Astronomy 206: STELLAR PHYSICS

Instructor:
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Time: Tu,Th 10:10-11:30
Web-page: http://cfa-www.harvard.edu/~sasselov/astro206/

Introduction and Overview (1 lecture) Sept. 17
- Stars in the Context of Structure Formation and Nucleosynthesis in the Universe
- Observational Quantities and Methods: Dynamics, Seismology, & Spectroscopy - the HR Diagram.

Thermodynamic Properties of the Stellar Interior (2 lectures) Sept. 19, 24
- The Ideal Gas with Radiation
- The Ionized Real Gas
- Degenerate Matter
- The Equation of State/Crystallization/Neutronization

Nuclear Processes and Burning Stages (2) Sept. 26, Oct. 1
- Basic Nuclear Physics; Nuclear Reactions
- Burning Stages

Energy Transport and the Interaction of Radiation & Matter (7) Oct. 3-24
- Radiative Transfer - Inside and Out (1) Oct. 3
- Convection (3) Oct. 8, 10, 15
- Through the Upper Boundary: Stellar Atmospheres (2) Oct. 17, 22
- Conduction & Neutrino Emission (1) Oct. 24

Overview of Stellar Data & Stellar Evolution (2) Oct. 29, 31
- Star Formation and Young Stellar Objects
- The Main Sequence Stars
- Late Stages of Evolution
- Binary Systems

Stellar Models: Structure and Evolution of Lower Mass Stars (3) Nov. 5, 7, 12
- From the ZAMS to the Present - The Standard Solar Model
- Helium Burning
- AGB Evolution & Nucleosynthesis
- Evolution with Rotation & Mass Loss

Stellar Models: Structure and Evolution of Massive Stars (2) Nov. 14, 19
- Hydrogen & Helium Burning of Massive Stars
- Advanced Burning Stages
- Supernovae & Explosive Nuclear Burning
- Neutron Stars & White Dwarfs

Stellar Stability & Acoustics (4) Nov. 21, 26, Dec. 3, 5
- Radial and Nonradial Pulsations
- Helioseismology
- Stellar Seismology

Chemical Evolution of the Galaxy and the Universe (2) Dec. 10, 12
- Galactic Evolution, Stellar Yields, & Cosmochronology
- Metal Enrichment Patterns from $z \geq 5$ to Present
- Stellar Population Synthesis and Primordial Galaxies
- A Glimpse into the Distant Future: The Long-Term Fate of Astrophysical Objects

Reading Material :
C.J. Hansen & S.D. Kawaler, *Stellar Interiors*, Spriger-V., 1994.

D.D. Clayton, *Principles of Stellar Evolution and Nucleosynthesis*, McGraw-Hill, 1984.

D. Arnett, *Supernovae and Nucleosynthesis*, Princeton, 1996.

G.B. Rybicki & A.P. Lightman, *Radiative Processes in Astrophysics*, 1979.

Grading :
40% final exam, 50% problem sets, 10% participation (journal review).