Keefe Mitman — Curriculum Vitae

Contact Information

Cornell University
Department of Astronomy
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Employment

Flatiron Research Fellow, Center for Computational Astrophysics. *Sep. 2027—Sep. 2028*

NASA Einstein Fellow, Cornell University. *Sep. 2024—Sep. 2027*

- ❑ Guest Researcher at the Flatiron Institute's Center for Computational Astrophysics.
- ❑ Guest Researcher at Princeton University's Gravity Initiative.

Postdoctoral Researcher, California Institute of Technology. *Jun. 2024—Aug. 2024*

Education

Ph.D. in Physics, California Institute of Technology. *Jun. 2024*

- ❑ Dissertation:
  Asymptotics with Numerical Relativity:
  Gravitational Memory, BMS Frames, and Nonlinearities.
- ❑ Dissertation Advisor: Professor Saul Teukolsky.

B.A. in Mathematics and B.A. in Physics (*cum laude*), Columbia University. *May 2019*

Honors/Awards

- ❑ NASA Hubble Fellowship. *Sep. 2024—Sep. 2027*
  NASA Hubble Fellowship Program.
- ❑ Leadership Award (for "excellence in leadership and service to the Institute"). *Jun. 2024*
  California Institute of Technology.
- ❑ Robert F. Christy Prize (for "an outstanding doctoral thesis in theoretical physics"). *Jun. 2024*
  California Institute of Technology.
- ❑ Everhart Lecturer (Lecture Video). *May 2024*
  California Institute of Technology.
- ❑ John S. Stemple Memorial Prize (for "outstanding progress in physics research"). *May 2022*
  California Institute of Technology.
- ❑ Best Student Presentation. *Mar. 2022*
  American Physical Society, Division of Gravitational Physics.
- ❑ American Physical Society, April Meeting Travel Grant. *Feb. 2022*
  American Physical Society, Division of Gravitational Physics.
- ❑ Rochus E. Vogt Graduate Fellowship. *Sep. 2019—Dec. 2019*
  California Institute of Technology.
- ❑ Physics Departmental Honors. *May 2019*
  Columbia University.
- ❑ Erwin H. Leiwant Scholarship. *Sep. 2016—May 2017*
  Columbia University.
- ❑ Outstanding Achievement in German Language and Literature. *Sep. 2015—May 2016*
  Columbia University, Department of Germanic Languages.

Research Interests

General relativity, numerical relativity simulations, black holes, gravitational waves, memory effects, the BMS group (and other symmetries of asymptotic infinity), black hole ringdowns, waveform models, binary black hole populations, active galactic nuclei, standard/dark siren cosmology.

Publication Summary

- ❑ **h-index** —As of **Oct. 28, 2025**: **18** (Google Scholar), or **20** (INSPIRE).
- ❑ **citations** —**1,219** (Google Scholar), or **1,313** (INSPIRE).
- ❑ **publications** —**33** papers, **8** as lead author, **2** LVK Collaboration papers.
- ❑ **news coverage** —**5** papers covered by press release or educational programs.

Publications (Refereed/ Accepted/ Submitted)

33. Taylor Knapp, Katerina Chatziioannou, **Keefe Mitman**, *et al.*,
A comprehensive look into the accuracy of SpEC binary black hole waveforms.
arXiv:2510.06393. (Submitted to PRD). Oct. 2025.

32. The LVK Collaboration (w/ **Keefe Mitman**: on the six-person paper writing team),
Black hole spectroscopy and tests of General Relativity with GW250114.
arXiv:2509.08099. (Submitted to PRL). Sep. 2025.
In Press: New York Times, Science, Caltech, etc.

31. The LVK Collaboration (w/ **Keefe Mitman**: provided science input based on NR analyses),
GW250114: testing Hawking's area law and the Kerr nature of black holes.
Phys. Rev. Lett. 135, 111403 (2025). arXiv:2509.08054. Sep. 2025.
Editors' Suggestion and Featured in Physics.
In Press: New York Times, Science, Caltech, etc.

30. Emanuele Berti, Vitor Cardoso, Gregorio Carullo, *et al.* (66 authors w/ **Keefe Mitman**),
Black hole spectroscopy: from theory to experiment.
arXiv:2505.23895. (Submitted to CQG). Jun. 2025.

29. Mark A. Scheel, Michael Boyle, **Keefe Mitman**, Nils Deppe, Leo C. Stein, *et al.*,
The SXS Collaboration's third catalog of binary black hole simulations.
Class. Quantum Grav. 42 195017. arXiv:2505.13378. Oct. 2025.
In Press: Caltech, Cornell.

28. Scott E. Field, Vijay Varma, *et al.* (12 authors w/ **Keefe Mitman**),
GWSurrogate: A Python package for gravitational wave surrogate models.
J. Open Source Softw. 10 (2025) 107, 7073. Mar. 2025.

27. Guido Da Re, **Keefe Mitman**, Leo C. Stein, *et al.*,
Modeling the BMS transformation induced by a binary black hole merger.
Phys. Rev. D 111, 124019 (2025). arXiv:2503.09569 Mar. 2025.

26. **Keefe Mitman**, Isabella Pretto, Harrison Siegel, *et al.*,
Probing the ringdown perturbation in binary black hole coalescences with an improved quasi-normal mode extraction algorithm.
Phys. Rev. D 112, 064016 (2025). arXiv:2503.09678. Mar. 2025.

25. **Keefe Mitman**, Leo C. Stein, *et al.*,
Length dependence of waveform mismatch: a caveat on waveform accuracy.
Class. Quantum Grav. 42 117001. arXiv:2502.14025. Jun. 2025.

24. Marina De Amicis *et al.* (20 authors w/ **Keefe Mitman**),
Late-time tails in nonlinear evolutions of merging black holes.
arXiv:2412.06887. Dec. 2024. (Accepted to PRL).

23. Matt Giesler, Sizheng Ma, **Keefe Mitman**, Naritaka Oshita, Saul A. Teukolsky, *et al.*,
Overtones and nonlinearities in binary black hole ringdowns.
Phys. Rev. D 111, 084041. arXiv:2411.11269. Apr. 2025.

22. Geoffrey Lovelace, *et al.* (31 authors w/ **Keefe Mitman**),
Simulating binary black hole mergers using discontinuous Galerkin methods.
Class. Quantum Grav. 42 035001. arXiv:2410.00265. Jan. 2025.

21. Lorena Magaña Zertuche, Leo C. Stein, **Keefe Mitman**, *et al.*,
High-precision ringdown surrogate model for non-precessing binary black holes.
Phys. Rev. D 112, 024077 (2025). arXiv:2408.05300. Aug. 2024.

20. **Keefe Mitman**, Leo C. Stein, Michael Boyle, *et al.*,
A review of gravitational memory and BMS frame fixing in numerical relativity.
Class. Quantum Grav. 41 223001. arXiv:2405.08868. May 2024.
In Media: PBS Space Time (animation used at 3:47), SciShow (animation used at 2:27).

19. Yitian Chen, *et al.* (12 authors w/ **Keefe Mitman**),
Improved frequency spectra of gravitational waves with memory in a binary black hole simulation.
Phys. Rev. D 110, 064049. arXiv:2405.06197. Sep. 2024.

18. Dongze Sun, Michael Boyle, **Keefe Mitman**, *et al.*,
Optimizing post-Newtonian parameters and fixing the BMS frame for numerical relativity waveform hybridizations.
Phys. Rev. D 110, 104076. arXiv:2403.10278. Mar. 2024.

17. Luisa T. Buchman, *et al.* (7 authors w/ **Keefe Mitman**),
Numerical relativity multimodal waveforms using absorbing boundary conditions.
Class. Quantum Grav. 41 175011. arXiv:2402.12544. Feb. 2024.

16. Teagan Clarke, *et al.* (12 authors w/ **Keefe Mitman**),
Toward a self-consistent framework for measuring black hole ringdowns.
Phys. Rev. D 109, 124030. arXiv:2402.02819. Feb. 2024.

15. Hengrui Zhu, Justin Ripley, Frans Pretorius, Sizheng Ma, **Keefe Mitman**, Robert Owen, *et al.*,
Nonlinear effects in black hole ringdown from scattering experiments I: spin and initial data dependence of quadratic mode coupling.
Phys. Rev. D 109, 104050 (2024). arXiv:2401.00805. Jan. 2024.

14. Hengrui Zhu, Harrison Siegel, **Keefe Mitman**, Maximiliano Isi, Will Farr, *et al.*,
Black hole spectroscopy for precessing binary black hole coalescences.
Phys. Rev. D 111, 064052 (2025). arXiv:2312.08588. Mar. 2025.

13. Alexander M. Grant, **Keefe Mitman**,
Higher memory effects in numerical simulations of binary black hole mergers.
Class. Quantum Grav. 41 175003. arXiv:2312.02295. July. 2024.

12. Matteo Boschini, *et al.* (21 authors w/ **Keefe Mitman**),
Extending black-hole remnant surrogate models to extreme mass ratios.
arXiv:2307.03435. Jul. 2023.

11. Jooheon Yoo, **Keefe Mitman**, Vijay Varma, *et al.*,
Numerical relativity surrogate model with memory effects and post-Newtonian hybridization.
Phys. Rev. D 108, 064027 (2023). arXiv:2306.03148. Sep. 2023.

10. Lorenzo Pompili, *et al.* (24 authors w/ **Keefe Mitman**),
Laying the foundation of the effective-one-body waveform models SEOBNRv5: improved accuracy and efficiency for spinning non-precessing binary black holes.
arXiv:2303.18039. Mar. 2023.

9. **Keefe Mitman**, Macarena Lagos, Leo C. Stein, *et al.*,
Nonlinearities in black hole ringdowns.
Phys. Rev. Lett. 130, 081402 (2023). arXiv:2208.07380. Feb. 2023.
Editors' Suggestion and Featured in Physics.
In Press: Caltech, Columbia, Cornell, APS Physics, etc.
In Media: Can gravitational waves INTERFERE with each other?

8. **Keefe Mitman**, Leo C. Stein, Michael Boyle, *et al.*,
Fixing the BMS frame of numerical relativity waveforms with BMS charges.
Phys. Rev. D 106, 084029 (2022). arXiv:2208.04356. Oct. 2022.

7. Sizheng Ma, **Keefe Mitman**, Ling Sun, *et al.*,
Quasinormal-mode filters: a new approach to analyze the gravitational-wave ringdown of binary black-hole mergers.
Phys. Rev. D 106, 084036 (2022). arXiv:2207.10870. Oct. 2022.

6. Lorena Magaña Zertuche, **Keefe Mitman**, Neev Khera, Leo C. Stein, *et al.*,
High-precision ringdown modeling: multimode fits and BMS frames.
Phys. Rev. D 105, 104015 (2022). arXiv:2110.15922. May 2022.
5. **Keefe Mitman**, Neev Khera, Dante A. B. Iozzo, Leo C. Stein, *et al.*,
Fixing the BMS frame of numerical relativity waveforms.
Phys. Rev. D 104, 024051 (2021). arXiv:2105.02300. Jul. 2021.
4. Dante A. B. Iozzo, Neev Khera, Leo C. Stein, **Keefe Mitman**, *et al.*,
Comparing remnant properties from horizon data and asymptotic data in numerical relativity.
Phys. Rev. D 103, 124029 (2021). arXiv:2104.07052. Jun. 2021.
3. **Keefe Mitman**, Dante A. B. Iozzo, Neev Khera, *et al.*,
Adding gravitational memory to waveform catalogs using BMS balance laws.
Phys. Rev. D 103, 024031 (2021). arXiv:2011.01309. Jan. 2021.
2. **Keefe Mitman**, Jordan Moxon, Mark A. Scheel, Saul A. Teukolsky, *et al.*,
Computation of displacement and spin gravitational memory in numerical relativity.
Phys. Rev. D 102, 104007 (2020). arXiv:2007.11562. Nov. 2020.

Unrefereed Publications

1. *Photo-nuclear dijet production in ultra-peripheral Pb+Pb collisions.*
ATLAS Collaboration, ATLAS-CONF-2017-011.

Invited Talks/ Workshops

24. Johns Hopkins University, STScI, NASA Hubble Fellowship Symposium. *Oct. 2025*
23. Wake Forest University, Physics Colloquium. *Sep. 2025*
22. Institute for Basic Science (IBS CTPU-CGA), Workshop on Black Hole Ringdown. *May 2025*
21. Albert Einstein Institute, Astrophysics and Cosmological Relativity Seminar. *May 2025*
20. University of Massachusetts Dartmouth, CSCDR Physics Colloquium Series. *Apr. 2025*
19. Princeton University, Princeton Gravity Initiative Fall Seminar Series. *Oct. 2024*
18. California Institute of Technology, NASA Hubble Fellowship Symposium. *Sep. 2024*
17. Niels Bohr Institute, Ringdown Inside and Out Conference. *Sep. 2024*
16. Brown University, ICERM, Simulating eXtreme Spacetimes Con. *Aug. 2024*
15. King's College London, Physics and Astrophysics at the eXtreme. *Jul. 2024*
14. LISA, Fundamental Physics Waveform Group (virtual). *Jul. 2024*
13. Dartmouth College, NAHOMCon + NENAD. *Jun. 2024*
12. California Institute of Technology, Everhart Lecture. *May 2024*
11. Cosmic Explorer Consortium, Science Call. *Jan. 2024*
10. Queen Mary University of London, Gravitational Memory Effects Workshop *Jun. 2023*
9. American Physical Society, DGRAV Seminar Series. *Feb. 2023*
8. Perimeter Institute, Strong Gravity Seminar. *Nov. 2022*
7. Institute for Fundamental Physics of the Universe, Holography and GWs Workshop. *Jul. 2022*
6. Harvard University, Black Hole Initiative Colloquium. *Mar. 2022*
5. California Institute of Technology, LIGO Seminar. *Nov. 2021*
4. Princeton University, Princeton Gravity Initiative Fall Seminar Series. *Nov. 2021*
3. Numerical Relativity Community, Monthly Meeting (virtual). *Sep. 2021*
2. LISA, Waveform Working Group (virtual). *Jun. 2021*
1. Galileo Galilei Institute. Gravitational Scattering, Inspiral and Radiation (virtual). *May 2021*

Contributed Talks

9. American Physical Society, Global Physics Summit. *Mar. 2025*
8. American Physical Society, April Meeting *Apr. 2023*
7. American Physical Society, Pacific Coast Gravity Meeting. *Mar. 2023*
6. California Institute of Technology, Astrophysics, Relativity, and Cosmology Seminar. *Oct. 2022*
5. American Physical Society, April Meeting. *Apr. 2022*
4. American Physical Society, Pacific Coast Gravity Meeting. *Mar. 2022*
3. California Institute of Technology, Three Minute Thesis Competition. *Apr. 2021*
2. American Physical Society, April Meeting. *Apr. 2021*
1. American Physical Society, Pacific Coast Gravity Meeting. *Mar. 2021*

Teaching Experience

Teaching Assistant, California Institute of Technology

- ❑ Ph205A (Quantum Field Theory, with Professor Sergei Gukov). *Sep. 2020—Dec. 2020*

  Pinned Review:

  "Perfect. Best TA I've ever seen, would be a phenomenal professor. Problem sets were difficult, and would have been demoralizing in the extreme without help in TA sessions. Especially remarkable was the fact that Keefe knew the material and the problems (as well as the solutions) absolutely inside and out, so no matter where I was stuck he immediately had a helpful suggestion. Plus, the TA demonstrated extensive knowledge of the material beyond the course itself, and could adroitly field questions related to current research and applications of QFT, recommend other texts that addressed the problems differently, or offer a different approach when (as was usually the case) the course text's presentation was lacking.

  Extremely approachable and available outside of organized office hours – genuinely concerned about the students in the class.

  All things considered, HW troubles would have made this class an exceptionally unpleasant experience but for the excellent TA, thanks to whom I had a pretty good time overall."
- ❑ Ph129C (Complex Analysis, with Professor Hiroshi Oguri). *Mar. 2020—Jun. 2020*

Teaching Assistant, Columbia University

- ❑ GU4040 (General Relativity, with Professor Rachel Rosen). *Jan. 2019—May 2019*

Mentoring/ Supervision

Ph.D. Student Mentor

- ❑ Peike Sun, Cornell University *Jun. 2025—Present*
- ❑ Guido Da Re, California Institute of Technology *Oct. 2023—Present*
- ❑ Taylor Knapp, California Institute of Technology *Jul. 2024—Oct. 2025*
- ❑ Isabella Pretto, California Institute of Technology *Aug. 2023—Mar. 2025*
- ❑ Jooheon Yoo, Cornell University *May 2021—Sep. 2023*

Master's Student Mentor

- ❑ Shawn Ray, City University of New York *Oct. 2024—Present*

Professional Activities

LISA Consortium

- ❑ Waveform Working Group, "BMS Frame" Project Coordinator. *Sep. 2025—Present*
- ❑ Waveform Working Group, "NR Accuracy" Project Coordinator. *Sep. 2025—Present*
- ❑ Core Member. *Aug. 2025—Present*

Cosmic Explorer Consortium

❑ Member. *Aug. 2025—Present*

LIGO-Virgo-KAGRA Consortium

❑ 10% Member. *Sep. 2019—Present*

Simulating eXtreme Spacetimes Collaboration *Sep. 2019—Present*

Organized Conferences

1. American Physical Society, Pacific Coast Gravity Meeting (at Caltech). *Apr. 2023*

Journal Referee

Astrophysics and Space Science, Classical and Quantum Gravity, European Physical Journal C, Physical Letters B, Physical Review D, Physical Review Letters.

Grant Referee

European Research Council Starting Grant, Swiss National Science Foundation.

Outreach

- ❑ NASA Hubble Fellowship, NHFP on Tour. *Sep. 2025—Present*
- ❑ California Institute of Technology, Everhart Lecture. *May 2024*
- ❑ California Institute of Technology, Visiting Scientists Program, Visiting Scientist at Madison Elementary School (Pasadena, CA). *Sep. 2019—Nov. 2022*
- ❑ California Institute of Technology, Caltech Y, Rise Tutor. *Sep. 2019—Jun. 2024*
- ❑ Columbia University, One-to-One Tutoring, One-to-One Tutor. *Sep. 2015—May 2019*

Computer Skills

Expert in Bash, C/C++, Python. Proficient in Mathematica. Experience in Java, Julia, ROOT. Markup languages: LaTeX, HTML, Markdown.

Software—Member of the Simulating eXtreme Spacetimes (SXS) Collaboration, contributor to the Spectral Einstein Code (SpEC) and the SpECTRE code, and the sxs and scri python packages.

References

Saul A. Teukolsky,
Professor, Graduate School and Hans A. Bethe Professor Emeritus of Physics, Cornell University,
Robinson Professor of Theoretical Astrophysics, California Institute of Technology,
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