AST 304, Fall 2018
Stars

Syllabus

This one-semester undergraduate course introduces the physics governing the structure and evolution of stars and star-like objects.

Course goals

Stars are macroscopic objects: to describe their behavior requires weaving diverse physics concepts into a coherent narrative, often via numerical simulation. In this course, you will gain competency both in using simple physical arguments to estimate stellar properties and in constructing numerical models of stellar phenomena. In addition, you will learn how to work collaboratively on larger, longer-term projects.

Instructors

Professor Edward Brown

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Office hours: M 2:00–3:00; TTh 11:30–12:30; also by appointment.

Undergraduate Learning Assistant Dylan Mankel

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Office hours: W 3:00–5:00

Lecture times and location

TTh 12:40–2:00 in 1420 BPS

Click on links in gold-colored text to go to online material.

Textbook and course materials

Required

1. Coursepack "To Build a Star", available from the Spartan Bookstore.
2. An up-to-date version of Anaconda Python (one that uses Python 3.6 or later).
3. An up-to-date installation of `git`. Mac and Linux users have this already as part of their OS. Windows users should download and install git for windows.
4. An account with the online CATME assessment tool for group projects. Instructions on how to access this will be sent to your MSU email account during the second week of the course.

Supplemental

1. Notes on stellar physics at a graduate level are available at this link or from the Open Astrophysics Bookshelf.
2. Allen Downey. *Think Python*. Green Tea Press, 2013. A free download is available from this link.
3. The open-source stellar evolution code `MESA`. Many user-contributed materials are available from the `MESA` user forum.
4. Consult the class reading list (posted on D2L) for additional texts on stellar physics, coding, writing, and project management.

Additional material, as well as homework assignments and projects, will be posted on D2L.

Grading

The final numerical course grade has the following qualitative meaning:

4.0 Mastery of subject, based on homework, exams, and in-class performance. Able to consistently apply concepts to solve problems. Ready for graduate-level coursework on this topic.

3.5 Demonstrates qualities described immediately above and below.

3.0 Generally understands concepts, but has some difficulties in applying them.

2.5 Demonstrates qualities described immediately above and below.

2.0 Incomplete or incorrect understanding of basic concepts.

The course evaluation is based on the following components.

Homework and in-class worksheets (25%)

Homework sets are assigned weekly and are due Thursdays at the start of lecture. For most sets we shall assign one of 4 grades: ⊘ (not done), − (below expectations), ✔ (meets expectations), + (exceeds expectations). Note that a grade of ✔ or + *does not guarantee* that the set is done correctly; it just means that the set appears to be on the right track. Some problems will be graded thoroughly and assigned a numeric grade. In addition, we will often assign in-class worksheets that you will complete as part of a team. These worksheets will be collected and graded in a similar fashion to the homework.

We will work through the solutions in class. You are responsible for making sure that you understand the solutions. Learning occurs when you are correcting mistakes, for in that moment misconceptions are exposed, examined, and discarded. Late homework assignments will be given half-credit.

I have no objection to you working on assignments collaboratively; the set you turn in must, however, be your own. If you do work in a group, you must list your collaborators and describe their contributions. Please refer to the "Spartan Code of Honor Academic Pledge" recently adopted by the Associated Students of Michigan State University (ASMSU)[1].

Group computational project (25%)

In addition to learning about stars, this course has two other ancillary goals. The first is learning to solve complex problems numerically. Computation has become an indispensable component of modern science. Many sophisticated libraries of computational software, such as MatLab and Mathematica, are readily available. Before using them successfully, however, a scientist must understand *how* the algorithms work. The second goal is learning to work collaboratively on larger projects. Large collaborations are now the norm in many fields of science, and anyone working in a scientific or technical field must know how to work effectively as part of a team.

To develop your skills in these areas, you will work in teams to complete progressively more sophisticated computational projects. For each project, your

[1] The text of the pledge is available on the login screen for D2L.

team will submit your code (`Python`) and a short report. You will also self-evaluate, using CATME, the performance of your team and your teammates; these reviews will form part of your grade for each project.

We expect to assign three group projects. The tentative due dates for each project are as follows.

Project	Title	Due by COB on
1	Kepler's problem	4 Oct
2	The white dwarf mass-radius relation	15 Nov
3	The low-mass main sequence	6 Dec

Midterm (20%)

There will be one midterm, tentatively scheduled for **Thursday, 18 October**.

Final (30%)

The final exam is scheduled for **Thursday, 13 Dec, from 12:45–2:45** in 1420 BPS. The final will be cumulative, but weighted toward the latter half of the course.

Disability accommodations

Students who require disability accommodations must bring their VISA forms to Prof. Brown during the first week of classes. If you require accommodations but have not yet registered as a student with a disability, please register with the MSU Resource Center for Persons with Disabilities at `https://www.rcpd.msu.edu/services/accommodations`.

When there is a conflict

Disagreements and conflicts occur from time to time and are a fact of life; the first rule of managing conflict is to make sure that it is promptly addressed. I therefore propose a "24–48" rule if you are unhappy about any aspect of the course: please bring your complaint to my attention promptly, within 24 hours of the issue arising; in turn, I shall evaluate your complaint and respond within 48 hours.