

# ASTR 400: Stellar Astrophysics

## Fall 2015

- Professor: Stephen Kane
- Class times: Tuesday, 12:35pm-1:50pm; Thursday, 12:35pm-1:50pm
- Class location: TH 425
- Text Book: An Introduction to Modern Astrophysics, 2nd edition
- Office: TH 309
- Office hours: Wednesdays, 2:00pm-4:00pm
- Phone: 415-338-2451
- Email: [skane@sfsu.edu](mailto:skane@sfsu.edu) (write ASTR 400 in subject)
- Course website: <http://physics.sfsu.edu/~skane/teaching/a400/>

### Course description:

Astronomy 400/700 is an introduction to the theory of stellar astrophysics: the birth, life and death of stars. Topics include: stellar properties from observation; stellar spectra & atmospheres; equations of state & stellar interiors; energy generation (gravity, nuclear fusion) and energy transport (radiation, convection); star formation; stellar evolution, death, and end states (white dwarfs, neutron stars, black holes); the Solar Cycle and the Sun-Earth connection. If time permits, we may cover binary evolution and/or stellar pulsations.

The course will apply theories of mechanics, electromagnetism, thermodynamics & statistical mechanics, quantum mechanics, and relativity to understand the nature of stars. The course will qualitatively and quantitatively describe the life-cycle of stars from birth, life, and ultimately death. Stellar astrophysics touches upon many areas of physics: classical mechanics and gravitation, radiation, thermodynamics, nuclear physics, quantum mechanics, E&M and general relativity. The course material will focus on making the connection between observational data and scientific theory.

### Requirements and Textbook:

- **Prerequisites:** The following courses are recommended as preparation: PHYS 320, 330, 385, and CSC 309.
- **Attendance:** Attendance is required for every lecture. Exams may contain questions covered in lectures but not elsewhere.
- **Textbook:** The textbook for the course is “An Introduction to Modern Astrophysics” 2nd edition by Carroll & Ostlie. These are available both used and new from the SFSU bookstore.
- **Electronic Devices:** In general, the use of electronic devices such as laptops, tablets, and cellphones is not allowed in class. Students are free to purchase the electronic versions of the textbook, but keep in mind that this may mean they cannot be viewed during class.

## Course Assessment:

- **Homework (50%/40%):** There will be seven homeworks during the semester and the lowest homework score will be dropped. Most problems will require analytic solutions, however there will usually be one problem per assignment that will involve graphing and numerical solution with computer software such as Mathematica, MATLAB, or any programming language. Homeworks for those enrolled in ASTR 700 will have additional questions and are worth 40% (instead of 50%) due to the oral exam component (see below).
- **Mid-Term Exam (25%):** There will be one mid-term exam held approximately in the middle of the semester which will examine material covered in the first half of the course. This will be held in class and is closed book. Exam dates are listed in the “Important Dates” section, please take note and arrive on time. If you arrive after someone else has finished the exam, you may not take that exam.
- **Oral Exam (10%):** Those enrolled in ASTR 700 are required to prepare and give a  $\sim 20$  minute seminar-type presentation in the last week of class. The topics for these presentations should be chosen by the students, in consultation with the instructor, and should be finalized by the time of the mid-term exam. They should be related to the stellar / nebular / radiation astrophysics topics covered in class, but clearly go beyond the class content.
- **Final Exam (25%):** The final exam will test on all material covered during the semester. Exam dates are listed in the “Important Dates” section, please take note and arrive on time. If you arrive after someone else has finished the exam, you may not take that exam.

Final grades will be assigned as follows:

- A = 90% to 100%
- B = 77% to 89%
- C = 65% to 76%
- D = 50% to 64%
- F = below 50%

## Important Dates:

- September 14: Last day to drop without a W
- October 6: **MID-TERM EXAM**
- November 21-25: Thanksgiving Break (No class)
- December 6/8: Oral exams for ASTR 700 students
- December 13: Last class meeting
- December 20: **FINAL EXAM** 10:45am-1:15pm in TH 425

## **Student Learning Outcomes:**

After successfully completing this course, students will be able to:

1. Explain the key concepts of stellar atmospheres, interiors, and evolution.
2. Apply basic physics such as the Boltzmann equation and Saha equation.
3. Use the concept of radiation transfer.
4. Explain the relationship between stars and their planets.
5. Write computer programs to explore and illustrate some of the key concepts.
6. Interpret the output from those programs to illustrate physical principles.

## **Wait List:**

I am maintaining a waiting list. The list begins with the official university list. Other students who would like to enroll in the course may add their names to the waiting list during class. Students on the waiting list must sign in every day. Priority will be given to students who attend lectures and complete homeworks. Students who miss any classes or homework during the first two weeks will be dropped from the class and replaced with those on the waiting list.

## **Useful Contacts:**

- General Computer problems: SFSU Helpdesk, 338-1420 or [helpdesk@sfsu.edu](mailto:helpdesk@sfsu.edu)
- MasteringAstronomy help:  
<http://www.masteringsupport.com/MasteringAstronomy/student/topfaqs.htm>
- Tutoring and Help sessions: <http://www.sfsu.edu/~lac/astronomy.html>

## **Academic Integrity:**

SFSU maintains a firm policy on plagiarism and cheating, which can be found in the SFSU Bulletin. The Physics and Astronomy department also maintains a set of guidelines stating specific practices that are prohibited and the procedures for handling cases of academic cheating or plagiarism. This policy can be viewed online at: <http://www.physics.sfsu.edu/policy/plagiarism.pdf>

## **Students with Disabilities:**

Students with disabilities who need reasonable accommodations are encouraged to contact the instructor. The Disability Programs and Resource Center (DPRC) is available to facilitate the reasonable accommodations process. The DPRC is located in the Student Service Building and can be reached by telephone (voice/TTY 415-338-2472) or by email ([dprc@sfsu.edu](mailto:dprc@sfsu.edu)).