

## Leo C. Stein

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EDUCATION	<b>Ph.D., Physics</b> , Massachusetts Institute of Technology, Cambridge, MA, USA Dissertation Advisor: Prof. Scott Hughes Dissertation Title: <i>Probes of strong-field gravity</i> <b>May 2012</b>	
	<b>B.S., Physics</b> , California Institute of Technology, Pasadena, CA, USA Degree conferred with honor. Senior Thesis Advisors: Dr. Patrick Sutton and Prof. Alan Weinstein <b>June 2006</b>	
EMPLOYMENT	<b>Senior Postdoctoral Researcher</b> , Caltech, Pasadena, CA USA <b>September 2015–Present</b>	
	<b>NASA Einstein Fellow</b> , Cornell, Ithaca NY, USA <b>September 2012–August 2015</b>	
	<b>Research and Teaching Assistant</b> , MIT, Cambridge MA, USA <b>September 2006–May 2012</b>	
	<b>Teaching Assistant</b> , Caltech, Pasadena, CA, USA <b>Fall 2004, Spring 2005</b>	
	<b>Summer Research Fellow</b> , Caltech, Pasadena, CA, USA <b>June–September 2003/2005</b>	
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	<b>Einstein Postdoctoral Fellow</b> , NASA <b>2012–2015</b>	
	<b>Henry Kendall Teaching Award</b> , Massachusetts Institute of Technology <b>2011</b>	
	<b>Upperclass Merit Scholarship</b> , California Institute of Technology <b>2005–2006</b>	
TEACHING EXPERIENCE	<b>Guest Lecturer</b> , California Institute of Technology Ph236, General relativity Ph237, Gravitational Waves <b>Fall 2017</b> <b>Spring 2016</b>	
	<b>Guest Lecturer</b> , Massachusetts Institute of Technology 8.901, Graduate Astrophysics I <b>Spring 2011</b>	
	<b>Teaching Assistant</b> , Massachusetts Institute of Technology 8.942, Cosmology 8.901, Graduate Astrophysics I 8.286, The Early Universe <b>Fall 2011</b> <b>Spring 2011</b> <b>Fall 2009</b>	
	<b>Teaching Assistant</b> , California Institute of Technology Ph 7, Nuclear and Quantum Physics Lab Ph 5, Analog Electronics for Physicists <b>Spring 2005</b> <b>Fall 2004</b>	

## 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**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, ~ 83 participants

34<sup>th</sup> 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**34<sup>th</sup> Pacific Coast Gravity Meeting (PCGM), Caltech**March 2018**33<sup>rd</sup> Pacific Coast Gravity Meeting (PCGM), UCSB**March 2017**

“April” APS meeting, Washington D.C.

**January 2017**32<sup>nd</sup> 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

**March 2018**

Lecture: “The truth about black holes”

Astronomy on Tap public lecture series speaker and volunteer

**2016–2018**

Close to a monthly basis

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

**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.

PUBLICATIONS IN PROGRESS	32. Isi, M., <b>Stein, L. C.</b> (2018) <i>Stochastic gravitational-wave energy density in beyond-GR gravity</i> . 31. McNees, R. <b>Stein, L. C.</b> , (2018) <i>Cosmological perturbations in dynamical Chern-Simons</i> .
SUBMITTED PUBLICATIONS	30. Prabhu, K., <b>Stein, L. C.</b> (2018) <i>Black hole scalar charge from a topological horizon integral in Einstein-dilaton-Gauss-Bonnet gravity</i> , [ <a href="#">arXiv:1805.02668</a> ].
ACCEPTED PUBLICATIONS	29. Gerosa, D., Hébert, F., <b>Stein, L. C.</b> (2018) <i>Black-hole kicks from numerical-relativity surrogate models</i> , Accepted by PRD. [ <a href="#">arXiv:1802.04276</a> ].
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

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) “Simplic” 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](#)].

UNREFEREED  
PUBLICATIONS

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 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

## INVITED TALKS

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|---|------------------------|
| 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	<del>April</del> January 2017
	15. Testing Gravity 2017	January 2017
	14. 21 <sup>st</sup> 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. 20 <sup>th</sup> 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

**Scott A. Hughes**, Professor of Physics, Massachusetts Institute of Technology  
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