# Daniel Pfeffer

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## KEY SKILLS

- **Programming**: Python, C, C++, SQL, Matlab, HTML, PHP, JavaScript, Mathematica, Bash
- **Analytical Techniques**: Machine Learning (Regression, Decision Tree, SVM, NN), Linear Algebra, Statistics (Maximum Likelihood Fitting)

## ACADEMIC PROJECTS

**Line Intensity Mapping with Neural Networks** *Aug 2018 - Present*

- Trained convolutional neural networks to predict the underlying galaxy-brightness distribution of a line intensity map from the map itself.
- Implemented a residual network architecture to increases the depth and learning ability of a neural network.
- Tested the trained convolutional neural networks on multiple untrained scenarios to understand how well it learned to learned line intensity maps.

**Comparison of Dark Matter Annihilation and Scattering in the CMB** *Aug 2016 – Present*

- Compared effects of dark matter annihilation and dark matter - baryon scattering on the CMB.
- Added dark matter annihilation and dark matter baryon scattering to the Boltzmann solver CLASS.
- Used Markov chain Monte Carlo's as well as Nested Sampling to probe the parameter space of interactions that would be allowed/detectable with the CMB.

## EXPERIENCE

**Johns Hopkins University** **Baltimore, MD**

*Graduate Teaching Assistant* *Aug 2014 - Dec 2018*

- Led teams of up to 11 teaching assistants to help teach courses for up to 300 undergraduates
- Managed administrative duties of teaching a large undergrad course at an R1 university
- Designed weekly section problems, solutions and homework solutions around the course to maximize student learning outcomes
- Held weekly reviews sections and office hours to cover material covered in lecture and help students with homework

*Graduate Research Assistant* *Aug 2014 – Present*

- Explored possible sources and mechanisms to produce observed ultra-high-energy cosmic rays
- Modified Boltzmann codes and ran Markov chain Monte Carlo's to test the detectability of interacting forms of dark matter
- Searched for unresolved sources of gamma rays using new anomaly detection techniques
- Implemented machine learning techniques to better understand information available in intensity maps

**University of Rochester** **Rochester, NY**

*Research Experience for Undergraduates (REU)* *Jun 2013 - Aug 2013*

- Modeled accretion onto red giant stars from white dwarf stars
- Used and modified AstroBear, a FORTRAN based modular hydrodynamic & magnetohydrodynamic adaptive mesh refinement code, to simulate accretion onto stellar objects

**NASA Glenn Research Center** **Cleveland, OH**

*Lewis Educational and Research Collaborative Internship Project (LERCIP) Intern* *Jun 2012 - Aug 2012*

- Prototyped new internal procurement system for satellite launches
- Used JavaServer Pages with Liferay Portal

**SpeculatingStocks** **Indiana, PA**

*Developer* *2011-2012*

- Developed tools to automatically scrape multiple websites for stock information and news
- Created SQL databases to store scraped data
- Prototyped social media features such as followers, likes and shares to increase engagement on a financial-news oriented site

## EDUCATION

**Johns Hopkins University** **Baltimore, MD**

*Ph.D. Physics and Astronomy* *Expected 2019*

*M.A. Physics and Astronomy* *June 2016*

**Case Western Reserve University** **Cleveland, Ohio**

*(summa cum laude) B.S. Mathematics and Physics* *June 2014*

## Publications

Daniel N. Pfeffer, Patrick C. Breysse, and George Stein. Deconfusing intensity maps with neural networks. 2019.

Daniel N. Pfeffer, Ely D. Kovetz, and Marc Kamionkowski. Ultrahigh-energy cosmic ray hotspots from tidal disruption events. *Mon. Not. Roy. Astron. Soc.*, 466(3):2922–2926, 2017.

## AWARDS

- Rowland Prize for Innovation and Excellence in Teaching 2017
- Case Western Reserve B.S. Chandrasekhar Prize 2013

## Conferences and Talks

- **"Complete CMB Constraints for Millicharged Dark Matter"** July 23-27, 2018.
  talk at Identification of Dark Matter (IDM 2018), Brown University
- Cosmo Tools Workshop 2018, RWTH Aachen University April 23-27, 2018
- Cosmic Opportunities (SSI 2017), SLAC National Accelerator Laboratory August 14-25, 2017.
- **"Ultra-high-energy cosmic-ray hot spots?"** August 7-11, 2017.
  talk at TeV Particle Astrophysics (TeVPA 2017), Ohio State University
- Cosmo-16 Conference, University of Michigan August 8-12, 2016.
- **"Tidal disruption events as UHECR sources"** June 20-22, 2016.
  talk at Workshop on Multi-messenger Approaches to Cosmic Rays: Origins and Space Frontiers (MACROS 2016), Penn State University

## Service

- Webmaster for Physics and Astronomy Graduate Student Organization at JHU 2016-2018
  PAGS Website
- Webmaster for Physics and Astronomy Outreach Group at JHU 2016-2018
  PAGS Outreach Website
- Active member of Physics and Astronomy Outreach Group at JHU 2014-Present