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Cahill Center for Astronomy and Astrophysics

1216 E California Blvd

Pasadena, CA 91125, USA

Employment

California Institute of Technology

Sherman Fairchild Postdoctoral Scholar

2022–

Kavli Institute for Theoretical Physics

University of California, Santa Barbara

Postdoctoral Scholar

2021–2022

Education

Princeton University

Ph.D. in Physics

2016–2021

Thesis: The Binary Black Holes of LIGO and Virgo

Advisor: Prof. Matias Zaldarriaga

Universidad de Buenos Aires

2011–2016

Licenciatura in Physics

Thesis: Average Activities in Populations of Excitable Phase Oscillators

Advisor: Prof. Gabriel B. Mindlin

Fellowships

Burke Fellowship, California Institute of Technology

2022–2025

President's Fellowship, Princeton University

2016–2017

Dean's Grant Research Allowance, Princeton University

2016

CONICET Doctoral Fellowship

2016

Teaching

Assistant in instruction

2017–2021

Princeton University

- Physics for Future Leaders
- Advanced Electromagnetism
- Introduction to General Relativity
- Advanced Physics
- Introduction to the Quantum Theory
- General Physics
- Biophysics

Teaching assistant

2015–2016

Universidad de Buenos Aires

- Fluid Dynamics
- Wave Mechanics
- Physics for Biologists

Publications

Lead author

- [1] **Javier Roulet**, Jonathan Mushkin, Digvijay Wadekar, Tejaswi Venumadhav, Barak Zackay, and Matias Zaldarriaga. “Fast marginalization algorithm for optimizing gravitational wave detection, parameter estimation, and sky localization”. In: *Phys. Rev. D* 110 (4 Aug. 2024), p. 044010. DOI: [10.1103/PhysRevD.110.044010](https://doi.org/10.1103/PhysRevD.110.044010).
- [2] **Javier Roulet** and Tejaswi Venumadhav. “Inferring binary properties from gravitational-wave signals”. In: *Annual Review of Nuclear and Particle Science* (June 2024). ISSN: 1545-4134. DOI: [10.1146/annurev-nucl-121423-100725](https://doi.org/10.1146/annurev-nucl-121423-100725).
- [3] **Javier Roulet**, Seth Olsen, Jonathan Mushkin, Tousif Islam, Tejaswi Venumadhav, Barak Zackay, and Matias Zaldarriaga. “Removing degeneracy and multimodality in gravitational wave source parameters”. In: *Phys. Rev. D* 106 (12 Dec. 2022), p. 123015. DOI: [10.1103/PhysRevD.106.123015](https://doi.org/10.1103/PhysRevD.106.123015).
- [4] **Javier Roulet**, Horng Sheng Chia, Seth Olsen, Liang Dai, Tejaswi Venumadhav, Barak Zackay, and Matias Zaldarriaga. “Distribution of effective spins and masses of binary black holes from the LIGO and Virgo O1–O3a observing runs”. In: *Phys. Rev. D* 104 (8 Oct. 2021), p. 083010. DOI: [10.1103/PhysRevD.104.083010](https://doi.org/10.1103/PhysRevD.104.083010).
- [5] **Javier Roulet**, Tejaswi Venumadhav, Barak Zackay, Liang Dai, and Matias Zaldarriaga. “Binary black hole mergers from LIGO/Virgo O1 and O2: Population inference combining confident and marginal events”. In: *Phys. Rev. D* 102 (12 Dec. 2020), p. 123022. DOI: [10.1103/PhysRevD.102.123022](https://doi.org/10.1103/PhysRevD.102.123022).
- [6] **Javier Roulet**, Liang Dai, Tejaswi Venumadhav, Barak Zackay, and Matias Zaldarriaga. “Template bank for compact binary coalescence searches in gravitational wave data: A general geometric placement algorithm”. In: *Phys. Rev. D* 99 (12 June 2019), p. 123022. DOI: [10.1103/PhysRevD.99.123022](https://doi.org/10.1103/PhysRevD.99.123022).
- [7] **Javier Roulet** and Matias Zaldarriaga. “Constraints on binary black hole populations from LIGO–Virgo detections”. In: *Monthly Notices of the Royal Astronomical Society* 484.3 (Jan. 2019), pp. 4216–4229. ISSN: 1365-2966. DOI: [10.1093/mnras/stz226](https://doi.org/10.1093/mnras/stz226).
- [8] **Javier Roulet** and Gabriel B. Mindlin. “A diagrammatic representation of phase portraits and bifurcation diagrams of two-dimensional dynamical systems”. In: *International Journal of Bifurcation and Chaos* 27.13 (Dec. 2017), p. 1730045. ISSN: 1793-6551. DOI: [10.1142/s0218127417300452](https://doi.org/10.1142/s0218127417300452).
- [9] **Javier Roulet** and Gabriel B. Mindlin. “Average activity of excitatory and inhibitory neural populations”. In: *Chaos: An Interdisciplinary Journal of Nonlinear Science* 26.9 (Sept. 2016). ISSN: 1089-7682. DOI: [10.1063/1.4962326](https://doi.org/10.1063/1.4962326).

Coauthor

- [10] Tousif Islam, Tejaswi Venumadhav, Ajit Kumar Mehta, Isha Anantpurkar, Digvijay Wadekar, **Javier Roulet**, Jonathan Mushkin, Barak Zackay, and Matias Zaldarriaga. *Data-driven extraction, phenomenology and modeling of eccentric harmonics in binary black hole merger waveforms*. Accepted for publication in *Phys. Rev. D*. July 2025. DOI: [10.1103/pk8n-fxvw](https://doi.org/10.1103/pk8n-fxvw). arXiv: [2504.12469 \[gr-qc\]](https://arxiv.org/abs/2504.12469).

- [11] Aaron D. Johnson, **Javier Roulet**, Katerina Chatzioannou, Michele Vallisneri, Chris G. Trejo, and Kyle A. Gersbach. “From the LISA global fit to a catalog of Galactic binaries”. In: *Phys. Rev. D* (June 2025). doi: [10.1103/95c5-sblc](https://doi.org/10.1103/95c5-sblc) .
- [12] Ajit Kumar Mehta, Seth Olsen, Digvijay Wadekar, **Javier Roulet**, Tejaswi Venumadhav, Jonathan Mushkin, Barak Zackay, and Matias Zaldarriaga. “New binary black hole mergers in the LIGO-Virgo O3b data”. In: *Phys. Rev. D* 111 (2 Jan. 2025), p. 024049. doi: [10.1103/PhysRevD.111.024049](https://doi.org/10.1103/PhysRevD.111.024049) .
- [13] Digvijay Wadekar, Tejaswi Venumadhav, Ajit Kumar Mehta, **Javier Roulet**, Seth Olsen, Jonathan Mushkin, Barak Zackay, and Matias Zaldarriaga. “New approach to template banks of gravitational waves with higher harmonics: Reducing matched-filtering cost by over an order of magnitude”. In: *Phys. Rev. D* 110 (8 Oct. 2024), p. 084035. doi: [10.1103/PhysRevD.110.084035](https://doi.org/10.1103/PhysRevD.110.084035) .
- [14] Horng Sheng Chia, Thomas D. P. Edwards, Digvijay Wadekar, Aaron Zimmerman, Seth Olsen, **Javier Roulet**, Tejaswi Venumadhav, Barak Zackay, and Matias Zaldarriaga. “In pursuit of Love numbers: First templated search for compact objects with large tidal deformabilities in the LIGO-Virgo data”. In: *Phys. Rev. D* 110 (6 Sept. 2024), p. 063007. doi: [10.1103/PhysRevD.110.063007](https://doi.org/10.1103/PhysRevD.110.063007) .
- [15] Digvijay Wadekar, Tejaswi Venumadhav, **Javier Roulet**, Ajit Kumar Mehta, Barak Zackay, Jonathan Mushkin, and Matias Zaldarriaga. “New search pipeline for gravitational waves with higher-order modes using mode-by-mode filtering”. In: *Phys. Rev. D* 110 (4 Aug. 2024), p. 044063. doi: [10.1103/PhysRevD.110.044063](https://doi.org/10.1103/PhysRevD.110.044063) .
- [16] Hang Yu, **Javier Roulet**, Tejaswi Venumadhav, Barak Zackay, and Matias Zaldarriaga. “Accurate and efficient waveform model for precessing binary black holes”. In: *Phys. Rev. D* 108 (6 Sept. 2023), p. 064059. doi: [10.1103/PhysRevD.108.064059](https://doi.org/10.1103/PhysRevD.108.064059) .
- [17] Seth Olsen, Tejaswi Venumadhav, Jonathan Mushkin, **Javier Roulet**, Barak Zackay, and Matias Zaldarriaga. “New binary black hole mergers in the LIGO–Virgo O3a data”. In: *Phys. Rev. D* 106 (4 Aug. 2022), p. 043009. doi: [10.1103/PhysRevD.106.043009](https://doi.org/10.1103/PhysRevD.106.043009) .
- [18] Horng Sheng Chia, Seth Olsen, **Javier Roulet**, Liang Dai, Tejaswi Venumadhav, Barak Zackay, and Matias Zaldarriaga. “Signs of higher multipoles and orbital precession in GW151226”. In: *Phys. Rev. D* 106 (2 July 2022), p. 024009. doi: [10.1103/PhysRevD.106.024009](https://doi.org/10.1103/PhysRevD.106.024009) .
- [19] Seth Olsen, **Javier Roulet**, Horng Sheng Chia, Liang Dai, Tejaswi Venumadhav, Barak Zackay, and Matias Zaldarriaga. “Mapping the likelihood of GW190521 with diverse mass and spin priors”. In: *Phys. Rev. D* 104 (8 Oct. 2021), p. 083036. doi: [10.1103/PhysRevD.104.083036](https://doi.org/10.1103/PhysRevD.104.083036) .
- [20] Barak Zackay, Liang Dai, Tejaswi Venumadhav, **Javier Roulet**, and Matias Zaldarriaga. “Detecting gravitational waves with disparate detector responses: Two new binary black hole mergers”. In: *Phys. Rev. D* 104 (6 Sept. 2021), p. 063030. doi: [10.1103/PhysRevD.104.063030](https://doi.org/10.1103/PhysRevD.104.063030) .
- [21] Barak Zackay, Tejaswi Venumadhav, **Javier Roulet**, Liang Dai, and Matias Zaldarriaga. “Detecting gravitational waves in data with non-stationary and non-Gaussian noise”. In: *Phys. Rev. D* 104 (6 Sept. 2021), p. 063034. doi: [10.1103/PhysRevD.104.063034](https://doi.org/10.1103/PhysRevD.104.063034) .
- [22] Yiwen Huang, Carl-Johan Haster, **Javier Roulet**, Salvatore Vitale, Aaron Zimmerman, Tejaswi Venumadhav, Barak Zackay, Liang Dai, and Matias Zaldarriaga. “Source properties of the lowest signal-to-noise-ratio binary black hole detections”. In: *Phys. Rev. D* 102 (10 Nov. 2020), p. 103024. doi: [10.1103/PhysRevD.102.103024](https://doi.org/10.1103/PhysRevD.102.103024) .

- [23] Tejaswi Venumadhav, Barak Zackay, **Javier Roulet**, Liang Dai, and Matias Zaldarriaga. “New binary black hole mergers in the second observing run of Advanced LIGO and Advanced Virgo”. In: *Phys. Rev. D* 101 (8 Apr. 2020), p. 083030. doi: [10.1103/PhysRevD.101.083030](https://doi.org/10.1103/PhysRevD.101.083030).
- [24] Tejaswi Venumadhav, Barak Zackay, **Javier Roulet**, Liang Dai, and Matias Zaldarriaga. “New search pipeline for compact binary mergers: Results for binary black holes in the first observing run of Advanced LIGO”. In: *Phys. Rev. D* 100 (2 July 2019), p. 023011. doi: [10.1103/PhysRevD.100.023011](https://doi.org/10.1103/PhysRevD.100.023011).
- [25] Barak Zackay, Tejaswi Venumadhav, Liang Dai, **Javier Roulet**, and Matias Zaldarriaga. “Highly spinning and aligned binary black hole merger in the Advanced LIGO first observing run”. In: *Phys. Rev. D* 100 (2 July 2019), p. 023007. doi: [10.1103/PhysRevD.100.023007](https://doi.org/10.1103/PhysRevD.100.023007).

Preprints

- [26] Mark Ho-Yeuk Cheung, Digvijay Wadekar, Ajit Kumar Mehta, Tousif Islam, **Javier Roulet**, Emanuele Berti, Tejaswi Venumadhav, Barak Zackay, and Matias Zaldarriaga. *Searching for intermediate mass ratio binary black hole mergers in the third observing run of LIGO-Virgo-KAGRA*. 2025. arXiv: [2507.01083 \[gr-qc\]](https://arxiv.org/abs/2507.01083).
- [27] Tousif Islam, Tejaswi Venumadhav, Ajit Kumar Mehta, Isha Anantpurkar, Digvijay Wadekar, **Javier Roulet**, Jonathan Mushkin, Barak Zackay, and Matias Zaldarriaga. *gwharmone: first data-driven surrogate for eccentric harmonics in binary black hole merger waveforms*. 2025. arXiv: [2504.12420 \[astro-ph.HE\]](https://arxiv.org/abs/2504.12420).
- [28] Ajit Kumar Mehta, Digvijay Wadekar, **Javier Roulet**, Isha Anantpurkar, Tejaswi Venumadhav, Jonathan Mushkin, Barak Zackay, Matias Zaldarriaga, and Tousif Islam. *Significant increase in sensitive volume of a gravitational wave search upon including higher harmonics*. 2025. arXiv: [2501.17939 \[gr-qc\]](https://arxiv.org/abs/2501.17939).
- [29] Jonathan Mushkin, **Javier Roulet**, Barak Zackay, Tejaswi Venumadhav, Oryna Ivashenko, Digvijay Wadekar, Ajit Kumar Mehta, and Matias Zaldarriaga. *dot-PE: Sampler-free gravitational wave inference using matrix multiplication*. 2025. arXiv: [2507.16022 \[gr-qc\]](https://arxiv.org/abs/2507.16022).
- [30] Digvijay Wadekar, Arush Pimpalkar, Mark Ho-Yeuk Cheung, Benjamin Wandelt, Emanuele Berti, Ajit Kumar Mehta, Tejaswi Venumadhav, **Javier Roulet**, Tousif Islam, Barak Zackay, Jonathan Mushkin, and Matias Zaldarriaga. *Improving gravitational wave search sensitivity with TIER: Trigger Inference using Extended strain Representation*. 2025. arXiv: [2507.08318 \[gr-qc\]](https://arxiv.org/abs/2507.08318).
- [31] Digvijay Wadekar, **Javier Roulet**, Tejaswi Venumadhav, Ajit Kumar Mehta, Barak Zackay, Jonathan Mushkin, Seth Olsen, and Matias Zaldarriaga. *New black hole mergers in the LIGO–Virgo O3 data from a gravitational wave search including higher-order harmonics*. 2023. arXiv: [2312.06631 \[gr-qc\]](https://arxiv.org/abs/2312.06631).
- [32] Tousif Islam, **Javier Roulet**, and Tejaswi Venumadhav. *Factorized parameter estimation for real-time gravitational wave inference*. 2022. arXiv: [2210.16278 \[gr-qc\]](https://arxiv.org/abs/2210.16278).

Presentations

Invited

- Talk, Multimessenger Astronomy in the Era of Foundational AI workshop, Vanderbilt University 2025
- Talk, AstroAI lunch, Center for Astrophysics | Harvard & Smithsonian 2025
- Panel, Gravitational Wave Physics and Astronomy Workshop 2022 2022
- Seminar, Perimeter Institute for Theoretical Physics 2022
- Seminar, International Center for Theoretical Sciences Tata Institute of Fundamental Research 2022
- Seminar, Department of Applied Math and Theoretical Physics University of Cambridge 2022
- Seminar, LIGO seminar, California Institute of Technology 2022
- Talk, Astrophysics Coffee, Weizmann Institute of Science 2020
- Talk, Brown Bag Lunch, MIT Kavli Institute 2020
- Seminar, Max Planck Institute for Gravitational Physics (Albert Einstein Institute) 2020
- Talk, High Energy Physics Journal Club, Princeton University 2020
- Seminar, Institut de Ciències del Cosmos, Universitat de Barcelona 2019

Contributed

- Poster, Scientific Machine Learning for Gravitational Wave Astronomy, ICERM topical workshop, Brown University 2025
- Talk, American Physical Society Global Physics Summit 2025 2025
- Talk, Gravitational Wave Physics and Astronomy Workshop 2024 2024
- Talk, American Physical Society April Meeting 2024 2024
- Talk, XVII Latin American Regional IAU Meeting 2023 2023
- Talk, ARC Centre of Excellence for Gravitational Wave Discovery (OzGrav), Swinburne University of Technology 2022
- Talk, American Physical Society April Meeting 2022 2022
- Local's Friday blackboard talk, Kavli Institute for Theoretical Physics 2021
- Talk, Gravitational Wave Physics and Astronomy Workshop 2021 2021
- Poster, Workshop III: Source Inference and Parameter Estimation in Gravitational Wave Astronomy, Institute for Pure and Applied Mathematics, University of California, Los Angeles 2021
- Talk, American Physical Society April Meeting 2021 2021
- Institute for Advanced Study / Princeton University Bahcall Lunch 2021
- Talk, American Physical Society April Meeting 2020 2020
- Talk, 22nd International Conference on General Relativity and Gravitation – 13th Edoardo Amaldi Conference on Gravitational Waves 2019
- Talk, Gravitational Wave Physics and Astronomy Workshop 2018 2018

Mentoring

- | | |
|----------------------------------|-----------|
| ◦ Isha Anantpurkar (graduate) | 2024– |
| ◦ Charles Gibson (undergraduate) | 2024– |
| ◦ Tousif Islam (graduate) | 2021–2022 |
| ◦ Cuishan Liu (undergraduate) | 2021–2022 |

Outreach

- | | |
|---|------|
| ◦ Talk & panel at <i>Noche de las estrellas</i> , California Institute of Technology | 2025 |
| ◦ Talk at <i>Noche de las estrellas</i> , Norton Science and Language Academy | 2024 |
| ◦ Volunteer at <i>Exploring Caltech</i> , California Institute of Technology | 2024 |
| ◦ Talk at <i>Astronomy Festival</i> , Great Basin National Park | 2024 |
| ◦ Talks and volunteering at total solar eclipse viewing and star party, Piedras Negras, Mexico | 2024 |
| ◦ Volunteer at annular solar eclipse viewing and star party, Bryce Canyon National Park, UT | 2023 |
| ◦ Talk at <i>Astronomy on Tap</i> , Grand Canyon National Park | 2023 |
| ◦ Panelist at <i>Stargazing in Spanish</i> , California Institute of Technology | 2023 |
| ◦ Volunteer at <i>International Astronomy Day</i>
Santa Barbara Museum of Natural History; Astronomical Unit | 2023 |
| ◦ Poster at <i>Princeton Research Day</i> , Princeton University | 2017 |

Software

`cogwheel`: A code for parameter estimation of gravitational wave sources implementing several original methods for efficiency.

Academic service

Lecturer

2025

Delivered hands-on sessions at Prospects in Theoretical Physics program
Institute for Advanced Study

Organizer

2023

Giambiagi Winter School on Cosmology 
International Center for Theoretical Physics; Universidad de Buenos Aires

Referee

- Astronomy & Astrophysics
- Astrophysical Journal
- Astrophysical Journal Letters
- Chaos, Solitons and Fractals
- Monthly Notices of the Royal Astronomical Society
- Physical Review D
- Physical Review X

References

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