Garvit Sonawala

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Research Interests

Theoretical astrophysics and particle cosmology, with a focus on early-Universe physics, dark matter phenomenology, high-energy theory, and gravitational-wave cosmology. My interests lie in developing and analyzing theoretical models of cosmic and particle phenomena, using computational and machine-learning techniques as tools for simulation, inference, and data analysis, while keeping the primary emphasis on advancing the underlying physical theory.

Education

Indian Institute of Science Education and Research (IISER) Thiruvananthapuram *2022 – 2027*
BS–MS (Integrated) in Physics *CGPA: 7.8*

Indian Institute of Technology Madras *2023 – Present*
BS in Data Science *CGPA: 8.21*

Delhi Public School, Varanasi *2020 – 2021*
CBSE Class XII *Percentage: 92.4*

Work Experience

Student Intern, Tata Institute of Fundamental Research (TIFR), Mumbai *May 2025 – Present*
Supervisor: Dr. Achamveedu Gopakumar
Developed gravitational-wave detection models for circular SMBHBs using 12-year PTA residuals (0PN–2PN). Implemented CNN, RNN, and Bayesian NNs for waveform classification and chirp-mass estimation at low SNR.

Student Intern, Indian Institute of Technology Guwahati (IITG) *Jul 2024 – Sep 2024*
Supervisor: Dr. Subhaditya Bhattacharya
Modeled the time evolution of dark-matter relic density via the Boltzmann equation. Explored astrophysical evidence to compare theoretical predictions with observational data.

Student Intern, IISER Thiruvananthapuram *Aug 2023 – Jul 2024*
Supervisor: Dr. Bindusar Sahoo
Reading project on Special Relativity, studied spacetime formulation, Lorentz transformations, and four-vector dynamics under guided supervision.

Presentations

Exploring Dark Matter Freeze-Out *ANVESHA 2024, IISER Thiruvananthapuram*
Poster presentation based on my internship work, illustrating dark matter's cosmological significance, freeze-out behavior, and observational evidence.

Technical Skills

Programming:	Python, Java, SQL
Libraries / Tools:	NumPy, Pandas, Matplotlib, Jupyter, PyTorch, scikit-learn, Git, LaTeX
Machine Learning:	CNN, RNN, Bayesian Neural Networks, supervised & unsupervised learning, regression, clustering
Database / Web:	MySQL, PostgreSQL, Flask, SQLAlchemy

Volunteering & Leadership

Core Committee Member, PSIT Physics Society, IISER TVM *Aug 2024 – Present*
Managing sponsorships, event logistics, merchandise, and content creation for departmental and outreach activities.

Relevant Coursework

Physics: Classical Mechanics, Quantum Mechanics I, Electrodynamics, Statistical Mechanics, Thermodynamics, Optics, Special Relativity, Quantum Mechanics II *(in progress)*, General Relativity *(in progress)*, Nuclear & Particle Physics *(in progress)*, Astrophysics *(in progress)*

Mathematics: Linear Algebra, Multivariable Calculus, Probability & Statistics

Programming / Data Science: Data Structures & Algorithms, Machine Learning, Data Analysis & Visualization, Database Management Systems