Hunting for PS NLS1s with VLBA

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From sources with presumably no significant radio emission to sources with relativistic jets, narrow-line Seyfert 1 galaxies (NLS1s) have challenged paradigms. These sources are identified by their distinct spectral line features. However, due to the spectral profile of NLS1s being very similar to other sources when using low- to moderate-quality spectra, i.e., the majority of data currently available, the true characteristics of these sources and their parent population remain unknown. Beyond some NLS1 having relativistic jets, some NLS1s have even showcased extraordinary radio variability. Due to this, finding the true characteristics and parent population of NLS1s becomes exceedingly important. Prior studies have suggested a possible connection between peaked-spectrum (PS) sources and NLS1s, suggesting that PS-like NLS1s could be part of the unbeamed jetted population. I am here to report on the results of a 5 GHz Very Long Baseline Array (VLBA) study on 11 NLS1s previously identified as potential PS candidates. Save for one source, these are the first radio maps of these sources with VLBA at 5~GHz, allowing for a unique opportunity to study the possible connection between NLS1s and PS, to understand the NLS1 parent population and, in general, the unification of kinematically young jetted AGN.

Insights from the spectro-temporal analysis of ultra-fast radio bursts and single- and multi-component frequency drift rates

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Repeating fast radio burst (FRB) sources exhibit a rich variety of morphologies in their dynamic spectra. Characterizing morphologies is a key strategy in investigating the underlying emission mechanism of FRBs. This type of analysis is typically accomplished using 2D Gaussian techniques and the autocorrelation function (ACF) of the waterfall. These techniques are effective but can be limited in the presence of scattered tails, complex morphologies, or microshot forests. Here, we present and use a technique that involves the tagging of per-channel arrival times with a Gaussian profile model to perform spectro-temporal measurements of an FRB. We present measurements of several hundred bursts across 12 repeating sources. This includes 400+ bursts from repeaters FRB 20121102A, FRB 20220912A, and FRB 20200120E (which exhibit microsecond-long ultra-FRBs), and 143 multi-component drift rates. In addition to retrieving the known linear relationship between sub-burst slope (aka; intra-burst drift) and duration, we find that this relation extends smoothly to ultra-FRBs. We also find that multi-component drift rates obey the same relation with duration as the single component sub-burst slopes. These result indicate an unexplored connection between the frequency drifting of single and multi-component FRBs, and are robust evidence for dynamical motions in the emitting material.

Deep-Learning-Based FRB Populations Simulation

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The statistical characterization of Fast Radio Burst (FRB) populations is currently hindered by the complex coupling of intrinsic source physics, extrinsic propagation effects, and instrumental selection biases. Key challenges, such as the DM-z degeneracy and morphological scattering, often obscure cosmological distances and progenitor signatures, leading to biased representations in existing catalogs. To address these hurdles, I am developing a computational pipeline that integrates an intrinsic FRB emission model with a stochastic transport module and a deterministic telescope response function. The initial phase establishes a "minimal physical model" to define baseline correlations, which will later be scaled using advanced tools like frbpoppy to incorporate sophisticated burst morphologies and DM-z relations. The core of the methodology utilizes a Deep Neural Network (DNN) to perform a stochastic inverse mapping of these forward-modeled populations. This allows us to test the feasibility of recovering intrinsic progenitor parameters directly from observed detection data. By training the network to "deconvolve" the effects of the intervening medium and telescope modulation, we aim to evaluate the pipeline's performance using the CHIME/FRB catalog. Ultimately, this framework serves as a preliminary assessment of whether such inversion techniques can reliably constrain burst geometry and enhance the utility of FRBs as high-precision cosmological probes.

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Blazar radio flux variability analysis using long term monitoring data

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Blazars are a subclass of AGNs whose relativistic jets are at a very small viewing angle from our line of sight. These objects are observed to display extreme variability in both timescales and amplitude across the electromagnetic spectrum, which provides us with the spatial information about the blazars' emitting region, propagation of the relativistic plasma in the jet, etc. The Radio monitoring of Blazars using the INAF telescopes (ROBIN) project has been observing a sample of 47 blazars since 2004 in the 5, 8, 24 and 43 GHz bands using the Italian radio telescopes. Over two decades the project database consists of around 21000 flux density measurements obtained on a monthly interval. I will present a systematic characterization of variability using metrics such as the shape of the structure function. We also test the robustness of this tool using simulations of lightcurves to study to effect of uneven sampling and noise. Preliminary results indicate a variety of variability patterns across frequencies. I will also discuss in particular, peculiar sources that exhibit unusual variability patterns, including evidence for rapid intraday variability and its implications on the jet physics and the emitting region, as well as morphological evolution of well-studied sources in higher angular resolution datasets.

A Deep Search for Pulsars in the Galactic Centre Using MeerKAT

Jake Mendelsohn[1], Colin Clark[2], Prajwal Voraganti Padmanabh[2], Kaustubh Rajwade[1], Bruce Allen[2], Michael Kramer[3], Ewan Barr[3], Vivek Venkatraman Krishnan[3]

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The Galactic Centre is predicted to host a large population of pulsars, yet relatively few have been detected due to strong interstellar scattering and dispersion from gas and dust along the line of sight. Detecting this population is crucial for probing the environment around Sgr A* and understanding the missing pulsar population. In particular, identifying slow pulsars would constrain neutron star formation and evolutionary pathways. While millisecond pulsars are expected to dominate, the presence of several known slow pulsars suggests their population may be non-negligible. I present results from a deep pulsar search of the Galactic Centre using the MeerKAT radio telescope at a central frequency of 2.8 GHz, as part of the Max Planck MeerKAT Galactic Plane Survey. The survey uses 3200 beams for contiguous coverage, with 4-hour integrations per pointing to maximise sensitivity to faint, highly accelerated systems. This strategy targets canonical pulsars, millisecond pulsars, and compact binaries. The data are processed with a pipeline incorporating single-pulse searches, Fast Folding Algorithm (FFA) periodicity searches for long-period sources, and jerk searches for binaries. I highlight progress from the FFA search, present promising discoveries, and discuss future prospects with MeerKAT and the Square Kilometre Array.

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The discovery of a hyper-luminous rotating radio transient with CHIME/FRB

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The CHIME/FRB instrument has revolutionized the landscape of ms-duration radio transients in the northern hemisphere. Along with extragalactic Fast Radio Bursts (FRB), CHIME/FRB has discovered 111 new Galactic radio transients. These are primarily rotating radio transients (RRAT), a subtype of pulsars that share many commonalities with FRBs. However, a problem remains: the luminosity of RRATs is orders of magnitude fainter than that of FRBs. In this talk, I will review the CHIME/FRB Galactic transient survey. I will pay particular attention to a new RRAT that we have discovered, PSR J2109+50. This source has been detected in the far sidelobes of CHIME, implying kJy peak flux densities. We find that, for the first time, we are bridging the energetics of the RRAT and FRB populations. I will subsequently discuss the future of our survey and its potential in the era of CHIME/FRB's VLBI outriggers.

Disentangling AGNs from Stellar contributions to the Cosmic Spectral Energy Distribution using eFEDS, GAMA, SWAG-X and EMU data

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

Broad-band Radio Observations of SN2012au - The Youngest Pulsar Wind Nebula Candidate

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In the months following initial detection of SN2012au, optical observations revealed it to be an extraordinary event. Compared to other Type Ib supernovae, it was very energetic, expanding rapidly, and the late-time spectra bear clear similarities with GRB supernovae. Despite all these peculiarities, radio observations at early times were remarkably ordinary. The radio spectra were consistent with a shock interacting with a wind density medium, as observed in many other core-collapse supernovae. It was not until later times that the extraordinary features of the radio spectra would emerge. Here, we present late-time radio observations of SN2012au, spanning from 7-13 years post explosion. These highly unusual radio SEDs feature luminous emission inconsistent with the initial shock, inverted spectra at low frequencies, and an unusually flat spectral index at high frequencies. Our analysis reveals these extraordinary features are most likely the result of two distinct radio emitting components: a low frequency component at large radii, consistent with late-time emission from the initial shock, and a high frequency component confined to smaller radii. This high frequency component, with its slow radial evolution, relatively flat spectral index, and accompanying hydrogen-poor optical spectra, presents our best known candidate for an emerging young pulsar wind nebula.

The Argus Array as a Persistent Optical Complement to Time-Domain Radio Facilities

Jonathan Carney, Nicholas Law, Hank Corbett, Alexandra Bucheli, Alan Vasquez Soto, Amy Ishiguro, Donovan Schlekat, Glenn Walters, James Dockery, Katie Fasbender, Lawrence Machia, Mae Dubay, Mike Ronco, Shannon Fitton, Thomas Procter, William Marshall
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The Argus Array is a 1200-telescope, two-color optical survey facility under construction at UNC Chapel Hill, with first light planned in 2027. Its telescopes work together as a coadded array to form an 8m-class instrument with an 8,000 sq. deg. field of view, building the first deep, high-speed movie of the northern sky. Argus will provide real-time public transient alerts at cadences ranging from 1 second to weeks via coaddition, along with images and long-term light curves. Its continuous, all-sky optical coverage makes Argus a natural complement to time-domain radio facilities: it will serve as a persistent optical backstop to the emerging multi-wavelength and multi-messenger alert ecosystem, providing simultaneous optical context for radio-detected transients and triggered follow-up programs. I will discuss how this continuous coverage and rapid alert distribution enable prompt identification of optical counterparts to events such as fast radio bursts and gamma-ray transients; constrain precursor and prompt optical emission; and facilitate rapid spectroscopic follow-up.

Detection of Fast Radio Burst Over-densities Toward Galaxy Clusters in the Second CHIME/FRB Baseband Catalogue.

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Galaxy clusters often dominate the total matter along lines of sight toward them, introducing gravitational lensing and an overdensity of low star formation galaxies into surveys of these areas. As a result, transients detected towards massive galaxy clusters can trace higher redshift epochs and alternative progenitor scenarios compared to other sky regions, providing valuable insight for population wide analysis. In this talk I discuss this technique in the context of Fast Radio Bursts (FRBs). Using the world's largest sample of arcminute localised FRBs from the Canadian Hydrogen Intensity Mapping Experiment (CHIME), I identify several sources occurring within or behind nearby galaxy clusters at above the average all sky rate. Harnessing observationally driven cluster models within state-of-the-art population synthesis, I compare these results to expected rates of cluster FRBs. From these expectations I draw conclusions about the origin of these over-densities and the implications their discovery has for the populations of FRBs within galaxy clusters and behind them in the high redshift universe. Finally, I discuss the outlook for cluster FRB science with the next generation of FRB instruments such as the Canadian Hydrogen Observatory and Radio Transient Detector (CHORD) and outline observational strategies to maximise cluster science from these facilities.

New measurements of radio pulsars in the EMU and POSSUM radio sky surveys

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We have investigated a sample region from the EMU and POSSUM 943 MHz sky surveys. These surveys are being carried out with the ASKAP radio telescope in Western Australia. EMU detects radio sources at 943 MHz in a 288 MHz bandwidth, including flux density and spectrum measurements, whereas the co-eval POSSUM survey contains the polarization measurements for the same radio sources. Radio pulsars from the ATNF radio pulsar catalogue are identified in our sample region which consists of 30 sky areas, each 6 degrees square (total area of about 1000 sq. degrees). The new results include measurement of a significant number of new rotation measures for pulsars which had no previous value, significant improvement in the measurement of spectral shape for pulsars, and a few detections of variable flux densities of some pulsars.

Combined Bayesian Modelling of Black Hole X-ray Binary Jet Ejecta

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Black hole X-ray binaries are among the brightest radio transients in the Galaxy. Moreover, these sources have been recently detected at PeV energies, suggesting that they are important sources of Galactic feedback, and high-energy cosmic rays/neutrinos. In outburst, these systems launch powerful, large-scale jet ejecta that are now routinely tracked at radio wavelengths out to parsec scales. However, despite detailed radio observations of numerous sources, key degeneracies in kinematic modelling have thus far prevented measurements of the ejecta energy, Lorentz factor, and the density of the surrounding medium. I will present the first joint Bayesian modelling of both the flux and kinematics of X-ray binary jet ejecta, which break these longstanding degeneracies and allow the feedback properties of the ejecta to be constrained. We find that a long-lived reverse shock powers most of the observed emission, and that the jet propagates into an extremely underdense interstellar environment. Finally, I will show that for off-axis astrophysical jets, incorporating non-detections of unseen counter jets into modelling frameworks can substantially improve Bayesian parameter estimation.

Chasing Blips: Unravelling the radio bursts of a young active M dwarf star

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M dwarfs are the most common type of star in the galaxy and are known for their strong magnetic activity, making them prime targets for studying stellar radio emissions. This work focuses on a particular star, V374 Peg, a young and rapidly rotating active M dwarf, with the goal of understanding its radio emission mechanisms. We analysed archival data from the Karl G. Jansky Very Large Array (VLA), observed over three nights in 2007 at 8.4 GHz. The data was processed using the Common Astronomy Software Application (CASA) for calibration and imaging, with custom Python scripts employed to generate lightcurves and detect transient events. Our analysis confirms the detection of at least three distinct radio bursts from V374 Peg. The bursts, along with the quiescent emission, exhibit a strong periodic dependence on the star's rotational phase, suggesting a highly beamed emission mechanism. While these characteristics point towards Electron Cyclotron Maser Instability (ECMI), the bursts mysteriously displayed low circular polarisation fraction, contrary to the high polarisation expected from ECMI. We interpret this as the superposition of two independent, highly circularly polarised bursts originating from the northern and southern magnetic hemispheres of the star, whose opposite polarisations effectively cancel each other out.

Revealing polarization properties of coherent radio emissions of pulsars

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Coherent radio waves of pulsars are an excellent tool for plasma diagnostics in neutron star magnetospheres. Many radio emission mechanisms have been proposed to interpret their radio observations; however, many lack wave-wave and particle-wave interactions and first-principles-based modeling of their observables, such as the luminosity spectrum, polarization, and directivity. Predictions on the polarization properties are one of the main tests for the radio models. We investigated the polarization properties of the radio waves emitted from pulsar polar caps using particle-in-cell kinetic simulations that include relativistic and pair cascade effects. We found that the present pair-creation events produce intense Poynting flux originating in an electric gap region near the star's surface directly by the oscillating electric gap. The produced pulsar radio beam does not have a cone structure; instead, the radiation can escape along open magnetic field lines where no pair creation occurs. The polarization is oriented in the direction of plasma density gradients that follow the structure of global magnetospheric currents. A small fraction of radiation escapes in the form of the Stokes V parameter, which may lead to misinterpretation of the observational data as circular polarization. Our plasma simulation results show good agreement with a category of high-spin-down pulsars.

Polarized blazars – Bridging the gap between observations and simulations

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We investigate how the morphology of synchrotron emission in astrophysical jets is shaped by the physical properties of relativistic plasma within the outflow. To do so, we combine multi-frequency observations—such as those obtained with the Very Long Baseline Array and Imaging X-ray Polarimetry Explorer—with three-dimensional relativistic magnetohydrodynamic simulations performed using the PLUTO code. This framework enables us to constrain intrinsic magnetic field configurations and jet kinematics in black hole systems. Polarization is computed via radiative transfer using RADMC-3D and 3DPOL, where non-thermal particle distributions are calculated and interpolated directly from the simulations. The resulting synthetic and observational datasets include full-Stokes maps (I, Q, U, V) and linear polarization, tracing magnetic field structure. Our analysis spans both active galactic nuclei and X-ray binaries. In AGN, multi-frequency radio observations reveal core shifts and magnetic field orientations; applying DoG-HiT imaging to nine blazars, we identify preferred magnetic geometries. For X-ray binaries, we explore the formation of recollimation shocks through controlled simulation setups. Extending to higher energies, our synthetic polarization predictions provide a direct bridge to X-ray observations, now accessible through IXPE.

Correcting for selection effects in the second CHIME/FRB catalog

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The second CHIME/FRB catalog represents a major advance in the statistical study of fast radio bursts (FRBs), but the observed population is shaped by observational selection effects. Accurately characterizing such biases is essential for inferring the intrinsic FRB population. We probe the CHIME/FRB selection function by injecting a large synthetic population of ~500,000 bursts with known properties into the telescope's live data stream. This enables direct measurement of detection and non-detection probabilities across the multidimensional FRB parameter space spanned by the injections. Using this dataset, we construct a parametric model of the survey selection function and apply it to correct observed distributions in Catalog 2, which contains nearly an order of magnitude more events than earlier releases. I will present the statistical methodology used to infer this selection function, quantify CHIME/FRB's biases with respect to burst properties, and demonstrate how these corrections improve constraints on intrinsic FRB distributions. In particular, we find that CHIME/FRB likely misses a substantial population of highly scattered bursts with timescales above ~10 ms. This highlights the critical role of selection effects in interpreting FRB surveys and constraining the true underlying population.

The Second CHIME/FRB Outrigger Catalog

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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 3333 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. I will present the radio properties of this sample and discuss the advantages of the two-baseline localizations, the technical challenges involved, and the science projects underway with the new sample.

Radio Monitoring of Her X-1

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Hercules X-1 (Her X-1) is a well-studied intermediate mass neutron star X-ray binary with a superorbital period due to a precessing, warped accretion disk. Her X-1 is the ideal system to test the interplay between sources with warped accretion disks and radio jets, especially now with the capture of its first radio detection published in 2018. We present our results of the radio monitoring campaign of Her X-1 with NRAO's Karl G. Jansky Very Large Array during a two-month period in 2024 - 2025. We discovered Her X-1 to showcase extreme radio variability never seen before and present the most constraining radio spectral index measurement to date. We discuss possible causes of radio variability in Her X-1 and how accretion disk configurations can affect radio jet observations in compact objects.

Probing foreground galaxy haloes in the nearby Universe using the CHIME/FRB Baseband Catalog 2

Affan Khadir, Ayush Pandhi, Jason Hes **fast radio bursts, galaxies, circumgalactic medium, radio transients** sels
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The circumgalactic medium (CGM) is the reservoir of gas around galaxies that can condense onto galactic halos and disks, driving star formation. In quenched galaxies, the CGM is heated by active galactic nuclei and supernovae feedback, as well as the hot intragroup medium, suppressing active star formation. Therefore, understanding the baryonic content of the CGM is important to obtain a full picture of galaxy evolution, and the partition of baryons throughout the Universe. Since the gas in the CGM is mostly composed of ionized baryons, fast radio burst (FRB) dispersion measures (DMs) are ideal to probe it. Using ~2100 FRBs (with positional accuracies of ~10") from the upcoming CHIME/FRB Baseband Catalog 2, we present the largest statistical study to date of the CGM's baryon content with FRB DMs, obtained by stacking sightlines as a function of foreground galaxy impact parameter. We find a negative correlation between the DM and the impact parameter, which is consistent with a radially declining CGM electron density. By fitting this DM profile, we find that the electron density falls steeper than what is seen in statistical studies of the CGM using X-ray data.

The follow-up observations and investigation on ASKAP J1839-0756

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ASKAP J1839−0756 is a long-period radio transient (LPT) discovered in early 2024. It currently holds the record for the longest-period LPT known, with a period of 6.45 hours. It is also the first LPT observed to emit interpulses. Its unusually long period, together with pulsar-like radio emission, has sparked considerable discussion regarding the emission mechanism and progenitor of these objects. In the original discovery paper of ASKAP J1839−0756 (Lee et al., 2025), 20 pulses were reported, showing a linear decline in flux density. Since then, we have carried out additional radio follow-up campaigns using ASKAP, MeerKAT, and ATCA. We have detected 30 more pulses, enabling us to analyse the evolution of flux density, investigate rotation measure variations, refine the timing solution of ASKAP J1839−0756, and fit a binary model. In this talk, I will introduce what LPTs are (ASKAP J1839−0756 in particular), and present observations spanning two years and discuss our results on the nature and possible emission mechanisms of the source.

Connecting the radio variability of active galactic nuclei to their physical characteristics

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Active galactic nuclei (AGN) are luminous centres of active galaxies, powered by a supermassive black hole. The observed radio emission is attributed to relativistic plasma jets, where shocks travelling in the jet result in highly variable light curves. Analysis of radio variability is key to understanding the physics of relativistic jets and it provides clues for the presence of supermassive black-hole binaries (SMBHBs). Analysing light curves requires rigorous methodology as the background emission mechanism is stochastic and the data include observational errors and gaps. We used 40 years of 37 GHz monitoring data from the Metsähovi Radio Observatory to estimate the characteristic timescale of AGN variability through power spectral density (PSD) analysis and light-curve decomposition. Our analysis revealed that the timescale obtained from PSD analysis is connected to the durations of flares. Furthermore, we found an association between the timescale and black hole mass and mass accretion rate, providing evidence on the link between the central engine and relativistic jet. Understanding these connections and robustly modelling the variability is essential for revealing SMBHB candidates, and will pave the way for analysing thousands of light curves at 30 to 280 GHz from the Atacama Cosmology Telescope and the Simons Observatory.

Scintillation studies in FRB 20240114A via wide-band Parkes UWL Observations

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Fast Radio Bursts (FRBs) are bright, millisecond-duration radio transients of extragalactic origin, broadly categorised into repeating and non-repeating sources. We present follow-up observations of the hyperactive repeater FRB 20240114A using the Parkes Ultra-Wideband Low (UWL) receiver. The continuous frequency coverage of the UWL (704–4032 MHz) provides a unique opportunity for detailed broad-band spectral studies. By measuring the scintillation bandwidths of various bursts across multiple epochs, we obtain a mean scintillation-frequency scaling index of $alpha = 2.4 pm 1.4$. This shallow scaling is inconsistent with expectations from standard Kolmogorov turbulence. The lack of a clear Galactic origin for the shallow $alpha$ and the suppressed modulation index motivates us to explore resolved regimes and multi-screen geometries along the FRB line of sight. We present two robust scenarios to explain these anomalies, suggesting that the observed propagation effects are likely dominated by environments local to the source or along the intervening path, rather than a single scattering medium.

Polarisation variability in Magnetars and FRBs: Insights from broadband observations

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The polarisation of radio emission provides crucial insights into the emission process and the intervening medium of a radio transient. Studying the polarimetric properties of known sources such as magnetars and Fast Radio Bursts (FRBs) allows a direct comparison of their emission characteristics, which for both remain poorly understood. These properties are frequency dependent and thus require large observing bandwidths for detailed studies. We present new polarimetric studies of the magnetar XTE J1810-197 and the repeating fast radio burst FRB 20121102A. Using broadband observations with the Parkes UWL receiver, we investigate the evolution of linear and circular polarization and polarisation position angle (PPA) across multiple epochs of the second known

radio-loud phase of XTE J1810-197. The time and frequency evolution of the PPA allows a direct comparison so the behaviour seen in other repeaters such as FRB 20180916B, with flat PPAs over time and FRB 20240114A strongly varying PPAs over time. Our analysis of FRB 20121102A presents the polarimetric properties over 15 years after the initial discovery in a time of drastically changing rotation measure using data from Effelsberg (1.2 - 1.5 GHz) and MeerKAT (2.2 - 3 GHz) focussing on the propagation induces depolarisation in frequency.

Constraining the evolution of dynamic environments surrounding actively repeating fast radio bursts

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Fast radio bursts (FRBs) are short-duration (ms), bright (Jy-kJy) bursts of radio emission, generally originating from cosmological distances. While most FRBs appear to be one-off events, ~3% of FRBs have been observed to repeat. One of the most vital unanswered questions regarding FRB origins is whether all FRBs are capable of repeating. The Canadian Hydrogen Intensity Mapping Experiment (CHIME) radio telescope has detected thousands of FRBs, monitoring a large number of repeaters over multi-year baselines with a daily cadence. Radio spectra of FRBs are uniquely able to probe the properties of the plasma in the FRBs' immediate vicinity. CHIME/FRB’s high time resolution (2.56 μs) and broadband, low-frequency coverage make CHIME/FRB ideal for constraining propagation effects and monitoring them over time. Recent works have discovered secular evolution of the magnetized plasma surrounding a few peculiar repeating FRBs, linking them to young stellar remnants of massive stars. Our project will build on this work by measuring changes in the magnetoionic plasma over a timescale of months to years, for a diverse sample of repeaters. By examining changes in the magnetoionic plasma for a larger population of repeaters, we aim to establish boundaries on the potential progenitor or environment for the general population of repeating FRBs.

Orbitally-phased Coherent Radio Pulsations from Ten Polars

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Polars are strongly magnetized white dwarfs accreting from a Roche-lobe-filling companion via a magnetically confined accretion stream. Although radio emission has been detected from more than 30 systems, orbital-phase-resolved radio properties remain poorly characterized. Here we report the detection of highly circularly polarized radio pulses at 8-12 GHz from ten polars observed at multiple epochs with the Karl G. Jansky Very Large Array. The pulses occur consistently near the secondary star's superior conjunction (orbital phase 0.5) and persist over timescales of at least months. Pulse detections from systems across a wide range of orbital inclinations imply a fan-shaped emission beam: narrow parallel to the orbital plane but extended in the orthogonal direction. These characteristics are consistent with electron cyclotron maser emission originating from the apex of magnetic loops oriented parallel to the orbital plane on the secondary star and near the L1 point.

Comparing the Scattering Environments of Fast Radio Bursts and Galactic Pulsars

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Radio waves from astrophysical transients are distorted as they propagate through turbulent plasma, producing frequency-dependent scattering that broadens signals in time. For Galactic pulsars, this effect typically follows a frequency dependent power-law scaling with an index near −4. Fast radio bursts (FRBs) are bright, micro-to-millisecond duration extragalactic signals whose propagation encodes information about their local and intervening environments. Comparing their scattering properties to those of pulsars offers a way to probe the physical conditions near FRB sources. We present a systematic comparison of scattering measurements from FRBs and Galactic pulsars observed with CHIME, using a uniform analysis of high-time-resolution data to extract scattering timescales and frequency scaling indices. We construct population-level distributions of these indices. We discuss how differences in these distributions may reflect variations in the structure and location of the scattering material. Our results will place new constraints on FRB propagation conditions and contribute to understanding their origins in the dynamic radio sky.

Probing the Intense Environments of Repeating FRBs

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The local environments of repeating Fast Radio Bursts (FRBs) provide critical clues to their progenitors, with some residing in compact persistent radio sources (PRS) while others appear in cleaner environments. We present high-resolution, multi-band (4-24 GHz) VLA observations of the hyperactive repeater FRB 20220912A. We report the detection of a radio source spatially coincident with the FRB, offset by ~300 mas (~450 pc) from its host galaxy's center. The source exhibits a steep spectral index (α≈−0.72) and high star-formation rate surface density (ΣSFR≳12.8M⊙yr^−1 kpc^−2). By combining VLA spatial constraints with VLBI non-detections, we constrain the emitting region's diameter to 75–190 pc. These properties identify the source as a compact star-forming knot, supporting the hypothesis that young magnetars formed in massive star-forming regions are primary FRB progenitors. In addition, we will also present recent results from our imaging study of FRB 20230607A at low radio frequencies. This repeater is characterized by an extremely high rotation measure (RM ~ 12,000 rad/m^2). Despite the expectations of highly magnetized local environment, our stringent constraints on any associated continuum radio emission enables further probes of the extreme circumburst medium.

The SMA Sub/millimeter Program to Rapidly Investigate Novel Time-domain Sources (SMA-SPRINTS)

Mark Gurwell, Garrett Keating, Paul Grimes, Rafael Martinez-Galarza, Scott Paine, Ramprasad Rao, Ranjani Srinivasan, Edward Tong, Jonathan Weintroub, David Wilner
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The transient and time-variable Universe encompasses a wide range of astrophysical phenomena, and is poised to be unveiled in ways never before possible as facilities like Rubin start scientific operations. Millimeter (mm) and submillimeter (submm) observations over a range of timescales are critical for untangling the physics of multi-messenger and time-variable astrophysical objects but at present no dedicated facility exists to perform follow-up of Rubin-detected sources at these wavelengths. To meet this need, we are developing the Sub/millimeter Program to Rapidly Investigate Novel Time-domain Sources (SPRINTS), which leverages Submillimeter Array (SMA) strengths to implement cutting-edge multi-band instrument and infrastructure packages for rapid-response observations at 3mm, 1.3mm, and 850μm simultaneously. We will present first 'proof of concept' observations demonstrating the rapid response capabilities of the SMA, with automated triggered response resulting in observations on source just minutes after receiving a broker alert. SPRINTS offers critically-needed dynamic, sensitive, and flexible observational capacity for time-domain astrophysics at mm/submm wavelengths, leading to transformative views into the time-variable Universe. With its expanded instrumentation, SPRINTS will position the SMA as a leading facility for the study of variable and transient objects, and provide a powerful tool for researchers working in time-domain astrophysics.

Robust VLBI calibration for CHIME/Outriggers Fast Radio Bursts

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The CHIME/FRB Outriggers are a Very Long Baseline Interferometry (VLBI) array built to dramatically increase the angular resolution of the Canadian Intensity Hydrogen Intensity Experiment (CHIME). While still in the commissioning phase, the Outriggers have already enabled precise localizations of many FRBs. We are working to increasing the success rate of these Outrigger localizations is by improving the VLBI calibration solution used for FRBs, which is imperative for localization. We are performing a survey to identify more calibrators in our field of view and bandwidth (400-800MHz). This builds upon a previous shallow survey (Andrew et al.), which used 0.1s integration times, by using 1.4s integration times. I will review the progress of this survey, focusing on the increase in calibrators by a factor of 3 or more. In parallel, we are also expanding the observational capabilities of the Outrigger telescopes to include real-time tracking beamformers on CHIME/Outriggers. These will take long integration single pointing observations of calibrators when an FRB is detected. I will summarize the commissioning process of these beams. With these methods, we will have robust VLBI calibration solutions for all FRBs detected by CHIME/Outriggers: limited not by VLBI calibration, but the sensitivity of the smaller Outrigger stations.

Probing high-latitude Galactic ISM using FRB scintillation

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Galactic electron density models are poorly constrained at high latitudes due to the scarcity of pulsar sightlines off the plane. Fast radio bursts (FRBs) detected mostly off the plane of the galaxy probe the Galactic electron density fluctuations through multipath propagation induced interference patterns in frequency called scintillation. In this talk, I will present scintillation measurements from ~300 CHIME/FRB baseband bursts in a 900 deg^2 region around the North Celestial Pole, probing sightline-to-sightline variations in interstellar scattering at high Galactic latitudes. Our early results reveal an order of magnitude spread of measured scintillation around the predictions of the latest Galactic electron density model, NE2025, in tension with the smooth latitude-dependent prescription for scattering off the plane. The high angular density of FRB sightlines in this region further allows us to search for spatial correlations in scintillation parameters, offering a complementary and independent probe of small-scale interstellar medium.

How To Run a Deep Daily Pulsar Search - CHAMPSS Overview

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The recently started CHIME All-Sky Multiday Pulsar Stacking Search (CHAMPSS) is an ambitious pulsar survey using the Canadian Hydrogen Intensity Mapping Experiment (CHIME) which operates at frequencies of 400-800 MHz.
CHIME is a drift telescope which is able to observe the full Northern sky daily which presents a unique opportunity for designing a pulsar search. Most pulsar surveys are limited to a small number of observations per sky position and the sensitivity of surveys is usually limited to the sensitivity of the individual observations. CHAMPSS allows us to tackle these limitation in two ways.
Firstly the data derived from the CHIME/FRB experiment allows us to observe about a quarter of the sky with daily cadence, with this limitation only arising from our current computing resources. Secondly we developed an analysis pipeline which uses incoherent summing of power spectra to slowly build up our sensitivity across time. I will present our survey pipeline and the first science results of the survey. To date we were able to detect more than 25 new pulsars, which resulted both from our daily observations and our stacked power spectra from multiple days..

Don't Side-Line the Sidelobes: Improving Localization of Far-Sidelobe FRBs Detected by CHIME/FRB

Isabella Rivera[1], Juan Mena-Parra[1], Nina Gusinskaia[2], Chessy Xie[1], Paul Scholz[4], Adam Dong[4], Daniele Michilli[3], Alexandra Moroianu[2]

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Fast radio bursts (FRBs) are millisecond-duration radio transients of extragalactic origin whose physical progenitors and emission mechanisms remain unknown. The Canadian Hydrogen Intensity Mapping Experiment Fast Radio Burst Project (CHIME/FRB) has discovered more than 4500 FRBs and now dominates the detection rate of these sources. Determining whether all FRBs repeat and identifying their host galaxy environments are key steps toward understanding their underlying astrophysical origins. CHIME's wide field of view and long daily exposure times enable the detection of exceptionally bright FRBs outside the telescope's primary beam, in the far sidelobes. Because the sidelobes have reduced sensitivity, only the brightest events are detected in this region, implying that these sources are typically nearby compared to the broader FRB population. As a result, sidelobe FRBs are promising targets for precise localization and multiwavelength follow-up observations. However, precise localization of sidelobe FRBs is complicated by poorly understood systematics and dearth of calibration sources due to reduced sensitivity arising from the complex beam response in these regions. In this work, I present the development of analysis techniques to improve the localization of far sidelobe FRBs by observing bright transient and steady astronomical calibrators to characterize and correct localization systematics.

Don't Side-Line the Sidelobes: Improving Localization of Far-Sidelobe FRBs Detected by CHIME/FRB

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A High-Frequency-Peaked Radio Source Evolving Over Decades

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The VLA Sky Survey (VLASS) is well suited for discovering luminous, long-lasting radio transients associated with supermassive black holes (SMBHs). Here, we present a decade(s)-old radio transient - VT J1823-2345 - found by comparing VLASS and the NRAO VLA Sky Survey. VT J1823-2345 brightened by a factor of three between 1996 and 2021 at 1.4 GHz and exhibited peaked spectra in 2023-2024 with a peak frequency above 6 GHz. The 3 GHz light curve appears to be fading and shows a time above half-max of about 10 years. VLBA observation in 2024 revealed a resolved Gaussian (major-axis) size of 0.4 mas. Although VT J1823-2345 is spatially coincident (on the sky) with a foreground star and a supernova remnant, its properties are inconsistent with Galactic transients. The timescale and radio properties are also too extreme to be associated with an ordinary explosive extragalactic transient. Instead, VT J1823-2345 is most likely a parsec-scale outflow from a SMBH and can be interpreted as a short-lived compact jet manifesting as a peaked-spectrum source. If this interpretation is accurate, we speculate that current radio surveys may start to probe extremely short-lived radio active galactic nuclei.

Unveiling the Origins of FRB Scattering: Sub-Galactic Environments and Implications for Dispersion Measure Constraints

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Fast Radio Bursts (FRBs) are excellent probes of the cosmic baryon distribution, but their cosmological utility remains limited by poorly constrained host galaxy dispersion measures (DM_{host}). Furthermore, recent studies indicate that global host galaxy properties fail to robustly predict observed FRB propagation effects, notably scattering timescales (τ), suggesting that the dominant contribution arises from the local interstellar environment of the burst. We investigate this connection by combining high-time-resolution burst measurements with precise sub-galactic localisation for the Australian Square Kilometre Array Pathfinder (ASKAP) sample of arcsecond-localised FRBs with robust host associations. By separating bursts associated with spiral-arm substructure and extended halo environments, we directly test whether multi-path propagation is governed by dense, turbulent star-forming regions rather than global galaxy properties. We further examine how τ varies with galactocentric offset and host-normalised radius, probing whether bursts located in the outskirts of galaxies systematically lack intrinsic scattering. Finally, we correlate scattering timescales with dispersion-measure residuals relative to the Macquart relation to test whether pulse

broadening provides an observable proxy for the host contribution to DM. Establishing such a link would provide a direct empirical pathway to constrain DM_{host}, reducing systematic uncertainties in FRB cosmology while simultaneously illuminating the sub-galactic environments in which FRB progenitors originate.

Intelligent Classification for Next-Generation Fast Radio Burst Detections

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Fast Radio Bursts (FRBs) are millisecond-duration radio transients, and the Canadian Hydrogen Intensity Mapping Experiment (CHIME) continues to play a central role in their detection. A key challenge in CHIME's pipeline is distinguishing genuine FRB events from radio-frequency interference (RFI), a process that currently requires hours of manual review. This bottleneck will become increasingly intractable for next-generation telescopes, which are expected to detect events at rates orders of magnitude higher. To address this challenge, we developed a deep-learning classifier trained on an expanded dataset and designed to use only a single waterfall plot as input. The classifier achieves negligible false-positive and false-negative rates, and preliminary evaluation on recent CHIME data supports its use as a replacement for human review. This system offers a scalable path toward fully automated FRB–RFI classification, enabling the rapid construction of comprehensive FRB catalogues and advancing studies of the physical origins of FRBs.

CanDIAPL- Enabling Data-Intensive, Multi-Messenger Astronomy at Scale

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The Canadian Data-Intensive Astrophysics Platform (CanDIAPL) aims to develop scalable cloud-based computing infrastructure and specialized software frameworks to enable the processing of petabyte-scale datasets generated by next-generation facilities such as the Vera C. Rubin Observatory and SKA precursors. This initiative will include Realtime Analysis pipelines to identify and classify time-critical astrophysical events, enabling rapid discovery and follow-up. It will also develop infrastructure for Dynamic Datasets that processes static sky observations across facilities while supporting queries on time-varying data. Ultimately, it will provide a multi-messenger portal that integrates data across the electromagnetic spectrum and from gravitational-wave detectors, accessible through a single interface for researchers. We present here an overview of the project, describing its infrastructure for ingesting and processing the Rubin Observatory's alert stream from the Legacy Survey of Space and Time (LSST) and how it can be combined in terms of radio observations across facilities. We also highlight the successful contribution of the team in processing and making data accessible for POlarisation Sky Survey of the Universe's Magnetism (POSSUM) and Widefield ASKAP L-band Legacy All-sky Survey (WALLABY) surveys. Finally, we welcome input from the astronomy community on potential features and use cases to guide the development of the platform.

Searching for thermal electrons in the relativistic tidal disruption event Swift J1644+57

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Tidal disruption events (TDEs) occur when a star passes sufficiently close to a supermassive black hole (SMBH) such that it is torn apart by its tidal forces. In some cases, the accretion of the disrupted material onto the SMBH can launch a relativistic jet. This jet produces a broadband synchrotron afterglow by interacting with the ambient medium. To date, radio emission has predominantly been interpreted using models that attribute it exclusively to non-thermal electrons accelerated at the jet-driven shock. In this work, we present a detailed reanalysis of radio observations of the most well-studied jetted TDE, Swift J1644+57. We identify deviations from standard afterglow models that cannot be explained by a single non-thermal electron population. We therefore suggest the presence of electrons that are thermally accelerated as a result of heating in the surrounding medium, induced by the passage of the shock wave. Their presence could provide further significant insights into the microphysics of astrophysical jets.