Astronomy 520: Advance Extragalactic Astronomy
Spring 2013 Syllabus

Instructor: Brant Robertson (brant@email.arizona.edu)

Overview:

Publication quality research in extragalactic astronomy requires a synthesis of many fields and skills including cosmology, galaxy formation, observational techniques, instrumentation, image processing, and numerical analysis. Astronomers who wish to conduct research competitive with the state-of-the-art world-wide must be flexible and maintain a high-level of technical acumen.

This course is designed to train students in attacking research problems by developing and maintaining the skills to perform theoretical calculations and model data quickly. Inevitably, achieving this goal requires computational techniques, especially programming.

The course meets two days a week:

On Mondays 3:00-3:50pm, the class meets in Steward 202 for an overview lecture describing a common problem in extragalactic astronomy that one might wish to solve. These problems range from pedestrian (calculating luminosity distances, distance moduli, universal age with redshift, etc.) to the more involved (linear power spectrum, halo mass function, Bayesian parameter estimation, etc.) that any astronomer working in extragalactic astronomy should be able to tackle. We will present the numerical techniques in the lecture required to solve the problem.

On Wednesdays 3:00-3:50pm, the class meets in the Steward Observatory Library for a hands-on session where we develop code required to solve the problem. The goal of these sessions is for students to work with the instructor to engineer tested and robust software libraries for quick computations needed in extragalactic astronomical research. The sessions will begin with some pedagogical examples of how to begin developing code for the numerical computations. The students will then have a supervised coding session where the instructor will assist as necessary, and the instructor will work in real time to develop similar code.

Grading:

Grading is based on class participation (50%) and assigned homework (40%; approx. every ~one-two weeks). Assigned homework is in the form of coding assignments, and grading is based on successful completion of the assigned numerical task. At the end of the class (last two-three weeks) a more involved project will be assigned (10%) that synthesizes several skills developed over the course. As this is a two-credit course, the homework will not be as central as coming to class (especially the weekly coding sessions).

Code Development:

The instructor is happy for students to use whatever programming language they feel comfortable with, but examples will be given only in C/C++ and IDL. No programming background is required to start, but you will need to learn a language if you don't know one! The instructor fully expects to help with basic coding issues in addition to scientific coding questions.

Texts:

There are no required texts. The following texts and websites may be useful:

Numerical Recipes	http://www.nr.com	Book available on amazon.com.
C++.com	http://www.cplusplus.com	Especially the STDLIB vectors.
Cosmo Calc	http://www.astro.ucla.edu/%7Ewright/CosmoCalc.html	

Class Topics:

A list of class topics will eventually be posted to the class website:

http://brown.as.arizona.edu/~brant/astro520