Eric Putney

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EDUCATION

Ph.D Candidate | *Rutgers, The State University of New Jersey* — August 2020 – Present

B.S *summa cum laude* Physics | *The University of New Mexico* — September 2016 – May 2020

RESEARCH

Normalizing Flows Learning Galactic Dynamics — January 2021 – Present
Advisor: Dr. Matthew Buckley — *Rutgers | New Brunswick, New Jersey*

- Fully data-driven measurement of the local Milky Way's gravitational potential and dark matter density.
- Training normalizing flows to learn the six-dimensional kinematic phase space of nearby stars from Gaia DR3 to solve the general equilibrium collisionless Boltzmann equation.
- Developed novel technique for unbiasing the kinematic phase space of stars obscured by dust extinction.
- Developed non-parametric Jeans analysis for benchmarking our flows technique in a hydrodynamically-simulated galaxy.

Neutrino Flavor Dynamics in Core-Collapse Supernovae — October 2018 – May 2020
Undergraduate Honors Thesis | Advisor: Dr. Huaiyu Duan — *UNM | Albuquerque, New Mexico*

- Analyzed the evolution of dense neutrino gases evolving in supernovae.
- Compared numerical simulations of neutrino oscillations in dense matter to analytic predictions.

GBAR Positronium Excitation Laser — June 2019 – August 2019
NSF REU | Advisor: Dr. Pauline Comini — *CERN | Geneva, Switzerland*

- Calibrated the positronium excitation beam stabilization and thermal management, delivered beamline to the positronium chamber to produce neutral antihydrogren.
- Implemented remote instrumentation of the positronium excitation laser.

PRESENTATIONS AND PUBLICATIONS

Publications

- Mapping Dark Matter in the Milky Way using Normalizing Flows and Gaia DR3 arXiv astro-ph, May 2023 & pending PRX submission
- Measuring Galactic Dark Matter through Unsupervised Machine Learning. arXiv astro-ph & hep-ph, May 2022
- What Dark Matter Halos Tell Us About Dark Matter. (Unpublished Masters Thesis, November 2021)
- Numerical Analysis of Collective Neutrino Oscillations in Dense Neutrino Media. (Unpublished Honors Thesis, May 2020)
- Measurement of the radial matrix elements for the $6s^2S_{1/2} \rightarrow 7p^2P_J$ transitions in cesium. (Published June 2019, *DOI 10.1103/PhysRevA.99.062510*)

Presentations

- Mapping Dark Matter in the Milky Way using Normalizing Flows and Gaia DR3 | November 2023, ML4Jets 2023, DESY. Abstract, Slides.

- Measuring Galactic dark matter through unsupervised machine learning | May 2023, Phenomenology 2023 Symposium, University of Pittsburgh. Abstract, Slides.
- Measuring Galactic Dark Matter through Unsupervised Machine Learning | January 2023, 241st AAS Meeting, Seattle WA. Abstract.
- What Dark Matter Halos Tell Us About Dark Matter | November 2021, Rutgers. *Slides*.
- Numerical Analysis of Collective Neutrino Oscillations in Dense Neutrino Media | April 2020, UNM. *Slides*, *Poster*.
- Laser Control for the Production of Excited Positronium in GBAR. | August 2019, CERN. *Slides*.
- Numerical Analysis of Collective Neutrino Oscillations in Core-Collapse Supernovae with Multidimensional Models | April 2019, UNM Physics Day. *Slides*.
- Precision Measurement of the $6S \rightarrow 7P_{1/2}$ Cesium Transition Radial Matrix Element via Simultaneous Absorption Spectroscopy. | October 2018 APS Four Corners, University of Utah. *Abstract*, *Slides*.
- Analysis of Diffusion of a Rhodium Adatom on a Tungsten (111) Surface. | October 2017 APS Four Corners, Colorado State University. *Abstract*, *Poster*.

SCHOLARSHIPS AND AWARDS

2021 Rutgers Academic Fellowship

2020 Eion Gray Scholarship

2020 UNM Feynman Award

2019 Goldwater Scholar

2019 Rayburn Outstanding Student in Laboratory Physics and Astronomy

REFERENCES

Dr. Matthew Buckley
Rutgers, The State University of New Jersey, Department of Physics and Astronomy
mbuckley@physics.rutgers.edu

Dr. David Shih – Rutgers, The State University of New Jersey
shih@physics.rutgers.edu

Dr. Huaiyu Duan
The University of New Mexico, Department of Physics and Astronomy
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