AST 393F
Survey of the Interstellar Medium

Fall 2009 MWF 11 Unique No. 49605

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Hours: after class or TTh mornings are best

Overview

The interstellar medium plays an important role in the evolution and appearance of galaxies. It is the source of material for star formation and a sink for mass lost during stellar evolution. It also processes much of the radiative and mechanical energy emitted by stars and supernovae. In this course, we will describe the important features of the ISM, discuss the relevant physics, and try to understand how interstellar matter behaves. We will take a broad definition of the ISM (everything outside of the photospheres of stars and planets). With this definition, the physical processes in the ISM are applicable to almost all areas of astrophysics.

Course Setup

The course will be a mixture of lecture and discussion. The last class day for each chapter of the text will concentrate on questions from me or you, with 2-3 of you designated as experts who will be prepared to ask and answer questions.

Deliverables

Problem Sets: There will be short problem sets every 2-3 weeks. (30% of final grade)
Hour Exams: There will be hour exams on Sep 25, Oct 23, and Nov 20. (each 10% of final grade)
Final Exam: There will be an oral final exam for each student. Exams will take place during the last week of classes. Exams will last 30 minutes. You need to arrange for a neutral senior party to be present at the exam. This can be your adviser or another professor or research scientist. (30% of final grade)
Participation: I am counting on you to keep up with the reading and to take an active part in the discussion. In particular when you are taking a turn as an "expert reader", you need to be prepared (10% of final grade).

Text

The Physics and Chemistry of the Interstellar Medium, by A.G.G.M. Tielens, 2005, Cambridge UP. This book assumes more knowledge of spectroscopy than most of you are likely to have. To fill in the gap, we will start with a summary of atomic and molecular structure and spectra. Chapters 9-11 of *Radiative Processes in Astrophysics*, by Rybicki & Lightman will be the text for this part of the course.

Tentative schedule

Dates	Chapter	Topic
8/20-8/28	1	The galactic ecosystem – introduction and overview
8/31-9/4	R&L 9	Atomic structure
9/7-9/11	R&L 10	Radiative transitions – atomic spectra
9/14-9/18	R&L 11	Molecular structure and spectra
9/21-9/23	2	Gas cooling – emission processes
9/25		Exam #1
9/28-10/2	3	Gas heating
10/5-10/7	4	Chemical processes
10/9-10/16	5&6	Interstellar dust & polycyclic aromatic hydrocarbons
10/19-10/21	7	HII regions
10/23		Exam #2
10/26-10/30	8	The phases of the ISM
11/2-11/6	9	Photodissociation regions
11/9-11/13	10	Molecular clouds
11/16-11/18	11	Interstellar shocks
11/20		Exam #3
11/23-11/25	12	Dynamics of the interstellar medium
11/30-12/4		Student talks and oral exams