Curriculum Vitae

# Jonathan P. Dumm

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**Personal Information**

Jonathan P. Dumm
Roslagsgatan 7
113 55 Stockholm
Sweden

mobile: +46735883141
jon.dumm@fysik.su.se
Language: English
Nationality: USA


**Education**

**Secondary Education (B. A.)** Physics, *summa cum laude* — **May 2005**
St John's University, Collegeville, MN, USA
Minors: Mathematics and Classical Languages

**Doctoral Degree (Ph. D.)** Experimental Astroparticle Physics — **May 2011**
University of Wisconsin-Madison, Department of Physics
Thesis: *Searches for Point-like, Extended, and Stacked Sources of Neutrinos Using Unbinned Methods and the 40-String Configuration of the IceCube Neutrino Observatory*
Advisor: Professor Teresa Montaruli

**Awards, Honors and Affiliations**

Antarctica Service Medal of the United States of America
Van Vleck Scholarship, University of Wisconsin-Madison
Regents' Scholar, St. John's University

**Research Experience**

Oskar Klein Fellow, Stockholm University (2014 – present)

Mentor: Chad Finley

- **Scientific Focus:** My current work focuses on the search for the origins of the high energy neutrino flux recently discovered by IceCube. In particular, I'm searching for an association with the galactic plane. This consists of correlating our observations of neutrinos with multiwavelength information such as gamma-ray observations by the Fermi-*LAT*, which trace out interactions of cosmic rays and gas in our galaxy. In addition, I'm involved in a real-time followup program between IceCube and VERITAS to look for very-high energy gamma-ray emission associated with promising astrophysical neutrino candidates.
- Service Work: I serve in two leadership roles in the IceCube collaboration. I am the muon working group convener, coordinating work on topics in muon reconstruction and analysis. I am also a member of the publication committee, working to ensure publications from the collaboration are timely and high quality.

Postdoctoral researcher, University of Minnesota (2011 – 2014)

Mentor: Professor Lucy Fortson

- **Scientific Focus:** My work in VHE ($E > 100$ GeV) gamma ray astronomy used the VERITAS array, located at the Fred Lawrence Whipple Observatory in southern Arizona. I developed new techniques to reconstruct the direction and energy of incoming gamma rays, separate them from the much larger background of randomly distributed cosmic rays, and extract scientific results from the observations. I worked with simulations of ultra-high energy cosmic ray interactions with universal background photon fields. These simulations are helping to determine whether or not cosmic rays originate in active galactic nuclei and determine how that impacts our limits on the total amount of light that has been emitted since the epoch of reionization. I also developed a simulation package to optimize the design of the next-generation experiment, the Cherenkov Telescope Array (CTA).

- **VERITAS Work**
  - Served as Offline Analysis Working Group coordinator and lead analysis software developer for 3 years.
  - Developed the *VERITAS Blazar Pipeline* for high quality next-day automated analysis with accompanying web page for collaborators providing near realtime updates.
  - Developed new advanced imaging analysis for improved gamma-ray reconstruction, leading to two new VHE blazar detections.
  - Optimized background rejection using machine learning techniques (Boosted Decision Trees).
  - Led time allocation committee proposals for the blazar discovery program.
  - Mentored several undergraduate and graduate students, as well as ran several collaboration-wide "software boot camp" training sessions.
- **CTA Work**
  - Helped develop a novel and flexible simulation and analysis chain.
  - Evaluated the sensitivity of the Schwarzschild-Couder telescope prototype, now under construction, using simulation.
- My work was funded at the 100% level by the National Science Foundation (USA).

University of Wisconsin (2005 – 2011)

Advisor: Professor Teresa Montaruli

- **Scientific Focus:** My thesis work focused on the search for point sources of extraterrestrial neutrinos using the IceCube Neutrino Observatory in several configurations (2006–2009). This included creating catalogs of sources from multi-messenger information for enhanced discovery potential through stacking. I developed an extension of the unbinned maximum likelihood search technique used for identification of point sources to spatially extended sources, particularly clusters of galaxies but now used to search for diffuse emission in the galactic plane as well as dark matter in the galactic halo.
- **IceCube Work**
  - Helped develop maximum likelihood techniques for identifying potential sources of neutrinos, including spatially extended and stacked collections of sources.
  - Applied technique to data from 2006–2009. Each search resulted in the best upper limits to date for neutrino point sources in the TeV–PeV energy range.
  - Designed "level 1" physics filters to select useful muon track events for transmission from the South Pole over satellite, used by all IceCube muon analyses.
  - Benchmarked and refined muon track fitting techniques, leading to the "standard processing" used by nearly all IceCube analyses.
  - Designed event classifications for extracting high quality neutrinos from $\mathcal{O}(10^7)$ higher backgrounds.
  - Participated in verification of physics and detector simulation as well as internal subsystem review panels.
  - Traveled to the South Pole during the Austral summer of 2008–2009 to perform final acceptance tests on hardware and to deploy instruments 1.5–2.5 km deep in South Pole ice.
  - Mentored both undergraduate and new graduate students, as well as ran collaboration-wide "software boot camp" training sessions.

## Invited Talks and seminars

1. *VERITAS Extragalactic Highlights.* IceCube Particle Astrophysics Symposium - Madison (2013).
2. *Hints of New Physics in Blazar Spectra?* UMN - Minneapolis (2013).
3. *Recent Results from IceCube.* OKC - Stockholm Univ., Sweden (2014).
4. *Neutrinos and Gamma Rays: The Milky Way and More.* Drexel University - Philadelphia (2016).

## Research Activities

1. Multiwavelength session chair at VLVNT, Rome (2015).
2. Gamma-ray session chair at IPA, Madison, WI (2015).