

# HONGYIN LIU

hongyin[at]ucsb.edu ☐ (215) 688 3162

Personal Website: [hy-liu.com](http://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: 3.97/4.0

## GENERAL RESEARCH INTERESTS

---

Particle Physics Beyond the Standard Model, Cosmology and High Energy Astrophysics,  
Dark Matter and Dark Sector Physics, Statistical Physics

## 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, 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. 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.
- Simulated hits of signal dark matter and background photonuclear events on the rotated Ecal geometry, analyzed its efficiency and compared with the old geometry by studying distributions of Boosted Decision Tree (BDT) variables, fiducial electron ratio, and energy containment.
- (Ongoing) Explore trigger methods and BDT variables for visible decays of the dark photon, and look at relevant physics models such as axion-like dark matter particles.

**Directed Reading on Dark Matter Theory**

Mar. 2020- Present

*PI: Prof. Joseph Incandela*

*UCSB*

- During 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 (related gauge bosons, millicharges, axion and scalar particles).
- Reading notes/presentations to be found in [hy-liu.com](http://hy-liu.com).

**Experimental Astrophysics Group**

Sept. 2019 - Mar. 2020

*PI: Prof. Ben 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 control panel of the detector by assembling temperature sensors to the control chips and an Arduino, and developing an algorithm to remotely receive and control 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 effects the drag force of an aerodynamic object, 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

---

<b>Programming</b>	Python, C++, Mathematica, GDML
<b>Hardware</b>	Raspberry Pi, Arduino
<b>Scientific Software</b>	ROOT, GEANT4

## SELECTED COURSEWORK

---

### Graduate Classes:

Elementary Particle Physics (Prof. Jeffrey Richman), Statistical Physics (Prof. Cristina Marchetti), General Relativity (Prof. Gary Horowitz, Ongoing: Fall 2021)

### Undergraduate Classes

Condensed Matter (Ongoing: Fall 2021), Complex Analysis, Linear Algebra, Fly by night physics (Prof. Anthony Zee), 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 project : Rediscovery of the Higgs Boson**

*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.