Curriculum Vitae

Dr. Anu Kundu

anukundu02@yahoo.com

Gender: Female
Nationality: Indian

Personal Website
ORCID

Employment History

Jan 2023 – * **Senior Postdoctoral Researcher**
Centre for Space Research (CSR), North-West University (NWU), Potchefstroom, South Africa.

Aug 2020 – Dec 2022 **Postdoctoral Researcher**
Centre for Space Research (CSR), North-West University (NWU), Potchefstroom, South Africa.

Education

2015 – 2018 **Ph.D. in Astrophysics, Strasbourg Astronomical Observatory (ObAS), University of Strasbourg**
Thesis: *Contribution of multipolar electromagnetic fields to the radio and high-energy emission in pulsars.*

2012 – 2014 **M.Sc. Physics, Indian Institute of Technology (IIT) Roorkee**
CGPA : 8.412/10

2009 – 2012 **B.Sc. (Honours) Electronics, Hansraj College, University of Delhi**
CGPA : 8.566/10

Research Publications

Journal Articles

1. **Kundu**, **A.**, Joshi, J., Venter, C., & et al. (2024). Spatio-spectral-temporal Modelling of Two Young Pulsar Wind Nebulae. *in-prep.*
2. Caleb, M., Driessen, L. N., Gordon, A. C., Tejos, N., Bernales, L., Qiu, H., … Schussler, F. (2023). A sub-arcsec localised fast radio burst with a significant host galaxy dispersion measure contribution. *arXiv e-prints*, arXiv:2302.09754. doi:10.48550/arXiv.2302.09754. arXiv: 2302.09754 [astro-ph.HE]
3. **Kundu**, **A.**, & Pétri, J. (2017b). Pulsed emission from a rotating off-centred magnetic dipole in vacuum. *MNRAS*, *471*(3), 3359–3377. doi:10.1093/mnras/stx1711. arXiv: 1703.03576 [astro-ph.HE]

Conference Proceedings

1. Davids, H., Venter, C., Backes, M., Harding, A. K., & **Kundu**, **A.** (2023). Broadband Spectral Modelling of the Galactic Globular Cluster 47 Tucanae. (Vol. HEASA2022, p. 021). doi:10.22323/1.426.0021
2. Venter, C., Rensburg, C. V., & **Kundu**, **A.** (2021). Modelling Spatial and Temporal Emission Properties of the Young Pulsar Wind Nebula Kes 75. In *Proceedings of 37th international cosmic ray conference — pos (icrc2021)* (Vol. 395, p. 928). doi:10.22323/1.395.0928
3. **Kundu**, **A.**, & Pétri, J. (2017a). Pulsed emission from a rotating off-centred magnetic dipole in vacuum. In *Pns-2017: Iop proceedings* (Vol. 932, p. 012013). doi:10.1088/1742-6596/932/1/012013
4. **Kundu**, **A.**, & Pétri, J. (2016). Consequences of rotating off-centred dipolar electromagnetic field in vacuum around Pulsars. In *Sf2a-2016: Proceedings of the annual meeting of the french society of astronomy and astrophysics* (pp. 65–68). Retrieved from https://sf2a.eu/proceedings/2016/2016sf2a.conf..0065K.pdf

Collaboration Articles

1. Grover, H., Singha, J., Joshi, B. C., Arumugam, P., Gugercinoglu, E., Bandyopadhyay, D., … **Kundu, A.** (2023). *Confirmation of glitch event detected in PSR J1740-3015 using the upgraded Giant Metrewave Radio Telescope (uGMRT).* Retrieved from https://www.astronomerstelegram.org/?read=15851

2. Abdalla, H., Aharonian, F., Ait Benkhali, F., Angüner, E. O., Ashkar, H., Backes, M., … H. E. S. S. Collaboration. (2021). *H.E.S.S. Follow-up Observations of Binary Black Hole Coalescence Events during the Second and Third Gravitational-wave Observing Runs of Advanced LIGO and Advanced Virgo.* doi:10.3847/1538-4357/ac2e04. arXiv: 2112.08307 [astro-ph.HE]

3. H. E. S. S. Collaboration, Abdalla, H., Aharonian, F., Ait Benkhali, F., Angüner, E. O., Arcaro, C., … Żywucka, N. (2021). *LMC N132D: A mature supernova remnant with a power-law gamma-ray spectrum extending beyond 8 TeV.* doi:10.1051/0004-6361/202141486

4. Abdalla, H., Aharonian, F., Ait Benkhali, F., Angüner, E. O., Arcaro, C., Armand, C., … H. E. S. S. Collaboration. (2021). *Searching for TeV Gamma-Ray Emission from SGR 1935+2154 during Its 2020 X-Ray and Radio Bursting Phase.* doi:10.3847/1538-4357/ac0fe1. arXiv: 2110.00636 [astro-ph.HE]

5. Abdalla, H., Aharonian, F., Ait Benkhali, F., Angüner, E. O., Arcaro, C., Armand, C., … H. E. S. S. Collaboration. (2021). *Search for Dark Matter Annihilation Signals from Unidentified Fermi-LAT Objects with H.E.S.S.* doi:10.3847/1538-4357/abff59. arXiv: 2106.00551 [astro-ph.HE]

Past/Ongoing Research

Nov 2021 – * **Searching for persistent emission in Fast Radio Burst (FRB) host galaxies using MeerKAT.**
MeerKAT data for FRB's host galaxies is being processed, to look for persistent emission between different epochs, making use of the Oxkat software pipeline for imaging.

Oct 2021 – * **Monitoring High Glitch rate pulsars using uGMRT.**
Continual monitoring of a sample of pulsars has been ongoing since 2021 using uGMRT to detect new glitches and understand their physical significance on the internal composition of neutron stars.

July 2021 – * **Spatio-spectral-temporal Modelling of Two Young Pulsar Wind Nebulae.**
A multizone spatio-temporal pulsar wind nebula (PWN) model is applied to the morphological and spectral data over several epochs. The aim is to constrain the model parameters for Kes 75 and G21.5 by finding simultaneous reasonable fits for the multiwavelength radiation spectrum, X-ray surface brightness profile, photon spectral index in the X-ray energy range, and the PWN's expansion rate, to understand the spectral and spatio-temporal properties of PWNe.

Feb 2021 – * **Constraining the multipolar magnetic field of NICER Millisecond Pulsars.**
The multipolar magnetic field of neutron stars is invoked up to the octupole component, to model the hotspots on the surface of millisecond pulsar (MSP) PSR J0030+0451, by fitting the X-ray light curve data from NICER telescope. The ultimate aim is to provide solid physically-founded estimates for mass and radius to constrain the Equation of State of extreme matter, by applying the model to all NICER MSPs.

Aug 2020 – Oct 2022 **Fitting the high-energy spectra for the Vela pulsar and constraining the model parameters.**
A pulsar emission modelling code - which generates emission sky maps, light curves, and spectra, for pulsars, was used to model Vela pulsar's high-energy spectra. The project time also involved documenting the code, and acclimatizing it to be used on the local cluster computer resources for our group. It involved studying how to constrain the range of free parameters, and finding the best possible spectral fit.

Feb 2020 – Mar 2020 **Searching and timing analysis of pulsars using Giant Metrewave Radio Telescope (GMRT).**
An internship which focused on learning methods for searching and timing analysis of pulsars observed from the GMRT, using the software PRESTO.

Past/Ongoing Research (continued)

Oct 2015 – Sep 2018 — **Contribution of multipolar electromagnetic fields to the radio and high-energy emission in pulsars.**
PhD project under supervision of Dr. Jérôme Pétri. An off-centred rotating magnetic dipole was used to study the consequences of the offset field on the pulsar emission. A broadband spectrum of pulsar radiation was mapped out for different emission regions to study evolution of the pulse profile with frequency.

Dec 2014 –Jan 2015 — **Jupiter Image Processing Project by Amateur Astronomers Association Delhi (AAAD)**
As a part of the project, students and people from various backgrounds came together to process the real time images of Jupiter.

Jan 2014 – Apr 2014 — **Clustering in Atomic Nuclei.**
Masters project under supervision of Dr. P. Arumugam. Numerical technique to solve Schrödinger equation for several potentials was developed, and Relativistic Hartree Approach in Cartesian basis was used to show clustered states in various nuclei of Ne, C, O etc.

What massive Neutron Stars may reveal?
Masters seminar work under supervision of Dr. P. Arumugam. Neutron stars, pulsars, and life cycle of a star were studied in detail. The conclusions on exotic cores based on the observations of massive neutron stars were discussed.

May 2013 – Jul 2013 — **General Relativity and Structure Formation in the Universe.**
Summer internship under supervision of Dr. Harvinder Kaur Jassal. Basics of General Relativity and necessary mathematical formulations were studied, while developing an introductory base to Cosmology and structure formation in the universe.

Skills

Languages	English (Fluent), Hindi (Fluent), French (Basic).
Programming	C++, C, FORTRAN, Python, Mathematica, MATLAB, Intel 8085.
Platforms	Windows, Linux, WSL, MobaXterm.
Applications/Miscellaneous	LaTeX, Microsoft Office, Zotero, GNU, MPI, HPC.

Teaching Experience

2023 — Assisting in Master's student supervision for a project titled *'Searching for pulsars in the Large Magellanic Cloud with MeerKAT.'*

Co-supervised Honours student project related to *'Observations and modelling of pulsars'*.

2022 — Co-supervised Honours student project titled *'Searching for pulsars and FRBs in a nearby galaxy using MeerKAT data.'*

2021 — Co-supervised Honours student project titled *'Understanding the shape of the high-energy tail of the Vela pulsar's spectrum.'*

2020 — Co-supervised Honours student project titled *'Modelling High-Energy Light Curves and Spectra from Pulsars.'*

2020 – 2023 — Assisting in PhD student's supervision for a project titled *'Phase-resolved spectroscopy of Fermi Millisecond Pulsars'*.

Taught 3rd-year NWU physics practical consecutively for three years and assisted in the fourth year.

Talks & Seminars

Invited talks

Feb 2020 — *Consequences of off-centred dipole for pulsars*, National Centre for Radio Astrophysics (NCRA), Pune, India.

Jul 2019 — *Contribution of multipolar electromagnetic fields to the radio and high energy emission of pulsars*, Center for Astrophysical Research of Lyon (CRAL), Lyon, France

Contributed talks

Oct 2023 — *Multipolar magnetic field of NICER millisecond pulsars*, GRASP (*Gravitational Radiation and Science with Pulsars*) monthly meetings, Virtual.

Sep 2023 — *Modelling the multipolar magnetic field of NICER MSP J0030+0451*, High Energy Astrophysics in Southern Africa (HEASA), Mtunzini, South Africa.

Jul 2023 — *Retarded multipolar magnetic field constraints for MSP J0030+0451*, European Astronomical Society Annual Meeting (EAS 2023), Krakow, Poland.

May 2023 — *Multipolar magnetic field of NICER MSPs*, High-energy Astrophysics Group meetings, CSR, NWU.

Oct 2022 — *Constraining the multipolar magnetic field of MSP J0030+0451 via NICER X-ray light curve fitting*, Tenth International Fermi Symposium, Johannesburg, South Africa.

Sep 2022 — *Constraining the multipolar magnetic field of MSP J0030+0451 via NICER X-ray light curve fitting*, 12-minute oral, HEASA 2022, Bloemfontein, South Africa.

Constraining the multipolar magnetic field of MSP J0030+0451 via NICER X-ray light curve fitting, 31st Texas Symposium on Relativistic Astrophysics, Prague, Czech Republic.

Jul 2022 — *Constraining the multipolar magnetic field of MSP J0030+0451 via X-ray light curve fitting*, 66th Annual Conference of the South African Institute of Physics (SAIP) 2022, Virtual.

Jun 2022 — *Constraining multipolar magnetic field of MSP J0030+0451*, High-energy Astrophysics Group meetings, CSR, NWU.

Dec 2021 — *Multipolar magnetic field of pulsars*, High-energy Astrophysics Group meetings, CSR, NWU.

Sep 2021 — *Constraining the magnetic field geometry of millisecond pulsar PSR J0030+0451 using NICER and Fermi data*, HEASA, Virtual.

Jul 2021 — *Constraining the magnetic field geometry of millisecond pulsar PSR J0030+0451 using NICER and Fermi data*, SAIP, Virtual.

Apr 2021 — *Constraining properties of millisecond pulsars using NICER data*, High-energy Astrophysics Group meetings, CSR, NWU, Virtual.

Sep 2020 — *Consequences of off-centred dipole for pulsars*, High-energy Astrophysics Group meetings, CSR, NWU, Virtual.

Jun 2020 — *Contribution of multipolar electromagnetic fields to the radio and high energy emission of pulsars*, Neutron Star Telecons, Virtual.

May 2020 — *Contribution of multipolar electromagnetic fields to the radio and high energy emission of pulsars*, Group meetings, Virtual.

Apr 2018 — *Understanding pulsar emission considering a rotating off-centred dipole*, Astro lunch meeting at Strasbourg Astronomical Observatory, Strasbourg, France.

Nov 2017 — *The mysterious dead stars: Pulsars*, The Congress of the Doctoral School 182, Strasbourg, France.

Electrodynamics of the pulsar magnetosphere: equilibrium, re-connection, emission, The National Research Agency Day (ANR), Paris, France.

Jul 2017 — *Pulsed emission from a rotating off-centred magnetic dipole in vacuum*, International Conference Physics of Neutron Stars (PNS), St. Petersburg, Russia.

May 2017 — *Pulsed emission from a rotating off-centred magnetic dipole in vacuum*, Workshop Neutron stars and their environments (MODE-SNR-PWN), Caen, France.

Apr 2017 — *Pulsed emission from a rotating off-centred dipole in vacuum*, Journal Club meeting at Strasbourg Astronomical Observatory, Strasbourg, France.

Talks & Seminars (continued)

Nov 2016 — *Pulsar population distribution using ATNF and FERMI-LAT catalogue*, ASTERICS Virtual Observatory (VO) School, Strasbourg, France.

Jun 2016 — *Consequences of Off-Centred Dipolar Electromagnetic Field around Pulsars*, French Astrophysics Week (SF2A), Lyon, France.

Poster Presentation

Sep 2023 — *Spatio-temporal Modelling of Young Pulsar Wind Nebulae*, HEASA 2023, Mtunzini, South-Africa.

Apr 2018 — *Understanding pulsar emission considering a rotating off-centred dipole*, European Week of Astronomy and Space Science (EWASS), Liverpool, England.

Jul 2017 — *Pulsed emission from a rotating off-centred magnetic dipole in vacuum*, 1st Institute of Space Sciences Summer School : Neutron Stars and their Environments, Barcelona, Spain.

May 2016 — *Consequences of Off-Centred Dipolar Electromagnetic Field around Pulsars*, International School of Computational Astrophysics, Les Houches, France.

Conferences

Sep 2023 — HEASA 2023, Mtunzini, South-Africa.

Jul 2023 — European Astronomical Society Annual Meeting 2023 (EAS 2023), Krakow, Poland.

Oct 2022 — Tenth International Fermi Symposium, Johannesburg, South Africa.

Sep 2022 — HEASA 2022, Bloemfontein, South-Africa.

— 31st Texas Symposium on Relativistic Astrophysics, Prague, Czech Republic.

Jul 2022 — 66th Annual Conference of the South African Institute of Physics (SAIP) 2022, Virtual.

Sep 2021 — HEASA 2021, Virtual

Jul 2021 — FRB 2021, Virtual.

— 65th Annual Conference of the South African Institute of Physics (SAIP) 2021, Virtual.

— 37th International Cosmic Ray Conference (ICRC), Virtual.

Jun 2021 — European Astronomical Society Annual Meeting, Virtual.

Mar 2021 — Virtual SKA Science Conference: A precursor view of the SKA Sky, Virtual.

Feb 2021 — PHAROS WG1+WG2 Workshop: neutron star equations of state and transport properties, Virtual.

Mar 2021 — Ninth International Fermi Symposium, Virtual.

Oct 2020 — Understanding the Most Energetic Cosmic Accelerators: Advances in Theory and Simulation, Princeton Centre for Theoretical Science (PCTS), Virtual.

Apr 2018 — European Week of Astronomy and Space Science (EWASS), Liverpool, England.

Jul 2017 — International Conference Physics of Neutron Stars (PNS), St Petersburg, Russia.

Jun 2016 — French Astrophysics Week (SF2A), Lyon, France.

Schools/Workshops/Meetings

Sept 2023 — Pulsar Timing Workshop, NWU, Potchefstroom, South Africa.

Aug 2022 — NICER Summer 2022 Proposal and Science Workshop, Virtual.

Nov 2021 — H.E.S.S. (High Energy Stereoscopic System) 2021 Nov virtual collaboration meeting, Virtual.

Sep 2021 — ILIFU Cloud computing for data-intensive research: Training sessions, Virtual.

Aug 2021 — Fermi collaboration meeting, Virtual.

Jun 2021 — Summer School in Statistics for Astronomers XVI, Virtual.

Schools/Workshops/Meetings (continued)

- 2021 African Radio Interferometry Winter School, Virtual.
- Radio interferometry data reduction training, Virtual.

Apr 2021
- H.E.S.S. 2021 April virtual collaboration meeting, Virtual.

Mar 2021
- Fermi collaboration meeting, Virtual.
- H.E.S.S. School - Standalone session, Virtual.

Nov 2020
- 1st H.E.S.S. Analysis school, Virtual.
- H.E.S.S. 2020 Autumn Collaboration Meeting, Virtual.

May 2019
- Data mining, machine learning and deep learning school, Strasbourg, France.

Nov 2017
- The Congress of the Doctoral School 182, Strasbourg, France.
- The National Research Agency Day (ANR), Paris, France.

Jul 2017
- 1st Institute of Space Sciences Summer School : Neutron Stars and their Environments, Barcelona, Spain.

May 2017
- Workshop on Neutron stars and their environments (MODE-SNR-PWN), Caen, France.

Nov 2016
- ASTERICS Virtual Observatory (VO) School, Strasbourg, France.

May 2016
- International School of Computational Astrophysics, Les Houches, France.

Research Visits

Feb 2020 – Mar 2020
- Visited National Centre for Radio Astrophysics (NCRA), Pune, India, for an internship which focused on learning methods for searching and timing analysis of pulsars observed from the GMRT, using the software PRESTO.

Dec 2014
- Visited NCRA and the GMRT site, Pune, India. The purpose of the visit was to discuss potential research work at NCRA, and get acquainted with the real time telescope data analysis.

Organization and Outreach

2023
- Presented a talk on the topic *Pulsars: Their Size and Multipolar Magnetic Fields* for the *NWU Research Open Day and Student Career Workshop* targeted at students from undergraduate to postgraduate level.
- Volunteered to be a day-shifter for H.E.S.S. telescope collaboration, involving the task of monitoring data for every night's observation for a month and reporting any issues.
- Worked as Local Organization Committee (LOC) member for the workshop *X-VISION 2023: X-ray Vision of the Energetic Universe*, Potchefstroom, South Africa.

2022-2023
- Worked towards outreach efforts to go to South African schools. The aim was to make students aware of the paths to a career in astronomy and provide an amateur introduction to the field.

2016
- Organized the conference titled *A peek into the Council of Europe* at Collège Doctoral Européen, University of Strasboug, Strasbourg, France.

Miscellaneous

Awards and Achievements

2017
- Won first prize for presentation skills for a talk titled *The mysterious dead stars: Pulsars*, The Congress of the Doctoral School 182, Strasbourg, France.

2015
- Achieved All India Rank (AIR) 38 in Physics in Graduate Aptitude Test in Engineering (GATE).

2013
- Was selected as a summer intern by Indian Academy of Sciences (IAS).

2012
- Scored AIR 167 in Physics and AIR 25 in Geophysics in IIT-JAM (Indian Institutes of Technology - Joint Admission Test for Masters).

2009-2012
- Received merit scholarship from the Central Board of Secondary Education (CBSE) during graduation.

Miscellaneous (continued)

2009 — Was listed in Extended Merit List in IIT-JEE (IIT - Joint Entrance Examination).

Other participations

2021 – * — Member of Fermi collaboration.

2020 – * — Member of H.E.S.S. collaboration.

Regularly attending monthly online meetings: GRASP (*Gravitational Radiation and Science with Pulsars*).

Regularly attending monthly online seminar series: SPINS-UK (*Science Possibilities Investigating Neutron Stars in the UK*).

2020 – 2022 — Regularly attended weekly online Neutron Star Telecons.

2016 – 2018 — *International PhD students association:* Active member of Association of doctoral candidates and doctors of Alsace - ADDAL.

2015 – 2018 — *International PhD students association:* Active member of Strasbourg Association of International Researchers - StrasAIR.

International Doctoral Program (PDI): Participated actively in the University of Strasbourg PDI program.

2014 – 2015 — *Amateur Astronomers Association Delhi (AAAD):* Participated actively in the amateur gatherings and projects organized by AAAD, New Delhi.