Physics 307L

Spring 2020

Prof. Darcy Barron

Course webpage

https://ghz.unm.edu/juniorlab/

Will post all course materials, experiment descriptions, schedule etc to this wiki

Please check your email regularly for course announcements and updates.

Initial Class Survey

Please fill out by Friday!

Email me if you have any questions or problems.

https://forms.gle/emUxCRcLoyJPiV228

Contact information

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Office Hours by appointment

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What is this class?

Physics is a science, so it is based on experiment and observation.

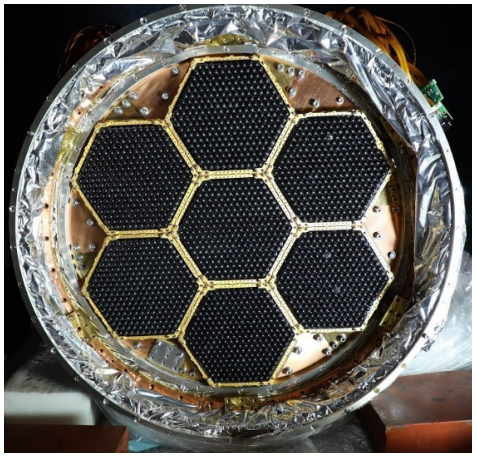
The majority of research physicists do experiments and make measurements.
This course is meant as an introduction to modern experimental techniques.

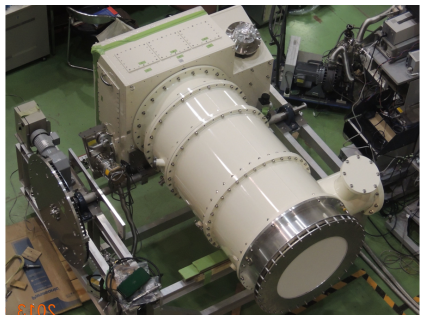
In this course you will:

- apply the theory you have learned in the real (experimental) world
- learn how to use various types of hardware, instrumentation, and software
- learn basic statistics, error analysis, and determination of statistical and systematic errors;
- perform the best possible (i.e. the most precise and accurate) experiment within the constraints of the available resources (equipment, time, etc.) - just like in real research!

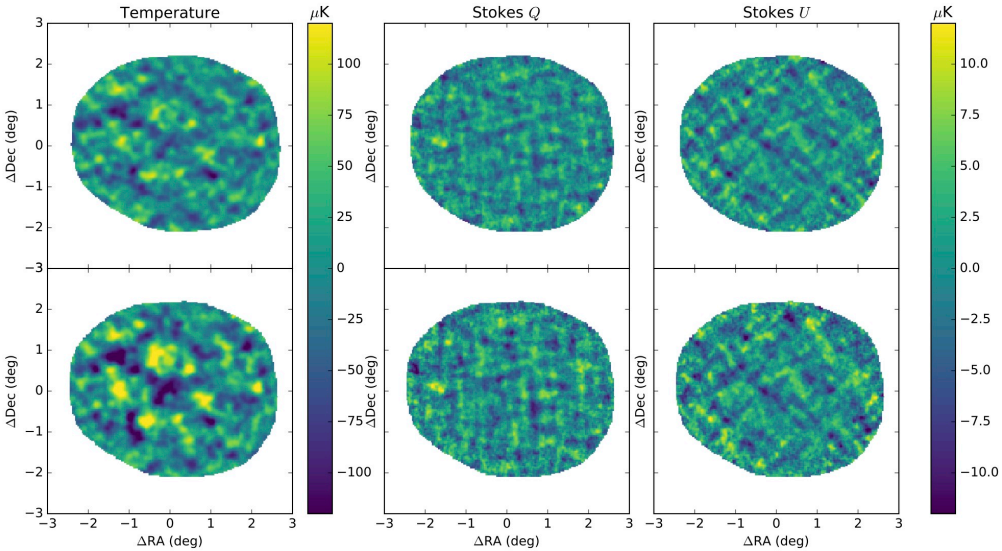
Cosmology with POLARBEAR and Simons Array

Prof. Darcy Barron





POLARBEAR/Simons Array is an experiment located in the Atacama desert in Chile, designed to map the cosmic microwave background's B-mode polarization signal. This faint pattern arises from gravitational lensing of the CMB, and is a powerful probe to study the composition and large-scale structure of the universe. A unique B-mode polarization pattern would also be imprinted by inflationary gravitational in the early universe. Measuring this signal would provide direct evidence for inflation, as well as provide insight into the mechanism and energy scale of inflation.



Grading

- In-class participation and performance 25%
  - Includes lecture and lab session
- Lab Notebook 25%
- Formal Reports and Presentations 50%

Challenging Modern Physics experiments

Require independent problem solving – harder than intro physics labs

10 experiments available; must do 6

1) Speed of Light
2) Balmer Series
3) Poisson Statistics
4) Planck's Constant
5) Compton Scattering
6) Electron Diffraction
7) Ratio e/m
8) Franck-Hertz experiment*
9) Electron spin resonance*
10) Millikan oil drop: electron charge*

* Should be attempted later in semester

First week lab (everyone): Review of oscilloscope and R-C circuits

Grading - participation and performance

- Lecture attendance and participation
- Lab session attendance
- Successful completion of 6 experiments

Grading – lab notebook

- This notebook is a diary of all your lab work
- Information is recorded as it is done, including include everything about the work so that another person can read the notebook and know exactly what was done (or so you can reproduce it)
- https://phys.libretexts.org/Bookshelves/Ancillary_Materials/Demos%2C_Techniques%2C_and_Experiments/The_Laboratory_Notebook
- http://pmaweb.caltech.edu/~phy003/notebooks/notebooks.html

Grading – formal reports and presentations

- Lab notebook is a chronological record of what was done
- Lab reports are a re-organized, structured report about what was done and what was found
- Need to submit 2 formal reports and give 2 presentations (on separate experiments)
- Format reports are written in the style of a scientific paper
- Presentations will be in the style of a conference talk

Overall Schedule

- You are expected to show up well-prepared for the lab sessions
- You will sometimes perform the experiments with a partner, but you must keep your own lab notebook, do your own data analysis and write your own lab reports and presentations
- Some experiments should be performed later in the semester, after you have more experience

This week

- Complete the pre-class survey
- Complete lab safety trainings and email certificate of completion
  - Laser Safety Training, UNM Physics and Astronomy
  - Radiation General Awareness
- Review the syllabus
- Review the list of experiments
- Start signing up for schedule of experiments
- Lab Session - Experiment 1: The Oscilloscope

Any questions?