Rohan Shenoy

PhD candidate, Physics — California Institute of Technology
rohanshenoy.github.io

rshenoy@caltech.edu
GitHub · LinkedIn

Education

•California Institute of Technology *2023 – present*

PhD candidate, Physics — David and Ellen Lee Distinguished Fellow; 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*

Research

•Background modeling and limit setting for SuperCDMS SNOLAB *2024 – present*

Golwala Lab, Caltech | Advisor: Sunil Golwala, PhD

- SuperCDMS searches for low-mass dark matter with cryogenic germanium and silicon detectors at 15 mK, two kilometers underground. Building the Python tool that turns its data into constraints on dark matter interactions.
- Extended maximum-likelihood fit of a candidate signal against the full background model: tritium, neutrons, coherent neutrino scattering, Compton events, surface betas, radon exposure and in-situ cosmic rays.
- Detector resolution and energy yield carried as fitted nuisance parameters rather than fixed assumptions; fiducial volume cuts applied.
- Validated against Monte Carlo trial datasets generated across the parameter space. Passed PhD candidacy on this work, Fall 2025.

•Simulation of low-temperature blackbody radiation backgrounds *2024 – present*

Golwala Lab, Caltech | Advisor: Sunil Golwala, PhD

- Extending GEANT4 to propagate blackbody photons emitted by warm fridge surfaces, where ray-like optical propagation fails because photon wavelengths approach the scale of gaps between detector components.
- Scripted ANSYS HFSS in Python to solve for transmission coefficients and near- and far-field electric fields across waveguide geometries; converted the field solutions into sampled transmission probabilities and angular emission profiles.
- Diffraction implemented and validated for a single photon frequency and crack dimension; presented as a poster at the Radiation Impact on Superconducting Qubits (RISQ) workshop, 2026.
- Applies to both SuperCDMS sensor noise and pair-breaking backgrounds in superconducting qubits.

•Differentiable approximation to the earth mover's distance *2021 – 2023*

Duarte Lab, UC San Diego | CMS Collaboration, LHC | PI: Javier Duarte, PhD **GitHub**

- The earth mover's distance (Wasserstein distance) is the physically meaningful metric for comparing energy distributions, but it is non-differentiable and too slow to train against.
- Trained a CNN in TensorFlow to approximate it to **5% resolution**, fast enough to use inside the training loop.
- Used it as the loss for the on-detector compression encoder at the high-luminosity LHC, outperforming MSE-based training on physics performance.
- **First-author paper**, *Machine Learning: Science and Technology* **4**, 045058 (2023); presented at the APS April Meeting 2022.

•Graph neural networks and object condensation for the HGCAL latent space *2022 – 2023*

Duarte Lab, UC San Diego | PI: Javier Duarte, PhD **GitHub**

- Reconstructed individual particles directly from the compressed latent space of the HGCAL on-chip encoder, using a graph neural network with object condensation loss in PyTorch Geometric.
- Reached **85% pileup mitigation accuracy** in high-luminosity LHC events with 200 simultaneous collisions.
- Presented at the A3D3 (Accelerated AI Algorithms for Data-Driven Discovery) Annual Meeting.

•Improved autoencoder training for the HGCAL Level-1 Trigger *2021 – 2023*

Duarte Lab with Fermilab | Supervisors: J. Duarte, J. Hirschauer, D. Noonan, C. Mantilla-Suarez, N. Tran **GitHub**

- With Fermilab, improved training of the on-detector ASIC encoder that compresses data from over 6 million channels in real time.
- Event-level selection on Monte Carlo data with uproot and awkward; Level-1 trigger simulation in CMSSW.
- Presented at the 2022 Fast Machine Learning for Science Workshop.

•Leptoquarks and the $R(D^*)$ anomaly *2022 – 2023*

High energy phenomenology, UC San Diego | Supervisor: Benjamin Grinstein, PhD **Overview**

- Studied scalar leptoquarks as an explanation for the excess in $B \to D^* \tau \nu$ decays.
- Built the models in FeynRules and simulated the pp $\to$ b + c + τ + MET final state at the LHC with MadGraph_aMC@NLO; checked results analytically at leading order.
- Found enhanced sensitivity in the $m_T(\tau)$ tail compared with previous searches.

Publications and Presentations

- **Machine Learning: Science and Technology**,
  Differentiable earth mover's distance for data compression at the high-luminosity LHC — first author *2023*
- **Radiation Impact on Superconducting Qubits (RISQ) Workshop**,
  Simulation of low-temperature blackbody radiation backgrounds — poster *06/2026*
- **A3D3 Annual Meeting**,
  Deep Learning for the High Granularity Calorimeter (HGCAL) *2022*
- **Fast Machine Learning for Science Workshop 2022**,
  EMD Neural Network Loss for the ECON-T ASIC Autoencoder *2022*
- **American Physical Society, April Meeting**,
  EMD Neural Network for HGCAL Data Compression Encoder ASIC *2022*
- **Undergraduate Summer Research Poster Session**,
  Deep Learning for the High Granularity Calorimeter L1 Trigger *2022*

Honors and Awards

- **David and Ellen Lee Distinguished Fellow**,
  Caltech fellowship for its most promising incoming graduate students, $46,500 *2023*
- **Undergraduate Summer Research Award**,
  For graph neural networks 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**,
  For improving autoencoder performance in the High Granularity Calorimeter, $1,000 *06/2021*

Leadership and Service

- **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
  - 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 bookstore, UC San Diego
  - Governance and operations for a nonprofit bookstore run without a manager; roughly **1,000 hours** of volunteer work.
  - Restarted inventory purchasing for the first time since 2009; recruited and trained volunteer staff; handled the cooperative's tax filings.
  - Built links with community organizations to host events and community education.
- **Organizer — ARMS, Advocating for and Representing Minority Students**,
  Started the effort in UCSD's physics department to improve the learning environment for all students *2021 – 2023*
- **Member — Society of Physics Students**, UC San Diego *2021 – 2023*

Technical Skills

- **Statistics**: Extended maximum-likelihood fitting, nuisance-parameter treatment of systematics, Monte Carlo methods, limit setting, optimal transport.
- **Machine Learning**: PyTorch, PyTorch Geometric, TensorFlow: CNNs, graph neural networks, autoencoders, custom differentiable losses.
- **Programming**: Python (NumPy, uproot, awkward, coffea, Minuit2), Java, MATLAB, Mathematica, Git, GitLab, LaTeX.
- **Simulation and HEP**: GEANT4, ANSYS HFSS (scripted in Python), CMSSW, CMS Open Data, MadGraph_aMC@NLO, MadAnalysis, FeynRules.