GREG FURLICH

Research Scientist

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6 years expertise in cosmic rays, computational physics, and analyzing large data structures with experience in :

- **reconstructing and analyzing transient moving optical events.**
- **aggregating, querying, and manipulating Pandas DataFrames.**
- **machine learning classification using Keras in Python with proprietary data.**
- **Linux systems administration of computational clusters and data servers.**
- **scrapping data from websites and interfacing with application programming interfaces (APIs).**
- **using remote sensing data from satellite or space shuttle to create maps with informational overlays.**

EDUCATION

Doctorate of Philosophy, *Physics*
Fall 2014 - Spring 2020

Master of Science, *Physics*
Fall 2014 - Summer 2018

University of Utah, Salt Lake City, UT

Research Specialization: Cosmic ray fluorescence event reconstruction and computational physics

Bachelor of Science, *Physics*
Fall 2010 - Spring 2014

Michigan Technological University, Houghton, MI

Magna Cum Laude

Minors: Mathematical Sciences and German

SKILLS

Programming Languages: Python (Numpy, Pandas, Keras, Scipy, Pyroot) | C | C++ | Cern Root | MATLAB | Mathematica

Markup Languages: HTML | CSS | LaTeX *Foreign Languages:* German

Miscellaneous: Strong analytic and problem solving experience, exceptional verbal and written communication skills, and collaborative finesse.

RESEARCH EXPERIENCE

Research Assistant in Cosmic Rays
Summer 2014 - Present

Telescope Array (TA) Cosmic Ray Observatory, Institute of High Energy Astrophysics, Department of Physics and Astronomy, University of Utah

Research Advisor: Douglas Bergman

- Analyzed 10 years of monocular fluorescence data to create a Cosmic Ray Energy Spectrum. Raw cosmic ray event data are analyzed by reconstructing event geometry and energy. The event information is aggregated into a large database to produce the event energy distribution with selection cuts. The aperture of the detectors in monocular mode is calculated through Monte Carlo thrown events over TA and simulating the response of the detectors.
- Classified weather over TA with the fluorescence detector photomultiplier tube baselines to create temporal snapshots of the detectors' field of view. These videos of snapshots are then used as inputs in a Recurrent Convolution Neural Network (RCNN) model constructed with Keras machine learning framework to determine clear weather data for further cosmic ray analysis.
- Created composite satellite maps in Python with site information overlays of TA using data from the Landsat 8 satellite pulled from Amazon Web Services and created topographical and shaded relief maps in Python with site information overlays using Shuttle Radar Topography Mission data.
- Field team leader in charge of safety of field crew and overseeing helicopter deployment to new surface detector's field site for TAx4.
- Linux systems administrator of the Telescope Array's data server and computational clusters at the University of Utah for 2 years.

Project Data Analyst

Spring 2019 - Summer 2019

College of Computing, University of Utah

- Collaborated on a College of Computing PhD Candidate's thesis project by analyzing air quality data with Python and Pandas DataFrames to query, aggregate, and present data in infographical plots in a quick fashion during face-to-face interviews with study participants.
- Aggregated outside data of local weather conditions and Air Quality Index though web application programming interfaces to give prospective to study participants about their collected home air quality data.

Research Assistant in Cosmic Rays

Summer 2013 - Spring 2014

Department of Physics, Michigan Technological University

Research Advisor: Brian Fick

Research Assistant in Nanofabrication

Fall 2011-Summer 2012

Department of Physics, Michigan Technological University

Research Advisor: Yoke Khin Yap

SELECTED PUBLICATIONS AND PROCEEDINGS

Telescope Array FD Weather Classification using Machine Learning, **Greg Furlich**, Proceedings of Science (ICRC2019) 261, 36th International Cosmic Ray Conference, Madison, WI, July 2019

Towards a Telescope Array 10 Year FD Monocular Energy Spectrum, **Greg Furlich**, Douglas Bergman, Proceedings of Science (ICRC2019) 260, 36th International Cosmic Ray Conference, Madison, WI, July 2019

Constraints on the diffuse photon flux with energies above $10^{18}eV$ *using the surface detector of the Telescope Array experiment*, R.U. Abbasi et al. (Telescope Array Collaboration), Astropart. Phys. **110** (2019)

Testing a Reported Correlation between Arrival Directions of Ultra-high-energy Cosmic Rays and a Flux Pattern from nearby Starburst Galaxies using Telescope Array Data, R.U. Abbasi et al. (Telescope Array Collaboration), ApJ **867** 2 (2018)

The Cosmic-Ray Energy Spectrum between 2 PeV and 2 EeV Observed with the TALE detector in monocular mode, R.U. Abbasi et al. (Telescope Array Collaboration), ApJ **865** 74 (2018)

Evidence of Intermediate-scale Energy Spectrum Anisotropy of Cosmic Rays $E \geq 10^{19.2}eV$ *with the Telescope Array Surface Detector* R.U. Abbasi et al. (Telescope Array Collaboration), ApJ **862** 91 (2018)

Depth of Ultra High Energy Cosmic Ray Induced Air Shower Maxima Measured by the Telescope Array Black Rock and Long Ridge FADC Fluorescence Detectors and Surface Array in Hybrid Mode, R.U. Abbasi et al. (Telescope Array Collaboration), ApJ **858** 76 (2018)

AWARDS

Departmental Scholar, Department of Physics, Michigan Technological University — Spring 2013
Michigan Space Grant Consortium Recipient — Summer 2012

EXTRACURRICULAR

Academic Senate, University of Utah
Member, Graduate Assembly Ad Hoc Committee — Fall 2019

College of Science, University of Utah
Member, College of Science Council — Fall 2017 - Summer 2018
Member, College of Science College Student Council — Fall 2017 - Summer 2018

Department of Physics and Astronomy, University of Utah
Chair, Graduate Student Advisory Council — Summer 2017 - Spring 2018
Member, Graduate Student Advisory Council — Fall 2015 - Spring 2019

Science Outreach
Volunteer, Physics Open House, Weber State University — Fall 2017, 2018, 2019
Volunteer, Science Open House, University of Utah — Fall 2019
Volunteer and Speaker, Great Basin Astronomy Festival, Great Basin NP — Summer 2018