

# Prof. Amy L. Connolly

The Ohio State University and CCAPP  
191 W. Woodruff Ave.  
Columbus, OH 43210-1117

3060 Physics Research Building  
Office: (614) 292-4368  
connolly@physics.osu.edu

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## Academic Appointments

- Assistant Professor of Physics, *The Ohio State University*, 2010-
- UCL Advanced Fellow and Royal Society USA/Canada Incoming Fellow, *University College London*, 2007-2010
- Post-Doctoral Researcher on ANITA and proposed radio Cerenkov experiments, *University of California, Los Angeles*, 2003-2007

## Education

- Ph.D. in Physics, *University of California, Berkeley, USA*, 2003
  - Research Assistant on CDF, *Lawrence Berkeley National Laboratory*, 1997-2003
- M.S. in Physics, *University of California, Berkeley, USA*, 1998
- B.S. in Physics, *Purdue University, USA*, 1996
  - Research Assistant on STAR Experiment, *Purdue University*, 1995-1996
  - Research Assistant on ZEUS, *Argonne National Laboratory*, Summer 1994

## Research Interests: Brief Summary

My interests lie in detecting cosmic neutrinos at the most extreme energies and in the unique particle physics and astrophysics questions probed by the results from neutrino observatories. Neutrinos are the only particles that we can observe at the highest energies that originated from cosmic distances, and thus are uniquely sensitive to the redshift dependence of the sources as well as the ultimate energy of cosmic accelerators. Ultra-high energy neutrino interactions probe higher center-of-mass energies than in collisions produced at the Large Hadron Collider and thus could point to new physics, for example through cross sections that may deviate from Standard Model expectations.

I have played a prominent role in radio Cerenkov neutrino experiments since joining the field after completing my PhD in 2003. The radio Cerenkov technique is the most promising for a long term program of ultra-high neutrino observatories that can measure a data sample large enough to probe these fundamental questions. I have made the largest impact on the field by developing simulation programs that either have influenced or are used by every experiment that uses the same technique. Building on the breadth of my contributions prior to joining OSU in 2010, my group at OSU is playing a central role in designing, building, testing and simulating current experiments ANITA (balloon-borne) and ARA (*in situ*) and an ambitious future balloon-borne experiment EVA. My group is at the cutting edge of data analysis and performing the world's best neutrino searches at all energies above  $10^{18}$  eV.

I am also working to connect results of current and future neutrino observatories with particle physics and astrophysics so that we can extract the most information from these unique messengers. Areas where I am the most interested in making these connections include tests of the Standard Model of particle physics, the origin of the highest energy cosmic rays, and the ultimate energy of cosmic accelerators.

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## Selected Refereed Journal Articles

1. “A Search for Correlation of Ultra-High Energy Cosmic Rays with IRAS-PSCz and 2MASS-6dF Galaxies,” F. Oikonomou, A. Connolly *et al.*, JCAP 1305 (2013) 015.  
Supervised UCL graduate student Foteini Oikonomou in assessing the degree of correlation between the directions of cosmic rays measured by Auger and large scale structure.
2. “Implications of ultra-high energy neutrino flux constraints for Lorentz-invariance violating cosmogenic neutrinos,” P.W. Gorham, A. Connolly *et al.*, Phys.Rev. D86 (2012) 103006.  
For the first time calculated the implications of Lorentz Invariance Violation in ultra-high energy neutrinos on the expected shape of spectrum of neutrinos observed from GZK interactions.
3. “Design and Initial Performance of the Askaryan Radio Array Prototype EeV Neutrino Detector at the South Pole,” P. Allison *et al.* [ARA Collaboration], Astropart. Phys. **35**, 457-477 (2012).  
Performed an analysis of the world’s best attenuation length measurement in ice using data from an in-ice deep high voltage pulser observed in the Askaryan Radio Array Testbed station. Modeled the ARA detector to assess the sensitivity of the experiment to ultra-high energy neutrino fluxes.
4. “Observational Constraints on the Ultra-high Energy Cosmic Neutrino Flux from the Second Flight of the ANITA Experiment,” P.W. Gorham *et al.* [ANITA Collaboration], Phys. Rev. D82, 022004 (2010). Erratum: Phys.Rev. D85, 049901 (2012). Over 50 citations.  
Simulated the ANITA 2 experiment to assess the energy-dependent sensitivity to cosmic neutrino fluxes necessary for the published constraints.
5. “Calculation of High Energy Neutrino-Nucleon Cross Sections and Uncertainties Using the MSTW Parton Distribution Functions and Implications for Future Experiments,” A. Connolly, R. Thorne and D. Waters, Phys. Rev. **D83**, 113009 (2011).  
Performed a calculation of high energy neutrino-nucleon cross sections using MSTW 2008 parton distribution functions and assessed the power of future *in situ* radio neutrino experiments to constrain models with extra space-time dimensions which predict enhanced cross sections.
6. “The Antarctic Impulsive Transient Antenna Ultra-high Energy Neutrino Detector Design, Performance, and Sensitivity for 2006-2007 Balloon Flight,” P. Gorham *et al.* [ANITA Collaboration], Astropart. Phys. **32**, 10-41 (2009).  
Developed a detailed simulation of the ANITA experiment that is described in the paper.
7. “Measurements of radio propagation in rock salt for the detection of high-energy neutrinos,” A. Connolly *et al.*, Nucl. Instrum. Meth. **A599**, 184-191 (2009).  
Led the planning, measurement and analysis for the world’s best measurement of radio absorption in rock salt.
8. “New Limits on the Ultra-high Energy Cosmic Neutrino Flux from the ANITA Experiment,” P. Gorham *et al.* [ANITA Collaboration], Phys. Rev. Lett. **103**, 051103 (2009). Simulated the ANITA 1 experiment to assess the energy-dependent sensitivity to cosmic neutrino fluxes necessary for the published constraints.
9. “Observations of Microwave Continuum Emission from Air Shower Plasmas,” P.W. Gorham *et al.*, Phys. Rev. **D78**, 032007 (2008). Participated in the SLAC beam test to measure the microwave emission from beam induced showers.

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10. "Observations of the Askaryan Effect in Ice," P.W. Gorham *et al.* [ANITA Collaboration], Phys. Rev. Lett. **99**, 171101 (2007). Over 50 citations. Participated in the beam test at SLAC that measured radio Cerenkov emission from showers induced by an electron beam on an ice target. This was the first time that radio Cerenkov emission had been observed in ice.
11. "Constraints on Cosmic Neutrino Fluxes from the ANITA Experiment," S.W. Barwick *et al.* [ANITA Collaboration], Phys. Rev. Lett. **96**, 171101 (2006). Over 100 citations. Simulated the ANITA-lite experiment to assess the energy-dependent sensitivity to cosmic neutrino fluxes necessary for the published constraints.
12. "A search for supersymmetric Higgs bosons in the di-tau decay mode in p anti-p collisions at s = 1.8-TeV," D. Acosta *et al.* [CDF Collaboration], Phys. Rev. **D72**, 072004 (2005). This is the publication of the results in my Ph.D. dissertation. I performed a search for a Supersymmetric Higgs boson in the di-tau decay channel at CDF, using a di-tau mass reconstruction technique for the first time at hadron colliders.
13. "Search for long-lived charged massive particles in  $p\bar{p}$  collisions at  $\sqrt{s}=1.8$  TeV," [CDF Collaboration] D. Acosta *et al.* Phys.Rev.Lett. 90 (2003) 131801. Over 50 citations. Expanded a search for long-lived charged particles to constrain the production of long-lived staus, the supersymmetric partner of the tau.
14. "Studies of Hadron - Electron separators for the ZEUS barrel calorimeter," I. Ambats, *et al.* Nucl. Instrum. Meth. A368 (1996) 364-377  
As an REU student, participated in a beam test at Argonne of one tower of the ZEUS barrel calorimeter, and contributed to the data analysis.
15. "The SVX3D integrated circuit for dead-timeless silicon strip readout," M. Garcia-Sciveres *et al.*, Nucl. Instrum. Meth. **A435**, 58 (1999).  
As a graduate student, was responsible for overseeing the design and carrying out testing of multi-layer, thick film circuit boards that housed the SVX3D integrated circuit used for reading out data from the silicon tracking detector in Run 2 at CDF.

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## Other Refereed Journal Articles

- “The First Limits on the Ultra-high Energy Neutrino Fluence from Gamma-ray Bursts,” A.G. Vieregg *et al.*, *Astrophys. J.* 736:50 (2011).
- “Ultra-Relativistic Magnetic Monopole Search with the ANITA-II Balloon-borne Radio Interferometer,” Detrixhe, M. *et al.* [ANITA-II Collaboration], *Phys.Rev.D*83 023513 (2011).
- “Observation of Ultra-high-energy Cosmic Rays with the ANITA Balloon-borne Radio Interferometer,” S. Hoover *et al.*, *Phys. Rev. Lett.*, *Phys.Rev.Lett.* **105** 151101 (2010).

I was also a co-author on all CDF papers from May 1999 to March 2006.

## National/International Conference Talks

- Invited talk given at TeV Particle Astrophysics in Irvine, CA on Aug. 27th, 2013.
- Invited talk on “Askaryan Experiments” at Snowmass Community Summer Study, July 30th, 2013.
- Invited review talk at second Workshop on Exotic Physics with Neutrino Telescopes in Marseilles, France on April 6th, 2013.
- Invited talk at Intensity Frontier Neutrino Subgroup Workshop 2013 at SLAC, March 6th, 2013.
- Invited talk at the Aspen Neutrino Workshop, Feb. 7th, 2013.
- Invited talk at American Physical Society meeting in Atlanta, Georgia, March 31st, 2012.
- Contributed talk given at International Cosmic Ray Conference in Beijing, China on behalf of the ARA Collaboration, August 17th, 2011.
- Poster given at International Cosmic Ray Conference in Beijing, China, August 17th, 2011.
- Invited talk at Very Large Volume Neutrino Telescopes in Erlangen, Germany, October 12, 2011.
- Invited talk given at UHECR2010 in Nagoya, Japan, Dec. 10th-12th, 2010.

## Invited Seminars, Colloquia and Other Talks

- Invited colloquium to be given at the University of Delaware on Nov. 6th, 2013
- Invited talk at Research Progress Meeting at LBNL on May 28th, 2013
- Invited colloquium at the University of California, Santa Cruz on May 30th, 2013
- Invited high energy physics seminar at Indiana University on April 1st, 2013
- Invited colloquium at the University of Cincinnati on Feb. 28th, 2013

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## Outreach and Synergistic Activities

- Faculty advisor for the Graduate Women in Physics organization at OSU
- Initiated and organize webpage with bi-weekly blogs written by young researchers at OSU about day-to-day life in physics: [go.osu.edu/womeninphysics](http://go.osu.edu/womeninphysics). Approximately 500 unique visitors to the site per month.
- GRASP (Girls Reaching to Achieve in Sports and Physics) summer science camps for girls
  - Organized CCAPP Astronomy Q&A between campers and CCAPP professors including myself, subsequently repeated and expanded in 2013
  - Gave physics of sports lectures in the 2011 and 2012 GRASP camps
  - Co-directed similar ScienceScape camp at Purdue in 1995
- As part of CAREER broader impacts, planning:
  - Workshop to bring former GRASP campers and other high schoolers to OSU for some hands-on physics and learn about OSU
  - Summer afternoon event for high school teachers so that they can learn about current events in physics and astronomy
- Neutrino coordinator for the Origins Program at UCL in 2008-2010, a program to bring about interdisciplinary research in the areas of neutrino physics, galaxy formation, planetary science and mathematical foundations

## Teaching

Most Recent Teaching Assignments:

- Taught *Physics 4700 Intro Electronics*, Autumn 2012 and Spring 2013  
Gave one lecture per week and led two lab sessions per week, assigned weekly homeworks, graded all lab reports. The class consisted of upper division physics and engineering physics majors.
- Taught *Physics 880 Experimental Methods in Particle Physics and Particle Astrophysics*, Winter 2012  
Designed a new graduate-level course giving an overview of current topics in both fields. Gave one lecture per week and led a detailed discussion of two papers per week, assigned and graded biweekly problem sets.
- Taught *Physics 132 Introductory Electricity and Magnetism* Spring 2011 and Fall 2011  
Gave three lectures per week, designed exams, coordinated grading by TAs for this calculus-based, introductory course with approximately 250 students each quarter.

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## Mentoring

Undergraduate Student Research Supervisor:

- Paul Schellin, 2011- (Department Research Scholarship 2011 and 2012)
- Anand Holtkamp, 2013-
- Adam Kavka, 2012-2013

Graduate Student (Ph.D.) Advisor:

- Eugene Hong, GRA, 2011-
- Brian Dailey, GRA, 2011-

Postdoctoral Scholars Mentored:

- Dr. Carl Pfendner, 2012-
- Dr. Patrick Allison, 2011-2013 (now Research Scientist at OSU)

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## Service

### Leadership Activities in Particle Astrophysics:

- Co-convener of the neutrino subgroup of the Cosmic Probes of Fundamental Physics Snowmass working group
- Panelist on US Strategy on Neutrino Physics at the Argonne Intensity Frontier Snowmass Workshop April 26th, 2013

### University and Departmental Service:

- CCAPP board 2011-present
- Computing Committee Fall 2012-present
- Grad Studies Committee 2010-2011
- Faculty Search Committee in Biophysics 2011-2012
- Member, Ph.D. Candidacy Exam Committee for 14 physics graduate students: Abigail Bogdan (Aug. 12th, 2013), Jacob Gordon (Aug. 2nd, 2013), Joseph Snyder (July 22nd, 2013), Shirley Li (June 17th, 2013), Michael Prikockis (April 25th, 2013), Nicolas Scozzaro (Jan. 8th, 2013), Kenny Chun Yu Ng (Aug. 8th, 2012), Sam Stafford (July 31st, 2012), Stanley Steers (July 12th, 2012), Brian Dailey (Nov. 2nd, 2011), Megan Harberts (Oct. 19th, 2011), Shen Jiang (Oct. 7th, 2011), Kenneth Patton (Sept. 8th, 2011), Ryan Hupe (March 1st, 2011)
- Graduate Faculty Representative, Candidacy Exam, Wenyan Jiang, Department of Molecular Cellular and Developmental Biology (2012)

### Workshop Organization:

- Organizer, CCAPP international workshop: *Interferometric Techniques for Impulsive Signals at Radio/Microwave Frequencies*, April. 22nd-24th, 2013.  
<http://ccapp.osu.edu/workshops/RadioSim2/workshop.html>
  - Brought world's leaders in interferometric techniques in astronomy and particle astrophysics to OSU to improve techniques for detecting impulsive signals in the radio/microwave
- Organizer, CCAPP international workshop: *Radio Simulations for Neutrino and Cosmic Ray Experiments*, Feb. 22nd-24th, 2012. <http://ccapp.osu.edu/workshops/RadioSim/workshop.html>
  - Unprecedented direct comparisons of all seven major simulations of geomagnetic signals from UHE cosmic rays
- Organizer, *ARA Collaboration Meeting*, OSU (2013)

### Professional Societies:

- Member, *American Physical Society, Division of Particles and Fields*