Physics 308 – Observational Astronomy – Fall 2021

Instructor

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Information

This is a basic course in observational astronomy with an emphasis on optical astronomy. The prerequisite is a course in introductory physics. Familiarity with elementary astronomy or astrophysics will be very helpful but is not required. Necessary materials will be provided, usually through the class website.

This semester the class has its content and assignments entirely online, topical video conferencing for individuals and groups, and observational sessions through the semester that you can also join by video conference. When the current surge in the pandemic subsides and it is safe to do so, we may offer in-person use of telescopes on campus for observing the Sun, Moon, and bright planets (Venus, Jupiter and Saturn are visible now), and visits to Moore Observatory nearby in Oldham County for those who want to see and use research telescopes in person. The fact is though, that except for a few technicians, engineers,and specialist observers, most contemporary observational astronomy is based on remote operation of instruments, and the analysis of astronomical data.

We will emphasize optical astronomy from the ground and from space with the goal of developing your understanding of how the data are acquired, how to access data, and the use of physics and computing to understand its meaning. Each week will cover a new topic with content usually available early in the week and an simple assignment due by the next Monday. To complement the weekly assignments we will have individual short research projects with a culminating report at the end of the semester.

Objectives

This course in observational astronomy builds on experiences with hands-on, live remote, and robotic astronomy for students to

- develop skills enabling research in observational astronomy
- learn how to explore large sets of data for new discoveries
- reinforce studies of fundamental astrophysics
- connect basic knowledge to contemporary astrophysics research

- understand the relationship of technology and engineering to scientific discovery
- propose critically reasoned tests of new ideas
- prepare and present reports on scientific work

We will use simple weekly assignments and a mentored creative project of your own to meet these goals.

Websites

The course will operate through Blackboard which will provide links to other resources that may change during the semester. Two other sites which will have content for you are.

The homepage for course resources is

http://prancer.physics.louisville.edu/classes/308

The U of L astronomy homepage with links to the observatories and weather information is

http://www.astro.louisville.edu

Requirements

Since the class is entirely online this semester with occasional virtual presence for conferences and observing, you will need a way to join into these sessions, receive routine email, and to do some computer-based work at home. A laptop with a camera and microphone suitable for video conferencing is recommended, but for that purpose a cell phone or a tablet should work. For computing and data analysis, most software requires a laptop or desktop with Windows, MacOS, or Linux. If you have a difficulty with this please let us know since we have resources on campus you may use too. There will be weekly announcements about the the class during the semester to help you stay current.

Class meetings and support

There are no fixed scheduled class meetings during the normal term. You will be asked to participate in online conferencing or virtual observing either individually or in groups a few times during the semester. If you need help at any time, try email and we may have one-on-one video conferences if you prefer.

Live online at an observatory

We will have remotely operating observing sessions from Moore Observatory here near Louisville, from our telescope on Mt. Lemmon near Tucson, Arizona, and perhaps from our facility at Mt. Kent Observatory of the University of Southern Queensland west of Brisbane, Australia.

Observing with a telescope in person

With the uncertainty of the developing pandemic surge at this time (August 2021) we are not sure what we may be able to do in person. Outdoor possibilities include observing the Sun in the daytime on campus, and using the telescope on the roof of the Natural Science Building to observe or record images of the Moon, Venus, Jupiter, Saturn and the brightest of star clusters and nebulae. Visiting Moore Observatory during early evening hours when the weather is favorable would be partly indoors (the telescopes are remotely operated) except for a small telescope that you can view through. Since typically September and October have a favorable probability of clear sky, and the bright planets this fall are visible soon after sunset, there should be opportunities of some kind available. We will assess the safely of in person activities in early September.

Assignments

The class will have weekly assignments intended to help you keep up with the content, and to stimulate questions so that even in the online environment we may have virtual discussions, and occasional meetings.

Project

After the first few weeks of the class, we will help you to choose your own topic that uses data you may acquire with our facilities, or retrieves data from ground- or space-based astronomy archives. While your will work will use the ideas and skills you develop in the class, we will help you with the research and preparation of a report and preparation. Group projects are also possible with 2 individuals working together on one topic combining their interests and skill sets.

Grading

Your course grade will be 80% from the weekly assignments and 20% from the research components. Be sure to participate weekly and complete the assignments by the end of the day the following Monday. Letter grades will be assigned based approximately on A (90 to 100); B (80 to 89); C (70 to 79); and D (60 to 69).

Title IX/Clery Act Notification

Sexual misconduct (including sexual harassment, sexual assault, and any other non-consensual behavior of a sexual nature) and sex discrimination violate University policies. Students experiencing such behavior may obtain confidential support from the PEACC Program (502.852.2663), Counseling Center (502.852.6585), and Campus Health Services (502.852.6479). To report sexual misconduct or sex discrimination, contact the Dean of Students (502-852-5787) or University of Louisville Police (502.852.6111).

Disclosure to University faculty or instructors of sexual misconduct, domestic violence, dating violence, or sex discrimination occurring on campus, in a University-sponsored program, or involving a campus visitor or University student or employee (whether current or former) is not confidential under Title IX. Faculty and instructors must forward such reports, including names and circumstances, to the University's Title IX officer.

For more information, see the Sexual Misconduct Guide.

http://louisville.edu/hr/employeerelations/sexual-misconduct-brochure

Weekly topics for class

August 23 The sky and celestial coordinates

August 30 Optical and infrared astronomy: what we observe, measure, and understand

September 6 Labor Day holiday Monday. Observatories and instrumentation including NASA TESS

September 13 Accessing existing data: Simbad, MAST, TESS, Gaia, and HST

September 20 Telescopes

September 27 Sensing and imaging light: CCD and CMOS detectors

October 4 Mid-term break Monday. AstroImageJ, our tool for almost everything with Python and Julia for everything else.

October 11 Observing the solar system: Sun, Moon, planets, their satellites, asteroids, and comets

October 18 Observing stars: magnitudes, colors, proper motion, parallax

October 25 Stellar spectra: composition, temperature, rotation, activity, velocity

November 1 Observing variable and binary stars

November 8 Detecting and characterizing planets of other stars

November 11 Extragalactic optical astronomy

November 22 Thanksgiving week. No new content or assignments

November 29 Project work due

December 6 Last day of classes with no new content or assignments

Version of August 11, 2021