

HONGYIN LIU

hongyin[at]ucsb.edu ☐ (215) 688 3162

Personal Website: hy-liu.com ☐ Github: hongyin-bug

EDUCATION

University of California, Santa Barbara

Expected June 2022

B.S. with Honors in Physics, College of Creative Studies

GPA: 3.93/4.0

RESEARCH EXPERIENCES

Experimental Particle Physics Group

Mar. 2020- Present

PI: Prof. Joseph Incandela, Co-Mentors: Dr. Valentina Dutta, Amina Li

UCSB

- Worked on the Light Dark Matter eXperiment (LDMX), a project aiming to produce and detect sub-GeV dark matter via a dark bremsstrahlung process, with a focus on the simulation and validation of new geometries for the Electromagnetic Calorimeter (ECal).
- Developed and implemented the rotation and layer shift of the Ecal in the simulation framework. Involves a combination of Python, C++, and Geant4 to build and link cell, module and layer maps. Improvements from previous Ecal simulation framework: allow rotation of hexagonal cell histograms, and unique identification of cell and module maps with respect to layer number.
- Validation and efficiency analysis on simulated hits of signal dark matter and background photonuclear events for the rotated Ecal geometry, mainly via Python: by studying distributions of Boosted Decision Tree (BDT) variables, fiducial electron ratio, hit containment, and comparing these with the original geometry.

Directed Reading on Dark Matter Theory

Mar. 2020- Present

PI: Prof. Joseph Incandela

UCSB

- During one-on-one bi- or tri- weekly meetings with Prof. Joseph Incandela, presented and discussed dark matter related papers on topics including nonbaryonic dark matter theory, high energy neutrino astrophysics, dark matter at colliders, Standard Model anomalies hints for dark matter, and dark matter models relevant to LDMX (thermal relic hypothesis, dark photon and other gauge bosons).
- Reading notes/presentations to be found in hy-liu.com.

Experimental Astrophysics Group

Sept. 2019 - Mar. 2020

PI: Prof. Benjamin Mazin, Co-Mentor: Noah Swimmer

UCSB

- Worked on Picture-C, a project that employs Microwave Kinetic Inductance Detectors (MKIDs) to image interstellar dust and debris.
- Focused on remote temperature monitoring for the instruments in the detector's control panel by designing and assembling (soldering) a circuit for the temperature sensors, and developing an algorithm to remotely receive real time temperature data from the Arduino.

Experimental Aerodynamics Research

Jul. 2017 - Aug. 2017

PI: Prof. Barry Luukkala, Co-Mentors: Diamond Moody, Luka Jelenak

CMU

- Pennsylvania Governor's School for the Sciences: analyzed the properties that affect an aerodynamic object's drag force, which involved testing different 2d and 3d shapes in a honeycomb wind tunnel.

AWARDS AND FELLOWSHIPS

Summer Undergraduate Research Fellowship (SURF)

Dean's Fellow, UCSB 2020

SELECTED TALKS AND PRESENTATIONS

(2021) “**Dark Sector Models for the Light Dark Matter eXperiment**”, 2021 Undergraduate Physics Research Symposium, Kavli Institute of Theoretical Physics, UC Santa Barbara, California

(2021) “Light Dark Matter eXperiment”, APS Conference for Undergraduate Women in Physics, Virtual Conference

(2020), “**Ecal Geometry for the Light Dark Matter eXperiment**”, College of Creative Studies Research and Creative Activities Conference, UC Santa Barbara, California

(2020) “Light Dark Matter eXperiment”, 2020 Undergraduate Physics Research Symposium, Kavli Institute of Theoretical Physics, UC Santa Barbara, California

TECHNICAL SKILLS

Programming

Python, C++, Mathematica, GDML

Hardware

Raspberry Pi, Arduino

Scientific Software

ROOT, GEANT4

SELECTED COURSEWORK

Graduate Classes:

Elementary Particle Physics (Prof. Jeffrey Richman), Statistical Physics (Prof. Cristina Marchetti), General Relativity (Prof. Gary Horowitz)

Undergraduate Classes

Condensed Matter, Complex Analysis, Linear Algebra, Fly by night physics, Teaching Physics

TEACHING EXPERIENCES

Learning Assistant

Hold three weekly discussion sections with the teaching assistant. Involves presenting example problems, facilitating classroom discussions, answering section or homework questions.

- PHYS 110B, Electromagnetism, with Prof. David Berenstein Fall 2021
- PHYS 125, Particle Physics, with Prof. Jeffrey D. Richman Spring 2021
- PHYS 110A, Electromagnetism, with Prof. Ania Jayich Fall 2020

Grader

Graded half of the students' weekly problem sets.

- PHYS 103, Intermediate Mechanics, with Prof. Georgios Koutroulakis

Fall 2019

OUTREACH

Student Volunteer to UCSB Physics Circus

Oct. 2018 - June 2019

- Visit primary schools in Santa Barbara on a weekly basis to showcase Van de Graaff generators, magnets, momentum conservation, and electromagnetic induction

Volunteer to The Franklin Institute Science Museum

Jan. 2017 - Jun. 2018

- Volunteer on a weekly basis to explain the science behind telescopes, gravity and space-time, brain imaging, and showcase optical illusions, puzzles, brain and heart specimen of common mammals, and the Zeiss Telescope.

PROJECT GALLERY

Term projects and paper: Laser Interferometry, Gamma Ray Spectroscopy, and Pulse Nuclear Magnetic Resonance

Supervisor: Prof. David Caratelli, Collaborators: Xiaoran Sui, Yining You Winter 2022

- Studied the wavelength and polarization of a He-Ne laser with the Michelson interferometer.
- Performed gamma ray spectroscopy using the Sodium Iodide crystal detector for common radioactive sources and studied Compton scattering with their gamma ray spectra.
- Performed Pulsed Nuclear Magnetic Resonance with a PS1-A spectrometer on mineral oil to study its spin-lattice and spin-spin relaxation times.

Term projects: Rediscovery of the Higgs Boson

Supervisor: Prof. Jeffrey Richman

Spring 2020

- Examined the Higgs signal and background simulated Monte Carlo samples through 4l channel, and compared the 4l invariant mass distribution with the CMS data of 2012.

Term projects: Raspberry Pi 4 Experiments

Prof. Everett A. Lipman

Winter 2020

- Projects done: Bang-bang and PID temperature control, controlling the brightness of an LED by accelerating an LIS3DH board, and measuring the dipole moment of a magnet.

Term paper: Digital Signal Processing and Fourier Transforms: Everyday Image Editing

Prof. Jean M. Carlson

Winter 2020

- Analyzed the methods used in digital signal processing, specifically how Fourier Transforms are used in image processing.