

Course Syllabus – Physics 631: The Physics of Astrophysics

Instructor: *Mark Henriksen*

Time and Day: MW 10:00 – 11:15 am

Place: Physics 414 or the conference room

Required Textbook:

Rybicki G., & Lightmann, A. , 1976, Radiative Processes in Astrophysics, Wiley Science, ISBN 0-471-82759-2

Other helpful Textbooks:

Harwit, M., 1988, Astrophysical Concepts, Springer-Verlag, ISBN-387-96683-8

Binney J., & Merrifield, 1998, Galactic Astronomy, Princeton University Press, ISBN 0-691-02565-7

Shu, F., 1991, The Physics of Astrophysics, Volume 1: Radiation, University Science Books, ISBN 0-935702-64-4

Ostlie, D., & Carroll, B., An Introduction to Modern Stellar Astrophysics, 2nd edition, Peason, Addison and Wesley

Silk, J., Big Bang, 2nd edition (October 1988) W H Freeman & Co.; ISBN: 071671812X

Goals for this Course

This course will provide astrophysics students with the fundamental background necessary to understand astrophysics. It is expected that the students in this course have a strong background in the core physics courses. Thus, each topic begins with only a brief review of the basic physics before focusing on an application in astrophysics.

I've tried to focus on applications to astrophysics that will not be covered in the other courses. Typically these topics are found in a course on galaxies and includes: normal galaxies, star clusters, the interstellar medium, groups of galaxies, clusters of galaxies, radio galaxies, intergalactic medium, radiation processes found in active galactic nuclei, and cosmic-ray acceleration.

Grading

Homework assignments will count for 30% of your grade. Two midterms will each count 20% and the final exam will count 30%.

Lecture Topics

1. Radiation and Radiative Transfer

Stellar Classification, Stellar Atmospheres, Interstellar Extinction, Masers, Morphology of Galaxies, luminosity functions, the Local Group, Star clusters

2. Radiation from Moving Charges

Magnetic dipole radiation from neutron stars

3. Bremsstrahlung

X-ray emission from galaxies, groups, and clusters of galaxies

4. Synchrotron Radiation

Radio galaxies, diffuse radio emission from clusters of galaxies

5. Compton Scattering

Klein-Nishina regime, hard X-ray and gamma-ray emission from galaxy clusters, intracluster magnetic field measurements, Sunyaev-Zeldovich Effect

6. Plasma Effects

Interstellar dispersion, Faraday depolarization, Fermi acceleration, cosmic-ray acceleration in structure formation

7. Atomic Structure

HI emission, Galaxies, interstellar medium, rotation measure

8. Radiative Transitions

Bound-Bound transitions, Photoionization, recombination lines in gaseous nebulae, Lyman alpha forest, forbidden line diagnostics in active galaxies