ASTR 301 – Introduction to Stellar Astrophysics
Fall 2024
MW 1:35–2:50 pm, LL 512

Instructor:

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Course Objectives:

1. To demonstrate how fundamental properties (including distance, brightness, mass, radius, and temperature) of stars can be measured;
2. To apply mathematical and physical models to describe the atmosphere, internal structure, and evolution of stars;
3. To understand how stars generate energy via nuclear reactions;
4. To use computational programs to visualize astronomical data;
5. To combine astronomical data analysis and theoretical modeling to describe the physics of a binary star.

Required Materials:

- Carroll & Ostlie, "An Introduction to Modern Astrophysics", 2nd edition
- An alternative to this book is the condensed version: Ostlie & Carroll, "An Introduction to Modern Stellar Astrophysics" (use only if you don't plan on taking ASTR 302)
- A Python programming tool with visualization capabilities (Anaconda with JupyterLab or Google CoLab are the recommended tools. Both are free to use.)
- A scientific calculator with trigonometric and logarithmic functions

Grading:

Homework – 40%
Hour Exam 1 – 20%
Hour Exam 2 – 20%
Final Project – 20%

Attendance is strongly recommended but not required. Late homework will be penalized by 5% per day late (up to 30% maximum penalty), and makeup exams are not allowed, without a valid excuse. If you have a valid excuse, I will work with you to set a reasonable deadline to complete the work.

Academic Integrity:

Academic dishonesty will not be tolerated on any assignment. Copying work from other students or outside sources is considered plagiarism. Outside references (other than the class textbook) must be properly cited if used on any assignment. If I have evidence of copying, cheating, plagiarism, or any other dishonest behavior, I will not hesitate to report my suspicions to the Office of Student Conduct. Their penalties may range from assigning a zero for that assignment, assigning an F for the final course grade, and even expulsion from the university. Please consider this your final warning.

For every assignment, please ensure that the work that you turn in is your own work. When you collaborate on homework assignments with your classmates, you may discuss the problem solving strategy together. Working together is encouraged when it is used as a learning tool. But, at no time should you share your paper or your answers with anyone else. Allowing someone to copy your answers makes you just as guilty as the copier. If someone asks you something like, "What did you get for Problem 2?" you should not provide the final answer. You may, however, tell them what equation you used or refer to the textbook or notes together and discuss the general topic. When you write your solutions, all mathematical calculations and written explanations must reflect your own work. Showing all of the steps of your calculations and explaining your reasoning throughout a problem is an excellent way to guard your independent work and remove suspicions of academic dishonesty.

Accommodations for Students With Disabilities:

Lehigh University is committed to maintaining an equitable and inclusive community and welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact Disability Support Services (DSS), provide documentation, and participate in an interactive review process. If the documentation supports a request for reasonable accommodations, DSS will provide students with a Letter of Accommodations. Students who are approved for accommodations at Lehigh should share this letter and discuss their accommodations and learning needs with instructors as early in the semester as possible. For more information or to request services, please contact Disability Support Services in person in Williams Hall, Suite 301, via phone at 610-758-4152, via email at indss@lehigh.edu, or online at https://studentaffairs.lehigh.edu/disabilities.

The Principles of Our Equitable Community:

- We affirm the inherent dignity in all of us, and we maintain an inclusive and equitable community.
- We recognize and celebrate the richness contributed to our lives by our diverse community.
- We promote mutual understanding among the members of our community.
- We confront and reject discrimination in all its forms, including that based on age, color, disability, gender identity, genetic information, marital status, national or ethnic origin, political beliefs, race, religion, sex, sexual orientation, socio-economics, veteran status, or any differences that have been excuses for misunderstanding, dissension, or hatred.
- We affirm academic freedom within our community and uphold our commitment to the highest standards of respect, civility, courtesy, and sensitivity toward every individual.
- We recognize each person's right to think and speak as dictated by personal belief and to respectfully disagree with or counter another's point of view.
- We promote open expression of our individuality and our differences within the bounds of University policies.
- We acknowledge each person's obligation to the community of which we have chosen to be a part. We take pride in building and maintaining a culture that is founded on these principles of unity and respect.

We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.

Tentative Schedule:

Week of Aug. 26:	Python and Jupyter Notebooks
Week of Sept. 2:	Celestial sphere (§1.3); Parallax & magnitudes (§3.1–3.2)
Week of Sept. 9:	Continuous spectrum of light (§3.3–3.6); atomic spectra (§5.1)
Week of Sept. 16:	Stellar spectra, HR diagram (§8.1–8.2); Gravity & orbits (§2.1–2.2)
Week of Sept. 23:	Binary stars & exoplanets (§7.1–7.4)
Week of Sept. 30:	**Exam 1 Sept. 30**; Boltzmann & Saha equations (§8.1)
Week of Oct. 7:	Stellar atmospheres (§8.1, 9.1–9.4); Spectral line profiles (§9.5)
Week of Oct. 14:	**Pacing break Oct. 14**; Stellar interiors (§10.1–10.2)
Week of Oct. 21:	Nuclear energy generation (§10.3); Energy transport (§10.4)
Week of Oct. 28:	Stellar structure models (§11.1); Solar activity (§11.2-11.3)
Week of Nov. 4:	**Exam 2 Nov. 4**; Special Collections visit (tentative)
Week of Nov. 11:	Star formation and evolution (§12.1–12.3, §13.1–13.2)
Week of Nov. 18:	Star clusters (§13.3); stellar pulations (§14.1–14.5)
Week of Nov. 25:	Core-collapse supernovae (§15.1–15.3); **Thanksgiving break Nov. 27–29**
Week of Dec. 2:	Stellar remnants (§18.6); white dwarfs & Type Ia supernovae (§18.3–18.5)
	Projects due Dec. 13

This syllabus is only a tentative outline of the course. The grading policy, dates of exams, or the topics covered in class may change as needed.