

Leo C. Stein

CONTACT INFORMATION	TAPIR 350-17 California Institute of Technology Pasadena, CA 91125 USA	leosteин@tapir.caltech.edu duetosymmetry.com 1-617-466-9536
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> May 2012	
	B.S., Physics , California Institute of Technology, Pasadena, CA, USA Degree conferred with honor. Senior Thesis Advisors: Dr. Patrick Sutton and Prof. Alan Weinstein June 2006	
EMPLOYMENT	Senior Postdoctoral Researcher , Caltech, Pasadena, CA USA September 2015–Present	
	NASA Einstein Fellow , Cornell, Ithaca NY, USA September 2012–August 2015	
	Research and Teaching Assistant , MIT, Cambridge MA, USA September 2006–May 2012	
	Teaching Assistant , Caltech, Pasadena, CA, USA Fall 2004, Spring 2005	
	Summer Research Fellow , Caltech, Pasadena, CA, USA 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 2012–2015	
	Henry Kendall Teaching Award , Massachusetts Institute of Technology 2011	
	Upperclass Merit Scholarship , California Institute of Technology 2005–2006	
TEACHING EXPERIENCE	Guest Lecturer , California Institute of Technology Ph236, General relativity Ph237, Gravitational Waves Fall 2017 Spring 2016	
	Guest Lecturer , Massachusetts Institute of Technology 8.901, Graduate Astrophysics I Spring 2011	
	Teaching Assistant , Massachusetts Institute of Technology 8.942, Cosmology 8.901, Graduate Astrophysics I 8.286, The Early Universe Fall 2011 Spring 2011 Fall 2009	
	Teaching Assistant , California Institute of Technology Ph 7, Nuclear and Quantum Physics Lab Ph 5, Analog Electronics for Physicists Spring 2005 Fall 2004	

MENTORING

Graduate students

Maria (Masha) Okounkova, Caltech

Fall 2015–present

Baoyi Chen, Caltech

Fall 2016–present**Undergraduate students**

Wayne Zhao, Harvard

Summer 2016PROFESSIONAL
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 organizerWorkshop 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 201834th Pacific Coast Gravity Meeting (PCGM), Caltech**March 2018**33rd Pacific Coast Gravity Meeting (PCGM), UCSB**March 2017**

“April” APS meeting, Washington D.C.

January 201732nd 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	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.

PUBLICATIONS IN PROGRESS	33. Isi, M., Stein, L. C. (2018) <i>Stochastic gravitational-wave energy density in beyond-GR gravity</i> . 32. McNees, R. Stein, L. C. , (2018) <i>Cosmological perturbations in dynamical Chern-Simons</i> .
SUBMITTED PUBLICATIONS	31. Barack, L., <i>et al.</i> (2018) <i>Black holes, gravitational waves and fundamental physics: a roadmap</i> , [arXiv:1806.05195].
ACCEPTED 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> , Accepted by PRD. [arXiv:1805.02668].
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

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](#)].

UNREFEREED
PUBLICATIONS

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

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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 |

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| 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)

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| 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. 21 st 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 th 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
 77 Massachusetts Avenue, Bldg. 37-602A
 Cambridge, MA 02139
 email: sahughes@mit.edu
 office phone: 1-617-258-8523

Nico Yunes, Associate Professor of Physics, Montana State University
 Barnard Hall Room 203, MSU
 Bozeman, MT 59717-3840
 email: nicolas.yunes@montana.edu
 office phone: 1-406-994-6182

Éanna É. Flanagan, Professor of Physics and Astronomy, Cornell University
 606 Space Sciences, Cornell University
 Ithaca, NY 14853
 email: flanagan@astro.cornell.edu
 office phone: 1-607-255-6534

Yanbei Chen, Professor of Physics, California Institute of Technology
 TAPIR 350-17, Caltech
 1200 E. California Boulevard
 Pasadena, CA 91125
 email: yanbei@caltech.edu (please send correspondence to joann@caltech.edu)
 office phone: 1-626-395-4258