Hariprashad Ravikumar

PhD Candidate in Physics, specializing in HPC & Machine Learning for High-Dimensional Data
New Mexico State University

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Education

PhD in Physics, New Mexico State University, USA *Aug 2021 – July 2026 (expected)*
MS in Physics, New Mexico State University, USA *Aug 2021 – May 2024*
MSc in Physics, National Institute of Technology Jalandhar, India *July 2019 – May 2021*
BSc in Physics, Dr. N.G.P. Arts and Science College, India *June 2015 – May 2018*

Technical Skills

Programming	Python, C++, CUDA, Bash, JavaScript, Lua, HTML/CSS, YAML
ML / DL	Pandas, TensorFlow, PyTorch, Scikit-learn, NumPy
Cloud & MLOps	Azure (App Service, Functions), AWS (Lambda, S3, API Gateway), Docker, GitHub
Data & Viz	SQL, Matplotlib, JupyterLab
APIs	Flask, FastAPI, RESTful APIs
Methods & HPC	Regression, Monte Carlo, HPC clusters, Statistical modeling

Technical Project Portfolio

- **AI-DataScience-Lab: Cloud-Hosted Forecasting App** GitHub Repository
  End-to-end forecasting platform: CSV upload, pandas cleaning, scikit-learn linear regression (R^2, MSE), GPT-3.5 summaries, and Matplotlib plots. Flask backend on Azure with GitHub Actions CI/CD; frontend on GitHub Pages. Modular design supports future polynomial, ridge, and time-series models. Frontend URL
- **Neural Network from Scratch with `NumPy`** GitHub Repository
  Two-layer NN in NumPy (ReLU hidden, softmax output); trained on 5 000 samples with lr=0.1 to achieve 80% accuracy in 60 epochs.
- **$\mathbb{Z}_2$ Lattice Gauge Monte Carlo Simulation** GitHub Repository
  Python MCMC simulation of $\mathbb{Z}_2$ gauge theory using Metropolis; measured Wilson loops and benchmarked against analytical predictions.

PhD Research

Doctoral Advisor: Dr. Michael Engelhardt (New Mexico State University, USA)

- **Lattice QCD Calculations of TMDs:** Processed multi-terabyte lattice QCD data involving ∼30,000 correlator evaluations. Applied Monte Carlo methods with jackknife and bootstrap resampling to extract transverse momentum-dependent parton distribution functions (TMDs). Leveraged PySR symbolic regression a machine learning technique to derive interpretable analytical models from high-dimensional simulation outputs.

External Research Collaborations

Collaborators: Dr. Rajan Gupta and Dr. Tanmoy Bhattacharya (Los Alamos National Laboratory, USA)

- **Lattice QCD Calculations of CP Violation Contributions to nEDM:** Processed multi-terabyte lattice QCD data across several computation stages using GPU-accelerated HPC clusters (NERSC Perlmutter). Performed Monte Carlo simulations and statistical analyses to extract hadronic matrix elements relevant to nucleon EDMs, enabling connections to CP-violating operators in Standard Model (SM) and Beyond Standard Model (BSM) physics. Supported by a Travel Grant from the New Mexico Consortium at Los Alamos.

Collaborator: Dr. Chueng-Ryong Ji (North Carolina State University, USA)

- **Interpolating Conformal Algebra:** Investigated conformal invariance in interpolating form dynamics between instant-form and light-front relativistic frameworks. Used Mathematica symbolic computation to analyze algebraic structures and symmetry constraints in interpolated Poincaré and conformal algebras.

Certifications

- (Apr 2025) **Google Advanced Data Analytics Professional Certificate**
  Credential ID: U0HU8UKT89L4
- (Apr 2025) **Kaggle Intro to Machine Learning**
  View Certificate

Graduate Assistantships

Research Assistant, NMSU (2022–2025):
Conducting research in Lattice QCD under Dr. Michael Engelhardt, including symbolic regression (PySR), high-performance computing, and theoretical modeling as part of PhD dissertation work.

Teaching Assistant, NMSU (2021–2023):
Conducted undergraduate physics labs, led discussion sections, and provided tutoring support for Physics (E&M and Mechanics) courses.

Selected Talks

- (May 16, 2024) *"First Principles Lattice QCD Calculations of nEDMs"*, T-2 Seminar, Theoretical Division (T-2), Los Alamos National Laboratory, USA
- (Jun. 07, 2024) *"Lattice QCD Calculations of Sivers TMD x Dependency"*, 2024 CFNS Summer School on the Physics of the Electron-Ion Collider, Center for Frontiers in Nuclear Science, Stony Brook University, NY, USA
- (May 16, 2024) *"Lattice QCD Calculations of x Dependence of Sivers TMD"*, T-2 Seminar, Theoretical Division (T-2), Los Alamos National Laboratory, USA
- (June 15, 2023) *"Lattice QCD Calculations of TMDs"*, HUGS Student Seminar Presentation, Thomas Jefferson National Accelerator Facility, Newport News, USA

- (Dec. 02, 2021) *"Interpolating Conformal Algebra Between the Instant Form and the Front Form of Relativistic Dynamics"*, Light Cone 2021: Physics of Hadrons on the Light Front, Jeju Island, South Korea

For a full list of talks, please visit: hariprashad-ravikumar.github.io/talks

Awards & Highlights

- Recipient of the **2023 George and Barbara Goedecke Physics Excellence Fund Scholarship**, awarded by the NMSU Physics Department
- Recipient of the **2021 Graduate Success Scholarship**, awarded by the NMSU Graduate School
- Nominated for participation in the **70th Lindau Nobel Laureate Meeting (2020)**, Germany, by the Department of Science & Technology, Government of India
- Recipient of the **2018 Indian Academy of Sciences Summer Research Fellowship**

MSc Thesis

Ravikumar, H. (2021, August). *The Poincaré algebra interpolation between instant form dynamics (IFD) and light-front dynamics (LFD)* (Master's thesis). National Institute of Technology, Jalandhar, India.
Supervised by Prof. Harleen Dahiya (NIT Jalandhar) in collaboration with Prof. Chueng-Ryong Ji (North Carolina State University).

Selected Summer Programs

- **Jun 03 – Jun 14, 2024:** CFNS Summer School on the Physics of the Electron-Ion Collider, Center for Frontiers in Nuclear Science, Stony Brook University, New York, USA
- **May 30 – Jun 16, 2023:** Hampton University Graduate Studies (HUGS) Summer Program, Thomas Jefferson National Accelerator Facility, Newport News, USA
  Awarded the HUGS Scholarship.
- **Jan 20 – Jan 26, 2022:** TMD Winter School, Santa Fe, USA
- **Jun 21 – Jun 25, 2021:** National Nuclear Physics Summer School (NNPSS), Universidad Nacional Autónoma de México (Mexico) and Indiana University (USA)