Phys 406 - Cosmology - Spring 2015

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Welcome to **Physics 406 – Cosmology**. Cosmology is the study of the nature and evolution of the universe as a whole. This goal of this course is to provide students with an understanding of the basic framework for the current scientific theories about the universe, and an introduction to many of the associated research areas. Typically there are two approaches in studying cosmology. One can work backward in time by looking at observational constraints and considering the physics at ever earlier (more distant) epochs. The other is to accept the general relativistic framework of standard big bang cosmology with known energy densities and pressures at the beginning, and explore the physical effects from earlier in time to later. Our approach will be more like the latter, although we will occasionally jump around in time. **This is the first time this class is offered, so the approach will no doubt be refined as we go through the semester.**

There is no required textbook for this course. Much of the material will be inspired by the following three texts:

The first book in particular will guide our approach. It is also the most up-to-date. If you want a single text that most approaches the focus of this class, buy it. The paperback version is modestly priced and provides an accessible and complete overview of current topics in cosmology. I will assign suggested optional readings from all texts. I will also provide an outline of upcoming lecture topics to guide your optional reading/note taking that includes relevant data/images.

**Course Content and Emphases**

- **Space, Time and Curvature**: A description of the Friedman-Robertson-Walker space-time metric and its justification based upon large-scale structures in the universe.

- **Cosmological Dynamics**: The Friedman and acceleration equations. Evolution of the universe for various single and multiple component universes.

- **ΛCDM Model and Ages, Distances, Volumes**: Description of the relevant energy densities defining our universe. Evaluation of the age of the universe, and look-back times given this model.

- **Cosmic Microwave Background**: An overview of the characteristics of the cosmic microwave background radiation. The primordial density power spectrum. The CMB dipole. Acoustic peaks. The Sachs-Wolfe effect. Reionization. Polarization of the CMB.

- **Inflation**: Big Bang paradoxes and the need for new physics. Inflationary epoch. The inflaton field.


Grading

Grades are calculated from the following components:

- Four 100 points quarterly exams. The final exam will be the fourth quarterly exam.
- Summed homework scores. Expect roughly one homework per topic from above.

The initial grade thresholds are:

- A- = 87.5%
- B- = 75%
- C- = 60%
- D- = 50%
- F - < 50%

It is possible that any of these thresholds will be moved lower. Do not count on this, however. Plus/minus grading will be used, with thresholds being determined later..

Academic Honesty: Discussion of lectures, readings and assignments with your classmates is encouraged. All work handed in, however, must be your own. No cheating or plagiarism will be tolerated. Sources used for completing assignments beyond the lecture notes must be referenced. Failure to follow this rule or any others listed in the Student Code of Conduct may have consequences including (but not limited to) ejection from the course with a failing grade.