

# PRIYABRATA JENA

*M.Sc. in Physics · IIT Mandi · Aspiring Researcher in Astrophysics*

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## RESEARCH INTERESTS

*Compact objects (neutron stars, white dwarfs) · Relativistic stellar structure · Equation of State of dense nuclear matter · General Relativity & gravitational physics · Computational Astrophysics*

## EDUCATION

### M.Sc. in Physics

2024 – 2026

*Indian Institute of Technology (IIT) Mandi, Himachal Pradesh, India*

*Relevant Coursework:* General Relativity, Theoretical Particle Physics, Classical Mechanics, Electromagnetic Theory, Quantum Mechanics, Statistical Mechanics, Mathematical Physics, Computational Methods.

### B.Sc. in Physics (Honours)

2021 – 2024

*Bhadrak Autonomous College, Bhadrak, Odisha*

## RESEARCH EXPERIENCE

### Tolman–Oppenheimer–Volkoff (TOV) Equation

2026 – Present

*Independent Study*

- Derived the TOV equation from Einstein field equations and numerically solve using python and compute neutron star mass-radius relation.

### Lane–Emden Equation and Polytropic Stellar Models

2025

*Independent Study*

- Derived and analytically, numerically solved the Lane–Emden equation for polytropic indices  $n = 0, 1, 1.5, 3, 5$ . Then analyzed mass–radius relations.

### Electronic Structure of $\text{LaSrMnO}_3$ and $\text{SrCaRu}_2\text{O}_6$

2025–2026

*First-Principles Computational Study | IIT Mandi*

- Performed electronic structure calculations using the PGP and PGP-2 computational frameworks.
- Analyzed electronic band structures, density of states, and magnetic properties of perovskite oxides.

### Entangled Photon Generation from Quantum Dots

2025

*Theoretical Study | IIT Mandi*

- Studied quantum dot systems as sources of polarization-entangled photon pairs from biexciton cascade process.

### Unitarity Fermi Gas

2025

*Theoretical Study*

- Investigated strongly interacting fermionic systems near the unitary limit where the scattering

length diverges and Studied universal thermodynamic properties and the Bertsch parameter governing the universal equation of state.

**A study of Complex Potential Well**

2024

*Theoretical and Numerical Study*

- Analyzed quantum mechanical bound states and scattering resonances in non-Hermitian complex potentials.

**Frustrated Magnetism in Correlated Spin Systems**

2024

*Course Project | IIT Mandi*

- Studied competing spin interactions and geometrically frustrated lattice systems. Refinement of LiCoVO<sub>3</sub> and SmAlGe using XRD data.

**TECHNICAL SKILLS**

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**Programming Languages:** Python, C++

**Scientific Computing:** Mathematica

**Numerical Methods:** Numerical Integration, Numerical Differentiation, Linear Algebra, finite difference methods

**Computational Physics:** Basic Density Functional Theory (DFT); experience with HPC cluster environments

**Document Preparation:** L<sup>A</sup>T<sub>E</sub>X (proficient)

**Operating System:** Linux (Ubuntu/Mint)

**Version Control:** Git (basic)

**Web Technologies:** HTML (basic)

**STANDARDIZED TESTS & QUALIFICATIONS**

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**Joint Admission Test for M.Sc. (JAM) — Physics**

2024

Qualified and secured admission to the M.Sc. Physics program at IIT Mandi through a competitive national examination.

**ACADEMIC ACTIVITIES**

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- Regular participant in departmental seminars and colloquia at IIT Mandi covering high-energy astrophysics and condensed matter physics.
- Pursuing self-directed advanced study in relativistic astrophysics, compact object physics, and neutron star theory beyond the formal curriculum.
- Actively engaging with current literature on neutron star equations of state and gravitational wave astrophysics in preparation for doctoral research.

**LANGUAGES**

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**Spoken Languages:** Odia (native), Hindi (fluent), English (professional proficiency)