

Semester	JAN 2022
Open to semester	8,14,22
Course code	PHY464/PH6434
Course title	Astrophysical Processes
Credits	3 /4
Course Coordinator & participating faculty (if any)	Prasad Subramanian
Nature of Course	Lectures
Pre-requisites	Basic Astrophysics (required), familiarity with elements of Fluid dynamics, some plasma physics (suggested, not absolutely required)
Objectives (goals, type of students for whom useful, outcome etc)	-
Course contents (details of topics /sections with no. of lectures for each)	<p>Two modules: module 1 (40% of course), module 2 (60% of course)</p> <p>Module 1:</p> <p>=====</p> <p>Quick review of gas dynamics: (Frank Shu, A. R. Choudhuri)</p> <p>Compressible flows, transonic flows, shocks,</p> <p>plus astrophysical examples (solar wind, accretion flows, detection of shocks near the Earth, in the solar corona, etc.)</p> <p>Particle acceleration: (Longair)</p> <p>Phenomenological treatment of particle acceleration -</p>

Fermi first and second order acceleration, both
kinematic and diffusion treatments 2 weeks

Cosmic rays

General features of the spectrum (power law, low energy flattening, knee, ankle, comparison with terrestrial accelerators)

Other constituents - like photons, antimatter, etc.

Discovery, modern detectors, especially large ones and Ooty - GRAPES-3

Acceleration sites - supernovae shocks (why),

Cosmic ray diffusive propagation/confinement in the galaxy - spallation, B/C ratio

Shock acceleration

energy estimates, power law index shock strength

- the injection problem

- strong turbulence ($\delta B/B$)

Unsolved problems - absence of a GZK cutoff, exotic candidates for higher energy cosmic rays

	<p>Module 2</p> <p>=====</p> <p>Radiative Processes:</p> <p>Rybicki & Lightman</p> <p>Chap 1 - Radiative Transfer 1 week</p> <p>Chap 8 - Plasma effects 1 week</p> <p>Chap 5 - Bremsstrahlung 1 week</p> <p>Chap 6 - Synchrotron 1.5 weeks</p> <p>Chap 7 - Compton scattering 1.5 weeks</p> <p>Propagation of radiation through plasma: Dispersion, pulse broadening, Faraday rotation, scattering 2 weeks</p>
<p>Evaluation /assessment</p>	<p>End-Sem Examination-40%</p> <p>Mid-Sem Examination-30%</p> <p>Others-Two quizzes 15% each%</p>
<p>Suggested readings (with full list of authors, publisher, year, edn etc.)</p>	<p>Books:</p> <p>Astrophysics for Physicists - A R Choudhuri</p> <p>Theoretical Astrophysics - vol 1, T Padmanabhan</p>

	<p>Radiative Processes in Astrophysics - Rybicki and Lightman</p>
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	<p>High Energy Astrophysics - Longair (vols I and II)</p>
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	<p>The Physics of Astrophysics - Frank Shu (vols I and II)</p>
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