

Introduction to Astrophysics

PHYS 208 - Spring 2025

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Overview and basic info

Course info

Classroom: Hugel 142

Lab: Mondays 1:15-4:00pm OR 7:00-9:45pm

Lecture: Tuesday & Thursday 2:45-4pm

Textbook: 21st Century Astronomy, 7th Edition (Palen & Blumenthal) with [online access](#)

Supplemental text: Open Stax College Physics 2e (Urone & Hinrichs) [Available free](#)

Office Hours: W 1-4pm and R 10am-noon

Instructor: Dr. Stephanie Douglas

Please call me “Professor Douglas” or “Doctor Douglas” or “Professor”

My pronouns are she/her/hers

Email: douglste@lafayette.edu

Office: Hugel 022

Course Policies

Attendance required, let me know ASAP if you will be absent

This class will be taught in person. All class and lab sessions will proceed assuming everyone is participating synchronously, and you will be graded on your participation in class activities. If you must miss class or lab sessions, please let me know as soon as possible. You are responsible for completing the day’s work to receive participation credit for that day.

Your health is always paramount, but even more these days. For minor illnesses, just let me know and I will waive participation for that day. **Please do not attend class if you are ill.**

If you will miss multiple classes due to an illness, let me know ASAP and work with Bailey Health Center and/or another health provider to obtain a Dean’s Excuse. Dean’s Excuses are also available for other disruptive life events. If you have a Dean’s Excuse, you will not be required to use the time bank, and participation grades will be waived for the time you were out.

If you will miss class, lab, or an assignment deadline due to a religious holiday, please **contact me by the add/drop deadline** so we can make plans for you to complete the relevant work.

Masks required

Wearing a mask is known to reduce the transmission of SARS-CoV-2, the virus responsible for COVID-19. **To protect the health of our class, masks must be worn during classes and labs,**

for at least the first two weeks of the semester. Masks should be made of a tightly woven cloth or non-woven synthetic filtering material, and should be worn properly over the nose and mouth and secured on the chin. Food and drink must also be consumed outside of the classroom (*brief* mask removal to drink water will be permitted as long as nobody abuses this). Students who show up to class without a mask will be asked to return to class wearing one in order to protect the health of our classroom community. In the event that you do not have access to a mask to wear during the class session, please let me know and I will help you obtain one.

Contact and office hours

Open drop-in “contact” or “office” hours are listed above. You do not need an appointment to stop by! If you would prefer to meet virtually for office hours, I will also keep a Zoom link open.

I also have blocks of time each week for one-on-one meetings; if these times don’t work for you, please email me.

You may send me an email at any time! I generally *check* email between 10-6 on weekdays, and will reply to your email by the end of the next weekday.

I expect you to check email (and read any announcements) at least once between each class.

Contingency plan for virtual meetings

Ideally we will be able to maintain in-person classes this semester. However, COVID-19 or weather may temporarily require us to switch to Zoom meetings. I will let you know as far in advance as possible if this is necessary. The Zoom link will be posted to Moodle.

Hopefully we’re all familiar with virtual class etiquette by now. Mute your mic when you’re not speaking, raise your hand physically or virtually to speak, be polite in the chat, etc. I would appreciate it if you keep your cameras on - if this isn’t possible, please [set up an appropriate profile picture](#) so that I’m not talking to blank squares.

Accommodations: flexible, let me know as early as possible

My policy: Your success in this class is important to me. If you need accommodations for any reason, please speak with me privately ASAP to discuss reasonable accommodations. I am happy to consider creative solutions as long as they do not compromise the learning goals of the activity.

Mandatory statement for any Lafayette course with a disability policy: Lafayette College is committed to creating a learning environment that meets the needs of its diverse student body. If you anticipate or experience any barriers to learning in this course, you are welcome to discuss your concerns with me. If you have a disability, or think you may have a disability, please meet with the [Office of Accessibility Services](#), to begin this conversation or request an official accommodation. If you have already been approved for accommodations through the Office of Accessibility Services, please meet with me so we can develop an implementation plan together.

Collaboration, Plagiarism, and Generative “AI”

We at Lafayette share the values of the academic community, which (among other things) require us to acknowledge the contributions that others have made and to continue to add to ongoing intellectual conversations. Failure to uphold these values, either intentionally or inadvertently, is a violation of the community’s standards. Moreover, certain violations of the community’s standards clearly rise to the level of academic dishonesty and can have serious consequences. [Review the full text of Lafayette’s Academic Integrity Policies.](#)

You are expected to abide by the principles of intellectual honesty outlined in the [Lafayette College Student Handbook](#). All answers must be given in your own words, not copied from the textbook or any other resources. Copying solutions from another source is a violation of the [Academic Integrity Policy](#). This includes Chegg, Bartleby, CourseHero, or similar websites; instructor/publisher solutions; the work of other students; or anything you can find on Google. Use of large language models or “generative AI” such as ChatGPT to generate text or project components is also prohibited. If you have any questions about whether something constitutes academic dishonesty, I encourage you to discuss it with me without hesitation.

Science is a social enterprise, and I encourage you to collaborate with your peers on in-class activities, labs, studying, etc. “Collaboration” does not mean “copying.” You must understand and individually write out your own answers, and you must turn in your own copy of each assignment (unless otherwise noted).

You may not work collaboratively on projects, unless otherwise noted.

Evidence of plagiarism or other academic dishonesty will be reported to the College.

Commitment to Inclusion and Equity

Lafayette College is committed to creating a diverse community: one that is inclusive and responsive, and is supportive of each and all of its faculty, students, and staff. The College seeks to promote diversity in its many manifestations. These include but are not limited to race, ethnicity, socioeconomic status, gender, gender identity, sexual orientation, religion, disability, and place of origin. The College recognizes that we live in an increasingly interconnected, globalized world, and that students benefit from learning in educational and social contexts in which there are participants from all manner of backgrounds. The goal is to encourage students to consider diverse experiences and perspectives throughout their lives. All members of the

College community share a responsibility for creating, maintaining, and developing a learning environment in which difference is valued, equity is sought, and inclusiveness is practiced.

If you are experiencing discrimination or harassment in this class, please do not hesitate to reach out to me so that I can help resolve the issue.

Do not repost learning materials, do not create your own recordings

All course materials are proprietary and for class purposes only. This includes posted recordings of lectures, worksheets, discussion prompts, and other course items. Such materials should not be reposted, and should be deleted at the end of the semester. Online discussions should also remain private and not be shared outside of the course. If you have any questions about proper usage of course materials feel free to ask me. You may not record classes yourself.

Mandatory Moodle privacy statement

Moodle contains student information that is protected by the Family Educational Right to Privacy Act (FERPA). Disclosure to unauthorized parties violates federal privacy laws. Courses using Moodle will make student information visible to other students in this class. Please remember that this information is protected by these federal privacy laws and must not be shared with anyone outside the class. Questions can be referred to the Registrar's Office.

Assignments and grading

Unless otherwise noted, all assignments must either be completed entirely within Moodle or Norton Smartwork. Submissions to Moodle must be uploaded as PDF files or working Panopto video links. Work that is uploaded as an image or video file from your camera will not be graded.

Course Grade Components

- Attendance and participation: 10%
- Pre-class work/reading "quizzes": 10%
- Classwork: 15%
- Labs: 15%
- Lab test: 5%
- Weekly challenge assignments: 30%
- Final project: 15%

Three 48-hour free passes to extend deadlines

Over the course of the semester, you will have three 48-hour passes that you can use to extend deadlines for homework, labs, or projects, no questions asked. You may combine 2 or 3 of these passes on a single assignment, but you may not subdivide the 48-hour increments. The only exception is the final project - you may only use 1 pass on the final. **To use a pass, email me**

(either ahead of time, or when you turn the assignment in), indicating the number of passes you would like to use.

Late work policy: 3% off per 24 hours late

If you do not use the time bank, late assignments will be penalized by 3 percentage points per 24 hours after the assigned deadline, up to 25% of the total points for that assignment. **Late work will still be accepted through the last day of class, but you are on your honor not to get solutions or assistance from your classmates.**

Pre-class work and reading quizzes (10%)

Reading and pre-class assignments will be assigned ahead of each lecture, generally at least 1 week in advance. These assignments may include watching videos or exploring interactive apps ahead of the class. The goal of the pre-class work is to increase the amount of interaction during our synchronous class time, and minimize the time you're spending watching me talk.

Expect to spend about 4 hours actively reading and interacting with pre-class material per week. Use the listed learning goals to guide your reading. Before each class, you will take small quizzes and/or submit short reflections on the content. These will be graded for completion only.

(If it becomes clear that many students are not completing pre-class work, the reading quizzes will be graded for accuracy.)

Attendance and class participation (10%)

Showing up to class is the bare minimum for receiving participation points. You can also increase your participation score by participating in poll questions, group work, and other in-class activities, and by attending office hours.

Classwork (15%)

Each day in class, you will complete a worksheet in collaboration with your group. Some days I will collect these worksheets to provide feedback and check completion. If you do not complete all the problems in class, you must complete and submit them **by Tuesday's class the following week**. To receive full credit for classwork, you must make a good-faith effort to work through as many problems as you can, carefully and thoughtfully.

Labs (15%)

Lab periods will generally involve extended activities intended to help you uncover challenging concepts and to meet the Natural Science requirements of the Common Course of Study.

Lab grades will be based on the following

- A completed worksheet or brief report turned in at the end of the lab period (one per group) (6/10 points)

- Accuracy of responses on the group worksheet (4/10 points)

Lab test (5%)

One lab period will serve as an evaluation of your understanding of Newton's Version of Kepler's Third Law. You will be provided with data related to one or more orbiting systems, and will need to derive the masses of the objects involved. This will likely be the Galactic Center lab.

During the lab test you will work with your group, but I will provide minimal assistance. You will have the rest of the week to finish your lab and write-up if needed.

Weekly challenge assignments (30%)

Each week you will be assigned 1-2 extra problems and/or short writing assignments. Any problems will be more difficult than those solved in class, and may involve material from multiple previous weeks (but not from the week in which the assignment is due). There will be 12 such weekly assignments; you must complete at least 9. Expect to spend at least 2-3 hours on homework each week. **Challenge assignments are due Thursdays at 5pm.**

You may consult your book, class material, and me for these assignments. You may consult outside sources as long as you cite them and paraphrase all material in your own words. You may discuss the problems with other students in PHYS 208, but you should choose different topics (if applicable) and write up your answers separately.

Final Project (15%)

You may work independently or in pairs on the final project. Each person or pair will receive a new set of data including stellar parallaxes, star cluster photometry, cepheid variable light curves, and Type Ia supernovae peak brightnesses & redshifts. Each group will receive different datasets. The completed project will consist of

- Correctly calibrated steps of the distance ladder, culminating in a plot showing the Hubble-Lemaître Law
- A measurement of the Hubble Parameter (H_0), with uncertainty
- Written description of the process used to find the information above
- 1 page of additional text explaining how this demonstrates the expansion of the universe, and what is missing from the Hubble-Lemaître Law.
- A one-on-one meeting with me to review your results

Course Outcomes (learning goals)

After completing this course, you will be able to...

- Describe the basic levels of structure in the universe and arrange objects in order of size
- Interpret the light coming from an object to determine its temperature, composition, motion, or other properties
- Use Kepler's laws, Newton's Laws, and the Law of Gravitation to evaluate the motion of orbiting bodies

- Differentiate between scientific and non-scientific hypotheses for the history of the universe and the motion of objects within it
- Explain why some types of stars are more common than others, and why that changes over time for a given group of stars
- Compare the evolution of stars of different masses, and their end products
- Relate the appearance of different galaxies and star clusters to their histories and current stellar populations
- Determine the relative distances to other objects using parallax or a standard candle technique
- Use a graph of galaxy recession velocity and distance to evaluate hypotheses about the expansion of the universe
- Define an ideal gas, and use the first law of thermodynamics to explain how energy moves within a system

In addition to the outcomes listed above, this course will promote the outcomes from the Natural Sciences/Study of the Natural World section of the Common Course of Study. You will be able to...

- NS/NW 1: Employ the fundamental elements of the scientific method in the physical and natural world by identifying and evaluating a testable scientific hypothesis.
- NS/NW 2: Create and evaluate descriptions and representations of scientific data via equations, graphs, tables, and/or models.

Specific learning goals for each unit will be distributed weekly.

Student work in this course is in full compliance with the federal definition of a 4 credit hour course.

Planned course schedule (subject to change)

Default text: 21CA = 21st Century Astronomy, 7th Edition (Palen & Blumenthal)

OSCP = OpenStax College Physics 2e (Urone & Hinrichs; only used in Weeks 2-3)

Wk	Dates	Ch.	Topic	Other notes
1	Jan 27-31	1, 3	Scientific method, structure, orbits and Kepler's Laws	Lab: intro/setup
2	Feb 3-7	21CA 13.1 OSCP 13, 14	Temperature, ideal gases, heat	Lab: Parallax Add/drop deadline Friday
3	Feb 10-14	OSCP 15 21CA 5	Thermodynamics Light and matter	Lab: Newton's Version of Kepler's 3rd Law
4	Feb 17-21	5	Light, continued	Lab: Spectroscopy
5	Feb 24-28	13	Observing the stars	Lab: Colors of Stars
6	Mar 3-7	13	Stellar properties, HR Diagrams	Lab: Ideal gas law/absolute zero
7	Mar 10-14	6	Telescopes	Lab: HR Diagrams
				Spring break, no classes
8	Mar 24-28	15	Star formation	Lab: Diffraction limit (Mid-term grades due)
9	Mar 31 - Apr 4	16	Stellar evolution - low mass stars	Lab: Cepheids
10	Apr 7-11	17	Stellar evolution - high mass stars	Lab: Exoplanet orbits
11	Apr 14-18	18	Stellar Remnants, black holes	Lab: Galactic Center (Lab Test)
12	Apr 21-15	19, 20	Galaxies	Lab: WD SNe/Hubble's Law
13	Apr 28 - May2	20, 21	The expanding universe	Lab: Galaxy Rotation curves
14	May 5-9	22, 23	Beyond the Big Bang	Lab: Evidence for the Big Bang
			Finals week	Final project due