MATTHEW HO

matthew.annam.ho@gmail.com
https://www.andrew.cmu.edu/user/mho1/

EDUCATION

Carnegie Mellon University August 2017 - May 2022
Ph.D., M.S. in Physics *Pittsburgh, PA*
Focus: Machine Learning Applications in Observational Cosmology
Advisor: Hy Trac
GPA: 3.91/4.0

University of Illinois at Urbana-Champaign August 2014 - May 2017
B.S. in Engineering Physics; Minor in Mathematics *Urbana, IL*
GPA: 3.54/4.0

EXPERIENCE

Research Assistant, Cosmology September 2017 - Present
Hy Trac Group, McWilliams Center for Cosmology *Pittsburgh, Pa*

- Developed a novel deep learning method for estimating dynamical masses of galaxy clusters which reduced predictive scatter of traditional techniques by a factor of three.
- Contributed to advancements in verification of uncertainties derived from approximate Bayesian neural networks.
- Served as a lead developer for multiple cluster cosmology and weak lensing analysis projects in the LSST Dark Energy Science Collaboration.
- Served on a McWilliams Center faculty panel to design and commission the new Vera computing cluster jointly with the Pittsburgh Supercomputing Center.

IT Administrator December 2019 - May 2020
Department of Physics, Carnegie Mellon University *Pittsburgh, Pa*

- Managed and maintained laboratory computers, computing clusters, and technical research equipment.
- Successfully planned, organized, and executed technical logistics of the department's transition to online teaching during the Covid-19 pandemic.

Teaching Assistant September 2017 - December 2019
Department of Physics, Carnegie Mellon University *Pittsburgh, Pa*

- Served as a recitation teacher and substitute lecturer for introductory undergraduate physics courses including Physics I/II for Engineering Students (33-141/33-142), Physics for Future Presidents (33-115), and Matter & Interactions I (33-151).
- Received an average teaching evaluation of 4.82/5 relative to a college-wide average of 4.25/5.

Quantitative Trading Intern May - August 2016, 2017
Virtu Financial (formerly KCG Holdings LLC) *New York City, NY; Chicago, IL*

- Applied regression analysis and machine learning techniques to signal research in ETF, Eurodollar future, and commodity future financial markets.

Undergraduate Researcher, Condensed Matter Theory May 2015 - May 2017
Lucas Wagner Group, University of Illinois at Urbana Champaign *Urbana, IL*

- Developed Materials Search, a full-stack data mining software designed to gather, parse, and analyze published results regarding magnetic and electronic properties of known superconductors.
- Identified new potential superconductors based on structural patterns of known materials.

Undergraduate Researcher, Informatics September 2014 - May 2015
Guy Garnett Group, National Center for Supercomputing Applications *Urbana, IL*

- Designed a set of motion classifiers based on Laban Movement Analysis to aid computer detection of human movements.
- Implemented a simulation control system to visualize artistic expression in live performance.

RELEVANT GRADUATE COURSEWORK

Physics

Quantum Mechanics I/II (33-755/33-756), Classical Electrodynamics I (33-761), Statistical Mechanics (33-765), Intro. to Cosmology (33-778), Particle Physics (PT-705)

Machine Learning

Intro. to Machine Learning (10-701), Probability & Mathematical Statistics (36-700), Advanced ML Theory & Method (10-716), Probabilistic Graphical Models (10-708), Convex Optimization (10-725)

SELECTED PUBLICATIONS

"Auditing Bayesian Prediction Uncertainties" Farahi, A., **Ho, M.**, Chen, Y. 2020, Submitted to AAAI

"Approximate Bayesian Uncertainties on Deep Learning Dynamical Mass Estimates of Galaxy Clusters" **Ho, M.**, Farahi, A., Rau, M. M., Trac, H. 2020, arXiv:2006.13231, Submitted to ApJ

"Aging Halos: Implications of the Magnitude Gap on Conditional Statistics of Stellar and Gas Properties of Massive Halos" Farahi, A., **Ho, M.**, & Trac, H. 2020 MNRAS, 255

"A Robust and Efficient Deep Learning Method for Dynamical Mass Measurements of Galaxy Clusters" **Ho, M.**, Rau, M. M., Ntampaka, M., et al. 2019, ApJ, 887, 1

SELECTED TALKS

"Galaxy Cluster Mass Estimation Using Deep Learning" Astrostatistics Interest Group 2020 Student Paper Finalists, Joint Statistical Meeting, August 2019

"Galaxy Cluster Mass Estimation Using Deep Learning" Weak Lensing Seminar, Universitaets-Sternwarte der Ludwig-Maximilians-Universitaet, June 2019

"A Robust and Efficient Deep Learning Method for Dynamical Mass Measurements of Galaxy Clusters" Artificial Intelligence Methods in Cosmology Workshop, Ascona, Switzerland, June 2019

"Improving Mass Measurements of Galaxy Clusters through Applications of Machine Learning" Machine Learning in Science and Engineering Conference, Carnegie Mellon University, May 2018

"Dynamic Particle Control and Simulation" NCSA Students Pushing Innovation Seminar, National Center for Supercomputing Applications, April 2015

"Gestural Recognition of Human Expression" NCSA Students Pushing Innovation Seminar, National Center for Supercomputing Applications, December 2014, *Awarded Top 3 Presenter*

ACTIVITES & LEADERSHIP

Project Lead September 2019 - May 2020
Data Science Club, Carnegie Mellon University

Led a diverse team of undergraduate and graduate students in creating artistic visualizations of astrophysical simulations using generative adversarial neural networks.

Industry Speaker Series Organizer December 2017 - Present
Department of Physics, Carnegie Mellon University

Established a semesterly seminar series to bring in CMU alumni and industry professionals to discuss careers outside of academia for science PhDs. Worked closely with the physics department head and representatives from the Mellon College of Science Corporate Relations Office to construct a seminar program that sufficiently addressed the professional interests of CMU's graduate students.

President December 2015 - December 2016
Triangle Fraternity - Illinois

Led and organized an engineering fraternity of over 80 members. Fostered the establishment of two independent member-run technology startups, a green energy microgrid project, and a 10% increase in overall house GPA.

Design Lead September 2014 - May 2016
iRobotics, University of Illinois at Urbana-Champaign

Led design and construction of motorized robotic systems to place in the Top 5 teams at the Midwestern Robotics Design Competition for two subsequent years.

Chemical Lead September 2014 - May 2016

Student Space Systems, University of Illinois at Urbana-Champaign

Led theoretical analysis and performance prediction of a Class N hybrid rocket engine design.

MEDIA

Murray, Elizabeth. "3 NCSA Interns Honored for Progress on Projects." NCSA Press Room *12 March 2015*: n. pag. National Center for Supercomputing Applications. University of Illinois. Web. Link.

Rivenberg, Paul. "Fusor Team Wins CPS Plasma Excellence Award at Intel ISEF." Plasma Page 16 *July 2013*: 1. Coalition for Plasma Science. Web. Link

RESEARCH INTERESTS

Physics	Observational Cosmology, Galaxy Clusters, Large Scale Structure, Cosmological Simulation, Weak Lensing
Data Science	Machine Learning, Deep Learning, Bayesian Modeling, Approximate Inference, Nonparametric Statistics, Generative Models, Reinforcement Learning, Genetic Algorithms

LinkedIn: /matthewho3 **Github**: /maho3