Upsilon Lab *Winter 2018 Quarterly Report*

an Official UCLA Physics & Astronomy Department Sponsored Organization

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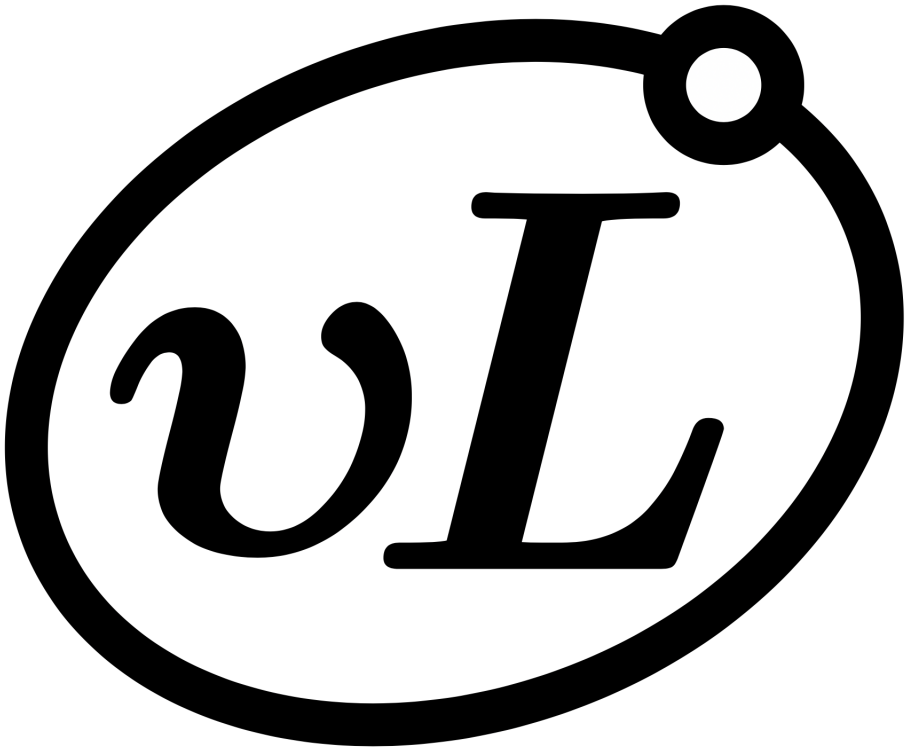

"A lab for undergraduates, by undergraduates."

Mission

The mission of Upsilon Lab is to provide undergraduate students in the UCLA Physics & Astronomy department the opportunity to learn valuable skills to succeed in their future endeavors, whether in research, engineering, or other fields.

Quarter Highlights

- Four active projects with twenty-three active members. Read about their progress on **pages 4-7**.
- All projects will continue into Spring 2018, along with five new projects. Interested in applying? Read more on **page 8**.
- We are hoping for around sixty total members for Spring 2018. This represents an approximately-10% capture of Physics & Astronomy undergraduate majors.
- We received a small grant from the Physics & Astronomy Department for our in-house projects.
- Contact us through our website! **upsilonlab.pa.ucla.edu** or **upsilonlab.org**.

Winter 2018 Summary

This quarter was Upsilon Lab's first quarter as an operational organization. In this time, we had twenty-one active members, working on four active teams with four active managers, for a total of twenty-seven department undergraduates involved directly in active projects.

Our four active teams for this quarter are listed below. More information is included later in the report, on the respective project pages.

Winter 2018 Non-Project Highlights

We published our **official website, upsilonlab.pa.ucla.edu**, which is the home for all of our academic materials, project descriptions, the membership application, and the source of all Upsilon Lab news and weekly updates.

We received a **small grant from the Physics & Astronomy Chair's Discretionary Fund** to be used for in-house project materials and website hosting costs. So far, we have directed approximately 5% of this budget to the PID with Microcontroller project, with the remainder available for future needs.

Raj Chaklashiya hosted our first **public workshop**, "Getting Started with LabVIEW", on February 22, 2018.

Four **skill guides** covering a wide range of topics are now available on our website.

Spring 2018 Projections

We have five additional managers who are either confirmed for a project or are in discussions with professors about project details for a total of of five upcoming Spring 2018 projects. Thus far, we have nineteen applicants, some of which are already placed in upcoming projects, and the remained ready to be placed in these teams. Our goal is to receive twenty applications in addition to this for a total of roughly seven members per team. These projects and their presently available specifics are discussed on page 8.

We expect a significant number of applicants will apply after their Physics 1A final exams this quarter, since they will then be eligible. We do not have any concrete information to forecast the number of expected applicants, but we have received numerous messages regarding the 1B Eligibility Requirement.

Advisory Board

The 2017-2018 Advisory Board is composed of three Department professors:

Prof. Jean Turner, Chair
Prof. David Saltzberg
Prof. HongWen Jiang

We would like to profusely thank the Advisory Board for their help and advice throughout the quarter, and their continued support throughout Spring 2018.

Pilot Waves

Sponsored by Prof. Seth Putterman

Managed by Stefan Orosco

Project Description

Pilot wave theory is an alternative interpretation of quantum mechanics, originally created by De Broglie and later refined into Bohmian mechanics. This research group will design, propose, and create an experiment that replicates the hydrodynamic pilot wave results shown in the John Bush paper, *Pilot-Wave Hydrodynamics*. This experiment will have specific requirements set by the sponsoring professor, such as the classical demonstration of quantum properties like entanglement. Team members will learn the basics of reading research papers, writing research proposals, and designing and building a professional experiment.

Quarter Project Highlights

The majority of the quarter was spent learning about the physics behind pilot waves, and performing a literature review of the current state of research. Prof. Putterman provided a budget and approved lab space for a first-prototype experimental apparatus to confirm experimental results from a premiere paper on the subject. The team drafted their own proposal for a prototype apparatus, with the with the expectation that we will improve its quality after an initial success. Construction of this prototype will commence immediately in Week 1 of Spring 2018.

Quarter Membership Roster

Nathan Burger

Obed Camacho

Rebecca Lewis

Shon Mackie

David Su

Alexander Tolstov

PID with Microcontroller

In-House

Managed by Krish Kabra

Project Description

A PID (Proportional-Integral-Differential) controller is a device used to make educated guesses with a system's history to predict its future and to control physical parameters using that knowledge. For example, most thermostats use PID controllers- they look at the current temperature, where it's going (derivative) and where it's been (integral). In this project, team members will learn how to program a microcontroller (e.g. Arduino) to perform a physical measurement interpret it in the manner of a PID controller, and use electronics to make a physical interface, e.g. a precision heating element.

Quarter Project Highlights

Members have learned basic Arduino knowledge, having built simple circuits with digital and analog inputs and outputs. In addition, they have gained insight into PID control and potential applications for feedback-based technology. The team has also outlined the procedure for constructing a water temperature control system using a PID controller. The team will commence building this water temperature control at the start of Spring 2018.

Quarter Membership Roster

Ahmad Ali

Nakul Gupta

Yuhui Huang

Sean Kwok

Cristian Manzo

Cyclotron Motion Simulation

In-House

Managed by Tony Alarcon

Project Description

Cyclotron motion is the motion that charged particles undergo in a magnetic field whereby they move outward in a spiral path. Team members will use Python to simulate the motion of charged particles undergoing cyclotron motion. They will then apply this simulation to physical systems to predict outcomes of potential experiments, examples of which include determining plasma wave behavior in the atmosphere using cyclotron accelerators.

Quarter Project Highlights

Team members completed an analytical investigation of particle motion in the presence of electromagnetic fields with application in cyclotron particle accelerators; generated Python programs involving control flow, class/function definitions, and 2D/3D plotting in the context of cyclotron accelerators; and implemented Runge-Kutta 4^{th} order and Euler approximations for particle tracking from Lorentz Force. The team will continue to expand on the simulation over the course of Spring 2018, adding features including simulation of multiparticle systems and position-dependent magnetic fields.

Quarter Membership Roster

Kelli Brookshire

Madeline Gullen

Shivangi Kulshreshtha

Christopher Ong

Yugantar Prakash

Huiyi Wang

Solar Batteries & Charging Analysis

In-House & Partnership with the UCLA Renewable Energy Association

Managed by Kenny Le

Project Description

As the effects of non-renewable energy resources, e.g. coal, oil, etc., are compounding the issue of global warming, the creation of practical and manufacturable renewable energy sources is necessary for the future of humanity. This experiment group will be designing, simulating and creating solar energy storage devices using lithium ion battery cells (18650) and various solar panels. In this experiment, team members will learn and use basic programming knowledge to simulate the efficiency of various solar panels and optimize a design that allows for the maximum return on investment for each solar pack.

Quarter Project Highlights

The team has gained an elementary proficiency in Mathematica under Kenny's guidance and teaching. They have applied it to a power efficiency simulation and are currently working on efficiency when paired with battery cells. Their next step is researching various solar and battery cell technologies, and implementing this knowledge into their simulation. This will meet the goals Upsilon Lab has agreed upon with in their collaboration with the UCLA Renewable Energy Association. They plan to use our results to create small solar generators they can rent to food vendors on BruinWalk to reduce the use of propane.

After that basic simulation is completed, the team will work on incorporating other physical factors into their simulation, such as the angle of incidence of light on the solar cells and considering the cost and benefits of incorporating an automated mechanism and sensor to rotate the solar panel.

Quarter Membership Roster

Amir Amhaz

Gregory Chang

Pedro Godoy

Emma Peavler

Spring 2018 Project Roster

All projects listed below are currently taking members. Apply through our website:
upsilonlab.pa.ucla.edu/join-member

To Commence Week 1-2

Data Analysis- Sponsored by Prof. Mayank Mehta
Managed by Mihai Bibireata

Efficient Electricity Generation via Novel Methods- In-House
Managed by Wynne Turner

Quantum Computer Noise Reduction- Sponsored by Prof. HongWen Jiang
Managed by Grant Mitts

High Speed Camera with Raspberry Pi for the Plasma Lab- Sponsored by Prof. Troy Carter
Managed by Chrystalla Havadjia

To Commence Week 3 or Later

TBA
Managed by Isabella Goetting

Special Thanks

The Founder-Presidents would like to thank:

- The Physics & Astronomy Department for their support and funding in operating Upsilon Lab.
- The Advisory Board for their invaluable advice throughout the course of the quarter.
- Professors Putterman, Mehta, Jiang, and Carter for sponsoring projects and their willingness to help the department undergraduates learn about physics from a research perspective.