

## Leo C. Stein

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CONTACT INFORMATION	TAPIR 350-17 California Institute of Technology Pasadena, CA 91125 USA	<a href="mailto:leosteinstein@tapir.caltech.edu">leosteinstein@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>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 Ph237, Gravitational Waves <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 <b>Fall 2011</b> 8.901, Graduate Astrophysics I <b>Spring 2011</b> 8.286, The Early Universe <b>Fall 2009</b>  <b>Teaching Assistant</b> , California Institute of Technology Ph 7, Nuclear and Quantum Physics Lab <b>Spring 2005</b> Ph 5, Analog Electronics for Physicists <b>Fall 2004</b>	

MENTORING	<b>Graduate students</b> Maria (Masha) Okounkova, Caltech	Fall 2015–present
	<b>Undergraduate students</b> Wayne Zhao, Harvard	Summer 2016
PROFESSIONAL ACTIVITIES, OUTREACH, AND SERVICE	<b>Member, American Physical Society</b>	2010–Present
	Division of Gravitational Physics	
	Executive Committee Member-at-Large	2016–2019
	Division of Astrophysics	
	<b>Conference organizer</b>	
	Workshop on <b>Unifying Tests of General Relativity</b> , Caltech Three day workshop, 52 participants	July 2016
	<b>Seminar organizer</b>	
	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
	<b>Conference session chair; Judge for best student speaker award</b>	
	32 <sup>nd</sup> Pacific Coast Gravity Meeting (PCGM), CSU Fullerton	April 2016
	Theoretical Astrophysics in Southern California (TASC), CSU Fullerton	November 2015
	<b>Journal referee</b>	
	Journal of Cosmology and Astroparticle Physics, Monthly Notices of the Royal Astronomical Society, Physics Letters B, Physical Review D, Physical Review Letters, Reviews of Modern Physics	
	<b>Outreach</b>	
	Caltech astronomy public lecture series panelist	June 10, 2016 February 19, 2016
	Guest on <i>The Titanium Physicists Podcast</i> <b>Episode 64: The edges of Einstein</b> <b>Episode 62: Black Bells</b>	April 25, 2016 February 1, 2016
	Quora <b>Q&amp;A Session</b> on gravitational waves and first detection 83.9k+ views, 12.8k+ 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 for Chrome.

**PUBLICATIONS IN PROGRESS**

4. **Stein, L. C.**, Okounkova, M. (2016) *First black hole mergers in dynamical Chern-Simons*.
3. **Stein, L. C.**, Zhao, W. (2016) *Metric of rapidly rotating black holes in dynamical Chern-Simons*.
2. **Stein, L. C.**, McNees, R. (2016) *Cosmological perturbations in dynamical Chern-Simons*.
1. **Stein, L. C.** (2016) *Separation of metric perturbations in near-Horizon near-Extremal Kerr*.

**SUBMITTED PUBLICATIONS**

2. Tso, R., Isi, M., Chen, Y., **Stein, L. C.** (2016) *Modeling the Dispersion and Polarization Content of Gravitational Waves for Tests of General Relativity*, (Proceedings of CPT '16) [[arXiv:1608.01284](#)]
1. Galley, C. R., Tsang, D., **Stein, L. C.** (2014) *The principle of stationary nonconservative action for classical mechanics and field theories*, [[arXiv:1412.3082](#)]

**ACCEPTED PUBLICATIONS**

1. McNees, R., **Stein, L. C.**, Yunes, N. (2015) *Extremal Black Holes in Dynamical Chern-Simons Gravity*, Accepted by Class. Quantum Grav. [[arXiv:1512.05453](#)]

**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**

17. 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](#)]
16. Yagi, K., **Stein, L. C.** (2016) *Black Hole Based Tests of General Relativity*, 2016 *Class. Quantum Grav.* **33** 054001 [[arXiv:1602.02413](#)]
15. 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](#)]
14. Berti, E., (5 authors), **Stein, L. C.**, (46 more authors) (2015) *Testing General Relativity with Present and Future Astrophysical Observations*, 2015 *Class. Quantum Grav.* **32** 243001 [[arXiv:1501.07274](#)]
13. 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](#)]
12. 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](#)]
11. **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](#)]
10. **Stein, L. C.**, Yagi, K., Yunes, N. (2014) *Three-Hair Newtonian Relations for Rotating Stars*, *ApJ* **788** 15 [[arXiv:1312.4532](#)]
9. **Stein, L. C.**, Yagi, K. (2013) *Parameterizing and constraining scalar corrections to general relativity*, *Phys. Rev. D* **89** 044026 [[arXiv:1310.6743](#)]

8. 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](#)]
7. 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](#)]
6. Vigeland, S., Yunes, N., **Stein, L. C.** (2011), *Bumpy black holes in alternative theories of gravity*, *Phys. Rev. D* **83** 104027 [[arXiv:1102.3706](#)]
5. Yunes, N., **Stein, L. C.** (2011), *Nonspinning black holes in alternative theories of gravity*, *Phys. Rev. D* **83** 104002 [[arXiv:1101.2921](#)]
4. **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](#)]
3. 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](#)]
2. 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](#)]
1. 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](#)]

#### UNREFEREED PUBLICATIONS

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 Inspirals Gravitational Waves from a Post-Newtonian Expansion*, Contribution to the Wolfram Demonstrations Project, <http://demonstrations.wolfram.com/BinaryInspiralsGravitationalWavesFromAPostNewtonianExpansion/>
1. **Stein, L. C.** (2006), *Gravitational Wave Burst Source Localization in a Coherent Network Analysis*, Senior thesis at California Institute of Technology

#### INVITED TALKS

12. *Black hole mergers: beyond general relativity*, Fellows at the Frontier 2016, CIERA.
11. *Alternative theories of gravity, novel physics around compact objects*: panel discussion at GR@100++ conference, Princeton, April 2016
10. *Rapidly rotating black holes in dynamical Chern-Simons gravity: Decoupling limit solutions and breakdown*, Einstein fellows symposium, October 2014.  
Available at ► [http://youtu.be/\\_ErPFnrQGnE?t=1m45s](http://youtu.be/_ErPFnrQGnE?t=1m45s).
9. *Probing (beyond) general relativity with compact binaries and gravitational waves*, Strong gravity seminar, Perimeter Institute, October 2014.  
Available at ► <http://www.pirsa.org/14100003/>.
8. Friends of astronomy outreach event, Cornell, November 2013
7. *Parameterizing and constraining scalar corrections to general relativity*, Einstein fellows symposium, October 2013
6. *Corrections to general relativity, and where to look for them*, Physics colloquium, SUNY Geneseo, October 2013
5. *Parameterizing scalar corrections to general relativity*, UMD gravity seminar, University of Maryland, October 2013
4. *Corrections to general relativity, and where to look for them*, YCAA seminar, Yale University, September 2013

3. *Scalar gravitational effects*, YITP long-term workshop, Kyoto University, June 2013
2. *Conditions for Preheating*, Einstein fellows symposium, October 2012
1. *Signatures of strong gravity corrections to GR*, Cornell Relativity Lunch, November 2011

#### CONTRIBUTED TALKS (SELECTED)

12. *Numerical black holes and mergers in dynamical Chern-Simons gravity*, GR21, July 2016
11. *Extremal black holes in dynamical Chern-Simons gravity*, April APS Meeting 2016
10. *Hiding corrections to GR with topology*, Eastern Gravity Meeting, May 2015
9. *Why neutron stars have three hairs*, April APS Meeting 2015
8. *Rapidly rotating black holes in dynamical Chern-Simons gravity: Decoupling limit solutions and breakdown*, NEB 16—Recent developments in gravity, September 2014
7. *Three-Hair Newtonian Relations for Rotating Stars*, April APS Meeting 2014
6. *Parameterizing and constraining scalar corrections to general relativity*, XXVII Texas symposium, December 2013
5. *Eccentric binary effects in dynamical Chern-Simons gravity*, April APS Meeting 2013
4. *Signatures of strong gravity corrections to GR*, Caltech TAPIR Seminar, December 2011
3. *Effective gravitational wave stress-energy tensor in alternative theories of gravity*, Eastern Gravity Meeting, June 2011
2. *Effective gravitational wave stress-energy tensor in alternative theories of gravity*, April APS Meeting 2011
1. *Tuning advanced gravitational-wave detectors to optimally measure neutron-star merger waves*, April APS Meeting 2010

#### REFERENCES

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