BHAVYA JAISWAL

4th Year BS-MS Student
Department of Physics
Indian Institute of Technology, Kanpur

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Education

2021-2026	**BS-MS Physics**, Indian Institue of Technology Kanpur
2021	**Class 12**, St. Marys Convent Inter College, Prayagraj
2019	**Class 10**, St. Marys Convent Inter College, Prayagraj

Research Interests

High Energy Physics, Quantum Field Theory, String Theory, Cosmology and Astrophysics, with an interest in exploring other areas of theoretical physics too.

Research Experience

Neutrinos in Cosmology *May 2024- ongoing*
Prof. Debtosh Chowdhury, Dept. of Physics, IIT Kanpur

- Conducted in-depth research on neutrinos in cosmology, focusing on their mass bound (including the neutrino mass bounds from the recent **DESI survey**) and their effects on structure formation.
- Studied the **Boltzmann equation** to model the cosmological evolution of particles, including neutrinos and **WIMPs**.
- Deriving the observed value of N_{eff} for neutrinos (from recent DESI data) and developing computational models to connect theoretical predictions with observational data.

Large Scale Structure Formation in the Universe *May 2023- July 2023*
Prof. Sharvari Nadkarni Ghosh, SPASE Dept., IIT Kanpur

- Engaged in rigorous study on **21 cm Cosmology** and the various techniques used in **N-body Simulations**.
- Studied literature on **Non-Linear DVDR**, **EDE** and **ΛCDM** models of the universe.
- Studied about the basics of **Radio Astronomy**.

Projects

Molecular Optomechanics in Anharmonic Cavity-QED Regime (Course Project) 6^{th} *Semester*
Prof. Shilpi Gupta, Dept. of Electrical Engineering, IIT Kanpur

- Studied molecular optomechanics in hybrid metal-dielectric cavity system under **strong coupling** conditions.
- Simulated cavity-emitted spectra and vibrational dynamics using QuTip.
- Studied the Hamiltonian, **Dressed states**, and eigenenergies of a strongly coupled system, deriving and implementing the **Master Equation** for numerical calculations.

Level Attraction in Coupled Pendulums (Lab Course Project) 5^{th} *Semester*
Prof. Krishnacharya, Dept. of Physics, IIT Kanpur

- Conducted an experimental study on dissipative coupling in a system of two pendulums linked via electromagnetic damping, and investigated synchronization dynamics in linear systems.
- Gained proficiency in using ImageJ for advanced image and video analysis to extract and interpret system behavior.

Building Diffraction Grating Spectrometer (Lab Course Project) 3^{rd} *Semester*
Prof. Venkata Jayasurya, Dept. of Physics, IIT Kanpur

- Designed and built a diffraction grating spectrometer to analyze the absorption spectra of various chemicals.
- Accurately determined the chemical composition of liquid solutions through spectral analysis

Relevant Coursework

General Relativity	Quantum Mechanics I, II	Probability & Statistics
Advanced General Relativity^o	Quantum Field Theory I, II^o	Mathematical Physics I & II^o
Physics of Universe (Astrophysics)	Statistical Mechanics	Computational Physics
Galaxies & Observational Cosmology	Advanced Statistical Mechanics	Quantum Optics
Classical Mechanics	Classical Electrodynamics I	Atomic & Molecular Optics^o

o = ongoing

Technical skills

Tools & Utilities LaTeX, MATLAB, Origin, ImageJ, Desmos, Phyphox
Programming languages C, Java, Python, HTML
Python Libraries NumPy, SciPy, QuTiP

Extracurriculars

Core Team Member: as Leader *2023-24*
Science Coffee House, SnT, IIT Kanpur

- Science Coffee House is a society that provides a platform for discussions, talks, and sharing scientific ideas along with projects for learning.
- Offered a summer project for freshmen on "Particle Physics and CERN".
- Started my own discussion group on "Basics of Cosmology" for undergraduate students.

Student Guide *2022-23*
Counselling Service, IIT Kanpur

- Assisted a group of 5 first year students to ease their transition into the campus and adjust to the campus environment.
- Helped in organizing the Orientation Program for the incoming batch of 1200+ students.

Secretary *2022-23*
Science Coffee House, SnT, IIT Kanpur

- Planned and organized talks and discussions by undergraduate students who had some research experience.
- Presented in various workshops and competitions throughout the year