Ryan Reece

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Former postdoctoral fellow at the Santa Cruz Institute for Particle Physics and researcher with the ATLAS experiment at CERN

RESEARCH INTERESTS

- Data science: mining, visualization, modeling, statistical inference
- Machine learning: deep neural nets, classification, anomaly detection
- Searches for new physics
- Measuring properties of the Higgs boson
- Hadronic tau reconstruction and identification
- Philosophy of science and science communication

EDUCATION

- **Ph.D. Experimental Particle Physics**

  The University of Pennsylvania (Philadelphia, PA), June 2006 - July 2013
  thesis: "A search for new physics in high-mass ditau events in the ATLAS detector"
  advisor: H.H. "Brig" Williams

- **B.S. Physics with Honors**

  The University of Texas, Austin, TX, Aug 2003 - May 2006
  thesis: "Late pulsing in the Hamamatsu R1408 PMT used in the Sudbury Neutrino Observatory"
  advisor: Joshua R. Klein, GPA: 3.91/4, physics GPA: 3.94/4

EXPERIENCE

- **Postdoctoral Research**, July 2013 - August 2017

  Santa Cruz Institute for Particle Physics, The University of California, Santa Cruz, and
  The European Organization for Nuclear Research (CERN), Geneva, Switzerland

  ATLAS is one of the multi-purpose experiments built to detect the products of 7-13 TeV proton-proton collisions at the Large Hadron Collider (LHC) at the European Organization for Nuclear Research (CERN) near Geneva, Switzerland. The ATLAS and CMS experiments at the LHC discovered the what appears to be the long-sought-after Higgs boson, evidence of which was announced on the 4th of July 2012. They are also designed to search for new physics including possible signatures of supersymmetry and other exotics signals that could be in reach at the TeV scale. Many theories of physics beyond the Standard Model have revolutionary implications for the concepts of symmetry and space-time, and for our understanding of the early universe.

  I have played leading roles in analyses searching for signals of supersymmetry in high-mass diphoton events with missing energy, and also furthering the search for exotic $Z' \to \tau\tau$ decays (a follow-up search from my Ph.D. thesis described bellow). From 2012 through 2015, I served as the Exotics Liaison to the ATLAS Tau Performance Group, consulting other ATLAS analyses on the technicalities of tau reconstruction.

  From April 2015 to April 2017, I lived in Geneva to be at CERN full-time, making six years spent at CERN when added to the four that I spent there as a Ph.D student. I supported the operations of the DAQ and DCS systems of the SCT, taking on-call shifts for those systems. I joined the ATLAS Physics Office, with which I have helped submit papers approved by ATLAS for publication to journals, and I have helped manage scripts for keeping statistics on the collaboration's publications.

  I have become an expert in petabyte data reduction, high-throughput computing, and data visualization as the primary adminstrator of our group's 200-CPU computing farm for doing analysis of ATLAS data. I have also served as a mentor for UCSC students, advising them in analysis, computing, and physics issues.

More recently, I have been building expertise in machine learning techniques, epsecially deep learning frameworks used in the tech industry, and I have been doing research and attending workshops focusing on the application of these techniques in high-energy physics reconstruction. With collaborators at Caltech, CERN, UTA, and UIUC, I am involved in particle identification studies using public simulation of a hypothetical detector design for ILC-CLIC and also for applications for ATLAS.

SCIPP: http://scipp.ucsc.edu/

- **Graduate Research**, June 2006 - July 2013

  The University of Pennsylvania, Philadelphia, PA, and
  The European Organization for Nuclear Research (CERN), Geneva, Switzerland

  During my time as a graduate student at the University of Pennsylvania, working with the ATLAS experiment at the Large Hadron Collider (LHC), I have witnessed one of the world's most complex scientific undertakings during its final construction, commissioning, operation, and announcement of the discovery of a Higgs-like new particle. It has been an exciting time.

  Penn helped design, assemble, and install the front-end electronics that read out, control, and power the Transition Radiation Tracker (TRT), the outermost sub-detector of the ATLAS tracker. I spent my first summers as a student with Penn (2006-08) at CERN, participating in the integration and commissioning of the TRT. I helped with diagnostic checks of the TRT front-end before the TRT was installed in ATLAS, and developed software for normalizing the analog-to-digital thresholds in the front-end electronics of the TRT. In January of 2009, I moved to the Geneva area to work at CERN full-time with the ATLAS Collaboration, and stayed there for the next four years. ATLAS began taking data from collisions at the LHC in November of 2009. Throughout most of the running of the LHC from 2010-2012, I rotated with others the on-call responsibility for the TRT data acquisition system (DAQ).

  My timing with the commissioning of the TRT and the arrival of the first collision data allowed me to contribute to a broad range of research efforts. The focus of my research with the data from ATLAS has been on the reconstruction of hadronic decays of tau leptons and their use in searches for new physics. I helped with the commissioning and validation of the ATLAS offline tau reconstruction with the first data, and the development of the cut-based identification. I contributed to the observation $Z \to \tau\tau$ and the measurement of its cross section, which lead to searching for new physics in high-mass ditau events. My Ph.D. thesis was a search for high-mass ditau events, like from hypothetical $Z' \to \tau\tau$ decays, which are predicted in many Grand Unified Theories (GUTs).

  Penn ATLAS group: http://www.hep.upenn.edu/atlas/

  You can download my thesis here: http://rreece.github.io/publications/

- **Teaching Assistant**, Sept 2006 - May 2007

  The University of Pennsylvania, Philadelphia, PA

  In the fall of 2006, I graded and lead tutoring for an intro level astronomy course and an intro level cosmology course. In the spring of 2007, I graded and lead a laboratory for an intro level course on electromagnetism.

- **Undergraduate Research Assistant**, Sept 2005 - May 2006

  The University of Texas, Austin, TX

  Working with Professor Joshua Klein, I demonstrated that the mysterious late pulsing of the Hamamatsu R1408 PMT model used in the Sudbury Neutrino Observatory (SNO) is intrinsic to the PMT by analyzing pulses in a dark box independent of SNO. This gave me much practice using ROOT and gave me the chance to learn the basics of neutrino oscillation. This study was compiled into my honors senior thesis.

  UT SNO group: http://www.hep.utexas.edu/sno/

AWARDS

- US ATLAS Scholar associated with LBNL in Berkeley, CA, Nov 2014 - Nov 2015
- Ira Lon Morgan Endowed Presidential Scholarship in Physics at U. of Texas, Fall 2005 - Spring 2006
- UT Undergraduate Research Fellowship, Fall 2005 - Spring 2006
- Research Experience for Undergrads (REU) with the Arisaka group at UCLA studing the PMTs for the Auger cosmic ray observatory, Summer 2005

SKILLS

- **General:** problem solving, programming, data visualization, object-oriented design, polymorphic interfaces, data analysis frameworks, petabyte data reduction, statistical analysis, writing technical reports, working independently and in groups, presenting my ideas, graduate level physics and mathematics
- **Programming Languages (fluent):** Python, C/C++/STL
- **Markup Languages:** LaTeX, (X)HTML with CSS, XML
- **General Software:** Linux (Redhat/SLC/Ubuntu/Debian), bash, svn/git, SQL, UML, QT, Mathematica, Keynote/PowerPoint/Beamer
- **Data Science / ML:** Keras, matplotlib, pandas, scipy
- **HEP Software:** ROOT, PyROOT, RooFit, RooStats, HistFactory, Bayesian Analysis Toolkit, TMVA, SFrame
- **ATLAS Software:** Athena, RootCore, SUSYTools, QuickAna, HistFitter, EventView
- **Hardware:** computer hardware, oscilloscopes, PMTs, ADCs, NIM electronics, soldering, high voltage, working with radioactive sources
- **Language:** Mother-tongue English, very basic French

MACHINE LEARNING PUBLICATIONS

1. Chiley, V. *et al*. Online Normalization for Training Neural Networks. arxiv:1905.05894. May 15, 2019.
2. Machine Learning in High Energy Physics Community White Paper. arxiv:1807.02876, July 8, 2018.

ATLAS PUBLICATIONS

1. Search for photonic signatures of gauge-mediated supersymmetry in 13 TeV pp collisions with the ATLAS detector, *Physical Review D*, *97*, 092006 (2018), arxiv:1802.03158, February 9, 2018.
2. Search for additional heavy neutral Higgs and gauge bosons in the ditau final state produced in 36 fb^{-1} of pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector. *Journal of High Energy Physics*, *1*, 55 (2018). arxiv:1709.07242. January 25, 2018.
3. Search for minimal supersymmetric standard model Higgs bosons H/A and for a $Z\prime$ boson in the $\tau\tau$ final state produced in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS Detector. *European Physical Journal C*, *76*, 585 (2016). arxiv:1608.00890. November 24, 2016.
4. Search for supersymmetry in a final state containing two photons and missing transverse momentum in $\sqrt{s}$ = 13 TeV pp collisions at the LHC using the ATLAS detector, *European Physical Journal C*, *76*, 517 (2016), arxiv:1606.09150, June 29, 2016.
5. Search for photonic signatures of gauge-mediated supersymmetry in 8 TeV pp collisions with the ATLAS detector, *Physical Review D*, *92*, 072001 (2015), arxiv:1507.05493, July 20, 2015.
6. A search for high-mass resonances decaying to $\tau^+\tau^-$ in pp collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector, *Journal of High Energy Physics*, *7*, 157 (2015), arxiv:1502.07177, February 25, 2015, (*served as editor*).
7. Identification and energy calibration of hadronically decaying tau leptons with the ATLAS experiment in pp collisions at $\sqrt{s}$ = 8 TeV, *European Physical Journal C*, *75*, 303 (2015), arxiv:1412.7086, December 22, 2014.
8. A search for high-mass resonances decaying to $\tau^+\tau^-$ in the ATLAS detector, *Physics Letters B*, *719*, 242-260 (2013), arxiv:1210.6604, October 24, 2012, (*served as editor*).
9. Measurement of the $Z \to \tau\tau$ production cross section in proton-proton collisions at $\sqrt{s}$ = 7 TeV with the ATLAS detector, *Physical Review D*, *84*, 112006 (2011), arxiv:1108.2016, August 9, 2011.

10. Performance of the ATLAS detector using first collision data, *Journal of High Energy Physics*, *9*, 56 (2010), arxiv:1005.5254, May 28, 2010.
11. The ATLAS Transition Radiation Tracker (TRT) proportional drift tube: design and performance, *Journal of Instrumentation*, *3*, P02013 (2008), February 29, 2008.
12. The ATLAS TRT Electronics, *Journal of Instrumentation*, *3*, P06007 (2008), June 27, 2008.
13. The ATLAS TRT Barrel Detector, *Journal of Instrumentation*, *3*, P02014 (2008), February 29, 2008.
14. The ATLAS TRT End-cap Detectors, *Journal of Instrumentation*, *3*, P10003 (2008), October 21, 2008.

The above is a selected list of ATLAS publications for which I made substantial contributions. I am also an author of several publications (more than 600 as of June 2017) because of my affiliation with ATLAS as a qualified author since June 1, 2008. See my INSPIRE-HEP profile for a more complete count of ATLAS publications: https://inspirehep.net/author/profile/R.Reece.1

including the discovery of the Higgs boson:

- ATLAS Collaboration, Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC, *Physics Letters B*, 716 (2012), arXiv:1207.7214.

ATLAS CONFERENCE NOTES / PROCEEDINGS / OTHER PUBLIC DOCUMENTS

1. ATLAS searches for heavy Higgs bosons and supersymmetry using tau decays, *Nuclear and Particle Physics Proceedings* 287-288 (2017) 195-198, June 21, 2017, (*only author*, proceedings for my talk at Tau2016: the 14th International Workshop on Tau Lepton Physics, in Beijing, China).
2. A re-interpretation of electroweak supersymmetry production ATLAS analysis results using 20.3 fb^{-1} pp collisions at $\sqrt{s}$ = 8 TeV to explore higgs-motivated general gauge mediated models, ATLAS-CONF-2016-033, July 11, 2016.
3. Searches for charged Higgs bosons, supersymmetry, and exotica with tau leptons with the ATLAS and CMS detectors at the LHC, *Nuclear Physics B (Proceedings Supplements)* (2014) 171-175, ATL-PHYS-PROC-2012-302, December 1, 2014, (*only author*, proceedings for my talk at Tau2012: the 12th International Workshop on Tau Lepton Physics, in Nagoya, Japan).
4. A search for high-mass ditau resonances decaying in the fully hadronic final state in pp collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector, ATLAS-CONF-2013-066, July 18, 2013.
5. Identification of the hadronic decays of tau leptons in 2012 data with the ATLAS detector, ATLAS-CONF-2013-064, July 18, 2013.
6. A search for high-mass resonances decaying to $\tau^+\tau^-$ in the ATLAS detector, ATLAS-CONF-2012-067, June 30, 2012 (*served as editor*).
7. Performance of the Reconstruction and Identification of Hadronic Tau Decays with ATLAS, ATLAS-CONF-2011-152, November 13, 2011.
8. Measurement of the W and Z boson production cross sections in pp collisions at 7 TeV with the ATLAS detector, ATL-PHYS-PROC-2011-240, November 10, 2011 (*only author*, proceedings for my talk at the 2011 International Europhysics Conference on High Energy Physics (EPS) in Grenoble, France).
9. Reconstruction, Energy Calibration, and Identification of Hadronically Decaying Tau Leptons, ATLAS-CONF-2011-077, March 24, 2011 (*served as editor*).
10. Observation of $Z \to \tau\tau \to \ell\tau_{\mathrm{h}}$ Decays with the ATLAS detector, ATLAS-CONF-2011-010, February 23, 2011.
11. Tau Reconstruction and Identification Performance in ATLAS, ATLAS-CONF-2010-086, October 11, 2010.
12. Event Display of $Z \to \tau\tau \to \mu\tau_{\mathrm{h}}$ in 7 TeV Collisions, ATL-COM-PHYS-2010-775, September 23, 2010 (*only author*).
13. Reconstruction of hadronic tau candidates in QCD events at ATLAS with 7 TeV proton-proton collisions, ATLAS-CONF-2010-059, July 10, 2010.

ATLAS INTERNAL NOTES

1. Search for strongly- and weakly-produced GMSB signatures in the diphoton and $E_{\mathrm{T}}^{\mathrm{miss}}$ final state with $\sqrt{s}$ = 13 TeV pp collisions at the LHC using the ATLAS detector, ATL-COM-PHYS-2016-1683, Draft: June 9, 2017, (Support note).
2. A re-interpretation of electroweak supersymmetry production ATLAS analysis results using 20.3 fb^{-1} pp collisions at $\sqrt{s}$ = 8 TeV to explore higgs-motivated general gauge mediated models, ATL-COM-PHYS-2015-1438, June 24, 2016, (Support note for ATLAS-CONF-2016-033).
3. Search for a diphoton and $E_{\mathrm{T}}^{\mathrm{miss}}$ final state in $\sqrt{s}$ = 13 TeV pp collisions at LHC using the ATLAS detector, ATL-COM-PHYS-2015-1136, May 17, 2016, (Support note for 1606.09150).
4. Search for a diphoton and $E_{\mathrm{T}}^{\mathrm{miss}}$ final state in $\sqrt{s}$ = 8 TeV pp collisions at LHC using the ATLAS detector, ATL-COM-PHYS-2014-442, February 23, 2015, (Support note for arxiv:1507.05493).
5. A search for high-mass resonances decaying to $\tau^+\tau^-$ in pp collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector, ATL-COM-PHYS-2014-276, January 23, 2015, (*served as editor*, Support note for arxiv:1502.07177).
6. Recommendations of the physics objects and analysis harmonisation study groups 2014, ATL-COM-PHYS-2014-451, May 12, 2014.
7. A search for high-mass ditau resonances decaying in the fully hadronic final state in pp collisions at $\sqrt{s}$ = 8 TeV with the ATLAS detector, ATL-COM-PHYS-2013-125, Feb 4, 2013, (Support note for ATLAS-CONF-2013-066).
8. Identification of the hadronic decays of tau leptons in 2012 data with the ATLAS detector, ATL-COM-PHYS-2013-155 Oct 11, 2013, (Support note for ATLAS-CONF-2013-064).
9. A search for high-mass resonances decaying to $\tau^+\tau^-$ in the ATLAS detector, ATL-COM-PHYS-2012-394, June 11, 2011, (Support note for ATLAS-CONF-2012-067, *served as editor*).
10. TRT Straw Hit Efficiency, ATL-COM-INDET-2011-088, September 23, 2011, (*only author*).
11. Measurement of $Z \to \tau\tau$ production cross section in proton-proton collisions at $\sqrt{s}$ = 7 TeV with the ATLAS detector - Support Note for lep-had channels, ATL-COM-PHYS-2011-416, April 21, 2011, (Support note for arxiv:1108.2016).
12. Measurement of $Z \to \tau\tau$ production cross section in proton-proton collisions at $\sqrt{s}$ = 7 TeV with the ATLAS detector - Combination of results, ATL-COM-PHYS-2011-419, April 21, 2011, (Support note for arxiv:1108.2016).
13. Reconstruction, Energy Calibration, and Identification of Hadronic Tau Decays for Winter 2011, ATL-PHYS-INT-2011-068, March 2, 2011, (Support note for ATLAS-CONF-2011-077, *served as editor*).
14. Observation of $Z \to \tau\tau \to \ell\tau_{\mathrm{h}}$ Decays with the ATLAS detector, ATL-COM-PHYS-2010-1033, December 10, 2010, (Support note for ATLAS-CONF-2011-010).
15. Tau identification performance with the ATLAS detector, ATL-COM-PHYS-2010-599, August 2, 2010, (Support note for ATLAS-CONF-2010-086).
16. Commissioning of the ATLAS Tau-Lepton Reconstruction Using 7 TeV data, ATL-COM-PHYS-2010-392, June 18, 2010, (Support note for ATLAS-CONF-2010-059).
17. Benchmark Analysis for $Z \to \tau\tau \to \ell\tau_{\mathrm{h}}$ with the First 100 pb^{-1}, ATL-PHYS-INT-2010-075, February 25, 2010, (*served as editor*).
18. A Selection Strategy for $Z \to \tau\tau \to \mu\tau_{\mathrm{h}}$ with the First $100\,\mathrm{pb}^{-1}$ from ATLAS, ATL-PHYS-INT-2009-044, May 5, 2009, (*only author*).
19. TRT Low Threshold Calibration, ATL-INDET-INT-2008-002, July 16, 2008, (*only author*).
20. I have authored the following sections in the ATLAS Physics Analysis Workbook: PyROOT, Services, How to Write an Athena Algorithm, EventView, (2008-2009)
https://twiki.cern.ch/twiki/bin/view/AtlasProtected/PhysicsAnalysisWorkBook.
21. EventView Tutorial: Writing Your Own EventView Tools (2008)
https://twiki.cern.ch/twiki/bin/view/AtlasProtected/WritingYourOwnEventViewTools.

CONFERENCE TALKS

1. *Machine learning and realism*, Deutschen Physikalischen Gesellschaft (DPG), Bremen 2017 meeting, March 16, 2017, Universität Bremen, Bremen, Germany.
2. *ATLAS searches for heavy Higgs bosons and supersymmetry using tau decays*, *on behalf of the ATLAS Collaboration*, Tau2016: 14th International Workshop on Tau Lepton Physics, Sep 23, 2016, IHEP, Beijing, China.
3. *Searching for new physics in high-mass ditau events at ATLAS*, *on behalf of the ATLAS Collaboration*, APS Meeting: Divison of Particles and Fields (DPF) 2013, Aug 15, 2013, Santa Cruz, CA, USA.
4. *Searches for charged Higgs bosons, supersymmetry, and exotica with tau leptons with the ATLAS and CMS detectors at the LHC*, *on behalf of the ATLAS and CMS Collaborations*, Tau2012: International Workshop on Tau Lepton Physics, Sept 20, 2012, Nagoya, Japan.
5. *Measurement of the W and Z boson production cross sections in pp collisions at 7 TeV with the ATLAS detector*, *on behalf of the ATLAS Collaboration*, International Europhysics Conference on High Energy Physics (EPS), July 22, 2011, Grenoble, France.

SEMINARS

1. *ATLAS, data reduction, and epistemology*, High performance computing centre in Stuttgart, Germany (HLRS), Nov 29, 2016
2. *Searching for new physics in high-mass ditau events at ATLAS*, UC Davis, Oct 15, 2013
3. ", Yale University, Dec 13, 2012
4. ", New York University, Dec 11, 2012
5. ", University of Texas, Austin, Nov 26, 2012
6. ", Brookhaven National Lab, Nov 20, 2012

WORKSHOP PARTICIPATION

1. California Quantum Interpretation Network (CQIN) meeting, Lake Arrowhead, CA, May 2018
2. Rutgers-Columbia Workshop on the Metaphysics of Science: Quantum Field Theories, New Brunswick, NJ, May 2018
3. California Quantum Interpretation Network (CQIN) meeting, Lake Arrowhead, CA, Sept 2017
   My talk: "Field Before Particles"
4. Data Science @HEP 2017, Fermilab, May 2017
5. 4th International Summer School in Philosophy of Physics, Saig (Black Forest), Germany, Jul 2016
   My talk: "Fields Over Particles"
6. ATLAS Machine Learning Workshop 2016, CERN, Mar 2016
7. 3rd International Summer School in Philosophy of Physics, Saig (Black Forest), Germany, Jul 2015
   My talk: "How Models Are Tested at the LHC"
8. Run 2 Performance Kick-Start Meeting at LBNL, Berkeley, CA, Mar 2015
9. Connecting the Dots 2015 - workshop on pattern recognition, LBNL, Berkeley, CA, Feb 2015
10. ATLAS xAOD Analysis Tutorial at LBNL, Berkeley, CA, Jul 2014
11. ATLAS Tau and $H \to \tau\tau$ Workshop, LAL-Orsay, France, Jun 2014
12. US ATLAS Workshop on LHC Searches, LBNL, Berkeley, CA, Jan 2014
13. US ATLAS Tracking Workshop, LBNL, Berkeley, CA, Nov 2013
14. ATLAS Tau and $H \to \tau\tau$ Workshop, Corfu, Greece, Apr 2013
15. Chicago 2012 Workshop on LHC Physics, Chicago, IL, Nov 2012
16. ATLAS Tau and $H \to \tau\tau$ Workshop, Oxford, England, Mar 2012
17. PhyStat2011: Statistics Workshop for LHC Physics, CERN, Jan 2011
18. ATLAS Tau Workshop, Freiburg, Germany, Oct 2010
19. ATLAS Tau Workshop, NBI, Copenhagen, Denmark, Apr 2009
20. US ATLAS Analysis Jamboree, Brookhaven National Lab, Sep 2008
21. CERN-Fermilab Hadron Collider Physics Summer School, Fermilab, Aug 2008
22. International Conference on High Energy Physics (ICHEP), Philadelphia, PA, Aug 2008
23. ATLAS Tau Workshop TU, Dresden, Germany, May 2008
24. US ATLAS Analysis Jamboree, Brookhaven National Lab, Mar 2008

25. US ATLAS Analysis Jamboree, Brookhaven National Lab, Dec 2007
26. PhyStat07: Statistics Workshop for LHC Physics, CERN, Jun 2007
27. US ATLAS Analysis Jamboree, Brookhaven National Lab, May 2007

ORGANIZATION

1. Session organizer, Run 2 Performance Kick-Start Meeting at LBNL, Berkeley, CA, Mar 2015
2. Session organizer, ATLAS Tau and $H \to \tau\tau$ Workshop, Oxford, England, Mar 2012

SERVICE FOR THE ATLAS EXPERIMENT

1. SCT DAQ on-call support (2016)
2. Member of the ATLAS Physics Office, helping with publication submission and statistics (2015-2017)
3. Analysis Harmonisation Effort, Particle-ID Exotics Contact (2014)
4. Liason for the ATLAS Exotics Working Group to the Tau Working Group (2012-2015)
5. Design and support of 2010 cut-based tau identification (2010-2011)
6. TRT tracking efficiency performance studies (2009-2011)
7. TRT DAQ on-call support (2009-2012)
8. Inner detector control room shifter (2009-2012)
9. TRT Low-threshold calibration (2008-2010)

SCIENCE OUTREACH AND OTHER SERVICE

1. Chosen as an Editor for Academia.edu, recommending papers in physics in their online archive since September 2015
2. Mentor for QuarkNet program at UCSC teaching high school students about physics and cosmic rays, Santa Cruz, CA, July, 2014
3. Volunteer mentor for Balloon Fest STEM Event for Paso Robles High School and surrounding students, May 3, 2014
4. Q&A panel after a showing of Particle Fever (a film about the discovery of the Higgs boson), The Nick theater, Santa Cruz, CA, March 14, 2014
5. My blogs about science and philosophy of science: statisticalsignificance.net and philosophy-in-figures.tumblr.com

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