Ali SaraerToosi — PhD Candidate • Scientific Machine Learning

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Professional Summary

Physics-informed machine-learning researcher with 4yrs of GPU-accelerated modeling. First-author *ApJ* publication on variational autoencoders for black-hole imaging; patent co-inventor on quantum-error-correction RNNs. Skilled in JAX, PyTorch, dynamic mode decomposition, neural operators, and Bayesian inference. Seeking applied-research roles bridging ML and scientific discovery.

Skills

JAX/PyTorch/Lightning • HPC • Dynamic Mode Decomposition • Neural Operators • Bayesian & MCMC Inference • Computational Imaging • Java • R

Languages: English (native), Persian (native), French (B1), German (A2)

Experience

University of Toronto & Vector Institute

PhD Researcher, Neural Operators for Astrophysics & Weather Forecast, Toronto — *2024–2028*

- Built NeuralDMD, recovering dynamics from very sparse observations ($\leq 0.5\%$) for scientific discovery (better than current state of the art to the best of our knowledge); already applied to black-hole & weather data with potential applications to medical imaging (MRI); submitted to ICCV.

1QBit

Research Intern, ML/Quantum, Vancouver/Waterloo — *2023–2024*

- Co-invented recurrent-NN decoder for surface-code error correction in near-zero temperatures; patent filed with P.Ronagh & B.Kulchytskyy.

Perimeter Institute

Graduate Researcher, member of Event Horizon Telescope (EHT) Collaboration, Waterloo — *2022-Present*

- Co-led development of an invertible recurrent inference machine that descatters black-hole images (better than state of the art in EHT community); published in ApJ.
- Created ALINet, speeding up black-hole parameter extraction $10,000\times$ and boosting reconstructed-image resolution $16\times$; first-author *ApJ* (2025). Toolkit incorporated into A.E.Broderick's software framework, Themis.

Education

University of Toronto, PhD, Computer Science; Advisor A. Levis — *Toronto, 2024–2028 (exp.)*

Perimeter Institute, MSc, Physics (PSI Fellowship $45 k / yr) — *Waterloo, 2022–2024*

Sharif University of Technology, BSc, Physics (minor CS), GPA 19.2 / 20 — *Tehran, 2018–2022*

Selected Publications

SaraerToosi, A. *et al.* "Neural Dynamic Modes: Computational Imaging of Dynamical Systems from Sparse Observations." (2025) *arXiv:2507.03094*

SaraerToosi, A. *et al.* "Autoencoding Labeled Interpolator: Inferring Parameters from Image and Image from Parameters." *Astrophysical Journal* (2025), arXiv:2312.04640, NeurIPS Workshop (preliminary version)

SaraerToosi, A. *et al.* "Validation and Calibration of Semi-Analytical Models for the Event Horizon Telescope Observations of Sagittarius A*." *Submitted to Astrophysical Journal* (2025), arXiv:2504.18624

Leadership & Outreach

2024-Present: Mentoring an undergraduate through cross-lab collaboration between computer science department and Canadian Institute for Theoretical Astrophysics (CITA).

2023-Present: Mentoring two undergraduates in scattering mitigation for black-hole observations (one ApJ publication and one in preparation).

2024–Present: Volunteer: 1. Creative Destruction Lab: facilitate mentor–startup sessions. 2. Planetarium Presenter: University of Waterloo & local schools (astronomy shows for Grades 4–6).