

PHY232: The Dynamic Interstellar Medium

Synopsis

The interstellar medium comprises the gas and dust that is located between stars in galaxy. This module aims to present an overview of the various components of the ISM, and its relevance to the cosmic cycle and astronomical observations; develop students appreciation of how atomic physics impacts upon astrophysical applications, such as the determination of properties of an ionized plasma; familiarize students with spectroscopic analysis tools during laboratory sessions.

By the end of the module, students will be able to demonstrate a general knowledge of the principal constituents of the ISM; Show an understanding of the processes involved in the heating and cooling of interstellar gas; indicate a basic appreciation of the properties of dust grains, including their formation and destruction mechanisms; understand the basic properties of ionized regions for the pure hydrogen case and the more realistic situation involving trace metals; contrast photo-ionized with shock ionized nebulae, and understand the basics of gas dynamics for HII regions and supernova remnants; become familiar with manipulation of spectroscopic datasets through specialized software.

Outline Syllabus

1. **Introduction** Historical context [1 lecture]
2. **Gas** spatial distribution, cold (molecular) cool (atomic), warm (ionized) hot (coronal). Cooling vs heating [5 lectures]
3. **Dust**, properties, dust formation, dust extinction [2 lectures]
4. **Ionized nebulae** pure hydrogen case, effect of metals, Stromgren sphere; radio properties, HII vs Planetary Nebulae [2 lectures]
5. **Nebular diagnostics** extinction, density, temperature, ionizing fluxes, metal abundances [2.5 lectures]
6. **Gas dynamics**, Theory, application to HII regions and SN remnants. Diagnostics of shocks vs photoionization [1.5 lectures]
7. **Star formation** Observations of protostars, Herbig-Haro objects, Theory of collapsing gas clouds, Jeans Mass [2 lectures]
8. **Superwinds and starbursts**, Effect of multiple SN, Galactic fountains, tracers of star formation in galaxies, starbursts, IR luminous galaxies; properties of high-z galaxies. [1 lecture]
9. **Active Galactic Nuclei** Seyfert galaxies, densities and size of narrow and broad line regions, source of energy. [1 lecture]

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