

Nihar Gupte

Github: <https://github.com/nihargupte-ph>

Email : Nihar.Gupte@aei.mpg.de

Mobile : +1-301-412-8618

EDUCATION

- **Max Planck Institute for Gravitational Physics** Potsdam, Germany
Ph.D in Physics
Relevant Coursework: Bayesian Inference and Gravitational Waves
Ongoing
- **University of Maryland** College Park, MD, USA
Ph.D in Physics
Relevant Coursework: Astrophysics of Compact objects, Quantum Theory, Electromagnetism, Classical Mechanics
Ongoing
- **University of Florida** Gainesville, FL, USA
B.S. in Physics and Math; GPA: 3.88
Relevant Coursework: General Relativity, Topology/Differential Geometry, Machine Learning,
Topological Data Science, Advanced Calculus, Abstract Algebra, Complex Functions
2017-2021

PUBLICATIONS

- [1] **Eccentricity constraints disfavor single-single capture in nuclear star clusters as the origin of all LIGO-Virgo-KAGRA binary black holes.** Gupte, N.+ , 2026. arXiv: 2603.29019 (astro-ph.HE).
- [2] **Accurate and efficient simulation-based inference for massive black-hole binaries with LISA.** Spadaro, A.+ , 2026. arXiv: 2603.20431 (astro-ph.HE).
- [3] **Accelerated inference of microlensed gravitational waves with machine learning.** Caldarola, M.+ , 2025. arXiv: 2511.08486 (astro-ph.CO).
- [4] **Real-time inference for binary neutron star mergers using machine learning.** Dax, M.+ . *Nature*, 639, pp. 49–53, 2025. DOI: 10.1038/s41586-025-08593-z. arXiv: 2407.09602 (gr-qc).
- [5] **Evidence for eccentricity in the population of binary black holes observed by LIGO-Virgo-KAGRA.** Gupte, N.+ . *Phys. Rev. D*, 112, p. 104045, 2025. DOI: 10.1103/vpyp-nvfp. arXiv: 2404.14286 (gr-qc).
- [6] **Flexible Gravitational-Wave Parameter Estimation with Transformers.** Kofler, A.+ , 2025. arXiv: 2512.02968 (gr-qc).
- [7] **GW200208_222617 as an eccentric black-hole binary merger: Properties and astrophysical implications.** Romero-Shaw, I.+ . *Phys. Rev. D*, 112, p. 063052, 2025. DOI: 10.1103/jj7m-x66y. arXiv: 2506.17105 (astro-ph.HE).
- [8] **Fast and accurate parameter estimation of high-redshift sources with the Einstein Telescope.** Santoliquido, F.+ . *Phys. Rev. D*, 112, p. 103015, 2025. DOI: 10.1103/wflk-p5cl. arXiv: 2504.21087 (astro-ph.HE).
- [9] **EinsteinPy: A Community Python Package for General Relativity.** Bapat, S.+ , 2020. arXiv: 2005.11288 (gr-qc).
- [10] **How would a nearby kilonova look on camera?** Gupte, N. and Bartos, I. *Am. J. Phys.*, 88, p. 568, 2020. DOI: 10.1119/10.0001193. arXiv: 1905.01594 (astro-ph.HE).
- [11] **Optimal Gravitational-wave Follow-up Tiling Strategies Using a Genetic Algorithm.** Gupte, N. and Bartos, I. *Phys. Rev. D*, 101, p. 123008, 2020. DOI: 10.1103/PhysRevD.101.123008. arXiv: 2003.04839 (astro-ph.IM).
- [12] **Gravitational-wave follow-up with CTA after the detection of GRBs in the TeV energy domain.** Bartos, I.+ . *Mon. Not. Roy. Astron. Soc.*, 490, pp. 3476–3482, 2019. DOI: 10.1093/mnras/stz2848. arXiv: 1908.09832 (astro-ph.HE).
- [13] **Observational consequences of structured jets from neutron star mergers in the local Universe.** Gupte, N. and Bartos, I., 2018. arXiv: 1808.06238 (astro-ph.HE).

PRESENTATIONS

- Gupte, Nihar. “**Population properties of eccentric binary black holes.**” Seminar. IUCCA. Nov. 28th, 2025, Pune, India
- Gupte, Nihar. “**Population properties of eccentric binary black holes.**” Talk. GR-Amaldi. Jul. 15th, 2025, Glasgow, UK
- Gupte, Nihar. “**Machine-learning methods in the era of gravitational-wave astronomy**”. Invited Talk. Sun Yat-Sen University, Mar. 26th, 2025, Online.
- Gupte, Nihar. “**Evidence for eccentricity in Binary Black Holes**”. Invited Talk. Korean Gravitational Waves Group. Jul. 11th, 2024, Online.

- Gupte, Nihar. “**Evidence for eccentricity in Binary Black Holes**”. Talk. AILands Workshop. Apr. 22nd, 2024, Isle of Arran, UK
- Gupte, Nihar. “**Evidence for eccentricity in Binary Black Holes**”. Seminar. University of Nottingham Apr. 18th, 2024, Nottingham, UK
- Gupte, Nihar. “**Evidence for eccentricity in Binary Black Holes**”. Talk. LIGO-Virgo-KAGRA conference. Mar. 11th, 2024, Louisiana State University, Baton Rouge, LA
- Gupte, Nihar, Kerezy Istvan, Bartos, Imre “**Using Lightning Data in the Quest for Real-time Detection of Wild Fires Using the ABI Instrument Onboard GOES-16**”. AGU Fall Meeting Abstracts. Vol. 2020. 2020.
- Gupte, Nihar. and Bartos, Imre “**How Would a Nearby Kilonova Look on The Sky**”. Poster. American Associate Of Physics Teachers 2020 Conference. Jan. 18, 2020, Royal Caribe Hotel Orlando, FL
- Gupte, Nihar. and Bartos, Imre “**Neutron Star Mergers, Gravitational Waves, and the origin of heavy elements on Earth**”. Poster. University of Florida Physics Graduate Research Symposium. Dec. 6, 2019, New Physics Building, Gainesville, FL

PUBLIC INTEREST

- **Science News: What a nearby kilonova would look like**
<https://www.sciencenews.org/article/what-near-earth-kilonova-would-look-like>
- **Techne News: What a nearby kilonova would look like**
<https://technenews.com/news/what-a-nearby-kilonova-would-look-like>

HONORS

- University of Maryland Graduate School Fellowship
- Goldwater Scholarship Nomination (From University of Florida)
- Florida Bright Futures Scholarship (4-year merit based full tuition scholarship)
- Wentworth Travel Scholarship
- University of Florida Honors Program
- University of Florida Dean’s List

EXPERIENCE

- **Gravitational Waves** MPI for Gravitational Physics
Ph.D student - Prof. Alessandra Buonanno, Prof. Jonathan Gair *Ongoing*
 - **Evidence for eccentricity in binary black holes:** Using a Bayesian analysis, we found evidence for eccentricity in the population of binary black holes. This is important for determining the formation of binary black holes. This was made possible using normalizing flows and importance sampling, which perform inference orders of magnitude faster than the current state-of-the-art without sacrificing accuracy.
 - **Using Normalizing Flows to Predict Quasi-Normal Modes of BBHs:** Used normalizing flows to do posterior estimation of gravitational wave events in the LIGO O1-O3 runs. Specifically, looking for deviations from general relativity in the quasi-normal mode spectrum of binary black holes.
- **Computational Research/Data Science** Gainesville, Florida
Researcher *March 2020 - May 2021*
 - **Detecting fires from satellite data using neural networks and cross referencing with lightning databases:** One of three founders of startup to predict where fires will occur in California. We worked with time-series infrared data to extract potential hotspots. I wrote the machine-learning algorithm for the detection and the first iteration of the real-time inference website with Django. www.fireneuralnetwork.com
- **Multimessenger Astrophysics** Gainesville, Florida
Undergraduate Researcher - Prof. Imre Bartos *October 2017 - May 2021*
 - **Evolutionary Algorithms to solve Circle Covering:** Covering LIGO localization maps with circles (telescope FOVs) efficiently is important for extracting information from multi-messenger events. However, analytic solutions to the circle covering problem are not well understood. In this project I developed an algorithm which uses genetic algorithms and BFGS optimization to optimally cover planar and spherical polygons with circles.
 - **Gravitational-wave follow-up with CTA after the detection of GRBs in the TeV energy domain:** I created a machine-learning algorithm to draw 2-dimensional confidence regions on multivariate bimodal data. In conjunction with Monte Carlo methods, this algorithm found the smallest regions with the highest likelihood for a gravitational wave detection.

- **How would a nearby kilonova look on camera:**
Designed new process to reconstruct the image of a kilonova on a camera if it occurred 1000 light years away given its light curves and spectral data. An article about this paper was published on Science News and other media sites as well as tweeted about by the NSF.
- **Observational consequences of structured jets from neutron star mergers in the local Universe:**
Wrote a Monte Carlo simulation in Python to find the number of binary neutron star mergers that result in a joint gamma ray burst and gravitational wave detection in Fermi-GBM, Swift, and LIGO.
- **Simulating the flow of actinides in Illustris-TNG:** Wrote code which utilized the simulations from Illustris-TNG to track the spatial and temporal evolution of actinides from Neutron Star mergers.

- **Cosmology**

Developer - Python, C++, SQL, R

March 2020 - May 2021

- **Topological Machine Learning to Explore Cosmic Voids:** Applied topological data analysis or hydrodynamic simulations into topological vectors. These topological vectors were then used to predict redshift and the hubble constant using support vector machines and convolutional neural networks. This was submitted for a NSF GRFP grant.
- **Open-Source Developer for Einsteinpy :** Developed code for the popular general relativity python package "Einsteinpy". Particularly, I wrote code to incorporate multiple metrics and calculate particle orbits in Kerr space-time.

- **Experimental Biophysics**

Undergraduate Researcher - Prof. Stephen Hagen

Gainesville, Florida

March 2019 - August 2019

- **Functional amyloid formation of *Streptococcus mutans* in flow:**
Utilized Optical Microscopy to study and image the formation of mutations of *S. mutans* biofilms in glass capillaries under growth media flow. Used Congo Red staining to study yellow-green birefringence of amyloid under cross-polarizers. Implemented experimental setup to pump growth media into delicate growth capillaries. Worked with micro-pipettes, glassware, creating chemical compounds, creating agar plates, and measured cellular optical density.

- **Space Systems Design Club**

Club President and Treasurer

Gainesville, Florida

August 2017 - May 2021

- **NASA Micro-g Challenge (design competition for building tools for astronauts):**
 - 2017: Built a plugging tool to allow astronauts to plug small spacecraft hull breaches
 - 2019: Software lead for building a UAV deploy-able auto-inflated autonomous boat
 - 2020: Team lead for building an automatic bag dispenser for use in the Artemis mission
- **Space System Design Club:**
 - President of Space Systems Design Club from Fall 2019-2020 and Treasurer for 2018. Organizer of GBMs, guest speakers, funding applications, outreach events, and club collaborations.
 - Built gyroscopic chair demo for UN Women in Science and Engineering event.
 - Member of a group of undergraduates researching CubeSats to get velocity and location of space debris in low earth orbit. This research is important for cross corroborating with land detection devices to prevent potential spacecraft crashes.
 - Organizer and teacher of a python workshop aimed at undergraduates with an interest in learning programming for research.