
AST 352: Stellar Astrophysics

Spring 2008

MWF 10:10-11am
310 Buttrick Hall
January 9 – April 22

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Course website: http://people.vanderbilt.edu/~a.berlind/teaching/352_sp08/

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

(not a complete list and in no particular order):

Equations of stellar structure

Observations of stellar properties

Virial Theorem and timescales

Equations of state

Nuclear reactions

Heat transfer by radiation, conduction, and convection

Opacity sources

Stellar evolution

Binaries

Stellar models

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.

Current Literature Reports

One of the goals of this course is to help you to read, understand, and evaluate current literature in stellar astronomy. New astronomy journal preprints appear daily on the web at <http://arXiv.org/list/astro-ph/recent>. Each week, pick one new paper (should have appeared on the preprint server within the previous two weeks) that is broadly relevant to the topics discussed in this course. Read it and write 1-2 paragraphs that summarize the paper. The style can be informal, as if you are mentioning the paper to a colleague and pointing out something interesting about it. Extra points for pointing out any potential weaknesses that the paper has. Reports are due via email every Monday.

Final Project

There will be a final project in place of an exam. The details of the project will be ironed out soon, but it will likely 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.

Grading

Grading will be 30% based on the problem sets, 20% based on the current literature reports, and 50% on the final project. There will be no exams.