Logan A. Morrison

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Summary: Theoretical particle physicist with extensive experience in Python, C/C++, Rust, Julia, git, machine learning, Bayesian analysis, numerical analysis, data science, NumPy, SciPy, JAX, PyTorch, Cython, and pybind11.

Education

Doctor of Philosophy (Ph.D.), Physics, *University of California, Santa Cruz - Santa Cruz, CA* — *December 2021*

- Awarded Master of Science in August 2016.
- **Thesis**: ***"Probing Dark Matter and New Physics With MeV Gamma-Ray Telescopes"***

Bachelor of Science (B.Sc.), Physics and Mathematics - *magna cum laude*, — *June 2015*
Western Washington University - Bellingham, WA

Selected Publications

SBI + pMSSM: Simulation-Based inference for Efficient Theory Space Sampling — *March 2022*
arXiv:2203.13403 | Code

- **Achieved state-of-the-art efficiency** for sampling high-dimensional parameter spaces resulting in a **10-100**× **runtime speed-up** compared to traditional methods by implementing simulation-based inference algorithms in JAX.
- **Relevant skills and tools:** Python, C/C++, JAX, NumPy, Bayesian statistics, pybind11

Hazma: a Python toolkit for studying indirect detection of sub-GeV dark matter — *July 2019*
arXiv:1907.11846 | Code

- **Developed and engineered** a high-performance Python library to **statistically analyze** the viability of dark matter models using experimental data.
- **Relevant skills and tools:** Python, Cython, NumPy, SciPy, High Performance Computing
- **Presented at:** SCIPP Graduate Symposium, Oral qualification exam

Nightmare: Large N-ightmare dark matter — *October 2020*
arXiv:2010.03586 | Code

- **Modeled complex dynamics** of the early universe to predict properties of dark matter by implementing cutting-edge stiff differential equation solvers.
- **Relevant skills and tools:** C++, Differential equations, Monte Carlo Integration
- **Presented at:** Pheno 2020, SCIPP Seminar 2020 and Extended ICNFP Session 2020.

2HDM: One-Loop Charge-Breaking Minima in the Two-Higgs Doublet Model — *October 2019*
arXiv:1910.08662 | Code

- **Devised a novel algorithm** for automatically differentiating eigenvalues of symmetric matrices to efficiently minimize equations involving logarithms of determinants.
- **Relevant skills and tools:** Julia, Automatic differentiation, SciML Ecosystem

Mentoring and Leadership

- **Led** two research projects aimed at developing software to analyze high-energy physics models fit using collider data. — *2021 - Pres.*
- **Instructed** over 2000 students in advanced and introductory physics. Received outstanding student reviews and was **rewarded Teaching Assistant of the year**.
- **Organized** three two-month-long study groups involving 5-10 graduate students to learn about new topics in high-energy physics. — *2015-2021, UCSC*
- **Presented** over 20 tutorials and **mentored** graduate and undergraduate students on using software tools and advanced mathematical techniques in research.