

Leo C. Stein

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| CONTACT INFORMATION | 205 Lewis Hall University of Mississippi University, MS 38677-1848 USA | lcstein@olemiss.edu duetosymmetry.com 1-662-915-1941 |
| EDUCATION | Ph.D., Physics , Massachusetts Institute of Technology, Cambridge, MA, USA Dissertation Advisor: Prof. Scott Hughes Dissertation Title: <i>Probes of strong-field gravity</i> B.S., Physics , California Institute of Technology, Pasadena, CA, USA Degree conferred with honor. Senior Thesis Advisors: Dr. Patrick Sutton and Prof. Alan Weinstein | May 2012 June 2006 |
| EMPLOYMENT | Assistant Professor , University of Mississippi, Oxford, MS USA Senior Postdoctoral Researcher , Caltech, Pasadena, CA USA NASA Einstein Fellow , Cornell, Ithaca NY, USA Research and Teaching Assistant , MIT, Cambridge MA, USA Teaching Assistant , Caltech, Pasadena, CA, USA Summer Research Fellow , Caltech, Pasadena, CA, USA | August 2018–Present September 2015–August 2018 September 2012–August 2015 September 2006–May 2012 Fall 2004, Spring 2005 June–September 2003/2005 |
| RESEARCH INTERESTS | General relativity (GR), gravitation, and astrophysical phenomena which can elucidate gravity. Recent work is focused on gravitational-wave predictions in beyond-GR theories of gravity. Work in progress and future work includes numerical simulations of black hole mergers in beyond-GR theories, cosmological signatures of beyond-GR theories, and investigations in near-horizon extremal Kerr. | |
| HONORS AND AWARDS | Einstein Postdoctoral Fellow , NASA Henry Kendall Teaching Award , Massachusetts Institute of Technology Upperclass Merit Scholarship , California Institute of Technology | 2012–2015 2011 2005–2006 |
| TEACHING EXPERIENCE | Assistant Professor , University of Mississippi Phys. 709, Advanced Mechanics I Guest Lecturer , California Institute of Technology Ph236, General relativity Ph237, Gravitational Waves Guest Lecturer , Massachusetts Institute of Technology 8.901, Graduate Astrophysics I Teaching Assistant , Massachusetts Institute of Technology 8.942, Cosmology 8.901, Graduate Astrophysics I | Fall 2018 Fall 2017 Spring 2016 Spring 2011 Fall 2011 Spring 2011 |

8.286, The Early Universe **Fall 2009**

Teaching Assistant, California Institute of Technology

Ph 7, Nuclear and Quantum Physics Lab **Spring 2005**

Ph 5, Analog Electronics for Physicists **Fall 2004**

MENTORING

Graduate students

Maria (Masha) Okounkova, Caltech **Fall 2015–present**

Baoyi Chen, Caltech **Fall 2016–present**

Undergraduate students

Wayne Zhao, Harvard **Summer 2016**

PROFESSIONAL
ACTIVITIES,
OUTREACH, AND
SERVICE

Simulating eXtreme Spacetimes collaboration

2015–Present

Executive committee member **2018–Present**

Member, American Physical Society

2010–Present

Division of Gravitational Physics

Executive Committee Member-at-Large **2016–2019**

Division of Astrophysics

Conference organizer

Workshop on **Numerical Relativity beyond General Relativity**, Benasque **June 2018**
Week-long international workshop, 59 participants

34th Pacific Coast Gravity Meeting (PCGM), Caltech **March 2018**
Two-day conference, ~ 125 participants

Workshop on **Unifying Tests of General Relativity**, Caltech **July 2016**
Three day workshop, 52 participants

Seminar organizer

TAPIR seminar, Caltech **Fall 2015–Present**

General Relativity Informal Tea-Time Series (GRITTS), MIT **Fall 2011–Spring 2012**

MKI Journal Club, MIT **Fall 2007–Spring 2010**

Conference session chair; Judge for best student speaker award

April APS meeting, Columbus, OH **April 2018**

34th Pacific Coast Gravity Meeting (PCGM), Caltech **March 2018**

33rd Pacific Coast Gravity Meeting (PCGM), UCSB **March 2017**

“April” APS meeting, Washington D.C. **January 2017**

32nd Pacific Coast Gravity Meeting (PCGM), CSU Fullerton **April 2016**

Theoretical Astrophysics in Southern California (TASC), CSU Fullerton **November 2015**

Journal referee

Journal of Cosmology and Astroparticle Physics, General Relativity and Gravitation, Monthly Notices of the Royal Astronomical Society, Physics Letters B, Physical Review D, Physical Review Letters, Physical Review X, Reviews of Modern Physics

Agency work

External reviewer for NSF, NASA

Outreach

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| Caltech astronomy public lecture series speaker Lecture: “The truth about black holes” | March 2018 |
| Astronomy on Tap public lecture series speaker and volunteer Close to a monthly basis | 2016–2018 |
| Caltech astronomy public lecture series panelist and emcee Approximately every three months | 2016–2018 |
| Invited guest lecture on black holes and gravitational waves <i>Science of Space and Time</i> , Hampshire College | November 2017 |
| Invited video Q&A session, public high school physics class <i>The Nova Project</i> school, Seattle | June 2017 |
| Guest on <i>The Titanium Physicists Podcast</i> Episode 64: The edges of Einstein Episode 62: Black Bells | April 25, 2016 February 1, 2016 |
| Quora Q&A Session on gravitational waves and first detection 83.9k+ views, 17.5k+ followers | February 17, 2016 |
| Invited guest host, public screening of <i>COSMOS</i> with Q&A, Science Cabaret/Cornell | March/June 2014 |
| Invited public talk at <i>Frontiers of Cornell Astronomy</i> , Cornell Friends of Astronomy | November 2013 |
| Invited video chat, <i>Topics in Physics</i> course, Stanford Education Program for Gifted Youth | July 2013 |

COMPUTER SKILLS **Languages**—Expert in MATHEMATICA. Proficient in C/C++. Experience in Python, Javascript, Java, Bash, Haskell; LaTeX, HTML, CSS.

Operating systems—Mac OS, Linux/*nix.

Software—Most contributions can be found at <https://github.com/duetosymmetry>. Member of the *Simulating eXtreme Spacetimes* (SXS) collaboration, contributor to the Spectral Einstein Code (SpEC). Core collaborator on xACT (<http://xact.es/>) abstract tensor calculus package for MATHEMATICA. Coauthor of xTERIOR package for exterior differential geometry under xACT. Co-maintainer of community contributions at <http://contrib.xact.es/>. Developed [arXiv-keys](#) browser extension/add-on for Chrome/Firefox.

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| PUBLICATIONS IN PROGRESS | 33. McNeese, R. Stein, L. C. , (2018) <i>Cosmological perturbations in dynamical Chern-Simons</i> . |
| SUBMITTED PUBLICATIONS | 32. Isi, M., Stein, L. C. (2018) <i>Measuring stochastic gravitational-wave energy beyond general relativity</i> , [arXiv:1807.02123]. 31. Barack, L., <i>et al.</i> (2018) <i>Black holes, gravitational waves and fundamental physics: a roadmap</i> , [arXiv:1806.05195]. |
| COLLABORATION PUBLICATIONS | From 2008–2012, I was coauthor on 34 refereed LIGO and/or LIGO/Virgo collaboration publications. The short author-list publications appear below. |
| REFEREED PUBLICATIONS | 30. Prabhu, K., Stein, L. C. (2018) <i>Black hole scalar charge from a topological horizon integral in Einstein-dilaton-Gauss-Bonnet gravity</i> , <i>Phys. Rev. D</i> 98 , 021503(R) (Rapid Communication) [arXiv:1805.02668]. 29. Gerosa, D., Hébert, F., Stein, L. C. (2018) <i>Black-hole kicks from numerical-relativity surrogate models</i> , <i>Phys. Rev. D</i> 97 , 104049 [arXiv:1802.04276]. 28. Chen, B., Stein, L. C. (2018) <i>Deformation of extremal black holes from stringy interactions</i> , <i>Phys. Rev. D</i> 97 , 084012 [arXiv:1802.02159]. 27. Chen, B., Stein, L. C. (2017) <i>Separating metric perturbations in near-horizon extremal Kerr</i> , <i>Phys. Rev. D</i> 96 , 064017 [arXiv:1707.05319]. 26. Okounkova, M., Stein, L. C. , Scheel, M. A., Hemberger, D. A. (2017) <i>Numerical binary black hole mergers in dynamical Chern-Simons: I. Scalar field</i> , <i>Phys. Rev. D</i> 96 , 044020 [arXiv:1705.07924]. 25. Tso, R., Isi, M., Chen, Y., Stein, L. C. (2017) <i>Modeling the Dispersion and Polarization Content of Gravitational Waves for Tests of General Relativity, CPT and Lorentz Symmetry</i> : pp. 205–208 [arXiv:1608.01284]. 24. McNeese, R., Stein, L. C. , Yunes, N. (2016) <i>Extremal Black Holes in Dynamical Chern-Simons Gravity</i> , <i>Class. Quantum Grav.</i> 33 235013 [arXiv:1512.05453]. 23. Flanagan, É. É., Nichols, D. A., Stein, L. C. , Vines, J. (2016) <i>Prescriptions for Measuring and Transporting Local Angular Momenta in General Relativity</i> , <i>Phys. Rev. D</i> 93 , 104007 [arXiv:1602.01847]. 22. Yagi, K., Stein, L. C. (2016) <i>Black Hole Based Tests of General Relativity</i> , <i>Class. Quantum Grav.</i> 33 054001 [arXiv:1602.02413]. 21. Yagi, K., Stein, L. C. , Yunes, N. (2016) <i>Challenging the Presence of Scalar Charge and Dipolar Radiation in Binary Pulsars</i> , <i>Phys. Rev. D</i> 93 024010 [arXiv:1510.02152]. 20. Berti, E., (5 authors), Stein, L. C. , (46 more authors) (2015) <i>Testing General Relativity with Present and Future Astrophysical Observations</i> , <i>Class. Quantum Grav.</i> 32 243001 [arXiv:1501.07274]. 19. Tsang, D., Galley, C. R., Stein, L. C. , Turner, A. (2015) “ <i>Slimplectic</i> ” Integrators: Variational Integrators for General Nonconservative Systems, <i>ApJ</i> 809 L9 [arXiv:1506.08443]. 18. Yagi, K., Stein, L. C. , Pappas, G., Yunes, N., Apostolatos, T. (2014) <i>Why I-Love-Q: Explaining why universality emerges in compact objects</i> , <i>Phys. Rev. D</i> 90 063010 [arXiv:1406.7587]. 17. Stein, L. C. (2014) <i>Rapidly rotating black holes in dynamical Chern-Simons gravity: Decoupling limit solutions and breakdown</i> , <i>Phys. Rev. D</i> 90 044061 [arXiv:1407.2350]. 16. Stein, L. C. , Yagi, K., Yunes, N. (2014) <i>Three-Hair Newtonian Relations for Rotating Stars</i> , <i>ApJ</i> 788 15 [arXiv:1312.4532]. 15. Stein, L. C. , Yagi, K. (2013) <i>Parameterizing and constraining scalar corrections to general relativity</i> , <i>Phys. Rev. D</i> 89 044026 [arXiv:1310.6743]. 14. Yagi, K., Stein, L. C. , Yunes, N., Tanaka, T. (2013) <i>Isolated and Binary Neutron Stars in Dynamical Chern-Simons Gravity</i> , <i>Phys. Rev. D</i> 87 084058 [arXiv:1302.1918]. |

13. Yagi, K., **Stein, L. C.**, Yunes, N., Tanaka, T. (2012), *Post-Newtonian, Quasi-Circular Binary Inspirals in Quadratic Modified Gravity*, *Phys. Rev. D* **85** 064022 [[arXiv:1110.5950](#)]
12. Vigeland, S., Yunes, N., **Stein, L. C.** (2011), *Bumpy black holes in alternative theories of gravity*, *Phys. Rev. D* **83** 104027 [[arXiv:1102.3706](#)]
11. Yunes, N., **Stein, L. C.** (2011), *Nonspinning black holes in alternative theories of gravity*, *Phys. Rev. D* **83** 104002 [[arXiv:1101.2921](#)]
10. **Stein, L. C.**, Yunes, N. (2011), *Effective gravitational wave stress-energy tensor in alternative theories of gravity*, *Phys. Rev. D* **83** 064038 [[arXiv:1012.3144](#)]
9. Lutomirski, A., Tegmark, M., Sanchez, N. J., **Stein, L. C.**, Urry, W. L., Zaldarriaga, M. (2011), *Solving the corner-turning problem for large interferometers*, *MNRAS* **410** 2075 [[arXiv:0910.1351](#)]
8. Sutton, P., Jones, G., Chatterji, S., Kalmus, P., Leonor, I., Poprocki, S., Rollins, J., Searle, A., **Stein, L.**, Tinto, M., Was, M. (2010), *X-Pipeline: an analysis package for autonomous gravitational-wave burst searches*, *New J. Phys.* **12** 053034 [[arXiv:0908.3665](#)]
7. Chatterji, S., Lazzarini, A., **Stein, L.**, Sutton, P., Searle, A. (2006), *Coherent network analysis technique for discriminating gravitational-wave bursts from instrumental noise*, *Phys. Rev. D* **74** 082005 [[arXiv:gr-qc/0605002](#)]
6. Galley, C. R., Tsang, D., **Stein, L. C.** (2014) *The principle of stationary nonconservative action for classical mechanics and field theories*, [[arXiv:1412.3082](#)]
5. **Stein, L. C.** (2014), *Note on Legendre decomposition of the Pontryagin density in Kerr*, [[arXiv:1407.0744](#)]
4. **Stein, L. C.** (2012), *Probes of Strong-field Gravity*, Ph.D. thesis at Massachusetts Institute of Technology [[hdl:1721.1/77256](#)]
3. Betancourt, M., **Stein, L. C.** (2011) *The Geometry of Hamiltonian Monte Carlo*, [[arXiv:1112.4118](#)]
2. **Stein, L. C.** (2009), *Binary Inspirational Gravitational Waves from a Post-Newtonian Expansion*, Contribution to the Wolfram Demonstrations Project, <http://demonstrations.wolfram.com/BinaryInspirationalGravitationalWavesFromAPostNewtonianExpansion/>
1. **Stein, L. C.** (2006), *Gravitational Wave Burst Source Localization in a Coherent Network Analysis*, Senior thesis at California Institute of Technology

UNREFEREED
PUBLICATIONS

INVITED TALKS

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|---|---------------------|
| 30. ETH-ITS Zurich, “New horizons for gravity” workshop | May 2018 |
| 29. UC San Diego, astrophysics seminar | March 2018 |
| 28. UC Berkeley, 4D particle physics seminar | March 2018 |
| 27. Kyoto University, YKIS2018a Symposium | February 2018 |
| 26. Oakland University physics seminar | February 2018 |
| 25. University of Wisconsin-Milwaukee gravity seminar | January 2018 |
| 24. Caltech/JPL Gravitational-Wave (CaJAGWR) seminar | January 2018 |
| 23. ICN UNAM, Relativity seminar | December 2017 |
| 22. University of Mississippi, Astrophysics seminar | November 2017 |
| 21. University of Florida, Astrophysics seminar | November 2017 |
| 20. University of Nottingham, Mathematical Physics seminar | July 2017 |
| 19. Sapienza University of Rome, New Frontiers in Gravitational-Wave Astrophysics | June 2017 |
| 18. Rochester Institute of Technology, CCRG seminar | March 2017 |
| 17. Penn State, IGC seminar | March 2017 |
| 16. University of Mississippi, Strong Gravity/Binary Dynamics workshop | February/March 2017 |
| 15. SUNY Stony Brook, “The universe through gravitational waves” | December 2016 |

14. University of Pennsylvania, New Frontiers in Gravitational Radiation workshop December 2016
13. Cambridge MA, Event Horizon Telescope collaboration meeting November/December 2016
12. Northwestern University CIERA, “Fellows at the Frontiers” August/September 2016
11. Princeton University, GR@100++ panel discussion April 2016
10. Cambridge MA, Einstein fellows symposium October 2014
9. Perimeter Institute, Strong gravity seminar October 2014
8. Cornell University, Friends of astronomy outreach event November 2013
7. Cambridge MA, Einstein fellows symposium October 2013
6. SUNY Geneseo, Physics colloquium October 2013
5. University of Maryland, UMD gravity seminar October 2013
4. Yale University, YCAA seminar September 2013
3. Kyoto University, YITP long-term workshop June 2013
2. Cambridge MA, Einstein fellows symposium October 2012
1. Cornell University, Relativity lunch November 2011

CONTRIBUTED
TALKS (SELECTED)

18. American Physical Society Meeting April 2018
17. Pacific Coast Gravity Meeting March 2017
16. American Physical Society Meeting ~~April~~ January 2017
15. Testing Gravity 2017 January 2017
14. 21st International meeting on GR (GR21) July 2016
13. American Physical Society Meeting April 2016
12. Eastern Gravity Meeting May 2015
11. American Physical Society Meeting April 2015
10. NEB 16 Recent developments in gravity September 2014
9. American Physical Society Meeting April 2014
8. XXVII Texas symposium on relativistic astrophysics December 2013
7. 20th International meeting on GR (GR20) July 2013
6. Eastern Gravity Meeting June 2013
5. American Physical Society Meeting April 2013
4. Caltech TAPIR Seminar December 2011
3. Eastern Gravity Meeting June 2011
2. American Physical Society Meeting April 2011
1. American Physical Society Meeting April 2010

REFERENCES

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office phone: 1-626-395-4258