HEASA 2025 (16 - 20 September)

Report of Contributions

Contribution ID: **4** Type: **Contributed Talk**

Disks, Jets, and Surprises: Exploring the X-ray Variability of Jetted AGNs (Blazars and Jetted NLSy1 Galaxies).

Wednesday 17 September 2025 15:15 (15 minutes)

In this talk I will discuss X-ray timing and spectral characteristics of two fascinating kinds of jetted Active Galactic Nuclei (AGN)—blazars and Fermi-detected Narrow-line Seyfert 1 (NLSy1) galaxies. In the first section, we highlight a two-decade-long X-ray monitoring program of several notable blazars: Mrk 421, 3C 273, and PKS 2155-304, revealing interesting multi-epoch, spectral, and temporal patterns. In the second section, we focus on jetted NLSy1 galaxies, separating disc and jet contributions by integrating NuSTAR, XMM-Newton, and ZTF data. The identification of thermal disc fingerprints in the soft X-ray and optical bands, cases of pure jet-dominated X-ray emission, and evidence for disc-jet coupling are discussed. The accretion-jet relationship in these low-mass, high-accretion AGN is uncovered using a variety of X-ray timing and spectral approaches. In a nutshell, these findings demonstrate the highly variable, stochastic X-ray behavior of jetting AGNs and the value of multi-epoch, multi-instrument studies in revealing the physics behind them.

Author: CHAUDHARY, Suvas (Department of Physics, University of the Free State, 205 Nelson Mandela Dr., Bloemfontein, 9300, South Africa.)

Presenter: CHAUDHARY, Suvas (Department of Physics, University of the Free State, 205 Nelson Mandela Dr., Bloemfontein, 9300, South Africa.)

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **6** Type: **Invited Talk**

The Gravitational Wave Transient Catalog 4: Results and Tests of General Relativity

Wednesday 17 September 2025 11:00 (30 minutes)

The worldwide network of gravitational-wave (GW) detectors, comprised of the Advanced LIGO, Advanced Virgo, and KAGRA detectors has been increasing in sensitivity, range, and hence quantity and quality of detected GW signals from compact binary coalescences.
We present the compact binary signals observed and included in the GW Transient Catalog 4 (GWTC-4), i.e. up to and including the first part of the fourth observing run of the detectors (O4a). We estimate the source properties, and provide new insight into compact objects in binaries.
The most confident signals allow us to perform ever-more sensitive tests of general relativity (GR) in the dynamical and strong-field regime of gravity.
We present the results of a suite of tests of GR, and discuss the both the compatibility, and what we learn from any discrepancies.

Author: LIGO, VIRGO, KAGRA COLLABORATIONS

Presenter: BIRNHOLTZ, Ofek (Bar Ilan University)

Session Classification: Multi-Messenger & Extreme Cosmic Frontier

Track Classification: GRBs, FRBs and other Transients

Contribution ID: **7** Type: **Contributed Talk**

The study of extended radio galaxies in MERGHERS fields

Wednesday 17 September 2025 16:30 (15 minutes)

Radio galaxies play an important role in the formation of structure in the Universe. Studying the physical properties of both classical radio galaxies (FRI and FRII), as well as their more morphologically complex counterparts (NATs, WATs, BTs, X-shaped, etc), can help in understanding their specific role and how their local environment affects their properties, and vice versa. The MERGHERS survey is carrying out targeted observations of galaxy clusters using MeerKAT's L-bands. The wide-field images contain many instances of extended radio galaxies across all morphologies. This project aims to catalogue and study the extended radio galaxies in the 21 cluster fields from the first tier of MERGHERS data, investigating their environmental link and studying their spectral properties.

AIMS & OBJECTIVES:
This project aims to use the first tier MERGHERS data, in conjunction with available multiwavelength data, to catalogue and study the extended radio galaxies in the cluster fields. The project will:

Investigate the statistics of the radio galaxies and their relationship to their environment (field versus cluster),

study the spectral properties of the sources by producing in-band spectral index maps, or other frequency data where available, and

Investigate the environmental impact on sources with non-classical morphologies.

Author: MTHEMBU, Banele (University of KwaZulu-Natal (National Astrophysics & Space Science Programme))

Presenter: MTHEMBU, Banele (University of KwaZulu-Natal (National Astrophysics & Space Science Programme))

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **8** Type: **Poster**

DIFFUSE EMISSION IN LOW MASS ACT CLUSTERS IN THE MGCLS

Thursday 18 September 2025 15:00 (20 minutes)

Galaxy clusters, the largest gravitationally bound structures in the Universe, provide a unique laboratory for
studying various astrophysical processes. This study focuses on diffuse radio emission associated with low-mass
Atacama Cosmology Telescope galaxy clusters observed using the MeerKAT telescope within the MeerKAT
Galaxy Cluster Legacy Survey (MGCLS). Our investigation aims to provide a detailed analysis of these clusters
using archival radio observations and archival X-ray data. We also conduct correlation studies between thermal
and non-thermal emission, probing the formation mechanism responsible for the observed emission. This is
achieved by calibrating and imaging radio data provided by the MGCLS project and producing spectral-index
maps to identify the type of diffuse radio emission. We can probe the formation mechanism responsible for the
observed emission through a correlation study with archival X-ray data. Radio data shows the structure of the
diffuse radio emission, showing a good distinction between radio relics and radio halos. In the four clusters,
Abell521, Abell2811, RXCJ0516 and J0225, we can see the radio halos and all of them have a steep spectral
index. In Abell521 and J0516, we see a centrally located radio halo and two radio relics on the periphery of
the two clusters. We note that the four low mass cluster halos have low power in trend with the mass-to-power
correlation. They all have ultra-steep spectra, $\alpha > 1.5$, with super-linear correlation between radio and X-ray
luminosity

Author: SABELO, Asabele (University of KwaZulu-Natal)

Presenter: SABELO, Asabele (University of KwaZulu-Natal)

Session Classification: Poster Session

Track Classification: Other High-Energy Sources

Contribution ID: **9** Type: **Contributed Talk**

The I Zw 1 type AGN: busy in X-rays but optically quiet

Wednesday 17 September 2025 17:00 (15 minutes)

A sub-class of narrow-line Seyfert 1 galaxies with exceptionally strong Fe II emission lines named after the prototype I Zw 1 show high variability in X-rays. Despite this, and in contrast with many other Seyferts, variations in the optical are comparatively small. I have collected Las Cumbres Observatory robotic telescope network BVugr photometry of 20 I Zw 1 type AGN over 2-3 years and can compare their optical variability to that of other sub-classes of AGN. The study confirms that on average the relative optical luminosity fluctuations of I Zw 1 type AGN are significantly smaller. Possible physical interpretations of this result are explored.

Author: WINKLER, Hartmut

Presenter: WINKLER, Hartmut

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **11** Type: **Contributed Talk**

The Stability of Anisotropic Compact Stars Influenced by Dark Matter under Teleparallel Gravity: An Extended Gravitational Deformation Approach

Wednesday 17 September 2025 12:00 (15 minutes)

In our investigation, we pioneer the development of geometrically deformed strange stars within the framework of teleparallel gravity theory through gravitational decoupling via the complete geometric deformation (CGD) technique. The significant finding is the precise solution for deformed strange star (SS) models achieved through the vanishing complexity factor scenario. Further, we introduce the concept of space-time deformation caused by dark matter (DM) content in DM haloes, leading to perturbations in the metric potentials g_{tt} and g_{rr} components. Mathematically, this DM-induced deformation is achieved through the CGD method, where the decoupling parameter α governs the extent of DM influence. To validate our findings, we compare our model predictions with observational constraints, including GW190814 (with a mass range of $2.5-2.67M_{\odot}$) and neutron stars (NSTRs) such as EXO 1785-248 [mass=$1.3^{+0.2}_{-0.2}\ M_{\odot}$], 4U 1608-52 [mass=$1.74^{+0.14}_{-0.14}\ M_{\odot}$], and PSR J0952-0607 [mass=$2.35^{+0.17}_{-0.17}\ M_{\odot}$].
Our investigation delves into the stability of the model by considering causality conditions, Herrera's Cracking Method, the adiabatic index, and the Harrison-Zeldovich-Novikov criterion. We demonstrate that the developed model mimics a wide range of recently observed pulsars. To emphasize its compatibility, we highlight the predicted mass and radius in tabular form by varying both the parameters α and ζ_1. Notably, our findings are consistent with the observation of gravitational waves from the first binary merger event. Furthermore, we compare our results with those obtained for a slow-rotating configuration. In addition to this, we discuss the moment of inertia using the Bejger-Haensel approach in this formulation.

Author: Ms PRADHAN, Sneha (BITS Pilani Hyderabad campus)

Presenter: Ms PRADHAN, Sneha (BITS Pilani Hyderabad campus)

Session Classification: Multi-Messenger & Extreme Cosmic Frontier

Track Classification: Other High-Energy Sources

Contribution ID: **12** Type: **Contributed Talk**

MeerKAT Observations of White Dwarf Pulsars

Thursday 18 September 2025 14:30 (15 minutes)

White dwarf radio pulsars (WD pulsars) are a fascinating, newly established class of compact binary systems. To date, only three have been confirmed: AR Sco, J1912−4410 and J2306+2440. Like their neutron star counterparts, they exhibit radio pulsations driven by rapid rotation and intense magnetic fields. Since its discovery in 2016, AR Sco has spurred significant debate regarding the nature and origin of WD pulsars, particularly the formation of their strong magnetic fields. These discussions yielded exciting and promising results, but the recent confirmation of J1912−4410 now challenges these prevailing formation scenarios, revealing shortcomings that observations from AR Sco alone could not expose. As such, J1912−4410 offers a crucial opportunity to refine our understanding not only of WD pulsar formation but also of their place in the broader context of magnetic cataclysmic variable (mCV) evolution. Here, I demonstrate how MeerKAT's exceptional 2-second timing resolution provides a uniquely powerful means of probing these systems. Its ability to capture fine temporal structure at a wide variety of radio frequencies allows us to place constraints on WD pulsar models.

Author: MEINTJES, Emil (Univeristy of Cape Town)

Presenter: MEINTJES, Emil (Univeristy of Cape Town)

Session Classification: Pulsars and Pulsar Wind Nebulae

Track Classification: Pulsar and Pulsar Wind Nebulae

Contribution ID: **13** Type: **Invited Talk**

Status, recent results and outlook of the KM3NeT neutrino telescope in the Mediterranean Sea

Wednesday 17 September 2025 09:00 (30 minutes)

The KM3NeT neutrino telescope is a research infrastructure currently under construction in the Mediterranean Sea. It consists of two deep-sea detectors: ORCA, near Toulon, France, and ARCA, off the coast of Sicily, Italy. ORCA is designed for precision study of atmospheric neutrinos in the GeV range, whereas for ARCA the aim is to detect and study cosmic neutrinos of higher energies. KM3NeT offers an infrastructure in the Northern Hemisphere, with a good view towards the Galactic Center.

The first detection units of ORCA and ARCA are taking data. In this presentation a selection of recent results will be shown, with emphasis on searches for astrophysical neutrinos. KM3NeT recently detected a cosmic neutrino with an energy of more than 200 PeV, and its detection and interpretation is discussed. KM3NeT searches for neutrino point sources and for a diffuse flux, from the full sky as well as from the galactic plane, are shown. Stacking analyses involving various sources including blazars, active galactic nuclei, Seyfert galaxies and starburst galaxies are presented. Further searches include those for neutrinos from transient events including fast radio bursts, gravitational wave events, microquasars or tidal disruption events.

In the context of multi-messenger astronomy, KM3NeT deploys a rapid analysis response to external alerts and results will be shown. KM3NeT also generates alerts; an alert system for core-collapse supernova neutrinos is already operational, and alert generation for high energy cosmic neutrino candidates is expected to be operational soon.

We will conclude with an outlook towards detector completion and future scientific capabilities of the full infrastructure.

Author: DE JONG, Paul (Nikhef National institute for subatomic physics (NL))

Presenter: DE JONG, Paul (Nikhef National institute for subatomic physics (NL))

Session Classification: Instrumentation

Track Classification: Instrumentation

Contribution ID: **15** Type: **Contributed Talk**

Dissecting Blazar Emission with IXPE: A Polarimetric Survey of BL Lac Objects

Wednesday 17 September 2025 14:15 (15 minutes)

BL Lacertae (BL Lac) objects are a subclass of active galactic nuclei whose emission is dominated by relativistic jets aligned closely with our line of sight. Their X-ray emission arises primarily from synchrotron or inverse Compton processes, and polarization measurements in this regime offer a direct probe of jet magnetic field geometry and emission mechanisms. The Imaging X-ray Polarimetry Explorer (IXPE) enables the first sensitive measurements of X-ray polarization in such sources, opening a new observational window into jet physics.
We present a systematic and uniform analysis of IXPE observations of BL Lac objects, combining previously published results with newly available multi-epoch data. Our study investigates temporal variations in polarization degree and angle, and explores correlations with spectral properties and Compton dominance derived from broadband spectral energy
distributions.
This work aims to understand how X-ray polarization evolves with activity state, photon energy, and blazar subclass, alongside lower-energy polarization behavior. The findings provide important constraints on jet composition, magnetic field structure, and emission region geometry. Results from this comprehensive polarimetric study will be presented and discussed at the conference.

Author: BHARATHAN, Athira M (North-West University, South Africa)

Co-authors: Prof. BÖTTCHER, Markus (North-West University, South Africa); Prof. STALIN, C S (Indian Institute of Astrophysics)

Presenter: BHARATHAN, Athira M (North-West University, South Africa)

Session Classification: AGN

Track Classification: Active Galactic Nuclei

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

Investigating Spectral Width Evolution in Gamma-Ray Bursts

Thursday 18 September 2025 15:10 (20 minutes)

The spectral width (W) is proposed as a new measure to address the complexities in the GRB prompt phase spectral studies. We carried out a detailed procedure to redefine the Band function with W as one of the parameters, to study the GRB spectra. This model was convolved with the XSPEC, and the temporal evolution of W, for the case of GRB 220426A and GRB 230812B using the Fermi/ GBM data, was investigated. The increasing trend of W was observed for both the bursts; however, it was more prominent in the case of GRB 230812B, with the W ranging from 0.84 to 1.64, compared to GRB 220426A, with the maximum difference in W being 0.15. The W evolution for fundamental emission processes, such as photospheric emission from the expanding fireball and synchrotron emission from the relativistic electron distribution, was studied. Under each scenario, the spectrum tends to get narrower with time, which is in contrast to the observation where it broadens with time. This study portrays the emission process as being more entangled and complex for the prompt phase.

Author: GUPTA, soumya (Bhabha Atomic Research Center)

Co-author: Prof. SAHAYANATHAN, Sunder (Bhabha Atomic research centre)

Presenter: GUPTA, soumya (Bhabha Atomic Research Center)

Session Classification: Poster Session

Track Classification: GRBs, FRBs and other Transients

Contribution ID: **17** Type: **Contributed Talk**

Time-resolved spectro-polarimetric analysis of extremely bright GRB 230307A: Evidence of evolution from photospheric to synchrotron dominated emission

Thursday 18 September 2025 10:00 (15 minutes)

The radiation mechanisms powering Gamma-ray bursts (GRBs) and their physical processes remain one of the unresolved questions in high-energy astrophysics. Spectro-polarimetric observations of exceptionally bright GRBs provide a powerful diagnostic tool to address these challenges. GRB 230307A, the second-brightest long-duration GRB ever detected, exhibits a rare association with a Kilonova, offering a unique and rare probe into the emission processes of GRBs originating from compact object mergers. We present a comprehensive time-averaged and time-resolved spectro-polarimetric analysis of GRB 230307A using joint observations from the AstroSat Cadmium Zinc Telluride Imager (CZTI), the Fermi Gamma-ray Burst Monitor (GBM), and Konus-Wind. Results. Spectral analysis reveals a temporal evolution in the low-energy photon index, , transitioning from a hard to a softer state over the burst duration. Time-averaged polarimetric measurements yield a low polarization fraction (< 12.7 %), whereas time-resolved polarization analysis unveils a marked increase in polarization fractions (> 49 %) in the later stages of the emission episode. This spectro-polarimetric evolution suggests a transition in the dominant radiative mechanism: the initial phase, characterized by thermal-dominated photospheric emission (unpolarized or weakly polarized), gives way to a regime dominated by non-thermal synchrotron emission (highly polarized). This transition provides critical evidence for the evolving influence of magnetic fields in shaping the GRB emission process and jet dynamics.

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Presenter: GUPTA, soumya (Bhabha Atomic Research Center)

Session Classification: GRBs, FRBs & other Transients

Track Classification: GRBs, FRBs and other Transients

Contribution ID: **18** Type: **Contributed Talk**

Modeling Particle Acceleration and Multi-Wavelength Emission of a PeVatron microquasar V4641 Sgr

Thursday 18 September 2025 17:20 (15 minutes)

The Large High Altitude Air Shower Observatory (LHAASO) has recently reported five Galactic microquasars as Ultra-High-Energy (UHE) gamma-ray emitters (>100 TeV), an unexpected result that challenges conventional models of Galactic particle acceleration. Among these sources, the microquasar V4641 Sgr exhibits gamma-ray emission up to ˜0.8 PeV, as well as the hardest UHE spectrum. The mechanisms behind particle acceleration to such energies are not well understood. Furthermore, the limited multi-wavelength (MWL) information on this source appears contradictory, further complicating interpretation and suggesting that V4641 Sgr may represent a particularly unusual case. In this work, we present a detailed physical model of V4641 Sgr that combines first-principles simulations of stochastic particle acceleration with MWL emission modeling. We adopt a leptonic scenario in which electrons are accelerated via second-order Fermi process driven by relativistic strong turbulence in the jet. The particle energization is simulated using a dedicated Monte Carlo framework that incorporates the effects of intermittent energy gains and radiative losses. The resulting high-energy electrons produce UHE gamma-rays through inverse Compton scattering on both the cosmic microwave background (CMB) and the interstellar radiation field (ISRF). Our model is capable of reproducing key observational characteristics of the system, including the PeV-scale gamma-ray emission. Nonetheless, several aspects remain unresolved, highlighting the need for deeper observational coverage and further theoretical refinement.

Author: DMYTRIIEV, Anton (North-West University)

Presenter: DMYTRIIEV, Anton (North-West University)

Session Classification: X-Ray and Gamma-Ray Binaries

Track Classification: X-Ray and Gamma-Ray Binaries

Contribution ID: **20** Type: **Invited Talk**

Search for dark matter particles with current and future ground-based gamma-ray observatories

Thursday 18 September 2025 11:00 (30 minutes)

High-energy gamma rays are one of the most promising tools to constrain or reveal the nature of Dark Matter (DM). During the almost two decades of the Fermi satellite mission, the data from its Large Area Telescope (LAT) were used to set constraints on Weakly Interacting Massive Particles (WIMP) and Axion -Like-Particle (ALP) models as well as to perform various searches for new physics. As a result, current WIMP annihilation cross section limits cut well into the theoretically-motivated region of parameter space for WIMP masses below 100 GeV. At the same time, the Cherenkov Telescope Array Observatory (CTA) is entering the construction phase and will soon offer a chance to probe a complementary parameter space of heavier dark matter (from O(200 GeV) up to several tens of TeV), with unprecedented sensitivity.

In this talk I will describe methods used to search for evidence of dark matter with the LAT, and review the status of the searches. I will also discuss the latest sensitivity predictions on the various targets with CTAO.

Author: ZAHARIJAS, Gabrijela (University of Nova Gorica)

Presenter: ZAHARIJAS, Gabrijela (University of Nova Gorica)

Session Classification: Astroparticle & Other High-Energy Sources

Track Classification: Multi-Messenger Astrophysics and Astro-Particle Physics

Contribution ID: **21** Type: **Contributed Talk**

NEON experiment in the multi-messenger era

Wednesday 17 September 2025 09:30 (15 minutes)

With the successful observations and synergies of golbal instruments and observatories, the multi-messenger has shown great ability and potential to solve the mystery of cosmic-ray origin. However, there are still quite some challenges, which may need the next-generation neutrino telescope with better angular resolution and bigger effective area. In this talk, I will present our proposal of the Neutrino Observatory in the Nanhai (NEON) and its current status and future plan.

Author: Dr YANG, Lili (Sun Yat-sen University)

Presenter: Dr YANG, Lili (Sun Yat-sen University)

Session Classification: Instrumentation

Track Classification: Instrumentation

Contribution ID: **22** Type: **Contributed Talk**

NEON experiment: current progress and detectability for extragalactic sources

Wednesday 17 September 2025 09:45 (15 minutes)

The IceCube neutrino observatory first detected high-energy neutrinos of extraterrestrial origin in 2013, marking a significant milestone for multimessenger astronomy. However, due to its limited angular resolution and sensitivity, only a few neutrino events can be associated with known sources observed in other bands. The exact production mechanisms of celestial neutrinos remain elusive. Consequently, neutrino observatories with larger scale and high precision are critically required. To address this, we proposed the NEutrino Observatory in the Nanhai (NEON), a detection array to be deployed in the South China Sea with a volume of about 10 km^3. This project is currently under development. We have estimated the sensitivity and effective area of the proposed detector array across different energy bands. Assuming the extragalactic neutrino background originates from active galactic nuclei (AGN), and adopting specific models for neutrino production in non-jetted AGN—such as magnetically-powered corona model and the radiatively inefficient accretion flow (RIAF) model—we evaluated NEON's detectability for extragalactic sources and calculated the expected event number for different models. Furthermore, we have conducted preliminary tests on key hardware and firmware components for the NEON experiment. The reliability of the photomultiplier tubes (PMTs), front-end and readout electronics, and mechanical structures has been successfully demonstrated in these initial tests.

Authors: XIE, Caijin (Sun Yat-sen university); YANG, Lili (Sun Yat-sen university)

Co-authors: ZHANG, Huiming (Sun Yat-sen university); LIN, Sujie (Sun Yat-sen university); SHI, Yihan (Sun Yat-sen university); CUI, Yudong (Sun Yat-sen university); HUANG, Yunlei (Sun Yat-sen university); QIU, Zijian (Sun Yat-sen university)

Presenter: XIE, Caijin (Sun Yat-sen university)

Session Classification: Instrumentation

Track Classification: Instrumentation

Contribution ID: **23** Type: **Contributed Talk**

Two-zone modelling of the very bright and variable FSRQ 3C 279

Friday 19 September 2025 10:00 (15 minutes)

The very bright Flat Spectrum Radio Quasar (FSRQ) 3C 279 (z = 0.536) is the first source of this class to be detected at very high energy gamma-rays and is characterised by an abundance of bright multi-wavelength (MWL) flaring events, especially at highest energies, where the amplitude and variability timescales are most extreme. The source is particularly known for its complex spectral variability during its gigantic flaring events, flare-in-flare structures and chaotic multi-band correlation behaviours, with sometimes the appearance of orphan flares, that standard one-zone lepto-hadronic models fail to reproduce. 3C 279 exhibited dramatic changes in the optical polarization, contemporaneous with sharp high-energy gamma-ray and optical flares, that do not seem to be connected with the X-ray radiation of the source, pointing towards the need for multi-zone radiative models. In this work, we present the results of the statistical characterisation of the MWL variability of 3C 279 during such events and its two-zone leptonic modelling.

Author: Dr LUASHVILI, Anna (Centre for Space Research - North-West University)

Co-author: BOETTCHER, Markus

Presenter: Dr LUASHVILI, Anna (Centre for Space Research - North-West University)

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **24** Type: **Poster**

Unveiling the Accretion Geometry of QS Tel Through Coordinated Photometric, Spectroscopic, and Polarimetric Observations

Thursday 18 September 2025 15:10 (20 minutes)

We present phase-resolved analysis of the polar QS Telescopii using photometry, spectroscopy, Doppler tomography, photopolarimetry, and circular spectropolarimetry collected between 2017 and 2025. We report the first detection of quasi-periodic oscillations (QPOs) in QS Tel, with timescales of 6–10 minutes, revealing dynamic accretion behavior. Doppler tomography of Hα and HeII (4686 Å) lines uncovers two distinct magnetically confined accretion streams, a feature rarely resolved in polars, confirming complex magnetic accretion. Flux-modulated Doppler maps further support complex magnetic accretion. Circular spectropolarimetry identifies two phase dependent strong cyclotron harmonics, implying magnetic field strengths ranging from 38 to 60 MG, indicating a non-dipolar, structured magnetic topology. We observe polarity reversals in circular polarization from +25% to −15%, supporting a two-pole geometry. A refined orbital ephemeris was derived from combined TESS and spectroscopic data. Collectively, our observations confirm that QS Tel exhibits an offset-dipole and complex magnetically channeled accretion flows. These results place QS Tel among a growing class of high-field polars with complex magnetic accretion.

Author: BOOI, Lutho (University of Cape Town/ SAAO)

Co-authors: Prof. WOUDT, Patrick (University of Cape Town); Dr POTTER, Stephen Brian (SAAO); Dr KHANGALE, Zwidofhelangani Ndamulo (University of Cape Town/SAAO)

Presenter: BOOI, Lutho (University of Cape Town/ SAAO)

Session Classification: Poster Session

Track Classification: GRBs, FRBs and other Transients

Contribution ID: **25** Type: **Poster**

Discovery of Spin-Modulated Circular Polarisation and Radial Velocity Variations in the Intermediate Polar 1RXS J080114.6−462324, with a possible long orbital period

Thursday 18 September 2025 15:10 (20 minutes)

We present a comprehensive phase-resolved photometric, spectroscopic, and polarimetric analysis of the intermediate polar (IP) 1RXS J080114.6−462324, based on multi-instrument observations. These include data from the HIgh-speed Photo-POlarimeter (HIPPO), the Southern African Large Telescope (SALT), and the SAAO 1.0-m and 1.9-m telescopes, complemented by archival photometry from the Transiting Exoplanet Survey Satellite (TESS). Notably, this system has previously been suspected to have undergone a micronova event.

The time-resolved spectroscopy reveals prominent emission features, including strong Balmer lines, most notably Hγ and Hβ, as well as He II λ4686, consistent with an actively accreting magnetic cataclysmic variable. In addition, we detect redshifted absorption dips modulated on the white dwarf spin period, likely arising from infall within the magnetically channelled accretion curtains.

We report the first detection of spin-modulated circular polarisation in this system, with an amplitude of ~4 %, observed independently in both photopolarimetric and circular spectropolarimetric data. The absence of Zeeman splitting and cyclotron harmonics constrains the magnetic field strength to ⊠10 MG.

We made the first detection of the periodic signal at the lowest frequency of about 2.032 d^{-1}, identified in both the TESS light curve and our spectroscopy, which is most likely to be the binary orbital frequency, placing 1RXS J080114.6−462324 among the intermediate polars with the longest known orbital periods. We further confirm the presence of a previously reported signal at 4.065 d^{-1}, likely to be the harmonic, and detected a coherent higher-frequency modulation at 66.081 d^{-1}, with no evidence of a beat frequency.

Author: MOLOI, Victor (University of Cape Town/ South African Astronomical Observatory)

Co-authors: Prof. WOUDT, Patrick (University of Cape Town/ South African Astronomical Observatory); Dr POTTER, Stephen Brian (South African Astronomical Observatory); Dr KHANGALE, Zwidofhelangani (University of Cape Town/ South African Astronomical Observatory)

Presenter: Prof. WOUDT, Patrick (University of Cape Town/ South African Astronomical Observatory)

Session Classification: Poster Session

Track Classification: Other High-Energy Sources

Contribution ID: **26** Type: **Contributed Talk**

Searching for astrophysical sources of the highest-energy neutrino event

Wednesday 17 September 2025 12:15 (15 minutes)

The detection of KM3-230213A, the most-energetic neutrino ever detected at an estimated energy of 220 PeV, by the KM3NeT neutrino telescope in the Mediterranean Sea, is a landmark discovery. Given its near horizontal direction and exceptionally high energy, the most likely explanation is that the muon resulted from interaction of a muon neutrino of cosmic origin. In this talk I will provide an astrophysical source origin scenario, using both transients and steady sources, of this intriguing event and discuss constraints on the sources that this event can provide.

Author: RAZZAQUE, Soebur

Presenter: RAZZAQUE, Soebur

Session Classification: Multi-Messenger & Extreme Cosmic Frontier

Track Classification: Multi-Messenger Astrophysics and Astro-Particle Physics

Contribution ID: **27** Type: **Contributed Talk**

Time-Dependent Leptonic Modeling of the High-Redshift Blazar 4C +01.02 Using Multiwavelength Observations

Friday 19 September 2025 10:15 (15 minutes)

Active galactic nuclei (AGNs) are powered by accretion onto supermassive black holes (SMBHs), yet the mechanisms governing their energy output and the growth of SMBHs, particularly at high redshift, remain incompletely understood. Blazars, a subclass of AGNs with relativistic jets oriented close to our line of sight, are detectable across the electromagnetic spectrum, from radio to gamma rays, even at cosmological distances due to Doppler boosting. The blazar 4C +01.02 is located at a high redshift z=2.107 and it is a flat spectrum radio quasar (FSRQ). In this work, we investigate a detailed long-term spectral and temporal analysis of 4C +01.02 using multiwavelength observations from Fermi-LAT, Swift-XRT, and Swift-UVOT, interpreted within the framework of a time-dependent one-zone leptonic model. Our analysis aims to characterize the variability behavior of the source in both flaring (Dec 2014-Sep 2017 & May 2020-Sep 2023) and quiescent states (Aug 2008-Dec 2014 & Sep 2017-May 2020) and to constrain key physical parameters of the emission region. We first model the time-averaged spectral energy distributions (SEDs) by solving the time-dependent Fokker–Planck equation for the electron population under steady-state conditions. Subsequently, we introduce perturbations in parameters such as the magnetic field strength, electron injection luminosity, and electron spectral index to simulate transitions between quiescent and flaring states. These variations allow us to compute time-dependent SEDs and multi-band light curves (optical, X-ray, and gamma-ray), facilitating a comparison with observational data. A black hole mass of approximately $M_{\rm BH} = 5 \times 10^9\ M_\odot$ and a magnetic field strength of B ≈ 0.15 G, are used to successfully reproduce the broadband spectral energy distributions (SEDs) consistent with the multiwavelength observational data. Furthermore, the model derives the characteristics of the relativistic electron energy distributions and magnetic field strength. Thus, the modeling of detailed broadband spectral energy distributions (SEDs) during different flaring and quiescent states reveals the physics of particle acceleration processes and radiative mechanisms in relativistic AGN jets.

Author: MUKHERJEE, Shruti (The University of Free State, Bloemfontein, South Africa)

Co-author: Prof. BOETTCHER, Markus (North-West University)

Presenter: MUKHERJEE, Shruti (The University of Free State, Bloemfontein, South Africa)

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **28** Type: **Contributed Talk**

Constraining GRB Prompt Emission Parametres Using IceCube Neutrino Upper Limits and pγ Simulation

Thursday 18 September 2025 12:00 (15 minutes)

High-energy neutrino detectors such as IceCube and ANTARES have followed up several bright gamma-ray bursts but have not found any associated neutrino signals, instead placing upper limits on the neutrino flux. In this work, we study the photo-hadronic interaction model during the prompt phase of GRBs and estimate the resulting neutrino flux both analytically and numerically using the publicly available SOPHIA Monte Carlo code.

We use various models of the dissipation radius and its connection to the Lorentz factor to constrain the baryon loading parameter. Three emission scenarios, Baryonic Photosphere (BPH), Magnetically Dominated Photosphere (MPH), and Internal Shocks (IS), are analyzed to explore the dissipation radius, Lorentz factor, and baryon loading for several GRBs with existing upper limits from the IceCube detector. For some of these GRBs, including GRB 221009A, we scan the parameter space to identify allowed regions consistent with the neutrino non-detections. The current upper limits provide insights on the baryon loading parameter and provide the model parameter space that identifies the potential GRB detection by future generation neutrino telescopes.

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Co-authors: Mr PRADHAN, Chiranjeet (Sardar Vallabhbhai National Institute of Technology, Surat, India); Dr C JOSHI, Jagdish (Aryabhatta Research Institute of Observational Sciences, Nainital, India)

Presenter: Ms SHARMA, Khushboo (Aryabhatta Research Institute of Observational Sciences, Nainital, India)

Session Classification: Astroparticle & Other High-Energy Sources

Track Classification: GRBs, FRBs and other Transients

Contribution ID: **29** Type: **Contributed Talk**

Multi-Wavelength Study of Blazar PKS 0446+11 in connection with IceCube Neutrino Event IC240105A

Wednesday 17 September 2025 14:45 (15 minutes)

We present a multi-wavelength study of the flat-spectrum radio quasar PKS 0446+11, located within the 90% localization region of the IceCube track-like neutrino event IC240105A, detected on 2024-01-05. Although no significant neutrino excess was found, PKS 0446+11 exhibited a major gamma-ray flare in late 2023 and remained X-ray bright in early 2024, suggesting temporally relevant activity. We performed broadband spectral energy distribution (SED) modeling using both leptonic and lepto-hadronic scenarios. The observed gamma-ray and X-ray emissions are best reproduced by a leptonic model involving external Compton scattering of photons from the broad-line region and dusty torus. In contrast, the lepto-hadronic model could not fully account for the observed SED, although cascade emission from hadronic interactions broadly covers the X-ray and gamma-ray bands at lower flux levels. We also estimate the expected neutrino flux, which peaks at energies beyond IceCube's optimal sensitivity range. The non-detection thus provides meaningful upper limits that help constrain neutrino production models.

These results highlight the importance of continued multi-wavelength and neutrino monitoring to better understand the physical conditions under which blazars may serve as neutrino sources

Author: KHATOON, Rukaiya

Co-author: BOETTCHER, Markus

Presenter: KHATOON, Rukaiya

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **30** Type: **Contributed Talk**

The Uncertain Universe and the First Measurement

Wednesday 17 September 2025 11:45 (15 minutes)

We demonstrate that the simplest three-dimensional superflow of logarithmic quantum Bose liquid can generate a four-dimensional relativistic quinton system, which comprises the dilaton and a combination of quintessence and the tachyonic phantom; the last two being non-minimally coupled to each other. Both gravity and these scalar fields are thus shown to be "infrared" projections of the dynamical evolution of superfluid vacuum density and its fluctuations onto the measuring apparatus of a relativistic observer. The unified model describes the transition from the inflationary epoch in the early universe to the contemporary accelerating expansion of the universe, commonly referred to as the 'dark energy' period.

In the second part of the talk we will reflect on the era preceding the inflationary epoch. Our conjecture is that the newly formed background matter was in a quantum superposition of its states, which created the primordial multiverse with uncertain spacetime geometry, akin to the Schrodinger's cat paradox. Fortunately, at a certain moment in time, the measurement event occurred (probably the first one ever), which broke the superposition and reduced that multiverse to one state, the Universe, to further evolve as discussed in the first part of my talk. We demonstrate that this measurement can be described via the quantum information extraction process, whose description naturally involves quantum Shannon entropy and requires logarithmic nonlinearity in the quantum evolution equations. The background matter thus became the logarithmic quantum liquid and superfluid and formed what we call now the physical vacuum.

Author: Dr ZLOSHCHASTIEV, Konstantin (Durban University of Technology)

Presenter: Dr ZLOSHCHASTIEV, Konstantin (Durban University of Technology)

Session Classification: Multi-Messenger & Extreme Cosmic Frontier

Track Classification: Multi-Messenger Astrophysics and Astro-Particle Physics

Contribution ID: **31** Type: **Contributed Talk**

Modelling the high-energy emission of the Vela pulsar as synchro-curvature radiation

Thursday 18 September 2025 14:15 (15 minutes)

In an ongoing study we interpret the curved spectrum of the Vela pulsar as seen by H.E.S.S. II (up to ˜100 GeV) and the Fermi Large Area Telescope to be the result of synchro-curvature radiation due to the acceleration of primary particles in a dissipative magnetosphere, within an extended separatrix region that leads into the current-sheet outside the light cylinder. We investigate the high-energy emission properties via energy-dependent light curve and phase-resolved spectral modelling, using the accelerating (azimuthally-dependent) electric field from global magnetospheric simulations. We expect our model to reproduce the observed trends, i.e., decrease of the flux of the first peak relative to the second one, evolution of the bridge emission, near-constant phase positions of peaks, and narrowing of pulses with increasing energy, relatively well. We will compare the predicted energy-dependent light curves and phase-resolved spectra with the observations from the Vela pulsar, expecting an improved phase lag between the radio and gamma-ray light curves upon updating the electric field description compared to our previous work.

Author: Dr BARNARD, Monica (Centre for Space Research, North-West University, Potchefstroom 2520, South Africa)

Co-authors: Prof. VENTER, Christo (Centre for Space Research, North-West University, Potchefstroom 2520, South Africa); Dr HARDING, Alice K. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, NM 58545, USA); Dr KALAPOTHARAKOS, Constantinos (Astrophysics Science Division, NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA)

Presenter: Dr BARNARD, Monica (Centre for Space Research, North-West University, Potchefstroom 2520, South Africa)

Session Classification: Pulsars and Pulsar Wind Nebulae

Track Classification: Pulsar and Pulsar Wind Nebulae

Contribution ID: **32** Type: **Poster**

Multi wavelength Analysis of Dwarf Novae Eruptions

Thursday 18 September 2025 15:10 (20 minutes)

Dwarf novae (DNe) are a subclass of Cataclysmic Variable Stars, which are a type of binary system that contain a white dwarf (WD) primary star and a main-sequence secondary star (typically a K- or an M-type star) where the secondary star transfers matter onto the WD via Roche-lobe overflow. These binary systems often have an accretion disk. DNe have outbursts, which are 2-6 magnitude increases in the brightness of the system that usually happen in regular intervals, which aren' t necessarily periodic. These outbursts occur on a timescale of the order of days or even years. Occasionally, these sources will go into superoutburst, which are much brighter and last longer than regular outbursts. The standard model that explains this is known as the disk instability model. This involves a thermal-viscous instability that switches the accretion disk between the outburst (hot, ionised) and quiescent (cold, unionised) states. During these processes the non-thermal emission is believed to be caused by magnetic reconnection. The aim of this study is to use the optical light curves of these sources to obtain target of opportunity observations using the MeerKAT telescope when these sources are in outburst. The aim is to see if any radio flux can be detected from these sources, and to model their spectra using the Van der Laan model, which assumes that the flux observed in the spectrum is from a superposition of multiple expanding blobs.

Author: MCPHERSON, Keith

Co-author: Prof. MEINTJES, Petrus

Presenter: MCPHERSON, Keith

Session Classification: Poster Session

Track Classification: Other High-Energy Sources

Contribution ID: **33** Type: **Invited Talk**

Optical and Radio Follow-up of Ultra-High-Energy Neutrino Source Candidates

Friday 19 September 2025 08:30 (30 minutes)

In this report, we present SAO RAS radio/optical observations of high-energy neutrino candidates - bright blazars. Extensive research has shown that the arrival directions of ultra-high-energy (UHE) neutrinos statistically coincide with bright blazar positions, while the timing of neutrino events coincides with powerful synchrotron flares in these objects. AGN have emerged as compelling candidates for astrophysical neutrino sources and efficient proton accelerators. We further present the multi-wavelength features (radio to gamma-ray) of several UHE neutrino candidates across long timescales and during neutrino events.

Author: SOTNIKOVA, Yulia (Special Astrophysical Observatory of the Russian Academy of Sciences (SAO RAS))

Co-author: Dr VLASYUK, Valery (Special Astrophysical Observatory of the Russian Academy of Sciences (SAO RAS))

Presenter: SOTNIKOVA, Yulia (Special Astrophysical Observatory of the Russian Academy of Sciences (SAO RAS))

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **34** Type: **Contributed Talk**

Investigating neutron star ULXs as evolutionary precursors to short gamma-ray bursts.

Wednesday 17 September 2025 11:30 (15 minutes)

The dual detection of a short gamma-ray burst (GRB 170817A) (Goldstein et al., 2017) and a gravitational wave (GW170817) (Abbott et al., 2017) signal marked the first direct confirmation that both phenomena can originate from the same astrophysical event. While the GW and SGRB signals give valuable insights into the properties of the merging neutron stars, they offer little information about the binary system's evolutionary history before the merger. This study examines the effect of extreme mass transfer to the NS during the ULX phase on the DNS system's final state and the SGRB jet's emergence.

Author: NYADZANI, Lutendo (University of Johannesburg)

Co-authors: FINKE, Justin (Naval Research Laboratory); RAZZAQUE, Soebur

Presenter: NYADZANI, Lutendo (University of Johannesburg)

Session Classification: Multi-Messenger & Extreme Cosmic Frontier

Track Classification: GRBs, FRBs and other Transients

Contribution ID: **35** Type: **Contributed Talk**

Hidden by a star: The redshift and the offset broad line of the flat-spectrum radio quasar PKS 0903−57

Friday 19 September 2025 09:30 (15 minutes)

PKS 0903−57 is a little-studied γ-ray blazar that has recently attracted considerable interest due to the strong flaring episodes observed since 2020 in high energy (HE; 100 MeV ≤ E ≤ 100 GeV) and very high-energy (VHE; 100 GeV ≤ E ≤ 10 TeV) γ-rays. Its nature and properties have not been well determined until recently by Goldoni et al. (2024), which this talk is based on. The main challenge has been the presence of a nearby star at a distance of 0.67" from the blazar, somewhat hiding it. The work of Goldoni et al. (2024) was carried out as part of the aims of Cherenkov Telescope Array Observatory redshift determination group. We performed spectroscopy of the optical counterpart of the PKS 0903-57 using the Southern African Large Telescope and the Very Large Telescope (VLT), and monitored it photometrically with the Rapid Eye Mount (REM) telescope. Using the VLT observations taken with a narrower slit (0.5" wide) under subarcsecond seeing (˜0.5") conditions, we were able to isolate the signatures of the blazar from those of the star and firmly measured its redshift to be z = 0.2621 ± 0.0006, thanks to the detection of five narrow optical lines. The detection of a symmetric broad Hα line with full width at half maximum (FWHM) of 4020 ± 30 km/s together with a jet-dominated continuum lead us to classify PKS 0903-57 as a flat-spectrum radio quasar. Finally, we detected with high significance a redshift offset (~1500 km/s) between the broad line and the host. This is the first time that such an offset has been unequivocally detected in a VHE blazar, possibly pointing to a very peculiar accretion configuration, a merging system, or a recoiling black hole. We have performed further VLT, REM and Swift observations recently (2025) that we are still analyzing.

Authors: BOISSON, Catherine (Observatoire de Paris); KASAI, Eli (University of Namibia); D'AMMANDO, Filippo (INAF); COTTER, Garret (University of Oxford, Department of Physics); Prof. BACKES, Michael (University of Namibia); GOLDONI, Paolo; PITA, Santiago; MAX-MOERBECK, Walter

Presenter: KASAI, Eli (University of Namibia)

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **36** Type: **Contributed Talk**

Prospects on detection of the Fermi Bubbles with CTAO

Thursday 18 September 2025 12:15 (15 minutes)

In 2010, the Fermi Gamma-ray Space Telescope observed two gamma-ray emitting structures, the Fermi Bubbles (FBs), that extend up to 55° above and below the Galactic plane and that seem to emanate from the Galactic center region. Although the spectrum at latitudes |b| > 10° has a softening or a cutoff around 100 GeV, the one at the base of the FBs, |b| <10°, extends up to about 1 TeV without a significant cutoff in the Fermi LAT data. The mechanism behind the FBs production is currently under debate. More observations of the FBs at different energies are required to improve our understanding of their origin.

Recently, H.E.S.S. and HAWC observatory have set upper limits on the FBs. In this work, we assess the sensitivity of the Cherenkov Telescope Array Observatory (CTAO) using the "alpha configuration" in the South site to detect the FBs and investigate the optimal strategies for their detection at low latitudes. We simulate the observations using the official CTAO science tool gammapy, considering several benchmark models for the FBs and the interstellar emission and test different observational strategies taking advantage of the proposed CTAO consortium surveys. We use these simulations to estimate the CTAO sensitivity to the FBs.

Authors: ECKNER, Christopher (University of Nova Gorica); Prof. MALYSHEV, Dmitry; XOTTA, Francesco (University of Nova Gorica); ZAHARIJAS, Gabrijela (University of Nova Gorica); PÉREZ-ROMERO, Judit (IFT UAM-CSIC); Ms BAVDAZ, Nina

Presenter: XOTTA, Francesco (University of Nova Gorica)

Session Classification: Astroparticle & Other High-Energy Sources

Track Classification: Other High-Energy Sources

Contribution ID: **37** Type: **Contributed Talk**

Investigating the impact of circumstellar discs on the non-thermal emission of HESS J0632+057 and other Be gamma-ray binaries

Thursday 18 September 2025 16:15 (15 minutes)

Gamma-ray binaries produce multi-wavelength, non-thermal emission that peaks at energies >1 MeV. It is largely understood that the high energy emission in these systems are produced in a termination shock formed between the stellar wind and/or circumstellar disc of the O/Be companion and the relativistic pulsar wind from a young, rapidly rotating, neutron star compact object. The gamma-ray binary HESS J0632+057 consists of a Be star and undetected compact object in a ˜317.3 day orbit, and displays two peaks in the TeV and X-ray lightcurves. These peaks are believed to be as a result of the compact object crossing the circumstellar disc, similar to what is observed for the Be gamma-ray binary PSR B1259-63. However, the interpretation of the emission from the system is complicated by the lack of a clear orbital solution, as multiple different orbital solutions have been proposed. We present an update on the long-term optical spectroscopic observations of HESS J0632+057 with SALT, from which we have obtained a new orbital solution and which will simplify the interpretation of the emission from this system. To this end, we are undertaking simple modelling of the optical and high energy emission from the pulsar-disc interaction along the orbit to probe the impact of the circumstellar disc on the multi-wavelength emission for this, and other Be gamma-ray binaries.

Authors: VAN SOELEN, Brian; MATCHETT, Natalie

Presenter: MATCHETT, Natalie

Session Classification: X-Ray and Gamma-Ray Binaries

Track Classification: X-Ray and Gamma-Ray Binaries

Contribution ID: **38** Type: **Contributed Talk**

Compton-induced γ-ray cascade emissions in radio galaxy NGC 1275.

Wednesday 17 September 2025 15:00 (15 minutes)

Among active galactic nuclei (AGNi), blazars are the brightest emitters of high- (HE, $E \geq 100$ \,MeV) to very-high-energy (VHE, $E \geq 100$ \,GeV) γ-rays from their jets. Radio galaxies, being the misaligned parent population of the blazar class, were historically not observed at these frequencies. However, advances in experiments and observatories have led to their detections in the HE–VHE γ-ray band. In this work, we leverage and refine a Monte-Carlo photon and electron-positron ($e^{\pm}$) pair tracking code in the AGN environment of the radio galaxy NGC 1275. In the code, we consider the isotropic broad emission line (BLR) and anisotropic Shakura-Sunyaev (SS) accretion disk radiation fields, with mild magnetic fields in the AGN environment. We find that cascade γ-rays from inverse-Compton scattering by relativistic $e^{\pm}$ pairs of these external radiation fields can explain the \emph{Fermi} Large Area Telescope's (LAT) and Major Atmospheric Cherenkov Experiment (MACE) observations from the radio galaxy NGC 1275. We present a set of plausible parameters obtained from the code by fitting the source's spectral energy distribution (SED) during flaring events reported in the period December 2022 to January 2023.

Author: NTSHATSHA, Mfuphi

Co-authors: BOETTCHER, Markus; RAZZAQUE, Soebur

Presenter: NTSHATSHA, Mfuphi

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **39** Type: **Dissertation Talk**

Radio/X-ray Monitoring of Two Gamma-ray Binaries: 1FGL J1018.6-5856 and LMC P3

Thursday 18 September 2025 16:45 (20 minutes)

Context. Gamma-ray binaries are a rare subclass of high-mass binary systems composed of a compact object (either a neutron star or a black hole) and an O- or B-type stellar companion. These systems exhibit broadband non-thermal emission that peaks in the gamma-ray regime and serve as ideal laboratories for studying relativistic particle acceleration, wind–wind interactions, and extreme radiative environments.

Aims. This study investigates the gamma-ray binaries 1FGL J1018.6-5856 and LMC P3, discovered in 2011 and 2016 respectively. Using phase-resolved 2019 MeerKAT L-band radio observations alongside archival Swift-XRT X-ray data, we aim to:
i Perform a comprehensive radio analysis of both systems, and
ii Conduct a radio/X-ray cross-correlation analysis to explore the physical connection between these emissions and constrain the dominant emission mechanisms

Results. Both 1FGL J1018.6-5856 and LMC P3 appear as compact, unresolved sources in MeerKAT L-band continuum images, each exhibiting clear sinusoidal modulation on its orbital period. In 1FGL J1018.6-5856, a persistent, low-surface-brightness extension is visible to the southeast of the compact core, however deeper analysis is needed to confirm its association with the binary system.

Their in-band spectral indices confirm a non-thermal synchrotron radio emission origin. Notably, both systems display a strong flatter-when-brighter trend, where the spectral index α flattens at radio maxima and steepens at minima, supporting shock-acceleration and cooling scenarios common in relativistic wind interactions.

Discrete correlation functions between radio and X-ray emission reveals a significant coherence in both binaries. X-ray variations lead the radio by ~ 1 day in 1FGL J1018.6-5856 and by ~ 4 days in LMC P3, along their respective 16.5507-day and 10.301-day orbits. These lags align with a synchrotron-cooling model in which energetic electrons radiate X-rays near the shock interface before cooling and emitting at radio frequencies downstream.

Conclusions. The timing, spectral, and cross-correlation signatures consistently point to a collision-powered scenario, where particles are accelerated in the wind-wind interaction zone. The results therefore provide further indirect evidence that the compact companions in both 1FGL J1018.6-5856 and LMC P3 are neutron stars.

Authors: MATHIBA, Andries (University of Cape Town); Dr MONAGENG, Itumeleng (UCT/SAAO)

Presenter: MATHIBA, Andries (University of Cape Town)

Session Classification: X-Ray and Gamma-Ray Binaries

Track Classification: X-Ray and Gamma-Ray Binaries

Contribution ID: **40** Type: **Dissertation Talk**

Preparatory studies for the Africa Milimetre Telescope

Wednesday 17 September 2025 10:00 (20 minutes)

The Event Horizon Telescope (EHT) is a network of antennas across the globe currently used to image supermassive black holes (SMBHs) at a frequency of 230 GHz. Since the release of the image of M87*in 2019 and, subsequently, that of Sgr A* in 2022 by the EHT collaboration, the focus has shifted towards dynamically imaging SMBHs. This has led to a search for potential sites to extend and fill the gaps within the EHT network. The Gamsberg Mountain and the H.E.S.S. site are both located within the Khomas highlands and have been identified as potential sites for the Africa Millimetre Telescope (AMT). Precipitable water vapour (PWV) in the atmosphere is the primary source of opacity and noise from atmospheric emissions, when observing at millimetre to sub-millimetre wavelengths. This study aims to establish the PWV content and meteorological conditions at the potential sites of the AMT using Global Navigation Satellite System (GNSS) measurements. Using conservative specifications and potential dish sizes of 13, 14 and 15 m for the AMT, the System equivalent flux density (SEFD) and Signal to Noise ratio (S/N) to the reference stations ALMA and NOEMA were also assessed from simulated observations of M87*and Sgr A*. The EHT window PWV had a 25th percentile of 12.21 mm at the H.E.S.S. site and 7.54 mm at the Gamsberg Mountain. The simulated results of M87*and Sgr A* showed the 15 m and 14 m dishes at the Gamsberg Mountain to have the lowest SEFD, with the performance of the 13 m dish being slightly comparable to the 15 m dish at the H.E.S.S. site. For M87*and Sgr A* observations, the 13 m dish at Gamsberg Mountain achieved a higher average S/N output for the ALMA-AMT baseline than the 15 m dish at the H.E.S.S. site. For M87*, the S/N output from Gamsberg Mountain was higher for the NOEMA-AMT baseline, with the 13 m dish providing 41 additional minutes of S/N ≥ 4 compared to the 15 m dish at H.E.S.S. For Sgr A*, the AMT at Gamsberg Mountain achieved the highest S/N for the ALMA-AMT baseline, yielding an additional 1h32 of S/N ≥ 4 for the 13 m dish compared to the 15 m dish at the H.E.S.S. site. The PWV and simulation results indicate that the Gamsberg Mountain is the more suitable site for the AMT.

Authors: FALCKE, Heino (Radboud University); FRANS, Lott (University of Namibia); Prof. BACKES, Michael (University of Namibia); Dr VENTURI, Tiziana (INAF-IRA)

Presenter: FRANS, Lott (University of Namibia)

Session Classification: Instrumentation

Track Classification: Instrumentation

Contribution ID: **41** Type: **Contributed Talk**

Multiband studies of bright blazars sample with SAO RAS telescopes

Friday 19 September 2025 09:00 (15 minutes)

In this report we present results of multi-wavelength investigations of brights blazars sample provided mainly with SAO RAS optical telescopes - 6-meter reflector and 1-meter class instruments. The campaign of optical monitoring spans over 20 years. The sample consists of almost two dozens sources in wide brightness range (optical R band) - between 14th and 20th magnitudes. The statistical analysis of some selected blazars light curves in optical range, being combined with radio and high-energy emission data revealed new features of non-stationary events in Active Nuclei. Spectral studies with 6 meter BTA telescope gave some findings concerning internal structure of blazars and matter localized on line-of-sight. The typical flux variation times gave estimates of emission zones size for individual objects.

Authors: Dr VLASYUK, Valery (Special Astrophysical Observatory of Russian Academy of Sciences); SOTNIKOVA, Yulia (Special Astrophysical Observatory of the Russian Academy of Sciences (SAO RAS))

Presenter: Dr VLASYUK, Valery (Special Astrophysical Observatory of Russian Academy of Sciences)

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **42** Type: **Contributed Talk**

Modelling Pulsar Gamma-ray Light Curves using a Geometric Current Sheet Model

Thursday 18 September 2025 13:45 (15 minutes)

The publication of the Third Pulsar Catalog (3PC) by the *Fermi* Large Area Telescope (LAT) team marked a significant milestone for high-energy pulsar science. In it, the light curves and spectra of nearly 300 pulsars are presented, along with some interesting correlations between timing and spectral parameters. This wealth of data provides impetus for continued development of pulsar emission models. Over the years, numerous models have been developed, focusing on different physical regimes (e.g., global current flow, magnetic structure, pair creation microphysics, or emission and beaming), and with different outputs (e.g., multi-frequency light curves, multi-component spectra, or single-band pulse shapes only). Magnetohydrodynamic (MHD) and particle-in-cell (PIC) models each have their respective strengths but are often computationally expensive to compute for a suitable coverage of the parameter space. Machine learning has recently been invoked to speed up the process. An alternative, interim step that we are exploring is to implement a geometric current sheet model, akin to the traditional outer gap and two-pole caustic models, but with emission occurring beyond the light cylinder (the magnetospheric boundary where the co-rotation speed equals that of light in vacuum). We will present first results and insights gained by comparing the beamed output (phase plots or sky maps which present beamed emission across the sky) from this model to those of the outer gap and two-pole caustic models, as well as from contrasting the fitting results of some pulsar light curves using the various geometric models. The latter comparison will feature joint fits of radio and gamma-ray light curve data, also using a geometric radio conal model.

Author: VENTER, Christo

Co-authors: HARDING, Alice (Los Alamos National Laboratory); KALAPOTHARAKOS, Constantinos; Dr WADIASINGH, Zorawar (NASA GSFC)

Presenter: VENTER, Christo

Session Classification: Pulsars and Pulsar Wind Nebulae

Track Classification: Pulsar and Pulsar Wind Nebulae

Contribution ID: **43** Type: **Contributed Talk**

The multi-wavelength behaviour of the gamma-ray binary PSR B1259-63/LS 2883 around the 2024 periastron passage

Thursday 18 September 2025 16:30 (15 minutes)

Gamma-ray binaries are a rare class of high-mass binary systems that produce non-thermal emission peaking in the gamma-ray regime (in a νF_ν distribution). The system PSR B1259–63/LS 2883 consists of a young pulsar in a 3.4-year orbit around an O9.5 Ve star. It was the first binary system discovered to host a pulsar orbiting a non-degenerate companion. The pulsed radio emission is eclipsed from approximately 17 days before until 17 days after periastron, interpreted as the pulsar crossing through the plane of the circumstellar disc surrounding the Oe star. The unpulsed radio and X-ray light curves display two maxima near these same orbital phases. In contrast, at GeV energies, the source exhibits rapid, luminous flares 30–80 days after periastron, exceeding the pulsar's spin-down luminosity. We present an overview of our long-term multiwavelength observation campaign of this system, including results from the most recent periastron passage in 2024, which was characterized by an earlier increase in X-ray (pre-periastron) and GeV (post-periastron) emission. This behavior can be explained by a larger decretion disc, as supported by optical observations.

Author: VAN SOELEN, Brian

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Presenter: VAN SOELEN, Brian

Session Classification: X-Ray and Gamma-Ray Binaries

Track Classification: X-Ray and Gamma-Ray Binaries

Contribution ID: **44** Type: **Contributed Talk**

From Fermi to Fractals: Stochastic Particle Acceleration in Strong MHD Turbulence

Wednesday 17 September 2025 16:00 (15 minutes)

Since Enrico Fermi first proposed the stochastic acceleration of protons due to multiple scatterings off of parsec-scale interstellar magnetic fields as a method of cosmic ray acceleration around the time of the 1950s, the theoretical framework of stochastic acceleration in magnetohydrodynamic (MHD) turbulence has undergone significant refinement, although these traditional models often fail to capture and incorporate the complex nature of MHD turbulence. Recent numerical simulations of stochastic acceleration incorporating realistic multifractal MHD turbulence yielded previously unknown effects, such as intermittent particle energization characterized by large jumps in particle momentum.

Here we present a Monte Carlo framework in which the stochastic particle acceleration of an instantaneously injected electron population is modelled as a continuous-time random walk based on the methodology developed in previous studies. In a parameter study, our Monte Carlo code simulates the effects of intermittent particle energization due to interactions with strong MHD turbulence on the electron particle spectrum, and incorporates synchrotron cooling in a self-consistent manner in the theoretical and computational models. Our findings suggest sharply peaked particle spectra exhibiting distinct high-energy power law tails, differing significantly from the log-parabolic spectra predicted by the standard Fermi theory.

Authors: Dr DMYTRIIEV, Anton (Centre for Space Research, North-West University); VAN DER MERWE, Frans (Centre for Space Research, North-West University); Prof. BÖTTCHER, Markus (Centre for Space Research, North-West University)

Presenter: VAN DER MERWE, Frans (Centre for Space Research, North-West University)

Session Classification: AGN

Track Classification: Other High-Energy Sources

Contribution ID: **45** Type: **Contributed Talk**

Radiation Signatures of Electron Acceleration in the Decelerating Jet of MAXI J1348-630

Thursday 18 September 2025 16:00 (15 minutes)

A discrete jet component (blob) ejection and its subsequent deceleration were observed in the 2019/2020 outburst of the low-mass X-ray binary MAXI J1348–630. A first kinematic analysis of the deceleration due to an abrupt transition from an evacuated cavity to the interstellar medium suggested a kinetic energy exceeding 10^{46} erg, surpassing estimates of the available total ejection energy. However, incorporating a transition layer with exponential density growth between the cavity and the interstellar medium recently enabled a kinematic analysis with much more realistic energy requirements of approximately 10^{44} erg.
Here, we study the expected radiative signatures of electrons accelerated within the decelerating blob by introducing a model akin to the relativistic blast wave model for gamma-ray bursts, considering radiative energy losses and radiation drag, to simulate the deceleration of a relativistically moving plasmoid. This model yields snap-shot spectral energy distributions and multi-wavelength light curves from synchrotron and synchron-self-compton (SSC) emission. Notably, the synchrotron emission peaks in the X-rays, but the predicted X-ray flux is negligible compared to thermal emission from the accretion disk. The predicted radio light curve closely resembles the observed one during the jet decleration phase following the outburst in 2019/2020.

Authors: SARATH, Aishwarya (Universidad Diego Portales); BOETTCHER, Markus

Presenter: SARATH, Aishwarya (Universidad Diego Portales)

Session Classification: X-Ray and Gamma-Ray Binaries

Track Classification: X-Ray and Gamma-Ray Binaries

Contribution ID: **46** Type: **Contributed Talk**

Radio continuum emission predominantly traces star-formation in radio-quite active galactic nuclei

Wednesday 17 September 2025 16:45 (15 minutes)

We investigate whether radio emission primarily traces star formation in RQ AGN. Our sample consists of 5223 galaxies detected by the MeerKAT International GHz Tiered Extragalactic Exploration (MIGHTEE) survey with multi-wavelength counterparts up to a $z \approx 6$ limit. We classified the sources using the infrared-to-radio luminosity ratio ($q_{\mathrm{IR})}$, X-ray luminosity cuts, and mid-infrared colour cuts into RQ AGN, radio-loud AGN (RL AGN), and star-forming galaxies (SFGs). We calibrated the star formation rate (SFR)-1.4 GHz radio luminosity ($L_{1.4\ \mathrm{GHz}}$) relation for both RQ AGN and SFGs. We find that in both populations SFR correlates positively with $L_{1.4\ \mathrm{GHz}}$, with average Spearman's rank correlation coefficients of 0.71 for RQ AGN and 0.76 for SFGs. With these results, we conclude that radio continuum from RQ AGN primarily traces star formation. This implies that we trace free-free and synchrotron emission in star-forming regions of the host galaxy, with the AGN jet component contributing less.

Author: Mrs KEKANA, Thando (University of Johannesburg)

Co-authors: Prof. THORAT, Kshitij (University of Pretoria); Prof. RAZZAQUE, Soebur (university of johannesburg); Dr KOLWA, Sthabile (University of South Africa)

Presenter: Mrs KEKANA, Thando (University of Johannesburg)

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **47** Type: **Contributed Talk**

Looking for axion decay around a black hole

Thursday 18 September 2025 11:30 (15 minutes)

In this work, we aim to compute the radio flux from the decay of axions close to Saggitarius A*, the supermassive black hole at the center of our galaxy. These particles can undergo stimulated decay in the presence of photons with energies of half the axion mass. We make use of an observed spectrum for Sgr A emission in the frequency range of SKA and the VLBA, to find the effect of stimulated decay on a range of axion masses. We also follow recent studies that indicate the existence of a dark matter spike near the black hole to boost the observed flux. These quantities are used in the computation of the predicted axion flux and in obtaining limits on the axion coupling as a function of axion mass that would result from a non-observation of an axion line via VLBI.

Authors: BECK, Geoff; MAKDA, Javeria (University of the Witwatersrand)

Presenter: MAKDA, Javeria (University of the Witwatersrand)

Session Classification: Astroparticle & Other High-Energy Sources

Track Classification: Multi-Messenger Astrophysics and Astro-Particle Physics

Contribution ID: **48** Type: **Contributed Talk**

Investigating machine learning approaches for differentiating MGFs and SGRBs

Thursday 18 September 2025 09:30 (15 minutes)

Magnetar giant flares (MGFs) and short $\gamma-$ray bursts (SGRBs) are short $\gamma-$ray transients (SGRTs) with overlapping temporal and spectral characteristics, making them challenging to distinguish, especially when their redshift is unknown. In this study, we apply supervised machine learning to classify MGFs and SGRBs in an SGRT sample of unknown redshift. Temporal parameters (including pulse rise times from Norris function fits) and spectral features (derived from Comptonized model fits over the 10 keV–40 MeV range) are extracted as input features for classification. Classifier performance is assessed using cross-validation, with preliminary results suggesting that some separation between MGFs and SGRBs is possible. This work highlights the potential and challenges of incorporating machine learning into the automated classification of $\gamma-$ray transients.

Author: Ms MAHESO, Dimakatso

Co-author: RAZZAQUE, Soebur

Presenter: Ms MAHESO, Dimakatso

Session Classification: GRBs, FRBs & other Transients

Track Classification: GRBs, FRBs and other Transients

Contribution ID: **49** Type: **Contributed Talk**

Compton polarization signatures in gamma-ray burst models

Thursday 18 September 2025 10:15 (15 minutes)

There is still much debate around the inner workings of the GRB prompt emission phase with many questions still left unanswered. Polarization signatures offer a promising new avenue to discriminate between the various GRB prompt emission models. The aim of the study is to estimate energy and time resolved polarization signatures resulting from inverse Compton (IC) scattering for two specific GRB prompt emission models, namely the back-scattering-dominated cork model by M. K. Vyas et al. (2021) and a Compton drag model by G. Ghisellini et al. (2000). In order to achieve this we apply an IC polarization Monte Carlo algorithm to the two GRB models in order to estimate the expected polarization signatures.

Author: VD MERWE, Pieter

Co-author: BOETTCHER, Markus

Presenter: VD MERWE, Pieter

Session Classification: GRBs, FRBs & other Transients

Track Classification: GRBs, FRBs and other Transients

Contribution ID: **50** Type: **Contributed Talk**

An Optical Spectropolarimetric Survey of TeV-emitting Blazars

Friday 19 September 2025 09:45 (15 minutes)

Blazars are among the most luminous and variable sources in the universe, producing emission up to TeV energies. The lower-energy component of the emission is dominated by non-thermal leptonic synchrotron radiation from the jet. However, the high energy component is not yet fully understood, as it can be reproduced by both leptonic and hadronic models. Polarization measurements at optical and X-ray energies provide important clues as to how the emission is produced and can be used as a tool to distinguish between the different models proposed for the high-energy emission. Optical polarization measurements, combined with multi-wavelength observations, provide a good foundation upon which the high-energy signatures of blazar emission can be interpreted. To this end, we have launched a long-term monitoring programme of selected TeV emitting blazars, using the Southern African Large Telescope (SALT). Here we present results from the first two years of SALT optical spectropolarimetry observations, which form part of a larger, coordinated multi-wavelength campaign. Special focus will be placed on the nature and frequency dependence of the polarization along with trends in the observed emission features.

Author: BARNARD, Joleen

Co-authors: Dr MARTIN-CARRILLO, Antonio (Space Science Group, School of Physics, University College Dublin); VAN SOELEN, Brian; BUCKLEY, David; SCHUTTE, Hester; VAN DER WESTHUIZEN, Izak; BÖTTCHER, Markus (Centre for Space Research, North-West University); ZACHARIAS, Michael

Presenter: BARNARD, Joleen

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **51** Type: **Contributed Talk**

X-Ray Polarization in Blazars

Wednesday 17 September 2025 14:00 (15 minutes)

The Imaging X-Ray Polarimetry Explorer (IXPE), launched in December 2021, has opened a new window on relativistic jets. In this talk, I will review results of IXPE and co-ordinated multi-wavelength observations of blazars. Highlights are the strong evidence for a leptonic origin of the high-energy emission in low-synchrotron-peaked blazars as well as indications of energy stratification in the jets of high-synchrotron-peaked blazars. Unexpected results, such as polarization-angle swings in the optical without corresponding counterpart features in X-rays, and vice versa, continue to pose new puzzles.

Author: BOETTCHER, Markus

Presenter: BOETTCHER, Markus

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **52** Type: **Contributed Talk**

GRB 250129A: linking late-time afterglow polarisation to jet Structure and viewing geometry

Thursday 18 September 2025 09:45 (15 minutes)

Gamma-Ray Burst (GRB) afterglows arise from the interaction of relativistic ejecta with the circumburst medium and are observed across the electromagnetic spectrum. Polarisation is expected during the early and late phases of the afterglow depending on the presence of reverse shocks and the viewing geometry of the jet. Polarimetric observations of GRB afterglows serve as a unique diagnostic tool to investigate the geometry and structure of magnetic fields in the emitting region, which cannot be directly inferred from photometric or spectroscopic data alone. We present late-time spectropolarimetric observations of GRB˜250129A using the Robert Stobie Spectrograph on the Southern African Large Telescope (SALT), obtained ∼19 hours post-burst. We detect a remarkably high linear polarisation of 5–10 % and a 180° rotation in polarisation angle across wavelength—an unprecedented result for this late afterglow phase. This indicates turbulence with large-scale toroidal and radially stretched magnetic-field structures in the late-time forward shock regime. Such high polarisation levels are typically expected during the early afterglow (∼100 s) when reverse shocks dominate. However, multi-wavelength observations from LCO, DOT, ZEISS, and Swift-XRT show no indication of reverse shock contribution at this epoch. XRT data reveal high-latitude emission with flaring activity between 5.5 and 11 hours. Afterglow modeling incorporating both forward and reverse shocks confirms that the reverse shock component fades rapidly after ∼100 s. The multi-wavelength afterglow is best explained by an off-axis viewing geometry of a Gaussian jet in a uniform ISM environment. GRB 250129A thus provides rare observational evidence linking late-time polarisation to geometric and jet-structure effects.

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Presenter: Dr GHOSH, ankur (University of Johannesburg)

Session Classification: GRBs, FRBs & other Transients

Track Classification: GRBs, FRBs and other Transients

Contribution ID: **53** Type: **Contributed Talk**

Radio and Optical Properties of the Blazar PKS 1614+051 at z=3.21

Friday 19 September 2025 09:15 (15 minutes)

We present a study of the radio and optical properties of the high-frequency peaker (HFP) blazar PKS 1614+051 at $z = 3.21$ based on the data covering the time period of 1997–2024. The radio data are represented by the instantaneous 1–22 GHz measurements from the SAO RAS RATAN-600 radio telescope, the 5 and 8 GHz data from the IAA RAS RT-32 telescopes, and the 37 GHz data from the RT-22 telescope of CrAO RAS. The optical measurements in the R band were collected with the SAO RAS 1-m Zeiss-1000 and 0.5-m AS-500/2 telescopes, and the ZTF archive data. We have found low overall variability indices (0.1–0.2) and a median spectral peak at 4.6 GHz, which is stable during the long-term period of monitoring. An analysis of the radio light curves reveals significant time delays (0.6 to 6.4 yrs) between the radio frequencies along with variability timescales ranging from 0.2 to 1.8 yrs in the source's rest frame, which is similar to the blazars at lower redshifts. Spectral modeling suggests the presence of both synchrotron self-absorption (SSA) and free-free absorption (FFA) processes. Based on the SSA model, we provide estimates of the magnetic field strength which peaks at approximately 100 mG. A spectroscopic study with the BTA SCORPIO-1 spectrograph has found evidence of the regular motion of a neutral hydrogen envelope around the blazar center, which confirms the presence of a sufficient amount of gaseous matter to form an external FFA screen. The results highlight the importance of multi-wavelength and long-term monitoring to understand the physical mechanisms driving the variability in high-redshift blazars.

Authors: MIKHAILOV, Alexander; KUDRYAVTSEV, Dmitry (Special Astrophysical Observatory of Russian Academy of Sciences); KHABIBULLINA, Margarita (Special Astrophysical Observatory of Russian Academy of Sciences); MUFAKHAROV, Timur (Special Astrophysical Observatory of Russian Academy of Sciences); Dr VLASYUK, Valery (Special Astrophysical Observatory of Russian Academy of Sciences); SOTNIKOVA, Yulia (Special Astrophysical Observatory of the Russian Academy of Sciences (SAO RAS))

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Presenter: MIKHAILOV, Alexander

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **54** Type: **Contributed Talk**

Fermi-LAT Observations of fast rotating, magnetic white dwarfs J191213.72-441045.1 and EUVE J0317-85.5

Thursday 18 September 2025 14:45 (15 minutes)

We report the possible detection of pulsed -ray emission from one confirmed white dwarf pulsar J191213.72-441045.1 and a candidate white dwarf pulsar EUVE J0317-85.5 using ~15 years of data from the Fermi-LAT observatory. Pulsed -ray emission in the 0.5-10 GeV energy range from J191213.72-441045.1 were found at a period of =319.99±0.35s with a -log(Pr)=6.76 which corresponds to a significance of ~5.74. The phase-folded -ray light curve on this period is remarkably in phase with the recent optical observations (Pelisoli et al. (2023a), Pelisoli et al. (2023b)) of J191213.72-441045.1 signifying that the pulsed -rays and optical photons might be emanating from the same region in J191213.72-441045.1. Pulsed -ray emission in the 0.5-10 GeV energy range were also found from the isolated, highly magnetic white dwarf EUVE J0317-85.5 at the period of =724.65±0.54s with a -log(Pr)=5.02 which corresponds to significance of ~4.01. The phase-folded -ray light curve on this period is also in phase with recent optical observations of EUVE J0317-85.5 using the BOOTES-6 robotic telescope. We propose that the pulsed -ray emission in the 0.5-10 GeV energy range from both of these fast spinning, magnetic white dwarfs is likely produced by the curvature radiation mechanism based on a recent study done by Meintjes et al. (2023) suggesting that fast spinning, magnetic white dwarfs to be possible low-level -ray emitters.

Author: MINNIE, Lurgasho (University of the Free State)

Co-authors: Dr MARITZ, Jacques (University of the Free State); Prof. MEINTJES, Petrus Johannes (University of the Free State)

Presenter: MINNIE, Lurgasho (University of the Free State)

Session Classification: Pulsars and Pulsar Wind Nebulae

Track Classification: Pulsar and Pulsar Wind Nebulae

Contribution ID: **55** Type: **Contributed Talk**

Can γ-rays be detected from accretion-driven systems?

Thursday 18 September 2025 17:05 (15 minutes)

Magnetically controlled accreting white dwarf binaries, which includes polars and intermediate polars, provide unique laboratories for high-energy particle acceleration in compact stellar systems. Their strong magnetic fields, rapid accretion flows, and dynamic magnetospheres enable distinct acceleration channels. In polars, which rotate synchronously with strong magnetic locking, unipolar induction under mild asynchronism and episodic diffusive shock acceleration are prime candidates. In intermediate polars, differential rotation can create transient vacuum gaps capable of curvature radiation, with magnetic reconnection at the boundary between the disk and magnetosphere acting as a complementary process. Historical reports of TeV emission from some polars, though not universally confirmed, motivated these models and highlighted the need for sensitive GeV-band searches. We present a Fermi-LAT analysis of accretion-driven systems, applying time-resolved, temporal analysis and TS-gating techniques to isolate transient gamma-ray signals. Although no persistent emission was detected at the >5 sigma level in time-integrated searches, multiple systems exhibit significant gamma-ray excesses that are spatially coincident with the white dwarf. Several exhibit significant periodic modulation at the white dwarf spin, beat, or orbital period, confirming a physical association with the binary. The nonthermal spectra, peaking below approximately 10 GeV, are consistent with predictions from unipolar induction, vacuum gap acceleration, and related inverse Compton, \piˆ0-decay, and curvature radiation processes. These results demonstrate that magnetic cataclysmic variables can act as low-level yet recurrent \gamma-ray sources, with activity governed by accretion geometry, magnetospheric structure, and plasma conditions. Future studies with more sensitive gamma-ray observatories such as CTA, AMEGO, or e-ASTROGAM, complemented by X-ray and optical monitoring, could provide deeper insight into the particle acceleration mechanisms driving emission in these compact binaries.

Author: Mr MADZIME, Spencer Tendai (University of the Free State)

Co-author: Prof. MEINTJES, Peter J. (University of the Free State)

Presenter: Mr MADZIME, Spencer Tendai (University of the Free State)

Session Classification: X-Ray and Gamma-Ray Binaries

Track Classification: X-Ray and Gamma-Ray Binaries

Contribution ID: **56** Type: **Poster**

Emission modelling of spider binary systems

Thursday 18 September 2025 15:10 (20 minutes)

'Spider'binary systems –black widow and redback binaries consisting of a millisecond pulsar and a low-mass companion in a compact orbit, are important types of pulsar system exhibiting various key features, including radio eclipses, optical light curves from the heated companion, and X-ray and GeV orbital light curves and spectra. In these systems, the intense pulsar wind heats and may ablate its companion, forming an intra-binary shock as a promising site for particle acceleration. The Fermi Large Area Telescope (LAT) has detected about 50 of these systems in the GeV band. We will extend our basic model of shock emission (Van der Merwe et al., 2020) to include updated injection spectra and shock geometries, and calculate synchrotron and inverse Compton spectral components as well as energy-dependent orbital light curves expected from a number of these systems.

Author: HURTER, Heinrich (Centre for Space Research, North-West University)

Co-authors: HARDING, Alice (Los Alamos National Laboratory); KOPP, Andreas (Centre for Space Research, North-West University); VENTER, Christo (Centre for Space Research, North-West University); BARING, Matthew (Rice University); Dr WADIASINGH, Zorawar (NASA GSFC)

Presenter: HURTER, Heinrich (Centre for Space Research, North-West University)

Session Classification: Poster Session

Track Classification: Pulsar and Pulsar Wind Nebulae

Contribution ID: **57** Type: **Contributed Talk**

Constraints on Cosmological Parameters Using Gamma-Ray Bursts with Measured and Machine Learning–Derived Redshifts

Thursday 18 September 2025 09:15 (15 minutes)

Gamma-Ray Bursts (GRBs), the most luminous explosions in the cosmos, are promising tools for cosmology due to their potential as standardizable candles. Among the empirical correlations proposed for this purpose, the Yonetoku relation, which connects the intrinsic peak energy ($E_{i,p}$) to isotropic peak luminosity (L_{iso}), provides a means to probe distances beyond the range of Type Ia supernovae (SNe Ia). The Yonetoku correlation is calibrated and analyzed using both GRBs with measured redshifts and a large sample with machine learning, derived pseudo-redshifts. This analysis focuses on estimating the distance modulus and constraining cosmological parameters using this relation. A joint Markov Chain Monte Carlo (MCMC) analysis is applied to simultaneously determine the Yonetoku parameters (k, m) and cosmological parameters (H_0, Ω_Λ). This method is applied across both the full redshift range and within specific redshift bins, assuming a flat universe within the Lambda Cold Dark Matter (ΛCDM) model. This unified fitting strategy avoids the circularity problem in GRB cosmology, in which adopting a fixed cosmological model for calibration can bias subsequent parameter inference, by allowing the data to self-consistently constrain both the GRB correlation and cosmology within a single statistical framework. 116 Fermi-GBM GRBs with known redshifts are utilized in combination with the pseudo-Redshift GRB sample, a combination with SNe Ia datasets from U2.1, Dark Energy Survey (DES), and Pantheon+SHOES is employed. This combined approach yields a consistent value for H_0 and Ω_Λ, indicating that GRBs with well-modeled pseudo-redshifts can serve as effective high-Redshift cosmological probes.

Authors: ALDOWMA, Tamador (Johannesburg University, Omdurman Islamic University); RAZZAQUE, Soebur

Presenter: ALDOWMA, Tamador (Johannesburg University, Omdurman Islamic University)

Session Classification: GRBs, FRBs & other Transients

Track Classification: GRBs, FRBs and other Transients

Contribution ID: **58** Type: **Contributed Talk**

A Fast Imaging Pipeline for Transient Detection in Interferometric Data

Wednesday 17 September 2025 10:20 (15 minutes)

Modern radio interferometers generate vast volumes of raw data, demanding efficient processing to enable real-time or quasi-real-time astronomical analysis. A critical challenge is the detection of transient sources within wide-field interferometric images, which requires rapid imaging and robust discrimination between true transients and false positives.

In this talk, we present a Fast Imaging Pipeline designed to address this challenge. The pipeline processes snapshot visibilities to construct images in (quasi) real time, identifies point sources in difference maps, and employs cluster analysis to distinguish genuine transients from artefacts. FITrig, a GPU-accelerated transient detector integrated into the pipeline, enables the detection of transients directly from dirty images as they are produced. Developed as part of the SKA Science Data Processor prototyping efforts, this pipeline optimises interferometric data processing in preparation for the upcoming SKA science operations. Our approach demonstrates a scalable solution for future large-scale radio surveys, balancing speed and accuracy for transient detection.

Author: STOLYAROV, Vladislav (University of Cambridge)

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Presenter: STOLYAROV, Vladislav (University of Cambridge)

Session Classification: Instrumentation

Track Classification: Instrumentation

Contribution ID: **59** Type: **Contributed Talk**

A Phase-Resolved Study of Bright Fermi-LAT Pulsars

Thursday 18 September 2025 14:00 (15 minutes)

Pulsars are rapidly rotating neutron stars that emit electromagnetic radiation over a broad energy band. The third pulsar catalogue (3PC) of the Fermi Large Area Telescope (LAT) contains more than 300 gamma-ray pulsars and pulsar candidates. However, phase-resolved spectroscopy has been performed on only a few of them, which was not sufficient to reveal new trends that could help constrain the pulsar emission mechanism. Our objective is to conduct a systematic study using phase-resolved spectroscopy on two samples (young and millisecond pulsars) using the recently released 3PC data in order to identify novel trends, such as a relationship between the spectrum' s hardness and the light curve peak brightness. The brightest candidates with a range of light curve profiles, spin-down power ranges, and radio pulse characteristics have been included in this sample. In this talk, we discuss our source selection, phase selection, analysis calibration, and preliminary spectral analysis results.

Author: Ms HAMED, Hend (North-West University)

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Presenter: Ms HAMED, Hend (North-West University)

Session Classification: Pulsars and Pulsar Wind Nebulae

Track Classification: Pulsar and Pulsar Wind Nebulae

Contribution ID: **60** Type: **Contributed Talk**

Dark matter search with a MeerKAT Pulsar Polarisation Array

Thursday 18 September 2025 13:30 (15 minutes)

The timing residuals of pulsar emissions have been used before to search for a stochastic Gravitational Wave Background (GWB), with several PTA collaborations recently reporting strong evidence for the Hellings and Downs correlation curve that would be characteristic of a GWB signal. In a similar manner, we analyse the polarisation data of a large population of pulsars observed with MeerKAT through the Thousand Pulsar Array programme, with the goal of finding evidence for the presence of an ultralight dark matter field within the Galaxy. This dark matter field, which would be composed of ultralight particles with mass around $\sim 10^{-22}$ eV, is predicted to couple to the electromagnetic field and have a birefringent dispersion relation, which ultimately results in the rotation of the polarisation angle (PA) of any linearly polarised light. Thus, by correlating the polarisation residual measurements from an array of pulsars, we should be able to distinguish a dark matter-related signal from other astrophysical sources of PA rotation. We present our current characterisation of the polarisation time series data and a set of new constraints on the coupling strength of the dark matter, which is the strongest in the current literature for the mass range of $\sim 10^{-23} - 10^{-21}$ eV.

Authors: Dr SARKIS, Michael (Stellenbosch University); Prof. MA, Yin-Zhe (Stellenbosch University); Dr YUWEN, Zi-Yan (Institute of Theoretical Physics (ITP), Chinese Academy of Sciences (CAS))

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Session Classification: Pulsars and Pulsar Wind Nebulae

Track Classification: Multi-Messenger Astrophysics and Astro-Particle Physics

Contribution ID: **61** Type: **Contributed Talk**

Astrophysical Neutrinos as Probes of Dark Matter around AGN

Thursday 18 September 2025 11:45 (15 minutes)

The fundamental nature of dark matter (DM), which constitutes a significant fraction of the universe's mass-energy budget, remains one of the foremost challenges in modern astrophysics and particle physics. Due to their weak interactions and cosmological origins, high-energy neutrinos serve as sensitive probes for potential neutrino-DM scattering processes. Specifically, dense accumulations of DM around supermassive black holes (known as DM spikes) in active galactic nuclei (AGN) are theorized to attenuate the neutrino flux emitted by these astrophysical sources. Recent IceCube observations of four point-like neutrino emitters, viz. TXS 0506+056, NGC 1068, PKS 1424+240 and NGC 4151, provide unprecedented opportunities to detect signatures of neutrino-DM interactions beyond conventional astrophysical explanations. In this work, we utilize publicly available IceCube data from these prominent sources to place stringent constraints on the neutrino-DM scattering cross-section, thereby advancing our understanding of potential dark matter signatures. We provide constraints on the neutrino-DM scattering cross-section from the individual sources, as well as from the stacking analysis, by combining the data from all sources.

Authors: Dr DIXIT, Khushboo (Centre for Astro-Particle Physics, University of Johannesburg); RAZZAQUE, Soebur; MOHLABENG, Gopolang (University of California, Irvine)

Presenter: Dr DIXIT, Khushboo (Centre for Astro-Particle Physics, University of Johannesburg)

Session Classification: Astroparticle & Other High-Energy Sources

Track Classification: Multi-Messenger Astrophysics and Astro-Particle Physics

Contribution ID: **62** Type: **Poster**

Refining the orbital solution of the gamma-ray binary LMC P3

Thursday 18 September 2025 15:10 (20 minutes)

Gamma-ray binaries are high-mass binary systems that emit predominantly in the high-energy and very-high-energy gamma-ray regimes. LMC P3 is the only known gamma-ray binary located outside our galaxy and consists of an O5,III companion star and a compact object with a mass in the range of a neutron star or a black hole. The leading theory is that all gamma-ray binaries contain a young, non-accreting pulsar, with the non-thermal emission produced in a shock which forms between the pulsar and the stellar wind. The gamma-ray light curves show that the emission from LMC P3 peaks around the phases of inferior and superior conjunction, at GeV and TeV energies respectively. However, the TeV peak occurs later than expected, even after accounting for gamma–gamma absorption. Refining the orbital solution for this source is crucial for understanding how very high energy emission is produced in this system. This motivated further observations with SALT–HRS to better constrain the phase of periastron. We present preliminary results of a refined orbital solution, which indicate a slightly more eccentric orbit and an earlier phase of periastron, and discuss how this will influence modelling of the very-high-energy emission.

Author: Mr QHWABE, Rick (University of the Free State)

Co-authors: Prof. VAN SOELEN, Brian (University of the Free State); Ms FISHER, Lalenthra (University of the Free State)

Presenter: Mr QHWABE, Rick (University of the Free State)

Session Classification: Poster Session

Track Classification: X-Ray and Gamma-Ray Binaries

Contribution ID: **63** Type: **Contributed Talk**

Angle-dependent and polarization-sensitive synchrotron and SSC blazar model

Wednesday 17 September 2025 14:30 (15 minutes)

Blazars, a subclass of radio-loud active galactic nuclei characterized by relativistic jets directed towards Earth, exhibit strongly linearly polarized emission and two broad, non-thermal spectral energy distributions (SEDs). These features are sensitive to various parameters, including the observer's viewing direction and the magnetic field orientation relative to the jet axis.

This talk presents a polarization-dependent synchrotron and synchrotron self-Compton (SSC) blazar model that accounts for arbitrary magnetic-field orientations and the viewing angle. Using this model, we simulate oblique and toroidal magnetic-field orientations and explore their effects on a generic blazar's SED and linear polarization degree (PD).

We show that the close alignment of the viewing direction and the magnetic field lines suppresses the synchrotron flux level, while leaving the SSC flux almost unaffected. However, both synchrotron and SSC polarization exhibit a pronounced dependence on the field orientation.

Authors: Prof. BOETTCHER, Markus (North-West University); TISANG, Motseothata

Presenter: TISANG, Motseothata

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **64** Type: **Contributed Talk**

Fast Radio Bursts as Tools for Astrophysics and Cosmology

Thursday 18 September 2025 09:00 (15 minutes)

Fast Radio Bursts (FRBs) are millisecond radio transients of extragalactic origin that have emerged as valuable tools for both astrophysics and cosmology. In this talk, I present recent advances on two complementary fronts: the use of machine learning techniques to classify FRB populations and the application of localized FRBs as model-independent probes of the cosmic expansion. These results illustrate the growing role of FRBs as versatile tools to investigate both their astrophysical nature and fundamental questions in cosmology.

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Presenter: FORTUNATO, Jéferson (University of Cape Town)

Session Classification: GRBs, FRBs & other Transients

Track Classification: GRBs, FRBs and other Transients

Contribution ID: **65** Type: **Contributed Talk**

Modelling Variability in the Emission and Polarization of Sub-Parsec Scale AGN Jets with 3D RMHD PLUTO Simulations

Wednesday 17 September 2025 16:15 (15 minutes)

Radio-loud active galactic nuclei (RLAGN) emit radiation across most of the electromagnetic spectrum. The lower-energy component (Radio - Soft X-rays) is typically dominated by synchrotron emission from non-thermal electrons in a relativistic jet. RLAGN are known to be highly variable on both short (intra-day) and long (months to years) timescales. Most of the variability observed in the optical and higher-energy regimes has been associated with sub-parsec to parsec scale emission regions located within the jet. In this study, we investigate the link between observations and the kinematics of the sub-parsec-scale relativistic jet using 3D relativistic magnetohydrodynamic (RMHD) simulations. The simulations employ a two-component jet model, consisting of a fast spine ($\Gamma = 10$) and a slower sheath ($\Gamma = 3$). The jet model features an initial helical magnetic field with a magnitude of 50 mG in the spine and 5 mG in the sheath. In order to simulate variability in the jet, a density perturbation is introduced at the jet inlet and allowed to evolve with time. The simulations are carried out using a modified version of the PLUTO code. To model the synchrotron emission, Lagrangian tracer particles, representing the non-thermal electron spectrum, are injected into the simulation. The spectral energy distribution of these particles are evolved over time to include effects from diffusive shock acceleration and radiative cooling. This is used to calculate the I, Q, and U Stokes parameters, for arbitrary lines of sight, accounting for relativistic transformations and light travel time. The Stokes parameters are used to reproduce simulated light curves of the flux, polarization degree and polarization angle.

Author: VAN DER WESTHUIZEN, Izak

Co-authors: Prof. VAIDYA, Bhargav (Indian Institute of Technology Indore); VAN SOELEN, Brian; Mr IMMELMAN, Reuben (University of the Free State)

Presenter: VAN DER WESTHUIZEN, Izak

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **66** Type: **Invited Talk**

What we can learn from a growing sample of Fast Radio Bursts

Thursday 18 September 2025 08:30 (30 minutes)

We will take a journey together beyond our galaxy to learn about Fast Radio Bursts, our attempts to discover thousands of them, the physics that drives them and how they teach us about the universe on local and large scales.

Author: Prof. WELTMAN, Amanda (University of Cape Town)

Presenter: Prof. WELTMAN, Amanda (University of Cape Town)

Session Classification: GRBs, FRBs & other Transients

Track Classification: GRBs, FRBs and other Transients

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

Exploring the Puzzling VHE Lightcurve of the Gamma-ray Binary LMC P3

Thursday 18 September 2025 15:10 (20 minutes)

Gamma-ray binaries are a rare class of high-mass binary systems where the peak of their spectral energy distribution occurs in the gamma-ray energy range. These systems have proven to be excellent laboratories for studying particle acceleration mechanisms. One such system is LMC P3, the most luminous gamma-ray binary discovered to date and, so far, the only one found outside the Milky Way. It is composed of an unknown compact object and an O5 III star, and is located in the Large Magellanic Cloud. LMC P3 exhibits an orbital period of 10.3 days and was initially discovered in Fermi-LAT data. The peak of the high-energy (HE; 100 MeV-100 GeV; phase 0) emission is near the superior conjunction of the compact object. H.E.S.S. subsequently reported the detection of very high-energy (VHE) gamma-ray emission during only 20% of the orbit, between orbital phases 0.2 and 0.4. This roughly corresponds to the inferior conjunction of the compact object and is in anti-phase with the Fermi-LAT light curve. However, using the existing orbital solution, a modelled inverse Compton light curve that is modulated only by gamma-gamma absorption, peaks earlier than the observed peak. In this work, we will present attempts to interpret the TeV light curve in the context of emission and absorption mechanisms and explore alterations to the orbital solution within error margins.

Authors: VAN SOELEN, Brian (University of the Free State); VAN SOELEN, Brian; KOMIN, Nukri (University of the Witwatersrand, Johannesburg, South Africa); QHWABE, Rick (University of the Free State)

Co-author: FISHER, Lalenthra (University of the Free State (UFS))

Presenter: FISHER, Lalenthra (University of the Free State (UFS))

Session Classification: Poster Session

Track Classification: X-Ray and Gamma-Ray Binaries

Contribution ID: **68** Type: **Invited Talk**

High-energy cosmic neutrinos, supermassive black holes, and gravitational lensing

Wednesday 17 September 2025 13:30 (30 minutes)

It is still unclear, where high-energy cosmic neutrinos (detected by IceCube, KM3Net, and other neutrino detectors) originate. Also, it is not clear, which physical processes dominate the emission mechanisms. Blazars seem to play a role but a detailed understanding is still lacking. We find signatures of gravitational lensing in three blazars - all of these three blazars have been reported as likely counterparts of high-energy cosmic neutrinos detected by the IceCube detector. Before, only two cases of strong gravitational lensing of blazar radiation were known. Gravitational lensing explains the extremely fast apparent speeds we discover, the traceable bending of jet structures with time, as well as the rapid flux-density variability of jet features. Although the neutrino-generating process is still not known, lensed blazars might play an important role in furthering our general understanding of the phenomenon.

Author: Dr BRITZEN, Silke (MPIFR)

Presenter: Dr BRITZEN, Silke (MPIFR)

Session Classification: AGN

Track Classification: Active Galactic Nuclei

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

Multi-Wavelength Blazar Modelling

Thursday 18 September 2025 15:10 (20 minutes)

Blazars, a subclass of active galactic nuclei with collimated jets of matter oriented at the observer, Earth. These jets produce radiation across the entire electromagnetic spectrum, in the form of two broad, non-thermal peaks. There are competing models capable of reproducing this radiation, which can be broadly categorised into two types: leptonic and lepto-hadronic, based on the exclusion or inclusion of protons in the jet, respectively. One effect that is sometimes neglected in hadronic models is the production of electron-positron pairs via the Bethe-Heitler process, whereby protons interact with photons to produce these pairs. These leptons, with their energy unrestricted by classical acceleration mechanisms, may therefore produce higher energy radiation. This radiation can relax constraints in the parameter space, a common problem faced by leptohadronic models.
This study involves the implementation of a recently published semi-analytical model for Bethe-Heitler pair production, which significantly reduces the computational cost of simulating this process. With this having been implemented, a pipeline is being written to fit blazar spectra to multi-wavelength observations, using the Gammapy Python package to perform joint fits on quasi-simultaneous observations using a full lepto-hadronic model. Currently, only ultraviolet, x-ray and γ-ray observations are supported, with archival flux points being used for lower energy observations.

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Presenter: ROBINSON, Joshua (North-West University)

Session Classification: Poster Session

Track Classification: Active Galactic Nuclei

Contribution ID: **70** Type: **Poster**

H.E.S.S. detection and multiwavelength study of the z ~ 1 blazar PKS 0346-27

Thursday 18 September 2025 15:10 (20 minutes)

We report the detection of a Low Synchrotron Peaked (LSP) blazar PKS 0346-27 at redshift 0.99 by the High Energy Stereoscopic System (H.E.S.S.) on 3rd November, 2021 with a significance above 5σ. The spectral energy distribution (SED) consists of the simultaneous observations by Fermi-LAT, Swift XRT/UVOT and ATOM during the H.E.S.S detection period while the multiwavelength light curve consists of all the observation period. The MWL light curve shows that a flare in high-energy (HE, E > 100 MeV) gamma-rays detected by Fermi-LAT preceded the H.E.S.S. detection by 2 days. A fit with a single-zone emission model to the contemporaneous spectral energy distribution during the detection night was possible with a proton-synchrotron-dominated hadronic model, requiring a proton-kinetic-energy-dominated jet power temporarily exceeding the source's Eddington limit, although alternative (e.g., multi-zone) models can not be ruled out. Due to strong EBL absorption at the VHE regime, the leptonic model couldn't provide a satisfactory fit.

Keywords: Galaxies: active, radiation mechanism: non-thermal- relativistic process, jets: quasars.

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Session Classification: Poster Session

Track Classification: Active Galactic Nuclei

Contribution ID: **72** Type: **Contributed Talk**

Blazar Variability and Time Lags at Millimetre Wavelengths: Insights from Metsähovi and ALMA Monitoring

Wednesday 17 September 2025 17:15 (15 minutes)

Blazars, a class of active galactic nuclei with relativistic jets oriented close to our line of sight, dominate the extragalactic γ-ray sky and are well known for their strong variability across the electromagnetic spectrum. Millimetre observations are of particular interest because they probe emission regions near the jet base, where high-energy flares are likely originating.

In this work, we present a variability study of the blazar 3C 279 using long-term light curves from Metsähovi (37 GHz) and ALMA Bands 3, 6, and 7 (84 to 345 GHz). We applied multiple time-series methods, including Interpolated Cross-Correlation Function (ICCF), Discrete Correlation Function / Z-transformed Discrete Correlation Function (DCF/ZDCF), Python Reverberation-mapping of Active galactic nuclei (PyROA), and Just Another Vehicle for Estimating Lags In Nuclei (JAVELIN), to search for time lags between frequencies. In many cases, we find the expected trend of higher-frequency emission leading the lower frequencies, consistent with opacity-driven delays in the jet. However, we also identify cases where this trend does not hold, suggesting a more complex emission geometry or additional variability drivers.

We further quantified the amplitude of variability through the fractional variability parameter ($F_{\rm var}$). Our results show a clear increase in $F_{\rm var}$ with observing frequency, rising from ˜0.29 at 37 GHz to ˜0.38 at 345 GHz, with intermediate values at 90 and 230 GHz. This trend indicates that the highest-frequency emission is the most variable, consistent with its origin closer to the central engine.

These results highlight the importance of dense, multi-frequency millimetre monitoring in constraining the connection between jet dynamics and high-energy emission. They also set the stage for the Africa Millimetre Telescope (AMT) to establish long-term blazar monitoring from the southern hemisphere.

Author: KATJAITA, Hiiko (University of Namibia)

Presenter: KATJAITA, Hiiko (University of Namibia)

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **73** Type: **Poster**

Namibian Astronomy: Exploiting Favorable Conditions for Multi-Wavelength Observatories

Thursday 18 September 2025 15:10 (20 minutes)

Namibia stands out as an exceptional location for astronomical research, offering pristine night skies and ideal observation conditions. Home to Africa's first International Dark Sky Reserve, the country boasts an arid climate with minimal rainfall, resulting in abundant cloudless nights perfect for extended viewing hours. This environment is ideal for facilities like the High Energy Stereoscopic System (H.E.S.S.). As the third least densely populated country globally, Namibia benefits from minimal light pollution, enhancing its appeal for astronomical endeavors. Recent studies have shown low radio frequency interference at proposed Africa Millimeter Telescope (AMT) sites, in-part highlighting Namibia's radio quietness. The country's low population density and minimal industrial activity contribute to reduced interference across various astronomical radio bands, creating versatile observing conditions.
Studies regarding the Night-sky brighness level as well as the levels radio frequency interference will be presented.

Authors: KATJAITA, Hiiko (University of Namibia); FRANS, Lott (University of Namibia); Prof. BACKES, Michael (University of Namibia)

Presenter: KATJAITA, Hiiko (University of Namibia)

Session Classification: Poster Session

Track Classification: Other High-Energy Sources

Contribution ID: **74** Type: **Contributed Talk**

Resolving acceleration to very high energies along the jet of Centaurus A, based on H.E.S.S. data from 2004 - 2016

Friday 19 September 2025 10:30 (15 minutes)

Centaurus A (Cen A), is the nearest known radio galaxy to Earth, and it is a significant source of γ-ray emission, offering an excellent opportunity to study high-energy astro-physical processes. The objective of this study is to investigate the particle acceleration to very high energies (VHE) along the jet of Cen A, using data from the High Energy Stereoscopic System (H.E.S.S.) collected between 2004 and 2016. The study reanalyzes
202 hours of previously published data with the aim of confirming the results published in 2020. The data were processed using the Paris Analysis software, which allowed for the generation of sky maps and theta-squared histograms to assess the γ-ray signal. Sky images of the detected γ-like events (ON map) and the background (OFF map), which were estimated using the ring background method, were produced in FITS format for the Sherpa morphology fitting process. The reanalysis of data collected between 2004 and 2016 from Cen A has confirmed a significant VHE γ-ray emission, consistent with earlier results, with a significance of 12.4σ. Furthermore, the elliptical Gaussian model fitting results confirm that the VHE γ-ray emission is elongated along the direction of the radio jet and not only in the very central region. The analysis framework lacked the implementation of new CT5 camera simulations, which restricted the use of data from the larger CT5 telescope. This limitation highlights the need for further improvements in the analysis software, which may allow future studies to provide further insight into the dynamics of Cen A's jet.

Author: Ms SIMON, Tuwilika (University of Namibia)

Co-authors: Mr SHAPOPI, Jimmy (University of Namibia); Prof. BACKES, Michael (University of Namibia)

Presenter: Ms SIMON, Tuwilika (University of Namibia)

Session Classification: AGN

Track Classification: Active Galactic Nuclei

Contribution ID: **75** Type: **Poster**

Prospects of the AMT single-dish science performance for monitoring AGN

Thursday 18 September 2025 15:10 (20 minutes)

Blazars make up the largest fraction of *Fermi*-LAT-detected sources of high-energy gamma-ray emission. At the same time, their emission is known to be highly variable throughout the electromagnetic spectrum. With hints of their highest fractional variability in the radio regime being present at the highest radio frequencies, monitoring blazars at mm-wavelengths shall be one of the key science programmes of the Africa Millimetre Telescope (AMT). Against this background, we study the expected science performance of the AMT based on a sample of 324 gamma-ray blazars with well-modelled spectral energy distributions, taking into account dependencies on likely telescope sizes and locations.

Authors: Prof. BACKES, Michael (University of Namibia); KATJAITA, Hiiko (University of Namibia)

Co-authors: FRANS, Lott (University of Namibia); Ms SHILUNGA, Sigrid (University of Namibia)

Presenter: Prof. BACKES, Michael (University of Namibia)

Session Classification: Poster Session

Track Classification: Instrumentation

Contribution ID: **76** Type: **not specified**

Welcome by Markus Böttcher on behalf of SA-GAMMA

Wednesday 17 September 2025 08:30 (5 minutes)

Presenter: BOETTCHER, Markus

Session Classification: Opening

Contribution ID: **77** Type: **not specified**

Remarks by Takalani Nemaungani on behalf of DSTI

Wednesday 17 September 2025 08:35 (5 minutes)

Session Classification: Opening

Contribution ID: **78** Type: **not specified**

Remarks by Angus Paterson on behalf of NRF

Wednesday 17 September 2025 08:40 (5 minutes)

Session Classification: Opening

Contribution ID: **79** Type: **not specified**

Remarks by Kulsum Kondiah on behalf of UJ Faculty of Science

Wednesday 17 September 2025 08:45 (5 minutes)

Session Classification: Opening

Contribution ID: **80** Type: **not specified**

Welcome by Soeb Razzaque on behalf of LOC/ host

Wednesday 17 September 2025 08:50 (5 minutes)

Presenter: RAZZAQUE, Soebur

Session Classification: Opening