# Sourav Bhadra

**Ph.D. student, Indian Institute of Science & Raman Research Institute, Bangalore**

sbhadra07@gmail.com, souravbhadra@iisc.ac.in
https://www.souravbhadra.com/
https://orcid.org/my-orcid?orcid=0000-0002-0044-9751
+91-9002161072,+91-6360653575.

## Education

2020 – Present — **Prime Minister's Research Fellow, Indian Institute of Science, Bangalore** in High Energy Astrophysics.

2019 – 2020 — **Junior Research Fellow, Indian Institute of Science, Bangalore** in High Energy Astrophysics.

2018 – 2019 — **Research Fellow, National Institute of Science Education and Research, Bhubaneswar** in cosmology.
Work topic: *De-correlation of dust polarization at two different frequencies due to line of sight effect.*

2016 – 2018 — **Master of Science (M.Sc), in Physics, Jadavpur University, Kolkata**
percentage -80.4%, First Class.
**Thesis title:** *Rapidity dependent Forward-Backward Multiplicity Correlation in p-Pb interaction at* $\sqrt{s} = 5.02$ *TeV: A study using EPOS3 Model.*

2013 – 2016 — **Bachelor of Science (B.Sc), in Physics, Jadavpur University, Kolkata**
percentage -74.4%, First Class.

2012 — **Higher Secondary exam, Kashiram Das Institution, Katwa, Purba Bardhaman**
percentage -89.2%

2010 — **Secondary exam, Kashiram Das Institution, Katwa, Purba Bardhaman**
percentage -92.3%

## Research Publications

### Journal Articles

1. S. Bhadra, S. Thoudam, B. B. Nath, and P. Sharma, "Between the Cosmic-Ray "Knee" and the "Ankle": Contribution from Star Clusters,", vol. 961, no. 2, 215, p. 215, Feb. 2024. DOI: 10.3847/1538-4357/ad1605. arXiv: 2312.06992 [astro-ph.HE].

2. S. Bhadra, S. Gupta, B. B. Nath, and P. Sharma, "Cosmic rays from massive star clusters: a close look at Westerlund 1,", vol. 510, no. 4, pp. 5579–5591, Mar. 2022. DOI: 10.1093/mnras/stac023. arXiv: 2201.00529 [astro-ph.HE].

### Conference Proceedings

1. S. Bhadra, "Between the cosmic-ray 'knee' and the 'ankle': Contribution from star clusters," in *38th International Cosmic Ray Conference (ICRC2023)*, Nagoya University, Japan, 2023, pp. 39–47. URL: https://inspirehep.net/files/d982b34c75084474788c95ffb593d0ce.

## Projects

2023–2024 **TeV spectral bumps of cosmic-ray protons and helium nuclei: the role of nearby sources**, ( Under Prof. Biman Nath, *RRI*, Prof. Prateek Sharma, *IISc*, Bangalore & Prof. Satyendra Thoudam, *Khalifa University, UAE*).

2022–2023 **Second component of Galactic cosmic rays originating from the distribution of star clusters in the Galaxy.**, ( Under Prof. Biman Nath, *RRI*, Prof. Prateek Sharma, *IISc*, Bangalore & Prof. Satyendra Thoudam, *Khalifa University, UAE*).

2021–2022 **Star clusters as a source of Galactic cosmic rays**, computational work on galactic astrophysics ( Under Prof. Biman Nath, RRI & Prof. Prateek Sharma, *IISc*, Bangalore).

2020 **Influence of 3D model of convection on the centre-to-limb variation and spectral lines for a K type star**, a computational project on solar astrophysics,(Prof. S.P. Rajaguru, *Indian Institute of Astrophysics (IIA)*, Bangalore).

2019 **De-correlation of dust polarization at two different frequencies due to the line of sight effect**, a computational project on Cosmology and Astrophysics, (Under Dr. Tuhin Ghosh, *NISER*, Bhubaneswar).

2018 **Rapidity dependent Forward-Backward Multiplicity Correlation in p-Pb interaction at 5.02 TeV: A study using EPOS3 Model**, a computational project on experimental high energy physics, (Under Dr. Mitali Mondal, *Jadavpur University*, Kolkata).

## Talks & Conferences

2023 **International Cosmic Ray Conference (ICRC), Nagoya University, Japan:** Oral presentation on *"Between the cosmic-ray 'knee' and the 'ankle': Contribution from star clusters".*

**Astronomical Society of India Meeting, IIT Indore:** Oral presentation on *"Star clusters as potential sites for cosmic ray acceleration".*

2022 **COSPAR 44th meet, Athens, Greece:** Poster presentation on *"Cosmic rays from massive star clusters: a close look at Westerlund 1".*

**Astronomical Society of India Meeting, IIT Roorkee:** Oral presentation on *"Gamma rays from young massive star clusters".*

## Awards and Achievements

2020 Selected as **Prime Minister Research Fellow (PMRF), Govt. of India, in astronomy & astrophysics.**

2019 Selected as Ph.D student in **IISc Bangalore.**

2018 Qualified **CSIR-NET**, All India Rank 78 (JRF), Physical Science.

Qualified **CSIR-NET**, All India Rank 38 (LS), Physical Science.

Qualified **GATE**, All India Rank 227, Physics, Percentile-98.5%.

Selected as a Ph.D. student in **Institute for Plasma Research, Gandhinagar (2018), IIT Guwahati (2018), NISER Bhubaneswar (2018), IGCAR Kalpakkam (2018).**

2016 Qualified **BARC-OCES**, Physics.

Qualified **JEST**, All India Rank 193, Physics, Percentile-95.4%.

Qualified **Indian School of Mines(IIT-ISM) admission**, All India Rank 09, Geophysics.

Qualified **JAM**, Physics.

2012 Selected for **INSPIRE Fellowship**, Govt. of India.

## Computing Skills

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|---|---|
| Coding | Python, Fortran, C, SQL. |
| Graphics | GNUPLOT, Matplotlib. |
| Tools | Origin, LaTeX, MS Office. |
| Operating Systems | Windows, MAC, Linux. |
| Misc. | PLUTO Code for Astrophysical GasDynamics |

## Collaborators

- **Prateek Sharma** (Indian Institute of Science, Bangalore).
- **Biman B. Nath** (Raman Research Institute, Bnagalore).
- **Siddhartha Gupta** (Princeton University, USA).
- **Satyendra Thoudam** (Khalifa University, UAE).

## Teaching & related experience

2024 **Tutor:** Fundamental of Astrophysics, Institute of Smart Structure and System (ISSS) online course.

2023 **Teaching Assistant:** Nuclear Astrophysics (PH 21), NPTEL online course.

2022 **Teaching assistant :** Introduction to Classical Mechanics (PH 28), NPTEL online course.

**Teaching assistant :** Galaxies and ISM course (JAP), IISc.

2021 **Teaching assistant :** Radiative processes in astrophysics course (JAP), IISc.

**Teaching assistant:** Kendriya Vidyalaya, IISc.

## Organising skills

2024 Organising team member of **Astronomical Society of India Meeting.**

2023 Organising team member of **Very Sirius Meeting**- a journal club in Raman Research Institute.

## Field of Interest

- Computational physics
- Astronomy & Astrophysics
- High energy physics
- General relativity & Cosmology

## Courses taken

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|---|---|
| Core courses | Quantum Mechanics I, II, Mathematical Physics I and II, Statistical Mechanics, Condensed Matter Physics, Classical Mechanics, Electromagnetic Theory I and II, Nuclear and Particle Physics, Atomic and Molecular Physics. ElectivesGeneral relativity and cosmology, Non-linear dynamics. |
| Electives | General relativity and cosmology, Non-linear dynamics, Astronomy & Astrophysics |

## Courses taken (continued)

Ph.D. coursework

- Fundamental of astrophysics, Galaxy & ISM, Radiative processes in astrophysics, Fluid and plasma physics, Astronomical techniques, General relativity & cosmology.