

Preet Patel

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SUMMARY

Highly motivated learner with a background in physics, math, python, HPC, data science, and statistics. I work independently and collaboratively and possess an arsenal of technical communication skills. Adept at using quantitative analyses to approach difficult & undefined problems which lack existing procedures.

EDUCATION

M.S. Physics	University of California, Davis	2020 - 2023
B.S. Physics	University of Michigan, Ann Arbor	2015 - 2019
B.S. Astrophysics	University of Michigan, Ann Arbor	2015 - 2019
<i>Minor in Statistics</i>		

PROJECTS

Python Module Development and Implementation (Element Tracers) - [Github](#)

- Implemented new models and made them accessible to entire collaboration (200+ people), enabling new and ongoing projects.
- **Optimized existing code** for element tracer processing from 2 classes into 1, **with a speedup over 50%** for use with ML.

Maximum Likelihood Estimation and MCMC - [Github](#)

- Wrote data analysis pipeline to analyze raw observational data with simple means and variance with fits to a gaussian profile; a maximum likelihood estimation after constructing a log-likelihood function; an MCMC algorithm (AstroPy/Emcee) to convergence.
- Successfully determined the wavelength of light at which the emission occurs, identifying the source for astrophysical calibration.

Metropolis-Hastings Algorithm: Galaxy Mass Luminosity Relation - [Github](#)

- Manually implemented an algorithm using a Metropolis-step to determine the best fit model to galaxy-catalog data, in mass-luminosity space, out to 50,000 steps with a burn in of 2,000 steps.
- Successfully converged on the observed/theoretically predicted galaxy mass-luminosity relation.

EXPERIENCE

Graduate Researcher (Astrophysics)

March 2021 - September 2023

University of California - Davis

- Utilized **Python**, parallel processing, supercomputers, advanced mathematics, **ML methods** (MCMC, likelihood analysis), scaling analysis, and hydrodynamic simulations to complete multiple projects with the FIRE collaboration.
- Parsed through several **petabytes** of simulation data stored as HDF5s across national supercomputers. Additionally **optimized runtime by 50%**. Result: 1 publication, with at least 2 more in prep. A subset of this data publicly found at <https://fire.northwestern.edu/>.

Teaching Assistant (TA)

October 2020 - April 2023

University of California - Davis

- Used **data visualization**, verbal communication, black/whiteboard skills to teach students about complex physical phenomena across various subfields of physics.
- (example: quantum mechanics for non-STEM majors, with detailed lectures and spontaneous visualizations) Class sizes: 30-250 students, for 1 to 3 hours per session.

Bluewaters Student Intern

May 2018 - May 2019

University of California - Davis

- Created my own computing cluster using laptops, and optimized programs on HPC systems with CUDA, OpenMP and MPI.
- Explored parallelization based on job type and architecture (**GPU vs CPU**) to create n-body (10^5) galaxy simulations.

SKILLS

Hard Skills: Git version control; high performance computing, **Python** and **data analysis** libraries (Numpy, Scipy, Matplotlib, **Pandas**); **big data analytics**, visualization, and machine learning (**ML**) analysis (Emcee, **Tensorflow**); post-graduate **mathematical** skills; LaTeX; Linux/Unix; **SQL**; OpenMP/MPI

Soft Skills: English communication skills, strong presentation skills, motivated and independent self-learner, persuasive writing, critical thinking, curiosity, teamwork, adaptability

Other: English, Gujarati, working proficiency in Spanish, Graphic Design (Photoshop, Cinema 4D), Media Production (Sony Vegas, After Effects)