# GREG FURLICH

Research Scientist

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6 years expertise in remote sensing, computational physics, and analyzing large data structures in Python with experience in:

- reconstructing and analyzing transient moving optical events.
- aggregating, querying, and manipulating Pandas DataFrames.
- machine learning image classification using the Keras machine learning framework.
- 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

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, TensorFlow, 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 - Spring 2020
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 UV fluorescence event data to calculate a cosmic ray energy spectrum. Raw cosmic ray event data were analyzed by reconstructing event geometry and energy. The event information was aggregated into a large database to produce the event energy distribution. The aperture of the optical detectors was calculated through simulating cosmic events in the atmosphere and simulating the response of the detectors.
- Analyzed the significance of the Greisen–Zatsepin–Kuzmin (GZK) Suppression at the highest energies of cosmic rays in the 10 year cosmic ray spectrum. Analyzed other features that give insight into cosmic ray populations or propagation effects.
- Classified weather over TA with the fluorescence detector photomultiplier tube baselines to create false color images of the detectors' field of view. These videos of snapshots were 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.
- 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 about their collected home air quality data.
- Aggregated outside data of local weather conditions and Air Quality Index.

### 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

*Observation of the GZK Suppression with the Telescope Array Fluorescence Telescopes and Deployment of the Telescope Array Expansion*, Greg Furlich, Thesis, University of Utah, April 2020, *Defended and Submitted*

*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)

## 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