Syllabus: Physics 5V49/4V10 – Spring 2006
INTRODUCTION TO COMTEMPORARY COSMOLOGY

Lectures: Tuesday and Thursday, 7:00 p.m. – 8:15 p.m. FN2.106

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Office hours: TBD in class

Textbook: Cosmology and particle astrophysics, second edition, by Lars Bergstrom and Ariel Edgar
(Also, notes will be given for many chapters)

Other books:
Introductory Astronomy and Astrophysics (Last 6 chapters), 4th edition, Zeilik and Gregory
An Introduction to Cosmology - J. V. Narlikar
Introduction to Cosmology Barbara Ryden
Cosmological Physics (Cambridge Astrophysics S.), John A. Peacock (advanced)
Modern Cosmology, Scott Dodelson (advanced)
An Introduction to Modern Cosmology, Andrew Liddle (advanced)
Large-Scale Structure of the Universe, James Peebles (advanced)
For relativity: Relativity: Special, General, and Cosmological. Wolfgang Rindler
Introducing Einstein's Relativity, Ray d'Inverno

Online resources:
http://science.hq.nasa.gov/universe/index.html
http://science.hq.nasa.gov/universe/science/index.html
http://en.wikipedia.org/wiki/Physical_cosmology
http://nedwww.ipac.caltech.edu/level5/
http://hyperphysics.phy-astr.gsu.edu/hbase/astro/astcon.html#astcon

Course general description: The course is an overview of contemporary cosmology including: cosmological models of the universe and their parameters; large scale structure of the universe; dark matter; cosmological probes and techniques such as gravitational lensing, cosmic microwave background radiation, and supernova searches; very early stages of the universe; dark energy and recent cosmic acceleration.

Grading: The course is intended for physics graduate students and advanced undergraduate students. There are no prerequisite courses. Student evaluation will be based on 4 homework assignments and a small project. The goal of the small project is to allow students to learn more about a topic of their choice in cosmology. The small project can be chosen by the student from one of the following:

i) A publication reading project: The student reads one introductory publication on a topic of their choice in cosmology (a list of various publications will be provided). The student will then write a short summary and give a short presentation about the publication. (This format is usually very popular in this course.)

ii) A numerical or analytical project in cosmology (a list of various small projects will be provided). For example, some projects will involve writing a simple program or adapting an existing code from the numerical recipes book in order to solve a known differential equation or known integral of interest to cosmology. Other projects will be semi-analytical and will involve the use of Mathematica, Maple, or Mathlab in order to solve semi-analytically (algebraic computing) some equations of interests to cosmology.

Online web page for the course: a web page for the course will be maintained at http://www.utdallas.edu/~mishak/courses/cosmology. Announcements and updates will be posted there on a regular basis.

Tentative table of content for the course

Topic	Suggested Reading Chapter(s)
Introduction to physical cosmology	B&G chap. 1
The physical content of the universe. The scale of distance.	B&G 1, also I will provide class notes
A simple introduction to General Relativity without tensor calculus: Principles of relativity. Curvature. Metrics.	B&G chap. 3 but skip any tensor equations (with indices). I will introduce the only few relevant equations in the class notes
Cosmological principles and the standard Lemaitre-Friedmann-Robertson-Walker metric	B&G chap 4 + Class notes
The standard cosmological model. Friedman equations. Expansion of the universe. Cosmological fluids.	B&G chap 4 + Class notes
Cosmological distances, redshift, horizons. Supernova type Ia as distance indicators (cosmological probe I)	B&G chap. 4 +Class notes
Cosmological parameters. Definitions. Measurements.	B&G Chap. 4 + Class notes
Dark Matter	Class notes + preprint will be provided
The formation of structures in the universe and growth rate of large scale structure.	B&G chap. 11.3-11.6 + Class notes
The cosmic microwave background radiation (CMB) (cosmological probe II)	B&G chap. 11.3-11.6 + Class notes
The acceleration of the expansion of the universe and dark energy	B&G chap. 11 + Class notes
Gravitational Lensing: strong regime, weak regime. (Cosmological probe III)	B&G chap. 5 + Class notes
The very early stages of the universe. The Big Bang. Chronology. Primordial Nucleosynthesis (cosmological probe IV)	B&G chap 8 (?), 9. + Class notes
The very early stages of the universe. Inflation, cyclic universe	B&G chap 6 + Class notes.