Ansh Desai

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Education

PhD, Physics, University of Oregon *Expected June 2026*

Thesis: Probing Dark Sectors with Small-Scale Experiments
Advisors: Prof. Eric Torrence, Prof. Tien-Tien Yu

MA, Physics, Stony Brook University (*incomplete, transferred to PhD Program*) *2021 - 2022*

Research: SENSEI Experiment *Advisor*: Prof. Rouven Essig

BA, Physics, University of Colorado Boulder *May 2021*

Summa Cum Laude, *Minors in Mathematics and Computer Science*

Thesis Title: An Analysis of the Efficacy of the CSIM Cubesat for SSI Continuity
Advisor: Dr. Erik Richard

Research Experience

Institute for Fundamental Science *Graduate Research Assistant* *Sep. 2022 to present*

Under the supervision of Prof. Eric Torrence and Prof. Tien-Tien Yu

The FASER Experiment

- Contributed to offline software for MC simulation, data reconstruction, and processing, leading to world leading results for dark sector physics and the first neutrino observations in collider experiments.
- Wrote a new fully parallelized flexible analysis framework for future searches using dask and python.
- Participate in regular monitoring shifts for the operations of the FASER experiment.
- (In progress) Leading second iteration of dark photon search, where we are expected to more than double our current sensitivity and improve our previous efficiency by $\sim 20\%$.

The SENSEI Experiment

- Set up analysis framework, calculated theoretical rate predictions, and wrote statistical tools required to maximize sensitivity for SENSEI dark matter searches.
- Co-lead of an analysis team searching for a modulation signal in SENSEI data as a dark matter search.
- Wrote rate calculation software that takes advantage of GPUs to efficiently calculate DM-electron scattering rates in silicon, xenon, argon.
- (In progress) Working on data taking, data quality checks, and background studies for the analysis of our third science run.

Theory

- Led a project to study dark matter daily modulation in the three canonical direct detection targets, and demonstrated that current experiments can improve their low-mass limits by performing this search.
- (In progress) leading a machine learning/theory project designed to extract halo independent information from existing DM-electron scattering datsets and compare results across experiments.

Fermi National Accelerator Laboratory *URA Visiting Scholar* *Jul. 2024 to Sept. 2025*

Under the supervision of Dr. Javier Tiffenburg

The SENSEI Experiment

- Worked on several hardware projects to reduce backgrounds by studying spurious charge and charge traps in Skipper-CCDs with the CCD group at Fermilab.
- Assisted with the packaging of sensors and testing of low-threshold acquisition electronics, set up and ran my own CCD system.
- (In progress) Invented a technique to generate uniform charge across our CCDs, and applied this to characterize charge traps in our sensors, an important background for dark matter searches in CCDs.

C.N. Yang Institute for Theoretical Physics *Graduate Research Assistant* *Aug. 2021 to Sept. 2022*
Under the supervision of Prof. Rouven Essig

The SENSEI Experiment

– Developed data quality cuts and and worked to characterize instrumental effects from the first SENSEI run taken in the MINOS tunnel at Fermilab.

Laboratory for Atmospheric and Space Physics *Undergraduate Research Assistant* *Aug. 2018 to Nov. 2021*
Under the supervision of Dr. Erik Richard

THE SORCE AND CSIM Experiments

– Developed optical degradation corrections for the SORCE SIM Instrument, a project that works to take solar cycle data. Applied this experience to develop a correction algorithm for the next generation experiment, a cubesat called CSIM.

Publications

Refereed

[1] Roshan Mammen Abraham et al. "First Measurement of the Muon Neutrino Interaction Cross Section and Flux as a Function of Energy at the LHC with FASER". In: *Phys. Rev. Lett.* 134 (21 May 2025), p. 211801.

[2] Roshan Mammen Abraham et al. "Shining light on the dark sector: search for axion-like particles and other new physics in photonic final states with FASER". In: *Journal of High Energy Physics* 2025.1 (Jan. 2025), p. 199.

[3] Prakruth Adari et al. "First Direct-Detection Results on Sub-GeV Dark Matter Using the SENSEI Detector at SNOLAB". In: *Phys. Rev. Lett.* 134 (1 Jan. 2025), p. 011804.

[4] Xavier Bertou et al. "Earth-scattering induced modulation in low-threshold dark matter experiments". In: *Journal of High Energy Physics* 2025.11 (2025), p. 42.

[5] Itay M. Bloch et al. "SENSEI at SNOLAB: Single-Electron Event Rate and Implications for Dark Matter". In: *Phys. Rev. Lett.* 134 (16 Apr. 2025), p. 161002.

[6] Henso Abreu et al. "Search for dark photons with the FASER detector at the LHC". In: *Physics Letters B* 848 (Jan. 2024), p. 138378. ISSN: 0370-2693.

[7] Henso Abreu et al. "First Direct Observation of Collider Neutrinos with FASER at the LHC". In: *Phys. Rev. Lett.* 131 (3 July 2023), p. 031801.

Under Review

[8] Itay M. Bloch et al. "SENSEI: A Search for Diurnal Modulation in sub-GeV Dark Matter Scattering". In: *arXiv preprint* (Oct. 2025). arXiv: 2510.20889 [hep-ex].

[9] Agustin Brusco et al. "Charge Trap Analysis in a SENSEI Skipper-CCD: Understanding Low-Energy Backgrounds in Rare-Event Searches". In: (Oct. 2025). arXiv: 2510.23336 [hep-ex].

Software

[10] Ansh Desai. *ande8412/DarkMatterRates: First Release*. Version v1.0. July 2025.

You can also find a complete list of my publications here: inspirehep.net

Presentations

Long-Lived Particle Searches with FASER *August 2025*
Parallel Talk at Lepton-Photon, Madison, WA

Latest Results and Prospects of the SENSEI Experiment *July 2025*
Parallel Talk at ICRC, Geneva, CH

New Physics Results from the FASER Experiment *May 2024*
Parallel Talk at DPF-Pheno, Pittsburgh, PA

Grants and Fellowships

URA Fellowship (20k Awarded) *Fermilab, USA* — *Sept. 2024*

Selected Press Coverage

Sub-GeV dark matter hunt: SENSEI collaboration reports first findings — Phys.org — *Jan 2025*

Teaching Experience

Teaching Assistant *University of Oregon, Physics Department* — *Sept. 2025 –*
Teaching Assistant *University of Oregon, Physics Department* — *Sept. 2022 to Mar. 2023*
Teaching Assistant *Stony Brook University, Physics Department* — *Jan. 2022 to May 2022*

Awards

Dr. Pliny A. and Margaret H. Price Prize Nominee *CCAPP, Ohio State University* — *May 2025*

Technological Competencies

Programming: C++, C, Python, IDL, Java, Javascript, Perl, Bash, Node JS, SQL, Unix/Linux, LaTeX, SDL, HTML, Git, Dask, ROOT

Software Techniques/Packages: Algorithms, Data Structures, PyTorch, Numpy, Scipy, Matplotlib, Pandas, Machine Learning, Neural Nets, Monte-Carlo Algorithms, Ray Tracing, Numerical Computation Techniques, Parallelization

Hardware: Circuit design, computer assembly, soldering, CCD testing, hardware monitoring, CCD Packaging, low-level board programming, vacuum systems, DAQ.

Summer Schools

Theory Meets Experiment: The High Intensity Frontier of Particle Physics — *Nov. 2023*
Galileo Galilei Institute, Florence, IT

ATLAS CAMPFIRE — *Jun. 2024*
Argonne National Laborator, Illinois, USA

Fermilab-CERN Hadron Collider Physics Summer School — *Jul. 2024*
Fermi National Accelerator Laborator, Illinois, USA