with a bandwidth of 3 MHz making images of the radio sky every second. AARTFAAC discovered some dispersed, likely Galactic, radio transients with durations of ~10 seconds. While revisiting these transients, we discovered a bright, repeating radio transient with unknown origin. In this presentation, I will outline the AARTFAAC discoveries and introduce the new AARTFAAC2.0 which will be operational on LOFAR2.0 in mid 2027. AARTFAAC2.0 will be significantly more sensitive than the original system, with an order of magnitude more bandwidth, and is expected to find the rarest radio transients with durations of seconds.

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Talk Abstract Submissions
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PSR B1259–63 at 2024 periastron: insights for repeating FRBs

Kavya Shaji[1,2,3]
[1]University of Sydney, Australia; [2]OzGrav (ARC Centre of Excellence for Gravitational Wave Discovery); [3]Commonwealth Scientific and Industrial Research Organisation (CSIRO); ksha0606@uni.sydney.edu.au

Fast radio bursts (FRBs) have been studied for nearly two decade, yet their underlying emission mechanisms and origins remain poorly understood. Although magnetars are a plausible source for some FRBs, they cannot explain the full diversity of observed phenomena. A unified theoretical framework is challenging to establish, as FRBs exhibit diverse characteristics, including variability in activity, spectro-temporal features, and polarimetric properties. A particularly intriguing subset of repeating FRBs shows periodic activity or periodic variations in rotation measure (RM), hinting at orbital motion and binary companion systems as potential progenitors.

In this talk I will discuss radio observations of the gamma-ray binary pulsar PSR B1259–63 taken during its 2024 periastron passage. We track how its pulsed emission evolves across frequency, orbital phase, and time, measuring DM, RM, scattering timescales, and polarisation properties close to the periastron passage. By comparing these results with the statistical properties of known repeating FRBs, we explore what fraction of repeating FRBs are consistent with binary systems of this kind as viable progenitor environments.

The DRS 2026 is the ideal place to present due to its focus on FRBs and transients, providing a chance to gain expert thoughts on binary progenitors and comparing FRBs with other transient populations.

The key to unlocking the origin of long-period transients

Sanne Bloot
ASTRON, Netherlands, The; bloot@astron.nl

Long-period transients (LPTs) are mysterious radio sources that produce bright pulses that repeat on periods of minutes to hours. While they have been suggested to be extremely slow magnetars or white dwarf binaries, conclusively determining their origins has been complicated due to their large distances and high extinction making follow-up at other wavelengths next to impossible. Furthermore, these objects have only been discovered over the last few years, which prevents multi-wavelength monitoring on the long timescales required to understand these objects simply because the time since their discovery does not cover these timescales. However, we recently discovered a system that bypasses all of these limitations. In this talk, I will present a new LPT that was discovered in a search for circularly polarized transients with LOFAR. It has a well-monitored optical counterpart, providing us with data going back over a decade. Combining this wealth of auxiliary data with the information gained from the radio detections, we can study the location where the radio emission is produced in unprecedented detail, constraining not only the origin of this specific LPT, but also the origins of LPTs as a source class.

Uncovering Radio-Bright Tidal Disruption Events with ASKAP and the VLA

Hannah Dykaar

McGill University, Canada; hannah.dykaar@mcgill.ca

Tidal disruption events (TDEs) occur when a star passes close enough to a supermassive black hole to be torn apart by tidal forces. Radio observations probe the resulting outflows, constraining their size, velocity, and the density of the surrounding environment. While most TDEs have historically been discovered at optical or X-ray wavelengths, new and upgraded radio facilities such as the ASKAP and the VLA are enabling radio-driven discovery and follow-up. I will present results from the first untargeted radio survey search for TDEs using the VAST Pilot Survey with ASKAP. By identifying nuclear radio variability, we find twelve radio-bright candidate TDEs, implying a volumetric rate of ~0.8 Gpc^{-3} yr^{-1}. This represents the first constraint on the TDE rate derived from an untargeted radio survey. I also present a multiwavelength study of AT2022dbl, a repeating partial TDE in which the stellar core survives an initial disruption and returns for a subsequent encounter. VLA radio observations constrain the size of the outflow and the density of the circumnuclear environment, providing insight into the nature of partial TDEs. Together, these results demonstrate how radio surveys and follow-up can advance our understanding of TDE demographics and outflow physics.

A spatial filter for mitigating radio interference and its application to CHIME/FRB Outriggers

Juan Mena-Parra[1], Shion Andrew[2]

[1]University of Toronto, Canada; [2]Massachusetts Institute of Technology, United States; juan.menaparra@utoronto.ca

The sensitivity of radio telescopes to the dynamic radio sky is increasingly limited by radio frequency interference (RFI), a challenge that will intensify as the radio spectrum becomes more crowded and that is particularly critical for fast radio burst (FRB) science. Detecting and precisely localizing FRBs requires robust mitigation of interference, especially as next-generation surveys aim to capture large samples of events. In this talk, I will present a spatial filtering technique based on the Karhunen–Loève transform designed to enhance interferometric sensitivity in the presence of RFI and other unwanted interference. I will demonstrate its application to FRB detection and localization using CHIME/FRB data. Our results show that this method not only recovers FRB signals from frequency bands persistently contaminated by strong interference, but also improves both sensitivity and localization efficiency for CHIME/FRB Outriggers. For a sample of 100 FRBs detected by CHIME and its Outriggers, we find that the filter doubles the number of successfully localized events compared to spectral-kurtosis methods. Although demonstrated here in the context of CHIME/FRB Outriggers, this spatial filtering technique is broadly applicable to other interferometric radio facilities engaged in FRB science and transient detection, including next-generation instruments such as CHORD, DSA-2000, BURSTT, and CHARTS.

The Future of Fast Radio Burst Cosmology with LSST

Hugh Roxburgh

Curtin University, Australia; hugh.roxburgh@postgrad.curtin.edu.au

Over the past decade, fast radio bursts (FRBs) have emerged as unique probes of the Universe's baryonic matter. Their dispersion measures trace the density of free electrons along their path, offering a statistical window to the otherwise invisible baryons in diffuse states near the edges of galaxies. Studies thus far have been limited by small samples, but rapid improvements in detection and localisation are expanding the known population - and this growth shows no sign of slowing.

A major challenge remains: FRB cosmology relies on spectroscopic host galaxy redshifts, and constraining parameters like the Hubble Constant could require hundreds of thousands of FRBs, an unrealistic demand on telescope time. The Legacy Survey of Space and Time (LSST) at the Vera C. Rubin Observatory offers a promising alternative. By providing photometric redshifts out to z~1, LSST opens the door to large-scale FRB cosmology without the spectroscopic burden. In this talk, I will assess the statistical feasibility of this approach using the current FRB sample and predictions from state-of-the-art cosmological simulations. Furthermore, I will highlight what may still be missed due to unseen contributions from faint foreground halos, emphasising the subtle biases that remain in our view of the baryon distribution.

On the nature of highly variable extra-galactic radio sources from ASKAP VAST

Akash Anumarlapudi[1], David Kaplan[2], Igor Andreoni[1]

[1]University of North Carolina at Chapel Hill, United States of America; [2]University of Wisconsin Milwaukee, United States of America; akasha@unc.edu

All sky surveys at radio wavelengths have revealed that the extragalactic radio sky is dominated by either active galactic nuclei (AGNs) or radio galaxies. At lower frequencies (~1GHz), radio emission from galaxies is usually not expected to be variable, while AGNs can exhibit modest variability (a few tens of percent), either due to intrinsic or propagation effects. This implies that highly variable radio emission (at GHz) points to extreme changes that are intrinsic to the source. Such sources can involve extragalactic afterglows, or accretion-induced outflows (relativistic or otherwise), or the birth of new radio jets. Radio emission from these sources can uniquely probe the AU-pc scale regions, allowing us to understand their immediate surroundings. However, most such radio observations to date are targeted with source discoveries driven by optical/high-energy surveys, posing a bias in the detected radio population. Multi-epoch radio surveys like the Variable and Slow transients (VAST), over multi-year timescales, are changing this approach. Using the first two years of VAST data, I will present the first large sample of highly variable GHz radio sources. I will discuss the nature of the radio emission in these sources and the expectations in the deep synoptic array (DSA) era.

VLBI Observations of the Enigmatic Optical Tidal Disruption Event AT2018hyz

Walter Golay[1], Yvette Cendes[2], Edo Berger[1]

[1]Center for Astrophysics | Harvard & Smithsonian; [2]University of Oregon; wgolay@cfa.harvard.edu

We present new very-long-baseline interferometry (VLBI) imaging and astrometry of the tidal disruption event (TDE) AT2018hyz, which was initially detected in the radio ~2.2 years after the optical flare despite previous non-detections. Since then, it has rapidly risen at all frequencies spanning at least ~1-20 GHz and at one point rose as fast as L~t^5.7. AT2018hyz has since reached a peak luminosity of 10^40 erg/s, comparable to the on-axis jetted TDE Sw J1644+57 on similar timescales. The multi-frequency spectral energy distribution modeling of the synchrotron-emitting outflow could be consistent with either a non-relativistic, quasi-spherical outflow launched 620 days post-disruption or a highly off-axis (>80 degrees) relativistic jet, both of which could explain the delayed onset of radio emission. Our new VLBI observations spanning the previous three years of AT2018hyz's radio flare, using the High Sensitivity Array and the Very Long Baseline Array, are providing new evidence to distinguish between these two scenarios. We will present this new dataset and discuss the potential resolved nature and astrometric motion of the source.

Constraining the near-source relativistic wind medium using Fast Radio Burst circular polarization

Om Gupta[1], Pawan Kumar[1], Paz Beniamini[2,3]

[1]The University of Texas at Austin, United States of America; [2]The Open University of Israel, Israel; [3]The George Washington University, United States of America; omgupta@utexas.edu

Fast Radio Bursts (FRBs) are short-duration radio transients that are ubiquitous across the sky, are primarily extragalactic, and are believed to originate from magnetars. They exhibit a rich and diverse range of properties in the spectro-temporal domain which can potentially probe emission physics and the variety of environments FRBs propagate through.

In this talk, I will present a model which explains the generation of circular polarization in FRBs. The model is based on Faraday conversion in the relativistic wind of magnetars. It employs the increase in the effective mass of electrons and positrons in the presence of the intense FRB wave.

The model explains a broad range of observed circular polarization properties, including its frequent non-detection. Upper limits from non-detections provide constraints on the wind luminosity, magnetization, and bulk Lorentz factor. Bursts exhibiting frequency evolution of Stokes parameters offer direct estimates of the wind environment.

The model successfully characterizes instantaneous wind parameters for several sources, including FRB 20201124A, FRB 20180301A, and SGR 1935+2154. The stringent setup of the model also helps us identify, in certain cases, where intrinsic and/or alternate explanations are required. I will also highlight some other interesting conclusions stemming from our model.

Radio transients and variables in the nearby starburst M82

David Williams-Baldwin

University of Manchester, United Kingdom; david.williams-7@manchester.ac.uk

The nearby (d=3.6 Mpc) Starburst Galaxy M82 is home to dozen of compact radio sources in the central kiloparsec of the galaxy. Owing to the high obscuration in the optical, the only way to study many of the supernova remnants, HII regions and exotic transients is through very long baseline interferometry (VLBI) radio observations using the e-MERLIN array and European VLBI network.

In this talk, I will present sub-arcsecond resolution observations of M82 obtained over the last 40 years, revealing the new supernova SN2008iz, the slowly decaying source 41.95+57.5, and the more recent discovery of radio mission from the intermediate mass black hole candidate M82 X-1.

I will highlight the latest data for M82 and stress the importance of high cadence, high resolution, high sensitivity monitoring of nearby galaxies to search for extragalactic radio transients in the era of the SKAO and ngVLA.

Probing the Origins of Fast Radio Bursts Through Searches for Multi-wavelength Counterparts

Melanie Szpigiel[1,2], Alice Curtin[1,2,5], Victoria Kaspi[1,2], Yuxin Dong[3,4]

[1]McGill University, Canada; [2]Trottier Space Institute (TSI), Canada; [3]Northwestern University, USA; [4]Center for Interdisciplinary Exploration and Research in Astrophysics (CIERA), USA; [5]University of Amsterdam, The Netherlands; melanieszpigiel@gmail.com

Fast Radio Bursts (FRBs) are highly energetic, ~millisecond duration bursts of radio emission with extragalactic origins that were discovered nearly 19 years ago. While there is some evidence suggesting FRBs may originate from magnetars, there still remains the question of whether all FRBs are produced by magnetars. One potential method for further understanding FRB progenitors is through cross-matching FRBs with different transients with a known progenitor by searching for positional, redshift, and/or temporal coincidences. In this talk, I will discuss a new pipeline for the Canadian Hydrogen Intensity Mapping Experiment (CHIME) which automatically cross-matches all FRB candidates with gamma-ray bursts (GRBs) detected by the Swift observatory and Fermi telescope, gravitational waves (GWs) detected by the Ligo-Virgo-Kagra (LVK) collaboration, and optical transients reported in the Transient Name Server (TNS). I will also describe the largest campaign to cross-match over 4000 FRBs with all known gamma-ray bursts (GRBs) to determine radio upper limits for GRBs within CHIME's field of view. Finally, I will discuss the results of FRB-TNS optical transient crossmatching as a direct test to the FRB progenitor model.

Millimeter-Wave Transient and Time Domain Astronomy With CMB Survey Instruments

Allen Foster
Princeton, United States of America; amfoster@princeton.edu

The next decade will be transformative for time-domain and transient astronomy, with a new generation of wide-field surveys poised to uncover a vast population of time-varying and transient astrophysical phenomena. The Simons Observatory (SO), a new cosmic microwave background (CMB) experiment, will provide high-cadence millimeter-wave observations over ~half the sky, notably delivering transient alerts and thousands of bright source light curves to the public on a ~daily cadence. In this talk I will discuss recent and future efforts in time domain astronomy using CMB survey instruments such as the South Pole Telescope (SPT), in particular using the SPT-3G and SPT-3G+ cameras, and SO, using the Advanced SO camera. These surveys are also synergistic with optical surveys like the Vera C. Rubin Observatory's Legacy Survey of Space and Time (LSST), radio surveys such as the Square Kilometer Array (SKA) and the Deep Synoptic Array (DSA-2000), and X-ray surveyors such as Einstein Probe (EP), among many others. SO will provide invaluable and open access to millimeter time-domain data, marking a fundamental change in the way CMB surveys interact with the broader astrophysical community.

Searching for radio transients in LoTSS

Sylvain Ranguin
University of Amsterdam, Netherlands, The; s.l.ranguin@uva.nl

Long-period transients (LPTs) are a recently identified class of coherent radio transients with durations ranging from a few seconds to several minutes, and periodicities on timescales of minutes to hours. To date, only twelve such sources have been reported, with few confirmed to reside in white dwarf–M-dwarf binary systems. Identifying more LPTs is critical to constraining the population and evolutionary pathways of neutron stars and white dwarfs.

Here, we present our ongoing analysis of the LOFAR Two-Metre Sky Survey (LoTSS) data from a systematic search for long-period transients and other coherent radio bursts probing a largely unexplored region of the northern radio sky. Our approach uses modern imaging techniques, including subtraction imaging and fast filter analysis, to detect rare bursts using 8-second and 2-minute snapshot images. We report the re-detection of an LPT with a 125.5-minute period, associated with a binary system containing an M-dwarf companion and known pulsars. We also present the initial results and highlight other transient candidates identified in the first 10% of the LoTSS Data.

This project serves as a benchmark for transient search methodologies with LOFAR 2.0 and lays the groundwork for the upcoming EuroFlash project, which aims to enable real-time detection of radio transients.

Can We Search for Slow Transients with CHORD?

Joshua Goodeve
McGill University, Canada; joshua.goodeve@mail.mcgill.ca

The Canadian Hydrogen Observatory and Radio Transient Detector (CHORD), currently under construction, will be an important complement to the highly successful CHIME array, and is a flagship project of Canadian radio astronomy. CHORD may have excellent capabilities as a detector of transient phenomena on day to year timescales, including TDEs, GRBs, AGN flares and more. In this talk, I will present the results of my critical evaluation of CHORD as a detector of long-timescale radio transients. I will cover the powerful advantages offered by CHORD due to its drift-scan design, large field of view and excellent electronics, as well as the significant difficulties posed by the regular array design. I will talk about the detailed imaging simulation pipeline we have developed, which includes radiometer noise, AGN and SFGs with realistic distributions, intrinsic and extrinsic source variability, and realistic transients simulated using Redback. I will discuss the challenge of identifying the transients in simulated fields, and will finish by discussing the potential future of CHORD for this purpose, including the ability to monitor the location of many known optical transients and the implications of an expanded CHORD array.

Periodicity in the Repeating FRB Population

Aaron B. Pearlman
Massachusetts Institute of Technology (MIT), United States of America; aaron.b.pearlman@mit.edu

The origin of the periodic activity observed in a small number of repeating FRB sources remains unclear. Proposed explanations include orbital modulation from a neutron star in a binary system, precession of a highly magnetized neutron star, and unusually slow rotation of a neutron star spun down by particle winds and/or a fallback accretion disk. A major unresolved question is whether periodic activity is common among repeating FRBs, with most periodicities remaining undetected because many sources yield too few bursts, have periods longer than typical observing baselines, or produce burst arrival times that are too sparse for conventional search methods. I will present results from a search for periodicities across a significant fraction of the repeating FRB population, including sources in the second CHIME/FRB catalog, enabled by recent advances in search algorithms. I will also discuss how these results constrain the prevalence of periodic activity among repeating FRBs and provide new insights into the physical origin of this behavior.

EuroFlash: a commensal real-time transient detection system for LOFAR2.0

Reshma Anna-Thomas
ASTRON, Netherlands, The; thomas@astron.nl

The low-frequency radio sky (<300 MHz) remains largely unexplored for transient phenomena, despite its strong potential to probe propagation effects and source environments. This regime is especially relevant for fast radio bursts (FRBs), extragalactic transients with microsecond–millisecond durations, and the recently identified class of long-period transients (LPTs). Only two FRBs have been detected at 150 MHz, placing strong constraints on free-free absorption in their local environments. In contrast, LPTs are Galactic sources with durations of seconds to minutes and periodicities on minute-to-hour timescales. LOFAR has discovered two such sources: ILT J1101+5521, associated with an M dwarf–white dwarf binary, and ILT J163430+445010, which shows nearly 100% circular polarization. The upgrade to LOFAR 2.0 will significantly enhance its capabilities, enabling higher bandwidth data transport and the formation of thousands of tied-array beams for rapid sky surveys. We present EuroFlash, a commensal real-time transient detection system for LOFAR 2.0. Operating on a dedicated compute cluster, it will independently perform beamforming and imaging to detect and localize transients, while probing an uncharted parameter space of slow, low-frequency radio phenomena. In this talk, I will present commissioning updates and an overview of the system.

Radio and X-ray Emissions Surrounding Glitches in the Young Pulsar PSR J2229+6114

Wenke Xia, Robert Main, Mason Ng, Victoria M. Kaspi, Jason W.T. Hessels
McGill University, Canada; wenke.xia@mail.mcgill.ca

We present the first result from an ongoing pulsar glitch monitoring campaign at the CHIME telescope. Using daily observations from the CHAMPSS instrument, we detected a glitch in the low-B-field pulsar PSR J2229+6114 in near-real-time and thereby triggered an X-ray follow-up from the NuSTAR mission two days after the glitch occurred. We also identified three other glitch events in archival observations from the CHIME/Pulsar instrument that were fortuitously observed in X-rays by the NICER mission. Our data show no measurable changes in the source's X-ray and radio emission during the four glitch events, in stark contrast to the post-glitch activities in high-magnetic-field (high-B) pulsars.

As two high-B pulsars exhibit transient magnetar-like outbursts immediately after large rotational glitches, they challenge the traditional dichotomous classification of pulsars and magnetars. Those two high-B pulsars are believed to be transitional objects, leading to a neutron-star model where the B-field strength serves as a unifying parameter. However, this unifying picture remains incomplete because the X-ray glitch follow-up for pulsars at the lower end of the B-field measures being rare. Our results further constrain the post-glitch behaviour of low-B-field pulsars, providing additional evidence that glitch-induced emission changes in high-B pulsars are probably unique.

The South Pole Telescope AGN and Extragalactic Transient Monitoring Campaign

Aidan Simpson
University of Chicago, United States of America; afsimpson21@gmail.com

In recent years, new cosmic microwave background (CMB) experiments with ~1 arcmin angular resolution have been recognized for their ability to serve as millimeter wave (mm-wave) transient monitors, as a byproduct of their observation strategy. One of these CMB experiments, which has demonstrated major promise in the area of transient and variable sources, is the South Pole Telescope (SPT). The observation strategy of the SPT allows it to create hour-to-day cadence light curves of transient objects within its 1500 square degree Main field for around nine months out of the year. With frequency bands at 95, 150, and 220 GHz in Stokes I, Q, and U, the third generation camera, SPT-3G, offers a unique opportunity to study the flux and polarization variability in AGN and other variable sources. Upcoming studies include the release of 158 2012-2016 SPTpol light curves, identification of mm-wave polarization angle swings in blazars, study of mm-wave time lags of NGC 7213, and the release of the 2019-2023 SPT-3G light curves. In the era of time-domain astronomy, the results of these studies demonstrate the effectiveness of CMB experiments like SPT as transient monitors and their potential to complement next-generation facilities such as the Vera Rubin Observatory.

Insights from the Largest Radio Polarization Catalog of Fast Radio Bursts from CHIME

Mason Ng, CHIME/FRB Collaboration
McGill University, Canada; mason.ng@mcgill.ca

Fast radio bursts (FRBs) are very brief (millisecond-duration), yet bright flashes of radio emission from all over the sky with yet unknown physical origins. Polarimetry provides us with a powerful tool to probe the emission mechanisms and local magneto-ionic environments of FRBs. I will present an overview of the polarisation properties of approximately 2,100 FRBs detected by the Canadian Hydrogen Intensity Mapping Experiment (CHIME) between 9 December 2018 and 15 September 2023, operating at 400-800 MHz. These FRBs originate from over 1,700 unique sources and represent the largest catalog of FRB radio polarimetric measurements (of unique sources) from a single instrument to date. I will highlight some key results from the catalog, including a comparison of polarimetric properties between repeating and apparently non-repeating FRBs, the diversity of polarisation angle swings in the bursts, as well as FRBs with high Faraday rotation measures (> 1000 rad/m^2) that suggest extreme local environments with strong magnetic fields and/or high electron number densities. I will conclude with a discussion of the implications for FRB emission models and their environments.

An emerging view of VLASS Galactic radio transients

Jessie Miller, Gregg Hallinan
Caltech, United States of America; jmmiller@astro.caltech.edu

Wide-field, mutli-epoch radio surveys have transformed our view of the dynamic radio sky. Despite major advances in extragalactic time domain radio science, the Galactic transient population remains poorly understood. The Very Large Array (VLA) Sky Survey (VLASS) has uncovered thousands of transients, including a population at low Galactic latitude where extinction and distance uncertainties complicate counterpart identification and classification. We present a coordinated multiwavelength study of 40 VLASS Galactic transients: 20 are newly discovered radio transients, while the remaining 20 are previously known Galactic objects, some identified here as radio transients for the first time. We combine broadband VLA and Very Long Baseline Array (VLBA) follow-up with Keck-I/MOSFIRE near-infrared imaging and spectroscopy to constrain emission mechanisms and progenitor classes. Radio spectra trace variability, energetics, and evolving outflows and shocks, while VLBA observations probe compactness and initiate a proper motion campaign for long-lived sources. Near-infrared detections, colors, and spectral features identify heavily obscured counterparts and enable classification. The most extreme and well-studied object, VTJ1906+0849, exhibits a decades-long evolving synchrotron outflow consistent with a distant Galactic accretor in a unique accretion state. Together, these results define the dominant source classes and establish practical diagnostics for next-generation radio transient surveys.

CHIME/Slow: A survey of second-scale transients with the CHIME Telescope

Jeff Huang
McGill University, Canada; jeff.huang@mail.mcgill.ca

CHIME/Slow is a newly developed real-time transient detection backend to search for second-scale coherent radio transients using the Canadian Hydrogen Intensity Mapping Experiment (CHIME) radio telescope, operating at 400-800 MHz. By probing timescales from 16ms up to 5 seconds, the survey aims to detect transients to which CHIME/FRB, searching at 1-ms time resolution, is less sensitive. Sources include wide and highly scattered fast radio bursts (FRBs) and long-period (radio) transients. CHIME/Slow will be a leading experiment for discovering (sub-)second-scale transients as a result of CHIME's high sensitivity, large field-of-view and continuous operation. CHIME/Slow is now operational and searching over ~70 square degrees of the sky 24/7 with ongoing efforts in pipeline improvements; we will soon scale-up the search to the full CHIME/FRB sky (~200 square degrees) and with improvements to the data quality. I will present an overview of CHIME/Slow, provide an update on the operational status, and discuss initial results of our survey, which includes detections of highly scattered FRBs.

Precisely Pinpointing FRBs: Sub-Arcsecond Astrometry with ASKAP

Akhil Jaini[1], Adam Deller[1,2], Yuanming Wang[1,2]
[1]Swinburne University of Technology, Australia; [2]ARC Centre of Excellence for Gravitational Wave Discovery (OzGrav), Australia; ajaini@swin.edu.au

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 pinpoint their locations within the host environment. 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 using a model developed through 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 other 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, 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.

An astrometric survey for long period transients

Kelly Gourdji

Galactic long-period transients (LPTs), with periodicities of minutes to hours, challenge the canonical picture of neutron star emission and the pulsar "death line" beyond which coherent radio emission is expected to cease. These sources exhibit a striking diversity of properties, often displaying combinations that are only partially consistent with known radio pulsars, magnetars, or white dwarfs, suggesting multiple progenitor channels. Key open questions include: what physical conditions govern the manifestation of a neutron star as a radio-quiet or radio-loud magnetar, pulsar, or LPT, and what evolutionary pathways lead to the extremely long periods observed? Here, I present the first systematic VLBI astrometric campaign targeting a sample of LPTs, designed to measure their immediate environments, transverse velocities, and ages through precise positions, parallaxes, and proper motions. These measurements provide critical constraints on their progenitors and evolutionary states. I additionally report on a targeted VLBI campaign of a 6-hour period LPT aimed at mapping its emission region, leveraging its exceptionally large light-cylinder radius. This offers a unique opportunity to directly probe emission scales and test fundamental predictions of pulsar emission models.