


# Barnali Das

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## RESEARCH INTERESTS

My current research is focused on **Galaxy Formation and Evolution**, especially its applications to **Cosmology**. (During my BS-MS Dual Degree, I proactively applied for and was awarded with two scholarships to carry out three research projects, including projects in the field of pulsar using radio data from GMRT.)

## ACADEMIC BACKGROUND

<b>INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (IISER) Kolkata, India</b>	<b>BS-MS DUAL DEGREE (Physics Major)</b>	SGPA: <b>10/10</b> (CGPA: 8.4/10)
	Year: Fifth Duration: Aug 2018 - Jun 2023	(Obtained A+ or A grades in 29 of my courses, including A+ in Advanced Mathematical Methods of Physics and Computational Physics and A in Fluid and Magneto- hydrodynamics and Quantum Mechanics)

## PUBLICATIONS AND CONFERENCE TALKS

Gravitational Waves Background (NANOGrav) from Quintessential Inflation <b>Das, B.</b> ; Jaman, N.; Sami, M	<a href="https://arxiv.org/abs/2307.12913">arXiv:2307.12913 [gr-qc]</a> submitted to <i>Phys. Rev. D</i>
<a href="#">Non-Gaussian Imprints in the Cosmic Microwave Background</a> Indirect imprints of primordial non-Gaussianity on cosmic microwave background <b>Das, B.</b> ; Ragavendra, H.V.	Cosmology from Home 2023 conference <a href="https://arxiv.org/abs/2304.05941">arXiv:2304.05941 [astro-ph.CO]</a> submitted to <i>Phys. Rev. D</i> and under review
Demonstration of Bomb Detection Using the IBM Quantum Computer Raj, A.; <b>Das, B.</b> ; Behera, B. K.; Panigrahi, P. K.	<a href="https://doi.org/10.20944/preprints201902.0232.v1">doi: 10.20944/preprints201902.0232.v1</a>

## AWARDS AND FELLOWSHIPS

Awarded the “National Initiative on Undergraduate Science” ( <b>NIUS</b> ) scholarship, that funded my participation in research projects (mentioned in section below).	2019 & 2021
Awarded the “ <a href="#">Undergraduate Associateship</a> ” ( <b>UGA</b> ) scholarship program at Saha Institute of Nuclear Physics, India, that fully funded my participation in the research project (mentioned in section below).	2019
Selected for the International Asteroid Search Campaign.	2020
Selected in “National Anveshika Experimental Skills Test” (NAEST) prelims.	2020
Selected among top 20 students of Odisha state in India, in YATS (Young Astronomer Talent Search) program in 2014, organised by “TATA STEEL” in collaboration with “Pathani Samanta Planetarium”, Bhubaneswar, Odisha, India. As a prize I was allowed a visit of 2 days to the Space Application Centre of Indian Space Research Organization ( <b>ISRO</b> ) in Ahmedabad.	2015

## RESEARCH PROJECTS

Project	Guide	Outcome	Duration
<a href="#">Analyzing Galaxy Cluster Distribution</a> Comparing expected and observed distribution of galaxy clusters over a range of redshifts.	<a href="#">Dr. Stefano Ettori</a> (INAF-OAS, Bologna, Italy)		Aug 2023 - Ongoing
<a href="#">Study of primordial perturbations, non-Gaussianity and their observational effects</a> Investigated/ing models of inflation, perturbations in fields generated due to them and non-Gaussianity associated with them. (MS thesis & project at RRI)	<a href="#">Dr. Koushik Dutta</a> <sup>1</sup> & <a href="#">Dr. H.V. Ragavendra</a> <sup>2</sup> & <a href="#">Prof. Shiv. K. Sethi</a> <sup>2</sup> ( <sup>1</sup> IISER Kolkata & <sup>2</sup> Raman Research Institute, India)	1. Codes in Cosmology: <a href="https://github.com/mibarnali00/Cosmology">https://github.com/mibarnali00/Cosmology</a> 2. See section “Peer Reviewed Publications”	Jul 2022 - Jun 2023 & Aug 2023 - Ongoing

<u>Primordial Gravity waves</u> Studied the properties of primordial gravity waves.	<u>Prof. Rajesh Kumble Nayak</u> (IISER Kolkata, India)	Independent Study Report	Aug 2022 - Nov 2022
<u>Study of properties of Millisecond Pulsars</u> Determined the binary period and its relation to the mass of the pulsar's companion star and the eccentricity of its orbit for a sample of 200+ millisecond pulsars available in ATNF pulsar catalogue. (Funded by NIUS)	<u>Dr. Bhaswati Bhattacharyya</u> (National Centre for Radio Astrophysics, India)	Report on " <a href="#">Study of the Pulsars Discovered with the GMRT High Resolution Southern Sky Survey-II</a> "	Jun - Jul 2021
<u>Identifying Pulsar signals from the GMRT telescope's raw data</u> Analyzed pulsar signals from GMRT radio data using the "PRESTO" software. (Funded by NIUS)	<u>Dr. Bhaswati Bhattacharyya</u> (National Centre for Radio Astrophysics, India)	Report on " <a href="#">Study of the Pulsars Discovered with the GMRT High Resolution Southern Sky Survey</a> "	Dec 2019
<u>Quantum Bomb detection</u> Investigated the regime of interaction free measurement in quantum physics, applied to the scenario of bomb detection.	<u>Prof. Prasanta K. Panigrahi</u> (IISER Kolkata, India)	See section "Peer Reviewed Publications"	Dec 2018 - Feb 2019
<u>Literature-review project in Astro-particle Physics</u> Explored the basics of particle physics, classical and quantum field theory. (Funded by UGA)	<u>Prof. Ambar Ghosal</u> (Saha Institute of Nuclear Physics, India)		Jul 2019

## OTHER PROJECTS

Work experience	Program	Duration
Analysing galaxy images at different wavelengths using the NASA sky view platform.	"RAD@home citizen-science research" by Prof. Ananda Hota (University of Mumbai - Department of Atomic Energy, Centre for Excellence in Basic Sciences)	Ongoing
Examining multiband galaxy images from the Subaru HSC survey.	"Citizen Science with Pune Knowledge Cluster"	Ongoing
Asteroid Search Camp wherein I observed near-Earth objects and Main Belt asteroids by analysing ".FITS" images from Pan-STARRS using "Astrometrica" software.	International Astronomical Search Collaboration	Jun 2020
Employed MATLAB to analyse the rotation curve of the Milky way and to research concepts of Dark Matter and modified Newtonian dynamics.	Observational Astronomy Workshop by Prof. Nirupam Roy (Indian Institute of Science) in National Students' Space Challenge organised by Indian Institute of Technology Kharagpur	Sep 2018

## SKILLS AND EXPERIENCE

<b>IT Skills</b>	<p><b>Languages:</b> Python, Matlab, Fortran (Basic), HTML, Mathematica;</p> <p><b>OS/Applications:</b> Windows, Linux, LATEX, MS-office;</p> <p><b>Softwares:</b> PRESTO, Origin Pro, Astrometrica, CAMB, COSMOMC;</p> <p><b>Machine Learning:</b> quadratic classifiers, PCA (Principal component analysis), LDA (Linear discriminant analysis), kPCA (Kernel Principal component analysis), KNN (K-nearest neighbors), K-means clustering, Cross validation and Bootstrap resampling methods</p>
<b>Teaching Experience</b>	<p>Teaching Assistant at IISER Kolkata for:</p> <ol style="list-style-type: none"> <li>"General Theory of Relativity and Cosmology" (a 4th year BS-MS course with 60 students)</li> <li>"Waves and Optics" (a 2nd year BS-MS course with 200+ students)</li> <li>"Mathematical Methods of Physics" (a 3rd year BS-MS course with 80 students).</li> </ol> <p>Hired by "Chegg" to be a Tutor/Expert to teach physics to international students.</p>
<b>Leadership Experience</b>	<p>Contributed in the logistics team of the 32nd meeting of Indian Association for General Relativity and Gravitation (IAGRG) which hosted 325 participants.</p> <p>Organized the "Utkal Divas 2021" event at IISER Kolkata for a 300+ audience.</p> <p>Served in the organizing team of the "Ek Pehal Anniversary 2020" event at IISER Kolkata for 350+ spectators.</p>
<b>Communication</b>	Fluent in English, Hindi, Odia and have a good knowledge of Bengali.

## CONFERENCES/WORKSHOPS

- 2023 Cosmology from Home 2023 (international virtual conference).
- 2023 In-person workshop on the [Less Travelled Path to the Dark Universe](#), hosted by International Center for Theoretical Sciences, India.
- 2023 Summer Programme hosted by Indian Institute of Astrophysics (IIA).
- 2022 The [10th KIAS Workshop on Cosmology and Structure Formation](#), hosted by Korea Institute for Advanced Study, Seoul, Korea.
- 2022 32nd meeting of Indian Association for General Relativity and Gravitation, hosted by IISER Kolkata, India.
- 2022 An Inaugural Conference on [Current Status of Cosmology](#), organised by The Thanu Padmanabhan Center for Cosmology and Science Popularization (CCSP), SGT University, Delhi, India.
- 2022 The 21st National Space Science Symposium (NSSS), hosted by Center of Excellence in Space Sciences India (CESSI) and IISER Kolkata, India.
- 2019 The National Initiative on Undergraduate Science (NIUS Physics) 16.1 camp initiated by Homi Bhabha Centre for Science Education (HBCSE), Tata Institute of Fundamental Research (TIFR), India.
- 2018 The National Students' Space Challenge initiated by Indian Institute of Technology (IIT), Kharagpur, India.

## SCIENTIFIC OUTREACH

- Authored articles in IISER Kolkata's multilingual science communication monthly magazine "Cogito137: The Thought Capsule".
- Own a science blogging website "<https://vigyanaparichaya.wixsite.com/vigyanaparichaya>" in Odia and English and its youtube channel "<https://www.youtube.com/channel/UC7drnNHdxAhkUJcYPF3Q4pA>".
- Volunteered in "Ek Pehal" which is an initiative by IISER Kolkata to provide free education (in Science, English and Maths) to underprivileged young students. I also participated in the monthly outreach activities which included demonstrating science experiments to high school kids to motivate them towards pursuing science.
- Contributed to the social media scientific outreach team of the National Space Science Symposium (NSSS) 2022.

## INTERNATIONAL ASSOCIATIONS

Active member of the "Supernova Foundation", an International mentoring organisation, wherein I interact with more senior scientists and participate in webinars on career development.

## RESEARCH GROUP/THESIS TALKS

- 2023 MS-thesis presentation on "Inflation, perturbations and non-Gaussian imprints on Cosmic Microwave Background" in IISER Kolkata, India.
- 2022 Half-yearly MS-thesis presentation on "Study of primordial perturbations and their observational effects" in IISER Kolkata, India.
- 2022 Talks presented in front of research group members at IISER Kolkata:
  - "Primordial non-Gaussianity and corresponding corrections to power spectrum"
  - "Some Inflationary models and their 'Potentials'"
  - "Basics of Inflationary Cosmology"
- 2021 Talks presented in front of research group members at the National Centre for Radio Astrophysics:
  - "Period of binary and Mass of the companion relation of Binary Pulsars"
  - "Aitoff plot for various characteristics of Binary Millisecond Pulsars"
  - "Pulsar timing"
  - "Millisecond Pulsars"
  - "Astronomy Paper Seminar Participation Guide and Reading Walkthrough"

## REFERENCES

**Dr. Koushik Dutta** (Associate Professor at IISER Kolkata, India): [koushik \[at\] iiserkol.ac.in](mailto:koushik@iiserkol.ac.in)

**Prof. Prasanta K. Panigrahi** (Director, Professor at IISER Kolkata, India): [pprasanta \[at\] iiserkol.ac.in](mailto:pprasanta@iiserkol.ac.in)

**Dr. Bhaswati Bhattacharyya** (Reader-F at National Centre for Radio Astrophysics, India): [bhaswati \[at\] ncra.tifr.res.in](mailto:haswati@ncra.tifr.res.in)