TROY K. TSUBOTA

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EDUCATION

University of California, Berkeley

B.A. Physics, B.A. Computer Science, B.A. Applied Mathematics

<u>Relevant Coursework</u>: Analytical Mechanics, Electromagnetism and Optics, Quantum Mechanics I/II, Thermodynamics and Statistical Mechanics, Experimental Physics I/II, Advanced Dynamics (graduate-level, audit), 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, Discrete Mathematics, Real Analysis, Complex Analysis, Macroeconomics (Math Intensive)

EXPERIENCE

Undergraduate Student Instructor (Teaching Assistant) – Math 1B – Calculus

UC Berkeley Department of Mathematics

- Teach two 30-student discussion sections, create worksheets, host in-person and online office hours, grade exams.
- Guide students through group work on integration techniques, infinite series, and differential equations.

Undergraduate Researcher

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 Researcher

UC Berkeley Department of Astronomy (Project Investigator: Dr. Michael Wong)

- Create optimized Python routines for general-purpose analysis of planetary Hubble Space Telescope data.
- Analyze atmospheric vortex dynamics with complex geometric and statistical calculations.

Research Intern

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.

Course Tutor – CS 61A – The Structure and Interpretation of Computer Programs

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 (2023). Bifurcation delay and front propagation in the real Ginzburg-Landau equation on a time-dependent domain (under review). <u>doi.org/10.48550/arXiv.2311.16363</u>.
- 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 (submitted). <u>doi.org/10.21203/rs.3.rs-3370920/v1</u>.
- 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.

August 2021–May 2025 GPA: 4.0/4.0

March 2022–present

August 2023-present

May 2023–August 2023

January 2023–May 2023

December 2021–present

AWARDS

- National Science Foundation Research Experience for Undergraduates (REU) at Purdue University, Summer 2023. 1.
- 2. UC Berkeley Physics Innovators Initiative (Pi²) Summer Scholar, Summer 2022.
- UC Berkeley Physics-and-Astronomy Undergraduate Research Scholar (BPURS), Spring 2023, Fall 2023. 3.

PROJECTS

RISC-V CPU

5-stage pipelined RISC-V CPU built in Verilog on a Xilinx FPGA with memory-mapped I/O and throughput optimization.

Pintos

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

Mathematics Directed Reading Program

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

Physics Directed Reading Program

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

VOLUNTEERING

Outreach Chair, UC Berkeley Society of Physics Students (SPS) August 2022–present Lead a committee of physics students in public science outreach. Teach circuits and magnets in elementary schools through Bay Area Scientists Inspiring Students (BASIS), with more than 30 classrooms reached. Create and perform physics demonstrations. Help organize Cal Day activities with physics department and SPS to recruit prospective students.

Mentor, Mathematics and Physical Sciences (MPS) Scholars September 2023–present Mentor a small group of freshmen in navigating available opportunities in the physics department and UC Berkeley.

Undergraduate Representative, UC Berkeley Physics Major Course Committee

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 Plan the physics department's semesterly undergraduate research fair.

Teacher, Splash@Berkeley

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, Synopsys VCS, Icarus Verilog, Xilinx Vivado, Git, Linux, Xcode

September 2023–present

October 2023–December 2023

September 2023–December 2023

January 2022–May 2022

January 2022–May 2022

September 2023–present

Spring 2022, Fall 2022, Spring 2023