Astronomy 541 — Extragalactic Astronomy and Cosmology

University of Arizona, Spring 2009
MW 1:15-2:30 pm
Replacement lectures Friday at the same time

Course Summary

This course will study extragalactic astrophysics, beginning with the fundamentals of modern cosmology and continuing with empirical and physical explorations of extragalactic phenomena.

Instructors

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Web site

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Prerequisites

Astronomy 540 (Structure and Dynamics of Galaxies) and Astronomy 575 (General Relativity and Cosmology) will be helpful but are not required.

Grading

Homework 67%, In-class, closed-book Final Exam 33%. We will drop the lowest homework grade. The final is Monday, May 11, from 11 am to 1 pm (note earlier time!).

Homework Assignments

While we recognize that people often study in groups, we expect homework solutions to represent each individual's independent work.

Many of the problems to be assigned we have assigned to past Astro 541 or 400B classes. It is not permitted to look at solution keys or student solution sets from past semesters, and you are on your honor not to do so.

Homework assignments will generally be weekly and due on Wednesdays.

Late Assignments

Homework will be due in class on the due date. Anything turned in after that time will be considered late. Late assignments turned in before the next class period (usually Monday) will receive 75% credit. Assignments turned in after that will receive no credit. Some exceptions can be made for extraordinary circumstances.

Suggested Text

Galaxy Formation, 2nd Edition, by Malcolm Longair. This book covers many topics to moderate depth and with modern notation. The second edition considerably expands the discussion of recent observations.

Other References

Cosmology, by Coles and Lucchin. A graduate-level general introduction to the subject. We haven't used this book ourselves, but several students gave it a strong recommendation.

Cosmological Physics, by Peacock. A new graduate-level book on cosmology. It's harder than Longair and it wanders off onto topics (e.g. field theory) that we're not going to need. The last few chapters, on cosmological perturbations, are very good.

The Early Universe, by Kolb and Turner. A older but excellent introduction to the intersection of particle physics and early-universe cosmology. The first six chapters are particularly good; the ninth chapter, on structure formation, is now dated.

Cosmological Inflation and Large-Scale Structure, by Liddle and Lyth. A new graduate-level book about gravitational structure formation. The book stands out for a complete (and yet accessible) technical description of cosmological perturbation theory.

Principles of Physical Cosmology, by Peebles. Slightly older (early 90's) and overly complete, this is not a good first book on cosmology, but it's really useful once you know what you're looking for (and where to find it).

Structure Formation in the Universe, by Padmanabhan. An advanced undergrad-level book on cosmology that you may find useful.

The Dynamic Cosmos, by Madsen. A short but advanced book that tries to highlight the physical principles behind modern cosmology.

Order of Topics (subject to change)

- Overview
- Relativity and metrics
- Homogenous universes, FRW metrics, Friedmann eqs.
- Classical cosmological tests
- The thermal history of the hot Big Bang
- The cosmic microwave background
- Big Bang nucleosynthesis
- Perturbative cosmology & Large-scale structure
- CMB anisotropies, theory & experiment
- Late-time perturbations & halo formalisms
- Gravitational lensing
- Galaxy clusters
- Statistical galaxy properties
- Galaxy evolution & high-redshift galaxies
- Galaxy formation theory
- The intergalactic medium & QSO absorption lines
- Reionization and first objects
- A critical summary of cosmological parameters
- Inflation & dark energy
- Observational cosmology in the next decade