Anushka Udara Abeysekara

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The University of Utah
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EDUCATION

Doctor of Philosophy (Ph.D.), Physics
Michigan State University, East Lansing, MI — May 2014
Specialities : High-Energy Astrophysics and Machine Learning

Master of Science (MS), Physics
Michigan State University, East Lansing, MI — May 2012

Bachelor of Science, First-class honors (BS), Physics
University Of Colombo, Sri Lanka — August 2006
Major: Physics
Minor: Computer Science

APPOINTMENTS

Assistant Research Professor — May 2017 – Present
The University of Utah, UT, USA

Postdoctoral Research Associate — July 2014 – April 2017
The University of Utah, UT, USA

Research Assistant — January 2009 – August 2009
ALICE experiment,
CERN, Geneve, Switzerland
Affiliated with Creighton University, NE, USA.

Research Assistant — January 2008 – December 2008
STAR experiment,
Brookhaven National Laboratory, NY, USA
Affiliated with Creighton University, NE, USA

Research Assistant — September 2006 – December 2007
Center for Instrument Development,
University of Colombo, Sri Lanka

Research Intern — May 2006 – August 2006
Arthur C. Clarke Institute for modern technologies,
Colombo, Sri Lanka

COMMITTEE INVOLVEMENT

- Served in several NASA proposal review panels
- VERITAS Science Board representative for the University of Utah (2014 – Present)
- Postdoctoral Affairs Committee Member, Department of Physics, University of Utah (2016 – 2017)
- An organizer of the fourth Fermi-VERITAS-HAWC joint workshop, 2017
- Main organizer of the third Fermi-VERITAS-HAWC joint workshop, 2016
- Session Chair of the Fermi-HAWC-VERITAS special session at APS April 2016 meeting
- Reviewer of the HAWC review panel for the 34^{th} International Cosmic-ray conference presentations
- Reviewer of the VERITAS review panel for the 34^{th} International Cosmic-ray conference presentations
- VERITAS paper review committee for the paper "HESS J1943+213: An Extreme Blazar Shining Though the Galactic Plane"
- VERITAS paper review committee for the paper "VERITAS Observations of M 31 Galaxy"

STUDENT SUPERVISION

- Isuru Gunawardhana, MPhil thesis — in progress
- Mithun Imeshka, MPhil thesis — in progress
- Erin Aadland , Summer REU student — Summer 2017
- Rylee Cardon, Summer REU student — Summer 2017
- Tingshiuan Wu, Undergraduate senior thesis — Fall 2016 and Spring 2017
- Patty Bolan, Summer REU student — Summer 2016

ACCEPTED RESEARCH PROPOSALS

- University of Utah Summer Program for Undergraduate Research: *Machine-Learning Based Background Rejection Software for the HAWC Gamma-Ray Observatory*
- VERITAS Observing Proposal 2014/2015: *VERITAS observations of HAWC source candidates*
- XMM-Newton AO 15: *Observations of a New Very-High-Energy Galactic source discovered by HAWC*

INVITED TALKS

- Workshop on a Southern Hemisphere All-Sky Observatory, Puebla, Mexico
  Talk : Interaction between HAWC and VERITAS — **November 2016**
- SLAC National Accelerator Laboratory, Menlo Park, CA, USA
  Talk : The High-Altitude Water Cherenkov Gamma-ray Observator HAWC — **March 2015**
- University of Wisconsin, Madison, Madison, WI, USA
  Talk : Understanding Nature's Particle Accelerators Using High Energy Gamma-ray Survey Instruments — **January 2015**
- Physics Department, Hope College, Holland, MI, USA
  Talk : Imaging the TeV Universe with Water Cherenkov Detectors — **October 2013**
- Physics Department, University of Colombo, Colombo,Sri Lanka
  Talk : Relativistic Heavy Ion Collisions at STAR — **May 2010**

CURRENT RESEARCH EXPERIENCE

- Performing a multiwavelength study to understand the origin of the broad and flat high-energy peak of pulsar wind nebula spectral energy distributions.
- Investigating the gamma-ray emission mechanisms and the location of the emission regions
- Designing an algorithm for understanding the extended very high energy gamma-ray emission in the galactic plane that was observed by the HAWC gamma-ray observatory
- Developing new techniques to measure extended gamma-ray sources using the VERITAS observatory
- Discover new gamma-ray emitting Active Galactic Nuclei
- Contributing the ongoing research on measuring extragalactic background light, and ultra-high energy cosmic ray production
- Calculating the systematic errors of the joint spectral measurements performed by combining data from the HAWC gamma-ray observatory and VERITAS gamma-ray observatory
- Developing the VERITAS plugin for the 3ML software, which is a software designed to combine data from multiple instruments.
- Investigating the possibilities in improving HAWCs background rejection criterion using machine learning algorithms.

SELECTED PAST RESEARCH EXPERIENCE

- Wrote a successful VERITAS proposal to followup HAWC sources and obtained high-resolution images and spectral images. Results are presented at many symposiums, and a refereed journal article is under preparation.
- Developed a new method to constrain pulsar gamma-ray emission mechanisms by studying the connection between pulsars and pulsar wind nebula. The details of this method and results obtained from this method are published in Ap.J.
- Studied the correlations between GeV and TeV emission of Active Galactic Nuclei. Results are presented at a HEAD meeting.
- Published an upper limit on the evaporation rate of primordial black holes, using Milagro data
- Discovered gamma-ray emission from Blazar RGB J2243+203 and placed an upper limit for its redshift.
- Measured very-high-energy gamma-ray emission from pulsar wind nebula and supernova remnants discovered by Fermi-LAT.
- Searched for TeV gamma-rays from gamma ray bursts
- Calculated the sensitivity of HAWC to detect the gamma-rays from dark matter annihilation
- Designed and developed FPGA firmware for HAWC GPS Timing and Control (GTC) system
- Developed a neural network based algorithm to measure the energy of gamma-rays detected by the Milagro observatory

TECHNICAL SKILLS

Digital electronics and PC interfacing

- Xilinx FPGA based embedded system designing
- PIC Microcontroller based embedded system designing
- Printed circuit board design with Cadence Design Systems
- USB, RS232 and parallel port based PC interfacing
- VME based data acquisition systems
- Sound knowledge in VHDL and Microcontroller programming with C

Operating Systems

- Unix/Linux(Red Hat, Scientific and Ubuntu)
- Microsoft Windows
- Macintosh Operating System (Mac OS)

Computer programming languages

- C^{++}
- Python
- Bash
- Delphi

Proficient with specialized computer applications

- TMVA Toolkit for Multivariate Data Analysis (TMVA) is an open source package designed to perform multivariate data analysis.
- GURU This is an unfolding package written in C^{++}.
- TRUEE This is another unfolding package written in C^{++}. The algorithm used in this package was originally implemented in an unfolding package call RUN which is written in FORTRAN.
- STARLIGHT This is a Monte Carlo event generator to simulate ultra-peripheral collisions. Ultra-peripheral collisions occur when relativistic nuclei pass each other without overlapping.

Proficient with generic computer applications

- Root
- LaTeX
- MatLab
- Statistica
- Minitab

TEACHING EXPERIENCE

Professor, Universe (AST/PHY 1060) **Spring 2017**
Department of Physics and Astronomy, Michigan state university, East Lansing, MI, USA.

Teaching Assistant, Investigations in Physics **Fall 2010**
Department of Physics and Astronomy, Michigan state university, East Lansing, MI, USA.

Teaching Assistant , Introduction Physics Lab I **Spring 2010**
Department of Physics and Astronomy, Michigan state university, East Lansing, MI, USA.

Teaching Assistant, Physics Project Laboratory **Spring 2009**
Department of Physics, Creighton University, Omaha, NE, USA.

Teaching Assistant , General Physics II **Fall 2008**
Department of Physics, Creighton University, Omaha, NE, USA.

Teaching Assistant , General Physics I **Summer 2008**
Department of Physics, Creighton University, Omaha, NE, USA.

CONFERENCE AND WORKSOP ATTENDANCE

- APS April meeting 2016 Talk: "Highlights of recent results from the VERITAS Active Galactic Nuclei Observing Program"
- 6$^{\text{th}}$ Fermi Symposium, Washington DC, USA, 2015 Talk: "HAWC Blind Searches for Steady Sources"
- 34$^{\text{th}}$ International Cosmic Ray Conference, Netherlands, 2015 Poster presentation: VERITAS Discovery of Very High-Energy Gamma-Ray Emission from RGB J2243+203
- 6$^{\text{th}}$ Fermi Symposium, Washington DC, USA, 2015 Poster presentation: VERITAS AGN Observation Program

- Gamma ray blazar workshop, CA, USA 2015: Talk: "The High-Altitude Water Cherenkov Gamma-ray Observator HAWC".
- IceCube Particle Astrophysics Symposium, WI, USA 2013: Talk: "Connection Between Pulsar GeV Emission and Pulsar Wind Nebula TeV Emission".
- 18^{th} Course of international school of cosmic-ray astrophysics, organized by Ettore Majorana foundation and centre for scientific culture, Italy., Participant
- APS April meeting 2012, Atlanta, GA, USA. Talk: "Milagro Observations of Potential TeV Emitters".
- Nebraska academy of science 108^{th} annual session 2008, Lincoln, NE, USA. Talk: "User Interfaces for the STAR slow controls system".
- Institute of Physics Sri Lanka technical session March 2007, Sri Lanka. Talk: "Home built Vibrating Sample Magnetometer".

AWARDS

- "Dissertation completion fellowship". Awarded by Michigan State University, MI, USA (2013)
- "Gulamhussein A.J Noorbhai Gold Medal" for the best Research Project in Physics. Awarded by University of Colombo Sri Lanka (2006).
- "Young inventors national award" awarded by Sri Lanka Young Inventors Commission (1997).
- "Best academic performance award" awarded by Matara District Educational office Sri Lanka (1998).

PUBLICATIONS UNDER REVIEW

1. Discovery of very-high-energy emission from RGB J2243+203, and derivation of its redshift upper limit.
   Draft version is under internal review with the VERITAS collaboration

PUBLICATIONS WITH MAJOR CONTRIBUTIONS

1. Gamma-Rays from the Quasar PKS 1441+25: Story of an Escape
   Abeysekara, A. U., Archambault, S., Archer, A., et al. 2015, ApJL, 815, L22
2. VERITAS and multiwavelength observations of the BL Lacertae object 1ES 1741+196
   Abeysekara, A. U., Archambault, S., Archer, A., et al. 2016, MNRAS, 459, 2550
3. Daily Monitoring of TeV Gamma-Ray Emission from Mrk 421, Mrk 501, and the Crab Nebula with HAWC
   Abeysekara, A. U., Albert, A., Alfaro, R., et al. 2017, ApJ, 841, 100
4. Observation of the Crab Nebula with the HAWC Gamma-Ray Observatory
   Abeysekara, A. U., Albert, A., Alfaro, R., et al. 2017, ApJ, 843, 39
5. The 2HWC HAWC Observatory Gamma-Ray Catalog
   Abeysekara, A. U., Albert, A., Alfaro, R., et al. 2017, ApJ, 843, 40
6. VERITAS Discovery of Very High-Energy Gamma-Ray Emission from RGB J2243+203
   A. U. Abeysekara, for the VERITAS Collaboration, Proceedings 34th ICRC conference, arXiv: 1508.06334
7. Experimental Constraints on Gamma-ray Pulsar Gap Models and Pulsar GeV to Pulsar Wind Nebula TeV Connection.
   Abeysekara, A. U., and Linnemann, J. T. 2015, ApJ, 804, 25
8. Milagro limits and HAWC sensitivity for the rate-density of evaporating Primordial Black Holes
   A. A. Abdo, **A. U. Abeysekara,** R. Alfaro, et al. 2015, Astroparticle Physics, 64, 4

9. Search for Gamma-Rays from the Unusually Bright GRB 130427A with the HAWC Gamma-Ray Observatory
A. U. Abeysekara, R. Alfaro, C. Alvarez, et al. 2015, ApJ, 800, 78
10. Sensitivity of HAWC to high-mass dark matter annihilations
A. U. Abeysekara, R. Alfaro, C. Alvarez, et al. 2014, PhRvD, 90, 122002
11. Observation of Small-scale Anisotropy in the Arrival Direction Distribution of TeV Cosmic Rays with HAWC
A. U. Abeysekara, R. Alfaro, C. Alvarez, et al. 2014, ApJ, 796, 108
12. Milagro Observations of Potential TeV Emitters
A. A. Abdo, **A. U. Abeysekara**, B. T. Allen. et al. accepted to the Astroparticle Physics Journal.
13. The HAWC Gamma-Ray Observatory: Dark Matter, Cosmology, and Fundamental Physics
Abeysekara, A. U., Alfaro, R., et al.
2013, arXiv:1310.0073
14. Sensitivity of the High Altitude Water Cherenkov Detector to Sources of Multi-TeV Gamma Rays
Abeysekara, A. U., Alfaro, R., Alvarez, C., et al.
2013, Astroparticle Physics, 50, 26
15. TeV Signatures of Fermi and IACT Sources Observed by Milagro
Abeysekara, A. U., & Milagro Collaboration
2013, AAS/High Energy Astrophysics Division, 13, #123.01
16. A Proposal to Localize Fermi GBM GRBs Through Coordinated Scanning of the GBM Error Circle via Optical Telescopes
Ukwatta, T. N.; Linnemann, J. T.; Tollefson, K.; **Abeysekara, A. U.**; Bhat, P. N.; Sonbas, E.; Gehrels, N.
2011, arXiv:1112.0622
17. First proton-proton collisions at the LHC as observed with the ALICE detector: measurement of the charged-particle pseudorapidity density at sqrts=900 GeV
Aamodt, K.; Abel, N.; **Abeysekara, U.**; Abrahantes Quintana, A.; Acero, A.; et al.
2010, European Physical Journal C, 65, 111

SELECTED PUBLICATIONS WITH MINOR CONTRIBUTIONS

1. A search for spectral hysteresis and energy-dependent time lags from X-ray and TeV gamma-ray observations of Mrk 421
Abeysekara, A. U., Archambault, S., Archer, A., et al. 2016, arXiv:1611.04626
2. VERITAS and multiwavelength observations of the BL Lacertae object 1ES 1741+196
Abeysekara, A. U., Archambault, S., Archer, A., et al. 2016, MNRAS, 459, 2550
3. Very High-Energy Gamma-Ray Follow-Up Program Using Neutrino Triggers from IceCube
Aartsen, M. G., Abraham, K., et al. 2016, arXiv:1610.01814
4. Constraints on the Emission Model of the"Naked-eye Burst" GRB 080319B.
Abdo, A. A.; **Abeysekara, A. U.**; Allen, B. T.; Aune, T.; et al.
2012, ApJ, 753, L31
5. Spectrum and Morphology of the Two Brightest Milagro Sources in the Cygnus Region: MGRO J2019+37 and MGRO J2031+41
Abdo, A. A.; **Abeysekara, U.**; Allen, B. T.; Aune, T.; Berley, D.; et al.
2012, ApJ, 753, 159

6. On the sensitivity of the HAWC observatory to gamma-ray bursts.
Abeysekara, A. U.; Aguilar, J. A.; Aguilar, S.; Alfaro, R.; et al.
2012, Astroparticle Physics, 35, 641

7. The lag-luminosity relation in the GRB source frame: an investigation with Swift BAT bursts.
Ukwatta, T. N.; Dhuga, K. S.; Stamatikos, M.; Dermer, C. D.; Sakamoto, T.; Sonbas, E.; Parke, W. C.; Maximon, L. C.; Linnemann, J. T.; Bhat, P. N.; Eskandarian, A.; Gehrels, N.; **Abeysekara, A. U.**; Tollefson, K.; Norris, J. P.
2012, Monthly Notices of the Royal Astronomical Society, 419, 614

8. Two-pion Bose-Einstein correlations in pp collisions at s=900GeV
Aamodt, K.; Abel, N.; **Abeysekara, U.**; Abrahantes Quintana, A.; Abramyan, A.; et al.
2010, Physical Review D, 82, 052001

9. Midrapidity Antiproton-to-Proton Ratio in pp Collisons at s=0.9 and 7 TeV Measured by the ALICE Experiment
Aamodt, K.; Abel, N.; **Abeysekara, U.**; Abrahantes Quintana, A.; Abramyan, A.; et al.
2010, Physical Review Letters, 105, 072002

MEMBERSHIPS

- VERITAS Collaboration, Science Board member
- HAWC Collaboration, member
- Milagro Collaboration, member
- American Physical Society (APS), member
- American Astronomical Society, member
- Sri Lanka Association of Advancement of Science, member
- Institute of Physics Sri Lanka (IPSL), member
- STAR Collaboration, Brookhaven National Laboratory, NY, USA, was a member in 2008 and 2009
- ALICE Collaboration, CERN,Geneve, Switzerland, was a member in 2009 and 2010