Daniel Pfeffer

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SUMMARY

Graduating astrophysics Ph.D. with experience in modeling, data driven analytics, and data visualization. Seeking to leverage academic experiences to transition in to a data science role.

TECHNICAL SKILLS

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

EDUCATION

Johns Hopkins University **Baltimore, MD**
Ph.D. Physics and Astronomy *GPA: 4.0* *Expected 2019*
M.A. Physics and Astronomy *June 2016*

Case Western Reserve University **Cleveland, OH**
B.S. Mathematics and Physics *GPA: 3.93 Summa Cum Laude* *June 2014*

ACADEMIC PROJECTS

Line Intensity Mapping with Neural Networks *August 2018-May 2019*
- Trained convolutional neural networks to predict the underlying galaxy-brightness distribution of a line intensity map. Tested the networks on multiple untrained scenarios to gauge robustness.
- Implemented a residual network architecture to increase the depth and learning ability of a neural network.
- Newly trained network is orders of magnitude faster and more robust than the previous technique.

Comparison of Dark Matter Annihilation and Scattering in the CMB *August 2016-Present*
- Modified complex numerical solver to explore the effects of dark matter interactions.
- Used Markov chain Monte Carlo and Nested Sampling to identify relevant influencing forces on dark matter interactions.

EXPERIENCE

Johns Hopkins University **Baltimore, MD**
Graduate Research Assistant *August 2014-Present*
- Built model to estimate flux of cosmic rays and proved its validity by correctly determining actual flux.
- Modified the Boltzmann solver CLASS and ran Markov chain Monte Carlo and Nested Sampling to test the detectability of interacting forms of dark matter and determine which interactions drive the detectability constraints. This was the first test done comparing two possible interactions of dark matter instead of assuming one constraint dominates.
- Implemented new anomaly detection techniques to search for unresolved gamma ray sources.
- Implemented machine learning techniques to better understand information available in intensity maps. By using CNNs to read intensity maps we were able to extract information from the maps on time scales orders of magnitude faster than previous techniques with comparable if not better accuracy. The CNN was also more robust to differences between physical models used to generate the maps.

Graduate Teaching Assistant *August 2014-December 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.

University of Rochester **Rochester, NY**

Research Experience for Undergraduates (REU) *June 2013-August 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 *June 2012-August 2012*

- Prototyped new internal procurement system for satellite data transfers with JavaServer Pages.

SpeculatingStocks **Indiana, PA**

Web Developer *June 2011-August 2012*

- Developed back-end tools to automatically scrape websites for stock information and news. Prototyped social media features such as followers, likes, and shares to increase engagement on a financial-news oriented web site.
- Created and managed SQL databases to store constantly updating stock information.

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

- **"Line Intensity Mapping with Neural Networks'** April 22nd, 2019.
  talk at Johns Hopkins CAS Wine & Cheese, Johns Hopkins University.
- **"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