

Nilanjandev Bhaumik

Department of Physics
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Current affiliation

Ph.D. student, Department of Physics, Indian Institute of Science, Bangalore
Thesis supervisor: Dr. Rajeev Kumar Jain
Expected date of completion : July, 2023

Education

- 2016 Master of Science (M.Sc) in Physics, *Indian Institute of Technology Guwahati*, India.
- 2014 Bachelor of Science (B.Sc) in Physics, *Presidency University*, Kolkata, India.

Research interests

Inflationary cosmology, Primordial black holes (PBH) from inflation, Second order stochastic gravitational wave (GW) background, Possible imprints of early matter domination through GW detection, Ultralight PBHs and their imprints in GW background, Black hole evaporation, Baryogenesis, Large scale CMB anomalies, Scalar-tensor theories, Cosmological data analysis

Publications

- 2018 1. Interior volume of $(1+D)$ dimensional Schwarzschild black hole , **N. Bhaumik**, B. R. Majhi, *Int. J. Mod. Phys. A* **33**, 1850011 (2018), [[arXiv:1607.03704](https://arxiv.org/abs/1607.03704) [gr-qc]].
- 2020 2. Primordial black holes dark matter from inflection point models of inflation and the effects of reheating, **N. Bhaumik**, R. K. Jain, *JCAP* **01**, 037 (2020), [[arXiv:1907.04125](https://arxiv.org/abs/1907.04125) [astro-ph.CO]].
- 2021 3. Small scale induced gravitational waves from primordial black holes, a stringent lower mass bound, and the imprints of an early matter to radiation transition , **N. Bhaumik**, R. K. Jain, *Phys. Rev. D* **104**, 023531 (2021), [[arXiv:2009.10424](https://arxiv.org/abs/2009.10424) [astro-ph.CO]].
- 2022 4. Doubly peaked induced stochastic gravitational wave background: Testing baryogenesis from primordial black holes , **N. Bhaumik**, A. Ghoshal and M. Lewicki, *JHEP* **07** (2022) **130**, [[arXiv:2205.06260](https://arxiv.org/abs/2205.06260) [astro-ph.CO]].
- 2023 5. Understanding large scale CMB anomalies with the generalized non-minimal derivative coupling during inflation , Y. Tiwari, **N. Bhaumik**, R. K. Jain, *Phys. Rev. D* **107** (2023), no. 10 103513 . [[arXiv:2206.13320](https://arxiv.org/abs/2206.13320) [astro-ph.CO]]
- 2023 6. Distinct signatures of spinning PBH domination and evaporation: doubly peaked gravitational waves, dark relics and CMB complementarity , **N. Bhaumik**, A. Ghoshal, R. K. Jain and M. Lewicki, *JHEP* **05** (2023) 169, [[arXiv:2212.00775](https://arxiv.org/abs/2212.00775) [astro-ph.CO]].

Presentations/Talks/Posters

- Oct 2019 (Offline) Oral presentation on "Formation of primordial black holes from inflationary models" in Young Astronomer's Meet 2019, Kodaikanal Solar Observatory, Kodaikanal, India
- Nov 2019 (Offline) Poster presentation on "Primordial black holes as a dark matter candidate" in in-house symposium, Department of Physics, IISc Bangalore
- Dec 2019 (Offline) Oral presentation on "Primordial black holes dark matter from inflection point models of inflation and the effects of reheating" in the 9th International Conference on Gravitation and Cosmology (ICGC), IISER Mohali, India

- Oct 2019 (Offline) Oral presentation on "Formation of primordial black holes from inflationary models" in Young Astronomer's Meet 2019, Kodaikanal Solar Observatory, Kodaikanal, India
- Nov 2019 (Offline) Poster presentation on "Primordial black holes as a dark matter candidate" in in-house symposium, Department of Physics, IISc Bangalore
- Nov 2020 (Online) Oral presentation on "Lowest mass limit of Primordial black holes from USR models and effects of reheating" in Less Travelled Path Of Dark Matter: Axions And Primordial Black Holes, ICTS, Bangalore, India
- Dec 2020 (Online) Oral presentation on "Lowest mass bound and reheating effects for primordial black holes from USR models of inflation" in 31st meeting of the Indian Association for General Relativity and Gravitation (IAGRG), IIT Gandhinagar, India.
- May 2021 (Online) Invited talk on "Ultra slow roll models of inflation with different reheating histories, to form primordial black holes and induced stochastic gravitational wave background" in a cosmology group meeting at Indian Institute of Technology Madras, India
- Aug 2021 (Online) Oral presentation on "PBHs and induced GWs from single field inflation and the small scale imprints of reheating " in The 24th International Conference on Particle Physics and Cosmology (COSMO'21), University of Illinois, USA
- March 2022 (Online) Poster presentation on "Primordial black holes and induced GWs from inflation and the imprints of reheating" in The 40th Annual Meeting of the Astronomical Society of India (ASI-22), IIT ROORKEE, INDIA
- June 2022 (Online) Oral presentation on "Detectable stochastic background of gravitational waves in the presence of primordial black holes" in Gravity: Current challenges in black hole physics and cosmology, YITP, Kyoto, Japan
- September 2022 (In person) Contributed talk on "Stochastic gravitational waves background to probe the reheating histories in the presence of primordial black holes" 31st Texas Symposium on Relativistic Astrophysics, Prague, Czech Republic
- September, 2022 (In person) (Talk) A Cosmic Window to Fundamental Physics: Primordial Non-Gaussianity (PNG) and Beyond, IFT Madrid
- December, 2022 (In person) (Talk) 32nd meeting of Indian Association for General Relativity and Gravitation (IAGRG32), IISER Kolkata
- February, 2023 (In person) (Poster and flash talk) Frontiers in Cosmology, Raman Research Institute, Bangalore
- March, 2023 (In person) (Talk) Less Travelled Path to the Dark Universe (LTPDU) , ICTS Bengaluru

Academic Visits

- 26 September 2022 Talk on "Formation of primordial black holes from inflation and their post inflationary imprints in gravitational wave background", Jagiellonian University, Kraków, Poland
- 27-28 September 2022 Talk on "Different aspects of primordial black holes : inflationary models and detectable gravitational wave background", Warsaw University, Warsaw, Poland
- 30 September 2022 Talk on "Stochastic gravitational wave background to probe primordial black hole scenarios and compatibility with inflationary models", Catholic University of Louvain, Louvain-la-Neuve, Belgium

Organizing experiences

- 2020-2021 Weekly journal-club meeting, cosmology group, Indian Institute of Science, Bangalore.

Teaching experience

- 2019-2020 Graduate course : Quantum Mechanis.
Course instructor : Dr. Manish Jain, Indian Institute of Science, Bangalore.

Technical skills

Operating Systems : Linux, Mac-Os

Programming Language: Fortran, C, Python

Symbolic computation : Mathematica

Computational Experience

High-Performance Computing :

- Param Pravega, ATOS Bull Sequana XH2000 series (I.I.Sc, India)
- SahasraT-Cray XC40 system (I.I.Sc, India)

Observational data : PLANCK-2018 data (Plik and Camspec12.5) and BICEP data (2020)

Schools/Workshops/Conferences attended (offline/online)

- March 2018 (Offline) Introductory School on Galaxy Formation, NISER, Bhubaneswar, India
- Jan 2019 (In Person) Cosmology - The Next Decade: School and Workshop, ICTS, Bangalore, India
- Oct 2019 (Offline) (Speaker) Young Astronomers' Meet 2019, Kodaikanal Solar Observatory, Kodaikanal, India
- Dec 2019 (In Person) International Conference on Gravitation and Cosmology, IISER Mohali, India
- Aug-Sept 2020 (Online) Physics Of The Early Universe - An Online Precursor, ICTS, Bangalore, India
- Nov 2020 (Online)(Speaker) Less Travelled Path Of Dark Matter: Axions And Primordial Black Holes, ICTS, Bangalore, India
- Dec 2020 (Online)(Parallel session speaker) 31st meeting of the Indian Association for General Relativity and Gravitation (IAGRG), IIT Gandhinagar, India.
- March 2021 (Online) Theoretical Aspects of Astroparticle Physics, Cosmology and Gravitation - 2021 GGI school, Florence, Italy
- Aug 2021 (Online)(Parallel session speaker) 24th International Conference on Particle Physics and Cosmology (COSMO'21), University of Illinois, USA
- Aug-Sept 2021 (Online) School-cum-Workshop on Data Analysis in Cosmology and Astroparticle Physics, ISI Kolkata, India.
- March 2022 (Online) The 40th Annual Meeting of the Astronomical Society of India (ASI-22), IIT ROORKEE, INDIA
- June, 2022 (Online) Gravity: Current challenges in black hole physics and cosmology, YITP, Kyoto, Japan
- July 2022 (In Person) Summer School on Cosmology 2022, ICTP, Trieste, Italy
- September, 2022 (In person) 31st Texas Symposium on Relativistic Astrophysics, Prague, Czech Republic
- September, 2022 (In person) A Cosmic Window to Fundamental Physics: Primordial Non-Gaussianity (PNG) and Beyond, IFT Madrid
- December, 2022 (In person) 32nd meeting of Indian Association for General Relativity and Gravitation (IAGRG32), IISER Kolkata
- February, 2023 (In person) Frontiers in Cosmology, Raman Research Institute, Bangalore
- March, 2023 (In person) Less Travelled Path to the Dark Universe (LTPDU) , ICTS Bengaluru

Academic achievements and scholarships

- 2017 Secured All India Rank - 142 in JRF-NET 2016 (National Eligibility Test for PhD in India) in Physics.
- 2017 Secured All India Rank - 78 in JEST 2017 in Physics.
- 2011-2016 **INSPIRE SHE Scholarship** (B.Sc and M.Sc), Department of Science and Technology, India.

Previous research experience

- 2015-2016 M.Sc thesis : Interior volume of $(1 + D)$ dimensional Schwarzschild black hole.
Supervisor : Dr. Bibhas Ranjan Majhi , Indian Institute of Technology, Guwahati.
- 2018 Computational course project: Obtaining primordial scalar and tensor power spectra for single scalar field inflationary models.
Course Instructor : Dr. Manish Jain, Indian Institute of Science, Bangalore.

Personal

DOB, Gender 26 April 1994, Male.
Citizenship Indian.
Languages English, Bengali, Hindi.