Stellar Structure and Evolution

Birth

Life

Death
Part I: Stellar Atmospheres
Part I: Stellar Atmospheres

Sept. 5: Intro and Overview of Observational Data (Chapters 3 and 5)
Sept. 7: Basics of Stellar Spectra I (Chapter 8)
Sept. 12: Basics of Stellar Spectra II (Chapter 8)
Sept. 13: **First PS due at 5:00 P.M.**

Sept. 14: Specific Intensity, Flux (Chapter 9.1)
Sept. 19: Optical Depth (Chapter 9.1)
Sept. 20: **Second PS due at 5:00 P.M.**

Sept. 21: Radiative Transfer, Kirchhoff’s Laws (Chapter 9.3 and 9.4)
Sept. 27: **Third PS due at 5:00 P.M.**

Sept. 28: Continuum Opacity and Stellar Atmospheres (Chapter 9.2)
Oct. 3: Line Absorption, Line Profiles (Chapter 9.5)
Oct. 5: **First Test (Covers Section I, incl. Chapters 3, 5, 8 and 9)**
Part II: Stellar Interiors
Part II: Stellar Interiors

Oct. 10: Line Absorption: Equivalent Width, Abundances (Chapter 9.5)
Oct. 12: Hydrostatic Equilibrium I. (Chapter 10.1 and 10.2)
Oct. 17: Hydrostatic Equilibrium II.
Oct 18: Fourth PS Due at 5:00 P.M.

Oct. 19: Radiative and Convective Energy Transport (Chapter 10.4)

Fall Break

Oct 26: Nuclear Reactions (Chapter 10.3)
Oct. 31: Stellar Structure (Chapter 10.5 and 10.6)
Nov. 1: Fifth PS Due at 5:00 P.M.

Nov. 2: Main Sequence Stars (Chapter 13.1)

Nov. 7: The Sun I. (Chapter 11)
Nov. 9: Second Test (Emphasis on Section II, incl. Chapters 10 and 13.1)
Part III: The Sun and Stellar Evolution

\[ \log_{10}(L/L_\odot) \]

\[ \log_{10} T_e (K) \]

\[ M_\odot \]

\[ X_{16}, X_{12}, X_3, X_{14} \]

\[ L = 1940 L_\odot \]

\[ T_e = 5770 \text{ K} \]

H, He envelope

H-burning shell

He-burning shell

CO core
Part III: The Sun and Stellar Evolution

Nov. 14: Post-Main Sequence Evolution (Chapter 13.2)
Nov. 16: Red Giants/ AGB stars/ Planetary Nebulae
Nov. 21: White Dwarfs (Chapters 16.1-16.5)
**Nov. 22: Sixth PS Due at 5:00 P.M.**

Thanksgiving Break

Nov. 28: Supernovae, Neutron Stars, Pulsars, Black Holes (Chapters 15.1-15.3 and 18.5, 16.6, 16.7, 17.3)
**Nov. 29: Seventh PS Due at 5:00 P.M.**

Nov. 30: Star Formation (Chapter 12.1 and 12.2)
Dec. 5: **Student Presentations (by graduate students)**
Dec. 7: Star and Planet Formation (Chapter 12.3)
**Prior to Final Exam: Eighth PS Due.**

TBD: **Final Exam (3 hours) (1/2 of Final will emphasize Section III and 1/2 will be a comprehensive overview of the course.)**
Text: An Introduction to Modern Astrophysics (2nd Ed.) by Carroll & Ostlie

Grading: Homework (8) 36%
   Term Tests (2) 30%
   Final Exam (1) 34%

Project for Graduate Students: Class Presentation on Dec. 5

Homework Policies: (1) You MAY work in groups but everyone should contribute and everyone hands in their own papers. Some questions will require short essays and must be written entirely on your own, although you may discuss these issues with others in the class. In fact, I ENCOURAGE you to work with others on the homework, to get used to the mode of collaborative learning that is common in science.

   (2) All Homework is due Tuesdays by 5:00 P.M. NO LATE PAPERS WILL BE ACCEPTED ... NOT EVEN BY 1 minute! If you have not finished everything by the deadline, then hand in what you have finished.
**Test Policies:** Tests will be closed book and may require a calculator. Term tests are 80 minutes long and the Final is 3 hours. Unlike the problem sets, tests are individual effort, not group effort. Studying for the tests is best done by a) reviewing all the problem sets and their solutions, b) reviewing your class lecture notes and c) doing the reading.

**Office Hours:** My schedule is that I will generally be **unavailable** for help with the class material during the mornings or early afternoons of class days (Monday and Wednesday) or on weekends. I will generally be **available** at all other times. You may feel free to come to my office if I am in or to send e-mail to schedule a meeting time. It will be easiest to contact me by e-mail usually. In an emergency you may also call my office number (x3672) or my home phone (at polite calling hours please!) which is 860-452-4251 and is a local call from Middletown.
**Programming Skills:** Starting with Problem Set 6 you will need to do some numerical integrations that can only be done with a computer program. You will need to know some programming language. IDL is the preferred language, but anything else is OK, including Mathematica. You will need to plot results from your numerical integrations. Please prepare for this, if necessary. Write some simple programs that will do numerical integrations of a simple function (e.g. cos x) and compare with the known analytical solution. Plot your results. Vary the integration step size to see how it affects correspondence with the known result. This is all just for practice and warm up. You do not have to hand in anything. However, the next problem set will require you to do a real numerical integration by computer. If any of you wish to do Question 10.24 from the *2nd Edition* of Carroll & Ostlie and obtain a Runge-Kutta IDL task off the Web, you are most welcome to do so, but it is not necessary.
Department (Orientation) Lunch: Thursday at noon - 1 P.M. in basement classroom of Observatory. Pizza lunch provided!

Astronomy Road Trip! to Wellesley College on Friday, Sept. 23/Sat. Sept. 24. This is the annual Keck Northeast Astronomy Consortium’s Undergraduate Research Seminar. If you did astronomy research this summer you should go and present paper (if you worked for a KNAC institution you must go!) Others are cordially welcome to go along. Rough Schedule is:

Friday, Sept. 23 at 3 P.M.: Depart from Observatory
  5-7 PM: Reception
  7 to ????? PM: Dinner & Party
Saturday, Sept. 24 9 - 4 P.M.: Undergraduate Research Seminar
  ~7 P.M.: Return to campus

We will probably need drivers. Let me know if you have a car and are willing & able to take some passengers. Dept. will cover ALL costs -- travel, lodging, food, etc.