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*
- Efficient methods for computing pulsar timing array signals due to supermassive eccentric binaries, implemented in the `GWecc.jl` package.
- Single-pulsar Bayesian search for supermassive eccentric binaries using `GWecc.jl` in the NANOGrav data.
- The `chimera` pipeline to reduce large volumes of pulsar data obtained using the CHIME telescope.
- Leading the development team for the `PINT` pulsar timing package.

Sep 2021 – Jan 2022
Postdoctoral Fellow, *National Centre for Radio Astrophysics, Tata Institute of Fundamental Research, Pune, Maharashtra, India*
- Multiple pulsar timing projects as part of the Indian Pulsar Timing Array, including the `InPTA Data Release 1`.

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.
- Mentored two undergraduate students and two masters students
- Conducted teaching and training sessions on Linux, Python, pulsar data reduction, and pulsar timing at multiple workshops.
- Teaching assistant for Astronomy & Astrophysics I, Astronomy & Astrophysics II, and Electro-

dynamics II

Sep 2012– **Scientist/Engineer**, *Liquid Propulsion Systems Centre, Indian Space Research Organiza-*
Jun 2015 *tion, Valiyamala, Thiruvananthapuram, Kerala, India*
- A searchable internal repository for quality assurance reports named PEARL-DB.
- An internal secure file-sharing service named BHANDAAR.
- Development and maintenance of the center website, employees' portal, and recruitment portal.

Publications

Publications with Major Contribution

2023* [1] Subhajit Dandapat, Michael Ebersold, **Abhimanyu Susobhanan**, et al., "*Gravitational Waves from Black-Hole Encounters: Prospects for Ground- and Galaxy-Based Observatories*", Submitted to Physical Review D

2022* [2] **Abhimanyu Susobhanan**, "*Post-Newtonian-accurate pulsar timing array signals induced by inspiralling eccentric binaries: accuracy and computational cost*", Submitted to Classical and Quantum Gravity, arXiv: 2210.11454

2022 [3] Pratik Tarafdar et al. (38 authors including **Abhimanyu Susobhanan**), "*The Indian Pulsar Timing Array: First data release*", Publications of the Astronomical Society of Australia, 39, E053, DOI: 10.1017/pasa.2022.46

2021 [4] Jaikhomba Singha et al. (32 authors including **Abhimanyu Susobhanan**), "*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

2021 [5] **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

2021 [6] **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

2018 [7] **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

2017 [8] **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

2017 [9] 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

Other Publications

2023* [10] Avinash Kumar Paladi et al. (31 authors including **Abhimanyu Susobhanan**), "*Multi-band Extension of the Wideband Timing Technique*", Submitted to Monthly Notices of the Royal Astronomical Society, arXiv: 2304.13072

2023* [11] Aman Srivastava et al. (31 authors including **Abhimanyu Susobhanan**), "*Noise analysis in the Indian Pulsar Timing Array Data Release I*", Submitted to Physical Review D, arXiv: 2303.12105

2022 [12] Bhal Chanda Joshi et al. (37 authors including **Abhimanyu Susobhanan**), "*Nanohertz Gravitational Wave Astronomy during the SKA Era: An InPTA perspective*", Journal of Astrophysics and Astronomy, 43, 2, 98, DOI: 10.1007/s12036-022-09869-w

2022 [13] K Nobleson et al. (31 authors including **Abhimanyu Susobhanan**), "*Low-frequency wideband timing of InPTA pulsars observed with the uGMRT*", Monthly Notices of the Royal Astronomical Society, 512, 1, 1234-1243, DOI: 10.1093/mnras/stac532

2021 [14] M A Krishnakumar et al. (22 authors including **Abhimanyu Susobhanan**), "*High Precision Measurements of Interstellar Dispersion Measure with the upgraded GMRT*", Astronomy & Astrophysics, 651, A5, DOI: 10.1051/0004-6361/202140340

2021 [15] Lankeswar Dey et al. (7 authors including **Abhimanyu Susobhanan**), "*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

2019 [16] Lankeswar Dey et al. (15 authors including **Abhimanyu Susobhanan**), "*The Unique Blazar OJ 287 and Its Massive Binary Black Hole Central Engine*", Universe, 5, 5, 108, DOI: 10.3390/universe5050108

2018 [17] Bhal Chanda Joshi et al. (20 authors including **Abhimanyu Susobhanan**), "*Precision pulsar timing with the ORT and the GMRT and its applications in pulsar astrophysics*", Journal of Astrophysics and Astronomy, 39, 4, 51, DOI: 10.1007/s12036-018-9549-y

Skills

Programming Languages	`C++, Python, C, Julia, Java, JavaScript, PHP, Wolfram Language, LaTeX, 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**

Other Activities

Public Outreach	– I have given talks to school and college students as well as helped to organize "Frontiers of Science" and National Science Day events as part of the public outreach activities of TIFR. I have been a member of the TIFR Outreach Committee during 2016-2018.

– During April 2020, I contributed to a popular YouTube video, created by *NASA Jet Propulsion Laboratory*, titled *Timing of Black Hole Dance Revealed by NASA Spitzer Space Telescope*.

– Online lecture on "Physics in Daily Life" to high school students as part of the Promotion of Excellence among Gifted Children program of the Government of Kerala (November 2020).

References

Prof. Achamveedu Gopakumar
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Prof. Bhal Chanda Joshi
National Centre for Radio Astrophysics, Tata Institute of Fundamental Research,
Pune, Maharashtra, India
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Dr. George Hobbs
CSIRO Space and Astronomy,
Marsfield, NSW, Australia
Email: George.Hobbs@csiro.au