



Abhimanyu Susobhanan

Areas of Interest

Gravitational Waves, Pulsars, Binary Systems, Astrophysical Software

Education

Aug 2015–
Sep 2021 **Master of Science in Physics + Doctor of Philosophy in Astrophysics**, *Department of Astronomy & Astrophysics, Tata Institute of Fundamental Research, Mumbai, Maharashtra, India*

Thesis Title: [Perspectives in nanohertz gravitational-wave astronomy](#)

Advisor: Prof. Achamveedu Gopakumar

Aug 2008–
May 2012 **Bachelor of Technology in Physical Sciences**, *Department of Earth & Space System Sciences, Indian Institute of Space Science and Technology, Thiruvananthapuram, Kerala, India*

CGPA: 8.27/10

Research & Professional Experience

Jun 2022 –
present **Postdoctoral Fellow**, *Center for Gravitation Cosmology and Astrophysics, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin, USA*

- Leading the development team for the [PINT](#) pulsar timing package. Frequentist pulsar timing noise characterization using PINT.
- Efficient methods for computing pulsar timing array signals due to supermassive eccentric binaries, implemented in the [GWecc.jl](#) package.
- A pilot all-sky single-pulsar Bayesian search for supermassive eccentric binaries using [GWecc.jl](#) in the NANOGrav 12.5-year data of PSR J1909–3744.
- Multi-messenger targeted search for a supermassive eccentric binary in the radio galaxy 3C 66B in the NANOGrav 12.5-year dataset.
- The [chimera](#) pipeline to reduce pulsar data obtained using the CHIME telescope, used for integrating CHIME data into NANOGrav.
- Pulsar timing array signals induced by hyperbolic encounters of supermassive black hole pairs, implemented in the [GW_hyp](#) package.
- Extension of the wideband timing technique to combine simultaneous multi-band observations.
- Noise characterization of the InPTA Data Release 1.
- Mentored three students
 - Mr Subhajit Dandapat (Doctoral student, Tata Institute of Fundamental Research)
 - Mr Aman Srivastava (Doctoral student, Indian Institute of Technology Hyderabad)
 - Mr Avinash Kumar Paladi (Master's student, Indian Institute of Space Science and Technology)

Sep 2021 –
Jan 2022 **Postdoctoral Fellow**, *National Centre for Radio Astrophysics, Tata Institute of Fundamental Research, Pune, Maharashtra, India*

- Led the [InPTA Data Release 1](#) project during its initial stages.
- Mentored one student
 - Mr Neel Kohle (Master's student, St Xavier's College, Mumbai)

Aug 2015–
Sep 2021 **Research Scholar**, *Department of Astronomy & Astrophysics, Tata Institute of Fundamental Research, Mumbai, Maharashtra, India*

- The [pinta](#) pipeline to reduce pulsar data obtained using the GMRT telescope.
- Modeling pulsar timing array signals induced by supermassive eccentric binaries.
- The *ELL1k* timing model for nearly circular pulsar binaries experiencing significant advance of periastron.
- A new phasing approach to modeling the optical outbursts of the blazar OJ 287 using its binary black hole central engine model, implemented in the [opha](#) package.
- An analytic solution to the third post-Newtonian-accurate Kepler equation.
- Characterization of the 2021 chromatic timing event in PSR J1713+0747.
- Modeling the jet position angle variations of the blazar OJ 287 using its binary central engine model.
- Mentored two students
 - Ms Nikita Agarwal (Undergraduate student, Manipal Institute of Technology)
 - Mr Akash Anumalapudi (Undergraduate student, Indian Institute of Technology Bombay)
- Conducted training sessions on Linux, Python, pulsar data reduction, and pulsar timing at multiple workshops.
- Teaching assistant for Astronomy & Astrophysics I, Astronomy & Astrophysics II, and Electrodynamics II
- Public outreach activities including organizing National Science Day and and Frontiers of Science events, and lectures to school and undergraduate students.

Sep 2012–
Jun 2015 **Scientist/Engineer**, *Liquid Propulsion Systems Centre, Indian Space Research Organization, Valiyamala, Thiruvananthapuram, Kerala, India*

- A searchable internal repository for quality assurance reports named PEARL-DB.
 - Managed a team of junior developers.
- An internal secure file-sharing service named BHANDAAR.
- Development and maintenance of the center website, employees' portal, and recruitment portal.

Selected Publications

- 2023* [1] Gabriella Agazie, ..., **Abhimanyu Susobhanan**, et al., “*The NANOGrav 12.5-year data set: Multi-messenger targeted search for gravitational waves from an eccentric supermassive binary in 3C 66B*”, Submitted to The Astrophysical Journal, arXiv: [2309.17438](#)
- 2023* [2] Avinash Kumar Paladi, ..., **Abhimanyu Susobhanan**, et al., “*Multi-band Extension of the Wideband Timing Technique*”, Accepted for publication in Monthly Notices of the Royal Astronomical Society, arXiv: [2304.13072](#)
- 2023 [3] Aman Srivastava, ..., **Abhimanyu Susobhanan**, et al., “*Noise analysis in the Indian Pulsar Timing Array Data Release I*”, Physical Review D, 108, 2, 023008, DOI: [10.1103/PhysRevD.108.023008](#)
- 2023 [4] **Abhimanyu Susobhanan**, “*Post-Newtonian-accurate pulsar timing array signals induced by inspiralling eccentric binaries: accuracy, computational cost, and single-pulsar search*”, Classical and Quantum Gravity, 40, 155014, DOI: [10.1088/1361-6382/ace234](#)
- 2023 [5] Subhajit Dandapat, Michael Ebersold, **Abhimanyu Susobhanan**, et al., “*Gravitational Waves from Black-Hole Encounters: Prospects for Ground- and Galaxy-Based Observatories*”, Physical Review D, 108, 024013, DOI: [10.1103/PhysRevD.108.024013](#)
- 2022 [6] Pratik Tarafdar, ..., **Abhimanyu Susobhanan**, et al., “*The Indian Pulsar Timing Array: First data release*”, Publications of the Astronomical Society of Australia, 39, E053, DOI: [10.1017/pasa.2022.46](#)

- 2021 [7] Jaikhomba Singha, ..., **Abhimanyu Susobhanan**, et al., “Evidence for profile changes in PSR J1713+0747 using the uGMRT”, Monthly Notices of the Royal Astronomical Society: Letters, 507, 1, L57–L61, DOI: [10.1093/mnrasl/slab098](https://doi.org/10.1093/mnrasl/slab098)
- 2021 [8] Lankeswar Dey, ..., **Abhimanyu Susobhanan**, et al., “Explaining temporal variations in the jet position angle of blazar OJ 287 using its binary black hole central engine model”, Monthly Notices of the Royal Astronomical Society, 503, 3, 4400–4412, DOI: [10.1093/mnras/stab730](https://doi.org/10.1093/mnras/stab730)
- 2021 [9] **Abhimanyu Susobhanan**, Yogesh Maan, Bhal Chanda Joshi, et al., “pinta: The uGMRT Data Processing Pipeline for the Indian Pulsar Timing Array”, Publications of the Astronomical Society of Australia, 38, E017, DOI: [10.1017/pasa.2021.12](https://doi.org/10.1017/pasa.2021.12)
- 2020 [10] **Abhimanyu Susobhanan**, Achamveedu Gopakumar, George Hobbs, and Stephen Taylor, “Pulsar timing array signals induced by black hole binaries in relativistic eccentric orbits”, Physical Review D, 101, 4, 043022, DOI: [10.1103/PhysRevD.101.043022](https://doi.org/10.1103/PhysRevD.101.043022)
- 2018 [11] **Abhimanyu Susobhanan**, Achamveedu Gopakumar, Bhal Chanda Joshi, and Ranjan Kumar, “Exploring the effect of periastron advance in small-eccentricity binary pulsars”, Monthly Notices of the Royal Astronomical Society, 480, 4, 5260–5271, DOI: [10.1093/mnras/sty2177](https://doi.org/10.1093/mnras/sty2177)
- 2017 [12] Yannick Boetzel, **Abhimanyu Susobhanan**, Achamveedu Gopakumar, Antoine Klein, and Philippe Jetzer, “Solving post-Newtonian accurate Kepler equation”, Physical Review D, 96, 4, 044011, DOI: [10.1103/PhysRevD.96.044011](https://doi.org/10.1103/PhysRevD.96.044011)

Skills

Programming Languages	C++, Python, C, Julia, Java, JavaScript, PHP, Wolfram Language, TeX , bash
Astrophysical software	PINT, TEMPO2, ENTERPRISE, PSRCHIVE, DSPSR
Telescope observations	Giant Metre-wave Radio Telescope, Parkes Radio Telescope
Data analysis	Bayesian inference, Data visualization

Languages

Malayalam (native), English, Hindi

Awards and Fellowships

- 2022-present NANOGrav NSF Physics Frontier Center Postdoctoral Fellowship
- 2019 **Ratanbai Jerajani Award** for the best seminar in the area of Astronomy and Astrophysics at TIFR
- 2019 **Sarojini Damodaran Fellowship** for international travel
- 2006-2012 **National Talent Search Scholarship**

References

Prof. David Kaplan

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Prof. Sarah Vigeland

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Prof. Achamveedu Gopakumar

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