

# Zigfried Hampel-Arias

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IQT Labs  
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**Personal**      DOB: 15 June, 1987  
Nationalities: USA, Mexico  
Languages: English (native), Spanish (native), French (intermediate), Greek (basic)

**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; using GAN for enhancing utility of synthetic imagery for remote sensing; 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

*Localizing Radio Frequency Targets Using Reinforcement Learning*  
Submitted to 3rd International Workshop on Robotics Software Engineering (RoSE'21).  
Notice expected 27th August, 2021. [RoSE'21 Website](#)

*Multimodal Approach for DeepFake Detection*  
49<sup>th</sup> 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  $\gamma$ -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

“DeepFake Detection Challenge.”  
*IQT Labs*, In-Q-Tel Blog, [Part I](#) & [Part II](#).

“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

### Center for Security & Emerging Technology

Invited reviewer for publication *Tracking AI Investment*, 06/2020.  
Invited reviewer for publication *Mapping the Global Defense Companies' AI Investment Activity*, release Fall 2021.

### NeurIPS

Reviewer for [LatinXinAI](#) Workshops, 2019 – Present.

### Journal of Open Source Software

Reviewer for eight codebase publications, 08/2018 – Present.

## Selected Presentations

### *Approaches for Multi-modal Synthetic Media Detection*

Invited Talk – Applied Imagery Pattern Recognition, 49<sup>th</sup> 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

**PyUnfold Iterative Statistical Unfolding Package.**   [Documentation](#)

**COVID Diagnostic Testing Dash App.**  [Toolkit Webpage](#)

**DeepFake Detection App.** 

**BirdsEye - RL on RF.**  Approval Pending for Public Release

**Charged Particle Geomagnetic GPU Toolkit.** 

**CNN Rotational Convolution Layer.** 

**CyperCat Machine Learning 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 Atómico 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.