Abhimanyu Susobhanan

Curriculum Vitae

▅▅▅ Research Interests

Gravitational Waves, Pulsars, Astrophysical Software

▅▅▅ Education

2015–2021	**Master of Science in Physics + Doctor of Philosophy in Astrophysics**, *Tata Institute of Fundamental Research, Mumbai, India*. Thesis Title: Perspectives in nanohertz gravitational-wave astronomy Advisor: Prof. A. Gopakumar
2008–2012	**Bachelors of Technology in Physical Sciences**, *Indian Institute of Space Science and Technology, Thiruvananthapuram, India*.

▅▅▅ Research & Professional Experience

2021–*present*	**Postdoctoral Fellow**, *National Centre for Radio Astrophysics, Pune, India*. I am working on the pulsar data combination and noise analysis for the first data release of the Indian Pulsar Timing Array experiment.
2015–2021	**Research Scholar**, *Tata Institute of Fundamental Research, Mumbai, India*. I am working on different aspects of nanohertz gravitational wave astronomy. My areas of interest include modeling pulsar timing array signals from isolated sources, probing dynamics of compact binaries and exploring its implications for pulsar timing, and software development for pulsar timing array data analysis.
2019	**Visiting Student**, *CSIRO Astronomy and Astrophysics, Marsfield, NSW, Australia*. Guide : Dr. George Hobbs
2012–2015	**Scientist/Engineer**, *Liquid Propulsion Systems Centre, Indian Space Research Organization, Valiamala, Thiruvananthapuram, India*. Design, development and maintenance of web-applications using Java, PHP and JavaScript for internal use.
2012	**Intern**, *U.R. Rao Satellite Centre, Indian Space Research Organization, Bengaluru, India*. Project Title : Study of Fe Line Emission from Black Hole Systems Guide : Dr. M.C. Ramadevi
2011	**Intern**, *Raman Research Institute, Bengaluru, India*. Project Title : Broadband spectroscopy of compact x-ray sources Guide: Prof. Biswajit Paul
2010	**Intern**, *Physical Research Laboratory, Ahmadabad, India*. Project Title : Understanding the Properties of Binary X-Ray Pulsars Guide: Prof. Sachindra Naik

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Teaching & Mentoring Experience

2018-2021 Conducted multiple training sessions for InPTA collaboration members on uGMRT data reduction, pulsar timing and PTA data analysis.

2021 Resource person for the IPTA school/workshop (conducted online). – Training session on TEMPO2

2019 Resource person for "Probing relativistic gravity in the SKA era" workshop conducted at Kantary Hills, Chiang Mai, Thailand. – Training session on Linux and Python

Autumn 2018 **Teaching Assistant**, *Tata Institute of Fundamental Research, Mumbai, India.*
Course Title : Astronomy and Astrophysics I (Instructors: H. M. Antia & A. Gopakumar)

2018 Resource person for "Pulsar Astronomy with uGMRT" bootcamp conducted at BITS-Pilani, Hyderabad, India. – Training sessions on Linux, Python and TEMPO2

Autumn 2017 **Teaching Assistant**, *Tata Institute of Fundamental Research, Mumbai, India.*
Course Title : Electrodynamics II (Instructors: Sushil Mujumdar & A. Gopakumar)

Spring 2016 **Teaching Assistant**, *Tata Institute of Fundamental Research, Mumbai, India.*
Course Title : Astronomy and Astrophysics II (Instructor: Manoj Puravankara)

Publications

Publications with Major Contribution

2021 [1] **Abhimanyu Susobhanan**, Yogesh Maan, Bhal Chandra Joshi, T. Prabu, Shantanu Desai 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

2020 [2] **Abhimanyu Susobhanan**, A. 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 [3] **Abhimanyu Susobhanan**, A. Gopakumar, Bhal Chandra 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 [4] Yannick Boetzel, **Abhimanyu Susobhanan**, A. Gopakumar, Antoine Klein, and Philippe Jetzer, "*Solving post-Newtonian accurate Kepler equation*", Physical Review D, 96, 4, 044011, DOI: 10.1103/PhysRevD.96.044011

2021* [5] **Abhimanyu Susobhanan**, Lankeswar Dey, A. Gopakumar, Tjonnie Li, and Mauri Valtonen, "*Timing OJ 287: An Efficient and Novel Computational Model and Improved Parameter Estimation for the Central Engine of the Blazar OJ 287*", In preparation

2021* [6] Lankeswar Dey, **Abhimanyu Susobhanan**, A. Gopakumar, and Mauri Valtonen, "*Pulsar timing array signals due to spinning black hole binaries in eccentric orbits*", In preparation

Other Publications

2021 [7] 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

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2021   [8] 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   [9] Lankeswar Dey, Mauri Valtonen, A. Gopakumar, Rocco Lico, José Gómez, **Abhimanyu Susobhanan**, and Pauli Pihajoki, "*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   [10] Lankeswar Dey, A. Gopakumar, Mauri Valtonen, Stanislaw Zola, **Abhimanyu Susobhanan**, et al., "*The Unique Blazar OJ 287 and Its Massive Binary Black Hole Central Engine*", Universe, 5, 5, 108, DOI: [10.3390/universe5050108](#)

2018   [11] Bhal Chandra Joshi et al. (19 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](#)

2021*   [12] The NANOGrav Collaboration and Others (including **Abhimanyu Susobhanan**), "*The NANOGrav 12.5 yr data set: Detection experiments for eccentric binary supermassive black holes in the nanohertz gravitational-wave regime*", In preparation

Non-peer reviewed communications

2021   [13] Jaikhomba Singha et al. (26 authors including **Abhimanyu Susobhanan**), "*Low frequency view of profile change event in PSR J1713+0747 with the uGMRT*", The Astronomer's Telegram, No. [14667](#)

Software Development

–   **pinta**, *For reducing the upgraded GMRT raw pulsar data for InPTA.*
https://github.com/abhisrkckl/pinta

–   **GWecc**, *for computing the pulsar timing array signals due to eccentric binaries .*
https://github.com/abhisrkckl/GWecc

–   **ugmrt2fil**, *for converting uGMRT beamformer data to sigproc-filterbank format.*
https://github.com/abhisrkckl/ugmrt2fil

–   **Opha**, *Implements a new 'phasing' approach to modeling outburst timings of OJ 287.*
https://github.com/abhisrkckl/opha

–   **TEMPO2**, *Contributed the* `ELL1k` *binary model to the pulsar timing package TEMPO2.*
https://bitbucket.org/psrsoft/tempo2/src/master/ELL1kmodel.C

–   **mikkola**, *An implementation of the Mikkola's method for solving the classical Kepler equation and its post-Newtonian extensions.*
https://github.com/abhisrkckl/mikkola

Skills

Programming Languages	C++, C, Python, Java, JavaScript, PHP, Wolfram Language, LaTeX, bash
Astrophysical software	TEMPO2, ENTERPRISE, PINT, psrchive, dspsr
Telescope observations	Giant Metre-wave Radio Telescope, Parkes Radio Telescope
Data analysis	Bayesian inference

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Awards and Fellowships

2019   **Ratanbai Jerajani Award** for best seminar in the area of Astronomy and Astrophysics at TIFR

2019   **Sarojini Damodaran Fellowship** for international travel

2006-2012   **National Talent Search Scholarship**

Languages

Malayalam (native), English, Hindi

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 programme of Government of Kerala (November 2020).

References

Prof. A. Gopakumar.
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Mumbai, Maharashtra, India
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Dr. George Hobbs.
CSIRO Astronomy and Space Science,
Marsfield, NSW, Australia
Email: George.Hobbs@csiro.au

Prof. Bhal Chandra Joshi.
National Centre for Radio Astrophysics, Tata Institute of Fundamental Research,
Pune, Maharashtra, India
Email: bcj@ncra.tifr.res.in

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