Astronomy 501
Radiative Processes
Spring Semester 2013

Astronomy 134 MWF 2:00–2:50 pm

Course web page URL
http://courses.atlas.uiuc.edu/spring2013/ASTR/ASTR501/

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1 Introduction

Radiative processes lies at the heart of astronomy and astrophysics, providing the link between astrophysical systems and observables. In this course, we will develop the tools to address:

- Given and astrophysical system, how will it look?
- Given how an observed astronomical object looks, what is the nature of the physical system?

It is my hope that students leave the course with an understanding of: how to assess what an astrophysical system will look like, spatially and across the EM spectrum; the physics and astrophysics of the underlying emission, absorption, scattering processes; the detailed spectra arising from idealized examples of radiating systems, and how these arise; how to calculate spectra for realistic systems; how to interpret and analyze spectra and to infer underlying physical properties.

Course work will focus heavily on (and reward!) problem solving. The intended audience is first-year graduate students and beyond

Prerequisites. We will develop most of the course from "first-ish" principles, so the main prerequisites are that you have familiarity with these principles. These include: (1) E&M, including Maxwell's equations, (2) elementary quantum mechanics, (3) basic thermal physics, and (4) basic special relativity. Our study of radiative processes will weave these together, and so this course provides and excellent opportunity to review and synthesize your understanding of these beautiful and important topics.

2 Course Requirements

Course work is heavily weighted towards frequent homework. Exams are to encourage synthesis of the material and to test your understanding of the main concepts and analytical tools.

Grading Scheme

Requirement	Unit Weight	Total Weight
Problem Sets	best 10 of 11: 7% each	70%
Midterm Exam		10%
Final Exam		15%
Class Participation		5%

3 Readings and Resources

Course Texts:

George Rybicki and Alan Lightman *Radiative Processes in Astrophysics*, Wiley (1979, reprinted 2004)
Recommended. A classic, with an excellent treatment of the fundamentals that does not show its age. Much of the course will follow this book.

Bruce Draine *The Physics of Interstellar Matter*, Princeton (2011)
Recommended. Complements Rybicki & Lightman with an updated choice of topics and discussion of observations, and a broader discussion of astrophysics. We will also draw on this for lectures and homework.

4 Problem Sets

I will assign 11 problem sets throughout the course, i.e., on a nearly weekly basis. The high frequency is intended to keep you up-to-date on the material. Problem sets are due in class; late homework will be deducted 25% for every calendar day late.

Science is a collaborative enterprise, and you are encouraged to discuss the class material and the problems with your classmates and the instructor. However, you are responsible for your own answers, which you should understand and write up in your own words.

5 Exams

An in-class Midterm exam will be given in class on **Friday March 1**.

The Final Exam be given during the scheduled exam period, **Tuesday May 7, 1:30 to 4:30 pm**.

More information will be forthcoming as each exam approaches.

6 Schedule

The course website contains the course schedule, along with webpages and notes for each lecture.