

# Interstellar Astrophysics

## ASTR 5740

### Instructor

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Office Hours: M, W, F 12:00-12:30 PM in F913 and by appointment

### Course Goals

To understand the physics of the interstellar medium, including the use of observations to probe physical conditions

### Course Content

The structure, dynamics, and ecology of the interstellar medium; the physical mechanisms that govern the thermal, ionization, and dynamic state of the gas and dust; star formation; the ISM in other galaxies

**Prerequisite** ASTR 5110 (IP 1) or instructor consent

### Textbooks

Required: Physical Processes in the Interstellar Medium, by L. Spitzer

Optional: Interstellar Astrophysics, Freeman & Dyson

On Reserve at the Lester Math/Physics Library:

Physical Processes in the Interstellar Medium, by L. Spitzer

Astrophysics of Gaseous Nebulae and AGN by D. Osterbrock

Interstellar Processes edited by D. J. Hollenbach & H. A. Thronson

### Grades

Homework 35%, Midterm Exam 20%, Final Exam 30%, Class Presentation 15%.

### Final Exam

Tuesday, May 4<sup>th</sup> from 10:30 AM to 1:00 PM

### Students with Disabilities

If you have specific physical, psychiatric or learning disabilities and require accommodations, please let me know early in the semester so that your learning needs may be met. You will need to provide documentation of your disability to the Disability Services Department (303-492-8671) at the beginning of the semester.

## Tentative List of Lecture Topics

- Review of Radiative Transfer
- Review of Spectroscopic Notation
- Overview of the ISM in the Milky Way
- Absorption Line Studies and the Curve of Growth
- Ionization Equilibrium
- Thermal Equilibrium
- Spectral Line Formation
- Spectral Line Diagnostics
- HII Regions
- Planetary Nebulae
- Molecular Clouds
- Interstellar Dust
- Models of the Multi-Phase ISM
- Shocks and Supernova Remnants
- Star Formation
- Stellar Winds
- ISM in External Galaxies
- X-Rays from Galaxies and Clusters
- Quasar Absorption Line Studies

## Class Presentations

Every Friday, the first twenty minutes of the lecture will be a student presentation. Exceptions are January 16, 23, and 30, when there will not be presentations, March 5 for the midterm exam, and April 16 & 23, when there will be two presentations. You are free to choose the topic of your classroom presentation, however, the topic must be approved by me. Some sample topics are:

- Cluster Physics from the Sunyaev-Zeldovich Effect
- Galactic Winds/Superbubbles
- Diffuse Interstellar Bands
- Interstellar Cirrus
- Sources of Cosmic Rays
- Polycyclic Aromatic Hydrocarbons
- The CO/H<sub>2</sub> Conversion Factor
- Masers, Megamasers as Distance Indicators
- Cooling of Primordial (Zero-Metal) Clouds
- D/H Abundances from Absorption Line Studies
- Aspects of Interstellar Chemistry (multiple possible presentations)
- Polarization and the Structure of AGN
- Formation of H<sub>2</sub>