

Leo C. Stein

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

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.

SUBMITTED
PUBLICATIONS

34. Varma, V., **Stein, L. C.**, Gerosa, D., (2018) *The binary black hole explorer: on-the-fly visualizations of precessing binary black holes*, [[arXiv:1811.06552](#)], [[project website](#)].
33. Barack, L., *et al.* (2018) *Black holes, gravitational waves and fundamental physics: a roadmap*, [[arXiv:1806.05195](#)].

ACCEPTED
PUBLICATIONS

32. Varma, V., Gerosa, D., Hébert, F., **Stein, L. C.**, Zhang, H., (2018) *High-accuracy mass, spin, and recoil predictions of generic black-hole merger remnants*, Accepted to PRL, [[arXiv:1809.09125](#)].

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

31. Isi, M., **Stein, L. C.** (2018) *Measuring stochastic gravitational-wave energy beyond general relativity*, *Phys. Rev. D* **98**, 104025 [[arXiv:1807.02123](#)].
30. Prabhu, K., **Stein, L. C.** (2018) *Black hole scalar charge from a topological horizon integral in Einstein-dilaton-Gauss-Bonnet gravity*, *Phys. Rev. D* **98**, 021503(R) (Rapid Communication) [[arXiv:1805.02668](#)].
29. Gerosa, D., Hébert, F., **Stein, L. C.** (2018) *Black-hole kicks from numerical-relativity surrogate models*, *Phys. Rev. D* **97**, 104049 [[arXiv:1802.04276](#)].
28. Chen, B., **Stein, L. C.** (2018) *Deformation of extremal black holes from stringy interactions*, *Phys. Rev. D* **97**, 084012 [[arXiv:1802.02159](#)].
27. Chen, B., **Stein, L. C.** (2017) *Separating metric perturbations in near-horizon extremal Kerr*, *Phys. Rev. D* **96**, 064017 [[arXiv:1707.05319](#)].
26. Okounkova, M., **Stein, L. C.**, Scheel, M. A., Hemberger, D. A. (2017) *Numerical binary black hole mergers in dynamical Chern-Simons: I. Scalar field*, *Phys. Rev. D* **96**, 044020 [[arXiv:1705.07924](#)].
25. Tso, R., Isi, M., Chen, Y., **Stein, L. C.** (2017) *Modeling the Dispersion and Polarization Content of Gravitational Waves for Tests of General Relativity*, *CPT and Lorentz Symmetry*: pp. 205–208 [[arXiv:1608.01284](#)].
24. McNees, R., **Stein, L. C.**, Yunes, N. (2016) *Extremal Black Holes in Dynamical Chern-Simons Gravity*, *Class. Quantum Grav.* **33** 235013 [[arXiv:1512.05453](#)].
23. Flanagan, É. É., Nichols, D. A., **Stein, L. C.**, Vines, J. (2016) *Prescriptions for Measuring and Transporting Local Angular Momenta in General Relativity*, *Phys. Rev. D* **93**, 104007 [[arXiv:1602.01847](#)].
22. Yagi, K., **Stein, L. C.** (2016) *Black Hole Based Tests of General Relativity*, *Class. Quantum Grav.* **33** 054001 [[arXiv:1602.02413](#)].
21. Yagi, K., **Stein, L. C.**, Yunes, N. (2016) *Challenging the Presence of Scalar Charge and Dipolar Radiation in Binary Pulsars*, *Phys. Rev. D* **93** 024010 [[arXiv:1510.02152](#)].
20. Berti, E., (5 authors), **Stein, L. C.**, (46 more authors) (2015) *Testing General Relativity with Present and Future Astrophysical Observations*, *Class. Quantum Grav.* **32** 243001 [[arXiv:1501.07274](#)].
19. Tsang, D., Galley, C. R., **Stein, L. C.**, Turner, A. (2015) “Simplictic” Integrators: Variational Integrators for General Nonconservative Systems, *ApJ* **809** L9 [[arXiv:1506.08443](#)].
18. Yagi, K., **Stein, L. C.**, Pappas, G., Yunes, N., Apostolatos, T. (2014) *Why I-Love-Q: Explaining why universality emerges in compact objects*, *Phys. Rev. D* **90** 063010 [[arXiv:1406.7587](#)].
17. **Stein, L. C.** (2014) *Rapidly rotating black holes in dynamical Chern-Simons gravity: Decoupling limit solutions and breakdown*, *Phys. Rev. D* **90** 044061 [[arXiv:1407.2350](#)].
16. **Stein, L. C.**, Yagi, K., Yunes, N. (2014) *Three-Hair Newtonian Relations for Rotating Stars*, *ApJ* **788** 15 [[arXiv:1312.4532](#)].

15. **Stein, L. C.**, Yagi, K. (2013) *Parameterizing and constraining scalar corrections to general relativity*, *Phys. Rev. D* **89** 044026 [[arXiv:1310.6743](#)]
 14. Yagi, K., **Stein, L. C.**, Yunes, N., Tanaka, T. (2013) *Isolated and Binary Neutron Stars in Dynamical Chern-Simons Gravity*, *Phys. Rev. D* **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](#)]
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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 Inspiral Gravitational Waves from a Post-Newtonian Expansion*, Contribution to the Wolfram Demonstrations Project, <http://demonstrations.wolfram.com/BinaryInspiralGravitationalWavesFromAPostNewtonianExpansion/>
 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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| 18. ETH-ITS Zurich, “New horizons for gravity” workshop | May 2018 |
| 17. UC San Diego, astrophysics seminar | March 2018 |
| 16. UC Berkeley, 4D particle physics seminar | March 2018 |
| 15. Kyoto University, YKIS2018a Symposium | February 2018 |
| 14. Oakland University physics seminar | February 2018 |
| 13. University of Wisconsin-Milwaukee gravity seminar | January 2018 |
| 12. Caltech/JPL Gravitational-Wave (CaJAGWR) seminar | January 2018 |
| 11. ICN UNAM, Relativity seminar | December 2017 |
| 10. University of Mississippi, Astrophysics seminar | November 2017 |
| 9. University of Florida, Astrophysics seminar | November 2017 |
| 8. University of Nottingham, Mathematical Physics seminar | July 2017 |
| 7. Sapienza University of Rome, New Frontiers in Gravitational-Wave Astrophysics | June 2017 |

6. Rochester Institute of Technology, CCRG seminar March 2017
5. Penn State, IGC seminar March 2017
4. University of Mississippi, Strong Gravity/Binary Dynamics workshop February/March 2017
3. SUNY Stony Brook, “The universe through gravitational waves” December 2016
2. University of Pennsylvania, New Frontiers in Gravitational Radiation workshop December 2016
1. Cambridge MA, Event Horizon Telescope collaboration meeting November/December 2016
0. Northwestern University CIERA, “Fellows at the Frontiers” August/September 2016
0. Princeton University, GR@100++ panel discussion April 2016
0. Cambridge MA, Einstein fellows symposium October 2014
0. Perimeter Institute, Strong gravity seminar October 2014
0. Cornell University, Friends of astronomy outreach event November 2013
0. Cambridge MA, Einstein fellows symposium October 2013
0. SUNY Geneseo, Physics colloquium October 2013
0. University of Maryland, UMD gravity seminar October 2013
0. Yale University, YCAA seminar September 2013
0. Kyoto University, YITP long-term workshop June 2013
0. Cambridge MA, Einstein fellows symposium October 2012
0. Cornell University, Relativity lunch November 2011

CONTRIBUTED
TALKS (SELECTED)

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

REFERENCES

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