

# Ana-Roxana Pop

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## EDUCATION

### Harvard University

Cambridge, MA

#### Ph.D., Astronomy and Astrophysics

expected May 2021

Secondary Field: Computational Science and Engineering, GPA 4.00/4.00

Awards: NASA Earth and Space Science Fellowship (top 5%)

Relevant Coursework: Machine Learning; Large Scale Data and Parallel Computing; Advanced Scientific Computing

### Princeton University

Princeton, NJ

#### A.B., Physics, *summa cum laude*, GPA 3.93/4.00

2015

Awards: Highest Honors, Phi Beta Kappa, Sigma Xi Research Honor Society, Kusaka Memorial Prize, Shapiro Prize, Gold Medal - International Physics Olympiad (IPhO) 2011

## TECHNICAL SKILLS

**Programming & Computation:** Python, Java, C, MATLAB, NumPy, Pandas, SQL, AWS, LaTeX, HTML, Linux, Git

**Machine Learning & Statistics:** regression, classification, clustering, reinforcement learning, Bayesian inference, deep learning, Markov chain Monte Carlo (MCMC)

## RESEARCH AND COMPUTATIONAL EXPERIENCE

### Harvard University

Cambridge, MA

NASA Graduate Research Fellow, Ph.D. Thesis

2018 – Present

- Developed post-processing pipeline for large scale dataset (over 500TB) from cosmological simulation of galaxies
- Produced high-fidelity mock X-ray observations of over 100k galaxies, accounting for observational bias and scatter
- Designed new statistical method using geometric means that improved slope estimates in logarithmic space
- Formulated novel mathematical model for a smoothly-broken power law and robust bootstrap regression model
- Achieved reliable predictions for galaxies spanning 3 orders of magnitude with major impact for future space missions

Graduate Course Project (Machine Learning)

Spring 2020

- Designed reinforcement learning algorithm to play side-scrolling video game and surpassed human score after 40 epochs

Graduate Research Fellow, Master Thesis

2015 – 2018

- Developed merger trees tracking the history of 1M+ stars in a large-volume simulation of the Universe
- Achieved 17x increased efficiency by incorporating hash tables to track and store over 1 million stellar trajectories
- Built code using logistic regression and SVM to classify galaxy mergers that create unique shell features
- Discovered new model proving major galaxy collisions have highest likelihood to form shells

Team Member, Graduate Course Final Project (Extreme Scale Data and Parallel Computing)

Spring 2018

- Developed GPU-accelerated, MPI-parallel N-body gravitation code executed on 576 cores/12 nodes with 25x speed-up

### Perimeter Institute

Waterloo, Canada

Research Fellow

Summer 2014

- Developed theoretical model for axion dark matter and numerically solved the Schrödinger-Poisson system
- Built MCMC pipeline to fit galaxy observations and published new limits on axion dark matter mass (150+ citations)

## LEADERSHIP EXPERIENCE

**Leader of the United States Team** | International Astronomy and Astrophysics Olympiad *Phuket, Thailand* 2017

- Devised novel problems for 2 national selection rounds and selected 5 students from 222 participants
- Co-organized one-week training camp for 15 students at MIT; coached the US team through weekly training video calls
- Achieved best result in history of US participations at IOAA: team placed 2nd in the world and won 2 Gold Medals

**Mentor and Scientific Adviser** | Banneker & Aztlán Institute

Cambridge, MA 2017

- Devised and directly supervised student research project as part of 10-week summer astronomy program for undergraduate students of color; provided training in programming, research methods, and science communication
- Project culminated with student giving her 1st conference talk at the annual American Astronomical Society Meeting

**Graduate Teaching Fellow** | Harvard University

Cambridge, MA 2016-2019

- Led lectures on Numerical Methods and Astrophysics; 2-times awarded Derek Bok Award for Teaching Excellence

## PUBLICATIONS AND CONFERENCES

5 publications (300+ citations) and 1 additional submitted manuscript in 2020; 17 conference presentations (8 international)