Kai van Brunt

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EDUCATION

Massachusetts Institute of Technology   Cambridge, MA | Class of 2025
Candidate for B.Sc. in Physics   GPA: 5.0/5.0

Coursework: Complex Analysis, Functional Analysis, Abstract Algebra, Nonlinear Dynamics, Classical Mechanics (grad), Quantum Physics, Statistical Physics, Real Analysis, Differential Equations

Teaching: TA for 8.02 (Physics II) in Spring 2023 · Physics Mentor for 8.01/8.012 (Physics I) in Fall 2022

RESEARCH

MIT CLIMATE AND SUSTAINABILITY CENTER
Automated Counting of Migrating Salmon   Sep 2023 - Present
- Training and evaluating computer vision object detection and tracking methods for accurate fish counting.
- Goal of building systems that can generalize to new rivers with minimal additional human labeling.

LOS ALAMOS NATIONAL LABORATORY
Simulating Turbulence in Advanced Rotating Stars   Jun 2023 - Present
- Assessing the impact of rotation and magnetism on supernova core-collapse mechanisms and supernova remnant characteristics.
- Evolving stars in 1D using the stellar evolution code MESA from pre-main sequence to core collapse and mapping resulting progenitor models to the 3D hydrodynamics code FLASH to evolve past core collapse.

MIT PLASMA SCIENCE AND FUSION CENTER
Energy Dissipation in Sheared Magnetic Fields   Jun 2022 - Dec 2022
- Investigated effect of shear magnetic field on turbulence and electron heating in kinetic plasmas through simulations using the spectral code Viriato.
- Presented at the undergraduate poster session at APS-DPP 2022.

Equilibrium Structures of Ions in a Penning Trap   Sep 2021 - May 2022
- Wrote Julia code which performs n-body simulations to investigate dynamics and equilibrium states of ions in electromagnetic traps.
- Created animations and visualizations to help analyze ion motions.
- Implemented particle pushing algorithm and Barnes-Hut algorithm to improve simulation speed and accuracy.
- Presented at MIT Nuclear Science and Engineering Research Expo.

SUMMER SCIENCE PROGRAM   Jun 2020 - Jul 2020
- Imaged asteroid 2011 XZ1 using research-grade telescopes, performed astrometry and photometry on images, coded orbit determination program using Python.
- Published in Minor Planet Circular.

EXTRACURRICULARS

ARCTURUS   Sep 2022 - May 2023
- Part of EE (electrical engineering) subteam for Arcturus, a team building an autonomous surface vehicle.
- Worked on electronics layout with a focus on interfacing overcurrent protection, power distribution terminal, relays, motor drivers, and other components; designed custom PCBs to integrate these components.

SOLAR ELECTRIC VEHICLE TEAM   Sep 2021 - Jan 2022
- Part of MechE subteam for SEVT, a team building a fully solar-powered electric vehicle.
- Used SolidWorks to design, model, and perform feasibility testing on door and hinge for multi-occupancy vehicle.
- Modeled brakes system using MATLAB and implemented improvements to brakes system based on results.

SKILLS

Programming Languages: Python, Julia, Java, MATLAB
Technology: Altium, SolidWorks, Git, bash, LaTeX, Microsoft Office, Adobe Suite