Spring 2-1-2018

ASTR 365.01: Stellar Astronomy and Astrophysics II

Daniel B. Reisenfeld
University of Montana - Missoula, dan.reisenfeld@umontana.edu

Astronomy 365: Stellar Astronomy & Astrophysics II Spring 2018

Overview:

Instructor:	Daniel Reisenfeld
Office:	CH Clapp Bldg. CHCB 121
Phone:	243-6423
Text:	*An Introduction to Modern Astrophysics (Second Edition)* by Bradley Carroll & Dale Ostlie (Pearson/Addison Wesley, 2007)
Lectures:	MWF, 10:00 – 10:50. CHCB Room 230
Office Hours:	M: 2-3, W: 2-3; Th: 2-3, and by appointment or right after class for quick questions
Course web site:	Moodle. `https://moodle.umt.edu` The course Moodle site contains course information, selected lecture presentations, syllabus, assignments, and solutions.

Description:
Stars in the night sky appear fixed and unchanging, eternal. In this course, we will apply our physical understanding of the structure and composition of stars to discover that they are in fact ever-changing objects locked in a constant struggle against gravity. We begin by returning to the Sun, and in particular, its' outer atmosphere, the Corona, as this is a portion of a star where we see rapid changes, due to solar magnetic activity and the solar cycle. We then look at the formation of stars, and then onto the relatively benign life cycle of low-mass stars like our Sun. Next, we will investigate the violent life cycle of high-mass stars. From there we will apply physical principles from mechanics, thermodynamics, statistical mechanics, relativity, and quantum, atomic and nuclear physics to develop a physical understanding of the nature of stellar remnants: white dwarfs, neutron stars and black holes. The unifying theme of the course will be to understand the Hertzsprung-Russell diagram via basic principles of physics. The first semester, ASTR 363, focused on the internal structure of individual main sequence stars. In the second semester, ASTR 365, we will investigate the time evolution of stars, including their birth and end states.

Prerequisites:
The perquisite for this class is the first semester, ASTR 363 or its equivalent.

Grading:

Midterm exams:	36% (12% each)
Final exam:	24%
Homework:	40%

Class Meetings:
I will spend most of each class period lecturing, but class participation will also be an important part of the course. We will sometimes go over homework problems during class. I will frequently ask you questions, and I expect you to ask me questions too.

Homework:
Homework will be assigned weekly. The assigned problems will be collected, graded, and returned. Homework will be due by **5:00 PM** on the due date, typically Mondays. There will be a late penalty of 10% off per day late (weekends and holidays excluded). If you have a conflict with the due date, it is recommended that you turn in the assignment early or talk to me ahead of time to see if other arrangements can be made. **I am much more agreeable if you talk to me ahead of time rather than after the fact.** You are encouraged to work together on the homework problems and to see me if you need hints; however, the work you turn in must be your own.

Exams:
There will be three mid-term exams and a final exam. The midterms will be in the **evenings**. The final, which will be on **Wednesday, May 9th** from 10:10 -12:10, will be comprehensive. I allow a calculator and one sheet (8½" x 11") of paper with anything written on *one* side that you want for exams. (Two sheets with both sides with writing for the final.) Make-up exams may be given in exceptional circumstances, but only if arranged in advance.

Student Conduct Code:
All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at http://www.umt.edu/vpsa/policies/student_conduct.php

Astronomy 365: Stellar Astronomy and Astrophysics II Spring 2018

Targeted Course Syllabus

Week	Week of	Topics	Chapter
		SPECTROSCOPY, THE SUN AND SOLAR WIND	
1	1/22	Spectral line formation	9.5
2	1/29	Solar Corona; Solar Cycle; Solar Wind	11.2, 11.3
3	2/05	Heliospheric Boundary; ISM	Supplements, 12.1
		STAR FORMATION	
4	2/12	ISM; Virial theorem **Exam 1 (2/14)**	12.1, 2.4
5	2/19	(*No class Monday*) Protostars	12.2
6	2/26	Pre-main sequence evolution	12.3
		STELLAR EVOLUTION	
7	3/05	Main Sequence evolution	13.1
8	3/12	Late Stages of Stellar Evolution, Clusters **Exam 2 (3/14)**	13.2, 13.3
9	3/22	Physics of pulsating stars	14.1-14.3
	3/26	*Spring Break*	
10	4/02	Supernovae	15.1-15.3
11	4/09	Interacting binaries and Type Ia supernovae	18.1, 18.5
		STELLAR REMNANTS	
12	4/16	White dwarfs, Neutron stars **Exam 3 (4/18**)	16.1 – 16.7
13	4/23	General Relativity	17.1, 17.2
14	4/30	Black holes; Review	17.3, 18.6
		Final Exam: Friday, 5/9, 10:10 am – 12:10 pm	

Drop/Add/Auditing: Drop/Add can be performed online until **February 10th**, and with the instructor's and advisor's signatures until **April 2nd**. Last day to drop with petition to the Dean is **May 4th**. Students interested in **auditing** the course must choose so on or before **February 10th.**

Disability Modification:
Students with disabilities will receive reasonable modifications in this course. Your responsibilities are to request them from me with sufficient advance notice, and to be prepared to provide verification of disability and its impact from Disability Services for Students. Please speak with me after class or during my office hours to discuss the details. For more information, visit the Disability Services for Students website at http://www.umt.edu/disability

Astronomy 365: Stellar Astronomy and Astrophysics II Spring 2018

LEARNING OUTCOMES:

By the end of this course, it is expected that the student will:

- develop an understanding of spectral line formation and line widths.
- understand the nature of solar activity, the solar cycle, and the origin of the solar wind.
- have an introduction to the physics and phenomena of star formation and the interstellar medium.
- be able to apply physics to understand the life cycle and end states of stars .
- be able to use a stellar evolution code to model the life stages of different mass stars in detail, and from this develop a deeper understanding of the internal changes in stars as they evolve.
- develop a basic understanding of general relativity as applied to stars and compact objects.