95.383/583. Intro to Astro. Course coverage and HW Fall 2012

Week 1-2. Celestial Sphere & Origins of Astronomy: Antiquity to the Renaissance

HW#1. Chapter 1

Problems:  1.1, 1.2, 1.5, 1.6, 1.8, 1.9

Reading 1: Find 2 examples of Archaeoastronomy

Reading 2: Describe some of the capabilities of HST.

Week 3. Telescopes: How the laws of physics determine the capabilities of telescopes and detectors.

HW#2. Chapter 6. Problems: 4, 7, 8, 9, 12, 16

AND: Describe the phenomenon of Chromatic aberration, and draw a ray diagram (as accurately as possible, using colored pens/pencils) for a two-element lens assembly that will bring light of two different wavelengths so to focus at the same point.

Week 4. The Spectrum of Light.

Planck’s Law to the Stefan Boltzmann law and Wien’s law, Magnitudes and Color index.

HW#3. Chapter 3. Problems 2,3, 9, 15, 19

Week 5. Spectral Lines and Quantum theory

Chapter 5.

HW #4: Problems 1, 4, 9, 11

Week 6. Boltzmann and Saha Equations. Energy level population vs ionization

HW #5: Chapter 8. Problems: 6, 15, 16

Week 7. Spectral Line Profiles and Radiative Transport (Diffusion)

Broadening: Natural, Temperature, Pressure, Rotation, turbulence

Chapter 9.

HW #6. Spectrum Data Analysis Assignment

Week 8. Binary Stars

HW #7. Chapter 7. Problems 4, 5, 6, 7

Take Home Assignment: An Unusual Binary System (IC10 X-1)

Week 9. Hydrostatic Equilibrium and Stellar Structure

Central pressure and temperature, Kelvin Helmholtz contraction, Free-fall timescale, Virial Theorem

HW #8. Chapter 10: 3, 4, 7,

Week 10. Nuclear Reactions as the Source of Stellar Energy

P-P Chain, CNO cycle, Triple-Alpha, Timescales and Temperature dependence

Stellar Evolution. Lifetimes and structural changes during evolution from the main sequence to the AGB and beyond.

Week 11. Stellar Pulsation. Instability Strip, Sound crossing time, Cepheids, Standard Candles

HW#9. Chapter 14: Problems 1, 3, 6

Week 12. Supernovae & Nucleosynthesis. S-process along the AGB, R-process in SNe. Types of SNe (I, Ia, II), radioactive elements in stellar spectra, line ratios

Quiz on Nucleosynthesis

Week 13. Supernovae, the IMF, Chandrasekhar Limit, WDs and NS

HW #10. Chapter 15. Problems 15.5, 15.6. 15.11, 15.12

Plus the following curiosity:

Using the available information in the textbook, try to figure out if it is possible that anyone actually "saw" the neutrino burst produced by Supernova 1987A.  This SN is situated in the Large Magellanic Cloud, and is the closest SN to have occurred in modern times.

Week 14. Pulsars, Accretion, Black Holes

HW#11 (The last one)

1. Prove that Radio Pulsars (periods ms-1s) cannot be White Dwarfs.

2. Develop a reasonable prediction for the spin period of a newly formed Neutron Star.