

Alexander Moskowitz, Ph. D.

Curriculum Vitae

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EDUCATION

Carnegie Mellon University, Pittsburgh, PA
Ph.D. in Physics.

August 2021

Brown University, Providence, RI.
B.Sc. in Physics. Graduated Magna Cum Laude, Phi Beta Kappa, Sigma Chi

May 2015

RESEARCH INTERESTS

Milky Way Satellite Galaxies; Dark Matter; Modifications to General Relativity; Machine Learning

RESEARCH EXPERIENCE

Physics Department, Carnegie Mellon University
Graduate Research Assistant

Distribution of Stars Project:

2016-2019

- Developed efficient models to aid supercomputing and tested models on simulated dwarf spheroidal galaxies (dSphs)
- Identified conditions under which models identified anomalous stellar distributions
- Used Maximum Likelihood and Markov chain Monte Carlo to fit models to data from almost all known dSphs
- First to identify steeper stellar distributions in several galaxies
- Lead author responsible for writing text and constructing plots for peer-reviewed first-author paper

Emergent Gravity Project:

2018-present

- Combined wide-field photometric data and targeted spectroscopic data into a single data product
- Developed a novel likelihood function to fit positions and velocities of stars simultaneously
- Created methods for automatic rejection of anomalous data points
- Transformed theoretical formulae of Emergent Gravity into testable predictions
- Compared Emergent Gravity models to dark matter models through the analysis of the Bayes Factor, velocity dispersion profiles, and stellar mass to light ratios.

Binary Stars Project:

2020-present

- Trained Neural Networks and Random Forest machine learning algorithms to differentiate binary stars from single stars in spectroscopic observations
- Simulated millions of mock observations with accurate treatment of observational uncertainties
- Compared machine learning to traditional Markov Chain Monte Carlo and statistical techniques for differentiating binary stars from single stars

PUBLICATIONS

Stellar Density Profiles of Dwarf Spheroidal Galaxies. 2020; The Astrophysical Journal, Volume 892, Number 1, 27.
doi.org/10.3847/1538-4357/ab7459

Proposed low-energy absolute calibration of nuclear recoils in a dual-phase noble element TPC using D-D neutron scattering kinematics. 2017; Nuclear Instruments and Methods in Physics Research Section A, Volume 851, 68-81.
doi.org/10.1016/j.nima.2017.01.053

PUBLICATIONS IN PREPARATION

Comparing Emergent Gravity to Dark Matter in Dwarf Spheroidal Galaxies. 2021.
Classification of Binary Stars via Machine Learning Algorithms. 2021.

AWARDS

- George E., S 1945, and Marjorie S. Pake Presidential Fellowship in Physics (2016)
- NASA Rhode Island Space Grant (2014)
- Brown Undergraduate Teaching and Research Award (2013)

TEACHING EXPERIENCE

Physics Department, Carnegie Mellon University

2015-2021

Teaching Assistant

- Teaching Assistant/Grader for: Introductory Astronomy, Physics for Future Presidents, Physics of Musical Sound, Science and Science Fiction, Basic Experimental Physics, Experimental Physics, Modern Physics Laboratory, and General Relativity.
- Led problem sessions and office hours, developed homework assignments
- Participant in Carnegie Mellon's Future Faculty Program to acquire research-based teaching methods, 2019-2020
- Selected by physics department to train new teaching assistants, 2015-current

OUTREACH

Carnegie Science Center, Pittsburgh, PA

2016-present

Expert Volunteer

- Performed visitor Q&A sessions, planetarium shows, and educational demonstrations during public telescope events
- Experienced with computerized and manual telescopes, as well as planetarium software
- Presented lectures for adults and school programming

Steel City Improv Theater, Pittsburgh, PA

2017-present

Expert Interviewee

- Interviewed as part of 24-hour fundraising drive, 2020
- Guest on "Absolute Truth," 2020

SKILLS and INTERESTS

Programming: Mathematical applications of Python, Fortran, and Mathematica.

Observational: Created optical fiber maps and hand plugged optical fibers into plate masks for 6 nights of nighttime observations at the 6.5-meter Magellan/Clay telescope at Las Campanas Observatory, Chile.

Software: Experienced with Linux, Mac, and Windows operating systems

Interests: Cellist, performing with music graduate students at CMU school of music (3 years); house team member at Steel City Improv Theater (3 years); Level 2 dog handler at Animal Friends Shelter (1 year).

PRESENTATIONS

Stellar Density Profiles of Dwarf Spheroidal Galaxies. Presented at AAS 235, Jan 5, 2020.

Comparing Emergent Gravity to Dark Matter in Dwarf Spheroidal Galaxies. Presented at AAS 237, Jan 11, 2021.