

Abhinav Roy

Integrated M.Sc. Physics 2020-2025

NISER, India

royabhinav.astro@gmail.com - abhinav.roy@niser.ac.in

 ORCID |  Website |  GitHub |  Medium

EDUCATION

Integrated M.Sc. in Physics

School of Physical Sciences

National Institute of Science Education and Research (NISER), India

December 2020 – June 2025

SKILLS

Tools: MP-GADGET, GADGET-4, ROCKSTAR, LaTeX

Programming Languages: Python, Shell Scripting, C/C++

Technical Skills: Astrophotography, Reflective Telescope Handling & Maintenance
(6" and 8" Newtonian Telescopes & 11" Schmidt-Cassegrain Hybrid Telescope)

EXPERIENCE


Masters Project

Evolution of Gas & DM Profiles of Galactic Halos in Cosmological Simulations

M.Sc. Thesis Project

Dr. Nishikanta Khandai , NISER



August 2024 – June 2025

- **Objective:** To study how AGN feedback influences the spatial distribution of gas and dark matter over time in galactic halos using the NINJA cosmological simulation suite.
- **Research Focus:** Classifying halos into Main Sequence and Feedback Dominated types based on black hole activity; analyzing the dissociation of gas and dark matter (as described in *McDonald et. al. 2022* ) , its link to quenching of star formation, and the structural transformation of halos across cosmic time.
- **Available on:** [Google Drive](#)

Research Projects

Forecasting BBH mergers with Cosmological Simulations

Computational Project (IUCAA VSP)

Prof. Shasvath J. Kapadia , IUCAA & Dr. Nishikanta Khandai , NISER

Ongoing since May 2023

- **Objective:** Forecasting statistics of binary black hole (BBH) mergers in future gravitational wave detectors using MP-GADGET cosmological simulations.
- **Research Focus:** Analyzing the mass distribution, redshift evolution, and detectability of BBH mergers, different galaxy properties over time, and tracking the evolution of host region properties before and after BBH mergers as a precursor to the BBH mergers.

QSOs As The Tracer Of Our Universe

Group Computational Project

Dr. Shadab Alam , TIFR

Ongoing since May 2024

- **Objective:** Investigating quasar properties to determine the relation between galaxies and the dark matter halos.
- **Research Focus:** Calculating the projected correlation function for different sources in the eBOSS survey data and leveraging MP-GADGET cosmological simulations to investigate the connection between QSOs and DM halos.

Galaxy Group Finder Algorithm

Group Computational Project

Dr. Shadab Alam , TIFR

May 2023 - July 2023

- **Objective:** Developing Group Finder Algorithms based on the matched filtering technique for detecting groups in actual deep-sky survey data.
- **Research Focus:** Simulating mock dark matter halos in a periodic box resembling the universe. Then we wanted to develop filters based on analytical halo profiles and test these by applying the developed filters to simulated mock universes.

Self Gravitating Systems

Dr. Nishikanta Khandai [✉](#), NISER

Reading Project

June 2022 - July 2022

- **Reading Focus:** Read about galaxy dynamics, exploring constituents, morphological classifications, and deriving equations for potential and mass distribution models based on observed structures. Furthered my understanding of galaxy formation, evolution, and the distribution of dark matter in halos.

Coding Projects

SPHERE: A SPH Visualization Module

Dr. Nishikanta Khandai [✉](#), NISER

Coding Project

Ongoing since August 2025

- **Objective:** Developed a flexible Python module for creating SPH-smoothed visualizations from large-scale particle datasets, specializing in 2D projections and 3D rotation animations from 3D cosmological simulation data.
- **Technical Implementation:** Includes high-performance CPU rendering using Numba parallelization, multiple SPH kernels (cubic spline, quintic, Wendland C4), memory-efficient chunked processing for datasets, and automated movie generation capabilities.
- **Visualizations:** Example renderings and animations created with SPHERE are available on my [website](#) [✉](#)

Experimental Lab Projects

Experimental Lab I: Stellar Spectroscopy With Reflecting Telescope

Supervisors: Dr. Kartik Senapati [✉](#) & Dr. Santosh Babu Gunda [✉](#), NISER

[🌐 Project Details](#)

August 2023 - December 2023

Designed and calibrated a 3D-printed stellar spectrometer using a diffraction grating and CMOS sensor. Collected and analyzed stellar spectra from five stars, showing good agreement with HST data.

Experimental Lab II: Rotational Period Of Sun & Solar Limb Darkening

Supervisors: Dr. Ashok Mohapatra [✉](#) & Dr. Santosh Babu Gunda [✉](#), NISER

[🌐 Project Details](#)

January 2024 - May 2024

Quantified the solar limb darkening effect using reflective telescopes and a CMOS sensor, and calculated the Sun's rotation periods by tracking sunspot movements for 3 months.

Experimental Lab II: Measuring Galaxy Rotation Curve Using Radio Telescope

Supervisors: Dr. Ashok Mohapatra [✉](#) & Dr. Santosh Babu Gunda [✉](#), NISER

[🌐 Project Details](#)

January 2024 - May 2024

Explored the Milky Way's rotation curve via 21cm neutral hydrogen emission, gaining valuable experience in radio astronomy instrumentation, troubleshooting, and custom spectrometer software development despite hardware challenges.

Term Projects

P464 NISER: Galactic Dynamos

Supervisor: Dr. Luke Chamandy [✉](#), NISER

[🌐 Project Details](#)

January 2024 - May 2024

P452 NISER: CTIS and Hyperspectral Cube Construction

Supervisors: Dr. Guneshwar Thangjam [✉](#) & Dr. Subhasish Basak [✉](#), NISER

[🌐 Project Details](#)

January 2024 - May 2024

P346 NISER: Orbit Simulation with Adaptive RK-4 Integrator

Supervisor: Dr. Subhasish Basak [✉](#), NISER

[🌐 Project Details](#)

August 2022 - December 2022

CONFERENCES & WORKSHOPS

Astronomical Society of India (ASI) – 43rd Annual Meeting

Hosted by National Institute of Technology, Rourkela, Odisha

[🌐 ASI 2025 Certificate](#)

February 2025

FELLOWSHIPS & AWARDS

DISHA Scholarship

Sponsored by DAE (Department of Atomic Energy), Government of India

2020 – 2025

IUCAA Vacation Students' Programme (VSP)

Selected for IUCAA Vacation Students' Programme (VSP)

June 2023 – July 2023

EXTRACURRICULARS

Positions of Responsibility

NISER Astronomy Club

Club Website [↗](#)

- NISER Astronomy Club Head *August 2023 - February 2024*
- NAC Advisory Committee Member *Since February 2024*
- NAC Events Committee Head *August 2022 - August 2023*
- Mentor, NAC Training Committee *Since 2022*

LitC (Literature Club NISER)

Club Website [↗](#)

- LitC Core Committee Member *August 2022 - August 2023*

Other Initiatives

- Astro Journal Club:** Regular participant and presenter in weekly meeting with Master's, PhD students, postdocs, and faculty; present recent astronomy research and have in-depth discussions on current advances.
- Event Coordination:** Organized and managed events for inter-college fest Tvisha 2023, NISER Open Day 2023, and various other intra-college and inter-college fests.
- Volunteering:** Contributed as a volunteer in the Blood Donation Camp 2022 and NISER Open Day 2023.
- Club Involvement:** A contributing member of NISER Astronomy Club and LitC NISER (Literature Club) and an active member of Vaktavya (Debate Club), Quizzone (Quizzing Club), and Mathematix Club.

Personal Interests

- Writing:** Writing poetry, essays, and short stories on my *Medium* [↗](#) blog.
- Leisure Activities:** Enjoy listening to music, watching sitcoms, cartoons, and anime, and reading novels, comics, mangas, and manhwas.
- Other Interests:** Passionate about technology and science, keeping up with the latest advancements. I also enjoy cooking and experimenting with new recipes in my free time.