SYLLABUS: ASTRONOMY 8300 – FALL 2024
THE INTERSTELLAR MEDIUM

Dr. Michael Crenshaw

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Class Location: Room 628, 25 Park Place
Class Times: 9:30 – 10:45; Monday, Wednesday

Recommended Text: Astrophysics of Gaseous Nebulae and Active Galactic Nuclei, 2nd Edition, Donald E. Osterbrock and Gary J. Ferland, University Science Books (2006)

Other Useful Texts:
Physical Processes in the Interstellar Medium, Lyman Spitzer, John Wiley & Sons (1978)
The Physics of the Interstellar Medium, 2nd edition, J.E. Dyson & D.A. Williams, Institute of Physics Publishing (1997).
Astrophysics of the Diffuse Universe, 1st edition, M.A. Dopita & R.F. Sutherland, Springer-Verlag (2003)

Description: This graduate-level course focuses on physical processes in the interstellar medium (ISM) in both cold and hot phases, an introduction to gas dynamics and ionization fronts in the ISM, properties of dust in the ISM, and physical conditions in various types of nebulae (H II regions, planetary nebulae, active galactic nuclei [AGN]).

Objectives: The principal objectives of this course are to provide an understanding of the observational characteristics of the ISM and ionized regions, a basic understanding of the physical processes, and techniques for determining the physical conditions, abundances, etc. in these regions (including the use of photoionization models).

Grading: There will be several problem sets distributed throughout the semester, and we will have both a midterm and final exam. In the second half of the semester, each person will be assigned a project to analyze a nebular spectrum and model the nebula using the photoionization code CLOUDY (appropriate instruction will be provided). The Midterm and Final will be take-home exams. Grades will be determined as follows:
Problem sets - 25%, Midterm - 25%, Project - 25%, Final - 25%

Additional Info.: This syllabus provides a general plan for the course; deviations may be necessary. On-time attendance in class is required unless excused by the professor. All students are expected to do their own work and abide by the University's Policy on Academic Honesty in the **Student Handbook**.

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SCHEDULE

Class Schedule:

Dates	**Lecture Topics**	**Osterbrock Chapter**
Aug. 26	Introduction to the ISM, Spectral Analysis	1
Aug. 28, Sept. 4	Diffuse ISM, Absorption Lines	(Spitzer)
Sept. 9, 11	Dust: Properties, Reddening Curves, Emission	7
Sept. 16, 18	Photoionized Gas, Ionization Equilibrium	2
Sept. 23, 25	Thermal Equilibrium, Emission Processes	3
Sept. 30, Oct. 2	Emitted Lines, Continuum; Diagnostics	4, 5
Oct. 7, 9	Photoionization Models	
Oct. 14, 16	Gas Dynamics, Ionization and Shock Fronts	6
Oct. 21, 23	H II Regions, PDRs, Planetary Nebulae	8, 9, 10
Oct. 28, 30	Novae, Supernova Remnants	12
Nov. 4, 6	Introduction to AGN, Circumnuclear Regions	13
Nov. 11, 13	Physics of AGN Emission and Absorption	11, 14
Nov. 18, 20	Intergalactic Medium	
Dec. 2, 4	TBD	
Dec. 9	Review	

Other Important Dates:

Sept. 2	No class (Labor Day)
Oct 21 - 28	**Midterm**
Nov. 21, 23	No class (Thanksgiving break)
Dec 9 – 16	**Final Exam**

Note: The above dates are subject to change depending on the pace of the course and other obligations.

Diversity, Equity, and Inclusion: As a class, we aim to be respectful to all individuals regardless of their faith, beliefs, or ethnic backgrounds. We strongly reject all forms of prejudice and discrimination, including but not limited to those based on age, color, race, religion, disability, gender, gender identity, gender expression, national origin, and sexual orientation. The class environment will be "a safe and a brave space" where faculty and students can express their thoughts and views on the subject matter while also demonstrating diligence in understanding how others' viewpoints may be different from their own. Students who wish to request accommodation for classwork or tests may do so by registering with the Access and Accommodation Center (https://access.gsu.edu/).