Zigfried Hampel-Arias

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Personal

DOB: 15 June, 1987
Nationalities: USA, Mexico
Languages: English (native), Spanish (native), French (intermediate)

Education

UW-Madison
Ph.D., Physics, 2017.
M.S., Physics, 2012.
Fields: Particle Astrophysics, Scientific Computing

Rice University
B.S., Chemical Physics, 2009.

Dissertation

Cosmic Ray Observations at the TeV Scale with the HAWC Observatory
Analyses of the all-particle energy spectrum from $10-500$ TeV, energy dependence of cosmic ray Moon shadow, and the spectrum of a regional excess in the cosmic ray anisotropy. Methods include iterative Bayesian unfolding, GPU-accelerated Markov Chain Monte Carlo for parameter estimation, machine learning algorithm testing for event classification, and GPU cosmic-ray simulations for detector calibration.

Current Research

IQT Labs, USA
09/2018 - Present
Project lead on radio frequency emission detection with Monte Carlo tree search & reinforcement learning methods; cross-view geolocation via ground-level to overhead imagery matching; multimodal deepfake detection; dashboard development for various research projects (COVID diagnostic tool, deepfake detection, internal investment data visualization). Past projects include statistical identification of GAN synthesized data, edge-sensor AI capabilities, machine learning security API.

Awards and Fellowships

Insight Data Science Fellowship
06/2018 – 09/2018

Belgian American Educational Foundation Research Fellowship
06/2017 – 06/2018

Wallonie-Bruxelles International Short Stay Fellowship
06/2017 – 09/2017

US Fulbright Alumni Ambassador
12/2012 – Present

NSF Graduate Research Fellowship
05/2011 – 05/2014

US Fulbright Research Fellowship
08/2009 – 06/2010

Mellon Mays Undergraduate Fellowship
05/2008 – 05/2009

Publications As Major Contributor

Multimodal Approach for DeepFake Detection
49th Annual IEEE AIPR 2020. Proceedings not yet available.
Conference Booklet

L2RPN: Learning to Run a Power Network in a Sustainable World
NeurIPS 2020 White Paper. ChaLearn

All-sky Measurement of the Anisotropy of Cosmic Rays at 10 TeV and Mapping of the Local Interstellar Magnetic Field
Astrophys. J. **871**, 96 (2019). arXiv:1812.05682

Observation of Anisotropy of TeV Cosmic Rays with Two Years of HAWC
Astrophys. J. **865**, 57 (2018). arXiv:1805.01847

PyUnfold: A Python Package for Iterative Unfolding
Journal of Open Source Software, **3**(26), 741 (2018). 10.21105/joss.00741

Constraining the $\bar{p}/p$ Ratio in TeV Cosmic Rays with the Moon Shadow
Phys. Rev. D **97**, 102005 (2018). arXiv:1802.08913

All-Particle Cosmic Ray Spectrum Measured by the HAWC from 10–500 TeV
Phys. Rev. D **96**, 122001 (2017). (**Editor's Suggestion**) arXiv:1710.00890

Probing Cosmic-Ray Propagation with TeV γ-Rays from the Sun with HAWC
PoS: Proceedings of the 35th ICRC (Busan), 2017. arXiv:1708.03732

All-Particle and Light-Component Cosmic Ray Energy Spectrum Measured by the HAWC Experiment
PoS: Proceedings of the 35th ICRC (Busan), 2017. arXiv:1801.05526

Gamma Hadron Separation using Pairwise Compactness Method with HAWC
PoS: Proceedings of the 34th ICRC (The Hague), 2015. arXiv:1508.04047

Towards a Measurement of the e^+e^- Flux Above 1 TeV with HAWC
PoS: Proceedings of the 34th ICRC (The Hague), 2015. arXiv:1508.03466

Other Publications

"What AI Can and Cannot Do for the Intelligence Community."
Defense One, Defense One, 5 Jan., 2021, Article link.

"Why IQT made the COVID-19 Diagnostic Accuracy Dash App."
Modern Data, Modern.Data, 27 August, 2020, Article link.

"Learning to Run a Power Network Challenge."
Gab41, IQT Labs, 4 May, 2020, Article link.

"Expecting the Unexpected – Cosmic Ray Physics in Argentina."
Fulbright Blog, Institute of International Education, 13 Feb., 2013, Article link.

Reviewer Activities

Journal of Open Source Software
Reviewer for eight codebase publications, 08/2018 – Present.

Center for Security & Emerging Technology
Invited reviewer for publication *Tracking AI Investment*, 06/2020.

Selected Presentations

Approaches for Multi-modal Synthetic Media Detection
Invited Talk – Applied Imagery Pattern Recognition,
49th Annual IEEE AIPR 2020, Online (15/08/2020)

Operationalize COVID-19 Statistics with Dash:
Featuring IQT's COVID-19 Diagnostic Accuracy Tool
Invited Webinar Talk – Plotly Dash (23/09/2020). Webinar link.

Cosmic Ray Observations with HAWC & GPU Simulations at TeV-Scales
Invited Talk for UG Astroparticle Seminar, Geneva, Switzerland (7/2/2018)
Invited Talk for MPIK Physics Seminar, Heidelberg, Germany (28/11/2016)
Invited Talk for RUB Astrophysics Seminar, Bochum, Germany (23/11/2016)

Unfolding Techniques and GPU Simulations at the TeV Scale with HAWC
Poster at SuGAR Solvay Workshop, IIHE, ULB, Belgium (24/1/2018)

TeV Scale Cosmic Ray Observations with the HAWC Observatory
Poster at ICFA Instrumentation School, UCI, La Habana, Cuba (5/12/2017)

Cosmic Ray Propagation Simulations and Spectral Features in the TeV Anisotropy
Invited Talk for Cosmic Ray Anisotropy Workshop,
UDG, Guadalajara, Mexico (10/10/2017)

Las partículas mas energéticas del universo: rayos cósmicos
Invited Public Talk for Semana Mundial del Espacio,
UDG CUCEI, Guadalajara, Mexico (9/10/2017)

Observation of the Moon and Sun with HAWC
Talk at TeVPA 2017, OSU, Ohio, USA (7/8/2017)

Very High Energy Cosmic Ray Observations with HAWC
Invited Talk for ULB-IIHE Seminar, Brussels, Belgium (14/10/2016)

Unfolding the All-Particle Cosmic Ray Spectrum Measured with HAWC
Talk at the American Physical Society, Salt Lake City, USA (18/4/2016)

Towards a Measurement of the e^+e^- Flux Above 1 TeV with HAWC
Poster at 34th ICRC, The Hague, Netherlands (5/8/2015)

Composition and Energy Resolution with HAWC 300
Talk at the American Physical Society, Denver, USA (13/4/2013)

Skills

Programming: Python, C, C++, GitHub, SVN, OpenCL, CUDA, PyOpenGL, PyTorch, TensorFlow
Analysis: Data Analysis, Unfolding Techniques, MCMC, GPGPU, Machine Learning

Codebases

CNN Rotational Convolution Layer.

PyUnfold Iterative Statistical Unfolding Package. Documentation

COVID Diagnostic Testing Dash App. Toolkit Webpage

DeepFake Detection Dash App. Approval Pending for Public Release

Charged Particle Geomagnetic GPU Toolkit.

CyperCat Machine Learing Vulnerability API.

Previous Positions

IIHE, ULB, Belgium
09/2014 – 09/2016
Postdoctoral researcher in IceCube group at Inter-University Institute for High Energies, Université Libre de Bruxelles, Belgium
Projects: Iterative Unfolding, MCMC codebase development, Gen-2 SiPM testing.

UW-Madison, USA
09/2014 – 09/2016
IT Administrator for PostleLab in Psychology & Neuroscience Dept.

Centro Atomico Bariloche, Argentina
08/2009 – 06/2010
Fulbright Research Scholar at the Pierre Auger Observatory
Project: High Energy Muon Simulations & Water Quality Analysis

Physics Department, Rice University, USA & CERN, Switzerland
05/2008 – 05/2009
Undergraduate Research Assistant
Project: CMS Endcap Muon System Commissioning Studies

C-NR, Los Alamos National Laboratory, USA
05/2004 – 07/2007
Undergraduate Research Assistant
Project: Aqueous Radiochemical Methods Development for Nuclide Separation

Professional Organizations

Strategic Leadership Council of LANL LEEP
11/2020 – Present

Institute of Electrical and Electronics Engineers
09/2020 – Present

Association for the Advancement of Artificial Intelligence
05/2019 – Present

LatinXinAI
03/2019 – Present

American Physical Society
08/2012 – Present

Society for the Advancement of Chicanos and Native Americans in Science (SACNAS)
08/2012 – 08/2015

Teaching

Stanford University
Mentoring of two CS229 undergraduate students for project on generative adversarial networks. Project summary, Spring 2020

Insight Data Science
Recurring Guest Lecturer, Spring 2019 – Present
A Guide to GitHub & Collaborative Coding

Physics Department, UW-Madison
Guest Lecturer, Acoustics for Musicians, Fall 2016

WIPAC, Physics Department, UW-Madison
Student Mentor, Jan. 2015 – Dec. 2016
Mentoring of two undergraduate research assistants through various HAWC astrophysics projects related to machine learning classification techniques and map-making optimization.

Physics Department, Rice University
Discussion Section & Grading, Computational Physics, Spring 2009

Computational & Applied Mathematics, Rice University
Discussion Section & Grading, Partial Differential Eqs, Fall 2008

Outreach Activities

08/2018 – Present
Introduced new content type to IQT Labs: impact videos. Co-wrote & narrated the first two videos on the VOiCES dataset, and Poseidon cyber-security network analysis tool.

08/2018 – Present
Academic & professional mentor for LatinXinAI members.

08/2010 – 05/2017
Volunteer for Wisconsin IceCube Particle Astrophysics Center (WIPAC). Participating in various WIPAC outreach programs including ice drilling demonstrations at Wisconsin public schools and 'Explorando las Ciencias' bilingual program for the Spanish-speaking community.

12/2012 – 05/2017
Fulbright Alumni Ambassador (AA). Participating in Fulbright outreach at 2013 National SACNAS Conference, informational and recruiting sessions at UW-Madison, UT-San Antonio and St. Mary's University.