Hello and Welcome!
Hello and welcome to Stellar Astronomy! I’m excited for you to join me this term. A bit about me: I grew up in Colorado and studied Engineering Physics at the Colorado School of Mines. My teaching journey started there: I was an undergraduate TA at Mines starting Freshman year. I came to the UO to pursue a PhD in physics, specifically in optical materials. My dream was to return to the National Renewable Energy Lab to make better solar cells. However, I found along the way that teaching captured my interest and curiosity and drew me toward it much more than time in the lab did. So, I started teaching immediately after earning my PhD (in spring 2019). I am honored to teach astronomy to you! I have an enduring interest in climate change and renewable energy, so if you ever want to chat about those topics, please drop by office hours!

Course Description
Astronomy (ASTR) courses provide an introduction to the science of astronomy for non-science majors, and satisfy 4 credit hours of the Science Area of the Core Education Requirement.

ASTR 122 focuses on the birth, evolution, and death of stars. We will use our star, the Sun, to study a “typical” star’s structure and function, and will see how all of the energy necessary to sustain life is produced by our Sun via nuclear fusion. In our journey, we will use fundamental physics concepts together with observational evidence to build an understanding of stars.

The class does not assume extensive prior knowledge of science, but it will require a willingness to apply quantitative reasoning. Your chances of success in this course are high if you ask a lot of questions starting with "why," "how" and "what if" - curiosity is what makes scientists tick.
Course Objectives

By the end of the course, students should be able to...

● **Understand science as a process and a skill:**
  ○ Explain how theories in astronomy are supported by specific observational data.
  ○ Support arguments and draw conclusions by interpreting data, figures, graphs, and images, and applying quantitative and logical reasoning.
  ○ Formulate questions and hypotheses based on your own curiosity, and reflect on what you learn to constantly refine your mental models.

● **Build an understanding of stars:**
  ○ Describe the location of a star in space (both its location on the sky and its distance from Earth) using standard conventions and units.
  ○ Explain how the observable quantities we measure about stars (such as brightness and color) are used to understand their actual physical characteristics (such as luminosity, temperature, distance, and size).
  ○ Describe how stellar spectra are used as a fingerprint to reveal physical characteristics about stars (such as motion, rotation, and expansion/contraction), and the contents of their space environments (such as interstellar matter).

● **Trace the evolution of stars:**
  ○ Use H-R Diagrams to identify types of stars and compare their temperatures, luminosities, and sizes, and use the “motion” of a star on the H-R diagram to discern information about a star’s progress in its life cycle.
  ○ Name the key measurement techniques used to study the physical characteristics and layers of the Sun, and identify key conclusions we have drawn from each technique.
  ○ Name the different steps involved in how a star evolves to become a giant or supergiant and eventually dies to create a stellar remnant such as a planetary nebula, supernova remnant, black hole, neutron star, or white dwarf.

Detailed learning goals will also be listed...

● For each textbook section in the weekly study guides
● For each lecture in the daily slides.
● For each activity and project within the assignment descriptions on Canvas.

I’m not a science major. Why should I take an astronomy course?

I think it’s important for students pursuing a variety of goals to learn astronomy, because:

● You will learn strategies for independent learning and study that will serve you well in other classes, and in your journey of lifelong learning.
● Astronomy builds skills employers want, including scientific and quantitative reasoning.
● Astronomy is part of our history and life. Learning astronomy is inspiring and contributes to a sense of purpose and belonging in our world - a sense of being an “Earthling.”
Andrea’s Teaching Philosophy

Research shows that people learn best through active learning, in which learners are active participants rather than passive observers. Our course design provides structured learning opportunities before, during, and after class to help you engage your brain and monitor your own understanding as you build your knowledge about astronomy.

Each learning opportunity has an essential role to play, and therefore they will all contribute to your grade. However, you will have choices about how to engage and will not be forced into a “one size fits all” solution. If you feel that any element of our course design presents a barrier to you or that you would benefit from different types of learning opportunities, please let me know.

Learning Opportunities and Assessments

Class Preparation: You are expected to read the daily text sections before class. You might read twice if needed. A “shallow” read before class and “deep” read after class can be highly productive, but more than that is unlikely to help you learn. While prep is ungraded, class will be most effective for you and your peers if you are familiar with terms and ideas before class.

In-Class Activities: We will work together on interactive activities during class to guide you through new ideas. Activities will be delivered through Canvas, so please bring a device. Due after class; grace period is through Mondays at midnight.

Homework: Homework problems (delivered through Canvas) will build up from the activities and require critical thinking and application of new ideas. Accordingly, homework will be challenging. You will have two attempts and should strive to understand each question by making mistakes and trying again. Please, work together, perhaps during office hours! Your lowest scores will be dropped (about 2-3 homeworks). Due Mondays at midnight.

Weekly Reflections: You’ll reflect on your learning, how you’re doing overall, and how we conduct the course. This is your chance to give me feedback - use it! Due Mondays at midnight.

Collaborative Quizzes: Short quizzes (on Canvas) will help you calibrate your understanding. You will have two attempts: the first is done before class, on your own. You will be able to see your score, but not which questions you got right or wrong. Next, you will have the chance to discuss your thinking with others in class and submit a second attempt based on your consensus as a group (this process mirrors the practice of science). The highest score of the two attempts will count toward your grade. Quizzes are open-book and open-note, but you should strive to attempt quizzes without these aids to maximize your learning. We will review quizzes in class immediately after they are due. To reward your growth and learning, you will be given an opportunity to retake quizzes toward the end of the term. These will be modified slightly. You will have only one attempt on quiz retakes. Due during class on Fridays.
Final Exam: The final exam will have similar formats of questions as quizzes, but will be longer. It will cover everything in the course and will be done individually in class during our university-scheduled final exam time (which cannot be changed). The weighting on the final exam has been carefully considered to maximize the opportunity for students to increase their final grade, while avoiding the unnecessary stress of a highly-weighted final. However, you’re unlikely to “save your grade” in an epic way by acing the final after a lackluster term. The best way to get a good grade in the class is to engage completely in all learning opportunities.

Project: You will complete one short project (in groups of 1-3) to demonstrate your learning expressively and explore your curiosity. Due the Monday of week 10 at midnight. Options:
- **Scientist Spotlight**: Learn more about astronomers past and present.
- **AstroBites**: Summarize new research in astronomy.
- **Study Tools**: Create a study tool for your classmates based on effective practices.

At the end of the term, we'll vote on the most helpful or interesting projects. The top three will win gift cards to J Tea or Sweet Life. Andrea will also select projects to add to her “wall of fame!”

### Grade Breakdown

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Frequency &amp; Policies</th>
<th>Percent of Grade</th>
<th>Out-of-class time per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Class Preparation</td>
<td>Daily</td>
<td>0%</td>
<td>2 - 3 hours</td>
</tr>
<tr>
<td>In-Class Activities</td>
<td>~ Daily</td>
<td>30%</td>
<td>~ 30 minutes (to review)</td>
</tr>
<tr>
<td></td>
<td>20-30% dropped</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homework</td>
<td>Weekly 2 attempts</td>
<td>30%</td>
<td>2 - 3 hours (including office hours)</td>
</tr>
<tr>
<td></td>
<td>2-3 dropped</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly Reflections</td>
<td>Weekly</td>
<td>0%</td>
<td>~ 15 minutes</td>
</tr>
<tr>
<td>Quizzes</td>
<td>Even weeks</td>
<td>20%</td>
<td>~ 30 minutes</td>
</tr>
<tr>
<td></td>
<td>2 attempts initially, plus retakes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final Exam</td>
<td>Week 11</td>
<td>15%</td>
<td>-</td>
</tr>
<tr>
<td>Project</td>
<td>Week 10</td>
<td>5%</td>
<td>&lt; 30 minutes</td>
</tr>
</tbody>
</table>

**Grade scale**: A: 90%, B: 80%, C: 70%, D: 60%. I use plus/minus: plus for grades ending in 7, 8, or 9 and minus for grades ending in 0, 1, and 2. I do not curve class grades, as I believe each of you is capable of meeting my expectations within this course structure.
Weekly Routine

The total out-of-class time is about 8-12 hours per week (the time above, plus about 2-4 hours per week of individual or group study, possibly in the Drop-In Help Center, Science Library B10). You should spread this time out to get the most out of your effort. Here’s my suggested routine.

A study guide, including an outline of effective study practices, is available. It links to weekly study guides, which you can use to guide your reading or to study throughout the term.

<table>
<thead>
<tr>
<th></th>
<th>Before Monday</th>
<th>Monday</th>
<th>Before Wednesday</th>
<th>Wednesday</th>
<th>Before Friday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>To Do</td>
<td>Read for Monday Complete a Homework Attempt</td>
<td>Class &amp; Activity</td>
<td>Read for Wednesday Review &amp; Study</td>
<td>Class &amp; Activity Review Notes &amp; Activity Begin Homework</td>
<td>Read for Friday Attempt Quiz</td>
<td>Class &amp; Activity Review Notes Quiz Due Continue Homework</td>
</tr>
</tbody>
</table>

Office Hours
Our graduate teaching assistants will join us in class to facilitate activities, will hold weekly office hours, and will also be available in the Price Science Commons Drop-In center.

<table>
<thead>
<tr>
<th>Who?</th>
<th>Office Hour</th>
<th>Drop-In Help Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrea Goering (She/Her)</td>
<td>Monday 3:30-4:30pm, Wil 143</td>
<td>-</td>
</tr>
<tr>
<td>Bret Brouse (He/Him)</td>
<td>Friday 10-11am, Wil 218</td>
<td>Monday 4-5pm</td>
</tr>
<tr>
<td>Conner Carnahan (He/Him)</td>
<td>TBD</td>
<td>Wed. 11am-12pm</td>
</tr>
<tr>
<td>James Haverstick (He/Him)</td>
<td>Monday 11am-12pm, Wil 219</td>
<td>Monday 12-1pm</td>
</tr>
<tr>
<td>Shannon Gallagher</td>
<td>TBD</td>
<td>Monday 1-2pm</td>
</tr>
</tbody>
</table>
Course Policies

Attendance, Absences, and Late Work
This is an in-person course; a Zoom option will not be offered. There is no grade deduction for absences; however, attendance is important because we will develop our knowledge through in-class activities that you can only benefit from if you actively engage during class.

If you are absent, there is no need to email me. Please fill out the absence report form to help me know what’s going on. You are responsible for completing missed in-class activities by the end of the grace period (Mondays at midnight) and are encouraged to attend office hours. For absences related to disability, sports, or religious observance, please consult the appropriate university policies listed in the following section.

Weekly work in this course is due Mondays at midnight. Quizzes are due Fridays during class. Deadlines are firm, to allow for timely grading and feedback. I have built flexibility into the course by dropping ~20-30% of activities / homework, and by offering quiz retakes at the end of the term. I hope that this combination of structure and flexibility supports your learning.

Classroom Community Expectations
This class involves a high level of interactive engagement during class because we learn best by learning together. All students are expected to participate by sharing their ideas (even when they might be wrong!) and listening to others share theirs. You should expect to be treated with respect, to be welcomed and included, and to be open to receiving help and feedback from others. We will all strive to cultivate a respectful, inclusive, and supportive learning environment.

Communication
I communicate with the class through Canvas announcements. I will typically send an announcement weekly on Mondays, with a summary of the week ahead, a checklist of the week’s due dates, and any feedback from the previous week. I will email individuals as needed.

To communicate with me with questions about…

- **Course content**: come to office hours! Office hours are free help sessions - come ask questions and work together!
- **Procedural questions** about assignments, reading, or course policy, please post your question on the “Questions and Answers” discussion forum, where your peers can also share answers. If you have a question, someone else probably does too (and may have already posted it!). This will save us collectively a lot of time that could be wasted in email back-and-forth.
- **Personal concerns**: email me. I will respond within about one business day. If your question is suited to the Q&A forum, I will re-post and respond to it there.
- **Technical challenges with Canvas**: contact the UO Service Portal.
University Policies & Resources

Academic Disruption and Inclement Weather
I will use Canvas announcements to communicate any course changes made in the event of a campus emergency or inclement weather. Students will be expected to continue coursework as outlined on Canvas.

Academic Integrity
The University Student Conduct Code (available at conduct.uoregon.edu) defines academic misconduct, which includes unauthorized help on assignments and examinations, the use of sources without acknowledgment, and publishing class materials without the permission of the instructor (including sites such as Chegg). I will report suspected misconduct to the Office of Student Conduct and Community Standards. If the Office finds a student has committed misconduct, consequences can include failure of the relevant assignment, or of the course.

However, I do want you to learn together, and find and cite sources properly! Each assignment and assessment will outline whether and how and whether you might work with others so you can clearly act with academic integrity. Info about plagiarism: https://researchguides.uoregon.edu/citing-plagiarism

Accessible Education
I want to enable accessible learning for every student. Please notify me if there are aspects of the instruction or design of this course that result in disability-related barriers to your participation (including access to lectures, activities, homework or quizzes, and exams). Please contact the Accessible Education Center (http://aec.uoregon.edu/) for assistance with access or with disability-related questions or concerns.

Accommodations for Religious Observance
The University of Oregon respects the right of all students to observe their religious holidays, and will make reasonable accommodations, upon request, for these observances. If you need to be absent from a class period this term because of a religious obligation or observance, please fill out the observance form at https://registrar.uoregon.edu/calendars/religious-observances and send it to me within the first two weeks of the course.

Basic Needs
Being able to meet your basic needs is foundational to your success as a student at the University of Oregon. If you are having difficulty affording food, don't have a stable, safe place to live, or are struggling to meet another need, visit the UO Basic Needs Resource page (https://blogs.uoregon.edu/basicneeds) for information on support for food, housing, healthcare, childcare, transportation, technology, finances (including emergency funds), and legal support.

COVID-19
Students with COVID should consult UO’s COVID-19 Safety Resources, and isolate and rest.
Course Experience Surveys
The midway and end-of-term Student Experience Surveys will be conducted during weeks 4, 9, and 10. If possible, I will offer 10 minutes of class time so that you have the time needed to reflect on your experiences and offer feedback. The key parts of the survey are the open-ended questions where you share concrete, actionable feedback and about the teaching practices that stand out to you. My courses continually evolve in response to student feedback, so thank you for your thoughtful reflections!

Discrimination and Violence Reporting
I am a mandatory reporter of child abuse and an assisting employee for discrimination or violence reporting. As an Assisting Employee, I will direct students who disclose prohibited discrimination and harassment, including sexual harassment or violence, to resources that can help and will only report the information shared to the university administration if the student requests me to report (unless someone is in imminent risk of serious harm or a minor).

Students who have experienced sexual assault, relationship violence, sex or gender-based bullying, stalking, and/or sexual harassment may seek resources and help at safe.uoregon.edu or call the 24-7 hotline 541-346-SAFE [7244]. Students experiencing all forms of discrimination or harassment may find support through the Title IX office or the Dean of Students: investigations.uoregon.edu/how-get-support

Extended Absences
If you experience extraordinary circumstances causing extensive absences or late work, it may be appropriate to engage in the Dean of Students’ Emergency Academic Notification process.

Mental Health and Wellness
Mental health is a critical factor in your overall well being. Students often feel overwhelmed or stressed, experience anxiety or depression, struggle with relationships, or just need help navigating challenges in their life. It’s healthy and normal to seek support. Support resources include trained clinicians through University Counseling Services (counseling.uoregon.edu) and from peers at the Duck Nest in the EMU.

One Stop Resources
Additional resources can be found at https://onestop.uoregon.edu/

Respect for Diversity
You can expect to be treated with respect in this course. Both students and instructors enter with many identities, backgrounds, and beliefs. Students of all racial identities, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, citizenship statuses, ability and other visible and non-visible differences belong in and contribute to this class and this discipline. All students are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. Please let me know if aspects of the instruction, course design, or class activities and content undermine these principles in any way. For additional resources, you may also consider contacting the Division of Equity and Inclusion or the Center for Multicultural Academic Excellence.
Fall 2022 Dates & Deadlines

- **Week 1 Saturday**: Oct. 1 is the last day to adjust registration without a 'W'
- **Week 2 Monday**: Oct. 3 is the last day to add a class via DuckWeb
- **Week 4**: Midway Student Experience Survey: Open Monday 8:00am-Friday 6:00pm
- **Week 7 Tuesday**: Nov. 8 is U.S. Election Day
- **Week 7 Sunday**: Nov. 13 is the last day to withdraw or change grade options
- **Week 9-10**: The End-of-Term Student Experience survey is available from Wednesday, November 23 to early Monday, December 5
- **Finals week Friday**: Dec. 9, at 5pm, is the last day/time to request an Incomplete. Incompletes must be initiated by the student, and will only be considered for extenuating circumstances after the last day to drop (the end of week 7).
### Tentative Class Schedule

Homework is due Mondays at midnight. Collaborative quizzes are Fridays at the start of class.

<table>
<thead>
<tr>
<th>Wk</th>
<th>Monday</th>
<th>Wednesday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Class&lt;br&gt;Sept. 26</td>
<td>Welcome to ASTR 122!&lt;br&gt;Reading: Syllabus</td>
<td>Observational Astronomy&lt;br&gt;● Read 1.1 - 1.5, 2.1&lt;br&gt;● Watch Observational Astro</td>
</tr>
<tr>
<td>2</td>
<td>Light&lt;br&gt;● Read 5.1 - 5.2&lt;br&gt;● Watch EM Spectrum</td>
<td>Spectroscopy&lt;br&gt;● Read 5.3 - 5.5&lt;br&gt;● Watch Introduction to Light</td>
<td>Doppler Effect&lt;br&gt;● Read 5.6</td>
</tr>
<tr>
<td>3</td>
<td>Brightness and Distance&lt;br&gt;● Read 17.1</td>
<td>Star Colors and Spectra&lt;br&gt;● Read 17.2 - 17.3&lt;br&gt;● Watch Stars</td>
<td>Star Motion and Rotation&lt;br&gt;● Read 17.4&lt;br&gt;● Watch Redshift</td>
</tr>
<tr>
<td>4</td>
<td>Binary Systems&lt;br&gt;● Read 18.1 - 18.3&lt;br&gt;● Watch Binary Star Systems</td>
<td>The H-R Diagram&lt;br&gt;● Read 18.4&lt;br&gt;● Watch Stars &amp; H-R Diagram</td>
<td>The H-R Diagram, Continued&lt;br&gt;Quiz 1</td>
</tr>
<tr>
<td>5</td>
<td>The Sun&lt;br&gt;● Read CH 15&lt;br&gt;● Watch The Sun</td>
<td>Energy from the Sun&lt;br&gt;● Read CH 16.1 - 16.2&lt;br&gt;● Watch How the Sun Shines</td>
<td>The Solar Interior&lt;br&gt;● Read CH 16.3 - 16.4</td>
</tr>
<tr>
<td>6</td>
<td>Stellar Distances&lt;br&gt;● Read 19.1 - 19.2&lt;br&gt;● Watch Distances</td>
<td>Cepheid Variable Stars&lt;br&gt;● Read 19.3 - 19.4</td>
<td>Interstellar Medium&lt;br&gt;● Read 20.1 - 20.3&lt;br&gt;● Watch Nebulae&lt;br&gt;Quiz 2</td>
</tr>
<tr>
<td>7</td>
<td>Star Formation&lt;br&gt;● Read 21.1 - 21.3</td>
<td>Star Formation, Continued</td>
<td>No Class&lt;br&gt;Nov. 11</td>
</tr>
<tr>
<td>8</td>
<td>Star Clusters&lt;br&gt;● Read 22.1 - 22.3&lt;br&gt;● Watch Star Clusters</td>
<td>Low Mass Star Evolution&lt;br&gt;● Read 22.4&lt;br&gt;● Watch Low Mass Stars</td>
<td>High Mass Star Evolution&lt;br&gt;● Read 22.5&lt;br&gt;● Watch High Mass Stars&lt;br&gt;Quiz 3</td>
</tr>
<tr>
<td>9</td>
<td>Death of Low Mass Stars&lt;br&gt;● Read 23.1&lt;br&gt;● Watch White Dwarfs</td>
<td>Death of High Mass Stars&lt;br&gt;● Read 23.2 - 23.3&lt;br&gt;● Watch Neutron Stars</td>
<td>No Class&lt;br&gt;Nov. 25</td>
</tr>
<tr>
<td>10</td>
<td>Stellar Remnants&lt;br&gt;● Read 23.4 - 23.5, 24.5&lt;br&gt;● Watch Black Holes Projects Due</td>
<td>Stellar Remnants, Continued</td>
<td>Final Exam Review&lt;br&gt;Quiz 4</td>
</tr>
</tbody>
</table>

Final Exam: Thursday, December 8, 2:45 - 4:45.