



# The Colorado College Physics Major A Brief Overview



**Get on the Mailing List today!** The only way to be in the know about all departmental events, new classes, research opportunities, and jobs. “A must have,” says one physics major. “I wish I had received these emails since freshman year,” exclaims another. Don’t hesitate, **ask Kate to add you to the physics mailing list today!**

## People

### Faculty

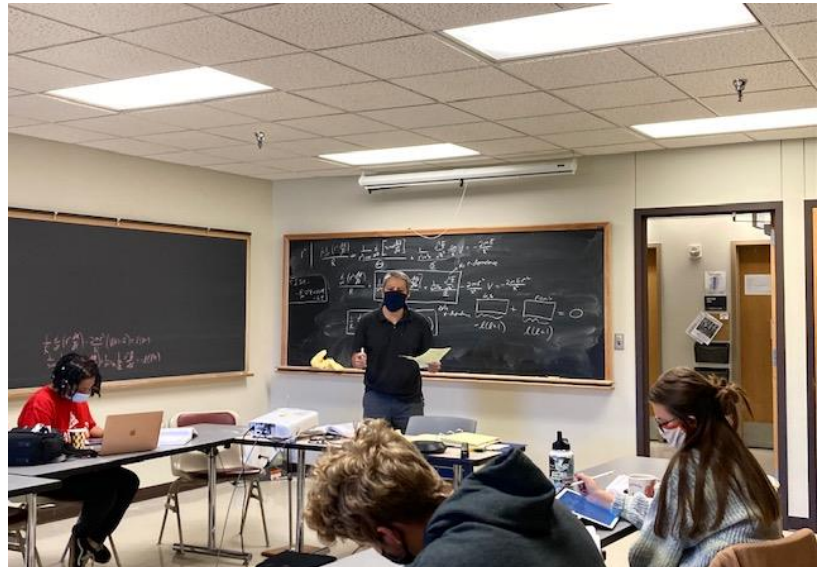
Take some time to say hi to faculty when you see them around. Majors will eventually take classes with most faculty members. Look at the Faculty/Majors board to learn more about each faculty member.

#### Current Faculty Members

Kristine Lang- chair  
Shane Burns  
Natalie Gosnell  
Phillip Cervantes  
Patricia Purdue  
Adam Light  
Dhanesh Krishnarao

#### Visiting Professors

Evelyn Schumer- visiting professor  
Charles Wetterer- astronomy adjunct  
Catherine Witherspoon - visiting professor  
Jeff Iuliano – visiting professor  
Juan Burciaga- summer astronomy class



### Kate Carlton

The “heart of the department”, you will often see Kate in the Department office making the physics department run from behind the scenes (Barnes 230).

The word in the seminar room is “get to know Kate, she can help in so many ways. Seriously, she will always commiserate on homework, help navigate the department and will always, always feed you.”

## Jeff Steele

Our Technical Director. Jeff helps with everything technical in the department from labs to personal projects. PS: He will save you in Electronics.

## Steve Burt

The Machine Shop Director. Steve works in the basement of Olin in the Machine Shop. You can work with him directly by taking his machining adjunct PC 108.

## Hart Hancock

Our current paraprofessional. He works around the department and helps with intro labs. Pop into his office (Olin 260) anytime for life advice or questions about the major. This position opens once a year in February and is a fantastic job to stay in academia while making decisions about what comes next!

## Places

### Seminar room (Barnes 213)

The academic and cultural hub of student life in the physics department. A meeting place for physics students to work on homework and debate the right way to do a problem. Expect discussion, whiteboard explanations, and comradery. And tea and coffee! To get access to the room, a cubby, and a major mug, contact the paraprof.

### Department (Kate's) office (Barnes 230)

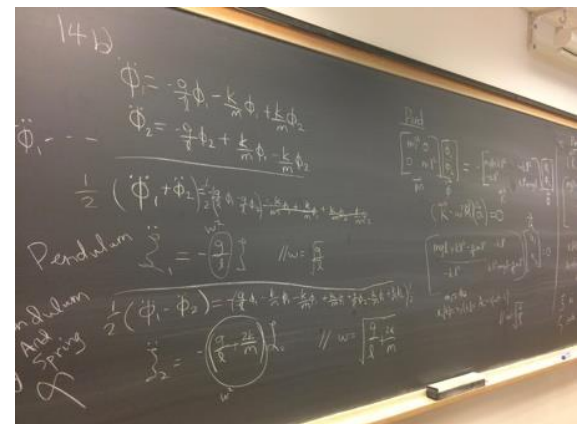
This is where you can do printing, copying, find staples, tape, etc. Oh, and snacks and conversation live here too!

## Classes

As a physics major, these are the classes you will take as you progress through the major.

### 3-Block Intro Sequence:

- Mechanics and Electricity and Magnetism (PC241/242): These classes are usually larger, and somewhat lecture based. They introduce you to most of the concepts you will continue to learn and use throughout physics at CC.
- Modern Physics (PC251): Offered third block of every year. This course introduces topics developed in or influenced by 20<sup>th</sup> century physics. You will be



introduced to special relativity and quantum mechanics.

### Lab Classes:

- Electronics (PC261): You spend your days in the electronics lab making friends with resistors, transistors, and your lab partner(s). This class introduces you to laboratory techniques and builds a basic understanding of analog circuits.
- Techniques OR Observational (PC361 OR PC362): You deepen lab skills with these classes. In techniques you will work with experimental design, data collection, analysis and presentation. Observational is focused on observation techniques and data collection and reduction.



### Upper-Division Classes:

Most of your classes as a major fall into this category. These classes tend to be smaller than intro classes. Class usually consists of a mix of lecture and going over problems with your classmates.

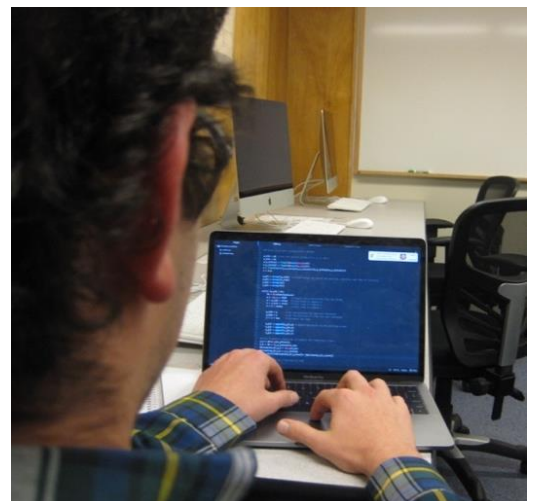
### Other Fun Non-Required Electives:

- Computational Physics Adjunct (PC263): Learn how to use python to work with data.
- Machining Adjunct (PC108): Use the machine shop in the basement of Olin to create cool projects with metal, wood and plastic.
- Observational for Amateurs Adjunct (PC132): Learn how to use the Phipps observatory at CC.
- Engineering Half Block (PC210): Learn about what different kinds of engineering consist of. Usually taught by someone currently working in the field, sometimes a CC grad. This year's topic is "Careers in Mechanical and Electrical Engineering."



## Community Opportunities

**Senior Seminars:** Each physics major takes a class in block one of their senior year where they develop techniques for presenting physics material. The culmination of this class is a paper and talk they give to the department. You are encouraged to attend these presentations! Kate will be asking for RSVP's.





**Career Talks:** We invite our majors back, once they are established in a job, to talk to us about how they got to where they are now! These talks outline their personal journey from a CC physics degree to their current position. The talks are always followed up by Q&A's. These are amazing networking experiences and informative as you navigate what's next.

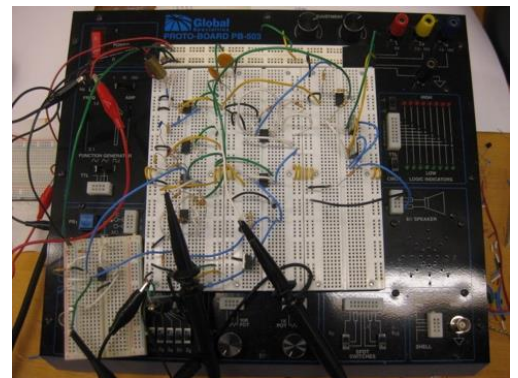
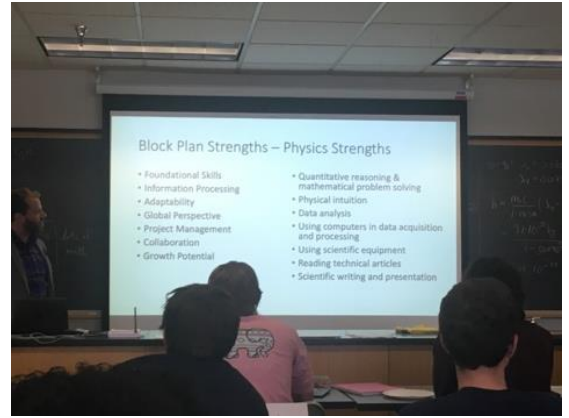
**Peer-Mentoring:** The department has a new peer mentoring program! We connect senior majors with students in the intro block sequence. The program aims to provide connection and support for new physics students and welcome them into the community. If you are interested in being connected with a mentor or want to know more, contact the paraprof (Hart).

## Student Jobs

**Grading:** Junior and Senior majors grade homework for introductory classes each block. This is a great way to brush up on intro physics skills and work on one's own schedule. Hart manages the schedule so reach out when you feel your skills are ready to start grading.

**Research:** Ask any physicist and they will tell you a research experience is a great idea for undergraduates and if you are considering Grad school it really is a must. Some of our faculty members host research students during the semester, in a research block or during the summer. If you are intrigued by the research interests of a faculty member talk to them early in the year about opportunities to work with them. See bottom of packet for information about faculty research interests!

There is an REU workshop every year. This year, Dr. Light will host the workshop. He will help you explore your options and craft your resume and application materials.



# Faculty Research Interests

## Dr. Light

- Our lab studies atmospheric pressure plasma physics and its applications. Our plasmas are unique because they do not reach thermal equilibrium. Neutral atoms and ions remain near room temperature while electrons gain enough energy to break chemical bonds ( $\sim 10^4$  K). Applications for these “cold” plasmas span materials science, environmental remediation, biological treatments, and more.
- We often design mechanical and electrical components, use lasers and high voltage electronics, make optical and electrical measurements, and write code to simulate or analyze our experiments.
- I typically have one block of research for credit during the school year and take several students for paid research during the summer.
- Depending on funding, 2-6 students is typical.

## Dr. Gosnell

- I am an observational astrophysicist. My research focuses on telling the stories of binary stars, specifically focusing on how the evolution of a star can be changed by being in a binary system. My group uses data from ground- and space-based telescopes to identify and more fully understand these binary stars. We use Python code to analyze our data and compare against theoretical models.
- I will be on sabbatical for the 2023-2024 academic year, so keep an eye out for new research opportunities with me Fall of 2024.

## Dr. Krishnarao

- I'm most interested in trying to understand how our Galaxy, the Milky Way, evolved to its current state. I frequently use observations of spectra from a ground-based telescopes in Chile (called WHAM!), or the Hubble Space Telescope, to search for gas in and around galaxies. I also enjoy digging through archives to make the most out of older observations with new techniques, like machine learning and AI.
- I hope to work with 3-5 students starting next summer.

## Dr. Cervantes

- I am a high pressure, solid state physicist interested in fundamental phenomena of crystal physics such as structural phase, phonons, bulk moduli, and electronic band properties. More specifically, I investigate such observables under high pressure conditions and compare the results with theoretical calculations, via collaborations.
- Band structures of materials change when under high pressure conditions. This is a common method for assessing band structure facets.

**Dr. Burns**

- I'm working on measuring the brightness of the night sky in support of a proposal for the dark sky reserve in the San Luis Valley. The work will involve assembling a Sky Quality Meter measurement system, programming the data acquisition, and analysis software.

**Dr. Purdue**

- My area of research is general relativity and gravitational waves, but prior knowledge of these subjects is not necessary for many student projects. For example, students can generate gravitational waveforms from elliptical binary systems or examine the effects of re-positioning a spacecraft's communications antenna on the spacecraft's gravitational-wave sensing system.
- Please contact me for more information.

**Dr. Lang**

- I am writing a biophysics textbook. I would love to work with a student who wants to research topics and problems. This is a great way to get paid to learn about a new field of physics and that could help with your Capstone project. I am amenable to students who want to work part of the summer or part time.

**Dr. Iuliano**

- I am an experimental cosmologist, focused on the Cosmic Microwave Background. This is the oldest light in the universe, and a rich source of information -- particularly about the very early universe. I help build telescopes that measure this ancient signal, which observe from a mountaintop in the Atacama Desert of Northern Chile. The work I do ranges from designing, building, and testing the instruments, to supporting and characterizing the instruments in the field, to processing the resulting data. If any of that sounds interesting, I am happy to tell you more about it!
- I expect to have funding for at least one student over the summer, but I could also work with someone during the year.

**Dr. Witherspoon**

- My research focuses on understanding the evolution of galaxies smaller than our own Milky Way, specifically in galaxies with an actively accreting supermassive black hole. I study where the gas lives in these galaxies and then compare that to where stars are forming using observations from the SDSS MaNGA optical survey and several radio telescopes around the world. I use Python and the radio astronomical code CASA to analyze the data.

# Events Calendar

Every 3<sup>rd</sup> Thursday- Peer Mentoring Meeting. Lunch and time to chat with fellow majors.

Nov 3<sup>rd</sup>, 12pm: Majors Meeting- TODAY

Nov 7<sup>th</sup>, 12:30pm: **NASA**- Zoom talk with Nayi Castro, engineer at NASA

Nov 10<sup>th</sup>, 12pm: **Career Talk**- John Jefferson. Chemistry professor at Luther College

Dec 1<sup>st</sup>, 12:15pm: **REU Workshop**- Building resume to help land research positions.

Dec 15<sup>th</sup>, 12pm: **Career Talk**- Morgan McInville. Mechanical Engineer Lead at Emtera.

May 3<sup>rd</sup>, 4<sup>th</sup> 12pm: **Retirement Party** - Shane Burns.

\*more career talks to be announced (make sure you are on the emailing list)

## Senior Seminar Schedule:

Feb 23: Merrit Curtis

Feb 27: Michael Braithwaite

Mar 1: Adam Keim

Mar 5: Will Wallace

Mar 8: Will Taylor

Mar 29: Gigi Jensen

Apr 2: Megan Prakash

Apr 5: Carol Zhang

Apr 12: Katie Joslyn

**Senior Seminar Saturday** Apr 13: Owen Cox, Nate Hohner, Liam Keeley, John Lê, Doug Peecher, Wanyan Yuan

Updated November 2023