Astrophysics

PHYS308 - Fall 2021

Overview and basic info

Course info

Classroom: Hugel 017
Time: 02:45-04:00pm TR

Textbook:

- Principles of Astrophysics (Keeton)

Additional resources on reserve at Skillman Library:

- An Introduction to Modern Astrophysics, 2nd Ed. (Carroll & Ostlie)
- Astrophysics in a Nutshell, 1st Ed. (Maoz)

Homeworks due Thursdays 2:45pm
Self-graded/corrected homeworks due Tuesdays 2:45pm
Midterm 1: Thursday 7 October
Midterm 2: Thursday 18 November
Final projects: last week of classes
Final Exam: scheduled by the registrar

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 (but office hours will be in Hugel 142)

Course Policies

Attendance/Absences

I’m not grading attendance. I do expect you to attend most classes and to actively participate. If you will miss a class, let me know ASAP. **Please do not attend class if you are experiencing COVID-19 symptoms.**

If you will miss multiple classes due to COVID-19 or another serious illness, let me know ASAP and work with your local health provider (if applicable) and Bailey Health Center 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 or an assignment deadline due to a religious holiday, please contact me by the add/drop deadline so that 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. Regardless of your vaccination status, to protect the health of our class, masks must be worn during class. 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 MWF 2-3pm, and TR 11am-noon. Office hours will be held in Hugel 142 (upstairs next to the physics lounge). If you would prefer to meet virtually for office hours, I will also keep a Zoom link open - see Moodle for the link.

If the above times will never work for you, please let me know ASAP so I can adjust.

I will also set up blocks of available time each week for one-on-one meetings; if these blocks don't work for you, please email me and we can schedule a meeting at another time. One-on-one meetings will be virtual unless we both agree otherwise.

I will generally check email between 10-6 on weekdays, and will reply by the end of the next weekday. I will sometimes check email at other times, but this is not guaranteed.

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, 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 at least not talking to blank squares.

Accomodations: flexible, let me know as early as possible

My policy: Your success in this class is important to me. If you need reasonable accommodations for any reason, please speak with me privately ASAP. I am happy to consider creative solutions as long as they do not compromise the learning goals of the activity. Requests for extra testing time must be made through the Office of Accessibility Services.

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 and Plagiarism

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 past students; or anything else you can find on Google.

Science is a social enterprise, and I encourage you to collaborate with your peers on homework, 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.

You may not work collaboratively on projects or exams.

Evidence of plagiarism will yield a reduced or zero grade for the assignment at the discretion of the instructor, and may 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 harrassment 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 class 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.

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 should be submitted to Moodle as PDFs. Work that is uploaded as an image straight from your camera will not be graded.

Course Grade Components

Problem sets: 30%
Midterms: 15% each (30% total)
Final project: 10%
Final exam: 20%
Extra credit/choose your own adventure: up to 15%

Late work: Notify me by deadline, otherwise -3.33% / 24 hrs late

If you need extra time on an assignment, just email me **before the assignment deadline** and tell me how much extra time you need. As long as you notify me ahead of time, I will not take points off.

Otherwise, late assignments will be penalized by 3.33 percentage points per 24 hours after the assigned deadline (10 percentage points per 3 days late), up to 25% of the total points for that assignment.

You are on your honor not to talk about the homework with students who already submitted on time, and not to look at the solutions. Students who have submitted the assignment on time are on your honor not to share the solutions with anyone else.

Problem sets (30%)

Roughly every other week, you'll be assigned 10-15 hours of homework consisting of conceptual questions, sketches, diagrams, math problems, and other tasks that suit the content from the previous week. I encourage you to work together on homework, though you must turn in your own copies of each assignment. It must be clear that short answer/essay questions were written in your own words.

Homeworks will be due on Thursdays at the beginning of class (2:45pm), as a PDF upload to Moodle. We will review any major questions in class at this point. 15% of your homework grade will come from having correct answers on your initial submission.

You will then grade your initial submission, revise/correct it, and write up an explanation for any incorrect answers. The graded homework will be due on Tuesday at the beginning of class (2:45pm), as a PDF upload to Moodle. 15% of your homework grade will come from your graded/corrected submission.

Here are some guidelines for what your homework should look like when you turn it in:

- Each problem should start on a new page. This is as much for you than for me - it will make it much easier for you if you need to go back and change something on a long problem solution.
- Write out the problem (or an abbreviated version containing all relevant information).
- Draw and use pictures/diagrams generously.
- Clearly work out the problem, commenting on your work as you go. Problem sets should never contain just math; use words to describe what you are doing and to reference where an equation came from and why it is relevant.
- Box your final solution. This makes it easier to grade and also tells me that you know what the problem was asking for. You may wish to underline, star, or otherwise highlight other major milestones as you do the problem.
- Comment on the significance of your answer. (Does it make sense? Is it what you expected? Why or why not? If it is a complicated algebraic expression, are there special cases you can consider for a "sanity check"?)
- You should acknowledge everyone you have collaborated with on the assignment. This includes any other fellow students, faculty, etc. (anyone who you consulted or worked with).
- Scan or save your work as a PDF, and upload it to Moodle

When you submit your corrected homeworks, you should include the following additions:

- Cover page with your assessment of each problem
- Revisions, corrections, and explanations for incorrect answers in a different color
- Any additions should come right after the original problem - insert additional pages into your PDF if necessary
- Acknowledge any additional collaborators
- Scan or save your work as a PDF, and upload it to Moodle

Final Project (10%)

Towards the middle of the semester, you will select a topic in stellar astrophysics to focus on for your final project. I will provide a list of pre-approved topics; if there is a particular topic of interest outside of the list, please speak with me about using it. The topic you choose will give you a chance to independently investigate a subject in depth and then convey your findings to the rest of the class in a presentation and a paper. Further details and project topics will be distributed later in the semester.

Midterm exams (2 x 15% = 30%) and Final exam (20%)

Exams will take place during class time on the dates noted in the schedule (midterms) and when scheduled by the registrar (final). Exams will be closed book, closed notes, no electronics. You may use a calculator, and I will provide an equation sheet ahead of time.

Exams will be in-person. If the COVID-19 situation requires us to move online during an exam, I'll provide an alternative virtual/take-home exam.

The final exam will be comprehensive.

Extra credit/choose your own adventure (up to 15%)

You'll note that the "typical" components of the course (homework, project, exams) only total 90%. You can increase your grade by completing assignments from the list below. The first 10% is more like a "choose your own adventure" option for part of your course grade, and you can gain up to 5% additional "extra credit" points as well.

With the exception of the LaTeX homework assignment (submitted like any other homework), you should email your submissions to me with "PHYS308 extra credit" in the subject line. Videos should be uploaded to Kaltura or YouTube as "unlisted" videos - then just email me the link.

Extra credit/choose your own adventure assignments must be submitted on or before the last day of classes. For everyone's sake, submitting them earlier in the semester is preferable!

Options:

- Write up your homework in LaTeX (1% per assignment)
- Attend a campus event relevant to this class, or watch a colloquium from this list, and write a 1-page report aimed at other undergraduate physics/engineering majors. Check with me ahead of time about non-physics events. (1% per event, max 5 events)
- Read a paper from this list and write a 2 page summary aimed at other undergraduate physics/engineering majors OR record a 5-10 minute video summary (2% per summary, max 3 summaries)
- Select an "Advanced Project" from SDSS (Color, Spectral Types, or Hertzsprung Russell Diagram); note that you may need to complete some basic activities for background. Submit your responses to all questions and exercises, including screenshots/images

where relevant. You don't need to do the Research Challenge; see below. (2% per project, max 3 projects)
- After completing one of the projects above, select and carry out the Research Challenge on the last page. Write a 7-10 page lab-style report presenting relevant background and your question, methods, results, and conclusions (up to 5%, max 1 project, one revision allowed)
- Pick a stellar astronomer from an underrepresented group (e.g., women, nonbinary/agender folks, BIPOC), and design a poster about their accomplishments that could be hung in the physics hallway (up to 5%, max 1 poster, one revision allowed)
- Choose a topic covered in this course, and write/record a 15 minute video presentation aimed at non-science majors (up to 5%, max 1 video, one revision allowed)

Course Outcomes

After completing this course, each student should…
- Understand the nature of planetary atmospheres
- Understand the nature and evolution of stars
- Understand the nature and evolution of the universe as a whole, as determined through observations of stars
- Be able to apply dimensional analysis, scaling relations, and power series expansions to astrophysical problem-solving
- Be able to apply gravity, kinematics, thermodynamics, and quantum mechanics to astrophysical problem-solving
- Have gained skill in problem-solving
- Have gained an appreciation for the applicability of physics to scales of time and space far vaster than those encompassed by an individual human being

Mandatory credit hour statement

The student work in this course is in full compliance with the federal definition of a four credit hour course.

Planned course schedule (subject to change)

Textbook: Principles of Astrophysics (Keeton)
CO = Introduction to Modern Astrophysics (Carroll & Ostlie), on reserve in the library & my office

Week	Dates	Ch.	Topic	Other notes
1	Aug 30 - Sep 3	1	Introduction: tools of the trade	
2	Sep 6-10	12	Planetary atmospheres	CO 8.1, 10.1-10.2 Add/drop deadline Friday
3	Sep 13-17	13.1 - 13.2	Planetary temperatures	CO 3.4-3.5 Problem Set #1 due Thursday
4	Sep 20 - 24	13.3 - 13.5	Planetary temperatures	CO 9.2, 20.2
5	Sep 27 - Oct 1	14	Stellar atmospheres and spectra	CO 8 Problem Set #2 due Thursday
6	Oct 4-8	15.1 - 15.2	Nuclear fusion	CO 10.3 Midterm 1 on Thursday
7	Oct 11-14	15.3 - 15.4	Nuclear fusion in stars	Fall break, no class Tuesday
8	Oct 18-22	16.1 - 16.2	Stellar structure	CO 9.3, 10.4-10.6, 11.1 Problem Set #3 due Thursday
9	Oct 25-29	16.3 - 16.4	Stellar evolution (low-mass stars, high-mass stars)	CO 13, 15.1-3
10	Nov 1-5	17	Stellar remnants	CO 4.4, 16 Problem Set #4 due Thursday
11	Nov 8-12	8.1.3, 19.1 - 19.3	The virial theorem, star formation	CO 2.4, 12.2, 26.2 Daylight Saving Time starts
12	Nov 15-19	19.1 - 19.3	Star formation	CO 12.2, 26.2 Midterm 2 on Thursday
13	Nov 22-26	18	Stellar pulsations	CO 29.1 Thanksgiving break, no class Thursday
14	Nov 29 - Dec 3	20, 11?	Cosmology	CO 29.2-29.4 Problem Set #5 due Thursday
15	Dec 6-10		Final project presentations	
	Finals	Week		Final exam scheduled by the registrar