Rohan Shenoy

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GitHub · LinkedIn

Research Experience

•Background Modeling and Limit Setting — SuperCDMS SNOLAB *2024 – present*

Golwala Lab, Caltech | Advisor: Sunil Golwala, PhD

- Building the Python tool that turns detector data into constraints on low-mass dark matter: an **extended maximum-likelihood fit** of a candidate signal against the full background model — tritium, neutrons, coherent neutrino scattering, Compton events, surface betas, radon and in-situ cosmic rays.
- Detector resolution and energy yield carried as **fitted nuisance parameters** rather than fixed assumptions; validated against Monte Carlo trial datasets generated across the parameter space.
- Core problem: separating a small signal from a large, structured, poorly-behaved background, and defending the separation under scrutiny.

•Simulation of Blackbody Radiation Backgrounds *2024 – present*

Golwala Lab, Caltech

- Extending GEANT4, the standard particle-physics simulation toolkit, to propagate blackbody photons from warm fridge surfaces, where its ray-like optical model fails — photon wavelengths approach the scale of gaps between components, so they diffract.
- Scripted ANSYS HFSS in Python to solve for transmission coefficients and near- and far-field electric fields, converting these into sampled transmission probabilities and angular emission profiles.
- Validated for a single frequency and geometry; poster at the Radiation Impact on Superconducting Qubits (RISQ) workshop, 2026.

•Differentiable Approximation to the Earth Mover's Distance *2021 – 2023*

Duarte Lab, UC San Diego | CMS Collaboration, LHC **GitHub**

- The earth mover's distance (Wasserstein distance) is the physically meaningful metric for comparing energy distributions, but is non-differentiable and too slow to train against.
- Trained a CNN to approximate it to **5% resolution**, fast enough for the inner training loop, then used it as the loss for on-detector compression hardware — outperforming MSE-based training.
- **First-author paper**, *Machine Learning: Science and Technology* **4**, 045058 (2023). Presented at the APS April Meeting 2022.

•Graph Neural Networks for Calorimeter Latent Space *2022 – 2023*

Duarte Lab, UC San Diego **GitHub**

- Reconstructed individual particles from the compressed latent space of an on-chip encoder using a GNN with object condensation loss (PyTorch Geometric), reaching **85% pileup mitigation accuracy** in HL-LHC events with 200 simultaneous collisions.

Leadership and Operations

•Vice President — CGPU-UAW Local 2478 *2025 – 2026*

Caltech Graduate Researchers and Postdocs United

- Elected Vice President of the first labor union in Caltech's history, **representing 2,000 graduate students and postdoctoral researchers**.
- Advocacy on federal science funding and on the rights of international researchers.

•Treasurer — Caltech Graduate Student Council *2024 – 2025*

Elected position, Caltech

- Administered a **$120,000 annual budget** on behalf of the graduate student body.
- Closed the year at **zero deficit — the first balanced budget since the pandemic**, after several years of shortfall.

•Board Member — Groundwork Books Collective *2019 – present*

Student-run workers' cooperative, UC San Diego

- Governance and operations for a bookstore run without a manager: **restarted inventory purchasing for the first time since 2009**, recruited and trained volunteer staff, handled tax filings. Roughly **1,000 hours**.

Education

•California Institute of Technology *2023 – present*

PhD candidate, Physics — David and Ellen Lee Distinguished Fellow ($46,500); candidacy passed Fall 2025

•University of California, San Diego *2019 – 2023*

*BS Physics, **GPA 3.98** — QFT, graduate quantum mechanics, advanced linear algebra, group theory*

Honors and Awards

•Undergraduate Summer Research Award, GNNs with object condensation loss for the HGCAL Level-1 Trigger, $4,000 *06/2022*

•UC San Diego Chair's Challenge Award, travel award to present research, $500 *01/2022*

•TRELS Scholarship, improving autoencoder performance in the High Granularity Calorimeter, $1,000 *06/2021*

Technical Skills

- **Statistics**: Extended maximum-likelihood fitting, nuisance-parameter treatment of systematic uncertainty, Monte Carlo methods, limit setting, optimal transport
- **Machine Learning**: PyTorch, PyTorch Geometric, TensorFlow — CNNs, graph neural networks, autoencoders, custom differentiable loss functions
- **Programming**: Python (NumPy, uproot, awkward, coffea, Minuit2), Java, MATLAB, Mathematica, Git, LaTeX
- **Simulation**: GEANT4, ANSYS HFSS, CMSSW, MadGraph_aMC@NLO, FeynRules