

Souradeep Das

First-year Graduate Student, Ohio State University

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Education

1. **The Ohio State University, Columbus, OH, USA** Aug 2025 – present
Doctor of Philosophy in Physics
 - C.G.P.A. - 4.0/4.0
 - Recipient of University Fellowship: A.Y. 2025-26
2. **Indian Institute of Science, Bengaluru, India** Aug 2024 – Jun 2025
Master of Science – Physics Major
 - C.G.P.A - **9.8/10.0**, Graduated *First Class with Distinction*
 - Recipient of Kishore Vaigyanik Protsahan Yojana (**K.V.P.Y.**) fellowship from IISc.
 - GRE Physics Score: **990** (scaled), **96** percentile
3. **Indian Institute of Science, Bengaluru, India** Nov 2020 – Jun 2024
Bachelor of Science (Research) – Physics Major
 - C.G.P.A - **9.7/10.0**, Graduated *First Class with Distinction*
 - Physics C.G.P.A - **9.9/10.0**
 - Recipient of **K.V.P.Y. fellowship** from IISc for the duration of study.

Publications and Pre-prints

1. ***Dark Secrets of Baryons: Illuminating Dark Matter-Baryon Interactions with JWST***
Souradeep Das, Ranjini Mondol, Abhijeet Singh, Ranjan Laha
Published: Phys.Rev.Lett 137, 011002 (2026). DOI: [10.1103/44nx-sgk4](https://doi.org/10.1103/44nx-sgk4); arXiv:[2511.02906](https://arxiv.org/abs/2511.02906)
2. ***Relaxation of Energy Constraints for Positrons Generating the Galactic Annihilation Signal***
Souradeep Das, Mark R. Krumholz, Roland M. Crocker, Thomas Siebert, Laura Eisenberger
Accepted for publication: Phys.Rev.Lett (2026). DOI: [10.1103/7v14-g7tf](https://doi.org/10.1103/7v14-g7tf); arXiv:[2506.00847](https://arxiv.org/abs/2506.00847)
3. ***Group Theory in Physics - An Introduction with Mathematica***
B Ananthanarayan, **Souradeep Das**, Amitabha Lahiri, Suhas Sheikh, Sarthak Talukdar
Published: Eur.Phys.J.ST 233 (2024) 7, 1443-1513. DOI: [10.1140/epjs/s11734-024-01245-9](https://doi.org/10.1140/epjs/s11734-024-01245-9); arXiv:[2408.01441](https://arxiv.org/abs/2408.01441)

Research Projects

1. **Probing Dark Matter - Standard Model Interactions using JWST Observations of high-redshift Galaxies (*Master's thesis*)** CHEP, IISc,
Bengaluru
Supervisor: Prof. Ranjan Laha Aug 2024 – Oct 2025
 - *Aim:* To obtain limits on interaction strength between Dark Matter (DM) and Standard Model (SM) particles using high-redshift Ultraviolet Luminosity Function (UVLF) data from the James Webb Space Telescope (JWST). These interactions suppress the UVLF at high redshifts, which is detectable using constraints from JWST spectroscopic observations.
 - *Role:* Performed numerical calculations of matter power spectrum using CLASS; Modified existing pipeline (MONTEPYTHON and GALLUMI) to determine upper limits on dark matter-baryon interaction cross-section by MCMC analysis.
 - *Outcome:* Obtained upper limits on interaction cross-section competitive with/stronger than existing cosmological constraints; Published in PRL.
 - *Skills:* Cosmological code CLASS; Markov Chain Monte Carlo (MCMC) analysis using MONTEPYTHON; Statistical Inference
2. **Energy Constraints on Positrons Generating the Galactic 511 keV Line** RSAA, ANU,

- *Aim:* To revisit constraints on the high-energy positrons in the Galactic bulge that contribute to the 511 keV line.
- *Role:* Lead author; Performed cosmic-ray simulations to compute gamma-ray spectra; Developed models to produce gamma-ray spectrum from simulated data; Performed MCMC runs to obtain constraints on injection energy.
- *Outcome:* Obtained relaxation of limits on positron injection energy; Significant amount of 511 keV emission could be produced by high-energy positrons up to 50 MeV (as compared to previous limits of ~ 5 MeV); Manuscript submitted to PRL (arXiv:2506.00847)
- *Skills:* Cosmic-ray propagation code CRIPATIC; MCMC analysis using EMCEE; Statistical Inference

3. Primordial non-Gaussianities from Inflation and Associated Soft Theorems (*Bachelor's thesis*)

Dept of Physics, IISc,
Bengaluru

Supervisor: Prof. Rajeev Kumar Jain

Oct 2023 – Apr 2024

- *Aim:* To evaluate the cross-correlations of a light scalar spectator field with the scalar and tensor metric perturbations during inflation.
- *Role:* Analytically evaluated dynamics and correlations of the light spectator field introduced in arXiv:2307.07502; Extended previous evaluations of the cross-bispectrum (which were focused on the Maldacena soft limit) to general points in k -space; Calculated local non-Gaussianity using the *in-in* formalism.
- *Outcome:* Obtained the equatorial and flattened limits of the tensor and scalar cross-correlations; Link to my thesis: bit.ly/4eCpa17
- *Skills:* Analytical calculations in early-Universe Cosmology; Mathematica

4. Group Theory in Physics – An Introduction with Mathematica

CHEP, IISc,
Bengaluru

Supervisor: Prof. B. Ananthanarayan

Jul 2023 – Jan 2024

- *Aim:* To develop a comprehensive resource for learners in Group Theory to grasp concepts along with the use of symbolic language.
- *Role:* Developed programs to evaluate properties of finite groups from first principles, for example, character tables of any finite group. Performed a detailed review of basic mathematical ideas in Group Theory, and related this work to modern ideas in various areas of Physics, such as particle phenomenology and quantum mechanics.
- *Outcome:* Contributed to the journal issue '*Group Theory in Physics – An Introduction with Mathematica*'. A follow-up work, on the uses of Mathematica in Differential Geometry and Topology, is in progress.
- *Skills:* Modules in Mathematica; Graphical representation; Group Theory

Talks/Presentations

Updated Constraints on the Injection Energy of Positrons Generating the Galactic 511 keV γ -ray Line

The Ohio State University
May 19, 2026

Talk delivered at CCAPP Cosmic Ray Transport Workshop

- More information available at [CCAPP website](#)

Dark Secrets of Baryons: Illuminating Dark Matter-Baryon Interactions with JWST

University of Pittsburgh
May 12, 2026

Talk delivered at 2026 Phenomenology Symposium

- Slides available at [PHENO 2026 website](#)

Probing Dark Matter-Baryon Interactions using JWST Early Galaxies

Indian Institute of Science
December 19, 2024

Talk delivered at 2nd Neighbourhood Cosmology Meeting, 2024

- Slides available at bit.ly/3ZMI4g7

Soft Gamma-ray Data Allow a Significant contribution of Relativistic Positrons to the Galactic Annihilation Signal

Indian Institute of Science
August 9-11, 2024

Poster presented at '*Frontier of Particle Physics 2024*'

- Link to the poster: bit.ly/30RiK3q

Other Talks

Indian Institute of Science

Presented at courses, Journal clubs

- Some selected titles are: *Dark Matter and Cosmology* (2024), *Non-Gaussianities from Inflation* (2024), *The Toomre Instability* (2024), *Neutrino Oscillations* (2023).
- Kindly visit my website soura-phy.github.io/slides to view the slides, with additional details.

Academic Achievements, Awards and Fellowships

Research award

One-time award conferred for graduate studies, based on ‘exceptional academic and research record’.

Ohio State University
2023

Future Research Talent award

Travel grant by the Australian National University for a visiting researcher position

ANU, Canberra, Australia
2023

All India Rank 1 – WBJEE

West Bengal Joint Entrance Examination (a state-level competitive engineering entrance test), among about 73 000 candidates

West Bengal, India
2020

AISSCE – Scored 98.6%, 2nd rank in state of Jharkhand

Higher Secondary Examination (12th standard), among about 36 000 candidates

CBSE, India
2020

All India Rank 120 – JEE Advanced

Joint Entrance Examination (Advanced), the premier national-level entrance examination for Indian Institute(s) of Technology (IITs), among 150 000 candidates

IIT Delhi
2020

All India Rank 284 (99.98 percentile) – JEE Main

Joint Entrance Examination (Main), an all-India engineering entrance, among 1.1 million candidates

2020

All India Rank 48 – KVPY

Qualified for the Kishore Vaigyanik Protshan Yojana (KVPY) fellowship through a nationwide competitive examination, among nearly 40 000 candidates

IISc, Bengaluru, India
2018

Skills and Extracurricular Activities

Programming skills

PYTHON, MATHEMATICA, C, C++, MATLAB

Leadership

Organized an Earth-science and astronomy themed quiz “*Pale Blue Dot*” at IISc during undergraduate fest *Pravega* (2022)

Languages

Fluent in English (TOEFL score: **107/120**), Bengali (Native Language), Hindi

References

1. **Prof. Ranjan Laha**
Assistant Professor, Center for High Energy Physics, Indian Institute of Science
Email: ranjanlaha@iisc.ac.in
2. **Prof. Mark Krumholz**
Professor, Research School of Astronomy and Astrophysics, Australian National University
Email: Mark.Krumholz@anu.edu.au
3. **Prof. Roland Crocker**
Associate Professor, Research School of Astronomy and Astrophysics, Australian National University
Email: Roland.Crocker@anu.edu.au