

## Robert Caldwell

### Contact Information:

Address: Dartmouth College  
 Department of Physics & Astronomy  
 Hanover, NH 03755  
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### Education:

A.B., Washington University in St. Louis, Physics, French, 1987  
 M.S., University of Wisconsin–Madison, Physics, 1989  
 Ph.D., University of Wisconsin–Milwaukee, Physics, 1992

### Research & Professional Experience:

2010-present Professor, Dartmouth College  
 2005-2010 Associate Professor, Dartmouth College  
 2000-2005 Assistant Professor, Dartmouth College  
 1998-2000 Postdoctoral Fellow, Princeton University, Physics  
 1996-8 Postdoctoral Fellow, University of Pennsylvania, Physics & Astronomy  
 1994-6 Postdoctoral Fellow, Cambridge University, DAMTP  
 1992-4 Postdoctoral Fellow, Fermilab Theoretical Astrophysics

### Awards & Honors:

Fellow of the American Physical Society (since 2008)  
 John M. Manley Huntington Award for Newly Promoted Faculty, Dartmouth (2010)  
 Outstanding Referee, American Physical Society (recognized in 2014)  
 \* Simons Foundation Sabbatical Fellowship in Theoretical Physics (2017-8)

### External Funding: (*since 2012*)

Department of Energy, High Energy Physics 390K, 4/16-3/19 (Caldwell, PI)  
 Department of Energy, High Energy Physics 525K, 7/13-3/16 (Caldwell, PI)  
 Templeton Foundation, 250K, 1/13-12/14 (Caldwell, Co-PI)  
 National Science Foundation, Theoretical Physics, 150K, 9/11-8/14 (Caldwell, Co-PI)  
 NASA Jet Propulsion Laboratory SURP, 40K, 4/11-3/12 (Caldwell, PI)

### Fellowships and Visiting Positions:

Visiting Associate in Physics, California Institute of Technology (2003/5-8/10-11)  
 Member, Kavli Institute for Theoretical Physics, UCSB (2002)  
 Visiting Researcher, Institut d'Astrophysique de Paris, France (2000/1)  
 Rosenbaum Fellow, Newton Institute, Cambridge, UK (1999)

### Impact: (*GoogleScholar, March 2017*)

\*h-index=43, i10-index=78, total citations =14,000

**PhD Advisor:**

Bruce Allen (University of Wisconsin–Milwaukee)

**Postdoctoral Advisors:**

Rocky Kolb, Joshua Frieman (Fermi National Accelerator Laboratory);

Paul Shellard, Stephen Hawking (Cambridge University);

Paul Steinhardt (University of Pennsylvania and Princeton University)

**Graduate Advisees:**

Peng Peng Yu (PhD, 2007), Ryan Michney (MS, 2007), Scott Daniel (PhD, 2009), Deanne Dorak (MS, 2011), Leonardo Motta (PhD, 2012), Jannis Bielefeld (PhD, 2015), Dhrubo Jyoti (PhD expected 2018), Chris Devulder (PhD expected 2018)

**Recent Collaborators:** (*since 2012*)

CMB-S4 Collaboration, Jannis Bielefeld (Dartmouth), Tate Deskins (Kenyon), Chris Devulder (Dartmouth), Olivier Dore (JPL), John Giblin (Kenyon), Steve Gubser (Princeton), Chris Hirata (Ohio State), Marc Kamionkowski (Johns Hopkins), Paul Lasky (Monash), Eric Linder (UC Berkeley), Nina Maksimova (Dartmouth), Chiara Mingarelli (Caltech), Leonardo Motta (Dartmouth), Michael Romalis (Princeton), Tristan Smith (Swarthmore), Eric Thrane (Monash), Kimmy Wu (Stanford)

**Professional Activities:** (*since 2011*)

Judge: Buchalter Cosmology Prize, 2014-2017

Editor: Division Associate Editor, Physical Review Letters (2007-2013)

Reviewer: NSF, NASA, DOE, and foreign science agencies

Member: American Association for the Advancement of Science,  
American Physical Society (Astrophysics, Gravitation, Particles & Fields, and  
Physics Education)

**Publications:**

1. \* R. R. Caldwell, C. Hirata, and M. Kamionkowski, “Dust polarization and ISM Turbulence,” *accepted for publication*, *Astrophysical Journal* (2017).
2. \* T. L. Smith and R. R. Caldwell, “Sensitivity to a Frequency-Dependent Circular Polarization in an Isotropic Stochastic Gravitational Wave Background,” *Phys. Rev. D* **95**, 044036 (2017).
3. \* R. R. Caldwell, C. Devulder, and N. A. Maksimova, “Gravitational wave—Gauge field oscillations,” *Phys. Rev. D* **94**, 063005 (2016).
4. P. Lasky, et al., “Gravitational-wave cosmology across 29 decades in frequency,” *Phys. Rev. X* **6**, 011035 (2016).
5. J. Bielefeld and R. R. Caldwell, “Cosmological consequences of classical flavor-space locked gauge field radiation,” *Phys. Rev. D* **91**, 124004 (2015).
6. J. Bielefeld and R. R. Caldwell, “Chiral Imprint of a Cosmic Gauge Field on Primordial Gravitational Waves,” *Phys. Rev. D* **91**, 123501 (2015).
7. J. Bielefeld, R. R. Caldwell, and E. Linder, “Dark energy scaling from dark matter to acceleration,” *Phys. Rev. D* **90**, 043015 (2014).
8. R. R. Caldwell and N. A. Maksimova, “Spectral distortion in a radially inhomogeneous cosmology,” *Phys. Rev. D* **88**, 103502 (2013).

9. J. T. Deskins, J. T. Giblin, and R. R. Caldwell, “Gauge field preheating at the end of inflation,” *Phys. Rev. D* **88**, 063530 (2013).
10. J. Bielefeld, W. L. K. Wu, R. R. Caldwell, and O. Dore, “Freezing out early dark energy,” *Phys. Rev. D* **88**, 103004 (2013).
11. R. R. Caldwell and S. S. Gubser, “Brief History of Curvature,” *Phys. Rev. D* **87**, 063523 (2013).
12. L. Motta and R. R. Caldwell, “Non-Gaussian features of primordial magnetic fields in power-law inflation,” *Phys. Rev. D* **85**, 103532 (2012).
13. R. R. Caldwell, L. Motta and M. Kamionkowski, “Correlation of inflation-produced magnetic fields with scalar fluctuations,” *Phys. Rev. D* **84**, 123525 (2011).
14. R. A. Vanderveld, R. R. Caldwell and J. Rhodes, “Second-order weak lensing from modified gravity,” *Phys. Rev. D* **84**, 123510 (2011).
15. R. R. Caldwell, V. Gluscevic and M. Kamionkowski, “Cross-Correlation of Cosmological Birefringence with CMB Temperature,” *Phys. Rev. D* **84**, 043504 (2011).
16. A.R. Cooray, D.E. Holz, R. R. Caldwell, “Measuring dark energy spatial inhomogeneity with supernova data,” *JCAP* **1011**, 015 (2010).
17. S. F. Daniel, E. V. Linder, T. L. Smith, R. R. Caldwell, A. Cooray, A. Leauthaud and L. Lombriser, “Testing general relativity with current cosmological data,” *Phys. Rev. D* **81**, 123508 (2010).
18. D. G. Figueroa, R. R. Caldwell and M. Kamionkowski, “Non-Gaussianity from self-ordering scalar fields,” *Phys. Rev. D* **81**, 123504 (2010).
19. R. R. Caldwell and M.P. Kamionkowski, “The physics of cosmic acceleration,” *Ann. Rev. Part. Nuc. Sci.* **59**, 397 (2009).
20. S.F. Daniel, R. R. Caldwell, A. Cooray, P. Serra and A. Melchiorri, “A multi-parameter investigation of gravitational slip,” *Phys. Rev. D* **80**, 023532 (2009).
21. P. Serra, A. Cooray, S.F. Daniel, R. R. Caldwell and A. Melchiorri, “Lensed cosmic microwave background constraints on post-general relativity parameters,” *Phys. Rev. D* **79**, 101301 (2009).
22. P.P. Yu and R. R. Caldwell, “Observer dependence of the quasi-local energy and momentum in Schwarzschild space-time,” *Gen. Rel. Grav.* **41**, 559 (2009).
23. R. R. Caldwell and A. Stebbins, “A test of the Copernican principle,” *Phys. Rev. Lett.* **100**, 191302 (2008).
24. S.F. Daniel, R. R. Caldwell, A. Cooray and A. Melchiorri, “Large scale structure as a probe of gravitational slip,” *Phys. Rev. D* **77**, 103513 (2008).
25. R. R. Caldwell and D. Grin, “Lower limit to the scale of an effective theory of gravitation,” *Phys. Rev. Lett.* **100**, 031301, (2008).
26. T. Smith, A. Erickcek, R. R. Caldwell, and M. Kamionkowski, “The effects of Chern-Simons gravity on bodies orbiting the Earth,” *Phys. Rev. D* **77**, 024015 (2008).
27. S.F. Daniel and R. R. Caldwell, “Consequences of a cosmic scalar with kinetic coupling to curvature,” *Class. Quant. Grav.* **24**, 5573 (2007).
28. R. R. Caldwell, A. Cooray, and A. Melchiorri, “Constraints on a new post-general relativity cosmological parameter,” *Phys. Rev. D* **76**, 023507 (2007).
29. R.J. Michney and R. R. Caldwell, “Anisotropy of the cosmic neutrino background,” *J. Cosmol. Astropart. Phys.* **014**, 0701 (2007).

30. A. Cooray and R. R. Caldwell, "Large-scale bulk motions complicate the Hubble diagram," *Phys. Rev.* **D73**, 103002 (2006).
31. R. R. Caldwell and P.P. Yu, "Long-lived quintessential scalar hair," *Class. Quantum Grav.* **23**, 7257 (2006).
32. R. R. Caldwell, W. Komp, L. Parker, and D. Vanzella, "A sudden gravitational transition," *Phys. Rev.* **D73**, 023513 (2006).
33. R. R. Caldwell and E.V. Linder, "Limits of quintessence," *Phys. Rev. Lett.* **95**, 141301 (2005).
34. R. R. Caldwell and M. Doran, "Dark-energy evolution across the cosmological-constant boundary," *Phys. Rev.* **D72**, 043527 (2005).
35. A. Cooray, M. Kamionkowski and R. R. Caldwell, "Cosmic shear of the microwave background: the curl diagnostic," *Phys. Rev.* **D71**, 123527 (2005).
36. K. Sigurdson, M. Doran, A. Kurylov, R. R. Caldwell, and M. Kamionkowski, "Dark-matter electric and magnetic dipole moments," *Phys. Rev.* **D70**, 83501 (2004).
37. R. R. Caldwell and M. Kamionkowski, "Expansion, geometry, and gravity," *J. Cosmol. Astropart. Phys.* **09**, 009 (2004).
38. R. R. Caldwell and M. Doran, "Cosmic microwave background and supernova constraints on quintessence: concordance regions and target models," *Phys. Rev.* **D69**, 103517 (2004).
39. R. R. Caldwell, M. Kamionkowski, and N.N. Weinberg "Phantom energy and cosmic doomsday," *Phys. Rev. Lett.* **91**, 071301 (2003).
40. R. R. Caldwell, M. Doran, C.M. Mueller, G. Schaefer, C. Wetterich, "Early quintessence in light of WMAP," *ApJ* **591**, L75-78 (2003).
41. S. DeDeo, R. R. Caldwell, and P.J. Steinhardt, "Effects of the sound speed of quintessence on the microwave background and large scale structure," *Phys. Rev.* **D67**, 103509 (2003); *Phys. Rev.* **D67**, 129902E (2003).
42. P. Schuecker, R. R. Caldwell, H. Bohringer, C.A. Collins, L. Guzzo, and N.N. Weinberg, "Observational constraints on general relativistic energy conditions, cosmic matter density and dark energy from x-ray clusters of galaxies and type-Ia supernovae," *Astron. Astrophys.* **402**, 53 (2003).
43. R. R. Caldwell, "A Phantom Menace? Cosmological consequences of a dark energy component with super-negative equation of state" *Phys. Lett.* **B 545**, 23 (2002).
44. R. Dave, R. R. Caldwell, and P.J. Steinhardt, "Sensitivity of the CMB anisotropy to initial conditions in Quintessence Cosmology," *Phys. Rev.* **D66**, 023516 (2002).
45. J.K. Erickson, R. R. Caldwell, P.J. Steinhardt, C. Armendariz-Picon, and V. Mukhanov, "Measuring the sound speed of quintessence," *Phys. Rev. Lett.* **88**, 121301 (2002).
46. L. Boyle, R. R. Caldwell, and M. Kamionkowski, "Spintessence! New models for dark matter and dark energy," *Phys. Lett.* **B 545**, 17 (2002).
47. A.D. Miller, et al., "The QMAP and MAT/TOCO experiments for measuring anisotropy in the cosmic microwave background," *ApJS* **140**, 115 (2002).
48. J.L. Puchalla, R. R. Caldwell, K.L. Cruz, M.J. Devlin, W.B. Dorwart, T. Herbig, A.D. Miller, M.R. Nolta, L.A. Page, E. Torbet, H.T. Tran, "Millimeter-Wavelength Galactic Observations with the Mobile Anisotropy Telescope," *AJ* **123**, 1978 (2002).
49. R. R. Caldwell and D. Langlois, "Shortcuts in the fifth dimension," *Phys. Lett.* **B 511**, 129 (2001).

50. R. R. Caldwell, R. Juszkiewicz, P.J. Steinhardt, and F.R. Bouchet, "A simple method for computing the non-linear correlation function with implications for stable clustering," *ApJ* **547**, L93-96 (2001).
51. L. Wang, R. R. Caldwell, J. P. Ostriker, and P. J. Steinhardt, "Cosmic concordance and quintessence," *ApJ* **530**, 17-35 (2000).
52. A.D. Miller, R. R. Caldwell, M.J. Devlin, W.B. Dorwart, T. Herbig, M.R. Nolta, L.A. Page, J. Puchalla, E. Torbet, H.T. Tran, "A measurement of the angular power spectrum of the CMB from  $\ell=100$  to 400," *ApJ* **524**, L1-4 (1999).
53. C.-P. Ma, R. R. Caldwell, P. Bode, and L. Wang, "The mass power spectrum in quintessence cosmological models," *ApJ* **521**, L1-4 (1999).
54. P.P. Avelino, R. R. Caldwell, and C.J.A.P. Martins, "Cosmological consequences of string-forming open inflation models," *Phys. Rev. D* **59**, 123509 (1999).
55. R. R. Caldwell, M. Kamionkowski, and L. Wadley, "The first space-based gravitational-wave detectors," *Phys. Rev. D* **59**, 027101 (1999).
56. G. Huey, L. Wang, R. Dave, R. R. Caldwell, and P.J. Steinhardt, "Resolving the cosmological missing energy problem," *Phys. Rev. D* **59**, 063005 (1999).
57. R. R. Caldwell and P.J. Steinhardt, "The imprint of gravitational waves in models dominated by a dynamical cosmic scalar field," *Phys. Rev. D* **57**, 6057 (1998).
58. R. R. Caldwell, R. Dave, and P.J. Steinhardt, "Cosmological imprint of an energy component with general equation of state," *Phys. Rev. Lett.* **80**, 1582 (1998).
59. B. Allen, R. R. Caldwell, S. Dodelson, L. Knox, E.P.S. Shellard, and A. Stebbins, "CMB Anisotropy induced by cosmic strings on angular scales greater than 15-minutes," *Phys. Rev. Lett.* **79**, 2624 (1997).
60. P. P. Avelino, R. R. Caldwell, and C.J.A.P. Martins, "Cosmic strings in an open universe: quantitative evolution and observational consequences," *Phys. Rev. D* **56**, 4568 (1997).
61. R. R. Caldwell, R. A Battye, and E.P.S. Shellard, "Relic gravitational waves from cosmic strings: updated constraints and opportunities for detection," *Phys. Rev. D* **54**, 7146 (1996).
62. B. Allen, R. R. Caldwell, E.P.S. Shellard, A. Stebbins, and S. Veeraraghaven, "Large angular scale CMB anisotropy induced by cosmic strings," *Phys. Rev. Lett.* **77**, 3061 (1996).
63. R. R. Caldwell, "On the evolution of scalar metric perturbations in an inflationary cosmology," *Class. Q. Grav.* **13**, 2437 (1996).
64. R. R. Caldwell, H.A. Chamblin, and G.W. Gibbons, "Pair creation of black holes by domain walls," *Phys. Rev. D* **53**, 7103 (1996).
65. P.P. Avelino and R. R. Caldwell, "Entropy perturbations from cosmic strings," *Phys. Rev. D* **53**, R5339 (1996).
66. R. R. Caldwell and P. Casper, "Formation of black holes from collapsed cosmic string loops," *Phys. Rev. D* **53**, 3002 (1996).
67. A. Stebbins and R. R. Caldwell, "No very large scale structure in an open universe," *Phys. Rev. D* **52**, 3248 (1995).
68. B. Allen, R. R. Caldwell, and S. Koranda, "CBR Temperature fluctuations induced by gravitational waves in a spatially-closed inflationary universe," *Phys. Rev. D* **51**, 1553 (1995).

69. R. R. Caldwell, "Green's functions for gravitational waves in FRW spacetimes," *Phys. Rev. D* **48**, 4688 (1993).
70. R. R. Caldwell and E. Gates, "Constraints on cosmic strings due to black holes formed from collapsed cosmic string loops," *Phys. Rev. D* **48**, 2581 (1993).
71. R. R. Caldwell and B. Allen, "Cosmological constraints on cosmic string gravitational radiation," *Phys. Rev. D* **45**, 3447 (1992).
72. R. R. Caldwell and J.L. Friedman, "Evidence against a strange ground state for baryons," *Physics Lett. B* **264**, 143 (1991).
73. B. Allen and R. R. Caldwell, "Small scale structure on a cosmic string network," *Phys. Rev. D* **43**, 3173 (1991).
74. B. Allen and R. R. Caldwell, "Kinky structure on strings," *Phys. Rev. D* **43**, R2457 (1991).
75. B. Allen and R. R. Caldwell, "Generation of structure on a cosmic string network," *Phys. Rev. Lett.* **65**, 1705 (1990).

### Conference Proceedings:

1. \*R. R. Caldwell, "Cosmic Parity Violation due to a Flavor-Space Locked Gauge Field," *Int. J. Mod. Phys. D*, **25**, 1640011 (2016).
2. R. R. Caldwell, "Dark Energy Models," in "TASI 2012: Searching for New Physics at Small and Large Scales," eds. E. Pierpaoli and M. Schmaltz, World Scientific (2013).
3. R. R. Caldwell, "Gravitational Screening: Geometry and Superposition," *AIP Conf. Proc.* 1514, pp. 169-178 (2013).
4. R. R. Caldwell, "A Gravitational Puzzle," *Phil. Trans. R. Soc.* **A369** 4998 (2011).
5. R. R. Caldwell, "Dark energy phenomena as gigaparsec voids: constraints due to spectral distortion," in "Proceedings, 4th Mexican Meeting on Mathematical and Experimental Physics," eds. A. Macias, M. Maceda, *AIP Conf. Proc.* 1318 (2010).
6. R. R. Caldwell "Perspectives on Dark Energy," *Space Science Reviews* **148**, 347 (2009); DOI 10.1007/s11214-009-9552-3.
7. P. Serra, A. Cooray, S. F. Daniel, R. Caldwell and A. Melchiorri, "Lensed cosmic microwave background constraints on post-general relativity parameters," *Nucl. Phys. Proc. Suppl.* **194**, 320 (2009).
8. R. Caldwell and L. Dias Da Motta, "Electro- and magnetostatics of a cosmic pseudoscalar field coupled to electromagnetism," *Nucl. Phys. Proc. Suppl.* **194**, 202 (2009).
9. R. R. Caldwell, "The Imprint of Dark Energy," in *CosPA 2003: Cosmology and Particle Astrophysics*, ed. W.-Y. Pauchy Hwang (World Scientific, Singapore, 2004).
10. R. R. Caldwell *et al.*, "Cosmological Parameters, Dark Energy, and Large Scale Structure," in *Snowmass 2001: The Future of Particle Physics*, 2001.
11. R. R. Caldwell, "An Introduction to Quintessence," in *Dark Matter 2000: Sources and detection of dark matter and dark energy in the universe*, ed. D. B. Cline, 74-91 (2000).
12. R. R. Caldwell, "An Introduction to Quintessence," *Brazilian Journal of Physics*, vol. 30, no. 2, 215-229, June (2000).
13. R. R. Caldwell, R. Dave, and P.J. Steinhardt, "Quintessential Cosmology: Novel Models of Cosmological Structure Formation," *Astrophysics and Space Science*, vol. 261, 303-310 (1999).

14. P. P. Avelino, R. R. Caldwell, and C.J.A.P. Martins, “The Promise of Structure Formation with Cosmic Strings in an Open Universe,” *Astrophysics and Space Science*, vol. 261, 319-320 (1999).
15. R. R. Caldwell and P.J. Steinhardt, “Introduction to Quintessence” in *Cosmic Microwave Background and Large Scale Structure of the Universe*, eds. Y.-I. Byun and K.-W. Ng (Astronomical Society of the Pacific, 1998).
16. R. R. Caldwell, R. Dave, and P. J. Steinhardt, “Quintessential Cosmology” in *The Non-Sleeping Universe*, eds. Alain Blanchard and M. Teresa V.T. Lago (1998).
17. R.A. Battye, R. R. Caldwell, and E.P.S. Shellard, “Gravitational waves from cosmic strings” in *Topological Defects in Cosmology*, eds. F. Melchiorri and M. Signore (1996).
18. B. Allen, R. R. Caldwell, E.P.S. Shellard, A. Stebbins and S. Veeraraghavan, “CMB Anisotropy due to cosmic strings: large angular scale,” in *Proceedings of the 18th Texas Symposium*, eds. A. Olinto, J. Frieman and D. Schramm (1996).
19. B. Allen, R. R. Caldwell, E.P.S. Shellard, A. Stebbins and S. Veeraraghavan, “Cosmic strings confront COBE,” in *Birth of the Universe and Fundamental Physics*, ed. Franco Occhionero (Springer-Verlag, Berlin, 1995).
20. B. Allen, R. R. Caldwell, E.P.S. Shellard, A. Stebbins and S. Veeraraghavan, “Cosmic microwave radiation anisotropy induced by cosmic strings,” in *CMB Anisotropies: Two Years After COBE*, ed. Lawrence Krauss (World Scientific, Singapore, 1994).
21. R. R. Caldwell, “The current status of observational constraints on cosmic strings,” in *Proceedings of the 5th Canadian Conference on General Relativity and Relativistic Astrophysics*, eds. R. McLenaghan and R. Mann (World Scientific, Singapore, 1993).
22. B. Allen and R. R. Caldwell, “Formation of kinks,” in *Proceedings of the 1990 Florida Conference on Non-Linear Problems in Astrophysics*, eds. J. Buchler, S. Detweiler, and J. Ipser (New York Academy of Sciences, 1991).
23. B. Allen and R. R. Caldwell, “Kinky strings: Evolution of kinks as small-scale structure on a cosmic string network,” in *Proceedings of the 1990 Banff Summer School on Gravitation*, eds. R. Mann and P. Wesson (World Scientific, Singapore, 1991).

#### White Papers:

1. \*CMB-S4 Collaboration, “CMB-S4 Science Book, First Edition,” arXiv:1610.02743 (2016).

#### Scientific Talks (Colloquia, Seminars, Conferences, Etc): (since 2012)

- \* Harvard-Smithsonian Center for Astrophysics, Astrophysics seminar
- \* Case Western University, Physics seminar
- \* University of Pennsylvania, Cosmology workshop, Invited speaker
- \* New Scientist, Boston, Public Lecture
- \* Brown University, Cosmology workshop, Invited speaker
- \* University of Michigan, Cosmology workshop
- Johns Hopkins University, Physics seminar
- Keene State College, Physics seminar
- University of Minnesota, Physics seminar
- American Physical Society, New England section, Dartmouth College, Plenary lecture
- Brown University, Physics colloquium
- Galileo Galilei Institute, Florence, Italy, Cosmology workshop

Johns Hopkins University, Cosmology workshop  
 University of Chicago, Cosmology workshop  
 American Physical Society, Division of Particles and Fields, Baltimore  
 Dartmouth College, Physics colloquium  
 Brandeis University, Physics seminar  
 Princeton University, Physics seminar  
 Eotvos University, Budapest, Hungary, Cosmology workshop  
 “Les Houches” Summer School of Theoretical Physics, France (2 lectures)  
 UNESCO International Center for Theoretical Physics, Trieste, Italy (3 lectures)  
 University of Tokyo, Physics seminar  
 University of Tokyo, Cosmology workshop  
 Ewha University, Seoul, Korea, Physics seminar  
 Arizona State University, Beyond Center, workshop, Invited Speaker  
 ICTP-SAIFR, Sao Paolo, Brazil, Cosmology Winter School (5 lectures)  
 University of Colorado, Boulder, Colorado, Public Lecture  
 Theoretical Advanced Studies Institute, Boulder, Colorado (4 lectures)  
 University of Heidelberg, Germany, Festschrift, Invited Speaker  
 University of Szczecin, Poland, Cosmology workshop, Invited Speaker

**Recent Media References / Interviews / Sound Bytes:** (*since 2012*)

1. \*“The ultimate fate of the universe,” by Giles Sparrow, *All About Space*, v.58 (2016).
2. \*“Dark energy could force the universe to gradually unzip itself,” by Rebecca Boyle, *New Scientist*, Nov. 9, 2016.
3. \*“Our universe could be reborn as a bouncing baby cosmos,” by Lisa Grossman, *New Scientist*, July 11, 2016.
4. “When will the universe end?” by Jacob Aron, *New Scientist*, Feb. 25, 2016.
5. Interview on “The Briefing” with Mike Mastanduno, *Sirius XM 121*, Feb. 20, 2016.
6. “How will the universe end?” by Adam Becker, *BBC*, Jun. 2, 2015.
7. “This is the way the world ends,” *Salon*, Mar. 9, 2014.
8. “To bake matter, first preheat universe,” by Lisa Grossman, *New Scientist*, Jun. 22, 2013.
9. “Will dark energy freeze or rip the universe?” by Kelly Oakes, *Astronomy Now*, Jan. 2013.
10. “Phoenix universe could rebuild itself after cosmic rip,” by Lisa Grossman, *New Scientist*, Oct. 17, 2012.

**Undergraduate Research Supervision:** (*since 2012*)

Laura Bergsten, Lucas Bezerra, \*James Detweiler, Matthew Digman, Connie Jiang, Nina Maksimova, Martin Moon, Saba Nejad, \*Andrew Sun



**Dartmouth Courses Taught:** (*since 2012*)

P13 Introductory Physics I: Mechanics (W12, F12, F15)

P14 Introductory Physics II: E & M (W14, 17)

P19 Relativistic and Quantum Physics (S15)

P50 Introductory Quantum Mechanics (F16)

P77 Introduction to General Relativity (F13, F15)

P92 Physics of the Early Universe (W13, W15)

P256 Instruction in Teaching for Graduate Students (F/W 12/13-13/14,15/16)