

Abigail Goodhue Vieregg

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CURRENT POSITION Assistant Professor, Department of Physics, Enrico Fermi Institute, Kavli Institute for Cosmological Physics at the University of Chicago, 2014-present

PREVIOUS POSITION NSF Postdoctoral Fellow, Harvard-Smithsonian Center for Astrophysics, 2010-2013

RESEARCH INTERESTS Particle Astrophysics, Neutrino Physics, Cosmic Microwave Background, Cosmology

EDUCATION Ph.D. (Physics), University of California, Los Angeles, 2010
Thesis: "The Search for Astrophysical Ultra-High Energy Neutrinos Using Radio Detection Techniques"
M.S. (Physics), University of California, Los Angeles, 2006
A.B. (Physics) with High Honors, Magna Cum Laude, Dartmouth College 2004
Honors Thesis: "The Search for Deuteron Photodisintegration in BLAST"

FELLOWSHIPS AND AWARDS NSF Office of Polar Programs Postdoctoral Fellowship, 2011- 2013
NASA Earth and Space Sciences Graduate Fellowship (NESSF), 2009-2010
Antarctic Service Medal, 2009
UCLA Physics Department Fellowship, 2005-2009
Chancellor's Recruitment Prize, UCLA, 2005
Physics and Astronomy Francis Sears Faculty Prize, Dartmouth College, 2004
Rufus Choate Scholar (top 5% of class), Dartmouth College, 2004
Francis L. Town Scientific Prize in Physics, Dartmouth College, 2002

CURRENT RESEARCH

Development of new detector technology to search for astrophysical ultra-high energy (UHE) neutrinos with ANITA, the Askaryan Radio Array (ARA), and the Greenland Neutrino Observatory (GNO)

Principal Investigator (PI) of the Greenland Neutrino Observatory (GNO)
Co-Investigator on the ARA Experiment
Co-Investigator on the ANITA experiment, a NASA long duration balloon experiment

Measuring Degree-Scale B-mode polarization in the Cosmic Microwave Background (CMB) in search of a signature of primordial inflation with BICEP2, the Keck Array, BICEP3, and CMB Stage IV

Collaborator on BICEP2, the Keck Array, and BICEP3
Development of a CMB Stage IV Experiment

TEACHING

Direct Graduate Student Research Supervision

Nora Shipp, U. Chicago Graduate Student, 2015
Monte Carlo simulations of a radio phased array
Andrew Ludwig, U. Chicago Graduate Student, 2015- present
Analysis of data from a prototype of GNO
Zoheyr Doctor, U. Chicago Graduate Student, 2014-2015
BICEP3 hardware and analysis

Chin Lin Wong, Harvard Graduate Student, 2010-2014
Analysis of beam characterization data for BICEP2 and the Keck Array, optics fabrication

Direct Postdoctoral Fellow Mentoring

Eric Oberla, Postdoctoral Fellow, 2015-present
Phased Array trigger electronics development for ARA and GNO
Nicole Larsen, KICP Fellow, 2015-present
BICEP3 performance optimization, CMB Stage-IV site characterization
Cosmin Deaconu, Postdoctoral Fellow, 2015-present
GNO deployment and analysis, ANITA-3 analysis and ANITA-4 development
Keith Bechtol, KICP Fellow, 2013-2015
ANITA-III trigger development, and GNO and phased array simulation and development.
Chris Sheehy, KICP Fellow, 2013-present
Key member on BICEP2 and Keck Array B-mode data analysis, CMB Stage-IV site characterization.

Direct Undergraduate Student Research Supervision

Isaac Malsky, U. Chicago Undergraduate, 2015-present
Design and fabrication of an RF delay generator
John Bowen, U. Chicago Undergraduate, 2015-present
Analysis of measurements of the firm properties at Summit Station Greenland
Sophia Kim, U. Chicago Undergraduate, 2014-present
Design and fabrication of an analog beamformer for a radio phased array
Jessica Avva, U. Chicago Undergraduate, 2014 - 2015
“An in-situ measurement of the radio-frequency attenuation in ice at Summit Station Greenland,” Journal of Glaciology, arXiv: 1409:5413
Christopher Hughes, U. Chicago Undergraduate, 2014 - 2015
Design and Fabrication of a DC/DC converter for GNO
Michael Gordon, Harvard Post-Undergraduate Student, 2011-2012
Design and fabrication of Keck Array optics components
Kristi Bradford, Harvard Undergraduate, 2011-2012
Senior Thesis: “Design and construction of a rotating polarized source for the characterization of the Keck Array detectors,” presented at AAS Meeting 2012.
Junior Project: “Development and fabrication of new and improved Keck vacuum windows”
Carter Graham, Harvard Undergraduate, 2011
Junior Project: “Near field beam mapping for the Keck Array Telescope”
Ankit Kumar, Ashland High School Student, 2012
Created a WorldWide Telescope tour highlighting CMB physics
Taylor Barrella, UCLA Undergraduate, 2008-2010
“Monte Carlo studies for neutrino detection from Minna Bluff and other mountainsides in Antarctica,” presented at APS April Meeting 2011.

Courses Taught

Introductory Mechanics, U. Chicago, Fall 2015
Senior Thesis, U. Chicago, Fall 2015
Advanced Methods of Data Analysis, U. Chicago, Spring 2015

Teaching Assistantships

Elementary Particle Physics Laboratory, UCLA, 2006
Introductory Mechanics, UCLA, 2005
Honors Introductory Mechanics Laboratory, Dartmouth College, 2003

UCLA Physics and Astronomy Tutoring Center Tutor, UCLA, 2005

PUBLICATIONS **PEER-REVIEWED PUBLICATIONS**

- BICEP2/Keck Array Collaborations. “BICEP2 / Keck Array VII: Matrix based E/B Separation applied to BICEP2 and the Keck Array,” arXiv:1603.05976 (2016).
- P. Gorham et al. (The ANITA Collaboration), “Characteristics of Four Upward-pointing Cosmic-ray-like Events Observed with ANITA,” arXiv:1603.05218 (2016).
- A. G. Vieregg, K. Bechtol, and A. Romero-Wolf. “A New Technique for Detection of PeV Neutrinos Using a Phased Radio Array,” JCAP 2016:02 (2016).
- BICEP2/Keck Array Collaboration. “Keck Array VI: Improved Constraints on Cosmology and Foregrounds when Adding 95 GHz Data from the Keck Array,” PRL 116, 031302 (2016).
- K. Belov et al. (SLAC T-510 Collaboration). “Accelerator measurements of magnetically-induced radio emission from particle cascades with applications to cosmic-ray air showers,” PRL, in Press (2016).
- H. Schoorlemmer et al. (The ANITA Collaboration). “Energy and Flux Measurements of Ultra-High Energy Cosmic Rays Observed During the First ANITA Flight,” Astroparticle Physics, In Press (2016).
- BICEP2/Keck Array Collaborations. “BICEP2/Keck Array V: Measurements of B-mode Polarization at Degree Angular Scales and 150 GHz by the Keck Array,” ApJ 811:126 (2015).
- P. A. R. Ade, et al. “Antenna-coupled TES bolometers used in BICEP2, Keck Array, and SPIDER,” ApJ 802:2 (2015).
- BICEP2/Keck Array/Planck Collaborations. “Joint Analysis of BICEP2/Keck Array and Planck Data,” PRL 114:101301 (2015).
- BICEP2/Keck Array Collaborations. “BICEP2/Keck Array IV: Optical Characterization and Performance of the BICEP2 and Keck Array Experiments,” ApJ 806:2 (2015).
- BICEP2 Collaboration. “BICEP2 III: Instrumental Systematics.” ApJ 814:2 (2015).
- A. Romero-Wolf, S. Hoover, A. G. Vieregg, et al. (The ANITA Collaboration). “An Interferometric Analysis Method for Radio Pulses from Ultra-high Energy Particle Showers,” Astroparticle Physics 60:72-85 (2015).
- J. Avva et al. “An In-Situ Measurement of the Radio-Frequency Attenuation in Ice at Summit Station, Greenland,” Journal of Glaciology 61:229 (2015).
- K.N. Abazajian et al., “Neutrino Physics from the Cosmic Microwave Background and Large Scale Structure,” Astroparticle Physics 63 (2015).
- K.N. Abazajian et al., “Inflation Physics from the Cosmic Microwave Background and Large Scale Structure,” Astroparticle Physics 63 (2015).
- D. Besson et al. (The ANITA Collaboration), “Antarctic Radio Frequency Albedo and Implications for Cosmic Ray Reconstruction,” Radio Science 50:1, 1-17 (2015).
- BICEP2 Collaboration. “BICEP2 II: Experiment and Three-Year Data Set,” ApJ 792:62 (2014).
- BICEP2 Collaboration. “BICEP2 I: Detection of B-mode Polarization and Degree Angular Scales,” PRL 112, 241101 (2014).
- P. Gorham, et al. “Implications of ultra-high energy neutrino flux constraints for Lorentz-

invariance violating cosmogenic neutrinos,” *Phys. Rev. D* 86:103006 (2012).

A. G. Viereg et al. (The ANITA Collaboration), “The First Limits on the Ultra-high Energy Neutrino Fluence from Gamma-ray Bursts,” *ApJ* 736:50 (2011).

P. Gorham et al. (The ANITA Collaboration), “Observational Constraints on the Ultra-high Energy Cosmic Neutrino Flux from the Second Flight of the ANITA Experiment”, *Phys. Rev. D* 82:022004 (2010); Erratum: *Phys. Rev. D* 85:049901 (2011).

M. Detrixhe et al. (The ANITA Collaboration), “Ultra-Relativistic Magnetic Monopole Search with the ANITA-II Balloon-Borne Radio Interferometer,” *Phys. Rev. D* 83:023513 (2011).

S. Hoover et al. (The ANITA Collaboration), “Observation of Ultra-high Energy Cosmic Rays with the ANITA Balloon-borne Radio Interferometer,” *Phys. Rev. Lett* 105:151101 (2010).

P. Gorham et al. (The ANITA Collaboration), “New Limits on the Ultra-high Energy Cosmic Neutrino Flux from the ANITA Experiment”, *Phys. Rev. Lett.* 103:051103 (2009).

P. Gorham et al. (The ANITA Collaboration), “The Antarctic Impulsive Transient Antenna Ultra-high Energy Neutrino Detector Design, Performance, and Sensitivity for 2006-2007 Balloon Flight”, *Astropart. Phys.* 32:10-41 (2009).

A. Connolly, A. Goodhue (Viereg), C. Miki, R. Nichol, D. Saltzberg, “Measurements of Radio Propagation in Rock Salt for the Detection of High-Energy Neutrinos”, *Nucl. Instrum. Meth.* A599:184-191 (2009).

D. Besson et al. (The ANITA Collaboration), “In Situ Radiological Measurements near Taylor Dome, Antarctica and Implications for UHE Neutrino Astronomy”, *Astropart. Phys.* 29:130-157 (2008).

P. Gorham et al. (The ANITA Collaboration), “Observations of the Askaryan Effect in Ice”, *Phys. Rev. Lett.* 99:171101 (2007).

K. Dow et al., “Magnetic Field Measurements of the BLAST Spectrometer”, *Nucl. Instrum. Meth.* A599:146-151 (2009).

WHITEPAPERS

A. G. Viereg and D. Saltzberg, “Greenland Neutrino Observatory (GNO): Radio Detection of Ultra-high Energy Neutrinos at Apex Station in Greenland,” Whitepaper for the Snowmass Process (2013).

CONFERENCE PUBLICATIONS

K. Wu et al. “Initial Performance of BICEP3: A Degree Angular Scale 95 GHz Band Polarimeter,” *Journal of Low Temperature Physics* (2016).

I. Buder et al. “BICEP2 and Keck Array: Upgrades and Improved Beam Characterization,” *Proceedings of the SPIE, Volume 9153: Millimeter and Submillimeter Detectors and Instrumentation for Astronomy VII* (2014).

K. Karkare et al. “Keck Array and BICEP3: Characterization of 5000+ Detectors,” *Proceedings of the SPIE, Volume 9153: Millimeter and Submillimeter Detectors and Instrumentation for Astronomy VII* (2014).

A. G. Viereg. “Radio Detection of Ultra-high Energy Neutrinos.” *Proceedings of Neutrino 2014* (2014).

Z. Ahmed et al. “BICEP3: A 95 GHz Refracting Telescope for Degree-scale CMB Polarization,”

Proceedings of the SPIE, Volume 9153: Millimeter and Submillimeter Detectors and Instrumentation for Astronomy VII (2014).

A. G. Vieregg et al. “Optical Characterization of the Keck Array Polarimeter at the South Pole,” Proceedings of the SPIE, Volume 8452: Millimeter and Submillimeter Detectors and Instrumentation for Astronomy VI (2012).

R. W. Ogburn IV et al. “BICEP2 and Keck Array Operational Overview and Status of Observations,” Proceedings of the SPIE, Volume 8452: Millimeter and Submillimeter Detectors and Instrumentation for Astronomy VI (2012).

S. Kernasovskiy et al. “Optimization and Sensitivity of the Keck Array,” Proceedings of the SPIE, Volume 8452: Millimeter and Submillimeter Detectors and Instrumentation for Astronomy VI (2012).

R. O’Brien et al. “Antenna Coupled TES Bolometers for the Keck Array, SPIDER, and Polar-1,” Proceedings of the SPIE, Volume 8452: Millimeter and Submillimeter Detectors and Instrumentation for Astronomy VI (2012).

Z. Staniszewski et al. “The Keck Array: A Multi Camera CMB Polarimeter at the South Pole,” Journal of Low Temperature Physics 162:827-833 (2012).

A. G. Vieregg et al. (The ANITA Collaboration), “Results from the Search for Ultra High-Energy Neutrinos with the Second Flight of ANITA”, Nuclear Physics B, Proceedings of Neutrino 2010 (2010).

A. G. Vieregg et al. (The ANITA Collaboration), “Results from the Search for Ultra High-Energy Neutrinos with the Second Flight of ANITA”, Proceedings of Recontres de Moriond (2010).

INVITED
SEMINARS
AND
COLLOQUIA

University of British Columbia Colloquium (2016), “Particle Astrophysics at the Highest Energies with a Radio Phased Array”

TRIUMF Seminar (2016), “Particle Astrophysics at the Highest Energies with a Radio Phased Array”

Michigan State Astronomy/HEP Seminar (2015). “Particle Astrophysics at the Highest Energies with a Radio Phased Array”

Harvard University Physics Seminar (2015). “Probing the Universe at the Highest Energies Through Astrophysics and Cosmology”

Indiana University Physics Colloquium (2015). “Recent Results and the Outlook for Cosmology with BICEP2, the Keck Array, and BICEP3”

Indiana University Physics Seminar (2015). “Particle Astrophysics at the Highest Energies with the Greenland Neutrino Observatory”

University of Illinois Astronomy Colloquium (2015). “Particle Astrophysics at the Highest Energies with the Greenland Neutrino Observatory”

Fermilab Astrophysics Seminar (2015) “Particle Astrophysics at the Highest Energies with the Greenland Neutrino Observatory”

University of Toronto Astronomy Colloquium (2014): “Particle Astrophysics at the Highest Energies with the Greenland Neutrino Observatory”

University of Chicago HEP Seminar (2014): “Detection of B-mode Polarization on Degree Angular Scales with the BICEP2 Experiment at the South Pole”

- Gran Sasso Seminar (2014): “Detection of B-mode Polarization on Degree Angular Scales with the BICEP2 Experiment at the South Pole”
- Ohio State CCAPP Seminar (2014): “Detection of B-mode Polarization on Degree Angular Scales with the BICEP2 Experiment at the South Pole”
- Cornell HEP Seminar (2014): “Detection of B-mode Polarization on Degree Angular Scales with the BICEP2 Experiment at the South Pole”
- Northwestern University CIERA Seminar (2014): “Detection of B-mode Polarization on Degree Angular Scales with the BICEP2 Experiment at the South Pole”
- Fermilab Wine and Cheese (2014): “Detection of B-mode Polarization on Degree Angular Scales with the BICEP2 Experiment at the South Pole”
- Dartmouth College Colloquium (2014): “Imaging the Beginning of Time from the Bottom of the World: the Search for Inflation with BICEP2 and the Keck Array at the South Pole”
- University of Chicago Physics Colloquium (2014): “Particle Astrophysics at the Highest Energies with the Greenland Neutrino Observatory (GNO)”
- Stanford Physics Seminar (2013): “Probing the Ultra-high Energy Universe Using Radio Detection Techniques”
- UCSD CASS Seminar (2013): “Radio and Millimeter Wave Astrophysics and Cosmology at the Bottom of the World”
- Penn State Astrophysics Seminar (2013): “Probing the Ultra-high Energy Universe Using Radio Detection Techniques”
- University of Chicago Enrico Fermi Institute Seminar (2012): “Probing the Ultra-high Energy Universe Using Radio Detection Techniques”
- McGill University Joint Astrophysics Seminar (2012): “Results of the Search for Ultra High-Energy Neutrinos with ANITA”
- UCLA HEP Seminar (2012): “The Search for Inflation with the Keck Array Polarimeter at the South Pole”
- Ohio State CCAPP Seminar (2012): “The Search for Inflation with the Keck Array Polarimeter at the South Pole”
- Northeastern University Colloquium (2012): “Imaging the Beginning of Time from the Bottom of the World: The Search for Inflation at the South Pole”
- Dartmouth College Colloquium (2011): “Results from the Search for Ultra High-Energy Neutrinos with the Second Flight of ANITA”
- Harvard-Smithsonian Center for Astrophysics Seminar (2011): “Results from the Search for Ultra High-Energy Neutrinos with the Second Flight of ANITA”
- University of Maryland HEP Seminar (2010): “Results from the Search for Ultra High-Energy Neutrinos with the Second Flight of ANITA”
- University of Chicago KICP Seminar (2010): “Results from the Search for Ultra High-Energy Neutrinos with the Second Flight of ANITA”
- MIT Laboratory for Nuclear Science Seminar (2010): “Results from the Search for Ultra High-Energy Neutrinos with the Second Flight of ANITA”
- UC San Diego CASS Seminar (2010): “Results from the Search for Ultra High-Energy Neutrinos

with the Second Flight of ANITA”

UCLA HEP Seminar (2010): “Results from the Search for Ultra High-Energy Neutrinos with the Second Flight of ANITA”

CONFERENCE PRESENTATIONS American Astronomical Society 227th Meeting, Kissimmee (2016): “Future Prospects for High Energy Neutrino Observations”

IceCube Particle Astrophysics Conference, Invited Review Talk, Madison (2015): “Radio Detection of the Highest Energy Neutrinos”

CIFAR Annual Meeting, Invited Talk, Banff (2015): “Recent Results and the Outlook for Cosmology with BICEP2, the Keck Array, and BICEP3”

Neutrino 2014, Invited Review Talk, Boston (2014): “Radio Detection of Ultra-High Energy Neutrinos”

APS April Meeting, Savannah (2014): “The Greenland Neutrino Observatory: A New Detector for Ultra-high Energy Neutrinos”

Snowmass on the Mississippi, Invited Review Talk, Minneapolis (2013): “The Future of GZK Neutrino Searches”

SLAC Snowmass Workshop, Invited Review Talk (2013): “An Overview of Ultra-high Energy Neutrino Searches”

SPIE Astronomical Instrumentation, Amsterdam (2012): “Optical Characterization of the Keck Array Polarimeter at the South Pole”

Harvard-Smithsonian Center for Astrophysics Postdoc Symposium (2011): “Searching for a Direct Signature of Inflation from the South Pole”

Neutrino 2010, Athens (2010): “Results from the Search for Ultra High-Energy Neutrinos with the Second Flight of ANITA”

SnowPAC Meeting, Utah (2010): “Results from the Search for Ultra High-Energy Neutrinos with the Second Flight of ANITA”,

Recontres de Moriond, La Thuile, Italy (2010): “Results from the Search for Ultra High-Energy Neutrinos with the Second Flight of ANITA”

April American Physical Society Meeting, Washington DC (2010): “New Results from the Search for Ultra High-Energy Neutrinos with the ANITA Experiment”

California American Physical Society Meeting (2009): “The Search for Ultra High-Energy Neutrinos with the ANITA Telescope”

American Physical Society April Meeting, St. Louis (2008): “The Outlook for ANITA-II”

OUTREACH Adler Planetarium, Astronomy Conversations Volunteer at the Space Visualization Laboratory, 2014 - present

Alan Alda Communicating Science Workshop Participant, 2013

WorldWide Telescope (WWT) Ambassadors Program, 2012 - present

- Trained as a WWT ambassador, using the WWT astronomy visualization software for educational outreach. www.worldwidetelescope.org and www.wwtambassadors.org
- Participated in a six week program developing astronomy research projects with 6th grade students as part of the 6th grade science curriculum in the Clarke Middle School in Lexington, MA, 2012

- Volunteered for “Science on the Street” at Boston Public Schools 6th grade orientation at Fenway Park, 2012

Telling Your Story, a Workshop by Science on the Street and the Cambridge Science Festival
Workshop participant for developing scientist-teacher-classroom partnerships, 2012

AstroMcGill podcast interview on neutrino astronomy and the ANITA experiment, 2012

Discover STEM Reverse Science Fair Contributor, Acton-Boxborough, MA, 2011
“Astronomy at the South Pole” exhibitor at a reverse science fair for grades 7-12

Malden Public Library teen program: “Meet South Pole Scientists!” Malden, MA, 2011
Writeup in the Malden Observer (town newspaper)

Science Club for Girls, school vacation program volunteer, Cambridge, MA, 2011

Keep a field Blog at South Pole, McMurdo Station, Taylor Dome, and Greenland 2008-present

SERVICE

University of Chicago Planning Committee: Chicagoland Collaboration for Women in STEM,
2015 – present

Physics Department Graduate Admissions Committee, 2015-2016

KICP Early Career Mentorship Committee, 2014 – present

KICP Colloquium Committee, 2014 – 2015

KICP Physics Frontier Center, Inflation Major Area Leader, 2014 – present

Physics Department Friday Lectures Committee, 2014 - 2015

KICP Women’s Lunch and Dinner Organizer, 2013 - present

KICP Fellowship Committee, 2013-2014

Graduate student recruitment committee, UCLA, 2005-2010

Women in Science Program Mentor, Dartmouth College, 2004

REFERENCES

Prof. David Saltzberg, UCLA

Prof. John Kovac, Harvard University

Prof. Jim Beatty, Ohio State University

Prof. Peter Gorham, University of Hawaii