Astronomy 601: Radiative Processes

Instructor:

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Class web page: http://www.astro.umd.edu/~miller/teaching/astr601

I will post lecture notes a few days before each class, and assume you have read them before the actual lecture.

Schedule:

Lectures on Tuesday and Thursday from 2:00 to 3:15, CSS 0201.

Textbooks:

Required: *Radiative Processes in Astrophysics* by Rybicki and Lightman.
Recommended: *The Physics of Astrophysics Volume 1: Radiation* by Shu.

Course Grading

Homework	25%
Midterm Exam	25%
Final Exam	35%
Individual Project	10%
Class Participation	5%

Feel free to discuss homework with other students, but you must work out and write up the solutions yourself. I will grade each problem (in the homework and in the exams) on a four-point scale. Approximately half of the credit will be for demonstrated understanding of the physical issues and/or equations associated with each problem, and half for correct solution of the problems. If you come up with an answer that is obviously incorrect (e.g., a velocity 1000 times the speed of light!), but correctly say why it is incorrect and approximately what the right answer is, you will get partial credit. For some of the problems (which will be marked clearly), to get full credit you will also need to show that your answer has the correct limits, symmetry, etc. as dictated by the problem. The midterm and final will both be in-class, and we can negotiate whether they are open-book or closed-book.

Homework will be assigned approximately every two weeks (or less, for short assignments), on Thursdays. The homework will be due at the beginning of class one or two Thursdays later, and I will return the graded homework to you by the following Thursday. The reason I want you to turn in your homework at the beginning of class is so that you can absorb the content of that lecture instead of worrying about the problems! I will therefore enforce this policy strictly, and will take off points for, e.g., homework turned in at the end of class.

The individual project will be a report on one current topic in radiative processes. I'll want you to have selected the topic you'll discuss by the week after the midterm, so that we can talk about it and make sure it's a good project. The report will be both a written report (4-5 pages in double-spaced 12pt format) and an oral report, which will be given in class at the end of the semester. For this project you will be graded on both content and presentation in the oral and written reports. Class participation will be determined by attendance and by participation during classes; I will ask many questions during class, and although I don't expect you to get the "right" answer every time I do want you to try.

Letter Grades

I will guarantee that you will receive no worse than the following letter grades for a given percentage of the total available points:

85%–100%	A
70%–85%	B
55%–70%	C
40%–55%	D

I may grade on a curve if the class average is significantly lower than suggested by the table. There will be no extra credit.

Late Policy and Make-Up Policy

Partial credit for late homework assignments may be given if you give me a valid reason by the Tuesday before the assignment is due. No credit will be given for homework turned in more than a week after the due date (i.e., after the beginning of class the following Thursday). If you cannot make the midterm or the final exam, then we can arrange a different time if you tell me at least a week before the exam (to be fair to other students, the alternate time should be before the scheduled time).

Tentative Course Outline

Sep 3–12: Overview, specific intensity, scattering and absorption.
Sep 17–19: Source function and rate equations.
Sep 24–26: Quantum statistical mechanics and equilibria.
Oct 1–10: Electromagnetism applied to radiation.
Oct 15: Midterm.
Oct 17–22: Thomson, Rayleigh, and Compton scattering.
Oct 24–31: Bremsstrahlung, cyclotron/synchrotron, plasma processes.
Nov 5: Statistics and interpretation of spectra.
Nov 7–19: Atomic structure, transitions, bound-bound and bound-free, line broadening.
Nov 21–26: Molecules, rotation and vibration spectra.
Nov 28: Thanksgiving.
Dec 3–5: Presentation of projects.
Dec 10: Neutrino and gravitational radiation processes.
Dec 12: Recap, emphasis of points brought up during semester.
Dec 19: Final exam, 10:30 AM to 12:30 PM.