ASTRONOMY 360a OVERVIEW

This course provides an introduction to the physical properties, dynamics, and evolution of the interstellar medium in its many forms and to the basic processes of star formation. It is taught at an advanced undergraduate/graduate level that assumes a good preparation in undergraduate mathematics and physics. The course has four broad sections: Observations and Physical Properties of the ISM; Thermodynamics of the ISM; Dynamics and Evolution of the ISM: and Dynamical Processes of Star Formation.

A. Observations and Physical Properties of the Interstellar Medium

Overview of the various forms of interstellar matter; studies of interstellar atomic hydrogen using optical, ultraviolet, and radio emission and absorption lines; studies of ionized hydrogen (HII) regions using optical and radio emission; observations and basic properties of molecular clouds; observations of supernova remnants and hot gas at optical, radio, and X-ray wavelengths, including thermal and synchrotron emission.

B. Thermodynamics of the Interstellar Medium

State of ionization of the ISM; heating and cooling processes and predicted thermal properties of the neutral and ionized regions; thermal equilibrium and non-equilibrium models; global models of the ISM based on thermal and pressure balance.

C. Dynamics and Evolution of the Interstellar Medium

Basic equations of gas dynamics; theory of shock fronts; applications to standard spherical models of expanding HII regions and supernova remnants, and some extensions to more realistic models; implications for ISM models and the dynamics and evolution of the ISM.

D. Dynamical Processes of Star Formation

Balance between self-gravity and opposing forces including tidal forces, thermal pressure, and magnetic fields; criteria for stability vs. collapse in various geometries, including the Jeans and Bonnor-Ebert criteria; effects of rotation and the stability of disks; predicted properties of star-forming cloud cores; simple models of collapse and some results from simulations; implications for general features of star formation, including the stellar Initial Mass Function.