Aditya Vijaykumar

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RESERACH INTERESTS Gravitational Wave Astronomy and Astrophysics, Tests of General Relativity and Cosmology, Scientific Computing

EMPLOYMENT

CITA Postdoctoral Fellow
Canadian Institute for Theoretical Astrophysics (CITA), Toronto
Independent research fellowship   Sep 2023 - *Present*
Member of the LIGO Scientific Collaboration

Graduate Student
International Centre for Theoretical Sciences (ICTS-TIFR), Bengaluru
Mentored by Prof. Parameswaran Ajith   Aug 2018 - Aug 2023
Member of the LIGO Scientific Collaboration and the LIGO-India Scientific Collaboration

Fulbright-Nehru Doctoral Research Fellow
Department of Physics, The University of Chicago
Mentored by Prof. Daniel Holz   Aug 2022 - Mar 2023

EDUCATION

International Centre for Theoretical Sciences (ICTS-TIFR), Bengaluru
Research Scholar and Graduate Student in Physics   2018 - 2023

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

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
SCORES AND AWARDS	• Fulbright-Nehru Doctoral Research Fellowship 2023 (Host Institution: The University of Chicago) • ICTS Graduate Fellowship 2018-2023 • Secured all-India rank 21 in the Joint Entrance Screening Test (JEST), 2018 for admission into Physics PhD programmes in India • Awarded the ICTS S.N. Bhatt Memorial Excellence Fellowship, 2018 • Scored 960/990 on the Subject GRE in Physics, October 2017 • Selected for the Summer Research Fellowship of the Indian Academy of Sciences in 2016 • Recepient of the INSPIRE-DST Scholarship for Higher Education for the period 2013 to 2018

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)

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

17. Sreejith Nair, **Aditya Vijaykumar**, Sudipta Sarkar
    Bounds on the charge of the graviton using gravitational wave observations
    Submitted to Phys. Rev. Lett., 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
    Accepted to ApJ, 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
    Accepted to ApJ, 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
    Submitted to ApJL, 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
    Accepted to Phys. Rev. D, 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
   Accepted to *Physical Review D*, 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.