Astronomy ASTB23
Astrophysics of Stars, Galaxies and the Universe

Fall 2019

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Office Hours: Thursday, 2-3 pm and by appointment

TIME & PLACE:

Thursdays, 12noon - 2pm, AA 206

DESCRIPTION:

This course is an introduction to the fundamental concepts of stellar and galactic astrophysics and cosmology. In stars, gravitational forces compress the gas to high pressures and temperatures, to the point where atomic nuclei overcome their electrostatic repulsion and fuse together, releasing nuclear energy and powering stellar light as we see it. In this course, we will introduce important concepts of Newtonian mechanics, thermodynamics, quantum mechanics, nuclear physics and relativity. We will use this knowledge to develop a quantitative understanding of the structure and the evolution of stars. This will allow us to interpret a large body of observations collected by generations of astronomers studying stars, galaxies and the origin and fate of the Universe.

TOPICS:

- Introductory mechanics, thermodynamics, quantum mechanics, nuclear physics and relativity
- Masses, distances, temperatures and colors of stars
- The structure of stars (including the Sun)
- The birth, life and death of stars (including supernovae)
- The remnants of stars: white dwarfs, neutron stars and black holes
- Milky Way
- Galaxy formation and Galactic structure
- Galaxy clusters

- Expansion of the Universe and dark energy

PREREQUISITES:

A working knowledge of calculus and calculus-based general physics.

Prerequisite: MATA30H3 & [MATA36H3 or MATA37H3] & PHYA21H3
Corequisite: MATB41H3
Exclusion: (ASTB21H3), (ASTC22H3), [AST221H & AST222H]

TEXTBOOK:

"An Introduction to Modern Astrophysics, " by Carroll & Ostlie.

It is also recomended that you take a look at **"The Physical Universe, " by Shu.**

PROBLEM SETS:

Handed out in class and posted on this website, approximately every other week (total of 4-5). Due one week later.

Policy on collaboration: You are welcome to discuss the problems with fellow students, but you must write your own solutions, individually.

Policy on late problem set returns: In order to be fair to those who turn assignments in on time, points will be deducted on assignments turned in late.

GRADING:

Problem sets: 40%
Midterm exam: 25%
Final exam: 35%

APPROXIMATE SCHEDULE (in relation to book chapters):

- Introduction, organisation and overview
- Stellar distances and colors, electromagnetic spectrum, photons [C&O 3, 5]
- Thermodynamic equilibrium, blackbody radiation, Bohr atom [C&O 3, 5]
- Stellar spectroscopy, Hertzsprung-Russel ("HR") diagram [C&O 8]
- Stellar masses [C&O 7]
- Newtonian gravity and mechanics [C&O 2]
- Our Sun, virial theorem and scaling relations [C&O 11, 2]
- Stellar structure [C&O 10]
- Stellar structure and evolution [C&O 10, 13]
- Stellar evolution [C&O 13]

- Stellar remnants [C&O 16, 17]

- Milky Way structure [C&O 24]
- Classification of galaxies [C&O 25]
- Galactic structure and dark matter [C&O 25, 26]
- Galaxy clusters and galactic mergers [C&O 27]
- Expansion of the Universe and dark energy [C&O 27, 29]