

## Leo C. Stein

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CONTACT INFORMATION	TAPIR 350-17 California Institute of Technology Pasadena, CA 91125 USA	<a href="mailto:leosteин@tapir.caltech.edu">leosteин@tapir.caltech.edu</a> <a href="http://duetosymmetry.com">duetosymmetry.com</a> 1-617-466-9536
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>NASA Einstein Fellow</b> , Cornell, Ithaca NY, USA <b>Research and Teaching Assistant</b> , MIT, Cambridge MA, USA <b>Teaching Assistant</b> , Caltech, Pasadena, CA, USA <b>Summer Research Fellow</b> , Caltech, Pasadena, CA, USA	<b>September 2015–Present</b> <b>September 2012–August 2015</b> <b>September 2006–May 2012</b> <b>Fall 2004, Spring 2005</b> <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>Henry Kendall Teaching Award</b> , Massachusetts Institute of Technology <b>Upperclass Merit Scholarship</b> , California Institute of Technology	<b>2012–2015</b> <b>2011</b> <b>2005–2006</b>
TEACHING EXPERIENCE	<b>Guest Lecturer</b> , California Institute of Technology Ph236, General relativity Ph237, Gravitational Waves <b>Guest Lecturer</b> , Massachusetts Institute of Technology 8.901, Graduate Astrophysics I <b>Teaching Assistant</b> , Massachusetts Institute of Technology 8.942, Cosmology 8.901, Graduate Astrophysics I 8.286, The Early Universe <b>Teaching Assistant</b> , California Institute of Technology Ph 7, Nuclear and Quantum Physics Lab Ph 5, Analog Electronics for Physicists	<b>Fall 2017</b> <b>Spring 2016</b> <b>Spring 2011</b> <b>Fall 2011</b> <b>Spring 2011</b> <b>Fall 2009</b> <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, ~ 60 participants

34<sup>th</sup> Pacific Coast Gravity Meeting (PCGM), Caltech

March 2018

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**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**

Astronomy on Tap public lecture series speaker and volunteer

2016–2017

Close to a monthly basis

Caltech astronomy public lecture series panelist and emcee

2016–2017

Approximately every three months

Invited guest lecture on black holes and gravitational waves

November 2017

*Science of Space and Time*, Hampshire College

Invited video Q&amp;A session, public high school physics class

June 2017

*The Nova Project* school, Seattle

Guest on *The Titanium Physicists Podcast*

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 *COSMOS* with Q&A,  
Science Cabaret/Cornell

March/June 2014

Invited public talk at *Frontiers of Cornell Astronomy*,  
Cornell Friends of Astronomy

November 2013

Invited video chat, *Topics in Physics* 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.

**PUBLICATIONS IN PROGRESS**

31. Isi, M., **Stein, L. C.** (2018) *Stochastic gravitational-wave energy density in beyond-GR gravity*.
30. McNees, R. **Stein, L. C.**, (2018) *Cosmological perturbations in dynamical Chern-Simons*.

**SUBMITTED PUBLICATIONS**

29. Gerosa, D., Hébert, F., **Stein, L. C.** (2018) *Black-hole kicks from numerical-relativity surrogate models*, [[arXiv:1802.04276](#)].

**ACCEPTED PUBLICATIONS**

28. Chen, B., **Stein, L. C.** (2018) *Deformation of extremal black holes from stringy interactions*, Accepted by PRD. [[arXiv:1802.02159](#)].

**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**

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) “Simplicctic” 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]
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

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)

17. Pacific Coast Gravity Meeting, March 2017
16. American Physical Society Meeting, ~~April~~ 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 (GR21), July 2013
6. Eastern Gravity Meeting, June 2013
5. American Physical Society Meeting, April 2013

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| 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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