Peter Scherbak

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Summary

PhD candidate (Caltech, 2026) specializing in computational modeling and large-scale numerical simulations of dynamical systems. Proficient in Python, C/C++, and HPC environments; experienced in developing high-dimensional simulations from physics-based principles, analyzing simulation outputs and astronomical datasets through numerical and statistical methods, and making testable predictions. Eager to apply these methods to multi-dimensional, data-rich problems in industry, where quantitative modeling and physical intuition drive real decisions.

Education

Ph.D., California Institute of Technology 2026 (expected)
Astrophysics Advisor: Jim Fuller

M.S., California Institute of Technology 2023
Astrophysics Advisor: Jim Fuller

B.A., Cornell University 2020
Physics *summa cum laude*
Astronomy *summa cum laude*
Cornell University Dean's List (2016–2020)
Yervant Terzian Undergraduate Scholarship (2019–2020)

Skills

Coding Python (NumPy/SciPy/pandas/PyTorch), C, C++, Java, Fortran 90, Bash, LaTeX, SQL, ADQL

Software PLUTO hydrodynamics code, MESA stellar evolutionary code, Athena++ radiation hydrodynamics code, Gyre stellar oscillation code, PROSPECTOR SED-fitting code, SLURM, MPI (OpenMPI), SAOImage Ds9, Git/GitHub

Quantitative methods Statistical modeling, Bayesian inference (dynesty)

Experience

California Institute of Technology, Pasadena, CA 2020 – present
Graduate Research Assistant

- Developing machine learning models (PyTorch) to classify and characterize stellar oscillation modes from photometric time-series data
- Developed hydrodynamic simulations of binary mass transfer using PLUTO and Athena++, modeling circumbinary outflow structure and angular momentum losses across mass transfer rates
- Led and managed NSF ACCESS Allocation PHY250215 (1,500,000 core-hours, 2025–2026): competed for and was awarded HPC resources to run large-scale binary stellar hydrodynamics simulations
- Applied statistical modeling and Bayesian methods to infer population-level parameters of supernova-hosting galaxies from observational datasets
- Built and evolved a large grid of binary stellar models in MESA to study common envelope evolution, magnetic braking, and tidal excitation of internal waves

Experience (continued)

Teaching Assistant

- Led recitation sections and assisted students with problem sets for Physics of the Interstellar Medium (2022) and Cosmology (2021)

Selected Talks

- "Circumbinary Outflows and Angular Momentum Losses across Mass Transfer Rates" ZTF Theory Network Meeting, Santa Margarita, CA (2025)
- "Host galaxies and delay times of Ca-rich gap transients vs 91-bg like SNe and Type Ia SNe", Cornell University (2025)
- "Rapid binary mass transfer: Outflows and AM losses through L2", 41st Liége International Astrophysical Colloquium, University of Liége, Belgium (2024)
- "White dwarf binaries suggest a common envelope efficiency $\alpha \sim 1/3$", White Dwarfs from Physics to Astrophysics, KITP, UCSB, CA (2022)

IBM Research Center, Yorktown Heights, NY 2019

Undergraduate Researcher — Quantum Computing

- Analyzed superconducting qubit coherence times as a function of dilution refrigerator parameters, characterizing performance degradation and identifying optimal operating regimes

Princeton University, Princeton, NJ 2019

Undergraduate Researcher — Ultracold Quantum Gases Lab

- Aligned laser optics and tuned trapping parameters to produce a molecular Bose-Einstein condensate in an ultracold quantum gases experiment
- Talk: "Creation and Confinement of a Rubidium BEC in Preparation for Ultracold NaRb Formation", QURIP presentation

Cornell University, Ithaca, NY 2016 – 2020

Undergraduate Researcher — Radio Astronomy Group

- Developed likelihood-based statistical framework to constrain Fast Radio Burst occurrence rates and repetition probabilities using ASKAP and Parkes observational data

Research Publications

P. Scherbak, W. Lu, and J. Fuller, "Radiatively Cooled Binary Mass Transfer: Flow Structure, Luminosities, and L2 Outflows Across Mass Transfer Rates," *PASP*, 138, 034206 (2026)

P. Scherbak, A. Polin, M. Kasliwal, et al., "Characterizing the Host Galaxies and Delay Times of Ca-rich Gap Transients vs 91bg-like SNe and Normal Type Ia SNe," *PASP*, 137, 114207 (2025)

P. Scherbak, W. Lu, and J. Fuller, "Rapid Binary Mass Transfer: Circumbinary Outflows and Angular Momentum Losses," *The Astrophysical Journal*, 990, 172 (2025)

P. Scherbak and J. Fuller, "Ultrashort-Period WD Binaries Are Not Undergoing Strong Tidal Heating," *The Astrophysical Journal*, 962, 185 (2024)

P. Scherbak and J. Fuller, "White Dwarf Binaries Suggest a Common Envelope Efficiency $\alpha \sim 1/3$," *Monthly Notices of the Royal Astronomical Society*, 518, 3966 (2023)