

# Kai van Brunt

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## EDUCATION

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### Massachusetts Institute of Technology

Candidate for B.Sc. in Physics & Math

Cambridge, MA | Class of 2025

GPA: 4.9/5.0

**Coursework:** Experimental Physics, Atomic and Optical Physics, Classical Mechanics III, Quantum Physics II, Physics of Solids, Power Electronics, Circuits and Electronics, Nonlinear Dynamics and Chaos, Complex Analysis, Functional Analysis, Abstract Algebra, 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, 2023

## RESEARCH

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### MIT CLIMATE AND SUSTAINABILITY CENTER

Automated Counting of Migrating Salmon

Sep 2023 - Present

- Training, evaluating, and fine-tuning computer vision object detection and tracking methods for accurate fish counting using PyTorch, in order to build systems that can generalize to new rivers with minimal additional human labeling.

### MIT LABORATORY FOR NUCLEAR SECURITY AND POLICY

Maneuverability of Atmospheric Reentry Vehicles

Jan 2024 - Feb 2024

- Analyzed effects of reentry vehicle geometry on their maneuverability and accuracy using Python.
- Wrote FORTRAN code that performs Monte Carlo integration to determine aerodynamic coefficients of reentry vehicles in hypersonic flow.

### LOS ALAMOS NATIONAL LABORATORY

Simulating Turbulence in Rotating Magnetic Stars

Jun 2023 - Aug 2023

- Assessed the impact of rotation and magnetism on supernova core-collapse mechanisms.
- Evolved stars in 1D using the stellar evolution code MESA from pre-main sequence to core collapse, and mapped resulting progenitor models to the 3D hydrodynamics code FLASH to evolve past core collapse.
- Ran simulations and analyzed data using LANL HPC clusters.

### 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.
- Implemented particle pushing algorithm and Barnes-Hut algorithm to improve simulation speed and accuracy.

## EXTRACURRICULARS

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### ARCTURUS

Sep 2022 - May 2023

- Worked on electronics layout for autonomous surface vehicle with a focus on interfacing overcurrent protection, power distribution terminal, relays, motor drivers, and other components.
- Designed custom PCBs using Altium to integrate these components.

### SOLAR ELECTRIC VEHICLE TEAM

Sep 2021 - Jan 2022

- 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

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**Programming Languages:** Python (numpy, scipy, pandas, matplotlib, pytorch, yt, jupyter), FORTRAN, C++, Julia, Java, Mathematica

**Technology:** Altium, SolidWorks, Linux, Git, bash, Slurm, emacs, L<sup>A</sup>T<sub>E</sub>X, Microsoft Office, Adobe Suite