AST 142: Stars
MWF 2-3PM, Hoyt 116
Lab: Wednesday, 6:30-9:30PM, Hoyt 104 or Field Station
Syllabus version 1.2

Course Website: https://brahms.phys.westminster.edu/stars

Instructor:
Prof. Rob Knop Hoyt 121 and/or Hoyt 106, x7201 knopra@westminster.edu
Office Hours MWF 1-2PM and by appointment

Textbook:

- *Astronomy* by Fraknoi, Morrison, and Wolff (2016, OpenStax; available free on the course website)
- Other online readings as assigned.

Course Overview

In the immortal words of Carl Sagan, we are made of starstuff. The stars shine in the night sky— and one star shines very brightly in the daytime sky. This course is all about them. We will learn about observing stars, about the nature of stars, and about the evolution of stars.

This is a general-level college course about the stars. As this is a college course, students are expected to be able to handle high-school level algebra and trigonometry, but no calculus will be required. We will learn about what we see in the sky, including identifying stars and constellations. We will learn how astronomers use more precise instruments than just their eyes, including photometry and spectroscopy, to discern a lot more about the nature of stars. We will learn an general-level overview of the theories of stellar structure and stellar evolution, and the scientific evidence that leads us to take those theories seriously. We will learn what sorts of stars there are in our galaxy, how far away they are, and how old they are. We will learn how a star is born, how it dies, and what it leaves behind after it’s dead.

Course Goals

These are the things I want students to be able to understand by the end of the course. I want students to be able to describe these things to other people, and to be able to understand the context of popular astronomy articles on related topics.

The successful student should be able to:
• describe the meaning of a logarithmic scale and how it relates to a linear scale;

• point out stars in the sky and have an approximate idea for the apparent magnitude of those stars;

• identify constellations in the sky, and predict how they will move across the sky over the course of the night and over the course of the year;

• describe the difference between apparent and absolute magnitude;

• put distances to nearby and distant stars in a relevant context (e.g. related to the size of our solar system, and related to more intuitive everyday measurements), and understand how we measure distances to stars;

• explain the difference between white dwarfs, neutron stars, and black holes, and identify the sorts of stars lead to which of these three types of objects;

• calculate distances to stars given an observed flux and the star’s intrinsic luminosity, or calculate the luminosity given the observed flux and distance;

• give an overview of the structure of a star, and identify the mechanism by which a star generates energy;

• give an overview of the life cycle of a star, and the timescales involved for different types of stars;

• explain why we are made of starstuff, and relate that to the chemical evolution of the universe.

Assignments and Grading

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<td>Final Exam</td>
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**Midterms:** There will be three in-class midterms during the semester. Each will be a combination of multiple-choice questions and short-answer questions requiring written answers (potentially with references to equations or simple calculations to back them up).

The **Final Exam** at the end of the semester will be comprehensive, covering material from the entire semester. It will have a format similar to the midterms, only it will be a bit longer. It will start with several multiple-choice questions, followed by several short-answer questions.

**Reading Questions** will be assigned every night there is a reading assignment. After you complete a reading assignment, go to the course webpage and click on the “Reading Questions” link in the sidebar. There, you will receive the reading questions associated with
this assignment. Reading questions will always be due by noon on the day the reading assignment is due; late reading questions will never be accepted. Reading questions are graded based on whether or not you made an honest effort, not on how correct your answer is. The purpose of the reading questions is twofold. First, it’s a way of giving you grade credit for doing the reading; your instructor has been teaching long enough to know that such incentives are helpful in encouraging students to do the things they should do to be ready for class anyway. Second, they will help the instructor figure out how well you understood the reading, so that he might adjust what we’ll do in class to compensate. (This is why the reading assignments are due a couple of hours before class starts.)

Reading questions must be completed on your own. You are certainly encouraged to discuss the reading with other students. Professors like to think that college is an intellectual learning environment where students are sufficiently inspired by the opportunity to partake in the human quest for knowledge that, on their own time, they spontaneously talk about their course material. However, the purpose of the reading questions is for me to gauge how well each of you understood the reading, and what you got out of it. As such, you need to provide your own answers. Do not do them in groups. Also, don’t just google up the answers. Again, that defeats the purpose of doing the reading, which is for you to learn something which we can then build on in class.

Homework Assignments will be assigned roughly once a week. You may discuss homework assignments with other students, and are encouraged to discuss them with the instructor. However, the answer you provide on the homework assignment must be your own, representing your own work and your own writing. Submitting copied or rephrased work from somebody else will be considered plagiarism and dealt with accordingly. After the homework assignment is returned, you will have an opportunity to correct what you got wrong on it and turn it in again to receive a higher score.

Lab will be a combination of data analysis and computer based labs, and observations of the night sky. When it is clear, we will head out to the field station and make observations of the stars, both using just our eyes (you can learn to see quite a lot), and using small telescopes. When it’s cloudy, we’ll meet in the general physics lab (Hoyt 104).

Your Final Presentation will be a ten-minute talk on a topic related to the course material that you will research on your own. Half-way through the semester I will suggest sample topics, and will ask you to choose research topics so that ideally you can work on them over the course of the last month and a half of the semester.
Attendance

You are expected to come to every class meeting. That being said, we’re all adults here. If you are unwell, or even just excessively tired and know you won’t get anything out of the lecture, make the decision that is best for you. However, if you do miss any meetings of the course, you are still responsible for everything that happened during that course meeting. I won’t rehash or summarize material from a class that you missed; you’ll need to try to get notes from fellow students to supplement anything that I may have posted online. You are also responsible for any announcements about changes in due dates for assignments, even if you aren’t in class on the day it is announced. While changes of these sorts of things will generally be announced on the course website, you should speak with a friend after any missed course meeting to make sure that you are up to date with the course.

Academic Integrity

(This section was borrowed and modified from a syllabus written by Jamie McMinn.)

You are expected to comply with Westminster College’s policy on Academic Integrity, as described in the College Catalog. If you are suspected of violating this obligation, then you will be required to participate in the procedural process at the instructor level.

Examples of academic integrity violations include but are not limited to: plagiarizing another person’s published work or ideas; cheating or receiving unauthorized help on assignments; damaging, destroying, or stealing material from library resources; using unauthorized materials during a midterm or final exam; falsifying data for laboratory experiments

Special Accommodations

(Borrowed from a syllabus written by Jamie McMinn.)

If you have special needs that may affect your academic life during this semester, you should speak to a member of Disability Resources at x7192. Accommodations that are consistent with college policy will be considered. If you need additional assistance with your coursework and study habits, then you should contact the Learning Center at x6700. For issues that may affect your personal life this semester, please contact the counseling Center at x7340.
Course Schedule

This schedule is subject to change! This is just a basic outline of what I expect we’ll be doing each week of the course. The detailed schedule of topics, including due dates for reading and homework assignments, can be found on the course website. (See the top of this syllabus for the address.) I am attempting to structure the course so that we will spend the first several weeks of the course on a quicker introduction to all of the material of the course. We will then circle back and cover the topics in more depth. Hopefully, this means that you’ll have some idea how what we’re doing fits into the whole course when we’re doing each topic in more depth. Also, by coming back to the same material more than once, you will have the opportunity to learn it better.

Week 1  Looking at the night sky; constellations; stellar magnitudes
Week 2  The makeup and nature of stars; photometry & spectroscopy; the H-R diagram
Week 3  The life cycle of stars; stellar remnants
Week 4  Stellar evolution; star clusters
Week 5  Exam 1 (Mon Sep. 24); logarithms and magnitudes
Week 6  The celestial sphere model; observing stars
Week 7  Distances to stars
Week 8  Flux / Distance / Luminosity / Temperature / Size
Week 9  Exam 2 (Mon Oct. 22) ; spectroscopy; the Doppler effect
Week 10  Stellar census; the structure of stars
Week 11  Stellar structure & evolution
Week 12  Chemical evolution; the cycle of star formation and death
Week 13  Exam 3 (Mon Nov. 19) ; Thanksgiving break
Week 14  White dwarfs, black holes, and neutron stars; general relativity
Week 15  Student Presentations

Unless I am mistaken, the Final Exam will be on Wednesday, December 12 at 11:30AM.