

# Hariprashad Ravikumar

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

**Website:** [hariprashad-ravikumar.github.io](https://hariprashad-ravikumar.github.io)  
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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 $\times$  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

- 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

- $\mathbb{Z}_2$  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

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

## Education

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

## Certifications

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- 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

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- **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

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- (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](http://hariprashad-ravikumar.github.io/talks)

## Volunteering

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- **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

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- Advanced Computational Physics, Statistical Mechanics, Quantum Computing