Aditya Vijaykumar

aditya@utoronto.ca • Canadian Institute for Theoretical Astrophysics (CITA) • Website • NASA ADS

Reserach Interests Gravitational Wave Astronomy and Astrophysics, Tests of General Relativity and Cosmology, Scientific Computing

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.*

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 and Talks

- *Probing host environments of gravitational-wave sources* at **CITA**, January 2024 (Invited talk)
- *Accelerating binaries and their gravitational-wave signatures* at **TASTY, Department of Astronomy and Astrophysics, University of Toronto**, January 2024 (Invited talk)
- *Accelerating gravitational wave sources* at **Joint CITA-PI Gravitational waves meeting**, October 2023 (Contributed talk)
- *Fast Likelihood Evaluation with Relative Binning* at **IUCAA, Pune**, July 2023 (Invited seminar)
- *Testing General Relativity with Gravitational Waves: Opportunities and Challenges* at **IIT-Gandhinagar**, June 2023 (Invited seminar)
- *Fast Likelihood Evaluation with Relative Binning* at **Seoul National University**, October 2022 (Invited online seminar)
- *Standard Sirens and Large Scale Structure* at **The Quest for Precision Gravitational-wave Cosmology, The University of Chicago**, September 2022 (Invited Talk)

- *Gravitational-wave probes of astrophysics and cosmology: Large Scale Clustering and Lensing* at **IGC, Pennsylvania State University**, August 2022 (Invited Seminar)
- *Constraints on the time variation of the gravitational constant using gravitational-wave observations* at **Second Chennai Symposium on Gravitation and Cosmology**, February 2022 (Invited online Seminar)
- *Probing Large Scale Structure using Binary Black Hole Observations* at ***Instituut-Lorentz* for Theoretical Physics, Leiden University**, June 2020 (Invited online seminar)
- *Constraints on Black Hole Mimickers using GWTC-1* at **ICTS In-house Symposium**, February 2020 (Contributed Poster)
- *Probing Large Scale Structure using Binary Black Hole Observations* at **ICTS In-house Symposium**, ICTS, Bengaluru, India, February 2020 (Contributed Talk)
- *Probing Large Scale Structure using Binary Black Hole Observations* at **International Conference on Gravitation & Cosmology**, IISER, Mohali, India, December, 2019 (Contributed Talk)
- *Probing Large Scale Structure using Binary Black Hole Observations* at **The Inter-University Centre for Astronomy and Astrophysics (IUCAA)**, Pune, India, September 2019 (Invited Talk)
- *Probing Large Scale Structure using Binary Black Hole Observations* at **Max Planck Institute for Gravitational Physics**, Hannover, Germany, June 2019 (Invited Talk)
- *Probing Large Scale Structure using Binary Black Hole Observations* at **GR22 and Amaldi13**, Valencia, Spain, July 2019 (Contributed Talk)
- *Gravitational Lensing from Orbiting Binary* at the **Paper Presentation competition of APOGEE 2017**, BITS Pilani, India (*Contributed Talk, First runner-up*)

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.

Mentorship

- Kaustubh Gupta (IISER, Pune) — May 2022 - *Present*
- 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

Other Conferences and Meetings

- Semester Participant, **Advances in Computational Relativity**, ICERM, Brown University, USA. September 2020 - December 2020 (Online)
- Participant, **Discussion Meeting - Astrophysics of Supermassive Black Holes**, ICTS, Bengaluru, India, December 2019
- Participant, **Discussion Meeting - Future of Gravitational Wave Astronomy**, ICTS, Bengaluru, India, August 2019
- Participant, **ICTS Summer School on Gravitational Wave Astronomy**, ICTS, Bengaluru, India, July 2017, July 2018, July 2019, May 2020, July 2021, May 2022.

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.
- 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

Technical Skills

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

References

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

Prof. Maya Fishbach
Canadian Institute for Theoretical Astrophysics,
60 St George St,
Toronto, ON M5S 3H8, Canada.
fishbach@cita.utoronto.ca

Prof. Shasvath J. Kapadia
Inter-University Centre for Astronomy and Astrophysics,
Post Bag 4, Ganeshkhind,
Pune, 411007, India
shasvath.kapadia@iucaa.in

Papers (short authorlist)

20. Kanchan Soni, **Aditya Vijaykumar**, Sanjit Mitra
Assessing the potential of LIGO-India in resolving the Hubble Tension
Submitted to Nature Astronomy, 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
Submitted to ApJ, arXiv:2405.14818.

17. Sreejith Nair, **Aditya Vijaykumar**, Sudipta Sarkar
Bounds on the charge of the graviton using gravitational wave observations
Accepted to JCAP, 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.