Rajapandi Nadar

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Research Interests

- Millisecond pulsars and compact binary systems
- X-ray and radio timing/spectral analysis
- Multi-wavelength studies of compact objects
- Gravitational wave astrophysics

Education

St. Xavier's Empowered Autonomous Institute Mumbai — **University Of Mumbai**
Msc. Physics(Astrophysics), Mumbai — *2023–2025*
CGPA : 8.75/10.00

St. Xavier's (Autonomous) College Mumbai — **University of Mumbai**
Bachelor of Science Physics Major, Mumbai — *2019–2022*
CGPA : 8.71/10.00

Research Experience

Tata Institute of Fundamental Research — **July 2025 - Present**
Research Project, Supervisor: Prof. Achamveedu Gopakumar — *Mumbai, India*
- Analyzing the timing properties of millisecond pulsars (MSPs) using archival X-ray data
- Investigating long-term variations in binary system parameters

St. Xavier's College(Empowered Autonomous) — **Feb 2025 - Present**
Research Project, Supervisor: Dr. Manojendu Choudhury — *Mumbai, India*
- My role is to look for the correlation between different spectral parameters
- Performing Spectral and Temporal analysis on 4U 1630-47
- Working with 3 other collaborators

St. Xavier's College(Empowered Autonomous) — **Nov 2024 - April 2025**
Master's Thesis, Supervisor: Dr. Manojendu Choudhury — *Mumbai, India*
- Analyzed 238 observations of `RXTE-PCA` data for the neutron star `SAX J1808.4-3658`
- Performed spectral and lightcurve analysis to study fast X-ray bursts

Short Project

Molecular Line Analysis of IRC+10216: Analyzed VLA spectral line data of the carbon star IRC+10216 using CASA and CARTA to identify and characterize HC_3N and SiS molecular transitions.

X-ray Spectral Analysis of SAX J1808.4–3658: Performed X-ray spectral analysis using `SWIFT-XRT` data to study flux evolution during the 2015 outburst of the accreting millisecond pulsar SAX J1808.4–3658.

Binary Evolution of Accreting MSPs: Simulated the evolutionary history of accretion-powered millisecond pulsars using MESA; focused on mass transfer dynamics, spin-up processes, and binary parameter evolution.

Horn Antenna Sensitivity for the H_I Line: Explored the sensitivity of a primordial Horn antenna setup to detect the 21-cm hydrogen line, with emphasis on system design and signal limitations.

Spectroscopic Study of Quasar Absorption Lines: Carried out spectroscopic analysis of quasar absorption features to estimate metal abundances and trace chemical enrichment of the intergalactic medium.

Gravitational Lens Modeling with PyAutoLens: Used PyAutoLens to model strong gravitational lenses; applied Sersic profile fitting to reconstruct lensed sources and constrain the mass distribution of foreground galaxies.

Determination of the Astronomical Unit (AU): Undergraduate thesis project estimating the AU using the Venus transit method and geometric triangulation.

Lunar Distance Estimation via Image Processing: Calculated lunar distance by processing images captured with a Canon EOS 200D; used angular size variations and reference baselines for estimation.

Internships

Generating Images in Bulk using the NASA SkyView
Assignment for project position, IIT Bombay
- The Assignment is for getting selected for collaborate with Sarvesh Gharat(IITB) and Prof. Gopal Bhatta(University of Zielona Góra)
- Learning of the ML technique for image classification algorithm
- The project used CNN for image identification of galaxies based of morphology

Conferences

Astronomical Society of India 2024 annual meeting: Selected for a poster presentation at the annual meeting of the Astronomical Society of India (ASI) for my project titled "A Simple Method to Calculate Lunar Distance Using a Camera."

Workshops

Open Data Workshop 2024:
- Gained hands-on experience in data analysis and the use of statistics in astrophysics
- Strengthened foundational skills in gravitational-wave data interpretation through expert-led sessions and practical exercises

Analysis and Statistical Modelling of Space Science Data:
- I have gained deeper insight about statistical approach of data analysis
- Hands-on experience on working with the `FERMI/LAT` data and extraction of the SED
- Insights about the X-ray / Gamma - ray instrumentation

Teaching Experience

Royal college of Arts, Science and Commerce **August 2025 - present**
Assistant Professor, Mira Road, Thane, India *Thane, India*
- Conducting the lectures and practical for under graduate level batches

Unblok - Online Education Platform **Jan 2023 - present**
Physics Teacher, Remote *Karnataka, India*
- Teaching physics to CBSE 12^{th} grade
- Teaching physics to GCSE level students

Ajay Tutorials **Jun 2022 - Spet 2023**
Physics Teacher, Andheri, Mumbai, India *Mumbai, India*
- Teaching physics to Maharashtra State Board 12^{th} grade
- Preparing the Students for the National and State level Examinations(JEE, NEET, MH-CET..)

Extracurricular activities / Volunteering Experience

Discussion Club **Aug 2023 - Sept 2024**
Founder, coordinator
- Select research articles and discuss with the fellows
- Focus on different methodology used for research in Astrophysics

Cosmic Fest **April 2024**
Mentor *S-Matrix, Mumbai*

Shiksha Sambal Programme **May 2023 - June 2023**
Science Teacher *Vidya Bhawan, Rajasthan*
- Teaching science for 10^{th} students
- Volunteering in extra-curricular activities sessions

Presentation and Posters

Determining Lunar Distance Using Image Processing — **Poster Presentation**
Science Day at St. Xavier's College — *Feb 2025*

Molecular spectral line analysis of Carbon Star IRC+10216 — **Poster Presentation**
Probe (*10^{th} Physics Student Research Seminar, St. Xavier's College* — *Feb 2025*

Determining Lunar Distance Using Image Processing — **Poster Presentation**
Avishkar Research Convention , University of Mumbai — *Dec 2024*

Acceleration due to gravity (Using the free fall motion of a body) — **Experiment Presentation**
Jigyasa (*Annual Exhibition*), *St. Xavier's College* — *Sept 2024*

Studying alpha decay with Quantum tunneling — **Poster Presentation**
Probe (*9^{th} Physics Student Research Seminar, St. Xavier's College* — *Feb 2024*

The Popcorn Problem — **Oral Presentation**
Probe (*7^{th} Physics Student Research Seminar, St. Xavier's College* — *Feb 2022*

Skills and Miscellaneous

Programming: Python | Wolfram Mathematica

Technical Skills: Bayesian inference | Basic Machine learning

Python Modules: bilby | stingray | Astropy | einsteinpy | pyraf | PyAutoLens | PyTorch | Fermi/Fermipy | Sherpa | NICERsoft | PINT

Markup: LaTeX | HTML

Softwares: HEASARC | CASA | CARTA | MESA

Operating System: Fedora | Mac | Ubuntu | Windows

Referees

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