Liam R. Brennan

E-mail: lbrennan@ucsb.edu LinkedIn: www.linkedin.com/in/liam-robert-brennan
Citations: Google Scholar github: www.github.com/LiamBrennan-UCSB
Website: www.liamrobertbrennan.com

Professional Summary: NSF Graduate Research Fellow Ph.D. candidate, specializing in machine learning systems, python, statistical modeling, and large-scale data analysis. Strong track record of research, contributions to large scale collaborative projects with rigorous code and data-quality controls, and technical leadership.

Technical Skills: Python, C++, PyTorch, scikit-learn, distributed computing (HTCondor), large-scale data processing (Pandas, NumPy, HDF5), generative models (Flow Matching, Diffusion Models), statistical modeling, Git version control

Education and Internships

University of California Santa Barbara (UCSB), Santa Barbara, CA, USA
Ph.D: Physics (in progress) Anticipated May 2026
M.A: in Physics 2024
Awards: NSF Graduate Research Fellowship
Breakthrough Prize in Fundamental Physics - Co-recipient
Joseph Polchinski Fellowship

University of Florida, Gainesville, FL, USA
B.S: Materials Science and Engineering 2015–2020

Research Positions: **Stanford University** (2020), **University of Chicago** (2018), University of Florida (2017-2019)

Selected Work and Research Experience

Compact Muon Solenoid Collaboration (CMS) - Anomaly Detection 2021–Present
NSF Graduate Research Fellow – Santa Barbara, CA
Incandela Research Group

- Translated theoretical physics concept into production ML system with zero existing codebase, building complete analysis framework from first principles: novel coordinate transformations, domain-informed generative models (Conditional Flow Matching), and weakly-supervised classification achieving $5\sigma+$ significance on ultra-rare events ($\leq$0.1% prevalence)
- Architected scalable Python/C++ pipeline processing terabyte-scale experimental data: compressed datasets 10,000× using HDF5/NumPy, automated distributed workflows across 1000+ parallel jobs via HTCondor, reduced iteration cycles from weeks to days
- Re-engineered collaboration's normalizing flow implementation from spline-based to conditional architecture: improved training speed 2× and model performance 65%, enabling application to previously intractable high-dimensional datasets
- Developed modular, reproducible analysis framework passing rigorous multi-institution code review: established systematic validation protocols, maintained comprehensive documentation for distributed team, integrated disparate tools into cohesive production system
- Leading cross-institutional effort scaling analysis to full Run-3 dataset (petabyte-scale): rebuilt pipeline architecture for extreme data scales, optimized resource allocation across distributed computing infrastructure, establishing benchmarks for expanding collaboration
- First-author publication (Phys. Rev. D, 2025): achieved 70% signal recovery on ultra-rare events, produced open-source analysis framework and validated datasets downloaded 250+ times by researchers, demonstrated capability to deliver production ML systems with measurable impact

The Light Dark Matter Experiment (LDMX) 2021–Present

- Trained and deployed GNN/ParticleNet models reaching $>$ 99.99% accuracy on sparse high-dimensional data; implemented distributed training and evaluation suite