Aditya Vijaykumar

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Reserach Summary

I work on a broad spectrum of topics in gravitational-wave astronomy, spanning astrophysics, cosmology, fundamental physics, and data analysis. Recently, my work has focused on investigating the environments that nurture the formation and evolution of compact object binaries, and their role as probes of the cosmos.

Employment

CITA Postdoctoral Fellow Sep 2023 - *Present*
Canadian Institute for Theoretical Astrophysics (CITA), Toronto

Graduate Student Aug 2018 - Aug 2023
International Centre for Theoretical Sciences (ICTS-TIFR), Bengaluru

Fulbright-Nehru Doctoral Research Fellow Aug 2022 - Mar 2023
Department of Physics, The University of Chicago

Education

International Centre for Theoretical Sciences (ICTS-TIFR), Bengaluru 2018 - 2023
PhD in Physics. Mentor: Prof. Ajith Parameswaran.
Thesis Title: *Exploring gravity, astrophysics, and cosmology with gravitational waves*

Birla Institute of Technology and Science (BITS), Pilani 2013 - 2018
M.Sc. (Hons.) Physics and B.E. (Hons.) Mechanical Engineering

Awards

1. **Justice Oak Award for Outstanding thesis in Astronomy 2024**, Astronomical Society of India (ASI)
2. **V. V. Narlikar Best Thesis Award 2024**, Indian Association for General Relativity and Gravitation (IAGRG)
3. **Fulbright-Nehru Doctoral Research Fellowship 2022**, US Department of State and Government of India
4. **Graduate Fellowship 2018-2023**, ICTS-TIFR
5. **S.N. Bhatt Memorial Excellence Fellowship 2018**, ICTS-TIFR
6. **Summer Research Fellowship 2016**, Indian Academy of Sciences
7. **INSPIRE-DST Scholarship for Higher Education 2013-2018**, Government of India

Publication Library NASA-ADS Link

Seminars

- Seminar at Caltech — March 2025
- Seminar at UCLA — March 2025
- IGC seminar, Penn State University — October 2024
- IUCAA gravitational wave seminar — August 2024
- Gravity Exploration Institute seminar, Cardiff University — July 2024
- CIERA seminar, Northwestern University — June 2024
- GRAPPA seminar, University of Amsterdam — May 2024
- Strong seminar, Niels Bohr Institute — April 2024
- CITA Seminar, University of Toronto — January 2024

- TASTY Seminar, University of Toronto — January 2024
- IUCAA gravitational wave seminar, Pune — July 2023
- Physics seminar, IISER Pune — July 2023
- Physics seminar, IIT Gandhinagar — June 2023
- Gravitational wave seminar, Seoul National University (virtual) — October 2022
- IGC seminar, Penn State University — August 2022
- Lorentz Institute seminar, Leiden (virtual) — June 2020
- IUCAA gravitational wave seminar, Pune — September 2019
- Albert Einstein Institute seminar, Hannover — July 2019

Conferences and Meetings

- APS Meeting, Anaheim, CA — March 2025
- Midwest Relativity Meeting, Ann Arbor, MI — November 2024
- PAX Meeting, London, UK (panelist) — July 2024
- CASCA Meeting, Toronto — June 2024
- Gravitational waves: A new ear on the chemistry of galaxies, Leiden — April 2024.
- Globular Clusters and their Tidal Tails, Toronto — May 2024
- Joint CITA-PI Gravitational waves meeting — October 2023
- Pune-Mumbai Cosmology Meeting — August 2023
- The Quest for Precision Gravitational-wave Cosmology, KICP, Chicago — September 2022
- Second Chennai Symposium on Gravitation and Cosmology, Chennai (virtual) — February 2022
- Advances in Computational Relativity, ICERM, Brown University (virtual) — September 2020
- ICTS In-house Symposium, Bengaluru — February 2020
- Astrophysics of Supermassive Black Holes, ICTS, Bengaluru — December 2019
- International Conference on Gravitation & Cosmology, Mohali — December 2019
- Future of Gravitational Wave Astronomy, ICTS, Bengaluru — August 2019
- GR22 and Amaldi13, Valencia — July 2019

Mentorship

- Ben Stadel (University of Alberta) — May 2024 - *Present*
- Kaustubh Gupta (IISER, Pune) — May 2022 - May 2023
- Adhrit Ravichandran (IIT Roorkee → UMass Dartmouth) — Sep 2021 - Aug 2022
- Kruthi Krishna (IISc → Radboud University) — Sep 2020 - Aug 2021
- Harsh Narola (IISER, Tirupati → Utrecht University) — Sep 2020 - Aug 2021

Teaching

- Instructor and organizer, **LIGO-Virgo Collaboration Gravitational-Wave Open Data Workshop #5 and #6** at ICTS.
- Tutor for the **Numerical Relativity** graduate course, ICTS, Jan-April 2022.
- Co-organizer and tutor, **ICTS Workshop on Parameter Estimation with bilby**, ICTS, Bengaluru, India, August 2020 (Online)
- Tutor, **Light and Beyond—Summer Course for Undergraduate Students by Prof. Rajaram Nityananda**, June 2020 (Online)
- Tutor, **LIGO-Virgo Collaboration Gravitational-Wave Open Data Workshop #3**, May 2020 (Online)
- Tutor for the following mini-courses, **ICTS Summer Schools on Gravitational Wave Astronomy**, ICTS, Bengaluru, India:
  1. *Compact binary evolution, rates and population modelling*, June 2022.
  2. *Astrophysical Stochastic GW Foreground*, July 2021.
  3. *Numerical Hydrodynamics*, May 2020.
  4. *Advanced General Relativity*, July 2019.

Outreach

- Co-PI of the *IndiaBioscience Outreach Grant* to communicate science using stage theatre.
- Panelist at the *Bengaluru: The Astronomy City*, a Q&A event organized for **National Science Day**, February 2022.
- Mediator for the **Contagion Exhibition**, Science Gallery Bengaluru, April-July 2021.
- Moderated a discussion with Prof. Smitha Vishveshwara on her collaborative science theatre project *Quantum Voyages* as a part of **Cosmic Zoom Online Exhibition**, April 2021
- Articles on the **ICTS blog**:
  1. A Conversation with ICTS Scientists Studying the Indian Monsoon, November 2019
  2. Summer School on Gravitational Wave Astronomy, November 2019
- Talk titled *The Whats, Whys and Hows of Gravitational-wave Astronomy*, **BMS College of Engineering, Bengaluru**, November 2019
- Talk titled *Gravitational Waves - A New Tool for Cosmology!* at **Vigyan Samagam**, Visvesvaraya Industrial and Technological Museum, Bengaluru, India, August 2019
- Biweekly interactive outreach sessions in rural primary schools, 2019

Technical Skills

Programming Languages - Python, C, C++, Shell Script
Softwares - MATLAB, Mathematica
Tools/Frameworks - LaTeX, Git

References

Prof. Maya Fishbach
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Prof. Peter Martin
Canadian Institute for Theoretical Astrophysics (CITA),
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Prof. Parameswaran Ajith
International Centre for Theoretical Sciences (ICTS-TIFR),
Shivakote, Hesaraghatta-Hobli,
Bengaluru, 560089, India.
ajith@icts.res.in

Prof. Daniel E. Holz
The University of Chicago,
Michelson Center for Physics,
Chicago, IL 60637, USA.
holz@uchicago.edu

Papers (short authorlist)

20. Kanchan Soni, **Aditya Vijaykumar**, Sanjit Mitra
Assessing the potential of LIGO-India in resolving the Hubble Tension
Submitted to CQG, arXiv:2409.11361.

19. Avinash Tiwari, **Aditya Vijaykumar**, Shasvath J. Kapadia, Sourav Chatterjee, Giacomo Fragione
Profiling stellar environments of gravitational wave sources
Submitted to Phys. Rev. Lett., arXiv:2407.15117.

18. Alexandra G. Hanselman, **Aditya Vijaykumar**, Maya Fishbach, Daniel E. Holz
Gravitational-wave dark siren cosmology systematics from galaxy weighting
ApJ 979 9, arXiv:2405.14818.

17. Sreejith Nair, **Aditya Vijaykumar**, Sudipta Sarkar
Bounds on the charge of the graviton using gravitational wave observations
JCAP 11 (2024) 004, arXiv:2405.05038.

16. **Aditya Vijaykumar**, Alexandra G. Hanselman, Michael Zevin
Consistent eccentricities for gravitational wave astronomy: Resolving discrepancies between astrophysical simulations and waveform models
ApJ 969 132, arXiv:2402.07892.

15. Mukesh Kumar Singh, Shasvath J. Kapadia **Aditya Vijaykumar**, Parameswaran Ajith
Impact of higher harmonics of gravitational radiation on the population inference of binary black holes
ApJ 971 23, arXiv:2312.07376.

14. Kruthi Krishna, **Aditya Vijaykumar**, Apratim Ganguly, *et al*
Accelerated parameter estimation in Bilby with relative binning
arXiv:2312.06009.

13. **Aditya Vijaykumar**, Maya Fishbach, Susmita Adhikari, Daniel E. Holz
Inferring host galaxy properties of LIGO-Virgo-KAGRA's black holes
ApJ 972 157, arXiv:2312.03316.

12. Divyajyoti, N.V. Krishnendu, Muhammed Saleem, Marta Colleoni, **Aditya Vijaykumar**, K.G. Arun, Chandra Kant Mishra
Effect of double spin-precession and higher harmonics on spin-induced quadrupole moment measurements
Phys. Rev. D 109, 023016, arXiv:2311.05506.

11. Avinash Tiwari, **Aditya Vijaykumar**, Shasvath J. Kapadia, Giacomo Fragione, Sourav Chatterjee
Accelerated binary black holes in globular clusters: forecasts and detectability in the era of

space-based gravitational-wave detectors
MNRAS, 527, 8586, arXiv:2307.00930.

10. **Aditya Vijaykumar**, Avinash Tiwari, Shasvath J. Kapadia, K.G. Arun, Parameswaran Ajith
Waltzing binaries: Probing line-of-sight acceleration of merging compact objects with gravitational waves
ApJ 954 105, arXiv:2302.09651.
In press: Astrobites

9. Adhrit Ravichandran, **Aditya Vijaykumar**, Shasvath J. Kapadia, Prayush Kumar
Rapid Identification and Classification of Eccentric Gravitational Wave Inspirals with Machine Learning
Submitted to *Physical Review D*, arXiv:2302.00666.

8. Srashti Goyal, **Aditya Vijaykumar**, Jose Maria Ezquiaga, Miguel Zumalacarregui
Probing lens-induced gravitational-wave birefringence as a test of general relativity
Phys. Rev. D 108, 024052, arXiv:2301.04826.
In press: Astrobites

7. Bikram Keshari Pradhan, **Aditya Vijaykumar**, Debarati Chatterjee
Impact of updated Multipole Love and f-Love Universal Relations in context of Binary Neutron Stars
Phys. Rev. D 107, 023010, arXiv:2210.09425.

6. **Aditya Vijaykumar**, Shasvath J. Kapadia, Parameswaran Ajith
Can a binary neutron star merger in the vicinity of a supermassive black hole enable a detection of a post-merger gravitational wave signal?
MNRAS, 513, 3577, arXiv:2202.08673.

5. **Aditya Vijaykumar**, Ajit Kumar Mehta, Apratim Ganguly
Detection and parameter estimation challenges of Type-II lensed binary black hole signals
Phys. Rev. D 108, 043036, arXiv:2202.06334.

4. Sumit Kumar, **Aditya Vijaykumar**, Alexander H. Nitz
Detecting Baryon Acoustic Oscillations with third generation gravitational wave observatories,
ApJ 930 113, arXiv:2110.06152.

3. M. Saleem et al. (including **Aditya Vijaykumar**)
The Science Case for LIGO-India
Class. Quantum Grav. 39 025004, arXiv:2105.01716.

2. **Aditya Vijaykumar**, M. V. S. Saketh, Sumit Kumar, Parameswaran Ajith, Tirthankar Roy Choudhury
Probing the large scale structure using gravitational wave observations of binary black holes,
Phys. Rev. D 108, 103017, arXiv:2005.01111.
In press: Astrobites.

1. **Aditya Vijaykumar**, Shasvath J. Kapadia, Parameswaran Ajith
Constraints on the time variation of the gravitational constant using gravitational wave observations of binary neutron stars,
Phys. Rev. Lett. 126, 141104, arXiv:2003.12832.
In press: phys.org.

PAPERS (LONG AUTHORLIST, WITH SUBSTANTIAL CONTRIBUTION)

4. Abbott et al. (LIGO Scientific and Virgo Collaborations)
Tests of General Relativity with GWTC-3,
Accepted to *Physical Review D*, arXiv:2112.06861.

3. Abbott et al. (LIGO Scientific and Virgo Collaborations)
Tests of General Relativity with Binary Black Holes from the second LIGO-Virgo Gravitational-Wave Transient Catalog,
Phys. Rev. D 103 (2021) 12, 122002, arXiv:2010.14529.

2. Abbott et al. (LIGO Scientific and Virgo Collaborations)
GWTC-2: Compact Binary Coalescences Observed by LIGO and Virgo During the First Half of the Third Observing Run,
Phys. Rev. X 11 (2021) 021053, arXiv:2010.14527.

1. P. Virtanen *et al.* (including **Aditya Vijaykumar** as *SciPy 1.0 Contributor*)
SciPy 1.0–Fundamental Algorithms for Scientific Computing in Python,
Nat Methods 17, 261–272 (2020), arXiv:1907.10121.