Robert Wayne Springer, Ph.D.

Curriculum Vitae

Education

- **Ph.D Physics**, Experimental High Energy Physics, Department of Physics and Astronomy, University of Maryland at College Park, College Park, MD, 1991, Advisor: Hassan Jawahery, Dissertation: *A Study of the Process* $e^+e^- \to Z^0 \to b\bar{b}$ *Using Muon-Inclusive* Z^0 *Decays.*
- **B.S Physics**, Department of Physics and Astronomy, University of Maryland at College Park, College Park, MD,1985

Employment Experience

- **Professor**, University of Utah, Salt Lake City, Utah, 2016-present
- **Associate Professor**, University of Utah, Salt Lake City, Utah, 2004-2016
- **Assistant Professor**, University of Utah, Salt Lake City, Utah, 1997-2004
- **Research Associate**, University of Alberta, Edmonton, Alberta, Canada, 1994-1997
- **Research Associate**, University of Maryland, College park, Maryland, 1991-1994
- **Graduate Research Assistant**, University of Maryland, College park, MD, 1985-1991
- **Graduate Teaching Assistant**, University of Maryland, College park, MD, 1985-1986
- **Visiting Scientist Position**, CERN (European Organization for Nuclear Research), Geneva, Switzerland 1988-1997

Grants

- **National Science Foundation** Utah Subaward WoU-MMA: Research & Development for the Southern Wide-Field Gamma-Ray Observatory (SWGO) (NSF tracking #2310013) ~($1149K total/ Utah $89K)/3years, August 2023- August 2026.
- **National Science Foundation**, University of Utah Particle Astrophysics Research Group Grant (VERITAS, HAWC, CTA) (NSF tracking # 2111531) ~$1200K/3years, August 2021- August 2024. (D.Kieda PI)
- **National Science Foundation** Gamma Ray Astrophysics Umbrella grant (NSF Grant PHY1807029) ~$805K/3years, August 2018- August 2021. (D.Kieda PI)
- **National Science Foundation** Gamma Ray Astrophysics Umbrella grant (NSF Grant PHY1510504) ~$1000K/3years, July 2015-July 2018. (D.Kieda PI)
- **National Science Foundation** Gamma Ray Astrophysics Umbrella grant (NSF Grant PHY1207595) ~$1500K/3years, July 2012-July 2015. (D.Kieda PI)
- **Willard L. Eccles Foundation** Observatory Enhancements, $100K, 2012.
- **K.W. & E.R. Dumke Foundation** Observatory Construction Grant**,** $160K, 2008.
- **Willard L. Eccles Foundation** Frisco Peak Observatory Grant, $650K, 2006.
- **University of Utah Research Instrumentation Fund** Instrumentation for Frisco Peak Observatory, $50K, 2007.
- **University of Utah VP Research** seed grant for observatory site surveys, $30K, 2006.
- **National Science Foundation** supported by various grants for the University of Utah Cosmic Ray Group, ~$1500K per annum 1997-2010. (P.Sokolsky PI)
- **Willard L. Eccles Foundation** Campus Observatory Grant, $88K, 2002.
- **NASA** Rocky Mountain Spacegrant seed funding ~$10K (D. Westenskow, PI. K.Dawson Co-I)

- **NASA & National Science Foundation** Several unfunded proposals for Instrumentation/Operation and outreach activities for the Frisco Peak Observatory.

Research Experience

- **The Southern Wide-field Gamma-ray Observatory (SWGO) (**http://www.swgo.org**) (2021-present)**
  - Detector Working Group coordinator (2021-present). Organize tasks and personnel related to development of detector instrumentation of SWGO. Development of prototypes for photosensors, electronics and data acquisition as well as mechanical aspects of the possible water cherenkov detecors. Provide specifications and cost estimates to facilitate simulation studies for detector designa and optimization. Participate in site selection and characterization studies and decision making. Participate in simulation and scientific analysis.

- **The Trinity Tau Neutrino Observatory (https://trinity.physics.gatech.edu/) (2021-present)**
  - Responsible for site development at Frisco Peak. Participate in detector development and instrument deployment. Participate in simulation and scientific analysis.

- **HAWC Gamma-Ray Observatory (http://hawc.umd.edu) (2010-present)**
  - Responsible for Web-Infrastructure task of the HAWC Collaboration (2014-present).
  - Publications committee member (2011-2015,2023-present, Chairman 2011-2013). Formulated guidelines for the internal review procedure for publications. Served on editorial panels.
  - Leader of the science verification cosmic ray sub-group (2010-2013). Developing tasks to verify simulation and reconstructions tools used for identifying and measuring cosmic ray events.
  - Developing software for evaluating systematic uncertainties in measurement of cosmic-ray flux (background) and gamma-ray flux.
  - Developing analysis to measure cosmic-ray spectrum using nearly horizontal muons that penetrate varying thickness of nearby volcanoes. Possible application to neutrino studies as well as muon content of EAS studies.
  - Developing a compute cluster for HAWC analysis and simulation tasks at Utah.
  - Responsible for developing procedures for testing, deploying various detector components. Particular responsibility for high voltage and signal cabling. Advise on issues of lightning protection and grounding.
  - Perform data-taking shifts.
  - Institutional representative for the University of Utah on collaboration board.
  - Supervised dissertations and tasks of Ph.D students.

- **Frisco Peak Observatory (http://www.physics.utah.edu/weo) (2007-present)**
  - Secured $810,000 in private donations to procure telescope and construct the observatory facilities.
  - Performed observatory site surveys and characterization studies. Developed solar powered monitors to measure atmospheric seeing.
  - Headed procurement and construction efforts for the Frisco Peak Observatory. Obtained all required federal and local permits to construct the observatory facility.
  - Supervised students in the development of observatory control system, remote operations capability and data analysis pipeline. Developed remote operation capabilities of the observatory facilities by implementing necessary networking and monitoring of the site.

- Utilized the observatory facility for a course in observational astronomy and facilitate the use of the Frisco Peak Observatory into education and public outreach activities.
- Developing a collaboration with colleagues from Mexico and BYU to perform polarimetry observations of Blazars and SNRs as well as observations associated with multi-wavelength observing program of HAWC.

- **Telescope Array (http://www.telescopearray.org) (2007-2013)**
  - Participated in the original design and deployment plans.
  - Provided guidance in development of reconstruction and simulation software and operations and calibration procedures.
  - Performed fluorescence detector calibration using "roving" N_2 laser system.
  - Performed detector operator shifts at Middle Drum Detector facility.
  - Supervised dissertations and tasks of Ph.D students.

- **High Resolution Fly's Eye Detector (http://www.cosmic-ray.org) (1997-2008)**
  - Developed a test facility using FADC based electronics that performed the tests of the HiRes2 PMT clusters.
  - Verified the functionality of the HiRes 2 DSP based data acquisition system.
  - Played a supervisory role in commissioning Camel's Back detector site.
  - Developed Graphical User Interface for operating the Camel's Back detector site.
  - Developed and implemented a cluster of Linux based PCs that was used to analyze the data from the HiRes detectors.
  - Developed a network firewall to protect the computing resources of the Utah HiRes group. The distinctive feature of this firewall (at the time) was that it had no live filesystem.
  - Developed a data reconstruction pipeline to process the Hires data in an automated fashion.
  - Developed a 3-D event display to visualize the UHECR events observed by the HiRes.
  - Developed techniques to calibrate the response of the HiRes detector elements.
  - Developed reconstruction and simulation analysis techniques used in nearly all of the published research results of the Hires collaboration.
  - Supervised group responsible for performing first measurements of UHECR energy spectrum using the HiREs detector in stereo mode.
  - Served in supervisory/management role in daily operations of the HiRes detector.
  - Participated in measurements of Fluorescence Yield of charged particles at the Flash Experiment carried out the Stanford Linear Accelerator Center.
  - Supervised dissertations and tasks of Ph.D students and post-doctoral research associate.

- **OPAL experiment (http://opal.web.cern.ch/Opal/) (1985-1997)**
  - Designed and built instrumentation including explosive gas mixing and distribution systems, high-voltage distribution systems, readout electronics, and robotic probe stations to test bare ASIC chips.
  - Developed automated data acquisition and control systems to control test instrumentation. These systems managed multiple computers through an integrated graphical user interface for use by technicians.
  - Characterized various detector elements including streamer chambers, photomultiplier tubes, plastic scintillators, silicon wafers for the OPAL detector.
  - Responsible for quality assurance testing of detector sub-assemblies for the OPAL hadron calorimeter, Tile Endcap and Silicon Tungsten Luminosity Monitor. Developed simple databases and interfaces to detector calibration and characterization information.
  - Developed and implemented online data acquisition and control software for the OPAL hadron calorimeter, Tile Endcap and Silicon Tungsten Luminosity monitors.
  - Designed and executed studies of prototype detector elements in CERN beam line

facilities. This entailed the development of specialized detector elements, readout electronics, and gas, high voltage and data acquisition systems. Analyzed data from testbeam studies of prototype OPAL detector elements. This analysis provided input to the simulation and reconstruction software for the OPAL detector elements response to pions,electrons, muons and protons.

- Performed final assembly, cabling and debugging of the OPAL hadron calorimeter, tile endcap and silicon tungsten luminosity monitor hardware.
- Developed reconstruction, simulation and event visualization software for various OPAL sub-detectors.
- Developed techniques and corresponding software to extract the first OPAL results for the partial width and asymmetry of the process $Z^0 \rightarrow b\bar{b}$.
- Developed software and performed analysis to measure the luminosity to the required precision of 0.1% necessary to fully exploit the large sample of Z0 decays used in the determination of several of the electroweak parameters.
- Developed selection cuts using neural networks to optimize the signal to background ratio for the Higgs search at OPAL during LEP I and for Higgs searches at ATLAS.

Teaching Experience

- Secured private funding to upgrade the University of Utah campus observatory and to construct the Willard L. Eccles observatory (WEO) to facilitate teaching and public outreach activities.
- Built astronomical observational facilities on the roof of the South Physics building as well as the Willard L. Eccles Observatory located on the remote mountaintop at Frisco Peak.
- Developed a course on Observational Astronomy that utilized the campus observatory.
- Taught a wide array of courses at both undergraduate as well as graduate level.
- Courses taught at the University of Utah (Fall 1997-Present)
  - Lower level Undergraduate
    - Popular Astronomy/The Universe
    - Popular Observational Astronomy
    - Preparation for University Physics
    - Physics for Scientists and Engineers I
  - Upper level Undergraduate
    - Electronics I
    - Electronics II
    - Modern Physics: Relativity, Nuclear and Particle Physics
    - Modern Optics
    - Introduction to Quantum Theory and Relativity
    - Introduction to (Stellar) Astrophysics
    - Observational Astronomy for Scientists
    - Undergraduate Laboratory
    - Computational Physics I
    - Intermediate Mechanics – Computational Lab
  - Graduate Level
    - Electronics I
    - Electronics II
    - Graduate Laboratory
    - Ionizing Radiation
    - Quantum Theory I

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Supervisory/Mentoring Experience

- Served as the faculty advisor since 2002 for outreach activities of the campus observatory.
- Employed undergraduate students to perform site survey/characterization studies for finding a suitable location for the University observatory constructed at Frisco Peak in southern Utah.
- Employed undergraduate students in the commissioning and development of the Frisco Peak observatory.
- Supervision of Graduate Students at CERN (Summer 1995-Spring 1997):
  - Jochen Schieck, University of Heidelberg , Heidelberg, Germany (Currently Director of the Austrian Institute for High Energy Physics)
  - Steven Lautenschlager, Duke University, North Carolina, USA
- Supervision of Graduate Students at University of Utah (Spring 1998-Present):
  - Kevin Reil (received PhD. 2002), William Hanlon (received PhD. 2008), Monica Allen(received Ph.D, 2013).
  - Ahron Barber (PhD 2019) (Advisor-Dave Kieda) , Michael Newbold (PhD 2019) (Advisor-Dave Kieda)
  - Joshua Bartkoske (Advisor-Dave Kieda), Anne Duerr (Advisor-Dave Kieda)
- Supervision of Undergraduate Students at University of Utah (Spring 1998-Present):
  - Thad Roberts, Dan Green, Paul Ricketts, Christopher Zimmer, Upul Samarasingha
  - Nicolas Ramsrud, Dennis Della Corte, Danielle Brown
- Supervision of postdoctoral research associates
  - Udara Abeysakara , Binita Hona

Departmental/College/University Service

- Academic Senator (8/2022-present)
- College of Science Retention, Promotion and Tenure Committee (8/2023-present)
- Undergraduate Council Substitute Member (2/2024-present)
- Physics & Astronomy Retention, Promotion and Tenure Committee Chair (7/2018-8/2023)
- Director of Graduate Studies (Fall 2012-Fall 2017)
- Graduate Program Committee (Spring 2018-Fall 2021)
- Graduate Comprehensive Exam Committee (Fall 2019-Fall 2020)
- Graduate Advising Committee (Fall 2012-present as Chair Fall 2012-Fall 2017)
- Computers Committee Fall 2013-present (Chairman Fall 2013-Fall 2022, Fall 2023-present)
- Co-developer of Graduate Professional Development Workshop (Boot-camp)
- Astronomy Initiative Task Force Member. Spring 2006-Fall 2017
- Public Education and Outreach Committee (2002-2012)
- Development Committee (Fall 2012-Fall 2015)
- REU–NSF committee (Fall 2013-present)
- South Physics 4th floor renovation (Fall 2012-Spring 2014)
- Member of University Radiation Safety Committee. Spring 1999-present.
- Physics Department Curriculum Committee member Spring 1998-Spring 2002, Fall 2011.
- College of Science Curriculum Committee Member Spring 2002-Fall 2005, Fall 2010-2013.(Chairman 2012-2013).
- Physics Department Common Exam Committee member. Spring 2002-Fall 2007 (Chairman 2006-fall 2007).
- Collaboration on NSF Aspire Project for Web Based Teaching Materials. 1998-2010.

- Chairman of the Task Force on the Department of Physics Observatory. Spring 2000-2010.
- Development of Observational Astronomy Course. Spring 2001-2010.
- Member of University Teaching Committee. Fall 2005-2008.
- Physics Department Policy Board. Fall 2004-Fall 2005.
- Physics Department Space Committee member. Spring 2005 Spring 2006, Fall 2010-2012, (Chairman 2005,2011).
- Astronomy Faculty Search Committee Member. Fall 2007.
- Admissions Committee Chairman. Spring 2009-July 2010.

Short/Long-term visits to other Institutions/Collaboration Meetings

- SWGO Collaboration Meeting – FZU , Prague, Czech Republic, October 2023
- SWGO Collaboration Meeting – CBPF , Rio de Janeiro, Brazil, May 2023
- DOE Dark Matter Panel Review – Hyatt Regency Bethesda, Bethesda MD, July 2019
- HAWC Collaboration Meeting – Virtual Online, October 26-30, 2020
- HAWC Collaboration Meeting – Virtual Online, June 1-5, 2020
- HAWC Collaboration Meeting, Universidad Nacional Autónoma de México, Mexico City, Mexico, June 2019
- Scientific Observation and Multi-messenger Astronomy Workshop and LHAASO Inauguration Site Visit, Chengdu and Daocheng, China , April, 2019
- HAWC Collaboration Meeting, Penn State University, June 2018
- 8th International Workshop on Air Shower Detection at High Altitudes, Shanghai, China, December 11-12, 2017
- Institute of High Energy Physics (IHEP), Beijing, China; Chinese Academy of Science/Sichuan University, Chengdu, China ; LHAASO complex/observatory site, Daocheng, China ; August 2017, Discussions of LHAASO participation.
- UNAM/INAOE, November 2017, HAWC Collaboration Meeting, Cocoyoc, Mexico.
- University of Rochester, June 2017, HAWC Collaboration Meeting, Rochester, New York
- Workshop on a Southern Hemisphere All-Sky Observatory, Puebla, Mexico, November 2016
- HAWC Collaboration Meeting, INAOE, Puebla, Mexico, November 2016
- Frisco Peak Observatory, Mirror Cleaning and Observatory Maintenance, Milford, Utah August 2016
- HAWC Detector Site, (outrigger survey and data taking), Sierra Negra, Mexico July 2016
- HAWC Collaboration Meeting, Michigan State University, November 2016
- HAWC Collaboration Meeting, UNAM, Mexico City, Mexico, January 2016
- HAWC Detector Site, (data-taking 5 days), Sierra Negra, Mexico July 2015
- HAWC Collaboration Meeting, Puerto Vallarta, Mexico, June 2015
- Hosted HAWC Collaboration Meeting at UofU February 2015
- HAWC Collaboration Meeting, Puebla, Mexico, October 2014
- Fermi-Veritas-HAWC Workshop Madison, Wisconsin October 2014
- UNAM-astronomy July 2014 (discussion of polarimetry measurements using FPO)
- HAWC Detector Site, (data-taking 7 days) Sierra Negra, Mexico, July 2014
- HAWC Collaboration Meeting, Collage Park, Maryland, June 2014
- Cottrell Scholars National Teaching Assistant Workshop, GA Tech, May 2014

- HAWC Collaboration Meeting, Pachuca, Mexico, February 2014
- HAWC Detector Site, (Construction 7 days) Sierra Negra, Mexico, May 2013
- HAWC Collaboration Meeting. INAOE, Puebla Mexico, May 2013
- HAWC Collaboration Meeting. Colorado State University, February 2013
- HAWC Collaboration Meeting, Chiapas, Mexico, October 2012
- HAWC Detector Site, (Construction 7 days) September 2012
- HAWC Detector Site, (Construction 12 days) July 2012
- Goddard Space Flight Center, Visit with Fermi/Swift Personnel July 2012
- HAWC Collaboration Meeting, Santa Fe, New Mexico, USA May 2012

Selected Talks/Presentations/Media Appearances

- Invited talk on the SWGO Observatory at the 2023 School for Astroparticle Physics, Obertrubach-Barnfels, Germany, October 10, 2023
- "Detector Design Consolidation," presentation and discussion at SWGO Collaboration Meeting – Prague, Czech Republic, September 30 – October 4, 2023
- "Site Deployability Constraints on Detector Design," SWGO Collaboration Meeting – CBPF , Rio de Janeiro, Brazil, May 2023
- Detector Unit Prototyping at US Sites," SWGO Collaboration Meeting General Call Meeting-Virtual Online, Presented, January 25,2023
- "Horizontal Muons" HAWC Cosmic Ray Working Group meeting-Virtual Online, Presented, March 29, 2022
- Detector Unit Cost Estimates – SWGO Collaboration General Call Meeting -Virtual Online, Presented, February 3, 2022
- "Reconstruction of Nearly Horizontal Muons in the HAWC Observatory", APS Meeting, Virtual Online, Presented April 18, 2021
- Reconstructing nearly horizontal muon trajectories, HAWC Collaboration Meeting – Virtual Online, October 26-30, 2020
- First look at neutrino candidates, HAWC Collaboration Meeting – Virtual Online, June 1-5, 2020
- Report on visit to LHAASO observatory, HAWC Collaboration Meeting, Universidad Nacional Autónoma de México, Mexico City, Mexico, June 2019
- Results from the High-Altitude Water Cherenkov Observatory - LHAASO Scientific Observation and Multi-messenger Astronomy Workshop during April, 2019
- TeV Astrophysics At The High Altitude Water Cherenkov Observatory, Invited Talk at The 8th International Workshop on Air Shower Detection at High Altitudes, Shanghai Astronomical Observatory, Shanghai China, December 2017
- The High-Altitude Water Cherenkov (HAWC) Observatory, Colloquium presented at Idaho State University Physics, Pocatello, Idaho, November 2017
- Detection of Near Horizontal Muons with the HAWC Observatory, Invited Talk at the Workshop on Astroparticle Physics II, Kavli Institute for Astronomy and Astrophysics at Peking University, Beijing, China, August 2017
- Detection of Near-Horizontal Muons with the HAWC Observatory, Contributed Talk to the International Conference on Cosmic Rays, Busan, South Korea, July 2017.
- Horizontal Muons, HAWC Collaboration Meeting, Rochester, New York, November 2016.

- Angular Distributions, HAWC Collaboration Meeting, Puebla, Mexico, November 2016
- HAWC Detector Description Paper, HAWC Collaboration Meeting, UNAM, Mexico City, Mexico, January 2016
- The High Altitude Water Cerenkov Observatory, Invited Talk, (For the HAWC Collaboration) Cosmic Ray International Seminar (CRIS 2015) Gallipoli, Italy September 15, 2015.
- TeV Astrophysics at the High Altitude Water Cerenkov Observatory, University of Utah Department of Physics Colloquium September 10, 2015.
- The High Altitude Water Cerenkov (HAWC) Observatory, Plenary Talk, (For the HAWC Collaboration) ICATPP Como,Italy October 2013.
- Appearance on KUTV television news Program "Take Two" to discuss Dark Matter and other topics in Astronomy, Willard L. Eccles Observatory and U of U Astronomy Program, April 2013
- The HAWC (High Altitude Water Cerenkov) Gamma Ray Observatory, University of Utah Department of Physics and Astronomy Colloquium, Salt Lake City, UT March 22,2012.
- Status of the High Altitude Water Cerenkov (HAWC) Gamma Ray Observatory, ICATPP, Como, Italy, October 2010.
- Appearance on KUTV television news Program "Take Two" to discuss the Bolide Meteor, Willard L. Eccles Observatory and U of U Astronomy Program, November 2009
- Willard Eccles Observatory First Light Symposium, University of Utah November 11, 2009
- "Main Injector Particle Production Experiment at Fermilab: Application to Cosmic Rays", Colliders to Cosmic Rays 2007, Lake Tahoe, California, February 2007
- "Measurements of UHECR Spectrum with the HiRes detector",29th ICRC, Pune, India, Aug 2005.
- Observing Ultra High Energy Cosmic Rays with the High Resolution Fly's Eye Detector", International Workshop on Particles and Radiation from Cosmic Accelerators, Chiba, Japan, March 2005
- "Update on Hires Stereo Spectrum Analysis", NSF Review Talk, National Science Foundation Headquarters, Arlington, Virginia, Novemeber 2004.
- Measurement of the Flux of UHE Cosmic Rays by the HiRes Detectors Observing in both Monocular and Stereoscopic Modes. 28th ICRC, Tsukuba, Japan August 2003.
- "Observing Ultra-High Energy Cosmic Rays with the High Resolution Fly's Eye Detector.", Invited Talk at Les Rencontres de Physique de la Valee d'Aoste, La Thuile,Italy, March 9,2003
- "The Observation of Ultra-High Energy Cosmic Rays using the HiRes Detector.", Invited Talk at the 2002 meeting of the Division of Particles and Fields, Williamsburg, VA, May 26,2002
- "Observing Ultra High Energy Cosmic Rays: Experimental Techniques and Results", Invited Talk at the April meeting of the American Physical Society, Washington D.C., April 28,2001
- "Observing Ultra-High Energy Cosmic Rays with the High Resolution Fly's Eye Detector ", International Workshop on Observing Ultra-High Energy Cosmic Rays, Metepec, Puebla, Mexico, August 2000
- "First Stereo Results from the High Resolution Fly's Eye Air Fluorescence Detector", 26th International Cosmic Ray Conference, Salt Lake City, Utah, August 1999
- "HiRes Flys's Eye experiment ",6th International Conference on Advanced Technology and Particle Physics, Villa Olmo, Como, Italy, 8 October 1998
- "Higgs Boson Searches at LEP", Colloquium at University of Utah, April 1997.
- 'Electroweak Physics at LEP'", Seminar at the State University of New York Stonybrook, December 1996.
- 'Recent Experimental Results in Electroweak Physics'", Seminar at the Stanford Linear Accelerator Center, October ,17 1995.
- "Precision Electroweak Measurements from LEP and SLC", April Meeting of the American Physical Society, Crystal City, VA, April ,22 1994.
- "The OPAL Silicon-Tungsten Luminometer", Invited Talk at 1992 Division of Particles and

Fields Conference at Fermilab, November 1992

- "Measurements of $\Gamma\left(Z^0 \rightarrow b\bar{b}\right)$ at LEP", Invited Talk at the San Miniato Conference, June 1992.
- "Experience in Construction and Testing of Plastic Limited Streamer Chambers", Invited Talk at the 1990 IEEE Nuclear Science Symposium Conference in San Fransisco , January 1990.

Selected Publications

- HAWC Collaboration, Albert, A., et al "An optimized search for dark matter in the galactic halo with HAWC", Journal of Cosmology and Astroparticle Physics, vol. 2023, no. 12, IOP, 2023. doi:10.1088/1475-7516/2023/12/038.
- HAWC Collaboration, Albert, A., "HAWC Study of the Very-high-energy γ-Ray Spectrum of HAWC J1844-034", The Astrophysical Journal, vol. 954, no. 2, IOP, 2023. doi:10.3847/1538-4357/ace967.
- HAWC Collaboration, Albert, A., "Discovery of Gamma Rays from the Quiescent Sun with HAWC", Physical Review Letters, vol. 131, no. 5, APS, 2023. doi:10.1103/PhysRevLett.131.051201.
- HAWC Collaboration, Abeysekara, A. U., "The High-Altitude Water Cherenkov (HAWC) observatory in México: The primary detector", Nuclear Instruments and Methods in Physics Research A, vol. 1052, 2023. doi:10.1016/j.nima.2023.168253.
- HAWC Collaboration, Alfaro, R., "Searching for TeV Dark Matter in Irregular Dwarf Galaxies with HAWC Observatory", The Astrophysical Journal, vol. 945, no. 1, IOP, 2023. doi:10.3847/1538-4357/acb5f1.
- HAWC Collaboration, Albert, A., "HAWC Detection of a TeV Halo Candidate Surrounding a Radio-quiet Pulsar", The Astrophysical Journal, vol. 944, no. 2, IOP, 2023. doi:10.3847/2041-8213/acb5ee.
- HAWC (& ANTARES) Collaborations, Ayala Solares, H. A., "Search for Gamma-Ray and Neutrino Coincidences Using HAWC and ANTARES Data", The Astrophysical Journal, vol. 944, no. 2, IOP, 2023. doi:10.3847/1538-4357/acafdd.
- HAWC Collaboration, Albert, A., "Detailed Analysis of the TeV γ-Ray Sources 3HWC J1928+178, 3HWC J1930+188, and the New Source HAWC J1932+192", The Astrophysical Journal, vol. 942, no. 2, IOP, 2023. doi:10.3847/1538-4357/ac8de3.
- HAWC Collaboration, A. Albert, et al., "HAWC Detection of a TeV Halo Candidate Surrounding a Radio-quiet Pulsar." *The Astrophysical Journal,* vol. 944, no. 2, 2023., doi:10.3847/2041-8213/acb5ee.
- HAWC Collaboration, A. Albert, et al., "γ-Ray Emission from Classical Nova V392 Per: Measurements from Fermi and HAWC." *The Astrophysical Journal*, vol. 940, no. 2, 2022. doi:10.3847/1538-4357/ac966a.
- Ackermann, M., et al." High-energy and ultra-high-energy neutrinos: A Snowmass white paper." *Journal of High Energy Astrophysics*, vol. 36, pp. 55–110, 2022. doi:10.1016/j.jheap.2022.08.001
- HAWC Collaboration, A. Albert, et al.," Validation of standardized data formats and tools for ground-level particle-based gamma-ray observatories." *Astronomy and Astrophysics*, vol. 667, 2022. doi:10.1051/0004-6361/202243527.

- HAWC Collaboration, R. Alfaro, et al.," Gamma/hadron separation with the HAWC observatory." *Nuclear Instruments and Methods in Physics Research A*, vol. 1039, 2022. doi:10.1016/j.nima.2022.166984.
- HAWC Collaboration, A. Albert, et al., "Constraints on the Very High Energy Gamma-Ray Emission from Short GRBs with HAWC." *The Astrophysical Journal,* vol. 936, no. 2, 2022. doi:10.3847/1538-4357/ac880e.
- HAWC Collaboration, R. Alfaro, et al., "Study of the Very High Energy Emission of M87 through its Broadband Spectral Energy Distribution." *The Astrophysical Journal*, vol. 934, no. 2, 2022. doi:10.3847/1538-4357/ac7b78.
- HAWC Collaboration, A. Albert, et al., "Probing the Extragalactic Mid-infrared Background with HAWC." *The Astrophysical Journal*, vol. 933, no. 2, 2022. doi:10.3847/1538-4357/ac7714.
- HAWC Collaboration, A. Albert, et al., "Long-term Spectra of the Blazars Mrk 421 and Mrk 501 at TeV Energies Seen by HAWC." *The Astrophysical Journal*, vol. 929, no. 2, 2022. doi:10.3847/1538-4357/ac58f6.
- HAWC Collaboration, A. Albert, et al., "HAWC Study of the Ultra-high-energy Spectrum of MGRO J1908+06." *The Astrophysical Journal*, vol. 928, no. 2, 2022. doi:10.3847/1538-4357/ac56e5.
- **Characterization of the background for a neutrino search with the HAWC observatory,** HAWC Collaboration , A. Albert et al.e-Print: 2108.07767 [hep-ex],DOI: 10.1016/j.astropartphys.2021.102670 (publication) ,Published in: Astropart.Phys. 137 (2022), 102670
- **HAWC as a Ground-Based Space-Weather Observatory** , HAWC Collaboration*,C. Alvarez et al.,DOI: 10.1007/s11207-021-01827-z ,Published in: Solar Phys. 296 (2021) 6, 89*
- **Probing the Sea of Cosmic Rays by Measuring Gamma-Ray Emission from Passive Giant Molecular Clouds with HAWC**, HAWC Collaboration (A. Albert, et al. ,e-Print: 2101.08748 [astro-ph.HE], DOI: 10.3847/1538-4357/abfc47 ,Published in: Astrophys.J. 914 (2021) 2, 106
- **HAWC Search for High-Mass Microquasars** ,HAWC Collaboration A. Albert et al.,e-Print: 2101.08945 [astro-ph.HE],DOI: 10.3847/2041-8213/abf35a ,Published in: Astrophys.J.Lett. 912 (2021) 1, L4, Astrophys.J. 912 (2021) 1, L4
- **Evidence that Ultra-high-energy Gamma Rays Are a Universal Feature near Powerful Pulsars ,HAWC Collaboration** , A. Albert et al., e-Print: 2101.07895 [astro-ph.HE],DOI: 10.3847/2041-8213/abf4dc ,Published in: Astrophys.J.Lett. 911 (2021) 2, L27, Astrophys.J. 911 (2021) 2, L27
- **Spectrum and Morphology of the Very-high-energy Source HAWC J2019+368** ,HAWC Collaboration , A. Albert, et al.,e-Print: 2101.01649 [astro-ph.HE],DOI: 10.3847/1538-4357/abecda ,Published in: Astrophys.J. 911 (2021) 2, 143
- **HAWC observations of the acceleration of very-high-1energy cosmic rays in the Cygnus Cocoon**, HAWC Collaboration (A.U. Abeysekara et al.), Nature Astronomy, March 2021, DOI: 10.1038/s41550-021-01318-y, arXiv:2103.06820v1v.
- **Evidence of 200 TeV Photons from HAWC J1825-134,** HAWC Collaboration (A. Albert et al.), The Astrophysical Journal Letters, February 2021, *ApJL* 907 L30,DOI: 10.3847/2041-8213/abd77b

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