TROY K. TSUBOTA
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EDUCATION

University of California, Berkeley **August 2021–May 2025**
B.A. Physics, B.A. Computer Science, B.A. Applied Mathematics *GPA: 4.0/4.0*

Relevant Coursework: Analytical Mechanics, Electromagnetism and Optics, Quantum Mechanics I/II, Thermodynamics and Statistical Mechanics, Molecular Biophysics, Instrumentation Laboratory, The Structure and Interpretation of Computer Programs, Data Structures, Computer Architecture, Probability and Random Processes, Digital Design and Integrated Circuits, Field-Programmable Gate Array (FPGA) Laboratory, Operating Systems and System Programming, Machine Learning, Discrete Mathematics, Real Analysis, Complex Analysis, Organic Chemistry I, Macroeconomics (Math Intensive)

EXPERIENCE

Research Intern **May 2024–present**
Apple

Undergraduate Researcher **March 2022–present**
UC Berkeley Department of Physics (Project Investigator: Prof. Edgar Knobloch)
- Create numerical simulations of partial differential equations with spectral and finite-difference methods.
- Use nonlinear dynamics theory to explain and generalize results from simulations.

Undergraduate Student Instructor (Teaching Assistant) – Math 1B – Calculus **August 2023–May 2024**
UC Berkeley Department of Mathematics (Prof. Mark Haiman – Fall 2023, Prof. Alexander Paulin – Spring 2024)
- Taught two 30-student discussion sections, create worksheets, host in-person and online office hours, grade exams.
- Guided students through group work on integration techniques, infinite series, and differential equations.

Undergraduate Researcher **December 2021–January 2024**
UC Berkeley Department of Astronomy (Project Investigator: Dr. Michael Wong)
- Create optimized Python routines for general-purpose analysis of planetary Hubble Space Telescope images: alignment, deconvolution, map projection with latitude/longitude coordinates, and limb-darkening correction.
- Analyze wave and vortex dynamics using image processing and computational geometry algorithms.

Research Intern **May 2023–August 2023**
Purdue University Department of Physics and Astronomy (Project Investigator: Prof. Tongcang Li)
- Designed waveguides with COMSOL Multiphysics to improve the brightness of spin qubits in hexagonal boron nitride for quantum sensing applications in integrated circuits and lithium-ion batteries.
- Prepared GDS files for nanofabrication and tested fabricated designs in optical experiments with confocal microscopy.

Course Tutor – CS 61A – The Structure and Interpretation of Computer Programs **January 2023–May 2023**
UC Berkeley Department of Electrical Engineering and Computer Sciences
- Hosted office hours and taught small group sections to provide additional support for the course.
- Created and updated homework, lab, and project assignments to align with the latest curriculum.

PUBLICATIONS

1. **Troy Tsubota**, Chang Liu, Benjamin Foster, and Edgar Knobloch (2024). Bifurcation delay and front propagation in the real Ginzburg-Landau equation on a time-dependent domain. *Physical Review E* **109**, 044210. doi.org/10.1103/PhysRevE.109.044210.
2. **Troy K. Tsubota**, Michael H. Wong, Tom Stallard, Xi Zhang, and Amy A. Simon (2023). UV-Dark Polar Ovals on Jupiter Trace the Depth of Magnetosphere-Atmosphere Connection (under review). doi.org/10.21203/rs.3.rs-3370920/v1.
3. A. James, P.G.J. Irwin, J. Dobinson, M.H. Wong, **Troy K. Tsubota**, A.A. Simon et al. (2023). The temporal brightening of Uranus' northern polar hood from HST/WFC3 and HST/STIS observations. *Journal of Geophysical Research: Planets* **128**, e2023JE007904. doi.org/10.1029/2023JE007904.

CONFERENCE PRESENTATIONS

1. Real Ginzburg-Landau equation on a time-dependent domain (contributed poster). Dynamics Days, Davis, CA, January 2024.
2. UV-dark polar ovals on Jupiter (contributed talk). Magnetospheres in the Outer Solar System Session, AGU Fall Meeting, San Francisco, CA, December 2023.
3. UV-dark polar ovals on Jupiter (invited poster). Bay Area Planetary Science Conference, Santa Cruz, CA, September 2023.

AWARDS

1. Outstanding Graduate Student Instructor (OGSI) Award, Spring 2024.
2. National Science Foundation Research Experience for Undergraduates (REU) at Purdue University, Summer 2023.
3. UC Berkeley Physics Innovators Initiative (Pi^2) Summer Scholar, Summer 2022.
4. UC Berkeley Physics-and-Astronomy Undergraduate Research Scholar (BPURS), Spring 2023, Fall 2023, Spring 2024.

PROJECTS

RISC-V CPU **October 2023–December 2023**

5-stage pipelined RISC-V CPU built in Verilog on a Xilinx FPGA with memory-mapped I/O and throughput optimization. Won the Fall 2023 Apple design challenge.

Pintos **September 2023–December 2023**

Operating system built with C and x86 with support for multithreaded user programs and an extensible file system.

Mathematics Directed Reading Program **January 2022–May 2022**

Guided study of manifolds and differential forms with graduate student mentor Zhongkai Tao.

Physics Directed Reading Program **January 2022–May 2022**

Guided study of fluid dynamics with graduate student mentor Ben Foster.

VOLUNTEERING

President, *Society of Physics Students at Berkeley (SPS)* **May 2024–present**

Lead ~20 SPS officers to coordinate academic and social events for UC Berkeley physics students each week.

Outreach Chair, *Society of Physics Students at Berkeley (SPS)* **May 2022–May 2024**

Led a committee of physics students in public science outreach. Taught electricity and magnetism in elementary schools through Bay Area Scientists Inspiring Students (BASIS), with more than 40 classrooms reached. Helped organize activities with the physics department to recruit prospective students.

Undergraduate Representative, *UC Berkeley Physics Major Course Committee* **September 2023–present**

Review the physics major curriculum and provide suggestions for improvements. Member of the Physics 5 series (honors introductory physics sequence) subcommittee.

Undergraduate Representative, *UC Berkeley Physics Undergraduate Research Fair Committee* **September 2023–present**

Plan the physics department's semesterly undergraduate research fair.

Mentor, *Mathematics and Physical Sciences (MPS) Scholars* **September 2023–May 2024**

Mentor a small group of first-year students in navigating available opportunities in the physics department and UC Berkeley.

Teacher, *Splash@Berkeley* **Spring 2022, Fall 2022, Spring 2023**

Taught a 1-hour lesson on mathematical cryptography to high school students.

CS 61A Associate Mentor, *Computer Science Mentors* **January 2022–May 2023**

Taught a supplemental small group section of CS 61A twice per week for students with no prior experience in computer science.

SKILLS

Languages: Python, C, Verilog, SystemVerilog, RISC-V, x86, Rust, Java, IDL, SQL, JavaScript, Objective-C, Swift
Tools/Libraries: NumPy, SciPy, Matplotlib, COMSOL Multiphysics, Ansys Lumerical, MATLAB, Mathematica, PyTorch, Synopsys VCS, Icarus Verilog, Xilinx Vivado, Git, Linux, Xcode