ASTR 541: Cosmology
Spring 2022 – MW 1-2:15 pm, SO 208

Instructor Information

Dr. Elisabeth Krause, krausee@arizona.edu, office: SO 324

Office hours: by appointment, or drop in if my door is open!

Course Description

This course will study cosmology, beginning with the fundamentals of modern cosmology, Friedmann Equations, to cosmological tests and cosmological parameters, to hot big bang theory and CMB, structure formation and large scale structure of the universe, to early galaxy formation, cluster of galaxies and gravitational lensing. See order of topics (below) for details.

Course Format

Live in-person, MW 1-2:15 pm in SO208. The majority of classes will be lectures, supplemented by student presentations on classic papers (see below).

Recommended Textbook

Galaxy Formation and Evolution, by Mo, van den Bosch and White. A new and comprehensive text with excellent coverage on galaxy properties and galaxy formation (this is also your galaxy class AST540 textbook).

Other References

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.

Cosmological Physics, by Peacock. A new graduate-level book on cosmology. It's more technical than Mo, van den Bosch and White (or Longair) and it wanders off onto topics (e.g. field theory) that we're not going to need. The last fewchapters, on cosmological perturbations, are very good.

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).

Order of Topics

Tentative schedule (subject to change, see D2L for latest version):

Week	Classes	Topic
1	01/12	Intro
2	01/19	Measurements
3	01/24, 01/26	Friedman Equations
4	01/31, 02/02	Classic cosmological tests
5	02/07, 02/09	thermal history
6	02/14, 02/16	perturbations
7	02/21, 02/23	perturbations/statistics
8	02/28, 03/02	CMB

9	03/14, 03/16	non-linear evolution
10	03/21, 03/23	dark matter halos
11	03/28, 03/30	star + galaxy formation
12	04/04, 04/06	IGM, reionization
13	04/11, 04/13	weak lensing
14	04/18, 04/20	galaxy clustering
15	04/25, 04/27	galaxy clustering, galaxy clusters
16	05/02, 05/04	blind analyses, future surveys

Expected Learning Outcomes

1. Exhibit an expert-level facility to engage with the principle findings, common applications, current problems, fundamental techniques, and underlying theory of cosmology
2. Demonstrate advanced discipline skills and knowledge necessary to utilize the observational techniques, instrumentation, computational methods, and software applications used to investigate modern astrophysical phenomena and problems.
3. Develop expertise with communicating, translating and interpreting fundamental astronomical concepts and research results in oral and/or written formats.
4. Conduct independent research and/or gain mastery-level knowledge of cosmology
5. Engage in the scholarly, ethical, and discipline specific practices of the field at a professional level

Grading

Homework 50% (6-7 homework sets, all weighted equally; lowest homework grade will be dropped)

Classic Cosmology **Paper Review** 25%

In-Class **Final Exam** 25%.

Homeworks

About 6-7 homework sets, all weighted equally. We will drop the lowest homework grade
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 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.

Late Assignments

Homework will be due on D2L 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 - e.g. observing runs or out-of-town travels.

Class Project

Most weeks, we will have one of the students lead a review of a classic cosmology papers. Paper list, signup, and requirements will be distributed separately.

Final Examination

Closed book, in-class final exam on 5/6 (time to be specified in consultation with other classes).

Nondiscrimination and Anti-harassment Policy

The University of Arizona is committed to creating and maintaining an environment free of discrimination. In support of this commitment, the University prohibits discrimination, including harassment and retaliation, based on a protected classification, including race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information. For more information, including how to report a concern, please see: http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

University Policies

All university policies related to a syllabus are available at: https://academicaffairs.arizona.edu/syllabus-policies. By placing this link in your syllabus, you no longer need to have each individual policy included in your syllabus.

Subject to Change Notice

Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor of this course.

Accessibility and Accommodations

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu/) to establish reasonable accommodations.

Graduate Student Resources

ınformation about the University of Arizona's Basic Needs Resources are available at http://basicneeds.arizona.edu/index.html