AST 8030/3600: Stellar Astrophysics Fall 2020

TR 9:35-10:50pm
August 25 – December 3
Zoom: https://tinyurl.com/yyo48ua3

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Course website: http://people.vanderbilt.edu/~a.berlind/teaching/8030_fa20/

Textbooks

The main textbook for this course is:
"Stellar Interiors" by Hansen, Kawaler, & Trimble (Springer - second edition)

Other classic textbooks:
"Stellar Structure and Evolution" by Kippenhahn & Weigert (Springer).
"Principles of Stellar Evolution and Nucleosynthesis" by Clayton (Chicago Press)

Topics Covered

Equations of stellar structure
Observations of stellar properties
Virial Theorem and timescales
Equations of state
Heat transfer by radiation and convection
Opacity sources
Nuclear energy generation
Stellar models
Stellar evolution

Course Requirements

Reading

There will be weekly reading from the main textbook and occasionally from journal review articles. The assigned readings will be posted on the website.

Problem Sets

There will be occasional (roughly bi-weekly) problem sets. These will contain both pencil and paper problems, and sometimes assignments that require using a computer. I will assume that you can program in your favorite language and that you are or can become familiar with a basic plotting package. This course is not meant to be competitive; you are welcome to collaborate with other students on any problems, as long as the final presentation is your own.

Final Project
There will be a final project in place of an exam. The project will involve building your own stellar structure computer model from scratch. The model will compute the density, temperature, luminosity, etc. as a function of radius within stars of various masses. This project will teach you how the various physical processes we will learn about during the course affect the physical characteristics of a star like the sun. As an aside, the project will also teach you how to numerically solve differential equations with incomplete boundary conditions.

Attendance
Attendance is required because much of the course material is not covered in the textbook so you cannot just miss a class and learn the material on your own. You can miss up to two classes without penalty. After that, missed classes will affect your course grade.

Grading

Grading will be 50% based on the problem sets and 50% on the final project or exam (assuming the attendance requirement is met). You must turn in all the problem sets, but the lowest problem set grade will be dropped.