

Aditya Vijaykumar

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RESEARCH 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 **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

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|-------------------------------------------------------|---------------------------|
| • Kaustubh Gupta (IISER, Pune) | May 2022 - <i>Present</i> |
| • 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.

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| OUTREACH | <ul style="list-style-type: none"> • Co-PI of the <i>IndiaBioscience Outreach Grant</i> to communicate science using stage theatre. • Panelist at the <i>Bengaluru: The Astronomy City</i>, 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 <i>Quantum Voyages</i> as a part of Cosmic Zoom Online Exhibition, April 2021 • Articles on the ICTS blog: <ul style="list-style-type: none"> 1. A Conversation with ICTS Scientists Studying the Indian Monsoon, November 2019 2. Summer School on Gravitational Wave Astronomy, November 2019 • Talk titled <i>The Whats, Whys and Hows of Gravitational-wave Astronomy</i>, BMS College of Engineering, Bengaluru, November 2019 • Talk titled <i>Gravitational Waves - A New Tool for Cosmology!</i> 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 - L ^A T _E X, Git |
| SCORES AND AWARDS | <ul style="list-style-type: none"> • 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 • Recipient of the INSPIRE-DST Scholarship for Higher Education for the period 2013 to 2018 |
| REFERENCES | <ul style="list-style-type: none"> • 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) | 10. Aditya Vijaykumar , Avinash Tiwari, Shasvath J. Kapadia, K.G. Arun, Parameswaran Ajith <i>Waltzing binaries: Probing line-of-sight acceleration of merging compact objects with gravitational waves</i> Submitted to <i>Astrophysical Journal Letters</i> , arXiv:2302.09651 . 9. Adhrit Ravichandran, Aditya Vijaykumar , Shasvath J. Kapadia, Prayush Kumar <i>Rapid Identification and Classification of Eccentric Gravitational Wave Inspirals with Machine Learning</i> Submitted to <i>Physical Review D</i> , arXiv:2302.00666 . 8. Srashti Goyal, Aditya Vijaykumar , Jose Maria Ezquiaga, Miguel Zumalacarregui <i>Probing lens-induced gravitational-wave birefringence as a test of general relativity</i> Submitted to <i>Physical Review D</i> , 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](#).