

## Dr. Andrew Samuel Friedman - Curriculum Vitae

University of California, San Diego,  
Center for Astrophysics & Space Sciences,  
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### EDUCATION

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May 2012 Ph.D. **Harvard University**, Astronomy & Astrophysics

*Thesis: Infrared Light Curves of Type Ia Supernovae*

June 2006 A.M. **Harvard University**, Astronomy

*Thesis: Toward a More Standardized Candle Using GRB Energetics & Spectra*

Dec 2001 B.A. **University of California, Berkeley**, Physics & Astrophysics

*Summa Cum Laude*, Phi Beta Kappa, Highest Honors in Physics, Highest Distinction in General Scholarship, *Thesis: The Lick Observatory Supernova Search: Type Ia Supernovae, Cosmology, and the Accelerating Universe*

### PROFESSIONAL APPOINTMENTS

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2017 – Assistant Research Scientist, **UC San Diego** Center for Astrophysics & Space Sciences

2017 – Research Affiliate, Program in STS, **Massachusetts Institute of Technology (MIT)**

2014-17 Research Associate, Program in Science, Technology, & Society (STS), **MIT**

2012-16 Visiting Research Scientist, **MIT Center for Theoretical Physics**

2012-14 National Science Foundation STS Postdoctoral Fellow, **MIT**

### FELLOWSHIPS, HONORS, & AWARDS

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2012-14 National Science Foundation STS Postdoctoral Fellowship, **MIT**

2006-09 National Aeronautics & Space Administration (**NASA**) Graduate Student Research Program Fellowship, **Harvard University / NASA Goddard Spaceflight Center**

2002-06 National Science Foundation (**NSF**) Graduate Research Fellowship, **Harvard Univ.**

2004-05 Certificate of Distinction in Teaching, **Harvard University** (Spring 2004, Fall 2005)

2003-07 James Mills Peirce Fellowship, Department of Astronomy, **Harvard University**

### GRANTS AND TELESCOPE AWARDS

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2015-19 **National Science Foundation, NSF INSPIRE Award PHYS #1541160** (\$900,360):  
“Testing Bell’s Inequality with Astrophysical Observations”, Co-PI Andrew Friedman (UCSD) with David Kaiser, Alan Guth (MIT); Co-Is Jason Gallicchio (Harvey Mudd), Brian Keating (UCSD) [with Anton Zeilinger (Vienna)]

2015-19 **NASA Hubble Space Telescope**, Cycle 23, Phase II, Award GO-14216 (\$320,686)  
“**RAISIN2**: Tracers of cosmic expansion with SN IA in the IR”, Co-I with PI, Robert Kirshner, Harvard University

2019 **Foundational Questions Institute FQXi Collaborative Mini-Grant**, (\$2,000)  
“Foundational Quantum Experiments with Astronomical Observations”, PI Andrew Friedman (UCSD); Co-Is David Kaiser (MIT), Jason Gallicchio (Harvey Mudd), 1/25/19-3/31/19

2019 **Gordon and Betty Moore Foundation** (\$6,000), “Screening Events: PBS NOVA Documentary, Einstein’s Quantum Riddle”, PI Andrew Friedman (UCSD, 3/4/19), with Co-I Jason Gallicchio (Harvey Mudd, 2/4/19)

- 2016-17 **NASA Jet Propulsion Laboratory R&TD Innovative Spontaneous Concept Proposal** (\$43,690), “Uncorrelated Random Number Generators from Astrophysical Processes”, Co-I with PI Hien Nguyen (JPL/Caltech), Jason Gallicchio (Harvey Mudd), David Kaiser (MIT)
- 2015 **Foundational Questions Institute FQXi Mini-Grant** (\$1,500) “Testing the Foundations of Quantum Mechanics with Cosmological Observations”, PI Alan Guth (MIT); Co-I with David Kaiser (MIT), Jason Gallicchio (Chicago), Anton Zeilinger (Vienna), Brian Keating (UCSD), 1/1/15-9/1/15
- 2012-14 **National Science Foundation, NSF SES Award #1056580** (\$120,000) “Dark Energy, Fine-Tuning, and the Multiverse: Testing Theories in Modern Cosmology”, Co-PI with David Kaiser (MIT)
- 2012-14 **NASA Hubble Space Telescope**, Cycle 20, Phase II, Award GO-13046 (\$350,542) “**RAISIN**: Tracers of cosmic expansion with SN IA in the IR”, Co-I with PI, Robert Kirshner, Harvard University
- 2013 **Rutgers Templeton Project in the Philosophy of Cosmology** (\$3,000) to attend the “Institute for the Philosophy of Cosmology”, UC Santa Cruz, 6/23-7/14/13
- 2005-13 **Peters Automated InfraRed Imaging TELEscope**, 13 Semesters 2005a-2013a, Awarded 300 hours each, Fred Lawrence Whipple Observatory, “CfA Supernova Program: Photometry with the PAIRITEL 1.3-m”, Co-I with PI, Robert Kirshner, Harvard University
- 2010 **NASA Infrared Telescope Facility**, Sem 2010A, “Using NIR Spectra from Type Ia Supernovae to Constrain NIR Light Curves and Physics”, Co-I with PI, Howie Marion, Harvard University
- 2007-08 **NASA Swift Satellite**, Cycle 4, Award #NNH07ZDA001N-SWIFT407, “Investigation of the UV Properties of Supernovae With Swift”, Co-I with PI, Robert Kirshner, Harvard University

## TEACHING

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- 2018 Lecturer, “Cosmology”, **UC San Diego** (Spring 2018)
- 2012-15 Co-Leader, “Harvard/MIT Philosophy of Science Group”, **Harvard University**
- 2015 Teaching Fellow, “The Energetic Universe”, **Harvard University** (Spring 2015)
- 2005 Teaching Fellow, “Cosmic Connections”, **Harvard University** (Fall 2005)
- 2004, 2005 Teaching Fellow, “Matter In the Universe”, **Harvard University** (Spring 04, 05)
- 2002 Teaching Assistant, **Summer Science Program**, Happy Valley School, Ojai, CA
- 2001 Teaching Assistant, “Introductory Astronomy”, **UC Berkeley** (Fall 2001)
- 1999 Student Instructor, “Science Fiction”, **UC Berkeley** (Spring 1999)

## 53 SCIENTIFIC PUBLICATIONS

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h-index: **18**, g-index: **40** ([NASA/ADS](#)), Citations: **1935**, Top 1<sup>st</sup> author: **190** ([Google Scholar](#))  
 Refereed: **27** (Accepted: **26**, Submitted: **1**), In prep: **3** 1<sup>st</sup>/2<sup>nd</sup> author Refereed: **12**, In prep: **2**  
 Non-Refereed: **27** (Conference: **1**, Popular: **11**, Circulars: **15**) 1<sup>st</sup> author non-refereed: **17**

## ALTERNATIVE METRICS

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- 5 articles since 2014 ([1](#), [2](#), [3](#), [4](#), [5](#)) in top 5% of all research outputs scored by [Altmetric.com](#), each in **97-99<sup>th</sup>** percentile for High Attention Score compared to outputs of same age and source.
- Articles [1](#), [5](#) among highest scoring outputs (top 0.2% all time) from *Physical Review Letters*.

- 415 online mentions on [Impactstory.org](https://www.impactstory.org). [Top publication](#) saved and shared 198 times (Only 7% of researchers get this much attention).
- Only 12% of researchers this highly Cited in Wikipedia ([1](#), [2](#), [3](#), [4](#)).

### REFEREED PAPERS (27)

- 2019 Avelino, A., **Friedman, A.S.**, Mandel, K.S., Jones, D.O., Challis, P. and Kirshner, R.P. 2019, “Type Ia Supernovae are Excellent Standard Candles in the Near-Infrared”, *the Astrophysical Journal submitted*, ([arXiv:1902.03261](https://arxiv.org/abs/1902.03261))
- 2019 **Friedman, A.S.**, Leon, D., Crowley, K.D., Johnson, D., Teply, G., Tytler, D., Keating, B.G., and Cole, G.M. 2019, “Constraints on Lorentz Invariance and CPT Violation using Optical Photometry and Polarimetry of Active Galaxies BL Lacertae and S5 B0716+714”, *Physical Review D accepted* ([arXiv:1809.08356](https://arxiv.org/abs/1809.08356))
- 2019 **Friedman, A.S.**, Guth, A.H., Hall, M.J.W., Kaiser, D.I., and Gallicchio, J. 2019, “Relaxed Bell Inequalities with Arbitrary Measurement Dependence for Each Observer”, *Physical Review A*, Vol. 99, Issue 1, id. 012121, ([arXiv:1809.01307](https://arxiv.org/abs/1809.01307))
- 2018 Pierel, J. D. R. , Rodney, S., Avelino, A., Bianco, F., Filippenko, A. V., Foley, R. J., **Friedman, A.S.**, Hicken, M., Hounsell, R., Jha, S.W., Kessler, R., Kirshner, R.P., Mandel, K., Narayan, G., Scolnic, D., Strolger, L. 2018, “Extending Supernova Spectral Templates for Next-Generation Space Telescope Observations”, *Publications of the Astronomical Society of the Pacific*, Vol. 130, Issue 993, pp.114504, ([arXiv:1808.02534](https://arxiv.org/abs/1808.02534))
- 2018 Rauch, D., Handsteiner, J., Hochrainer, A., Gallicchio, J., **Friedman, A.S.**, Leung, C., Liu, B., Bulla, L., Ecker, S., Steinlechner, F., Ursin, R., Hu, B., Leon, D., Benn, C., Ghedina, A., Cecconi, M., Guth, A.H., Kaiser, D.I., Scheidl, T., Zeilinger, A. 2018, “Cosmic Bell Test Using Random Measurement Settings from High-Redshift Quasars”, *Physical Review Letters*, Vol. 121, Issue 8. id. 080403 ([arXiv:1808.05966](https://arxiv.org/abs/1808.05966)) (DOI) [Editor’s Suggestion]
- 2018 Leung, C., Brown, A., Nguyen, H., **Friedman, A.S.**, Kaiser, D.I., and Gallicchio, J.+2018, “Astronomical random numbers for quantum foundations experiments”, *Physical Review A*, Vol. 97, Issue 4, id. 042120, 15pp ([arXiv:1706.02276](https://arxiv.org/abs/1706.02276)) (DOI) [Featured in Physics]
- 2017 Hicken, M., **Friedman, A.S.**+ 2017, “Type II Supernova Light Curves and Spectra From the CfA”, *The Astrophysical Journal Supplement Series*, Volume 233, Issue 1, id 6, 11pp, ([arXiv:1706.01030](https://arxiv.org/abs/1706.01030)) (DOI)
- 2017 Handsteiner, J., **Friedman, A.S.**+ 2017, “Cosmic Bell Test: Measurement Settings from Milky Way Stars”, *Physical Review Letters*, Vol. 118, Issue 6. id. 060401 ([arXiv:1611.06985](https://arxiv.org/abs/1611.06985)) (DOI) [Featured in Physics, Editor’s Suggestion]
- 2016 Marion, G.H. + 2016, “SN 2012cg: Evidence for Interaction Between a Normal Type Ia Supernova and a Non-Degenerate Binary Companion”, *The Astrophysical Journal*, Volume 820, Issue 2, id. 92, 16 pp ([arXiv:1507.07261](https://arxiv.org/abs/1507.07261)) (DOI)
- 2015 **Friedman, A.S.** + 2015c, “[CfAIR2: Near-Infrared Light Curves of 94 Type Ia Supernovae](#)”, *The Astrophysical Journal Supplement Series*, Volume 220, Issue 1, id. 9, 35 pp ([arXiv:1408.0465](https://arxiv.org/abs/1408.0465)) (DOI)
- 2014 Fransson, C. + 2014, “[High Density Circumstellar Interaction in the Luminous Type II In SN 2010jl: The first 1100 days](#)”, *The Astrophysical Journal*, Volume 197, Issue 2, id. 118, 40 pp ([arXiv:1312.6617](https://arxiv.org/abs/1312.6617)) (DOI)
- 2014 Bianco, F. + 2014, “[Multi-Color Optical and NIR Light Curves of 64 Stripped-Envelope Core-Collapse Supernovae](#)”, *The Astrophysical Journal Supplements*, Volume 213,

- Issue 2, Article id. 19, 21 pp. ([arXiv:1405.1428](#)) ([DOI](#))
- 2014 Gallicchio, J., **Friedman, A.S.**, Kaiser, D.I., 2014, “[Testing Bell’s Inequality with Cosmic Photons: Closing the Setting-Independence Loophole](#)”, *Physical Review Letters*, Vol. 112, Issue 11, id. 110405, 5 pp. ([arXiv:1310.3288](#)) ([DOI](#))
- 2014 Marion, G.H. + 2014, “[Type IIb Supernova SN 2011dh: Spectra and Photometry from the Ultraviolet to the Near-Infrared](#)”, *The Astrophysical Journal*, Vol. 781, Issue 2, article id 69, 18 pp. ([arXiv:1303.5482](#)) ([DOI](#))
- 2014 Margutti, R. + 2014, “[A Panchromatic View of the Restless SN 2009ip Reveals the Explosive Ejection of a Massive Star Envelope](#)”, *The Astrophysical Journal*, Vol. 780, Issue 1, article id. 21, 38 pp. ([arXiv:1306.0038](#)) ([DOI](#))
- 2013 **Friedman, A.S.**, Kaiser, D.I., & Gallicchio, J. 2013, “[The Shared Causal Pasts and Futures of Cosmological Events](#)”, *Physical Review D*, Vol. 88, Issue 4, id. 044038, 18 pp. ([arXiv:1305.3943](#)) ([DOI](#))
- 2013 Drout, M. + 2013, “[The Fast and Furious Decay of the Peculiar Type-I Supernova 2005ek](#)”, *The Astrophysical Journal*, Vol. 774, Issue 1, article id. 58, 18 pp. ([arXiv:1306.2337](#)) ([DOI](#))
- 2013 Sanders, N.E. + 2013, “[PS1-12SK is a Peculiar Supernova From a He-Rich Progenitor System in a Brightest Cluster Galaxy Environment](#)”, *The Astrophysical Journal*, Vol. 769, Issue 1, 39, 15 pp. ([arXiv:1303.1818](#)), ([DOI](#))
- 2012 **Friedman, A.S.** 2012, PhD Thesis, Harvard University, “[Infrared Light Curves of Type Ia Supernovae](#)”, *ProQuest Dissertations and Theses*, Pub. #: AAT 3513964; ISBN: 97812674446190; 272 pp. ([NASA/ADS](#))
- 2012 Hicken, M. + 2012, “[CfA4: Light Curves for 93 Type Ia Supernovae](#)”, *The Astrophysical Journal Supplement*, Vol. 200, Issue 2, article id. 12, 15 pp. ([arXiv:1205.4493](#)), ([DOI](#))
- 2009 Mandel, K., Wood-Vasey, W.M., **Friedman, A.S.**, & Kirshner, R.P. 2009, “[Type Ia Supernova Light Curve Inference: Hierarchical Bayesian Analysis in the Near Infrared](#)”, *The Astrophysical Journal*, Vol. 704, Issue 1, pp. 629-651 ([arXiv:0908.0536](#)), ([DOI](#))
- 2009 Modjaz, M. + 2009, “[From Shock Breakout to Peak and Beyond: Extensive Panchromatic Observations of the Type Ib Supernova 2008D Associated with Swift X-ray Transient 080109](#)”, *The Astrophysical J.*, Vol. 702, Issue 1, pp. 226-248 ([arXiv:0805.2201](#)), ([DOI](#))
- 2009 Foley, R. + 2009, “[SN 2008ha: An Extremely Low Luminosity and Exceptionally Low Energy Supernova](#)”, *The Astronomical Journal*, Vol. 138, Issue 2, pp. 376-391 ([arXiv:0902.2794](#)), ([DOI](#))
- 2009 Wang, X. + 2009, “[The Golden Standard Type Ia Supernova 2005cf: Observations from the Ultraviolet to the Near-Infrared Wavebands](#)”, *The Astrophysical Journal*, Vol. 697, Issue 1, pp. 380-408 ([arXiv:0811.1205](#)), ([DOI](#))
- 2008 Wood-Vasey, W.M., **Friedman, A.S.** + 2008, “[Type Ia Supernovae are Good Standard Candles in the Near Infrared: Evidence from PAIRITEL](#)”, *The Astrophysical Journal*, Vol. 689, Issue 1, pp. 377-390 ([arXiv:0711.2068](#)), ([DOI](#))
- 2005 **Friedman, A.S.** & Bloom, J.S. 2005b, “[Present and Future Prospects for GRB Standard Candles](#)”, *Il Nuovo Cimento C*, Vol. 028, Issue 04-05, pp. 669-672 ([astro-ph/0502559](#)), ([DOI](#))
- 2005 **Friedman, A.S.** & Bloom, J.S. 2005a, “[Toward a More Standardized Candle Using GRB Energetics and Spectra](#)”, *The Astrophysical Journal*, Vol. 627, Issue 1, pp. 1-25 ([astro-ph/0408413](#)), ([DOI](#))

**CONFERENCE PROCEEDINGS AND ABSTRACTS (14)**

- 2019 Kirshner, R.P.; Challis, P.; Avelino, A.; Jones, D.; Mandel, K.; **Friedman, A.S.**, “[Results from RAISIN: SNIa in the IR](#)”, *American Astronomical Society*, AAS Meeting #233, id.315.03
- 2018 Avelino, A.; Kirshner, R.P.; Mandel, K.; Challis, P.; **Friedman, A. S.**; RAISIN Team, “[Near Infrared SN Ia Cosmology](#)”, *American Astronomical Society*, AAS Meeting #231, id.209.03
- 2017 Avelino, A.; **Friedman, A. S.**; Mandel, K.; Kirshner, R.P.; Challis, P. “[Near-infrared absolute magnitudes of Type Ia Supernovae](#)”, *American Astronomical Society*, AAS Meeting #229, id.410.02
- 2016 **Friedman, A. S.**; Kaiser, D. I.; Gallicchio, J.; Team 1: University of Vienna, Institute for Quantum Optics and Quantum Information; Team 2: UC San Diego Cosmology Group; Team 3: NASA/JPL/Caltech, “[Testing Quantum Mechanics and Bell's Inequality with Astronomical Observations](#)”, *American Astronomical Society*, AAS Meeting #228, id.403.05
- 2015 **Friedman, A. S.**; Gallicchio, J.; Kaiser, D. I.; Guth, A. H., “[Testing Quantum Mechanics and Bell's Inequality with Astronomical Observations](#)”, *American Astronomical Society*, AAS Meeting #225, id.255.13
- 2014 **Friedman, A. S.**; Gallicchio, J.; Kaiser, D. I.; Guth, A., “[Testing Quantum Mechanics and Bell's Inequality with Cosmological Observations of Quasars](#)”, *American Astronomical Society*, AAS Meeting #224, id.304.02
- 2014 **Friedman, A. S.**; Kaiser, D. I.; Gallicchio, J.; Guth, A. H., “[Testing Quantum Mechanics with Observations of Causally Disconnected Cosmological Events](#)”, *American Astronomical Society*, AAS Meeting #223, id.127.01
- 2010 Mandel, K.; Kirshner, R. P.; Narayan, G.; Wood-Vasey, W. M.; **Friedman, A. S.**; Hicken, M., “[Type Ia Supernova Light Curve Inference: Hierarchical Models for Nearby SN Ia in the Optical and Near Infrared](#)”, *American Astronomical Society*, AAS Meeting #215, id.343.05; *Bulletin of the American Astronomical Society*, Vol. 42, p.449
- 2010 **Friedman, A. S.**; Kirshner, R. P.; Wood-Vasey, M.; Bloom, J. S.; Mandel, K.; Challis, P.; Hicken, M.; Narayan, G.; Foley, R.; Rest, A.; Modjaz, M.; Starr, D.; Blondin, S.; Blake, C.; Cfa Supernova Group; PAIRITEL collaboration, “[Infrared Light Curves of Type Ia Supernovae](#)”, *American Astronomical Society*, AAS Meeting #215, id.343.04; *Bulletin of the American Astronomical Society*, Vol. 42, p.449
- 2009 **Friedman, A. S.**; Wood-Vasey, M.; Mandel, K.; Hicken, M.; Challis, P.; Bloom, J.; Starr, D.; Kirshner, R. P.; Modjaz, M.; CfA Supernova Group; PAIRITEL, “[Disentangling Intrinsic Color Variation and Dust Extinction of Type Ia Supernovae With Near-Infrared, Optical, and Ultraviolet Photometry](#)”, *American Astronomical Society*, AAS Meeting #213, id.438.06; *Bulletin of the American Astronomical Society*, Vol. 41, p.311
- 2007 **Friedman, A. S.**; Wood-Vasey, W. M.; Bloom, J. S.; Modjaz, M.; Hicken, M.; Kirshner, R. P.; Starr, D.; Blake, C. H.; Falco, E.; Szentgyorgi, A.; Challis, P.; Blondin, S.; Rest, A.; Skrutskie, M., “[The Absolute Brightness of Type Ia Supernovae in the Near-Infrared from PAIRITEL: Improved Reddening Estimates and Distances](#)”, *American Astronomical Society*, AAS Meeting #211, id.91.17; *Bulletin of the American Astronomical Society*, Vol. 39, p.886

- 2006 **Friedman, A. S.**; Wood-Vasey, W. M.; Modjaz, M.; Kirshner, R.; Bloom, J. S.; Blake, C. H.; Szentgyorgyi, A. H.; Falco, E. E.; Starr, D.; Skrutskie, M., “[First Two Years: Infrared Light Curves of Type Ia Supernovae with the Peters Automated Infrared Imaging Telescope \(PAIRITEL\)](#)”, 2007 AAS/AAPT Joint Meeting, American Astronomical Society Meeting 209, id.90.06; *Bulletin of the American Astronomical Society*, Vol. 38, p.1026
- 2005 **Friedman, A. S.**; Modjaz, M.; Wood-Vasey, W. M.; Blake, C. H.; Kirshner, R. P.; Challis, P.; Falco, E. E.; Bloom, J. S.; Skrutskie, M. F.; CfA Supernova Group Team; PAIRITEL Collaboration, “[Infrared Light Curves of Nearby Supernovae with the Peters Automated Infrared Imaging Telescope \(PAIRITEL\)](#)”, American Astronomical Society Meeting 207, id.171.05; *Bulletin of the American Astronomical Society*, Vol. 37, p.1432
- 2004 **Friedman, A. S.**, Bloom, J. S, and cosmicbooms.net Team, “[The Present and Future of GRB Cosmography](#)”, American Astronomical Society Meeting 205, id.159.07; *Bulletin of the American Astronomical Society*, Vol. 36, p.1611
- 2000 Li, W. Filippenko, A.V., Treffers, R., **Friedman, A.S.** + 2000, “[The Lick Observatory Supernova Search](#)”, *American Institute of Physics Conference Proceedings*, Vol. 522, pp. 103-106 ([astro-ph/9912336](#)), ([DOI](#))

#### **ASTRONOMICAL NOTICES (15)**

- 2012 Marion, G.H. + 2012b, “[Updated Physical Parameters of SN 2012cg](#)”, *The Astronomer's Telegram*, ATEL #4215, 6/2012 ([NASA/ADS](#))
- 2012 Marion, G.H. + 2012a, “[Early Optical and NIR Photometry and Optical Spectroscopy of SN 2012cg](#)”, *The Astronomer's Telegram*, ATEL #4159, 6/2012 ([NASA/ADS](#))
- 2011 Marion, G.H. + 2011, “[Helium Detection in IRTF Spectra of SN 2011dh](#)”, *The Astronomer's Telegram*, ATEL #3435, 6/2011 ([NASA/ADS](#))
- 2008 Challis, P. + 2008, “[Supernova 2008fj in UGC 10759](#)”, *Central Bureau Electronic Telegrams*, 1495, 1, 9/2008 ([NASA/ADS](#))
- 2008 Modjaz, M. + 2008, “[XRB 080109/SN 2008D:PAIRITEL NIR observations and t<sub>0</sub> from Swift.](#)”, *GRB Coordinates Network*, Circular Service, 7175, 1 (2008) ([NASA/ADS](#))
- 2007 Bloom, J.S. + 2007, “[PAIRITEL Monitoring of SN 2007sr](#)”, *The Astronomer's Telegram*, ATEL #1343, 12/2007 ([NASA/ADS](#))
- 2006 Blondin, S. + 2006, “[GRB 061201: magellan redshift of nearby Abell cluster.](#)”, *GRB Coordinates Network*, Circular Service, 5944, 1 (2006) ([NASA/ADS](#))
- 2001 **Friedman, A.S.**, Li, W.D., Schwartz, M. 2001, “[Supernova 2001ae in IC 4229](#)”, *International Astronomical Union (IAU) Circulars*, 7597, 1 (2001) ([NASA/ADS](#))
- 2001 **Friedman, A.S.**, Li, W.D., Chornock, R. 2001, “[Supernova 2001L in MCG -01-30-11](#)”, *International Astronomical Union (IAU) Circulars*, 7566, 1 (2001) ([NASA/ADS](#))
- 2000 **Friedman, A.S.**, Li, W.D., Schwartz, M. 2000, “[Supernova 2000fa in UGC 3770](#)”, *International Astronomical Union (IAU) Circulars*, 7533, 2 (2000) ([NASA/ADS](#))
- 1999 **Friedman, A.S.**, Li, W.D., Puckett, T. 1999, “[Supernova 1999gb in NGC 2532](#)”, *International Astronomical Union (IAU) Circulars*, 7316, 2 (1999) ([NASA/ADS](#))
- 1999 **Friedman, A.S.**, King, J.Y., Li, W.D., Lick Observatory Supernova Search 1999, “[Supernova 1999ej in NGC 495](#)”, *International Astronomical Union (IAU) Circulars*, 7286, 1 (1999) ([NASA/ADS](#))

- 1999 **Friedman, A.S.**, Li, W.D. 1999, "[Supernova 1999bx in UGC 11391](#)", *International Astronomical Union (IAU) Circulars*, 7154, 1 (1999) ([NASA/ADS](#))
- 1999 Li, W.-D., Modjaz, M., King, J. Y., Papenkova, M., Johnson, R. A., **Friedman, A.S.**, Treffers, R. R., Filippenko, A. V. 1999, "[Comet 1999 E1](#)", *International Astronomical Union (IAU) Circulars*, 7126, 1 (1999) ([NASA/ADS](#))
- 1999 Modjaz, M., King, J. Y., Papenkova, M., **Friedman, A.S.**, Johnson, R. A., Li, W. D., Treffers, R. R., Filippenko, A. V. 1999, "[Supernova 1999ac in NGC 6063](#)", *International Astronomical Union (IAU) Circulars*, 7114, 1 (1999) ([NASA/ADS](#))

### POPULAR SCIENCE ARTICLES (10)

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- 2017 **Friedman, A.S.** 2017a, [Make the Cosmic Perspective Your Next Coping Mechanism](#), *Nautilus, Facts So Romantic: On Ideas*, Nov 7 2017
- 2015 **Friedman, A.S.** 2015b, [Are the Quantum World and the Real World the Same Thing?](#), *NOVA Physics Blog: The Nature of Reality*, May 7 2015
- 2015 **Friedman, A.S.** 2015a, [Ask Astro: Could quantum entanglement be a result of the big bang?](#), *Astronomy*, Vol. 43, Issue 5, May 2015, pg. 44-45
- 2014 **Friedman, A.S.** 2014d, [Can the Cosmos Test Quantum Entanglement?](#), *Astronomy*, Vol. 42, Issue 10, October 2014, pg. 28-33
- 2014 **Friedman, A.S.** 2014c, [Web Extra: Another cosmic thought experiment](#), *Astronomy*, Vol. 42, Issue 10, October 2014
- 2014 **Friedman, A.S.** 2014b, [Heart of a Star, Revealed](#), *Rune: The MIT Journal of Arts and Letters*, Issue 35, pg. 20-21
- 2014 **Friedman, A.S.** 2014a, [The Universe Made Me Do It? Testing "Free Will" With Distant Quasars](#), *NOVA Physics Blog: The Nature of Reality*, Mar 9 2014
- 2006 **Friedman, A.S.** 2006, [Using GRBs For Cosmology](#), p35 (with Naeye, R.S, *Dissecting the Bursts of Doom*, *Sky & Telescope*, Volume 112, No. 8, p30-37, 2006)
- 2002 **Friedman, A.S.** 2002, [The Fundamental Distinction Between Brains and Turing Machines](#), *Berkeley Scientific Journal*, Vol. 6, Issue 1, Spring 2002, p. 28-33
- 2001 **Friedman, A.S.** 2001b, [Fundamental Constants of Physics: The Genes of the Universe](#), *Berkeley Scientific Journal*, Vol. 5, Issue 2, Fall 2001, p. 100-104
- 2001 **Friedman, A.S.** 2001a, [The Fabric of Reality](#), *Berkeley Scientific Journal*, Vol. 5, Issue 1, Spring 2001, p. 28-30

### INVITED TALKS

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- 2018 [A Cosmic Test of Quantum Entanglement: Choosing Experimental Bell Inequality Measurements with Light from High Redshift Quasars](#), Physics and Astronomy Colloquium, **San Diego State University**, 11/30/18
- 2017 [A Cosmic Test of Quantum Entanglement](#), **Summer Science Program**, Summer Science Program Guest Lecture, **New Mexico Tech**, 7/12/17
- 2017 [A Cosmic Bell Test with Measurement Settings from Milky Way Stars](#), Astrophysics Seminar, Center for Astrophysics & Space Sciences, **UC San Diego**, 3/8/17
- 2016 [Math, Science, and the Mind of God](#), Arthur C. Clarke Center for Human Imagination, **UC San Diego**, 8/10/16
- 2016 [Math, Science, and the Mind of God](#), Center for Astrophysics & Space Sciences, **UC San Diego**, 8/3/16
- 2016 [Testing Quantum Mechanics and Bell's Inequality with Astronomical Observations](#),

- American Astronomical Society**, Meeting #228, San Diego, CA, 6/16/16
- 2016 [Testing Quantum Mechanics and Bell's Inequality with Astronomical Observations](#), Center for Astrophysics & Space Sciences, **UC San Diego**, 6/7/16
- 2015 [Comparing Recent Entanglement Tests to a Cosmic Bell Test: Loopholes & Spacetime Diagrams](#), Center for Astrophysics & Space Sciences, **UC San Diego**, 12/18/15
- 2015 [Cosmic Bell: Testing Quantum Mechanics and Bell's Inequality with Astrophysical Observations](#), [Summer Science Program Alumni Dinner](#), **MIT Media Lab**, Cambridge, MA 11/14/15
- 2015 Optimal Source Selection for a Cosmic Bell Experiment, Institute for Quantum Optics & Quantum Information, **University of Vienna**, 10/1-2/15
- 2015 [The Physics of Free Will](#), Arthur C. Clarke Center for Human Imagination, **UC San Diego**, 8/6/15
- 2015 [The Physics of Free Will](#), Center for Astrophysics & Space Sciences, **UC San Diego**, 8/5/15
- 2015 [Cosmic Bell: Testing Quantum Mechanics and Bell's Inequality with Astrophysical Observations](#), Center for Astrophysics & Space Sciences, **UC San Diego**, 7/1/15
- 2014 [How Big Is The World? Exploring the Multiverse in Modern Astrophysics, Cosmology, and Beyond](#), Arthur C. Clarke Center for Human Imagination, **UC San Diego**, 7/29/14
- 2014 [How Big Is The World? Exploring the Multiverse in Modern Astrophysics, Cosmology, and Beyond](#), Center for Astrophysics & Space Sciences, **UC San Diego**, 7/16/14
- 2014 [Testing Quantum Mechanics and Bell's Inequality with Cosmological Observations of Quasars](#), **American Astronomical Society**, Meeting #224, Boston, MA, 6/4/14
- 2014 [Testing Quantum Mechanics and Bell's Inequality with Cosmological Observations](#), Brown Bag Lunch Talk, Kavli Institute for Astrophysics & Space Research, **MIT**, 3/10/14
- 2014 [Testing Quantum Mechanics and Bell's Inequality with Cosmological Observations](#), Philosophy of Physics Group, Department of Philosophy, **UC San Diego**, 2/20/14
- 2014 [Testing Quantum Mechanics and Bell's Inequality with Observations of Causally Disconnected Cosmological Events](#), Institute for Theory and Computation, **Harvard-Smithsonian CfA**, 1/13/14
- 2013 [Testing Quantum Mechanics and Bell's Inequality with Observations of Causally Disconnected Cosmological Events](#), Tufts/MIT Cosmology Seminar, **MIT Center for Theoretical Physics**, 11/19/13
- 2013 [The Shared Causal Pasts and Futures of Cosmological Events](#), Center for Astrophysics & Space Sciences, **UC San Diego**, 6/19/13
- 2013 [Infrared Photometric Uncertainties with the PAIRITEL 1.3-m Telescope](#), Center for Astrophysics & Space Sciences, **UC San Diego**, 1/2/13
- 2012 [CfAIR2: 100 Type Ia Supernovae Light Curves From PAIRITEL](#), Special Astro. Seminar, Center for Astrophysics & Space Sciences, **UC San Diego**, 6/19/12
- 2012 [CfAIR2: Infrared Observations of ~100 Type Ia Supernovae With PAIRITEL](#), A PITT PACC Workshop, Dept. of Physics & Astronomy, **U. of Pittsburgh**, 3/28/12
- 2012 [CfAIR2: Infrared Observations of ~100 Type Ia Supernovae With PAIRITEL](#), Optical and Infrared Seminar, **Harvard-Smithsonian Center for Astrophysics**, 2/22/12
- 2011 [Rescuing Type Ia Supernovae From Dust: Bayesian Inference With Near-Infrared and Optical Data](#), Philosophy of Cosmology Workshop and Logic, Mathematics, & Physics Graduate Conference Panelist, Rotman Institute, **University of Western Ontario**, 5/7/11



- 2010 [Infrared Light Curves of Type Ia Supernovae](#), **American Astronomical Society**, Meeting #215, Washington, DC, 1/5/10
- 2007 [Infrared Light Curves of Type Ia Supernovae from PAIRITEL](#), Accretion and Explosion: The Astrophysics of Degenerate Stars, Kavli Institute for Theoretical Physics, **UC Santa Barbara**, 2/20/07
- 2006 [Selected PAIRITEL Data Analysis Issues](#), 2nd PAIRITEL Workshop, **Harvard-Smithsonian Center for Astrophysics**, 6/16/06
- 2006 [The Promise and Limitations of GRB Standard Candles](#), Graduate Student Research Forum, Dept. of Astronomy, **Harvard University**, 3/14/06
- 2005 [The Present and Future of GRB Cosmology](#), Supernova Acceleration Probe Science Meeting, **Lawrence Berkeley National Laboratory**, 7/15/05
- 2005 [Toward a More Standardized Candle Using GRB Energetics and Spectra](#), High Energy Astrophysics Division Lunch Talk, **Harvard-Smithsonian CfA**, 2/9/05
- 2005 [The Present and Future of GRB Cosmography](#), **American Astronomical Society**, Meeting #205, San Diego, CA, 1/13/05

### POSTER PRESENTATIONS

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- 2018 [Testing Quantum Entanglement with Astronomical Observations](#) and Type Ia Supernovae are Excellent Standard Candles in the Near-Infrared, “Adventures in Astrophysics: A Symposium Celebrating Alex Filippenko's 60th Birthday”, Aptos, CA, **UC Berkeley**, 8/15-8/18/2018
- 2014 [Testing Quantum Mechanics and Bell's Inequality with Astronomical Observations](#), “2<sup>nd</sup> Annual MIT Postdocs Share Their Science Poster Session”, **MIT**, 5/12/14
- 2009 [Disentangling Dust Extinction and Intrinsic Color Variation of Type Ia Supernovae With Near-Infrared and Optical Photometry](#), “RogerFest: A Festival of Cosmic Explosions”, Cahill Center, **Caltech**, 8/21-23/09
- 2009 [Disentangling Dust Extinction and Intrinsic Color Variation of Type Ia Supernovae With Near-Infrared and Optical Photometry](#), “Stellar Death & Supernovae, Kavli Institute for Theoretical Physics”, **UC Santa Barbara**, 8/17-21/09
- 2009 [Disentangling Intrinsic Color Variation and Dust Extinction of Type Ia Supernovae With Near-Infrared, Optical, and Ultraviolet Photometry](#), **American Astronomical Society**, Meeting #213, Long Beach, CA, 1/9-14/09
- 2008 [Type Ia Supernovae are Good Standard Candles in the Near Infrared: Evidence from PAIRITEL](#), **American Astronomical Society**, Meeting #211, Austin, TX, 1/7-11/08
- 2007 [The Absolute Brightness of Type Ia SNe in the NIR from PAIRITEL: Implications for the NASA/DOE Joint Dark Energy Mission](#), “NASA Graduate Student Research Program Symposium”, **NASA Goddard Space Flight Center**, Greenbelt, MD, 9/19-21/07
- 2006 [Infrared Light Curves of Nearby Supernovae with the Peters Automated Infrared Imaging Telescope \(PAIRITEL\)](#), **American Astronomical Society**, Meeting #207, Washington, DC, 1/8-12/06
- 2004 [Toward a More Standardized Candle Using GRB Energetics and Spectra](#), “4th Workshop on Gamma-Ray Bursts in the Afterglow Era”, **Rome, Italy**, 10/18-22/04

### CONFERENCES AND WORKSHOPS

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- 2019 “Cosmic Bell team workshop”, Center for Theoretical Physics and Department of Physics, **MIT**, March 2019

- 2018 “Adventures in Astrophysics: A Symposium Celebrating Alex Filippenko's 60th Birthday”, Aptos, CA, **UC Berkeley**, 8/15-8/18/2018
- 2016 **American Astronomical Society**, Meeting #228, San Diego, CA, 6/12-6/16
- 2015 “Cosmic Bell team workshop”, Institute for Quantum Optics & Quantum Information, **University of Vienna**, 9/30-10/4/15
- 2014 **American Astronomical Society**, Meeting #224, Boston, MA, 6/1-6/5
- 2013 “Institute for the Philosophy of Cosmology”, **UC Santa Cruz**, 6/23-7/14
- 2012 “Type Ia Supernovae in the Near-Infrared: A PITT PACC Workshop”, Department of Astronomy, **University of Pittsburgh**, 3/28-30/2012
- 2011 **American Astronomical Society**, Meeting #218, Boston, MA, 5/22-26/11
- 2011 “Logic, Mathematics & Physics Graduate Conference: Topics in the Philosophy of Cosmology panel”, Rotman Institute, **University of Western Ontario**, 5/7-9/11
- 2011 “Philosophy of Cosmology Workshop”, Rotman Institute, **University of Western Ontario**, 5/6-7/11
- 2010 **American Astronomical Society**, Meeting #215, Washington, DC, 1/3-7/10
- 2009 “RogerFest: A Festival of Cosmic Explosions”, Cahill Center, **Caltech**, 8/21-23/09
- 2009 “Stellar Death & Supernovae, Kavli Institute for Theoretical Physics”, **UC Santa Barbara**, 8/17-21/09
- 2009 **American Astronomical Society**, Meeting #213, Long Beach, CA, 1/9-14/09
- 2008 **American Astronomical Society**, Meeting #211, Austin, TX, 1/7-11/08
- 2007 “NASA Graduate Student Research Program Symposium”, **NASA Goddard Space Flight Center**, Greenbelt, MD, 9/19-21/07
- 2007 “Accretion and Explosion: The Astrophysics of Degenerate Stars”, Kavli Institute for Theoretical Physics, **UC Santa Barbara**, 2/20/07
- 2007 **American Astronomical Society**, Meeting #209, Seattle, WA, 1/5-10/07
- 2006 “NASA Graduate Student Research Program Symposium”, **NASA Goddard Space Flight Center**, Greenbelt, MD, 9/18-22/06
- 2006 “Penn State Summer School in Astrostatistics”, **Pennsylvania State University**, 6/6-10/06
- 2006 **American Astronomical Society**, Meeting #207, Seattle, WA, 1/8-12/06
- 2005 **American Astronomical Society**, Meeting #205, Seattle, WA, 1/9-13/05
- 2003 **American Astronomical Society**, Meeting #201, Seattle, WA, 1/5-9/2003

**RESEARCH EXPERIENCE**

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- 2017- **UC San Diego**, Assistant Research Scientist, UCSD Center for Astrophysics & Space Sciences
- 2012-17 **MIT**, Postdoctoral Fellow, Program in Science, Technology, & Society (STS), Visiting Research Scientist, MIT Center for Theoretical Physics; Research Associate & Research Scientist, MIT STS Program  
Collaborated with MIT faculty Prof. David Kaiser (Physics, STS) and Prof. Alan Guth (Physics) on theoretical cosmology projects, including a proposed test of quantum mechanics using astronomical observations. 1 first author paper, 1 2<sup>nd</sup> author paper. 3 popular articles. Co-PI on NSF INSPIRE Award #1541160, Co-I on NSF SES Award #1056580. Took lead writing both grant proposals.
- 2006-12 **Harvard University**, Graduate Research Assistant, Department of Astronomy

Collaborated with Prof. Robert P. Kirshner (Harvard Astronomy) and Prof. Michael Wood-Vasey (now at University of Pittsburgh Astronomy & Astrophysics) on Infrared observations of Type Ia and other supernovae. 1 first author paper, 1 Ph.D. thesis paper, 2 2<sup>nd</sup>/3<sup>rd</sup> author papers, 4 other papers up to 2012. *8 other supernova papers since 2013 (1 first author).*

2002-05 Collaborated with Prof. Joshua S. Bloom (now at UC Berkeley Astronomy) on the Energetics and Cosmological Applications of Gamma-Ray Burst explosions. 2 first author papers. Friedman & Bloom 2005a has 185 citations (Jun 2017)

1998-01 **UC, Berkeley**, Undergraduate Research Assistant, Dept. of Astronomy Collaborated with Prof. Alexei V. Filippenko and Dr. Weidong Li on observational astronomy project to discover supernova explosions. Discovered 8 supernovae from 1999-2001. Co-author on 2000 conference paper.

### **OTHER POSITIONS**

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2017 – Affiliated Research Scientist, Arthur C. Clarke Center for Human Imagination, **UC San Diego**

2014-16 Visiting Scholar, Center for Astrophysics & Space Sciences, **UC San Diego**

2013 Invited Scholar, Institute for the Philosophy of Cosmology, **UC Santa Cruz**

### **PROFESSIONAL SOCIETIES & SERVICES**

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2014 – Manuscript Referee: *The Astrophysical Journal*

2004 – Manuscript Referee: *The Astronomical Journal*

2004 – Manuscript Referee: *Journal of Cosmology & Astroparticle Physics*

2002 – Member, *American Astronomical Society*

2002 – Member, *American Association for the Advancement of Science*

### **SELECTED MEDIA COVERAGE**

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2019 [Researchers Limit Experimental Free Will to Fake Quantum Entanglement](#), by Cynthia Dillon, *UCSD Physical Sciences News*, Feb 4 2019 [PDF]

2019 [Researchers limit experimental Free Will to fake Quantum Entanglement](#), by Cynthia Dillon, *Newswise*, Feb 1 2019 [PDF]

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2019 [Einstein's Quantum Riddle](#), TV Documentary, directed by Jamie Lockhead, *PBS NOVA*, WGBH Boston, Season 46, Episode 2, Jan 9, 2019 [[TV Schedule](#)] [[Free Streaming](#)] [[Amazon Prime](#)] [[Teaser Trailer](#)] [[Buy DVD](#)] [[Amazon DVD](#)]

2018 [Photons, Quasars and the Possibility of Free Will](#), by Brian Koberlein, *Scientific American*, Nov 21, 2018 [PDF]

2018 [Einstein was wrong: Why 'normal' physics can't explain reality](#), by Anil Ananthaswamy, *New Scientist*, Nov 17 2018 [PDF]

2018 [The quest to test quantum entanglement](#), by Laura Dattaro, *Symmetry Magazine*, November 6 2018 [PDF]

2018 [Break It Down Show](#) podcast, "[Andrew Friedman – Scientific Method](#)", with hosts Pete Turner and David West, November 1 2018

2018 [Break It Down Show](#) podcast, "[Andrew Friedman – Cornering Quantum Physics Part 1](#)", with hosts Pete Turner and David West, October 30 2018

- 2018 [Cosmic Bell Test of Entanglement Using Distant Quasars](#), *Deep Astronomy*, YouTube channel, by Tony Darnell, Sep 8 2018
- 2018 [Physicists race to demystify Einstein's 'spooky' science](#), by Cynthia Dillon, *Phys.org*, Aug 27 2018 [PDF]
- 2018 [Black Holes Bolster Case For Quantum Physics' Spooky Action](#), by Jake Parks, *Discover Magazine, D-Brief*, Aug 23 2018 [PDF]
- 2018 [Quantum entanglement loophole quashed by quasar light](#), by Jake Parks, *Astronomy Magazine*, Aug 23 2018 [PDF]
- 2018 [Closing a loophole in Bell's theorem with light from ancient quasars](#), *Astronomy Now*, Aug 21 2018 [PDF]
- 2018 [Ancient Quasars Provide Incredible Evidence for Quantum Entanglement](#) by Chelsea Gohd, *Space.com*, Aug 21 2018 [PDF] [MIT News Clips] [Live Science (repost)] [Science Alert (repost)] [ESIST (repost)] [Brinkwire (repost)]
- 2018 [Cosmic Bell test uses light from ancient quasars](#), by Hamish Johnston, *Physics World*, Aug 21 2018 [PDF]
- 2018 [Ancient Starlight Just Helped Confirm the Reality of Quantum Entanglement](#) by Daniel Oberhaus, *Motherboard (Vice)*, Aug 21 2018 [PDF] [MIT News Clips]
- 2018 ['Spooky' Quantum Entanglement Confirmed Using Distant Quasars](#) by Ryan F. Mandelbaum, *Gizmodo*, Aug 21 2018 [PDF] [i09] [UK] [Australia] [MIT News Clips]
- 2018 [Old Light Confirms Quantum Entanglement](#) by Editorial Staff, *University of Vienna*, Aug 21 2018 [PDF] [Original German]
- 2018 [Quantum Entanglement Confirmed With Light From Distant Quasars](#), *Harvey Mudd College News*, Aug 22 2018 [PDF]
- 2018 [Light from ancient quasars helps confirm quantum entanglement](#), by editor@science360.gov, *NSF Science 360 News*, Aug 20 2018 [PDF]
- 2018 [Quantum Entanglement Confirmed with Light from Distant Quasars](#) by Sven Hartwig, *Austrian Academy of Sciences*, Aug 20 2018 [PDF] [IQOQI] [Original German]
- 2018 [Physicists Race to Demystify Einstein's 'Spooky' Science](#) by Cynthia Dillon, *UC San Diego News Center*, Aug 20 2018 [PDF] [UCSD News Main Page]
- 2018 [Light from ancient quasars helps confirm quantum entanglement](#), *NSF News from the Field*, Aug 19 2018
- 2018 [Light from ancient quasars helps confirm quantum entanglement](#) by Jennifer Chu, *MIT News Office*, Aug 19 2018 [PDF] [MIT News Clips]
- 2018 [Closed Loophole Confirms the Unreality of the Quantum World](#) by Anil Ananthaswamy, *Quanta Magazine*, Jul 25 2018 [PDF] [reprinted in *WIRED* as [Loopholes and the 'Anti-Realism' of the Quantum World](#) Aug 5 2018] [PDF]
- 2018 [Into the Impossible Podcast: Episode 20:](#), with Adam Becker and Charles Sebens, *UC San Diego Arthur C. Clarke Center for Human Imagination*, 2018 TBA
- 2018 [Physics Paper Delves Inside the Box](#), *Harvey Mudd College News*, Apr 24 2018
- 2018 [Synopsis: Random Bit Stream from Cosmic Light](#), Michael Schirber, *APS Physics: News and Commentary*, Apr 24 2018
- 2017 [Love, quantum physics and 'entanglement'](#), Ari Daniel and Peter Thomson, *PRI (Public Radio International)*, July 25 2017
- 2017 [Cosmic Bell Experiment](#), *MIT Museum*, July 18 2017
- 2017 [Local realism is dead, long live local realism?](#), Rebecca Holmes, *Physics World*, June 2017

- 2017 [A Cat, a Game Show, and a Ball of Yarn: A Play about Quantum Physics](#), Kate Repantis, *Slice of MIT*, Alumni Life, Campus Culture, Events, Modern Geekhood, Science, May 17 2017
- 2017 [Stars as random number generators could test foundations of physics](#), Lisa Zyga, *Phys.org*, May 16 2017
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- 2017 [Starlight Puts Quantum Mechanics to the Test](#), Rachel Gaal, *APS News*, Research News: Editor's Choice, Mar 2017 (Volume 26, Number 3)
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- 2017 [The Universe Is as Spooky as Einstein Thought](#), Natalie Wolchover, *The Atlantic*, Feb 10 2017 (reprinted from [Quanta magazine](#))
- 2017 [Quantum Entanglement For the First Time Confirmed by Starlight](#), *Austrian Academy of Sciences*, Feb 8 2017 [Original German]
- 2017 [Quantum Loopholes And The Problem Of Free Will](#), Chad Orzel, *Forbes*, Feb 8 2017
- 2017 [Flash Physics: Starlight closes Bell test loophole...](#), Sarah Tesh, *physicsworld.com*, Feb 8 2017
- 2017 [Both/And in "Love and Other Entanglements" at the MIT Museum](#), Patrick Gabridge, Feb 7 2017
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- 2017 [Quantum Theory by Starlight](#), David Kaiser, *The New Yorker*, Feb 7 2017
- 2017 [Experiment Reaffirms Quantum Weirdness](#), Natalie Wolchover, *Quanta Magazine*, Feb 7 2017
- 2017 [Quantum Physics Tells Us Our Fate Is Not Written in the Stars](#), Brian Koberlein, *Forbes*, Feb 7 2017
- 2017 [Starlight test shows quantum world has been weird for 600 years](#), Leah Crane, *New Scientist*, Feb 7 2017
- 2017 [Synopsis: Cosmic Test of Quantum Mechanics](#), Katherine Wright, *APS Physics*, Feb 7 2017
- 2017 [Physicists address loophole in tests of Bell's inequality using 600-year-old starlight](#), Jennifer Chu, *Phys.org*, Feb 7 2017 [reprinted from [MIT News Office](#)]

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- 2016 [Un Satellite Pour Tester La Physique Quantique](#), David Fosse, *Ciel & Espace* (France) 546, Mars-Avril 2016, pg. 44-49
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- 2015 [Is the Cosmos Random?](#), George Musser, *Scientific American*, 313, 88-93, September 2015
- 2015 [Sorry Einstein. Quantum Study Suggests ‘Spooky Action’ Is Real](#), John Markoff, *New York Times, Sunday Review*, 11/14/14
- 2014 [Is Quantum Entanglement Real?](#), David Kaiser, *New York Times, Sunday Review*, 11/14/14
- 2014 [Cosmic Test For Quantum Physics’ Last Major Loophole](#), Bruce Dorminey, *Forbes*, 6/18/14
- 2014 [Bell’s Theorem: Closing the Loopholes](#), Iulia Georgescu, *Nature Physics, News & Views*, 4/1/14
- 2014 [Cosmic Experiment Aims To Close Loophole In Quantum Theory: Distant quasars could help confirm ‘spooky action’ between particles](#), Charles Q. Choi, *Inside Science, NBC News*, 3/5/14 (Physics Central: physics buzz blog)
- 2014 [Cosmic light could close quantum-weirdness loophole: Distant quasars would decide whether quantum entanglement is an illusion](#), Zeeya Merali, *Nature, News & Comment*, 2/25/14
- 2014 [Is entanglement real or is there a super-deterministic cosmic conspiracy? Researchers use quasars to kill off the last of the quantum hidden variables](#), Matthew Francis, *Ars Technica*, 2/21/14
- 2014 [Closing the 'free will' loophole: MIT researchers propose using distant quasars to test Bell's theorem](#), Jennifer Chu, *MIT News Office*, 2/20/14
- 2009 [Peculiar, Junior-sized Supernova Discovered By New York Teen](#), David Aguilar and Christine Pulliam, *Harvard-Smithsonian Center for Astrophysics*, 6/11/09
- 2006 [Astronomers Push and Pull Over Dark Energy’s Role in Cosmos](#), Robert Irion, *Science*, 1/20/06
- 2004 [Gamma Ray Bursts: New Cosmic Rulers?](#), Robert Irion, *Science* (with below), 10/8/04

2004 [Astronomer's Eager for a Swift New Vision of the Universe](#), Robert Irion, *Science*, 10/8/04

#### OTHER MEDIA COVERAGE

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- 2018 [Free Will, the Future, and Flickers of Light from the Edges of the Universe](#), by Brett Tingley, *Mysterious Universe*, Nov 30 2018 [PDF]
- 2018 Letting quasars substitute for free will, by Roger, *Dark Buzz*, Nov 28 2018 [PDF]
- 2018 [The biggest experiment of the universe](#), by Martin Baker, *Jahre ScienceBlogs*, Nov 24 2018 [PDF] [Original German]
- 2018 [To prove quantum entanglement](#), by Gerardo Costante Blanco, *KosmosLogos*, Nov 10 2018 [PDF] [Original Spanish]
- 2018 [Spooky Action at a Distance](#), by David Gozzard, *WordPress*, Oct 30 2018 [PDF]
- 2018 [Spooky distance effect without cosmic conspiracy](#), by Robert Gast, *Spektrum.de* (Germany), Sep 3 2018 [PDF] [Original German]
- 2018 Quantum Entanglement Confirmed by Ancient Starlight by Laura Fyle, *Advocator (Canada)*, Aug 23 2018 [PDF] [Australia (repost)]
- 2018 Light from Ancient Quasars Helps Confirm Quantum Mechanics of Entanglement, *Photonics Media*, Aug 23 2018 [PDF]
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- 2018 Ancient Quasars Light Confirms Quantum Entanglement by Jasmine Petters, *Advocator (Canada)*, Aug 20 2018 [PDF] [News.Club (repost)]
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- 2018 'Spooky' Quantum Entanglement Confirmed Utilizing Distant Quasars by Satoshi Nakomoto, *Satoshi Nakomoto Blog*, Aug 21 2018 [PDF]
- 2018 Light From Quasars Older Than Earth Confirm Quantum Entanglement by Naia Carlos, *Nature World News*, Aug 20 2018 [PDF]
- 2018 [Billions of years old light confirms quantum haunting](#), *ORF.at (Austria)*, Aug 21 2018 [PDF] [Original German]
- 2018 [Billions of years old quasar light confirms quantum entanglement](#), *derStandard (Austria)*, Aug 21 2018 [PDF] [Original German] [derStandard.de (Germany) (repost)]
- 2018 [A New Study May Have Confirmed Quantum Entanglement By Using Light From Quasars That Are Billions Of Years Old](#) by Kristine Moore, *The Inquisitr*, Aug 20 2018 [PDF]
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- 2018 [Quasars may prove quantum entanglement - or a 12 billion-year-old conspiracy](#) by Michael Irving, *New Atlas*, Aug 21 2018 [PDF]
- 2018 [The World's Biggest Quantum Entanglement Experiment Proved Einstein Wrong](#), by Ashley Hamer, *Curiosity*, May 18 2018 [PDF]
- 2017 [How Odd Can It Be?](#), Joachin Schulz, *Spektrum.de* (Germany), May 11 2017 [Original German]
- 2017 [Crazy quantum effect confirmed again experimentally](#), Natalie Wolchover, Apr 11 2017 [Original German] (reprinted from [Quanta magazine](#))

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- 2017 [Saved by the Bell](#), Emily Conover, *Science News*, Comments, Feb 22 2017
- 2017 [Quantum Entanglement is Just as Einstein Predicted](#), Ryan Young, *Trend In Tech*, Feb 21 2017
- 2017 [Bell's Theorem – Is Everything Predetermined?](#), Bruce Fenton, *The Scientific & Medical Network*, Feb 18 2017
- 2017 [Quantum Entanglement: A Bell Test from the Stars](#), Sean Bailly, *Pour La Science*, Feb 17 2017 [Original French]
- 2017 [Physicists demonstrate that quantum entanglement exists](#), ZAP, Feb 16 2017 [Original Portuguese]
- 2017 [New results of testing quantum entanglement of spatially separated particles](#), RSF Research Staff, *Resonance Science Foundation*, Feb 16 2017
- 2017 [Quantum entanglement confirmed thanks to the light of a star](#), Trends 21, *SOTT (Sign of the Times)*, Feb 13 2017 [Original Spanish]
- 2017 [Quantum physics with stars](#), *Investigacion Yciencia*, Feb 13 2017 [Original Spanish]
- 2017 [Quantum physics with stars](#), *Noticiera Universal*, Feb 13 2017 [Original Spanish]
- 2017 [ATTACKING killing of quantum mechanics: something totally weird happened in the last 600 years in the universe](#), Danas, *Net.hr* (Croatia), Feb 12 2017 [Original Croatian]
- 2017 [Starry Fate](#), Brian Koberlein, *One Universe At A Time*, Feb 12 2017
- 2017 [Experiment Confirms Quantum “Spooky Action at a Distance”](#), Brett Tingley, *Mysterious Universe*, Feb 11 2017
- 2017 [QUANTUM PHYSICS SHOCKER: Scientists discover we have LESS free will than we thought](#), Sean Martin, *Express* (UK), Feb 11 2017
- 2017 [Interstellar Bell Test](#), Michael Gogins, *tumblr*, Feb 10 2017
- 2017 [Physicists Just Showed That Quantum Entanglement Is a Physical Reality](#), Dom Galeon, *Futurism*, Feb 10 2017
- 2017 [A MYSTERIOUS FORCE IN THE UNIVERSE INFLUENCES PARTICLES OVER HUNDREDS OF YEARS AND BILLIONS OF KILOMETERS](#), Daniel Higson, *Evo News*, Feb 10 2017
- 2017 [Quantum experiments, between rigor and virtuosity: Random Choices Generated From the Stars 600 Years Ago](#), Marco Malaspina, *Media INAF*, Feb 10 2017 [Original Italian]
- 2017 [Starlight confirms that "God plays dice." Stars align in test supporting "spooky action at a distance"](#), Constantine Vakouftsis, *Universe Art and Literature*, Feb 10 2017 [Original Greek]
- 2017 [Cosmic Bell experiment, once again proved ghostly as the role of distance](#), *Gigcasa* (China), Feb 10 2017 [Original Chinese]
- 2017 [600 YEARS OLD STARLIGHT HELPS TEST LOOPHOLE IN QUANTUM THEORY](#), Sumayah Aamir, *I4U News*, Feb 9 2017
- 2017 [Quantum Physics – Bell Inequalities: Light from the Milky Way stars provide strong demonstration of quantum entanglement of two particles](#), *Egno Editorial*, Feb 9 2017, [Original Greek]
- 2017 [Quantum spookiness with ancient starlight](#), *ORF.at* (Austria), Feb 9 2017 [Original German]
- 2017 [Quantum physics with stars: Vienna used photons from the Milky Way](#), *Die Presse*, Feb 9 2017 [Original German]



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- 2017 [Among the stars in search of quantum physics tricks: Tests to rule out a cosmic 'Big Brother'](#), *ANSA* (Italy), Feb 6 2017 [[Original Italian](#)]
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- 2017 [600-year-old starlight addressed a loophole in quantum theory](#), Andrew Dalton, *Engadget*, Feb 8 2017
- 2017 [600-Year-Old Starlight Helps Physicists Address Quantum Theory Loophole](#), Dianne Depra, *Tech Times*, Feb 8 2017
- 2017 [Sorry, Einstein - physicists just reinforced the reality of quantum weirdness in the Universe](#), Bec Crew, *Science Alert*, Feb 8 2017
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- 2017 [Physicists first checked on the quantum physics of interstellar distances](#), *ria.ru*, RIA Science, Feb 3 2017 [[Original Russian](#)]
- 2016 [How to Evaluate the November 30th Big Bell Test](#) by Wei Zhiyuan, *Zhihu* (China), Nov 30 2016 [[Original Chinese](#)]
- 2016 [In the universe there is no local realism](#), *Trinitas*, *Academy Trinitarian*, Nov 27 2016 [[Original Russian](#)]
- 2016 [Lack of Realism Proved in the Universe](#), *Lenta.RU*, Science and Technology (Russia), Nov 23 2016 [[Original Russian](#)]
- 2016 [Is This Why the Original Ghostbusters Don't Exist in the Reboot?](#), Evan Jacobs, *MovieWeb*, 6/25/16
- 2015 [Spooky Action is Real: Bizarre Quantum Entanglement Confirmed in New Tests](#), Tia Gose, *Live Science*, 11/17/15
- 2015 [Quantum weirdness proved real in first loophole-free experiment](#), Jacob Aron, *New Scientist*, 8/28/15
- 2015 [Quantum 'spookiness' passes toughest test yet](#), Zeeya Merali, *Nature News*, 8/27/15
- 2015 ["Spookiness" Confirmed by the First Loophole-free Quantum Test](#), Zeeya Merali, *FQXi Community*, 8/26/15
- 2015 [How to Travel Faster than Light Without Really Trying](#), Brian Koberlein, *Starts With A Bang! (Medium.com)*, 5/26/15
- 2014 [All Tangled Up](#), Dr. Jason Gallicchio, interviewed by Samantha Thomas, *University of Chicago Groks Science Radio Show and Podcast*, 12/3/14
- 2014 [Of Stephen Hawking, Eddie Redmayne, and Quantum Entanglement](#), Wade Roush, *Knight Science Journalism at MIT*, 11/17/14
- 2014 [The Berenstain Bears, Nelson Mandela, and how we may have slipped into an alternate time-stream](#), by Joe Crollard, *Newsvine*, 8/30/14
- 2014 [Exploring the Multiverse and the Origin of Life](#), Ramin Skibba, *Science Political*, 8/13/14

- 2014 [It would be strange if there was only one universe](#), Bas den Hond, *Trouw* (The Netherlands), 7/5/14
- 2014 [What if the world has always been inside a black hole?](#), Guido Meyer, *Die Welt* (Germany), 6/8/14
- 2014 [Free will, the quantum and the cosmos](#), Valerio Scarani, *Spreadquantum* (National University of Singapore), 3/4/14
- 2014 [Free Willy](#), Brian Koberlein, *Briankoberlein.com* (Rochester Institute of Technology), 2/28/14
- 2014 [Cosmic test for quantum theory](#), Rainer Kayser, *Weltraum Aktuell* (Germany), 2/26/14
- 2014 [Does Free Will Exist? Ancient Quasars May Hold the Clue](#), Jason Major, *Universe Today*, 2/25/14
- 2014 [MIT wants quasars to help put free will to rest: Ringing the Bell on inequality](#), Richard Chirgwin, *The Register* (United Kingdom), 2/24/14
- 2014 [For the last loophole, let there be light!](#), Vasudevan Munkuth, *The Hindu* (India), *The Copernican Blog*, 2/24/14
- 2014 [A Test of Bell's Theorems Using Distant Quasars](#), Andrius T., *Physics Database*, 2/24/14
- 2014 [Op-Ed: Do quantum or classical physics rule? MIT wants to find out](#), Paul Wallis, *Digital Journal*, 2/22/14
- 2014 [Distant quasars to fill a loophole of Bell's theorem](#), Analissa Arci, *Gaia News* (Italy), 2/21/14
- 2014 [Closing 'Free Will' Loophole From Bell's Theorem](#), Lee Rannals, *redOrbit*, 2/21/14
- 2014 [Bell's Inequality And The Speed Of Light: Quasar Findings Might Close The 'Free Will' Loophole](#), News Staff, *Science 2.0*, 2/20/14
- 2014 [The Dilemma of Randomness and Super-Determinism](#), Michael Gogins, *tumblr*, 2/20/14
- 2013 [Cosmic Bell](#), Sabine Hossenfelder, *Backreaction* (NORDITA), 11/27/13
- 2013 [Closing Loopholes in Quantum Mechanics](#), Warren Huelsnitz, *The Fun is Real!*, 10/16/13

## **PUBLIC TALKS**

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- 2019 Arthur C. Clarke Center for Human Imagination, **UC San Diego**, 3/4/19
- 2017 [A Cosmic Test of Quantum Entanglement](#), Summer Science Program Guest Lecture, **New Mexico Tech**, 7/12/17
- 2016 [Math, Science, and the Mind of God](#), Arthur C. Clarke Center for Human Imagination, **UC San Diego**, 8/10/16
- 2016 [Math, Science, and the Mind of God](#), Center for Astrophysics and Space Sciences, **UC San Diego**, 8/3/16
- 2015 [Cosmic Bell: Testing Quantum Mechanics and Bell's Inequality with Astrophysical Observations](#), Summer Science Program Alumni Dinner, **MIT Media Lab**, 11/14/15
- 2015 [The Physics of Free Will](#), Arthur C. Clarke Center for Human Imagination, **UC San Diego**, 8/6/15
- 2014 [How Big Is The World? Exploring the Multiverse in Modern Astrophysics, Cosmology, and Beyond](#), Arthur C. Clarke Center for Human Imagination, **UC San Diego**, 7/29/14
- 2012 [CfAIR2: Infrared Observations of ~100 Type Ia Supernovae With PAIRITEL](#), Ph.D. Thesis Talk, Harvard/CfA Optical & Infrared Seminar, **Harvard University**, 2/22/12
- 2008 [Our Place in Space](#), Dudley House Crosstalk Series, (with Jason Gallicchio), **Harvard University**, 3/6/08

- 2006 [Measuring Cosmic Expansion and Acceleration with Supernovae and Gamma-Ray Bursts](#), Guest Lecture, **Summer Science Program**, Ojai, CA, 7/3/06
- 2005 The Coolest Things In Astronomy: II, Guest Lecture, The Math Circle, **Northeastern University**, 12/10/05
- 2005 [Your Place in the Cosmos: From Planets to Stars to Galaxies and Beyond](#), Dudley House Crosstalk Series, (with Ryan Hickox), **Harvard University**, 12/8/05
- 2005 [White Dwarfs, Neutron Stars, Black Holes, Supernova Explosions, and the Origins of Humanity](#), Guest Lecture, “Cosmic Connections”, **Harvard University**, 11/7/05
- 2005 The Coolest Things In Astronomy, Guest Lecture, The Math Circle, **Northeastern University**, 5/22/05

## OUTREACH

- 2019 [Einstein’s Quantum Riddle: Special PBS NOVA Screening and Panel Discussion](#), *UC San Diego Arthur C. Clarke Center for Human Imagination*, Mar 4 2019
- 2019 [Quasars to the Rescue! A Cosmic Test for Quantum Entanglement](#), *Boston Museum of Science*, Feb 23 2019 (led by David Kaiser, MIT)
- 2019 [Einstein’s Quantum Riddle, Special NOVA Screening and Panel](#), *Harvey Mudd College*, Feb 4 2019 (led by Jason Gallicchio, HMC)
- 2019 [Einstein’s Quantum Riddle, a special advanced screening from the PBS science Series NOVA](#), *Massachusetts Institute of Technology*, Jan 9 2019 (led by David Kaiser, Alan Guth, MIT)
- 2019 [Einstein’s Quantum Riddle](#), TV Documentary, directed by Jamie Lockhead, *PBS NOVA*, WGBH Boston, Season 46, Episode 2, Jan 9, 2019 [[TV Schedule](#)] [[Free Streaming](#)] [[Amazon Prime](#)] [[Teaser Trailer](#)] [[Buy DVD](#)] [[Amazon DVD](#)]
- 2018 Into the Impossible Podcast: Episode 2?, with Adam Becker and Charles Sebens, *UC San Diego Arthur C. Clarke Center for Human Imagination*, recorded April 2018
- 2017 [Cosmic Bell: Exploring Quantum Weirdness](#), *MIT Museum* [[Video](#)], Mar-Sep 2017
- 2016-17 Cosmic Bell Experiment Workshop, *MIT Museum’s Compton Studio*, Sep 16-Feb 17
- 2016 [Fleet Night of Science](#) Volunteer, “Time Travel”, San Diego Comic-Con After Party, Ruben H. Fleet Science Center, 7/21/16
- 2014 Science Consultant, [Video: Do We Live in a Multiverse?](#), by Charles Q. Choi and Greg Kestin, *NOVA*, PBS, WGBH Boston, 9/24/14
- 2014 [Do We Live in A Multiverse?](#), Guido Meyer interview, *IQ*, Bavarian Public Radio, Germany, 6/2/14
- 2014 Science Consultant, [What is Gravity Made Of?](#), by Greg Kestin, *NOVA*, PBS, WGBH Boston, 5/8/14
- 2014 [Heart of a Star, Revealed](#), Art of Astrophysics Contest, *MIT Kavli Institute for Astrophysics & Space Sciences*, 1/31/14
- 2013 [Science Consultant](#) for television series *Wilfred* on FX, Starring Elijah Wood, 8/13
- 2013 Created [animations to visualize current project](#), basis for MIT Museum Exhibit
- 2006 Gamma-Ray Bursts (GRBs): Andrew Friedman, Astronomy Q & A Podcast series, *Harvard-Smithsonian Center for Astrophysics Science Media Group*, Robert Naeye Interview, Senior Editor of Sky & Telescope Magazine, 5/10/06
- 2005 Temporary Autonomous Zones: Dialogue with an Astrophysicist, San Diego radio DJ Onto the Ontologist Interview, *American Astronomical Society* Meeting #205, 1/10/05

**MENTORING AND ADVISING**

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- 2019 – Physics undergraduate student (recently graduated from UCSD), *Walker Stevens*, **UCSD Physics/CASS**
- 2018 – Physics graduate student *Roman Gerasimov* with Prof. Brian Keating, **UCSD Physics/CASS**
- 2017 – High school sophomore *Isaac Broudy* with Prof. Brian Keating, **UCSD Physics/CASS**
- 2017 – Physics undergraduate *Kevin Crowley* with Prof. Brian Keating, **UCSD Physics/CASS**
- 2016 – Physics undergraduate student *Calvin Leung* with Prof. Jason Galicchio, **Harvey Mudd College Physics (University of Vienna)**, Prof. David I. Kaiser, **(MIT Physics graduate school)**
- 2015 – Physics graduate student *David Leon* with Prof. Brian Keating, **UCSD Physics/CASS**
- 2015-16 Physics undergraduate *Jonah Saidian* with Prof. Brian Keating, **UCSD Physics/CASS**
- 2012 – *Isabella Sanders & Anthony Mark* on MIT Undergraduate Research Opportunities Astrophysics Project with Prof. David Kaiser, **MIT STS / Physics**
- 2012-13 *Jeff Iuliano* on Harvard college senior thesis in philosophy of science with Prof. Edward Hall, **Harvard Philosophy**

**ACADEMIC LEADERSHIP POSITIONS**

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- 2012 Resident Proctor, Harvard Summer Program in Cambridge, England: A Program on Nineteenth Century Science & Religion, Prof. Anne Harrington (Harvard History of Science), Prof. John Durant (MIT STS), **Cambridge University**
- 2003-10 Editor In Chief/Webmaster, The Harvard Satirical Press: A Graduate School of Arts & Sciences (GSAS) Student Organization, **Harvard University**
- 2006-07 Web Designer, Graduate Student Council, **Harvard University**
- 2006-07 Arts & Comedy Fellow, Dudley House, **Harvard University**
- 2004-06 Resident Advisor, GSAS Residence Halls, **Harvard University**
- 2003-04 Social Coordinator/Webmaster, Graduate Dormitory Council, **Harvard University**
- 1999-02 Staff Writer & Graphic Designer, **Berkeley Scientific Journal**
- 2001 Physics & Astronomy Tutor, Cesar E. Chavez Student Learning Center, **UC Berkeley**

**COMPUTER SKILLS**

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**Programming Languages:** Python, IDL, Perl, php, MySQL, shell scripting, HTML, LaTeX  
**Software:** Photoshop, In Design, Quark, Dreamweaver, Word, Excel, Power Point, Keynote, Mathematica  
**Social Media:** Facebook, Twitter  
**Operating Systems:** Mac OSX, Unix/Linux, PC

**PRIMARY COLLABORATORS**

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D.I Kaiser, A.H. Guth (MIT), J. Gallicchio (Harvey Mudd), B.G. Keating, D. Tytler (UCSD), A. Zeilinger (Vienna), M.J.W. Hall (ANU), K. Mandel (Cambridge), R.P. Kirshner, P. Challis, M. Hicken (Harvard/CfA), R.J. Foley (Santa Cruz), W.M. Wood-Vasey (Pittsburgh), G.H. Marion (Texas), J.S. Bloom, A.V. Filippenko (UC Berkeley), M. Modjaz, F.B. Bianco (NYU), G. Narayan, A. Rest (Hubble STScl)

**Thesis Committee (5):** R.P. Kirshner (Ph.D. Advisor), E. Berger, A. Soderberg, D. Eisenstein (Harvard), W.M. Wood-Vasey (Pittsburgh)

**Graduate Advisors (2):** J.S. Bloom (UC Berkeley), R. Narayan (Harvard)

**Postdoctoral Sponsors (2):** D.I. Kaiser, A.H. Guth (MIT)

### **STUDENTS MENTORED**

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**Undergraduates (7):** Jeff Iuliano (Harvard), Isabella Sanders, Anthony Mark (MIT), Jonah Saidian, Kevin Crowley, Walker Stevens (UCSD), Calvin Leung (Harvey Mudd)

**High School Students (1):** Isaac Broudy (Bonita Vista High School / UCSD)

**Graduate Students (3):** David Leon, Roman Gerasimov (UCSD), Calvin Leung (Vienna/MIT)

**Postdocs (1):** Arturo Avelino (Harvard)

### **REFERENCES**

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[hman@astro.as.utexas.edu](mailto:hman@astro.as.utexas.edu)

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