

Hariprashad Ravikumar

PhD Candidate specializing in High-Performance Computing (HPC) and Deep Learning
Expertise in GPU-accelerated computing with C++/CUDA and Python

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Experience

Graduate Research Assistant, New Mexico State University *(Aug 2021 - Present)*

PhD Project: Lattice QCD and Machine Learning Approaches to TMD Physics

- Generated 30,000+ high-fidelity synthetic data points by solving Partial Differential Equations with large-scale Monte Carlo simulations and built an end-to-end AI for Science pipeline to model the underlying physics, achieving over 98% predictive accuracy with symbolic regression machine learning.
- Reduced data processing time 10× by developing GPU-accelerated CUDA C++ (cuFFT) pipelines for multi-terabyte Fourier transforms on HPC clusters.
- Developed production-grade Python, Lua, & Mathematica packages for reproducible statistical analysis, ensuring numerical stability in multi-stage workflows (jackknife resampling, uncertainty propagation)

Independent Collaborations

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- Los Alamos National Laboratory** - Computational Physics *(May 2024 - Present)*
 - Accelerated multi-terabyte scientific calculations by developing and optimizing parallelized C++ CUDA kernels for GPU-accelerated HPC clusters (NERSC Perlmutter), significantly reducing runtime for large-scale Monte Carlo simulations.
 - Managed and executed 75,000+ CPU/GPU compute hours by designing and deploying custom SLURM workflows for large-scale job orchestration
 - Investigated advanced simulation techniques using gradient flow, a method conceptually similar to Flow-Based Generative Models, to analyze the properties of quantum systems and ensure numerical stability
 - Increased model reliability through rigorous statistical validation on over 50,000 correlated data points, applying methods like AIC-based selection and chi-squared minimization with full covariance matrices.
 - North Carolina State University** - Mathematical Physics *(Dec 2020 - Present)*
 - Implemented and managed Mathematica symbolic computation workflows on HPC clusters to analyze complex algebraic structures and symmetry constraints.

Technical Projects

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- \mathbb{Z}_2 Lattice Gauge Monte Carlo Simulation** GitHub
 - Developed a Physics-Based Simulation from scratch to generate synthetic lattice gauge configurations using Monte Carlo methods on HPC clusters, validating the generated data against known analytical benchmarks.
 - AI-DataScience-Lab: Cloud-Hosted Forecasting App** GitHub | Live App
 - Developed a full-stack ML forecasting platform on AWS/Azure featuring automated MLOps pipelines and a GPT API for generating natural-language insights.
 - Neural Network from Scratch with NumPy** GitHub
 - Implemented and trained a neural network from scratch in NumPy for MNIST digit recognition, achieving 80% accuracy by building and tuning core components like backpropagation and activation functions

Technical Skills

Programming	Python, C++, CUDA, Bash, SQL, Lua, HTML/CSS, YAML
ML & APIs	Numba, TensorFlow, PyTorch, Scikit-learn, Pandas, cuFFT, cuDNN, Flask, FastAPI, RAG
Cloud & MLOps	Azure, AWS (Lambda, S3), CI/CD, Docker, Git, SLURM
Methods & HPC	Parallel Computing (GPU, MPI), Numerical Methods (PDEs, Monte Carlo, Regression)

Education

PhD in Physics , New Mexico State University, USA	<i>Aug 2021 – May. 2027 (expected)</i>
MS in Physics , New Mexico State University, USA	<i>Aug 2021 – May 2024</i>
MSc in Physics , National Institute of Technology Jalandhar, India	<i>July 2019 – May 2021</i>
BSc in Physics , Dr. N.G.P. Arts and Science College, India	<i>June 2015 – May 2018</i>

Certifications

- Getting Started with Accelerated Computing in CUDA C/C++ by NVIDIA
- Fundamentals of Accelerated Computing with CUDA Python by NVIDIA
- Advanced Learning Algorithms by DeepLearning.AI
- Supervised Machine Learning: Regression and Classification by DeepLearning.AI
- Google Advanced Data Analytics Professional Certificate

Awards

- **2025 NMC Collaboration Grant**, awarded by the New Mexico Consortium to conduct my independent research project in collaboration with scientists at Los Alamos National Laboratory
- **2023 George and Barbara Goedecke Physics Excellence Fund Scholarship**, awarded by the NMSU Physics Department
- **2021 Graduate Success Scholarship**, awarded by the NMSU Graduate School

Selected Talks

- (Jun 3, 2025) "*First Principles Lattice QCD Calculations of $nEDMs$* ", T-2 Seminar, Theoretical Division, **Los Alamos National Laboratory**, USA
- (May 16, 2024) "*Lattice QCD Calculations of x Dependence of Sivers TMD*", T-2 Seminar, Theoretical Division, **Los Alamos National Laboratory**, USA
- (June 15, 2023) "*Lattice QCD calculations of TMDs*", HUGS Student Seminar, **Thomas Jefferson National Accelerator Facility**, USA

Full list available at: hariprashad-ravikumar.github.io/talks

Volunteering

- **Vice President**, Physics Graduate Student Organization (NMSU) *Sep 2025 – Present*
Organized professional development events and served as the primary liaison between 40+ graduate students and faculty.

Relevant Graduate Coursework

- Advanced Computational Physics, Statistical Mechanics, Quantum Computing