Swaraj Pradhan
Curriculum Vitæ

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Research Interests

Cosmology and Structure Formation, Black Holes, Neutron Stars, Cosmological Bounces, Computational Cosmology and Astrophysics, Numerical Hydrodynamics, Explosions

Education

Indian Institute of Science Education and Research (IISER) — Kolkata
BS-MS Dual Degree in Physical Sciences — August 2019 – May 2024
CGPA: *8.28* *(BS: 8, MS: 9.5)* — Certificate Transcripts

Sri Prakash Synergy School — Peddapuram
Intermediate, CBSE AISSCE — May 2017 – May 2019
Percentage: *93.2%* — Certificate

Sri Prakash Synergy School — Peddapuram
High School, CBSE AISSE — March 2016 – April 2017
CGPA: *10.0* — Certificate

Research Experience

MS Thesis Project — August 2023 – May 2024
Title: 'Black Hole Universe: An alternate model for the expansion of the Universe'
Supervisor: *Prof.* Enrique Gaztañaga (ICG Portsmouth and ICE Barcelona)
Co-supervisor: *Prof.* Michael Gabler (University of Valencia)

- Ran numerical simulations of collapse of very large low-density FLRW clouds (using Castro) for both pressureless and non-zero pressure scenarios to explore various possibilities that might lead to the formation of a black hole and successive bounce back inside its Schwarzschild radius.

Summer Research Internship — June 2022 – July 2022
Title: 'Modeling condensation in the life support system of spacecrafts'
Supervisor: *Prof.* Akhilesh Tiwari (IIIT, Allahabad)

- Developed a numerical code to model the condensation on the walls and analysed how the condensation mass flux varies when we vary different parameters such as ambient temperature, relative humidity, surface temperature of the wall, etc.

Publications

Journal Articles (submitted to MNRAS)

- ***Pradhan, S.***, *Gabler, M., and Gaztanaga, E. (2024). Cold Collapse and Bounce of a FLRW Cloud. Preprint arXiv:2410.06785*

Coursework Projects

Independent Study Project August 2023 – December 2023
Topic: 'Studying CMB Anisotropies'

Space Astronomy Project January 2023 – May 2023
Topic: 'Analysis of LIGO-VIRGO data from the first gravitational wave detection (GW150914 event)'

Magneto-Hydrodynamics Project January 2023 – May 2023
Topic: 'Simulating the motion of charged particles in uniform and dipolar magnetic fields and studying their trajectories'

Science Outreach Project August 2022 – December 2022
Topic: 'Making a science communication video on the lifecycle of stars'

Non Linear Dynamics Project August 2022 – December 2022
Topic: 'Studying a 3 species predator-prey model with hierarchy in food chain using numerical simulations'

Workshops

Workshop on Computational Astrophysics and HPC with PLUTO code
Organizer: Indian Institute of Science (IISc), Bangalore July 2023

Qiskit Global Summer School 2022: Quantum Simulations
Organizer: IBM Quantum July 2022

Skills

Programming
Languages: python, C, basics of C++/FORTRAN
Codes Used: PLUTO, SPriBHoS, Castro

Softwares
LINUX, MPI, MATLAB, PyCharm, Anaconda, GNUPLOT, yt, Git, Arduino, MS/Libre Office, LaTeX, Inkscape, Canva, DaVinci Resolve, Blender

Languages
English (C1 Proficiency), Odia (Native), Hindi (Bilingual proficiency)

Certifications

IELTS Academic Certificate
Band Score: *8 (R:9, L:8.5, W:7, S:7)* September 2023 – September 2025

Other Interests

DIY Projects, making animations of physical/mathematical phenomena using Python's visual libraries, digital art, watching Sci-Fi movies, writing poems and stories, listening to songs, playing football and badminton