Sajad Ahmad Bhat

Personal Details

Nationality: Indian
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Present Affiliations

- **Postdoctoral Research Fellow (Second Postdoc)**, Inter-University Center for Astronomy and Astrophysics (IUCAA), Meghnad Saha Road, Savitribai Phule Pune University Campus, Ganeshkhind, Pune 411007, India, (August, 2023 – present).

Research Interests

- **Broad areas of interest :** Gravitational Waves (GWs) and Nuclear Astrophysics (Neutron Star Equation of State).
- **Specific areas of research :** Source modelling of compact binaries, tests of general relativity and nature of compact objects using gravitational waves, multi-messenger astrophysics and formation channels of compact binaries; Exotic matter inside neutron stars and its observable consequences, Tidal deformability of neutron stars and I-Love-Q universality, Dark matter Admixed neutron stars, Oscillation modes inside neutron stars.

Education

- **Ph.D.** : Astroparticle Physics and Cosmology Division, Saha Institute of Nuclear Physics, Kolkata 700064, (2015-2020)

  Ph.D. Registration: Homi Bhabha National Institute, Anushakti Nagar, Mumbai 400094, (2015-2020)

  Thesis Topic: *Some Studies on Novel Phases of Neutron Stars and their observational consequences*.
  Supervisor: Prof. Debades Bandyopadhyay

- **Post-M.Sc.** (Pre PhD coursework) : Saha Institute of Nuclear Physics, Kolkata 700064, (2015-2016)

  Specialised Courses: Quantum Field Theory, Particle Physics, Astroparticle Physics and Cosmology and Gravity

  Grade: **71.5 %**, 1^{st} Class with Grade One

  Post-M.Sc. Project: *Mass-Radius relationship and Moment of Inertia of (Non)- rotating Neutron Star*.
  Supervisor: Prof. Debades Bandyopadhyay

- **M.Sc.** (Physics) : Department of Physics, University of Kashmir Hazratbal, Srinagar, Jammu and Kashmir 190006, (2012-2014)

  Grade: **76.09 %**, 1^{st} Class with Distinction

  Master's Thesis: *Feynman Diagrams: Applications to some Physical problems*.
  Supervisor: Dr. Muzaffar Qadir Lone

- **B.Sc.** : Government Degree College (Boys) Anantnag, Jammu and Kashmir India, (2009-2011)

  Grade: **69.16 %**, 1^{st} Class with Grade One

- **10+2** : Government Higher Secondary School Yaripora, Kulgam Jammu and Kashmir, (2007-2008)

  Grade: **81.33 %**, 1^{st} Class with Distinction

- **10th** : Model Islamia Institute Bachroo, Kulgam Jammu and Kashmir, (2006)

  Grade: **71.2 %**, 1^{st} Class with Grade one

Achievements and Awards

- Recipient of International Travel Support (ITS, ITS/2025/002317) from Anusandhan National Research Foundation (ANRF) for participating in international conference "24th International Conference on General Relativity and Gravitation (GR24) and 16th Edoardo Amaldi , United Kingdom (14 July, 2025 to 18 July, 2025"
- Marie Skłodowska-Curie Postdoctoral Fellowship (MSCA-PF): Proposal evaluated above the quality threshold by the European Commission (Score: 75/100).
- Recipient of Postdoctoral Research Fellowship from IUCAA, Pune-411007, India (August, 2023–present).
- Recipient of Postdoctoral Research Fellowship from Chennai Mathematical Institute (CMI), Siruseri-603103, India (2020– July, 2023).
- Recipient of Senior Research Fellowship from Department of Atomic Energy (DAE), Govt. of India (2017-2020).

- Recipient of Junior Research Fellowship from Department of Atomic Energy (DAE), Govt. of India (2015-2017).
- Qualified UGC/CSIR JRF June-2015 with 34 All India Rank.
- Qualified GATE-2015 with score 456.

Membership

- Member of LIGO Scientific Collaboration (LSC)
- Member of LIGO India Scientific Collaboration (LISC)
- Member of LISA (Laser Interferometer Space Antenna) Consortium
- Member of CE (Cosmic Explorer) Consortium

Research Experience

- **Postdoc II:** Postdoctoral Research Fellow, Inter-University Center for Astronomy and Astrophysics (IUCAA), Meghnad Saha Road, Savitribai Phule Pune University Campus, Ganeshkhind, Pune 411007, India, (1, August, 2023 – present).
- **Postdoc I:** Postdoctoral Research Fellow, Chennai Mathematical Institute (CMI), H1, SIPCOT, IT Park, Siruseri 411007, India, (1, July, 2020 – 31, July, 2023).

Contributions to LIGO Scientific Collaboration (LSC)

I am contributing to the activities related to testing General Relativity (TGR) particularly, I am involved in the tests of black hole nature using spin-induced quadrupole moment (SIQM) measurements performed on the events detected in the fourth observing run (O4) of LIGO-VIRGO-KAGRA (LVK) Collaboration. I am also contributing as a PE ROTA member and Level-0 shifter in the rapid response team (RRT) of the fourth observing run (O4).

Teaching Experience

- **Lecturer in Physics (Contractual Basis)**

  Courses: Engineering Physics I and II
  Sessions: Two Semesters (01-09-2014 to 31-07-2015)

Tutor Experience

- **Tutor in ICTS Summer School on Gravitational-Wave Astronomy**

  Courses: Core-collapse supernovae: dynamics

  Core-collapse supernovae: neutrinos and gravitational waves.

  Sessions: One Week (May 30 - June 3, 2022)

Schools/ Conferences/ Workshops

0.1 Conferences

- Oral presentation on "Distinguishing eccentricity from eccentricity mimickers" in Asian Gravitational Wave Astronomy Meeting 2026 (AGWAM2026) held in National Astronomical Research Institute of Thailand (NARIT), Chiang Mai, Thailand during July 5-11, 2026.
- Oral presentation on "Neutron stars in eccentric binaries: Promising candidates for probing EOS and compact binary formation channel" in A Brainstorming Workshop on Neutron Stars held at The Institute of Mathematical Sciences (IMSc), Chennai, during August 11-14, 2025.
- Oral presentation on "EECT: an Eccentricity Evolution Consistency Test for testing general relativity and identifying eccentricity mimickers" in GR24 and Amaldi16 joint conference organized during 13-18 July, 2025 by University of Glasgow at Scottish Exhibition Centre, Glasgow, UK
- Oral presentation on "Binary Eccentricity: Role in testing general relativity with Gravitational Waves from Compact Binaries" in Eccentricity Workshop titled "Challenges in Unraveling Astrophysical Eccentric Compact Binaries" organized at IIT Madras, Chennai, during March 01-04, 2025.
- Oral presentation on "Binary Inspirals as Proxies for Detecting Near-Horizon Black Hole Memory" in the 33rd meeting of Indian Association for General Relativity and Gravitation (IAGRG33) organised during 02-04 January, 2025 at Birla Institute of Technology and Science (BITS) Pilani, Pilani-333031, Rajisthan, India
- Poster presentation on "Testing general relativity in presence of binary eccentricity" in 10th International Conference on Gravitation and Cosmology (ICGC-2023) held from 6-9 December, 2023 at Indian Institute of Technology, Guwahati, India
- Oral presentation (online) on "Testing general relativity with gravitational wave signals from binary black holes in eccentric orbits" in premier international conference on gravitational waves (Amaldi15) with the theme "The Broad Reach of Gravitational Wave Science" held virtually from July 17-21, 2023.
- Oral presentation on "Multi-messenger astronomy using intermediate mass binary black holes (IMBBHs) in the LISA band" in the 32nd meeting of Indian Association for General Relativity and Gravitation (IAGRG32) organised during 19-21 December, 2022 at Indian Institute of Science, Education and Research (IISER), Kolkata-741252, India
- Oral presentation (online) on "Premerger Localisation of Intermediate Mass Binary Black Holes in LISA and Astrophysical Implications" in "14th International LISA Symposium" organised during 25-29 July, 2022 at University of Glasgow, Glasgow-G12 8QQ, United Kingdom
- Oral presentation (online) on "Systematic bias on the inspiral-merger-ringdown (IMR) consistency test of general relativity due to neglect of orbital eccentricity" in "23^{rd} International Conference on General Relativity and Gravitation (GR23)" organised during 03-08 July, 2022 at Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing-100190, China
- Oral presentation on "Effect of dark matter on neutron star cooling" in international workshop on "Advances in Astroparticle Physics and Cosmology (AAPCOS-2020)" organised during 6-10 January, 2020 at Saha Institute of Nuclear Physics, Kolkata-700064
- Oral presentation on "Constraining Neutron Star Equation of State with GW170817" in workshop on "The first Compact Star Merger Event - Implications for nuclear and particle physics" organised during 14-18 October 2019 in ECT* Villazzano Italy
- Poster presentation on "Role of strong first order hadron-quark phase transition on universality relation " in ASI-2018 held at Osmania University, Hyderabad during 05-09 Feberuary 2018
- Oral presentation on "Violation of universal relations in rotating neutron stars" in UGC sponsored national seminar on"Growth Points in Physics (GPP- 2017 " organised from 21^{st} to 23^{rd} of October 2017 in university of Kashmir

0.2 Schools/ Workshops

- Summer School on Gravitational-Wave Astronomy held in ICTS campus, Bangalore, India from 30th May to 10th June, 2022
- Summer School on Gravitational-Wave Astronomy held in ICTS campus, Bangalore, India from 5th July to 16th July, 2021
- Summer School on Gravitational-Wave Astronomy held in ICTS campus, Bangalore, India from 17th July to 28th July, 2017
- Summer School on Gravitational-Wave Astronomy held in ICTS campus, Bangalore, India from 25th July to 05th August, 2016
- Workshop on "Astronomical Techniques and science virtual Observatories" held at University of Kashmir , Srinagar during 23-26 September 2013

Seminars and Colloquia

- *talk title*: Binary Inspirals as Proxies for Detecting Near-Horizon Black Hole Memory.
  Gravitational Wave Research Group (GWRG), IUCAA, Pune, 411007, India, (06-09-2024)
- *talk title*: Testing general relativity with gravitational wave signals from binary black holes in eccentric orbits.
  Gravitational Wave Research Group (GWRG), IUCAA, Pune, 411007, India, (04-10-2023)
- *talk title* : Fundamental Physics with Gravitational Waves from Compact Binaries in Eccentric Orbits.
  Department of Physics, Shiv Nadar Institution of Eminence deemed to be University, Gautum Budha Nagar, Uttar Pradesh 203207, India, (21-08-2025)
- *talk title* : Dense matter inside neutron stars and astrophysical observables.
  National Center for Radio Astrophysics (Tata Institute of Fundamental Research) Pune India , (26-08-2019)
- *talk title* : Systematic bias on the inspiral-merger-ringdown consistency test due to neglect of orbital eccentricity.
  Astrophysical Relativity Group-International Centre for Theoretical Sciences (Tata Institute of Fundamental Research) Bengaluru India , (17-08-2022)

List of Publications

inspirehep-citation-summary, googlescholar-citation-summary

(1). D. Bandyopadhyay, **Sajad A. Bhat**, P. Char and D. Chatterjee, "Moment of inertia, quadrupole moment, Love number of neutron star and their relations with strange matter equations of state,"
Eur. Phys. J. A **54**, no. 2, 26 (2018)

(2). **Sajad A. Bhat** and D. Bandyopadhyay "Dense matter in strong gravitational field of neutron star,"
J. Astrophys. Astr. **39**, 18 (2018)

(3). **Sajad A. Bhat** and D. Bandyopadhyay, "Neutron star equation of state and GW170817,"
J. Phys. G **46**, no. 1, 014003 (2019)

(4). **Sajad A. Bhat** and A. Paul, "Cooling of Dark-Matter Admixed Neutron Stars with density-dependent Equation of State,"
Eur. Phys. J. C **80**, 544 (2020)

(5). Pankaj Saini, **Sajad A. Bhat** and K. G. Arun, "Premerger localization of Intermediate Mass Binary Black Holes with LISA and prospects of joint observations with Athena and LSST,"
Phys. Rev. D 106, 104015 (2022), arXiv:2208.03004 [gr-qc]

(6). **Sajad A. Bhat**, Pankaj Saini, Marc Favata and K. G. Arun, "Systematic bias on the inspiral-merger-ringdown consistency test due to neglect of orbital eccentricity ,"
Phys. Rev. D 107, 024009 (2023), arXiv:2207.13761 [gr-qc]

(7) Pankaj Saini, **Sajad A. Bhat**, Marc Favata, and K. G. Arun, "Eccentricity-induced systematic error on parametrized tests of general relativity: hierarchical Bayesian inference applied to a binary black hole population,"
Phys. Rev. D 109, 084056 (2024), arXiv:2311.08033

(8) Md Arif Shaikh, **Sajad A. Bhat**, and Shasvath J. Kapadia, "A study of the Inspiral-Merger-Ringdown Consistency Test with gravitational-wave signals from compact binaries in eccentric orbits,"
Phys. Rev. D 110, 024030 (2024), arXiv:2402.15110v1

(9) **Sajad A. Bhat**, Pankaj Saini, Marc Favata, Chinmay Gandevikar, Chandra Kant Mishra and K. G. Arun, "Parametrized tests of general relativity using eccentric compact binaries"
Phys. Rev. D 110, 124062 (2024), arXiv:2408.14132

(10) A. Gupta, K. G. Arun, E. Barausse, L. Bernard, E. Berti, **Sajad A. Bhat** et al., "Possible Causes of False General Relativity Violations in Gravitational Wave Observations"
SciPost Phys. Comm. Rep. 5 (2025), arXiv:2405.02197v1

(11) **Sajad A. Bhat**, Srijit Bhattacharjee, Shasvath J. Kapadia, "Can the Near-Horizon Black Hole Memory be detected through Binary Inspirals?"
Phys. Rev. D 112, 024068 (2025), arXiv:2406.15604v1.

(12)**Sajad A. Bhat**, Avinsh Tiwari, Md Arif Shaikh, Shasvath J. Kapadia, " Eccentricity Evolution Consistency Test to distinguish eccentric gravitational-wave signals from eccentricity mimickers"
Phys. Rev. D 112, 124004 (2025), arXiv:2508.14850v1.

(13) Avinash Tiwari, **Sajad A. Bhat**, Md Arif Shaikh, Shasvath J. Kapadia, "Testing the nature of GW200105 by probing the frequency evolution of eccentricity"
The Astrophysical Journal, 995:48 (6pp), 2025 December 10, arXiv:2509.26152

(14) N.V. Krishnendu, Tamara Evstafyeva, Aditya Vijaykumar, ..., **Sajad A. Bhat** et al. Implications of GW241011 for rotating exotic compact objects
arXiv: 2511.17341, Accepted in Physical Review Letters

(15) Avinash Tiwari, **Sajad A. Bhat**, Shasvath J. Kapadia, Tirthankar Roy Choudhary et al. "Gravitational Wave informed inference of 21-cm global signal parameters" MNRAS 549, 1–7 (2026), arXiv:2602.07631

(16) Md. Asim Ansari, Avinash Tiwari, **Sajad A. Bhat**, Sreejith Nair, Shasvath J. Kapadia
Line-of-sight acceleration (LOSA) driven effects in eccentric compact binary coalescences
In preparation ...
(17) Md. Asim Ansari, Avinash Tiwari, **Sajad A. Bhat** , Shasvath J. Kapadia
Line-of-sight acceleration (LOSA) driven effects in unequal-mass compact binary coalescences
In preparation ...
I am also a co-author on quite a few papers of LIGO-Virgo-KAGRA (LVK) Collaboration

(18) "GWTC-4.0: An Introduction to Version 4.0 of the Gravitational-Wave Transient Catalog"
Astrophys. J. Lett. **995**, L18 (2025)

(19) "GWTC-4.0: Methods for Identifying and Characterizing Gravitational-wave Transients"
Astrophys. J. Lett. 1004 (2026) 2, L21

(20) "GWTC-4.0: Updating the Gravitational-Wave Transient Catalog with Observations from the First Part of the Fourth LIGO-Virgo-KAGRA Observing Run"
Astrophys. J. Lett. 1004 (2026) 2, L22

(21) "GWTC-4.0: Tests of General Relativity. I. Overview and General Tests"
submitted to ApJL, arXiv:2603.19019

(22) "GWTC-4.0: Tests of General Relativity. II. Parameterized Tests"
submitted to ApJL, arXiv:2603.19020

Skills

- **Programming and Packages**

  Fortran, Mathematica, Python

- **Type Setting**

  LaTeX, LaTeX Beamer, MS Word, Powerpoint, Libre Word, Impress

- **Languages**

  English, Kashmiri, Urdu, Hindi

Computational Requirements

- **Tools and Softwares**

  Jupyter Project, Mathematica, Python

- **Computational Facilities**

  High Performance Computing Cluster

Budgetary Requirements

- **Research Support**

  Financial support for attending national and international Conferences/Meetings/Workshops/Seminars

- **Membership Support**

  Financial support in the form of Membership Fee for being an active member of international scientific collaborations like LIGO Scientific Collaboration (LSC), Cosmic Explorer (CE) Consortium, Einstien Telescope (ET) Consortium, Laser Interferometer Space Antenna (LISA) Consortium

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References

1. Prof. Debades Bandyopadhyay
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   Department of Physics,

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3. Dr. Shasvath Kapadia
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