

Course Syllabus – Physics 631: High energy Astrophysics I

Instructor: Mark Henriksen

Time and Day: TuTh 10:30 – 11:45 AM

Place: 011 Sherman Hall

Required Textbook:

Longair, High Energy Astrophysics, 3rd Edition, Cambridge University Press, ISBN 9780521756181

Other helpful Textbooks:

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

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, Pearson, 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 students with the fundamental background necessary to pursue research in high energy astrophysics.

Astrophysics topics include: stars, stellar evolution, binary stars, normal galaxies, 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

Weekly 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

H I 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