Curriculum Vitae

Karen G. Andeen

Personal Information

Karen G. Andeen
1 Spring St, #703
New Brunswick, NJ 08901
USA

office: ++1 (732)445-5500 x0052
mobile: ++1 (608)239-3189
kandeen@physics.rutgers.edu
www.icecube.wisc.edu/~kandeen

Citizenship: United States of America
Languages: English (mother tongue)
German (intermediate level)

Education

Doctor of Philosophy, Experimental Astroparticle Physics — **January 2011**
University of Wisconsin-Madison, Department of Physics
Thesis: *First Measurements of Cosmic Ray Composition from 1-50 PeV using New Techniques on Coincident Data from the IceCube Neutrino Observatory*
Advisor: Professor Albrecht Karle
PhD Minor: Energy Policy

Master of the Arts, Physics — **May 2006**
University of Wisconsin-Madison, Department of Physics

Bachelor of the Arts Physics and Mathematics, *cum laude* — **May 2003**
Augustana College, Rock Island, Illinois, USA
Minor: East Asian Studies

Employment

Rutgers University, New Brunswick, NJ
Post-Doctoral Research Associate: CMS Collaboration — **2011-present**

University of Wisconsin-Madison, Madison, WI
Research Assistant: IceCube Neutrino Observatory — **2005-2011**
Research Assistant: ZEUS Collaboration — **2004** (Summer)
Teaching Assistant: Department of Physics — **2003-2004, 2007**

Augustana College, Rock Island, IL
Teaching Assistant: Department of Physics and Astronomy — **2002-2003** (Academic Year)
Tutor: Department of Mathematics — **2002-2003** (Academic Year)

CERN, Geneva, Switzerland
CERN Summer Student: ATLAS Collaboration — **2002** (Summer)

Fermi National Accelerator Laboratory, Batavia, IL
FermiLab Summer Intern: CDF Collaboraiton — **2001** (Summer)

Research Experience

CMS at the LHC: CERN, Geneva, Switzerland (March 2011–Present)
Supervisor: Prof. Stephen Schnetzer

- **Hardware**
  My primary task has been to prepare a new pixel luminosity telescope (PLT) for installation into the CMS detector this coming January. The PLT will be the first of its kind, utilizing diamond detector technology together with the standard readout chip from the CMS pixel system. The resulting detector will provide a stable ∼1% precision bunch-by-bunch luminosity measurement.
  - Wrote and automated new calibration software and initialization procedure.
  - Streamlined detector initialization process, from startup to data-taking, with goal toward a user interface. Reduced startup time from hours to minutes.

- Verified and revised all components of the PLT software package.
- Generated simulations to verify and update geometry and alignment in the standard CMS software package.
- Participated in two beam tests at Fermilab and at CERN respectively, requiring setup and tear down of detector in the beam area and full cycle testing of all components. A third beam test is scheduled for mid-October to test all final software and hardware components.

- **Data Analysis and Simulation**
  My main analysis task has been to develop new algorithms for photon identification and improved energy resolution for the Higgs$\rightarrow \gamma\gamma$ analysis, both high priority tasks as the new data from the LHC has a large fraction of pile-up events.
  - Developed an innovative new method to improve photon identification. Was able to remove pile-up events with high efficiency.
  - Trained and supervised a group of three undergraduates to conduct a machine learning algorithm study to improve the energy resolution. Improved energy reconstruction by more than 10%.
  - Generated and maintained large simulation datasets using standardized CMS simulation tools.

IceCube Neutrino Observatory (2005 – 2011)

Advisor: Professor Albrecht Karle

- **Data Analysis and Simulation** My analysis was a unique first measurement of the cosmic ray composition and energy spectrum using the IceTop surface array in coincidence with the in-ice detector of the IceCube Neutrino Observatory operating in the 2008 40-string configuration at the South Pole. These detectors cover an energy range which reaches down to the highest energies measurable directly ($\sim$3 PeV, the region of the knee), and extends to energies nearing the ankle ($\sim$10 EeV), and will provide a new bridge between the two unique regions and insight into the origin of cosmic rays, which current models attribute to black holes, active galactic nuclei, supernova remnants or perhaps new physics.
  - Developed unique analysis technique utilizing neural networks and minimization algorithms to measure the primary cosmic ray composition and energy spectrum using the electromagnetic component of the air shower measured at the surface, together with the muonic component measured in deep ice.
  - Applied technique to three years of data from the SPASE-II surface array operating in coincidence with the AMANDA-2 in-ice detector
  - Updated and applied method to the latest available IceTop/IceCube data from the 40-string 2008 configuration
  - Used the CORSIKA package to generate simulated air showers of 5 primary types, multiple hadronic interaction models, and various atmospheric models, over a continuous energy range for the SPASE-II/AMANDA-2 analysis.
  - Participated in verification of new GEANT4 surface array simulation.
  - Updated and tested detector reconstruction algorithms.

- **Hardware and Field Work**
  - Lead tester of Digital Optical Modules (DOMs–the detectors comprising the IceCube and IceTop arrays) at the South Pole during the 2009-2010 Austral summer season.
  - Performed final acceptance tests of DOMs prior to shipment to the South Pole, from 2007-2009.
  - Traveled to the South Pole during the Austral summer seasons of 2008-09 and 2009-10 for further field tests of DOMs prior to deployment in the South Pole ice.
  - Deployed DOMs in South Pole ice in 2008-09 and 2009-10.

- Trained new DOM-testers in 2008 and acted as consultant for same new DOM-testers during 2009.
- Synchronized DOM information from multiple databases to identify and remove inconsistencies for assimilation into a master MySQL database of accurate information for all DOMs, prior to the beginning of the Austral summer seasons in 2008 and 2009.
- Assisted with deployment of IceTop tanks in 2008-09.
- Tested IceTop DOMs after deployment in 2009-10.

ZEUS at HERA: DESY, Hamburg, Germany (Summer 2004)

Advisor: Professor Wesley Smith

- Calibrated the 6-Meter Tagger, a Tungsten/Scintillator spaghetti calorimeter which detects the electron in the Bethe-Heitler process for the Luminosity system of Zeus at HERA. The 6M-Tagger provides an essential cross-check of the calibration of the other luminosity components and, thereby, an accurate calculation of the beam luminosity.

ATLAS at the LHC: CERN, Geneva, Switzerland (Summer 2002)

Advisor: Dr. Christoph Amelung

- Developed a reconstruction algorithm to calculate and correct for the gravitational deformation of the ATLAS muon endcap chambers.

CDF at the Tevatron: Fermilab, Batavia, IL, USA (Summer 2001)

Advisor: Dr. Frank Chlebana

- Analyzed the efficiency of the Level 1 and Level 2 QCD triggers for some of the first Run 2 data. Results showed a loss of important events due to the stringency of the Level 1 trigger and led to a significant change in their settings.

Awards, Honors and Affiliations

Antarctica Service Medal of the United States of America
Elizabeth S. Hirschfelder Award, University of Wisconsin-Madison
Van Vleck Scholarship, University of Wisconsin-Madison
Presidential Scholar, Augustana College
Augustana College Music Scholarship
Sigma Pi Sigma (physics honor society), former local chapter secretary
Sigma Xi (science honor society)
American Physical Society
American Association for the Advancement of Science
American Association for Women in Science

Summer Schools

16th International School on Cosmic Ray Astrophysics
Ettore Majorana Centre, Erice, Sicily, Italy, 2008

CERN Summer Student Programme
CERN, Geneva, Switzerland, 2002

Computing Experience

Platforms and Applications

- UNIX/LINUX, OSX, Microsoft Windows, ROOT
- Experienced with large code frameworks, batch systems, machine learning algorithms such as neural networks, and analysis software packages such as MINUIT

Languages

- C++, Perl, Python, HTML (with CSS), UNIX shell scripting and LaTeX
- Familiar with FORTRAN, tcl and MySQL

Teaching Experience

University of Wisconsin-Madison

- Fall 2007, Teaching Assistant: Physics 107, the Ideas of Modern Physics
- Fall 2004, Teaching Assistant: Physics 109, Physics in the Arts
- Spring 2004, Teaching Assistant: Physics 202, General Physics
- Fall 2003, Teaching Assistant: Physics 201, General Physics
- Private Tutor for students of various levels over several semesters

Augustana College

- Department of Physics, teaching assistant for introductory labs, 2 years
- Department of Mathematics and Computer Science, general tutor, 1 year

Service Work

Graduate Student Representative to Physics Department Museum Committee (2006-08)
Graduate Student Representative to Physics Department Climate and Diversity Committee (2007-08)
Organizing Committee, First Annual Physics Open House (2008)

Public Outreach and Presentations

South Pole Science Lecture, "IceCube: Searching for Signals from the Great Beyond" (Nov, 2009)
Interview, StarDate, (astronomy radio program through University of Texas), aired on NPR, 2010
Physics Club Guest Speaker, Augustana College (Fall 2008)
Wonders of Physics Show for Families: Script-writer, Actor, Demonstrator (each spring, 2006-09)
Wisconsin State Science Olympiad Event Supervisor (April 2008)
Physics Museum Docent (2006-09)
Frequent organizer, speaker and presenter for local IceCube outreach events (2006-2010)

Conference Proceedings

K. Andeen, K. Rawlins, and T. Feusels (for the IceCubeCollaboration). *Cosmic Ray Composition from the 40-string IceCube/IceTop Detectors.* Proceedings of the 32st International Cosmic Ray Conference, Beijing, China (2011)

K. Andeen and K. Rawlins (for the IceCube Collaboration). *Cosmic Ray Composition using SPASE-2 and AMAND-II.* Proceedings of the 31st International Cosmic Ray Conference, Łódź, Poland (2009)

K. G. Andeen, K. Rawlins and C. Song (for the IceCube Collaboration). *Measuring Cosmic Ray Composition at the Knee with SPASE-2 and AMANDA-II.* Proceedings of the 30th International Cosmic Ray Conference, Mérida, México (2007)

Selected Presentations

Update on a Pixel Luminosity Telescope for CMS, RD42 Collaboration Meeting, Toronto, Ontario, Canada, September 2011

Results of the IceTop/IceCube-40 Composition and Energy Spectrum, IceCube Collaboration Meeting, Brussels, Belgium, September 2010

Cosmic Ray Composition and Energy Spectrum: Extending the Neural Network Analysis to IceTop/IceCube-40, IceCube Collaboration Meeting, Berlin, Germany, September 2009

Cosmic Ray Composition using SPASE-2 and AMANDA-II, International Cosmic Ray Conference, Łódź, Poland, July 2009

Cosmic Ray Composition with AMANDA and IceCube, Cosmo 2008, Madison, WI, August 2008

Measuring Cosmic Ray Composition at the Knee with SPASE-2 and AMANDA-II, International Cosmic Ray Conference, Mérida, México, July 2007

Cosmic Ray Composition with SPASE and AMANDA, IceCube Collaboration Meeting, Baton Rouge, LA, USA, March 2006