# ASTR 5110 – INTERNAL PROCESSES 1

http://jilawww.colorado.edu/~pja/astr5110/

**TIME & PLACE:** Monday / Wednesday / Friday at 10:00am in Duane E126

**INSTRUCTOR:** Phil Armitage (pja@jilau1.colorado.edu; office JILA A909; office phone 2-7836). There are no official `office hours' for this class – I'm normally in the office afternoons / early evenings (2-6pm) and you're welcome to stop by at any time. Email or call if you want to be *certain* I'm around.

**AIMS:** The primary goal of this course is to understand the radiation from astronomical objects – how it's produced and what it can tell us about the physical conditions of gas in nebulae and at the surfaces of stars, planets, accretion disks etc.

**OUTLINE:** Topics to be covered in the class include

- Review of quantum mechanics – the Schrodinger equation, operators, angular momentum, perturbation theory
- Hydrogen-like atoms and their spectroscopy
- Subtleties of hydrogen – spin, fine and hyperfine structure, Zeeman splitting
- Multi-electron spectroscopy, L-S coupling, selection rules, different types of transitions
- Ionization, excitation, and radiative cooling
- Introduction to radiative transfer
- Opacities
- Spectral line profiles
- Molecular physics
- Statistical mechanics and quantum statistics

The focus will be on non-relativistic processes – topics such as inverse Compton and synchrotron radiation will be covered in IP2 and / or high energy classes for those interested.

**TEXTBOOKS:** The `required' textbooks for this course are *Radiative Processes in Astrophysics* by George Rybicki and Alan Lightman, and *Statistical Mechanics* by R. Pathria. Since we won't follow either text to any significant degree, I wouldn't rush out to buy these, though Rybicki and Lightman especially is a useful reference to have eventually.

**GRADING:** Grades will be based upon

- Problem sets – 50%
- A take-home midterm – 20%, to be attempted independently
- A final presentation – 30%, done either individually or in a group of 2

I reserve the option to award a small amount of extra credit (up to 5%) for class participation above and beyond what's normal.

**QUERIES:** Questions and discussion in class are welcome – the more the merrier! Likewise please let me know if particular topics prove to be too hard (or, too easy) – there's no absolute list of topics we have to cover and I'd much prefer you gain a firm grasp of a more limited set of skills than a hazy idea of everything.