Abstract #8

The MezCal (310 MEgahertZ absolutely CALibrated) Map

Akshatha Vydula, University of Richmond

Large-area, absolutely calibrated zero-level maps of diffuse radio emission are indispensable for constraining Galactic and extragalactic astrophysical phenomena, including understanding of CMB foregrounds, radio synchrotron background and redshifted 21cm signal from the Cosmic Dawn. The current standard remains the all-sky map from the Haslam et al. (1982) survey, conducted in the 1980s. Despite its enduring utility, Haslam map relied on overlaps with earlier, decades-old calibration measurements. 310 MEgahertZ absolutely CALibrated (MezCal) Map is a dedicated effort using the Green Bank Telescope (GBT) outfitted with a custom high-edge-taper, low-sidelobe feed and an absolutely calibrated balanced correlation receiver. I will describe our observation strategy for producing a 310 MHz map covering the full sky north of $\delta = -47°$ at a degree scale, and present results from recent commissioning and beam characterization measurements.

Abstract #9

A new view of the ELAIS-N1 field: The deepest wide-field observations at 50 MHz with LOFAR

Jort Boxelaar, INAF - Istituto di Radioastronomia

In the past decade, the Low Frequency Array has proven to be an influential instrument for low-frequency radio astronomy, enabling the scientific community to carry out a wide range of impactful studies. Over the past years,, it has become possible to reliably and consistently calibrate and image data taken with the Low Band Antennas (LBA), operating between 10 and 90 MHz. This progress has largely been driven by advances that mitigate the lower sensitivity and strong ionospheric effects that previously limited our ability to phase-calibrate LBA data. We are now able to present the deepest wide-field image ever obtained at 50 MHz using 120 hrs of LOFAR observations. This is the second sub-mJy/bm wide-field image at these frequencies and the first reaching a depth of 0.5 mJy/bm (the first sub-mJy image was obtained by Williams et al. 2021). These data of the ELAIS-N1 field allow us to study faint and high redshift active galactic nuclei and star-forming galaxies at the low-frequency end of the radio spectrum, a frequency regime that has remained largely unexplored. For the first time, we are also sensitive to a population of these star-forming galaxies which allows to study their radio spectra to the lowest frequencies. In addition to presenting the final deep-field image and spectra of star-forming galaxies, this work focuses on source identification and cross-matching with higher-frequency radio observations and optical surveys, as well as on studies of low-frequency spectral indices, radio luminosity functions and the source counts of radio sources at 50 MHz. Finally, this data provides a glimpse into what we can expect to see with the increased LBA sensitivity after the LOFAR 2.0 upgrade.

Abstract #10

Radio Detection of Ultrahigh Energy Neutrinos: Status and Recent Results

Abigail Vieregg, University of Chicago

The highest energy astrophysical and cosmogenic neutrinos allow us to understand the most energetic cosmic accelerators in the universe, and still await discovery. I will discuss the status, plans, and highlight recent results from experiments that aim to detect the highest energy neutrinos, focusing on instruments that look for sub-GHz radio emission from in-ice interactions from UHE neutrinos. I will highlight recent results from the Askaryan Radio Array (ARA) experiment, which has been operating at the South Pole for over a decade, discuss the status and plans for the larger Radio Neutrino Observatory in Greenland (RNO-G), and discuss the recent flight of the Payload for Ultrahigh Energy Observations (PUEO), which is a NASA Astrophysics Pioneers Long Duration Balloon Mission, and launched from McMurdo Station in Antarctica on December 20, 2025 and flew for 23 days.

Abstract #11

EuroFlash: a commensal fast transient search machine for LOFAR2.0

Dirk Kuiper, University of Amsterdam

The last decade has revealed that the Universe creates fast radio transients that are visible across giga-parsec distances and a vast range of timescales, lasting from tens of seconds to as short as nanoseconds. These ephemeral radio flashes occur sporadically and they must originate from coherent radiation processes in environments with extreme energy density. We aim to understand the physical origin(s) of these enigmatic signals and to use them as unique and powerful probes of the otherwise invisible matter and magnetic fields that lie between stars and galaxies.

LOFAR2.0 offers us a new way to explore the sky as never before possible by giving a novel, wide-field view of the lowest radio frequencies observable from Earth at both high time and angular resolution. To turn LOFAR2.0 into a fast transient search machine, we are constructing the EuroFlash backend, which will receive a commensal stream of raw station data (and maybe even raw antenna data) to search for milliseconds- to seconds-duration transients in all observations. EuroFlash will begin on-sky operations in early 2027, bringing these searches into use in the near future. In this talk, I will outline the scientific case, technical approach, and project status.

Abstract #12

Zebra patterns in the radio emission from RS CVn binary UX Arietis

Jiale Zhang, Peking University

The Zebra Pattern (ZP) refers to a peculiar type of radio emission fine structures manifested as a series of narrowband, parallel stripes in frequency. Such radio emission patterns are extensively studied on the Sun and occasionally observed from Jupiter and Crab Pulsar. Here, we present the first example of ZP radio emission from an RS CVn binary, UX Arietis, consisting of a K0 sub-giant primary and a G5 main-sequence secondary components. The radio observation was taken by the Five-hundred-meter Aperture Spherical Radio Telescope at L-band (1000-1500 MHz). The ZP emission lasts for around 3 mins, with almost 100\% right-hand circular polarization. We identified 6-7 frequency stripes across the observing bandwidth, with a typical separation between two stripes of around 80 MHz. The emission stripes were further resolved as narrowband, short-duration sub-bursts with a single-frequency duration around 0.1 s and a drift rate of $\sim$100 $\rm MHz\;s ^{-1}$. We noticed that ZP stripes above 1250 MHz are split into two sub-stripes with a separation of $\sim$20 MHz, which have not been reported in previous ZP observations. We interpret the ZP emission as double plasma resonance at electron or ion cyclotron harmonics. This allows us for the first time to simultaneously determine the electron density and magnetic field strength at the source region of stellar radio emission. The density scale length constrained by the sub-burst frequency drift is inconsistent with a barometric coronal density model of the more active sub-giant star. Our work demonstrates the unique diagnostic potential of ZP emission for probing the plasma environment in stellar coronae.

Abstract #13

Pushing the Precision of Fast Radio Burst Localization by Assessing sub-GHz VLBI Calibrator Integrity

Danté Hewitt, University of Amsterdam

Fast radio bursts (FRBs) are millisecond-duration extragalactic radio flashes. Nearly two decades after their discovery, their origin(s) remain largely unknown. To distinguish between competing source scenarios, the local (sub)galactic environment of these sources need to be resolved, which necessitates their precise (subarcsecond) localization. The primary FRB discovery machine is CHIME/FRB, and with the recently commissioned Outrigger VLBI array, it is now capable of routinely localizing FRBs to ~50 milliarcsecond precision --- more than sufficient for host galaxy identification. Pushing the precision even further requires an understanding of the systematic errors unrelated to the instrument itself, and a rarely studied contribution to this error is related to the accuracy of VLBI (Very Long Baseline Interferometry) calibrator positions at sub-GHz frequencies. These calibrators are bright active galactic nuclei that approximate compact point sources at ~2--22 GHz. However, toward lower frequencies (such as 400--800 MHz where CHIME operates) core-shift, optically thin jet emission and complex source structure can become significantly more prominent. Together with the coarser angular resolution, this can result in positional offsets that propagate into e.g. FRB positions. Firstly, I will discuss how localization precision of repeating FRBs improves by combining bursts. Secondly, I will describe and present the first results of a pilot VLBA study to statistically quantify the impact of core shift and frequency-dependent source structure on calibrator positions down to ~330 MHz. With the advent of a new generation of low-frequency interferometers (e.g. DSA-2000, SKA-Low and LOFAR2.0), quantifying these effects is essential in order to develop a robust low-frequency calibration grid.

Abstract #14

Where are the Magnetic Extrasolar Planets?

Joseph Lazio, Univ. of Michigan

Soon after the discovery of radio emission from Jupiter at 22 MHz, it was identified as being generated due to Jupiter's planetary-scale magnetic field. Subsequent spacecraft investigations have revealed that many of the planets, and even some moons, either have or have had large-scale magnetic fields. In the case of the Earth, Saturn, Uranus, and Neptune, their magnetic fields are generated by internal dynamo processes, and interactions between the solar wind and their magnetic fields generates intense radio emissions via the electron cyclotron maser instability. For Jupiter's radio emission, there is both a solar wind-driven component and a component due to the interaction between its magnetic field and its moon Io.

Extrasolar planets reasonably may be expected to generate large-scale magnetic fields and to sustain an electron cyclotron maser instability. Observations of magnetic star-planet interactions for hot Jupiters and inferences about atmospheric circulation for ultra-hot Jupiters are consistent with theoretical expectations that Jupiter-mass planets sustain strong and global magnetic fields, though the actual field strength estimates are highly model-dependent.

Nonetheless, after more than two decades of searching, there has not been a compelling detection of magnetically-generated radio emission from any extrasolar planet. I review the observations, then address how the *absence* of detections nonetheless can provide constraints, particularly in the context of future space-based missions.

Abstract #15

A Near-Simultaneous Radio–Optical Flare from J0508–21

Simranpreet Kaur, University of Valencia, Spain

J0508-21 is a young, rapidly rotating M-dwarf system showing complex periodic optical variability and strong radio emission. Recent VLBA observations have confirmed that the system is a binary in which both stellar components are radio emitters. Here, I'll present simultaneous radio and optical observations of J0508-21, focusing on a bright radio burst detected with the uGMRT at 0.65 GHz on 7 September 2024.

At a time resolution of 3s, the burst reaches a peak flux density of >54mJy and is nearly 100% circularly polarized, strongly favouring a coherent emission mechanism. The burst is broadband across the observed frequency range and shows no clear frequency drift. Interestingly, an optical/NIR flare is detected almost simultaneously with the radio burst. Although the optical cadence limits the exact measurement of the time delay, the two events occur very close in time, making a chance coincidence unlikely. A second optical flare is also detected approximately 8 min later.

The close temporal association between the radio and optical emission suggests that both may originate from the same magnetic energy-release event, with accelerated particles producing the coherent radio emission and depositing energy in the lower stellar atmosphere, giving rise to the optical flare. This event provides a rare opportunity to probe the connection between coherent radio emission and magnetic flaring in young, rapidly rotating stars, and highlights the importance of simultaneous multi-wavelength observations for understanding their magnetospheric activity.

Abstract #16

Searches for Prompt Low-frequency Radio Counterparts to Gravitational-wave Event S250206dm with the OVRO-LWA Time Machine

Nikita Kosogorov, Caltech

Compact-object mergers may produce coherent radio bursts in the seconds to minutes surrounding coalescence, providing a direct probe of the magnetospheric environments and electrodynamic interactions associated with merging neutron stars and newly formed compact remnants. We present the first gravitational-wave event search with the OVRO-LWA Time Machine, a system that records raw voltage data from the full array and enables retrospective coherent beamforming toward regions identified by low-latency gravitational-wave alerts. We apply the system to S250206dm, whose early classification favored a neutron-star-containing merger. Using data recorded around the event, we formed 51 coherent beams covering the accessible gravitational-wave localization and searched the 69–86 MHz band for dispersed millisecond radio bursts. No astrophysical burst was identified above a conservative 7 sigma fluence threshold of approximately 150 Jy ms. The non-detection places limits on prompt coherent-radio emission associated with the merger and its surrounding environment. More broadly, this observation demonstrates the ability of the OVRO-LWA to search large gravitational-wave localization regions at millisecond resolution and establishes a framework for population-level studies of prompt radio emission from compact-object mergers.

Abstract #17

Detecting the 21 cm EoR Power Spectrum with MWA Phase III: The Impact and Mitigation of New RFI Sources

Morgan Lee, Brown University

The Murchison Widefield Array (MWA) 2025 Phase III upgrade offers the highest-quality EoR data from the experiment to date, largely attributable to the removal of coarse-band lines, a significant instrumental artifact that contaminated all previous MWA data. Despite these major instrumental improvements, the 2025 season also exhibits more distinct and complex radio frequency interference (RFI) compared to previous seasons – driven, at least in part, by the increased satellite presence in earth orbit. Due to the evolving RFI environment, the number of RFI-free observations in the 2025 season is extremely limited. This presents a pressing challenge: Identifying and mitigating increasingly complex RFI to recover clean regions of affected observations.

We will present a novel flagging strategy developed to precisely excise localized RFI. Previous MWA data did not require this level of flagging due to the larger availability of clean data, but the prevalence of RFI in 2025 data necessitates this analysis. I will present the analysis of all newly upgraded 2025 MWA Phase III high-band EoR0 data with a focus on RFI detection, identification, and removal of evolving RFI, including a conclusive characterization of Starlink satellites in our data. We characterize RFI through three complementary methods, namely Chi-Squared, Sky-Subtracted Incoherent Noise Spectra (SSINS), and Expected Amplitude of VIsibiLity Spectra (EAVILS) in tandem to show the small subset of RFI-free observations across the entire season. Our approach to mitigate new and recurring RFI by recovering RFI-free times and frequencies within otherwise generally contaminated data has preliminarily shown the potential to increase the amount of usable data fivefold. Additionally, I will present the initial promising improvements to the two-dimensional power spectrum, as a metric to assess the impact of residual or undetected RFI, of observations processed through our flagging strategy to validate our analysis. As the new RFI signatures are expected to continue contaminating observations for the foreseeable future, our targeted method to detect, identify, and mitigate RFI in an ever-changing environment is critical in the preservation of usable data required for future 21 cm measurements.

Abstract #18

OVRO-LWA Discovery of an Extreme Coherent Stellar Radio Transient

Nikita Kosogorov, Caltech

Wide-field low-frequency surveys provide a powerful way to discover coherent stellar radio emission. We present the discovery of an exceptionally bright decametric stellar radio transient in an all-sky total-intensity and circular-polarization survey with the Owens Valley Radio Observatory Long Wavelength Array (OVRO-LWA). The emission is consistent with nearly complete circular polarization and exhibits complex temporal and spectral structure on 10 s timescales. Its rapid variability and high flux density imply an extraordinary brightness temperature exceeding 10^17 K, requiring a coherent emission process. The polarization and spectral structure favor an electron cyclotron maser instability (ECMI) interpretation, allowing the radio emission to probe magnetic-field strengths and plasma conditions in the emitting magnetosphere. The electrodynamic engine powering this luminous coherent emission remains uncertain: intrinsic coronal and magnetospheric activity provides the simplest interpretation, although currents driven by an unseen orbiting companion remain possible. This discovery demonstrates the potential of wide-field low-frequency surveys to uncover extreme coherent radio activity and probe magnetic-field strengths and plasma conditions that are otherwise difficult to access.

Abstract #19

Realising SKA-Low: operations planning and timeline to science

Wendy Williams, SKA Observatory

With SKA-Low now well advanced in its construction and commissioning phase, the first release of SKA data to the astronomy community through Science Verification with SKA-Low is almost in sight. In this talk I will discuss the expected timeline to community-led science as we navigate through the key milestones of commissioning, Science Verification and our first shared-risk Cycle. I will give an overview of our anticipated build-up towards a full suite of capabilities and the expected evolution of the SKAO Operational model through these periods. I will introduce several user-facing tools that SKAO has recently released to the community to enable preparation for science.

Abstract #21

Crosstalk characterization and subtraction in the CHIME experiment

Kana Sakaguri, Yale University

The Canadian Hydrogen Intensity Mapping Experiment (CHIME) is a radio interferometer designed to map the redshifted 21 cm emission of neutral hydrogen over the redshift range z = 0.8 – 2.5. The telescope consists of four 100 m × 20 m cylindrical reflectors. Due to the faintness of the cosmological signal, we must characterize and mitigate the instrumental systematics with high precision.

In this work, we focus on crosstalk, the coupling signal generated by one antenna and picked up by another. Due to CHIME's cylindrical design, crosstalk is particularly significant for antenna baselines within a cylinder, and is the dominant contributor to foreground leakage at these angular scales. Currently, we remove these baselines from cosmological analysis, but would improve our signal-to-noise ratio at BAO scales by including them. In this talk, I will discuss the properties of crosstalk and its subtraction using CHIME sky data. We use a simple model to characterize the frequency and time dependence of the crosstalk and find it effectively subtracts the crosstalk from the measured visibilities, currently to ~10%. I will show subtraction results compared to the current subtraction methods and discuss future directions.

Abstract #22

Beyond Haslam: Progress Toward Absolutely Calibrated Diffuse Galactic Emission Maps at 400–800 MHz

Carolin Höfer, Ruđer Bošković Institute

The Milky Way is a powerful radio emitter whose Galactic synchrotron emission is of great interest in itself, but also obscures the fainter signals of the distant Universe.

For over four decades, the field has relied on the Haslam 408 MHz map as its primary reference template, despite well-known shortcomings such as coarse angular resolution, single-frequency coverage, and no absolute calibration tied to noise standards.

Our aim is to address this by combining two state-of-the-art Northern Hemisphere radio telescopes: the Canadian Hydrogen Intensity Mapping Experiment (CHIME) interferometer and the DRAO Global Magneto-Ionic Medium Survey (GMIMS) of the Northern Sky (DRAGONS) single-dish experiment. By fusing CHIME's high angular resolution and daily all-sky cadence with DRAGONS' absolute calibration, we will deliver four absolutely calibrated, Northern-sky maps of diffuse Galactic emission in four sub-bands: 400–500, 500–600, 600–700, and 700–800 MHz. We will also produce matching spectral index maps, reaching angular resolutions of up to 15 arcmin depending on frequency sub-band. Work is currently ongoing to reduce residual artefacts in the CHIME maps and to combine them with DRAGONS' absolute calibration.

These maps will provide new constraints on cosmic-ray electron populations and the structure of the Galactic magnetic field, while also serving as a new reference standard for Galactic synchrotron emission, enabling improved foreground component separation for CMB and hydrogen intensity mapping experiments across the radio community.

In this talk, I will give an overview of the recent progress we have made in producing these northern sky maps and show our first preliminary results.

Abstract #23

Impacts of soil surface inhomogeneity and topography on global 21-cm feature extraction using the MIST antenna

Francis McGee, McGill University

The Mapper of the Intergalactic Medium (IGM) Spin Temperature (MIST) is an experiment located in the Canadian High Arctic designed to detect the global 21-cm signal from cosmic dawn. Other global 21-cm experiments, such as EDGES and SARAS 3, have reported results in tension with each other, while the amplitude of the EDGES feature is larger than expected from standard theoretical models. One proposed explanation for the EDGES feature centers on systematic effects associated with a finite metal ground plane. The MIST experiment aims to alleviate these concerns by operating without a metal ground plane, instead focusing on modeling the impact of the soil below the antenna on the recovered global signal.

Measurable impacts from deviations in ground-plane structure and topography have been noted in past studies focusing on experiments with a ground plane, such as REACH, but to date comparatively little research has focused on the impact of surface features on global experiments without a ground plane. Preliminary results from a simulation campaign will be presented, providing quantitative bounds on the impact of individual surface anomalies, alongside more complex surface conditions. An overview of the MIST analysis pipeline will be given, and detailed results will be provided for individual surface features, gently undulating soil typical of the Arctic area, and sparse rock fields that may be present in the region of the antenna. Multiple soil compositions will be examined, covering possible Arctic soil conditions.

The findings presented have broad applicability to measurements taken outside of Arctic environments, providing a starting point for analysis of complex environments where a ground plane is not desired or feasible, such as lunar-based global 21-cm experiments.

Abstract #24

The Second CHIME/FRB Outriggers Catalog

Adam Lanman, MIT

Identifying the host galaxies of Fast Radio Bursts (FRBs) is essential for understanding their progenitors and using them as cosmic probes. The CHIME/FRB Outrigger telescopes combine VLBI resolution with CHIME's survey speed, enabling host galaxy identification for hundreds of FRBs. This talk will report on the operations of the now-complete Outrigger array and present the second catalog of host galaxies identified with them. This sample incorporates the second outrigger, at the Green Bank Observatory (GBO), which forms a single 3334 km baseline with CHIME capable of one-dimensional localization constraints at the ~50 milliarcsecond level. From FRBs detected by CHIME/FRB between 2023-03-25 and 2025-02-01, we obtain 169 new VLBI localizations and provide updated positions for 21 events published in the first outrigger catalog. Combining with the first catalog, this yields a total sample of 252 FRB localizations. For the new localizations, we identify candidate host galaxies from the DECaLS and Pan-STARRS catalogs, assigning association probabilities with the Probabilistic Association of Transients to their Hosts (PATH) framework. Combined with dedicated spectroscopic follow-up, we confirm 42 high-confidence host associations, bringing the combined total across both outrigger catalogs to 59 FRB host redshifts. With the full array now operational, and new advances in RFI removal and host association, our host galaxy yield is improving rapidly.

Abstract #26

A Drone-Based Precision Emitter for 21 cm Array Coherent Calibration

Morgan Cole, Yale University

Foreground mitigation remains a central challenge for 21 cm intensity mapping experiments, which require precise, wideband calibration of telescope beams and gains. I will present a digitally synthesized calibration source that generates broadband, time-synchronized Gaussian noise, and optimized for aerial deployment. This calibration source uses a dual-source architecture with one unit mounted on an aerial platform, and a second reference unit connected directly to the radio data acquisition system. This configuration enables improved sensitivity in the low-SNR regime and direct phase measurement. The system further supports configurable band selection, allowing adaptation to various 21 cm intensity mapping telescopes. This source has been validated through anechoic chamber measurements and by integrating the source on a drone flown over various radio dish testbeds. In both settings, the correlated channel substantially outperforms the auto-correlation channel across all signal-to-noise regimes of interest, confirming the key advantage of the dual-source architecture. This is the first known demonstration of a free-space coherent calibration signal synchronized only by clocks, the first deployment of such a source on a drone, and the first published beam measurements made with such a source. Given the growing interest in drone-based calibration for 21 cm arrays, this work establishes the feasibility of high-fidelity digital calibration for next-generation 21 cm instruments, and provides a practical path towards improved foreground control and beam calibration in future arrays.

Abstract #27

The Lunar Farside Technology and Transients Telescope (LFT3) Mission

Jake D. Turner, Cornell University

The lunar farside provides one of the most pristine radio environments in the inner Solar System, overcoming two fundamental limitations of terrestrial radio astronomy: pervasive radio-frequency interference (RFI) and the Earth's ionosphere. The ionosphere is a particular challenge as it blocks observations below 15 MHz and introduces time-variable propagation effects at higher frequencies. In this talk, we will present an overview of the Lunar Farside Technology and Transients Telescope (LFT3) mission. LFT3 is a proposed broadband radio observatory spanning 0.1–2700 MHz to be operational in the next five years that will explore an inaccessible transient parameter space. LFT3's main science goals are to search for low-dispersion-measure fast radio burst analogues, probe neutron-star magnetospheres, conduct a commensal technosignature search, search for axion-like particles, and perform the first systematic broad-frequency survey of low-frequency atomic and molecular transitions. In addition to these priority science cases, LFT3 will produce a broadband synoptic spectral survey of the low-frequency sky, providing a legacy dataset for astrophysics and fundamental physics while establishing a record of the cislunar radio environment before increasing human activity permanently alters it.

Abstract #28

Imaging the Radio Sky and the Polar Ionosphere at sub-20 MHz with ALBATROS

Mohan Agrawal, McGill University

A detection of the 21 cm signal of neutral hydrogen from the cosmic dark ages has the potential to constrain fundamental cosmological parameters with unprecedented precision, and probe exotic physics during the universe's infancy. The primary hurdle in detecting the 21 cm signal, expected to peak between 5-20 MHz today, is separating it from the diffuse Galactic emission. At sub-20 MHz, the foregrounds are expected to be 106-107 times brighter than the cosmological signal, and are yet to be fully characterized. Terrestrial radio-frequency interference (RFI) and high ionospheric plasma frequency have long made interferometry at these frequencies challenging. As a result, sky maps below 20 MHz remain sparse, reflected by the dearth of input to the Global Sky Model (GSM) at very-low frequencies. In fact, the state-of-the-art in radio astronomy below 10 MHz dates back to the 1960s, when Grote Reber and Bill Ellis caught brief glimpses of the Milky Way disk around ~5 MHz with ~5° resolution from Tasmania.

The Array of Long Baseline Antennas for Taking Radio Observations from the Seventy-ninth Parallel (ALBATROS) is a drift-scan interferometer deployed on Axel Heiberg Island (79.8° N, 91.3° W) in the Canadian high Arctic to address these challenges. Favorable ionospheric conditions outside the auroral zone and 10-km-long baselines allow ALBATROS to map the northern sky between 5–20 MHz with ≲10' resolution—an order-of-magnitude improvement over existing maps. These high-resolution maps will pave the way for GSM improvements and open new avenues for studying low-frequency phenomena in the local universe.

Long baselines and high-Arctic's rugged terrain preclude real-time correlation. Therefore, each ALBATROS antenna station operates autonomously over the polar night using methanol fuel cells and saves coarsely-channelized, 1-bit electric-field data for later offline correlation. In this talk, I will outline novel aspects of the data pipeline designed to overcome these extreme power and bandwidth constraints, making long-baseline interferometry possible. Key algorithms include: accurate polyphase filter bank inversion at 50 GSPS for up-channelization, nanosecond-level clock synchronization by carrier-phase tracking of weather satellites, and a GPU mapmaker for exact all-sky multi-time, multi-frequency dirty imaging. Furthermore, I will demonstrate how ALBATROS performs in-situ passive ionosphere sounding by detecting Eureka Station ionosonde broadcasts in baseband. Finally, I will showcase initial observational results: oblique ionograms between 4–10 MHz

that probe the poorly-understood high-latitude plasma environment, and arcminute-scale dirty maps of the northern sky around 20 MHz.

Abstract #29

Real-time Correlated Radio Frequency Interference Monitor

Libby Berkhout, McGill University

Radio Frequency Interference (RFI) is one of the biggest challenges facing radio astronomy experiments. The electromagnetic spectrum becomes more crowded as time goes on, and upcoming experiments need to adapt to mitigate these challenges. I will present a prototype auxiliary array of horizon-pointed antennas that are cross-correlated at full cadence with the Canadian Hydrogen Observatory and Radio Transient Detection (CHORD) pathfinder instrument, providing a real-time set of flags directly in the CHORD backend. The major benefit of the version proposed here over a more traditional omnidirectional observatory monitor is the capability to synchronize with CHORD and provide cross correlations, as well as provide flags on timescales shorter than the file writing cadence. The prototype results in a significant increase in RFI flagging capability vs. the CHORD instrument alone with an identical flagging algorithm. While initially optimized for CHORD, the general setup and techniques used here will be applicable to other radio observatories.

Abstract #30

OVRO-LWA Discovery of a Radio Transient from an RVCn Star

Tanazza Khanam, Rice University

Wide-field low-frequency surveys provide a powerful means of discovering stellar radio emission. We present the discovery of a bright decametric stellar radio transient in an all-sky total-intensity and circular-polarization survey with the Owens Valley Radio Observatory Long Wavelength Array (OVRO-LWA). The emission is consistent with a large degree of circular polarization and shows temporal variability on 10 s timescales. Its high flux density implies a brightness temperature exceeding 10^14 K, requiring a coherent emission process. The polarization and spectral structure favor an electron cyclotron maser instability (ECMI) interpretation, allowing the radio emission to probe magnetic-field strengths and plasma conditions in the emitting region. In the talk, we will discuss possible field engines and field morphologies.

Abstract #32

Mutual coupling in the aperture plane: how much coupling can be modeled as a linear combination of visibilities?

Vincent MacKay, MIT

Mutual coupling between elements of low-frequency arrays is a leading systematic for 21 cm cosmology, leaking foregrounds into the clean regions of the power spectrum. Many mitigation models describe coupling as a linear combination of uncoupled signals re-radiated from neighboring feeds, but data suggest that not all coupling is of that kind. We present a decomposition, inspired by antenna scattering theory, that separates the coupling based on whether the linear model is expected to remove it: the antenna mode, made of copies of the isolated response, and a structural mode, the remainder. We extend the use of holographic projection to coupled beams such that the perturbations are localized in the aperture plane, making the mode decomposition visually explicit.

Using full-wave simulations of HERA-like feeds and dishes in a 37-element hexagonal array, we then quantify this decomposition and find that the presumably removable antenna-mode fraction is only about 1% of the perturbation power in the beam, a pessimistic assessment. We identify and explain two effects that improve the prospects for mitigation. First, the beam power fraction is not the right metric: in visibility space, where the beams have been correlated and weighted by the sky, the antenna mode's share of the coupling power grows to about a third. Second, by loosening the physical constraints of the re-radiation picture, we demonstrate that a freely fitted linear model reaches into structural-mode coupling too. With this approach, sky-agnostic linear corrections based solely on knowledge of the coupled and uncoupled beams remove 70-94% (depending on the field) of the coupling power from simulated observations, and adding knowledge of the sky brings the removal to 96-98%.

These figures depend on the beam model and sky field, and assume noiseless simulations of perfectly redundant arrays with known beams and isolated visibilities; we discuss those and other caveats, along with the requirements for achieving comparable suppression in observations while preserving the cosmological signal.

Abstract #34

Tracing the Invisible: M31's Halo Revealed by FRB Dispersion

Lordrick Kahinga, University of California, Santa Cruz

We leverage fast radio bursts (FRBs) detected at 400-800 MHz to constrain the ionized baryonic mass of the circumgalactic medium (CGM) of the Andromeda Galaxy (M31). Previous studies using quasar absorption lines, X-ray observations, and the Sunyaev-Zel'dovich effect have constrained different thermal phases of M31's CGM. However, its total baryonic mass remains poorly understood because these measurements depend on assumptions about gas metallicity, temperature, and ionization state. The strong frequency dependence of plasma dispersion makes low-frequency FRB surveys particularly sensitive to the integrated column density of free electrons across all ionized phases.

Using CHIME/FRB Catalog 2, we compare the dispersion measures of 158 FRBs whose sightlines intersect M31's halo, within a virial radius of 302 kpc, with a matched control sample of 790 FRBs. A two-sample Anderson-Darling test yields a p-value of 0.25, indicating no statistically significant difference between the unweighted DM distributions. We then employ a weighted-mean-difference estimator to suppress contamination from large non-M31 DM contributions. We constrain M31's excess DM to $(-8$ to $(52\ \mathrm{pc\,cm^{-3}}$ at projected distances of approximately 0-151 kpc and 19 to $(61\ \mathrm{pc\,cm^{-3}}$ at approximately 151-302 kpc.

We interpret these measurements using a generalized halo model parameterized by the radius at which the halo recovers the cosmic baryon fraction. We infer a closure radius of $r_{\rm close}=12.9^{+19.6}_{-6.7}\,r_{\rm vir}$ and a total ionized CGM mass within the virial radius of $M_{\rm b,halo}=14.5^{+9.0}_{-8.3}\times10^{10}\,M_\odot$. These results suggest that M31 contains a substantial reservoir of diffuse ionized gas. More broadly, they demonstrate how coarsely localized FRBs can be utilized as probes of intervening plasma and the baryonic content of nearby galactic halos.

Abstract #35

High Energy Cosmic Rays with the OVRO-LWA

Kathryn Plant, NRAO

A poorly understood transition in the high energy cosmic ray spectrum from sources within the Milky Way to extragalactic sources likely occurs in the tens-to-thousand PeV cosmic ray energy range, which is accessible to low frequency radio arrays of a few square kilometers in size. I will present the cosmic ray detection system for the Owens Valley Radio Observatory Long Wavelength Array and its first sample of cosmic ray candidates. The brief (5-10 nanoseconds) radio pulses emitted by the cascading particle showers triggered by cosmic ray interactions with Earth's atmosphere are sensitive to the mass and energy of the cosmic ray primary particle. Radio based observations have several advantages (cost, duty cycle) over other methods, but human-generated radio frequency interference has generally prevented radio emission from being used independently of these other methods. Advances in fast digital signal processing enable the Owens Valley Radio Observatory Long Wavelength Array to observe cosmic rays from their radio emission alone in a 30—80 MHz band. This presentation will present search methods, including RFI rejection, the first sample of detections, and the capabilities of and science plan for the instrument.

Abstract #37

From Metrology to Cosmology: Propagating Mechanical Systematics into the 21-cm Power Spectrum for CHORD

Aditya Krishna Karigiri Madhusudhan, McGill University

Redundant interferometer arrays are a promising architecture for 21-cm intensity mapping experiments, providing high sensitivity and enabling calibration strategies that exploit nominally identical baselines. However, these techniques require a high degree of uniformity between antenna elements. Mechanical imperfections, such as reflector surface deformations and feed misalignments, can introduce antenna-to-antenna variations in the primary beam, breaking redundancy and imprinting spatial and spectral structure on the measured visibilities. Quantifying how these effects propagate from the physical instrument to the recovered cosmological signal is therefore essential for precision 21-cm cosmology. The Canadian Hydrogen Observatory and Radio-transient Detector (CHORD) is one such interferometer, currently being deployed at the Dominion Radio Astrophysical Observatory in Canada. CHORD aims to constrain the expansion history of the universe and dark energy through baryon acoustic oscillation measurements using 21-cm intensity mapping, while also enabling studies of radio transients and pulsars. The core array will comprise 512 six-metre parabolic composite reflectors with a focal ratio of 0.21, and its broad 300–1500 MHz observing band enables 21-cm measurements over redshifts up to 3.7. In this talk, I will present an end-to-end framework that connects precision metrology of individual antenna elements to their impact on the 21-cm power spectrum. I will first discuss metrology measurements of the CHORD reflector and feed systems used to characterize dish surface deformations and feed misalignments. I will then incorporate these measured mechanical perturbations into full-wave electromagnetic simulations to generate realistic perturbed primary beams across the observing band and quantify the resulting changes in gain, beam centroid and shape, sidelobe structure, and frequency dependence, with particular emphasis on antenna-to-antenna variations that break array redundancy. Finally, I will propagate these perturbed beams into interferometric visibility simulations and construct two-dimensional 21-cm power spectra, directly linking millimetre-scale mechanical imperfections to their impact on the cosmological observable. While I demonstrate this framework primarily using CHORD and extend it to the Hydrogen Intensity and Real-time Analysis eXperiment (HIRAX), the methodology is broadly applicable to redundant interferometric arrays where element-to-element beam variations may limit precision cosmological measurements.

Abstract #39

Evidence of binarity in long-period radio transients

Csanád Horváth, Curtin University

Galactic long-period transients (LPTs) are a recently uncovered and still-enigmatic class of coherent radio source. They exhibit periods of tens of minutes to hours and produce strongly polarised pulses lasting seconds to minutes. Although their phenomenology resembles neutron-star pulsars operating on vastly longer timescales, the underlying emission mechanism remains unclear.

Crucially, the discovery and characterisation of LPTs has been driven almost entirely by low-frequency (<1 GHz) radio telescopes. These instruments have opened an unexpected new frontier in time-domain astrophysics: the LPT parameter space was not predicted to host coherent emitters, yet it is now proving rich with previously unknown systems.

A growing subset of LPTs are recognised as compact binaries, with several optically confirmed to host white dwarfs with low-mass main-sequence companions. Their radio intensity is modulated on both orbital and spin periods. In this talk I will review recent progress with a geometric binary model of LPTs, and demonstrate its explanatory power in spin-orbit synchronous and asynchronous systems. Together, these results advance the broader goal of placing LPTs within the wider context of binary evolution and low-frequency coherent emission.

Abstract #40

Neutral Hydrogen Power Spectrum Measured with CHIME and Comparison with Hydrodynamical Simulations

Shabbir Shaikh, Arizona State University

The Canadian Hydrogen Intensity Mapping Experiment (CHIME) targets the redshifted 21 cm signal from neutral hydrogen (HI) over the redshift range $0.8 \lesssim z \lesssim 2.5$. CHIME has recently measured the 21 cm auto-power spectrum at $z \sim 1$ with a signal-to-noise ratio of 12.5. In this talk, I will discuss this measurement and its comparison with predictions from the IllustrisTNG simulations. We find that the measurement disagrees with the TNG100 and TNG300 predictions at 3.1σ and 4.0σ, respectively. This discrepancy motivates further investigation of the physical processes in simulations that determine the abundance and spatial distribution of neutral hydrogen on nonlinear scales. I will also discuss HI power spectrum predictions from a publicly available suite of hydrodynamical simulations spanning a range of galaxy formation and feedback models.

Abstract #44

Searching for FRB Emission Below 100 MHz in Nearly Six Years of NenuFAR Observations

Yuhao Zhu, LPC2E

Fast radio bursts (FRBs) are millisecond-duration bursts of coherent radio emission, mostly originating at extragalactic distances. Their physical origin and emission mechanism remain uncertain, while their propagation through the intergalactic medium makes them powerful probes of the ionized Universe. Extending FRB observations to very low frequencies can constrain the spectral extent of their emission and provide understanding of emission and propagation effects. FRB emission has so far been detected only down to approximately 110 MHz, leaving its low-frequency spectral behaviour and propagation effects poorly constrained.

NenuFAR is the most sensitive radio telescope operating in the 10–85 MHz band. We are searching archival NenuFAR beamformed observations targeting 19 known repeating FRB sources. The dataset spans December 2020 to August 2026 and comprises 870 observations with approximately 3180 observing hours. The analysis is ongoing, with full-band searches over a range of burst durations currently in progress and sub-band searches planned to improve sensitivity to band-limited bursts.

The co-location of NenuFAR and the Nançay Radio Telescope (NRT), with the latter observing at approximately 1.2–1.7 GHz, provides a valuable opportunity for simultaneous observations of the same FRBs across different radio frequencies. We are cross-matching the NenuFAR archive with NRT observing records and burst catalogues to identify periods of simultaneous coverage and determine whether bursts were detected at higher frequencies while NenuFAR was observing. These higher-frequency detections provide independent evidence of source activity during part of the NenuFAR coverage, allowing stringent limits to be placed on any potential low-frequency emission in the NenuFAR band.

At SALF 2026, we will present results from the systematic search for FRB emission in the NenuFAR archive. This survey will probe the occurrence of detectable FRB emission below 100 MHz and constrain the very-low-frequency behaviour of repeating FRB emission.

Abstract #45

The CHORD Outrigger network: Overview and status

Sophia Da Costa, University of Toronto

The Canadian Hydrogen Observatory and Radio-transient Detector (CHORD) is a next-generation radio interferometer currently under construction at the Dominion Radio Astrophysical Observatory in British Columbia. Its core array will comprise 512 closely packed six-meter dishes operating across 300–1500 MHz. With its wide field of view, high sensitivity, and ultra-wide bandwidth, CHORD is expected to detect tens of fast radio bursts (FRBs) per day.

To complement the transient-discovery capabilities of the core array, CHORD will include two outrigger stations at the Hat Creek Radio Observatory in California and the Green Bank Observatory in West Virginia. Each station will consist of 64 six-meter dishes equipped with ultra-wideband feeds. Together, the three sites will form a very-long-baseline interferometry (VLBI) network spanning thousands of kilometres. By combining milliarcsecond localizations with CHORD's high FRB detection rate, this network will produce an unprecedented sample of precisely localized FRBs. This will enable robust host-galaxy associations, provide new insights into FRB progenitors and their local environments, and support the use of FRBs as cosmological probes.

The outrigger system is currently being developed alongside the CHORD core, with recent efforts focused on integrating commercially available steel dishes with the ultra-wideband receiver system. In this talk, I will present an overview of the CHORD Outriggers, discuss their scientific goals, and report on the project's current development and deployment status.

Abstract #49

End-to-end development and on-sky validation of the CHARTS radio interferometer

Bruno Pollarolo, University of Toronto

The Canadian Chilean Array for Radio Transient Studies (CHARTS) is a planned wide-field, 256 element radio interferometer operating at 300-500 MHz band, aimed at detecting fast radio bursts (FRBs) and other radio transients (magnetar flares, RRATs, etc) in the Southern Hemisphere (Santiago, Chile). The scientific objectives of the project include constraining FRB emission mechanisms, expanding the population of repeaters in the Southern Hemisphere, and leveraging the array's privileged location to study the Galactic center in search of radio transients of Galactic origin.

To maximize detection rate and minimize costs, we prioritize number of antennas and field of view over raw bandwidth. Following that premise, the CHARTS architecture incorporates at its core a multiplexing scheme that utilizes custom-made frequency division multiplexing (FDM) cards developed on printed circuit boards (PCBs). This analog front-end utilizes an 8-input FDM module that upconverts 201.6 MHz sub-bands using four digitally generated local oscillator tones, combining eight antenna paths into a single broadband RF stream spanning 300 to ~2366 MHz. Digitization is carried out on an RFSoC 4×2 platform sampling four streams at ~5 GSPS in quadrature I/Q mode, enabling a single board to process 32 antennas simultaneously. The real-time FPGA pipeline implements a 4-tap biplex polyphase filter bank (PFB) and an 8192-point FFT, followed by 4+4 bit requantization and packetization for transmission over 100 GbE links to GPU correlation nodes.

Finally, we show laboratory bench verification alongside early on-sky commissioning results from our pathfinder array, including solar transit measurements, initial baseline correlation, and phase calibration stability. We conclude with our operational deployment status and the roadmap for scaling to the full 256-element array.

Abstract #50

Tracing Megaparsec-Scale Diffuse Emission in a Massive Merging Galaxy Cluster with the SKA Pathfinder uGMRT

Sameer Tanaji Salunkhe, School of Computing, MIT Art Design and Technology University, Pune, India

Diffuse radio emission in galaxy clusters uniquely probes non-thermal processes associated with structure formation. Beyond the well-studied categories of radio halos, relics, and minihalos, recent low-frequency (~100 MHz) observations have revealed even larger structures, termed megahalos, which extend to scales approaching the cluster's R500 or beyond. These components, often distinguished by their steep spectra and low surface brightness, point to physical conditions in the intracluster medium that differ substantially from those shaping classical radio halos. Understanding their origin requires disentangling the interplay between turbulence, particle reacceleration, and magnetic field evolution in merging environments.

In this work, we present uGMRT observations (at 300 to 850 MHz) of the merging cluster PLCKG287.0+32.9, which uncover diffuse emission on megaparsec scales. The data reveal a central halo enveloped by an extended outer component that is consistent with the properties of a megahalo. The detection demonstrates that such multi-component radio structures are not restricted to the lowest frequencies (~100 MHz). It highlights the potential of sensitive wide-band observations to trace the evolution of relativistic plasmas across different cluster environments. These results strengthen the emerging picture in which megahalos represent a distinct class of diffuse cluster emission, offering new insights into how turbulence from hierarchical mergers shapes the non-thermal intracluster medium.

Abstract #51

Revealing the Sites of Energetic Particle Acceleration with the Sun Radio Interferometer Space Experiment (SunRISE)

Marin Anderson, JPL

Understanding particle acceleration is one of the most pressing open questions in Heliophysics, as solar energetic particles (SEPs) accelerated by solar flares and coronal mass ejections (CMEs) drive hazardous space weather events throughout the heliosphere, yet the exact physical mechanisms, acceleration regions, and magnetic transport pathways remain unresolved. The Sun Radio Interferometer Space Experiment (SunRISE) mission addresses this fundamental knowledge gap using a constellation of six 6U SmallSats in a supersynchronous orbit above Earth's ionosphere, operating in a passive formation spanning roughly 10 km. As the first space-based radio interferometer, SunRISE will observe decametric-hectometric (0.1–25 MHz) radio bursts from 2 to >20 solar radii to directly probe particle acceleration and transport. SunRISE will answer key Heliophysics questions by spatially localizing Type II radio bursts to discriminate between competing CME acceleration hypotheses—such as shock fronts, flank expansion, current sheet reconnection, and non-local acceleration—while tracking Type III radio bursts to map the 3D magnetic field topology connecting solar active regions into interplanetary space. Beyond transforming solar physics, SunRISE will pave the way for future NASA Astrophysics space-based radio arrays designed to explore the low-frequency universe.

Abstract #52

21 cm Cosmology with the OVRO-LWA Stage III

Ruby Byrne, Caltech

Measurement of 21 cm line emission from neutral hydrogen represents a promising probe of the universe's large-scale structure across cosmic time. At near redshift, this emission traces galaxies and the Cosmic Web; during the Epoch of Reionization, it maps ionization of the intergalactic medium by early stars and galaxies. At the highest observable redshifts, 21 cm emission offers a key observable for constraining the Dark Ages and Cosmic Dawn. The Owens Valley Radio Observatory Long Wavelength Array (OVRO-LWA), currently in its Stage III upgrade, could provide constraints on the 21 cm power spectrum from the Cosmic Dawn, at z~18. We describe progress toward achieving these new constraints.

The OVRO-LWA Stage III is a low-frequency radio interferometric array in California's Owens Valley consisting of 352 fully cross-correlated dual-polarization dipole antennas. Baselines up to 2.4 km in length enable precision calibration to compact calibrator sources, while the compact core offers good sensitivity to the 21 cm signal on large scales. We describe progress and challenges analyzing data from the OVRO-LWA Stage III. In particular, we discuss a source of systematic error from whitening ("equalization") and re-quantization of the digital signal, with implications for current and future line intensity mapping experiments. We also present new tools for precision calibration, compact source peeling, and RFI mitigation developed for the OVRO-LWA but with broad applicability to radio astronomical data analysis.

Abstract #53

Toward Real-Time 21 cm Calibration: GPU-Accelerated CorrCal for CHORD

Michael Jafs, McGill

Gain calibration is one of the primary obstacles standing between next-generation intensity mapping arrays and a detection of the redshifted 21 cm line. Sky-based approaches imprint artificial spectral structure through model incompleteness, while redundant calibration still requires a sky model to break its remaining degeneracies, pushing foreground power into nominally clean regions of 2D Fourier space. The Canadian Hydrogen Observatory and Radio-transient Detector (CHORD), currently being deployed at the Dominion Radio Astrophysical Observatory, will consist of 512 six-meter dishes observing between 300 and 1500 MHz, and errors in beam placement, beam pointing, and antenna cross-talk mean the array will never be perfectly redundant in practice. My work develops CorrCal for use in CHORD's calibration pipeline. CorrCal fits for a model covariance rather than a set of model visibilities: the sky is modeled as point sources with known positions and poorly known fluxes plus a diffuse component described by its angular power spectrum, so baselines within a redundant group are correlated rather than assumed equal. The covariance is sparse, and its inverse is obtained through repeated applications of the Woodbury identity.

In this talk, I will present a custom CUDA implementation of the CorrCal algorithm, which currently achieves a speedup of two orders of magnitude over the CPU reference. I will discuss the design choices behind the implementation and show how performance scales with array size and with the size of the assumed sky model. I will additionally discuss how improvements in speed of this magnitude are what make near real-time calibration of the full CHORD array tractable, reducing the need to store large volumes of uncalibrated data and allowing for the correction of fast time-varying systematics. Finally, I will discuss an extension to CorrCal that enables cross-frequency calibration, placing the frequency dependence of the sky directly into the model covariance. This offers a statistically well motivated approach to bandpass calibration, in contrast to methods that impose spectral smoothness on the gains by hand. I will close by discussing this method of bandpass calibration in the context of CHORD's 21 cm calibration requirements.

Abstract #54

RadioSim: A versatile visibility simulator for precision studies of low-frequency radio interferometers

Kartik Mandar, University of Catania

Accurate visibility simulations are essential for understanding how the sky, instrument, and analysis choices affect low-frequency radio observations. Searches for the redshifted 21-cm signal particularly require controlled studies of instrumental systematics, foreground contamination, and signal loss. We present a highly configurable Python visibility simulator designed to support these studies through a common framework for sky modelling, instrumental response, and observational configuration.

The simulator evaluates the full-polarization radio interferometer measurement equation through direct summation, supporting point-source skies, diffuse HEALPix emission, and their combination. Users can specify array layouts, observing times and frequencies, per-antenna primary beams, pointing offsets, and receptor configurations. A modular Jones-matrix framework incorporates effects including complex gains, bandpass structure, cable reflections, polarization leakage, and ionospheric propagation. Analytic and file-based beam models, integrated sky loaders, and standard visibility outputs support a range of simulation and analysis workflows.

We discuss applications to non-redundancy and signal-loss studies in arrays such as HERA. By varying antenna positions, beam responses, and sky structure independently, simulated visibilities can be used to examine how departures from redundancy affect coherent averaging and to assess whether foreground-based diagnostics represent the loss of the cosmological signal.The framework enables reproducible experiments with known sky and instrumental inputs, helping researchers isolate systematic effects, evaluate analysis assumptions, and explore instrument and observing configurations.

Abstract #55

Enabling 21-cm Cosmology from the Moon: Progress towards the Dark-ages EXplorer (DEX)

Sonia Ghosh, Kapteyn Astronomical Institute, University of Groningen

Our understanding of the early Universe has grown with facilities such as JWST and ground-based radio arrays, but periods before the first stars -the Dark Ages- remain largely unexplored observationally. The redshifted 21-cm signal from neutral hydrogen provides a unique probe of this epoch, but observations at the very low radio frequencies are severely limited from Earth due to terrestrial radio-frequency interference and ionospheric distortions. The Dark-ages EXplorer (DEX) is a proposed low-frequency radio interferometer for the lunar farside, one of the most radio-quiet environments accessible for observations in the 7-50 MHz frequency range. The fiducial DEX configuration consists of a 32X32 array of 3-m crossed-dipole antennas. Realistic deployment on the lunar surface, however, introduces important instrumental challenges such as antenna position and orientation errors, while the compact configuration makes mutual coupling and the electromagnetic properties of the lunar regolith potentially significant. I will present an overview of the DEX concept together with related developments such as GloDEX and PRE-DEX, and discuss efforts towards understanding these instrumental effects using a science-driven forward model pipeline, called SPADE-21cm. I will also briefly discuss the ongoing studies of antenna design, lunar-regolith effects, and mutual coupling, in the context of maturation of these concepts.

Abstract #56

Analysis of Diffuse Galactic Low-Frequency (18–82 MHz) Emission with the Expanded OVRO-LWA

Andrea Isella, Rice University

Understanding the Galactic diffuse radio sky at low frequencies (f<100 MHz) is essential for unravelling cosmic-ray transport, probing the diffuse ionized gas, and providing foreground models for Epoch of Reionization (EoR) cosmology. We present a multi-frequency spectral analysis across 15 bands (18–82 MHz) using all-sky mosaic images from the Expanded OVRO-LWA First Data Release (DR1). Comprising ~600 hours of observations across all LST hours, these maps achieve synthesized resolutions between 5' and 20'. These high-resolution images provide unprecedented constraints on diffuse Galactic synchrotron radiation, cosmic-ray electron (CRe) populations, free-free absorption from HII regions, and the presence of Supernova Remnants (SNRs). By measuring and disentangling Galactic synchrotron emission from free-free processes, this analysis aims to constrain models of CRe transport and halo aging, isolate diffuse HII region absorption, and systematically search for uncatalogued, steep-spectrum SNRs embedded within the bright diffuse background.

Abstract #60

Correlation Calibration

Bobby Pascua, University of Toronto & Perimeter Institute

Calibration is a fundamental challenge in radio astronomy. With the increased prevalence of drift-scanning arrays, which do not always have a reliable calibration source available, there is an increased need for calibration approaches that can perform well when limited sky information is available. Correlation Calibration, or CorrCal, is a new calibration technique that can provide reliable calibration solutions when provided with incomplete sky information, only requiring a model of the few brightest observed point sources, an estimate of the power spectrum of the rest of the radio sky, and a model of the instrument response. End-to-end validation simulations show that CorrCal can provide a highly accurate calibration when point source fluxes are not precisely known, and preliminary tests suggest that CorrCal is fairly robust to instrument modeling errors at the level expected for interferometric arrays currently under construction. This talk will review the formalism supporting CorrCal, present the results from end-to-end validation tests, and provide an early look at a broader scope of tests investigating CorrCal's performance in the presence of instrument modeling errors.

Abstract #61

Canadian Hydrogen Observatory and Radio-transient Detector (CHORD): First Look at Commissioning Data

Arnab Chakraborty, Dunlap Institute for Astronomy and Astrophysics, University of Toronto

The Canadian Hydrogen Observatory and Radio-transient Detector (CHORD) is a next-generation drift-scan interferometer under construction at the Dominion Radio Astrophysical Observatory in Penticton, Canada. The full instrument will comprise 512 six-metre dishes in a close-packed, highly redundant configuration, with ultra-wideband feeds covering 300–1500 MHz and a receiver noise temperature of approximately 30 K. CHORD will use this combination of sensitivity, bandwidth, and field of view to map the 21 cm line over $0 < z < 3.7$, supporting catalogues of nearby HI galaxies at low redshift and precision measurements of the expansion history through line intensity mapping at higher redshift, alongside fast radio transient and pulsar surveys. The design incorporates lessons learned from the Canadian Hydrogen Intensity Mapping Experiment (CHIME) while providing a substantial increase in sensitivity, with an emphasis on precision beam control and stable instrumental response to support high-fidelity foreground separation for 21 cm intensity mapping.

Construction is well advanced, with 130 dishes now installed on their foundations, and integration of the analog and digital systems is proceeding in parallel. We have collected the first commissioning data from 16 antennas whose signals are routed from the LNAs to the F-engine and X-engine. In this talk I will present an early characterisation of these data from a 21 cm cosmology perspective, including the RFI environment across the observing band and first steps toward sky-based calibration, provide an update on the project status, and outline the path from these early data to the first CHORD intensity mapping analyses.

Abstract #62

A New Window on the Ultra-Low-Frequency Universe with the Moon Radio Interferometer for Science & Exploration (MoonRISE)

Marin Anderson, JPL

The universe below ~20 MHz remains one of astronomy's last unexplored frontiers, as the Earth's ionosphere makes these frequencies largely inaccessible from the ground. The Moon Radio Interferometer for Science & Exploration (MoonRISE) is a 9-element radio interferometer that will operate from 0.1 – 30 MHz as the first radio interferometer on the Moon and the first connected-element radio interferometer in space. Located on the lunar farside, where it will be shielded from Earth's natural and artificial radio frequency interference in the quietest radio environment in the inner Solar System, MoonRISE will simultaneously address key science objectives that span heliophysics and planetary science, including characterization of solar wind turbulence in the inner heliosphere, continuous monitoring of the tenuous lunar ionosphere, characterization of the plasma sources and dynamics of Uranus's magnetosphere. In this talk, I will discuss both the science of MoonRISE and how this low-cost, small-N radio interferometer will pave the way for the large-scale, lunar-based radio telescopes of the (near) future.

Abstract #63

The Great Observatory for Long Wavelengths (GO-LoW): NIAC Phase II study results

Mary Knapp, MIT Haystack Observatory

A space-based low frequency observatory will open up the last unexplored band of the electromagnetic spectrum - radio below ~10 MHz, which is blocked by the Earth's ionosphere. We present results from a 2-year NIAC Phase II study on a free-flying constellation interferometer designed to access the low frequency sky. We will provide an overview of the wide variety of science that can be addressed by a free-flying array, describe the architecture choices made for this constellation telescope, explain why recent developments in commercial constellations, laser communication, smallsats, and antenna topologies are enabling for a science constellation, and highlight the benefits of a free-flying constellation, including reconfigurability, graduated growth, and resilience to element failures. We also present a flexible multi-agent simulation framework that was developed for GO-LoW which has potential applications to other science constellations or large interferometric systems on Earth or the Moon. Finally, we preview some unique features of a free-flying constellation for 21-cm science, such as fixing the constellation relative to the sky rather than allowing baseline rotation.

Abstract #64

The New LWA Station Architecture

Greg Taylor, UNM

While the antennas are largely unchanged, the LWA station architecture has evolved considerably from the original implementation on LWA1 that became operational in 2011. This system relied on an early version of the analog receiver boards (ARX) that had a cutoff at 10 MHz. Due to interest in the ionosphere newer ARX designs lowered the cutoff to 3 MHz. In contrast Citizen's Band (CB) radio at 27 MHz was largely unfiltered in the original ARX design which caused problems when the Sun became more active resulting in an ionosphere reflective at these frequencies. I will discuss the evolution of filter settings. On the digital side the LWA1 has moved from a custom design by JPL, to ROACH2 boards, to SNAP2 boards and most recently to a significantly less expensive, but much more flexible design using the AMD ZCU102 development boards and GPU servers. I will discuss the advantages and some unexpected development costs associated with this major change. The new LWA architecture has been implemented at LWA1 and LWA-SV stations in New Mexico and is poised to roll out at three new mini stations in Arizona and Texas in 2027. Together with the OVRO-LWA and LWA-NA stations this will constitute the 7-element LWA Swarm Telescope.

Abstract #66

Detecting Exoplanet Radio Bursts Through Singular Value Decomposition of Beam-Formed Dynamic Spectra

Caden Kunkel, University of Colorado Boulder Center for Astrophysics and Space Astronomy

The search for habitable worlds outside of the Solar System has become a central goal of modern astronomy. One critical component for sustaining life on an exoplanet is the existence of a stable atmosphere, which may be protected from stellar-wind erosion and generally regulated by a planetary magnetic field (Brain et al. 2024). After decades of searching, astronomers have yet to confirm a radio detection of such a magnetosphere, and the search remains a priority in The Planetary Science and Astrobiology Decadal Survey 2023-2032 (National Academies 2023).

We are developing a new generalized method for analyzing signals from exoplanet magnetospheres applied to electron cyclotron maser emission in beam-formed low-frequency observations. This uses singular value decomposition (SVD) of the ON minus OFF beam dynamic spectra to identify coherent burst emission in the leading modes and distinguish it from the background noise which spans the full SVD spectrum. Separating the two parts requires a technique to select the mode threshold, for which we are considering several criteria including the Marchenko–Pastur distribution, the Shannon entropy of singular values, and principal angles between subspaces. Using the Jupiter-as-an-exoplanet injection framework of Turner et al. (2019, A&A 624, A40) and data from the Low-Frequency Array (LOFAR), we will compare the limiting detectable scale factor obtained with previous methods and our own. We additionally examine how radio-frequency interference (RFI) flagging applied to the injected template affects recovered signal strength.

Because much of the auroral radio emission from Solar System planets occurs below Earth's ionospheric cutoff, we anticipate applying this method to radio telescopes on the lunar surface, where the required frequencies below ~10 MHz become accessible. We will discuss applications for the pathfinders LuSEE-Night (scheduled to launch early 2027) and ROLSES-2 (scheduled to launch 2028), as well as proposed lunar arrays capable of detecting exoplanet magnetospheres.

Abstract #68

Observational Analysis and Modeling of Moving Sources of Radio-frequency Interference

Jade Ducharme, Brown University

Radio-frequency interference (RFI) is among the most pressing challenges for modern radio astronomy operations, in particular for high-precision experiments that target the faint 21-cm signal from the Epoch of Reionization and are sensitive to even the weakest residual RFI contamination. In this talk, I will present novel techniques for characterizing and modeling moving sources of RFI in interferometric data. I will demonstrate these techniques using archival observations from the Murchison Widefield Array, illustrating how new approaches can still extract additional value from existing data and improve detection and flagging of RFI. Given the ever growing rate of satellite proliferation, such techniques will become increasingly important for distinguishing and ultimately removing the expanding range of RFI contaminants present in radio interferometric data.

First, I will introduce a new method for estimating the altitude of moving RFI emitters located close to the array, within the near-field regime. Combined with the right ascension and declination obtained from interferometric imaging, this method enables three-dimensional localization of an RFI source. I will then present an analytic model that describes a moving source in the interferometric uv-plane. Moving sources produce a distinct sinc-like pattern in the uv-plane, which our model reproduces with high accuracy, allowing us to constrain the source motion directly from the interferometric data.

Finally, I will present recent work demonstrating that RFI emitted by satellites can, in some cases, produce little or no apparent contamination in the time-frequency representation of visibilities—and therefore remain undetected by established RFI flagging algorithms—while becoming clearly visible once the same visibilities are converted into sky images. This highlights an important limitation of conventional RFI flagging and motivates a broader shift toward improved physical modeling of RFI, which forms a central focus of this talk.

Abstract #70

Measurement of All-sky Neutral hydrogen Absorption Spectrum (MANAS): An Error-Budget-Driven Approach to the Global 21-cm Signal

Nivedita Mahesh, CU Boulder

The sky-averaged ("global") 21-cm signal traces the IGM's thermal history through the Dark Ages, Cosmic Dawn, and reionization. But its detection is limited less by sensitivity than by instrumental systematics that can mimic a tens-of-mK feature against foregrounds many orders of magnitude brighter (four to five for the Cosmic Dawn epoch): antenna chromaticity, calibration errors, and foreground uncertainties. MANAS (Measurement of All-sky Neutral hydrogen Absorption Spectrum) is a new ground-based global 21-cm radiometer. Operating in the RFI-quiet 30–90 MHz band as an outrigger to a co-located low-frequency array.

MANAS combines the strongest elements of three current experiments: the achromatic cone-monopole antenna of SARAS, the four-load absolute receiver calibration of EDGES, and in-situ beam and foreground calibration from the array it shares a site with. The receiver output is split: one path feeds the array backend for cross-correlation, enabling beam holography and ionospheric calibration for MANAS, while the science path is digitized by a ZCU111 RFSoC backend at 7.5 kHz resolution. Because the receiver is calibrated against standard loads at known thermodynamic temperatures, MANAS in turn anchors the array's sky maps to an absolute flux scale, potentially reducing their calibration uncertainty from 10–15% to 1–5% level.

MANAS is built around the premise that a credible detection requires a complete, empirically validated instrument error budget. In this talk, I will cover our approach, which sets a frequency-dependent tolerance curve that defines the allowable residuals. The contributing effects fall into two main categories, instrumental and environmental. We perform controlled hardware perturbations to measure how individual systematics propagate into the spectrum, and we cross-check that propagation against the forward model.

MANAS achieved first light in June 2026, with antenna S11 measured in situ. We present the instrument and first results from analyzing the first season of data with the EDGES pygsdata package and our preliminary results in populating and validating the error budget.

Abstract #71

Estimating the Cross-power Spectrum of CHIME 21cm IM and eBOSS Quasars

Alex Reda, Boston University

Intensity mapping (IM) of the 21cm line of neutral hydrogen is a promising, novel approach for charting the large scale structure of the Universe. The Canadian Hydrogen Intensity Mapping Experiment (CHIME), in particular, is pursuing the 21cm line to trace the expansion history of the Universe via measurements of the baryon acoustic oscillation (BAO) scale imprinted on the underlying matter distribution. Yet this approach faces a critical challenge: bright astrophysical foregrounds overwhelm the 21cm signal by ~5 orders of magnitude. In this context, CHIME has played a crucial role in establishing the observational viability of this probe, recently achieving the first independent detection of the cosmological 21cm power spectrum at redshift ~ 1. However, the foreground filter required to enable this measurement also erases the data's sensitivity to the BAO scale and the science thereof. Looking forward, cross-correlation style analyses which combine the statistical power of cutting edge LSS surveys with a relaxed foreground filtering approach for 21cm IM will likely offer the clearest near-term pathway to detection of the BAO signal in 21cm data. To this end I will present the development of a pipeline for cross-power spectrum estimation between CHIME maps and traditional spectroscopic large scale structure surveys, tested on the sample of QSOs from the SDSS-IV eBOSS survey program.

Abstract #72

Multi-band, 3-pi Imaging of Low-Frequency Sky with OVRO-LWA

Casey Law, Caltech

The OVRO-LWA is composed of 352 dipole antennas that are fully cross-correlated to produce a clean PSF and all-sky sensitivity from 15 to 85 MHz. At the top of the observing band, the array has a spatial resolution of 5' and confusion-limited image sensitivity of roughly 100 mJy. We have generated co-added all-sky images from 500 hours of data in 15 subbands and identified over 200,000 sources with measurements in multiple subbands. This sample includes hundreds of local galaxies and clusters, many pulsars and supernova remnants, accreting compact objects, and more. By cross matching with other surveys, we estimate radio spectral turnovers to constrain jet properties, luminosities to estimate star-formation rates, and measure SSA and free-free absorption. We will present the initial all-sky, wideband catalog and maps from the OVRO-LWA, including highlights of early science applications to the study of the static sky.

Abstract #74

Performance and Early Science of the OVRO-LWA

Gregg Hallinan, Caltech

The Long Wavelength Array at the Owens Valley Radio Observatory (OVRO-LWA) is a 352-antenna interferometer with baselines up to 2.4 km, operating in the 13–87 MHz band. A versatile digital backend supports simultaneous, continuously running observing modes, including all-sky imaging at 10-s and 0.1-s cadence, 12 independently steerable beams, cosmic-ray detection, and a triggered voltage buffer. I will present an overview of telescope performance and early science, ranging from cosmic rays to detected transient populations. I will also describe ExoPipe, a new pipeline that now processes OVRO-LWA data through imaging, transient detection, and classification in near real time, with a particular focus on detecting the magnetospheres and space weather environments of extrasolar planets.

Abstract #75

Development of Cubesat-based Beam Mapping of CHORD with the Canadian Calibrator for Radio Telescopes (CARAT)

Yifan Zhao, University of Toronto

Knowledge of the beam response of radio telescopes is a limiting factor for science cases such as 21-cm intensity mapping, which requires highly precise knowledge of instrumental systematics for accurate foreground separation. Traditional methods of beam measurement are imperfect at low frequencies and wide bandwidths due to environmental factors and limited calibration sources. Next-generation instruments such as the Canadian Hydrogen Observatory and Radio-transient Detector (CHORD), a high-N, wide-bandwidth array, aim to provide enough redundancy to use precision calibration techniques. However, the calibration of such arrays are sensitive to per-antenna inconsistencies, so in-situ measurements are needed to quantify the dish-to-dish variations in the beam response.

The Canadian Calibrator for Radio Telescopes (CARAT) is a proposed cubesat project that will fly a coherent noise source in low-Earth orbit. CARAT will act as a known astronomical reference source for ground-based radio telescopes including CHORD. The benefit of CARAT is its wide-bandwidth pseudo-random noise source, which allows for beam mapping over the entire CHORD bandwidth and for an acceptable SNR far into the sidelobes, even at low power and over long distances. Initial development of CARAT has focused on using drones as a testbed for payload development and testing. Drone-based beam mapping provides a platform that is fully under experimenter control and allows for rapid prototyping of the calibration payload. I will discuss the feasibility and initial payload development of CARAT through orbit simulations and a drone-based experiment to map the beam of a CHORD antenna.

Abstract #76

Commissioning SKA-Low - Advancing toward Science

George Heald, SKA Observatory

The SKA Observatory is constructing two complementary next-generation radio telescopes: SKA-Low in Australia (50–350 MHz) and SKA-Mid in South Africa (350 MHz–15.4 GHz). When completed later this decade, they will be the most sensitive facilities in their respective frequency ranges. Both instruments are now undergoing science commissioning activities in the leadup to the first public release of data products arising from the Science Verification phase. I will outline the Observatory-wide science commissioning approach and summarise technical and scientific progress to date. The talk will then focus on SKA-Low, located in the Murchison region of Western Australia that will ultimately comprise 512 aperture array stations distributed over baselines up to 74 km. With a sixteen-station array currently operational, and the ramp-up to next year's 68-station array underway, SKA-Low commissioning activities include: system stability, verification of calibration at the station and array levels, validation of tied-array beamforming, detections of transient objects such as pulsars and long period radio transients, sensitivity assessments, early interferometric imaging, and development of a Global Sky Model surveys plan. I will highlight commissioning progress and plans for upcoming test phases, that are paving the way toward science verification, early science operations, and SKA-Low's transformational low-frequency science.

Abstract #79

A Radio Search for Brown Dwrafs and Gas Giant Exoplanets

Mikaela Webber, Stellenbosch University / University of Groningen

Brown dwarfs are cool stars known to emit highly circularly polarised radio emission, driven by auroral processes similar to those observed on Jupiter. Traditionally, brown dwarf surveys have been conducted in the infrared, with subsequent follow-up observations in the radio band. However, the coldest brown dwarfs are challenging to detect in the infrared due to their low temperatures. Their radio emission may still be detectable with new sensitive radio telescopes such as the MeerKAT radio telescope. The emission is due to the cyclotron mechanism: it is circularly polarised and is a direct probe of the dwarf's magnetic field. As circularly polarised sources are rare in the radio sky, this provides a powerful method to search for the coldest brown dwarfs. Low frequency radio observations allow us to probe brown dwarf magnetic fields that border on "planetary-scale" magnetic fields, and can be used to test scaling laws in the exoplanet regime. This will allow us to bridge the gap between substellar and planetary scaling laws.

We have observed the Rho Ophiuchi molecular cloud, one of the richest nearby star-forming regions and home to thousands of brown dwarfs, making it an ideal testbed for a radio search. In addition to brown dwarfs, the cloud hosts a rich population of young stellar objects whose radio emission traces magnetic activity, energetic particles, and ionised outflows. In this talk, we present results from a pilot MeerKAT study of the L\,1688 dark cloud within the Rho Ophiuchi complex. We report the detection of radio emission from several brown dwarf candidates and two candidate stellar bow shocks.

Abstract #80

Updates from the MWA Epoch of Reionisation program

Nichole Barry, ICRAR-Curtin/CSIRO

We will report initial results from the MWA Phase 3 Epoch of Reionisation project. Over the 2025A semester, we observed several hundred hours of data on three primary fields, and in a redshift range of 6.2 < z < 9.5. We will demonstrate the increased parameter space opened by the improvements in spectral quality, comparing Phase 1 and 2 data with Phase 3 data, and present 21 cm power spectra from the new system from 2025A and 2026A datasets. We will further discuss plans for 2027 onwards for the EoR program, and describe how the MWA EoR program is helping to shape the future experiments with the SKA-Low telescope.

Abstract #81

Results from REACH year 1 observations

Eloy de Lera Acedo, University of Cambridge

In this talk I will describe the progress in the REACH global 21-cm experiment. In particular, I will talk about the data analysis from year 1 observations, which has focused on data from our first antenna on site (a wide band dipole on a raised ground plane). This has led to initial foreground science (absolute and spectral measurements of the diffuse galactic emission) and attempts to detect the redshifted 21cm line from atomic Hydrogen at Cosmic Dawn. I will also present the next steps in the experiment.

Abstract #82

Breaking the cool-core barrier: radio halos, mergers, and the CC–NCC evolutionary cycle

Ramananda Santra, International Centre for Theoretical sciences

Low-frequency radio observations are opening a new window on the merger history of galaxy clusters by revealing steep-spectrum, low-surface-brightness synchrotron emission from electron populations that are often invisible at GHz frequencies. This makes them uniquely sensitive to weak turbulence, ageing particles, and dynamically subtle merger activity, and therefore particularly powerful for understanding how non-thermal phenomena connect to the cool-core–non-cool-core (CC–NCC) evolution of the intracluster medium. We present multi-frequency radio observations with uGMRT, MeerKAT, and the VLA, together with XMM-Newton and Chandra data, of two massive clusters that probe strikingly different stages of this cycle.

Abell 2219 (\(z=0.225\)) hosts an exceptionally extended radio halo reaching approximately \(r_{500}\), with radio morphology closely following its strongly disturbed X-ray structure. Strong point-to-point radio–X-ray correlations and multiple merger-driven shock fronts reveal in detail the coupling between merger energetics, turbulence, and relativistic particles in a major merger. In contrast, MACS J0417.5−1154 (\(z=0.443\)) hosts a \(\sim1.8\) Mpc radio halo and a peripheral candidate relic while still retaining a cool core. Spatially resolved spectral steepening, together with X-ray sloshing signatures, shows that a comparatively minor merger can re-energize relativistic particles over megaparsec scales without fully destroying the core, blurring the traditional boundary between radio-halo and cool-core systems. We place these systems in a broader evolutionary framework using 98 clusters, nearly four times the sample of Rossetti et al. (2011). The enlarged sample strongly disfavors the previously proposed three-state model and yields an NCC to CC relaxation timescale of \(1.52^{+0.65}_{-0.46}\) Gyr, tightening the previous upper bound by nearly a factor of two. We also find suggestive evidence for shorter relaxation timescales at higher mass, with no significant evolution across redshift bins. These results suggest that low-frequency radio emission is not simply a tracer of violent mergers, but a sensitive probe of the full thermodynamic and dynamical memory of clusters. In the SKA-Low era, this opens the possibility of mapping the CC–NCC evolutionary cycle through large populations of faint, steep-spectrum halos and merger remnants that are currently only beginning to emerge.

Abstract #84

The ordered magnetic field in the Milky Way's halo

Elena Orlando, Trieste

Synchrotron polarization offers a powerful probe of the large-scale ordered magnetic field in the Galaxy, but its interpretation requires a self-consistent treatment of cosmic rays and magnetic fields. By modeling synchrotron polarization in the Galactic halo using cosmic-ray-constrained models and recent magnetic-field models inferred from rotation measures, we find a significant large-scale synchrotron excess compared to the data. This points to the existence of a strong ordered toroidal field in the Galactic halo that remains largely invisible to rotation measures. The polarization data favor a cosmic-ray halo of about 4 kpc and suggest that the synchrotron excess is unlikely to be explained entirely by local structures such as the Local Bubble.

Abstract #86

The MWA Phase III upgrade complete, and a complementary path to SKA-Low

Steven Tingay, Curtin University

In this presentation I will provide an update on the Murchison Widefield Array (MWA), on behalf of the six nation partnership that supports the operation of this facility. The MWA is an SKA precursor and in the presentation I will briefly summarise recent MWA science results of significance, the recent completion of the Phase III upgrade of the MWA facility (describing new capabilities, new observing modes, and new science opportunities), and

the path to transition from the MWA to the SKA-Low facility toward the end of this decade. This transition offers unique opportunities for joint science between the MWA and SKA-Low, in particular as the SKA-Low moves through the Array Assembly 2 (AA2) phase. I will describe these opportunities.

Abstract #89

STRIDE: Unlocking the Low-Frequency Radio Transient Sky through Scalable Imaging Dedispersion

Cristian Di Pietrantonio, Curtin Institute of Radio Astronomy / Pawsey Supercomputing Research Centre

The low-frequency radio transient sky remains largely unexplored, particularly at millisecond timescales. Although instruments such as the Murchison Widefield Array (MWA) offer wide fields of view and sensitivity to a range of transient phenomena, systematic searches are limited by the enormous data volumes generated by high-time- and frequency-resolution interferometric observations. These challenges are compounded by the strong frequency-dependent dispersive delays at low frequencies, which require substantial computational resources to search for highly dispersed signals.

In this talk, I will present Streaming high Time-Resolution Imaging DEdispersion (STRIDE), a novel algorithm designed to make imaging-based transient searches computationally feasible. STRIDE generates dedispersed time series directly from interferometric images without explicitly constructing dynamic spectra or shifting entire image cubes. Its key innovation is to partition the dispersive sweep in both frequency and time, enabling an incremental, streaming approach that processes only a subset of the data at once. This substantially reduces the memory required for dedispersion while retaining the ability to search across long dispersive delays.

In the test case presented in our recent publication, STRIDE reduces the minimum memory requirement by 97.9%, from 684.5 GB to 14.4 GB. This advance provides a practical pathway towards searching large volumes of archival and future low-frequency interferometric data at high time resolution. By enabling wider and less targeted surveys, STRIDE opens new opportunities to discover fast radio bursts and other transient populations, investigate their low-frequency emission and propagation properties, and develop an unbiased view of the dynamic radio sky in preparation for SKA-Low and LOFAR 2.0.

Abstract #90

Impact of Lunar-Reflected Radio Frequency Interference on 21-cm Line Observations with the Murchison Widefield Array

Daichi Nagakura, Kumamoto University

The detection of the 21-cm line, originating from the hyperfine structure transition of neutral hydrogen, at redshifts of $z \sim 13$–17 (75–100 MHz) is attracting attention as a powerful tool for studying the physical processes involved in the Epoch of Reionization (EoR). However, this frequency range is also affected by strong Radio Frequency Interference (RFI), including terrestrial FM radio emissions.

It is known that terrestrial RFI, such as FM radio broadcasts, can be reflected by the Moon, producing lunar-reflected RFI. When observing the redshifted 21-cm line from the Earth, observational data may therefore be contaminated by lunar-reflected RFI. It may be difficult to identify and flag using conventional RFI mitigation techniques.

In this study, we analyze Murchison Widefield Array (MWA) Phase II observational data in the 74–105 MHz frequency range with an 80-kHz frequency resolution to investigate the intensity and frequency dependence of lunar-reflected RFI. We characterize the detected lunar-reflected RFI and evaluate its potential impact on 21-cm line observations.

Although it is difficult to completely distinguish lunar-reflected RFI from other sources of contamination, our results demonstrate that lunar-reflected RFI can significantly affect 21-cm line observations.

Abstract #93

Radio signatures of extrasolar aurorae in the compact M-dwarf system LHS 1610

Yessica Calatayud-Borras, Universitat de Valencia

Low-frequency radio observations provide a unique tool to investigate magnetic interactions between stars and their companions or planets beyond the Solar System. When a companion or planet orbits within the sub-Alfvénic regime of its host star, magnetic coupling can efficiently extract energy from the stellar wind, channeling Poynting flux into auroral electron-cyclotron maser (ECMI) emission. This type of emission is expected to be highly circularly polarized, strongly beamed, and variable on short timescales, making radio observations particularly sensitive probes of magnetospheric processes. The efficiency and detectability of this mechanism are strongly modulated by the orbital properties of the system.

In this talk, I will present radio observations of a nearby M-dwarf system that highlight the importance of these conditions. The system, LHS 1610, is composed of an M5 dwarf hosting a brown dwarf companion. This system is especially compelling because it is one of the closest known M-dwarf systems with a substellar companion, and its brown dwarf, LHS 1610 b, is the second most eccentric substellar object known to orbit an M dwarf. Previous Very Large Array (VLA) observations revealed a single, highly polarized (~80%), approximately one-hour-long radio burst confined to 1.0-1.2 GHz and detected only near periastron, with no detections in other epochs. These results are consistent with predictions from magnetic star-companion interaction models. However, the origin of this emission remains uncertain and may arise from intrinsic stellar activity, brown-dwarf auroral emission, or magnetic star-companion interaction.

Together with the small number of previously reported cases of star-planet interaction, these results add new evidence for extrasolar, wind-powered aurorae and demonstrate the potential of radio observations as a powerful probe of magnetic interactions in compact stellar systems. They also motivate targeted time-domain monitoring to search for orbital modulation, which would establish if LHS 1610 represents the first convincing example of magnetic interaction in a star-brown dwarf system.

Abstract #94

The LOFAR Two-metre Sky Survey (LoTSS)

Timothy Shimwell, ASTRON

In this talk, I will describe the third data release from the LOFAR Two-metre Sky Survey (LoTSS), for which we used almost 13,000 hours of LOFAR observations to produce 120–168 MHz images at 6" resolution covering 88% of the northern sky, together with a catalogue containing 13,667,877 radio sources. I will summarise the accuracy and limitations of the data products, highlight a few use cases, and discuss plans to build on LoTSS with the upgraded LOFAR2.0 telescope.

Abstract #95

The GaLactic and Extragalactic All-sky MWA eXtended (GLEAM-X) Survey

Kathryn Ross, Australian SKA Regional Centre - AusSRC

The GaLactic and Extragalactic All-sky MWA eXtended (GLEAM-X) survey boasts twice the resolution, and up to an order of magnitude higher sensitivity to its predecessor the GLEAM survey. Several parts have already been released, including a Galactic Plane release combining GLEAM and GLEAM-X, and the South Galactic Pole release. In this talk, I present the entire GLEAM-X survey covering the entire sky south of Dec+30, with a typical RMS of <1mJy/beam, and a catalogue of over 1million sources with spectral fitting.

This talk will also demonstrate the rich potential of science with GLEAM-X, the complimentary possibilities with other radio surveys, including RACS and LOTSS, and long term uses as we head into the Science Verification stage of SKA-Low. In particular, it will focus on a specific use case, presenting a new classification system for peaked spectrum sources (PSS), believed to be early stages of typical radio loud active galactic nuclei. We showcase the capabilities of GLEAM-X presenting a new catalogue of PSS that increases known PSS by an order of magnitude and estimates completeness and reliability of this new classification schema. This talk will summarise the lessons learned, evolving scientific goals, and legacy value of the GLEAM-X survey.

Abstract #96

First FRB detection with the MWA

Marcin Sokolowski, AusSRC/UWA

Despite thousands of Fast Radio Bursts (FRBs) discovered at frequencies above 400 MHz, detections below 300 MHz remain scarce. This observational gap has fostered a perception that low-frequency FRBs are either intrinsically rare or very difficult to detect. To address this, we developed BLINK, a GPU-accelerated, image-based FRB search pipeline, enabling us to process the entire 4 PB archive of the MWA SMART pulsar survey. This effort yielded the first FRB detection with the MWA. Notably, FRB 20191203A is also the first to be discovered via an untargeted search at frequencies below 300 MHz. Our derived event rate is consistent with rates measured at higher frequencies, strongly suggesting the existence of a substantial population of low-frequency FRBs awaiting to be explored with the advanced computational pipelines. This detection also demonstrates that despite amplified scattering and dispersion, low-frequency FRB detections are highly viable and offer unique diagnostics for studying progenitor environments. I will present the details of this detection, the architecture of the BLINK pipeline, and the broader implications for low-frequency transient science using current arrays and upcoming facilities like SKA-Low.

Abstract #97

LAMBDA: Low Frequency VLBI Demonstrator in the Southern Hemisphere

Jaiden Cook, CSIRO

SKA will enable a broad range of new science with exciting VLBI prospects. SKA-mid is poised to be a key element of global-scale VLBI arrays. However, currently the SKA-low baselines are limited to just around 70km and there are few resources to call upon to enable VLBI observations with SKA-Low. SKA-Low by itself will not provide the sub-arcsecond angular resolution required for maximising synergy with frontline optical/IR telescopes such as JWST. The planned tied-array mode does allow the capability to participate in VLBI observations. To make use of this mode for SKA-low, new stations or facilities need to be developed that can link with it. With significant science being produced with LOFAR international baselines in the Northern hemisphere, we at CSIRO are motivated to take the first steps to establish low-frequency VLBI capability in the Southern hemisphere. A modest project is sufficient to demonstrate capability, provide the basis of a long-term technology development pathway, and provide motivation for future expansion of SKA-Low to match the original vision of a continent-scale telescope. Our development project is called LAMBDA: the Low-frequency Australian Megametre-Baseline Demonstrator Array. A full array would consist of several (4-6) low-frequency aperture arrays that will be located at sites of existing LBA telescopes across Australia. Although the project design is not motivated by an attempt to optimise imaging fidelity to achieve specific science goals, we will nevertheless seek to achieve a balanced mixture of intermediate- and long-baseline spacings. These stations will enable local studies of pulsars and stars, transient event follow-up and host localization, AGN and high-redshift science, and the flexible new backend will enable innovative single- station science as well. We will give an overview of the project, its status and future plans, and touch on science that can be enabled by the array.

Abstract #98

Low-frequency imaging surveys: the new frontier for transient discoveries

Natasha Hurley-Walker, Curtin University / International Centre for Radio Astronomy Research

Recent radio surveys have demonstrated that the radio sky is far more dynamic and variable than previously thought, with a host of new transient discoveries rapidly following wide-area surveys conducted with SKA precursors such as LOFAR, ASKAP, and the MWA. In particular, the long-period radio transients (LPTs) have motivated searches of the time domain between seconds to hours, a timescale historically understudied.

In this talk I describe a high-cadence monitoring survey covering the entire Galactic Plane south of Declination +30 degrees, using the MWA at 200MHz. Covering timescales from four seconds to three years, this survey has enabled the discovery of three LPTs, five pulsars, 20 new supernova remnants, and has contributed measurements to a host of other projects, including ASKAP-selected LPTs, studies of eclipsing binary millisecond pulsars, and new Galactic Centre Radio Transients.

Low-frequency surveys offer a multitude of benefits, but also challenges, and I will describe our solutions, along with future upgrades that will enable an even larger discovery space. I will conclude with an outlook on the future of low-frequency monitoring of the southern celestial sky, both in the medium-term, and once the SKA-Low arrives. I will also describe our plans with the SKA Regional Centres capitalising on precursor data to build SKA-ready pipelines that will produce legacy products to maximise value for the community.

Abstract #99

Revisiting pulsar profile evolution and single-pulse modulation using low-frequency, wideband observations

Fabian Jankowski, LPC2E, Paris Observatory, France

The details of the pulsars' radio emission remain uncertain. Their integrated pulse profiles are the most readily available observables, whose morphology reflects the pulsar geometry, emission altitude, and magnetospheric configuration. Both their profile evolution with radio frequency and frequency-dependent single-pulse emission are important observables that probe the elusive pulsar radio emission mechanism. The pulse profile evolution is commonly described using the radio-to-frequency mapping (RFM) paradigm, in which emission at higher frequencies originates from closer to the neutron star surface. This is one of the cornerstones in pulsar astrophysics.

In this talk, I will present a new wideband study of how the pulsars' integrated pulse profiles and single-pulse modulation evolve with radio frequency, while separating intrinsic and propagation effects. The latter is crucial at low frequencies.

Firstly, I will present integrated pulse profiles and phase-resolved modulation index curves for 12 radio pulsars at up to five frequency bands. Our wideband dataset was systematically acquired with the Nançay Radio Observatory telescopes and the uGMRT, covering the frequency range 10 MHz to 2.8 GHz, including NenuFAR, LOFAR FR606, uGMRT, and NRT observations. We carefully measured the pulse widths and scattering times using multi-component profile fitting. We employed a profile width scaling model to separate the profile evolution into scattering and intrinsic contributions. We quantified the pulsars' single-pulse variability across frequency.

Secondly, I will revisit the pulse profile evolution, RFM picture, and scattering. Only two of our pulsars have scattering indices compatible with Kolmogorov turbulence, while the majority have flatter scattering indices between -3 and -0.5. This suggests complex scattering environments, dominated by localised turbulence. Complex scattering behaviour is seen in some pulsars, and most profiles are scattering-dominated below 200 MHz. The measured intrinsic power law indices are small, with absolute values between 0 and 0.3. Five pulsars exhibit decreasing intrinsic widths, two or three pulsars show flat behaviour, and four pulsars have increasing profile widths with frequency. Accounting for biases, most

pulsar modulation parameters decrease with frequency, while three pulsars show flat behaviour.

Thirdly, I will explain the pulse width evolution by intrinsic radio beam narrowing, the emergence of profile components, and the balance between the two. Our modulation analysis indicates that the single-pulse emission from most of our pulsars becomes more erratic towards lower radio frequencies, consistent with increasing amplitude modulation.

Finally, I will discuss ideas for similar future studies with SKA-Low in the Southern Hemisphere.

Abstract #100

Coherent 45 MHz emission from a nearby exoplanetary system in V-LoLSS

Henrik Edler, ASTRON

M dwarfs are the most numerous hosts of terrestrial planets in the solar neighborhood, and thus a primary target for habitability studies. However, their stellar activity can drive energetic events that erode planetary atmospheres. An intrinsic magnetic field can shield the planet from the stellar wind and preserve its atmosphere.

The detection of planetary magnetic fields is challenging, and low-frequency radio observations are the most promising tool - either directly, via the auroral radio emission as observed from the magnetized solar system bodies, or indirectly, via star-planet interaction (SPI) between the planetary magnetosphere and the stellar magnetic field, analogous to the well-studied Jupiter-Io system. In both cases, the emission arises from the electron cyclotron maser instability (ECMI), which has a maximum frequency directly proportional to the ambient magnetic field MHz. Thus, ultra-low frequency (MHz) observations are necessary to probe magnetic fields of tens of Gauss or below.

Key observational signatures of ECMI emission are a high degree of circular polarization and extreme brightness temperatures. We use these signatures to carry out V-LoLSS, the most extensive search for circularly polarized radio sources at ultra-low frequencies, using the LOFAR LBA Sky Survey.

In this talk, I will introduce this blind survey, present a census of the Stokes V sky at 50 MHz, and highlight an exciting discovery in the data:

We detected a transient source coincident with a nearby binary, the emission is only detected below 50 MHz (mJy), and is 75% circularly polarized. The source is detected at 8σ significance across a single 1h epoch, but not in any other LOFAR survey observation.

We clearly establish an astrometric association between the radio source and one of the binary components, a quiescent M dwarf hosting a terrestrial planet. Based on the inferred brightness temperature and the high level of polarization, we identify ECMI as the emission mechanism. This leaves open the question of the origin of the emission: direct auroral emission of an as-yet-undetected, Jupiter-like planet, or emission in the stellar magnetosphere, powered either by SPI with the known terrestrial planet, or stellar activity. I will show where in the parameter space each scenario remains viable, and how follow-up

observations with LOFAR 2.0, NenuFAR, as well as in the UV, X-ray and IR, will clearly distinguish between them.

Abstract #101

Monitoring the low frequency radio transient sky with AARTFAAC

Kate Kelley, University of Amsterdam & ASTRON

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.

Abstract #102

The NenuFAR Long-Period Transient Monitoring Programme

Fabian Jankowski, LPC2E, Paris Observatory, France

Long-period transients (LPTs) are a new source class recently identified and currently a hot topic. Their long periods and wide profiles make them hard or impossible to detect in the time domain using conventional radio survey techniques. Many are believed to be white dwarf binaries or slowly spinning exotic neutron stars, which challenge evolutionary models.

In this talk, I will give an overview of the LPT monitoring programme with the NenuFAR telescope in France (10 - 85 MHz) that we have been developing since mid-2023 and which has recently picked up steam. I will introduce the team, the dataset of six LPTs we have acquired so far, and highlight two LPTs we have focused on most recently. I will show how low-frequency monitoring will characterise their pulsar timing properties, as well as their spectral and polarimetric characteristics. Then I will discuss the challenges we face observing LPTs with wide pulse profiles at low frequencies, present our solutions, and highlight some of the intriguing candidate signals we have seen. I will conclude by discussing our current and future refinement work on the transient search pipelines and how it can benefit future search and monitoring programmes with SKA-Low in the Southern Hemisphere.

Abstract #105

Solar and Space Weather Science with the Long Wavelength Array at the Owens Valley Radio Observatory

Bin Chen, New Jersey Institute of Technology

The Long Wavelength Array at the Owens Valley Radio Observatory (OVRO-LWA) is a highly versatile, multi-use, all-sky interferometer operating at 13–87 MHz. Its 352 antennas and solar-dedicated backend provide daily observations of the Sun and its extended corona in three simultaneous modes: high-spectrotemporal-resolution beamformed spectroscopy, 10-s-cadence full-array spectral imaging, and 0.1-s-cadence fast imaging. These capabilities enable sensitive studies of coronal mass ejections, coronal shocks, energetic electron beams, and radio-wave propagation through the turbulent corona and solar wind. This presentation will highlight recent science results, publicly available solar data products, and new near-real-time tools for space-weather monitoring. In concert with the Expanded Owens Valley Solar Array (EOVSA) at microwave frequencies, OVRO-LWA extends broadband radio imaging spectroscopy from the upper chromosphere into the middle corona.

Abstract #106

Connecting Type II Radio Burst Structure to CME Shock Magnetic Geometry

Peijin Zhang, NJIT

Solar type II radio bursts provide a diagnostic of coronal shocks and particle acceleration, yet the physical origin of their multiple spectral lanes and split bands remains uncertain. We investigate these features by combining radio imaging spectroscopy with a three-dimensional magnetohydrodynamic simulation of the associated coronal mass ejection (CME), using the Alfvén Wave Solar atmosphere Model-Realtime (AWSoM-R). This approach connects the observed radio source evolution with the simulated shock geometry and magnetic environment. During the event, the dominant emission transitions from fundamental to harmonic, while the preferential source region shifts from the Earth-facing side of the shock toward the limb or far side. These source regions coincide with quasi-perpendicular portions of the shock exhibiting enhanced Mach numbers. Furthermore, the spatial displacement between fundamental and harmonic sources is generally aligned with the projected magnetic field at the simulated shock surface, consistent with anisotropic radio-wave scattering in magnetized coronal turbulence. These findings link the spectral and spatial complexity of type II bursts to the evolving magnetic geometry of CME-driven shocks and demonstrate the diagnostic value of combining radio imaging spectroscopy with global coronal modeling.

Abstract #107

Probing the Origin of the Persistent Radio Source Associated with FRB 20190417A Using uGMRT

Ajay Kumar, Ponitificia Catholica University of Chile

The origin of Fast Radio Bursts (FRBs) still remains an open question. A small number of FRBs are associated with a persistent radio source (PRS), and FRB 20190417A is only the fifth such source to be confirmed. In this study, we present the first multi-frequency, long term study of this PRS with the uGMRT. We observed the source from 400 to 1460 MHz over a period of five months and find that the variability in its flux density can be explained by the Galactic refractive scintillation. We also construct the spectral energy distribution (SED) of the source from 400 MHz to 6 GHz and find that it is well described by a smooth broken power law, revealing a clear evidence of a spectral turnover for the first time in a FRB-PRS system. We find the break frequency is 565 MHz, and the optically thin spectral index above the break is 0.23, implying an electron energy index of 1.46. Under the synchrotron self-absorption (SSA) interpretation of the turnover, we infer a magnetic field of ~ 0.016 G and a source radius of 0.19 pc for the emitting nebula. We also discuss that free free absorption is likely in this case. These results suggest that the PRS associated with FRB 20190417A is likely powered by a young, energetic pulsar wind nebula or magnetar wind nebula

Abstract #108

Probing Space Weather and Magnetic Fields with Low-Frequency Radio Emission

Harish Vedantham, ASTRON

Stellar low-frequency radio bursts carry key information about space weather around exoplanets that is not accessible by other means. I will present recent discoveries of such bursts from stars other than the Sun—specifically, type II and type III bursts that signal the presence of coronal mass ejections and energetic particle events, respectively.

Low-frequency polarized emission may also be the only means of detecting the magnetic fields of exoplanets, which play a key role in determining how space weather affects their atmospheres. I will also present a proof-of-concept measurement of the magnetic field of a cold brown dwarf, which enabled a test of dynamo scaling laws used to predict exoplanetary magnetic field strengths. I will end with a report on our efforts to push thermal-noise-limited imaging down to 15 MHz, with the aim of directly detecting radio emission from gas-giant exoplanets.