Brent Tan

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Summary

Research Scientist and Computational Astrophysicist with expertise in numerical simulations, algorithm development, and scientific Machine Learning. Proven track record of leveraging computational methods to solve complex multiphysics problems in galaxy evolution, contributing to research proposals, and mentoring graduate students. 5 First Author Publications and 170+ Citations (Click here for a complete list). Seeking to apply skills in data-driven modeling and high performance computing to industry challenges. Always eager to learn new technologies and tackle exciting problems.

Technical Skills

Programming Languages: Python, C++, Linux/UNIX, Bash

Machine Learning/Deep Learning Frameworks: JAX, PyTorch

Libraries & Tools: NumPy, SciPy, Git, LaTeX, Matplotlib, Pandas, SQL, Kokkos

Experience

Scientific Software Engineer 2025 – Present
Cornell Center for Astrophysics and Planetary Science, Cornell University *Ithaca, NY*
- Built a digital twin of a galaxy. This is a GPU based state-of-the-art adaptive mesh magnetohydrodynamics exascale simulation.
- Debugged and refactored legacy codes for galactic cooling flows to improve reliability and maintainability.
- Built personal website using React (Next.js, Chakra, Framer Motion) and Three.js.

Flatiron Research Fellow 2023 – 2025
Center for Computational Astrophysics, Flatiron Institute, Simons Foundation *New York, NY*
- Nationally competitive postdoctoral fellowship in the computational sciences.
- Core developer of novel sub-grid models for galaxy simulations using Neural ODEs and Symbolic Regression. Accepted to **NeurIPS 2024** ML and the Physical Sciences Workshop (Click here for the paper). Leveraged **pytorch, JAX, Diffrax, Equinox and PySR** to increase accuracy and decrease runtime compared to traditional methods.
- Mentored multiple junior graduate students in scientific HPC and research.

Graduate Researcher 2017 – 2023
University of California Santa Barbara *Santa Barbara, CA*
- Developed an optimized radiative cooling module, achieving over 300% improvement in speed for large-scale simulations.
- Architected and implemented data processing pipelines to analyze large datasets (tens of TBs) of galactic winds generated by running highly parallelized fluid dynamical simulations (several million CPU hours) run on national supercomputing clusters.
- Modeled galactic rain using wind-tunnel setups to study the evolution of clouds in both galactic atmospheres and the solar corona. Developed tracking algorithms to stay in the cloud's frame of reference. Tested model predictions against observations.
- Developed a cross-disciplinary model of turbulent radiative mixing layers and implemented multiple new physics modules.
- Produced data visualizations displayed in the Santa Barbara Museum of Art.

Undergraduate Researcher 2015 – 2017
McWilliams Center for Cosmology and Astrophysics, Carnegie Mellon University *Pittsburgh, PA*
- Contributed to the open-source project GALSIM by implementing functionality for simulating images of astronomical objects.
- Developed an error analysis model to quantify the impact of light polarization effects on weak lensing systematics in the upcoming Wide-Field Infrared Survey Telescope.
- Implemented a parallel multi-KD-tree algorithm to efficiently compute 2-point cross-correlation statistics for galaxies in cosmic voids. Explored viability of developing distributed algorithms for similar problems.
- Scaled a novel algorithm for filament identification in Cosmic Web Reconstruction to be able to run on large 3D datasets.

Education

University of California-Santa Barbara Santa Barbara, CA
Ph.D. in Astrophysics. GPA: 3.9 *2017 – 2023*
- TA for multiple courses including Introduction to Scientific Computing. Summer high school plasma physics instructor.

Carnegie Mellon University Pittsburgh, PA
B.S. in Physics with a Minor in Computer Science. GPA: 3.82 *2013 – 2017*
- College and University Honors, Phi Kappa Phi, Phi Beta Kappa, Science and Humanities Scholar.
- 2^{nd} prize for final project in 15-112 Fundamentals of Computing implementing algorithms that replicate paintings stroke-wise.
- Other CS Classes: Parallel and Sequential Data Structures and Algorithms, Computer Vision, Computer Graphics, Computer Systems, Principles of Imperative Computation, Principles of Functional Programming, Great Ideas in Theoretical Computer Science