



# Abhimanyu Susobhanan

## Curriculum Vitae

### Areas of Interest

Gravitational Waves, Pulsars, Binary Systems, Astrophysical Software

### Education

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

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

**Advisor:** Prof. A. Gopakumar

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

**CGPA:** 8.27/10

### Research & Professional Experience

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

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

Multiple projects as part of the Indian Pulsar Timing Array, including the first data release.

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

Different aspects of nanohertz gravitational wave astronomy, including 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.

Jul 2019– **Visiting Student**, *CSIRO Astronomy and Astrophysics, Marsfield, NSW, Australia*

Oct 2019 Guide : Dr. George Hobbs

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

Design and development of web-applications using Java, PHP and JavaScript. My completed projects include a secure internal file sharing service and a database system for storing and analyzing quality assurance reports.

Jan 2012– **Intern**, *U.R. Rao Satellite Centre, Indian Space Research Organization, Bengaluru, India*

Apr 2012 Project Title : Study of Fe Line Emission from Black Hole Systems

Guide : Dr. M.C. Ramadevi

*National Centre for Radio Astrophysics, Tata Institute of Fundamental Research, Pune 411007, India*

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🔗 [abhisrkckl](#) • <sup>®</sup> [Abhimanyu-Susobhanan](#)

- Jun 2011– **Intern**, *Raman Research Institute, Bengaluru, India*  
 Aug 2011 Project Title : Broadband spectroscopy of compact x-ray sources  
 Guide: Prof. Biswajit Paul
- Jan 2010– **Intern**, *Physical Research Laboratory, Ahmadabad, India*  
 Feb 2010 Project Title : Understanding the Properties of Binary X-Ray Pulsars  
 Guide: Prof. Sachindra Naik

## Teaching & Mentoring Experience

- 2021-2022 Mentored Mr Avinash Kumar Paladi in his masters project.
- 2020-2021 Mentored Ms Nikita Agarwal in her undergraduate projects as part of the InPTA collaboration.
- 2021 Mentored Mr Neel Kohle in his masters project.
- 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

- 2022\* [1] 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](https://arxiv.org/abs/2210.11454)
- 2022\* [2] Pratik Tarafdar et al. (38 authors including **Abhimanyu Susobhanan**), “*The Indian Pulsar Timing Array: First data release*”, Accepted for publication in Publications of the Astronomical Society of Australia, arXiv: [2206.09289](https://arxiv.org/abs/2206.09289)
- 2021 [3] **Abhimanyu Susobhanan**, Yogesh Maan, Bhal Chandra 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 [4] **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](https://doi.org/10.1103/PhysRevD.101.043022)
- 2018 [5] **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](https://doi.org/10.1093/mnras/sty2177)

- 2017 [6] 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](https://doi.org/10.1103/PhysRevD.96.044011)

#### Other Publications

- 2022\* [7] Bhal Chandra Joshi et al. (37 authors including **Abhimanyu Susobhanan**), “Nanohertz Gravitational Wave Astronomy during the SKA Era: An InPTA perspective”, Accepted for publication in Journal of Astrophysics and Astronomy, arXiv: [2207.06461](https://arxiv.org/abs/2207.06461)
- 2022 [8] 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](https://doi.org/10.1093/mnras/stac532)
- 2021 [9] 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](https://doi.org/10.1093/mnrasl/slab098)
- 2021 [10] 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](https://doi.org/10.1051/0004-6361/202140340)
- 2021 [11] 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](https://doi.org/10.1093/mnras/stab730)
- 2019 [12] 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](https://doi.org/10.3390/universe5050108)
- 2018 [13] 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](https://doi.org/10.1007/s12036-018-9549-y)

#### Non-peer reviewed communications

- 2021 [14] 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](https://www.astronomer-tel.com/2021/07/14/14667/)

## 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>
- **PINT**, Member of the development team for the PINT pulsar timing package.  
<https://github.com/nanograv/PINT>
- **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/ophat>
- **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++, Python, C, Java, JavaScript, PHP, Wolfram Language, $\text{\LaTeX}$ , bash
Astrophysical software	TEMP02, ENTERPRISE, PINT, psrchive, dspsr
Telescope observations	Giant Metre-wave Radio Telescope, Parkes Radio Telescope
Data analysis	Bayesian inference, Data visualization

## 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

Dept. of Astronomy and Astrophysics, Tata Institute of Fundamental Research,  
Mumbai, Maharashtra, India  
Email: [gopu@tifr.res.in](mailto:gopu@tifr.res.in)

### Prof. Bhal Chandra Joshi

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Pune, Maharashtra, India  
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