

Hare Krishna

MACHINE LEARNING RESEARCHER • THEORETICAL PHYSICIST

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Summary

Machine learning researcher and theoretical physicist studying how neural models reason and how agents learn to coordinate. Combines mathematical analysis with controlled experiments to explain model behavior and develop methods for more reliable and efficient computation. Brings a strong record of independent research, from formulating theoretical questions to testing predictions and publishing results. Ph.D. in physics with a substantial peer-reviewed research record.

Machine Learning Research

- **When Recursive Models Finish Computing.** [arXiv:2609.26487](#).
Studied how recursive neural models improve with additional inference steps and developed diagnostics for when their internal computation stabilizes. Analyzed latent trajectories and Jacobian geometry, identifying anisotropic stability without uniform contraction.
- **Forecasting Corpus-Sampling Disagreement in Masked Text Reconstruction.** [arxiv:2610.12987](#)
Derived a statistical forecast of disagreement between count-based predictors fitted to independent text corpora, using only a separate reference corpus. Validated across TinyStories, WikiText-103, and CNN/DailyMail over the full 50,257-token vocabulary; a source-split jackknife reduced small-reference forecast error by 57–59%. Compared the forecasts with small masked diffusion language models, identifying partial agreement in input sensitivity and different scaling with corpus size.
- **Multi-Agent Reinforcement Learning.** *Manuscript in preparation*.
Developing a framework in which language-model agents learn adaptive computation and coordination. Investigating credit assignment and resource-aware learning for collaborative reasoning under constrained inference budgets.
- **When Should We Believe a Lens?** *Manuscript in preparation*.
Developing causal tests for language-model lenses, including J- and R-lenses, using representation probes and activation interventions. Studying the gap between when intermediate concepts become decodable and when they begin to influence a model's answer.
- **Computer Vision: Optical + SAR; Othello-GPT for Radar.**
Developed land-cover segmentation models for paired optical and SAR imagery using dual-encoder fusion, U-Net, ViT, and Swin architectures. *Othello-GPT for Radar (manuscript in preparation)* investigates whether self-supervised radar models learn scattering structure beyond amplitude and land-cover cues. Built controlled synthetic benchmarks, compared pretraining objectives with matched linear and nonlinear probes, and used identifiability controls and spatial-context tests to distinguish input ambiguity, readout limitations, and learned shortcuts.

Technical Skills

Programming	Python, PyTorch, TensorFlow, scientific Python
Language Models	Transformers, LLM evaluation, diffusion language models, representation probing, activation interventions
Computer Vision	ViT, Swin, U-Net, DeepLab, SegFormer, semantic segmentation, multimodal fusion
ML Methods	Reinforcement learning, Bayesian optimization, TPE, Gaussian processes, energy-based models
Scientific ML	Statistical modeling, sparse autoencoders, topological data analysis, persistent homology, controlled experiments

Machine Learning Talks & Community

- **Harrington Faculty Fellows Symposium, UT Austin (2026):** poster and research presentation on *When Recursive Models Finish Computing*.
- **UT Austin Physics Machine Learning Seminars:** presentations and discussions on YOLO-based particle detection, Bayesian optimization, Gaussian processes, and Tree-structured Parzen Estimators.
- **UT Austin CS / NLP Seminar Community:** active participant in the NLP seminar series and broader machine learning research community.

Research Experience

University of Texas at Austin, USA
Postdoctoral Fellow

Aug 2024 – Present
Supervisor: Prof. Willy Fischler

- Conduct research across machine learning, quantum gravity, holography, and quantum computation.
- Study inference-time computation, corpus sensitivity, and neural representations through recursive models, masked diffusion language models, and controlled interpretability experiments.
- Investigate de Sitter and AdS holography, including horizon physics, gravitational shock waves, and thermal holographic renormalization-group flows.

C.N. Yang Institute for Theoretical Physics, Stony Brook University
Graduate Research Assistant

Aug 2020 – Aug 2024
Advisor: Prof. Martin Roček

- Conducted doctoral research in quantum gravity, holography, scattering amplitudes, and celestial conformal field theory.
- Studied the universality of loop-corrected soft theorems in gauge theory and gravity for general matter content and interactions; developed loop-level celestial gluon and graviton operator product expansions.
- Published peer-reviewed papers in JHEP and collaborated with researchers across institutions.

Education

Stony Brook University
Ph.D. in Physics

Aug 2018 – Aug 2024
Stony Brook, NY, USA

Thesis: *Aspects of Holography in AdS and Flat Spacetime*; advisor: Martin Roček.

IISER Bhopal
BS–MS Dual Degree in Physics

2012 – 2017
Bhopal, India

Thesis: *Holography for Non-relativistic Systems*; advisor: Suvankar Dutta.

Selected Publications

Full publication list: [INSPIRE-HEP](#) | [Google Scholar](#)

- Hare Krishna and B. Sahoo, *Universality of Loop Corrected Soft Theorems in 4d*, JHEP **11** (2023) 233. [arXiv:2308.16807](#).
- Hare Krishna, *Celestial gluon and graviton OPE at loop level*, JHEP **03** (2024) 176. [arXiv:2310.16687](#).
- Hare Krishna, Willy Fischler, and Sarah Racz, *There is more to the de Sitter horizon than just the area*, JHEP **07** (2025) 103. [arXiv:2412.12097](#).
- Hare Krishna, Willy Fischler, and Sarah Racz, *Seeing double: shock waves and the de Sitter horizon*, JHEP **07** (2026) 114. [arXiv:2511.03781](#).
- Hare Krishna and D. Gomez, *Holographic thermal correlators revisited*, JHEP **11** (2021) 139. [arXiv:2108.00277](#).

Selected Research Talks

- **UT Austin**: Double-scaled SYK and 3d de Sitter gravity (2025).
- **Caltech**: Holographic stress tensor for asymptotically flat spacetime (2025).
- **Southwest String Conference**: Static patch holography (2026).
- **Celestial Holography Seminar Series**: Stress tensor for flat spacetime (2025).
- **Holography Journal Club, UT Austin** (2024–2025).
- **IISER Bhopal Seminar**: Universality of loop-corrected soft theorems (2024).

Fellowships & Awards

- UT Austin Postdoctoral Fellowship (NSF and Celestial Holography CNS Spark Grant).
- INSPIRE Fellowship, Government of India (2012–2017).
- NTSE Fellowship, NCERT and Government of India (2008–2012).

Teaching, Mentorship & Service

- Delivered four quantum mechanics lectures at UT Austin; mentor to graduate students (2025–Present).
- Graduate mentor for incoming students, Stony Brook University (2020–2024).
- Teaching Assistant: Quantum Mechanics I & II (2019–2020); undergraduate Electricity & Magnetism Lab (2018–2019).
- Reviewer for *Classical and Quantum Gravity*, *JHEP*, and *Nuclear Physics B*.