Aditya Vijaykumar

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

Education

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

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

Employment

Graduate Student
International Centre for Theoretical Sciences (ICTS-TIFR), Bengaluru
Mentored by Prof. Parameswaran Ajith Aug 2018 - *Present*
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

SN Bhatt Fellow
International Centre for Theoretical Sciences (ICTS-TIFR), Bengaluru
Mentored by Prof. Parameswaran Ajith May 2018 - July 2018
Topic - Cosmological Large-scale Structure probes using gravitational-wave observations

Summer Research Intern
The Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, India
Mentored by Prof. Raghunathan Srianand May 2016 - July 2016
Topic - Analysis of Quasar Absorption Lines from SDSS Photometric Data

Summer Research Intern
The National Centre for Radio Astrophysics (NCRA-TIFR), Pune, India
Mentored by Prof. Yashwant Gupta May 2015 - July 2015
Topic - Testing the fast transient detection pipeline of the GMRT

Seminars and Talks

- *Standard Sirens and Large Scale Structure* at 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 binary neutron star observations* at **Second Chennai Symposium on Gravitation and Cosmology**, February 2022 (Online Invited Seminar)
- *Probing Large Scale Structure using Binary Black Hole Observations* at ***Instituut-Lorentz* for Theoretical Physics, Leiden University**, June 2020 (Online Invited 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**.
- 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. *Astrophysical Stochastic GW Foreground*, July 2021.
  2. *Numerical Hydrodynamics*, May 2020.
  3. *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.
- 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

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, ICTS – ajith@icts.res.in
- Dr. Shasvath Kapadia, IUCAA – shasvath.kapadia@icts.res.in
- Prof. Bala Iyer, ICTS – bala.iyer@icts.res.in

Papers (short authorlist)

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
Submitted to *MNRAS*, 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
Accepted to *Astrophysical Journal*, arXiv:2302.09651.
9. Adhrit Ravichandran, **Aditya Vijaykumar**, Shasvath J. Kapadia, Prayush Kumar
Rapid Identification and Classification of Eccentric Gravitational Wave Inspirals with Machine Learning
Accepted 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
Accepted to *Physical Review D*, arXiv:2301.04826.

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 (2023) 2, 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
Submitted 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, Submitted to *Physical Review Letters*, 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 (2021), 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.