

# PHYS 4368 / 6368 – Foundations of Modern Cosmology

Fall 2020

(Dates and some details listed in this syllabus subject to change due to evolving COVID-19 situation.)

**Instructor:** Professor Joel Meyers ([jrmeyers@smu.edu](mailto:jrmeyers@smu.edu), Office phone: 214-768-2048)

**Lectures:** TuTh 3:30-4:50 PM, Clements Hall 224 (and online)

**Required Textbook:** *Modern Cosmology*, by Scott Dodelson (ISBN 9780122191411)

## Other Useful Reading:

- *Cosmology*, Steven Weinberg
- *Lecture Notes on Cosmology*, Daniel Baumann, <http://cosmology.amsterdam/education/cosmology/>
- *Introduction to Cosmology*, Barbara Ryden
- *The First Three Minutes*, Steven Weinberg

## Grading:

- Homework - 30%
- Quizzes - 30%
- Midterm exam (In class Thursday October 8) - 20%
- Final paper (undergraduate students) / Final exam (graduate students) - 20%

**Office Hours:** TBD, Fondren Science Building 209 (May be online only due to COVID-19)

**Course Objectives (4368/6368):** After taking this course, all students should be able to:

- Identify and explain the observational evidence in favor of the big bang model of cosmology
- Understand the expansion history of the universe
- Describe the thermal history of the universe
- Outline the motivation for and principles of cosmic inflation
- Explain the context and goals of modern cosmological surveys

**Course Objectives (4368):** Undergraduate students should be able to:

- Interpret and discuss outstanding issues in modern cosmology
- Investigate and report on a cosmology-related topic not directly covered in class

**Course Objectives (6368):** Graduate students should be able to:

- Apply techniques of general relativity to solve problems in cosmology
- Distinguish the physical effects of changes to cosmological parameters

**Topics to be covered:**

- Introduction to General Relativity
- The homogeneous Universe
- Dynamics of expansion
- Thermal history of the Universe
- Cosmological nucleosynthesis
- The cosmic microwave background
- Dark matter
- Dark energy
- Cosmic inflation
- Sketch of cosmological perturbation theory

**Homework:** Students are allowed and encouraged to work in groups on homework, but each student must submit unique and individual answers to be graded. Undergraduate students will typically have fewer and less-demanding problems to complete than graduate students.

**Quizzes:** Short quizzes (5-10 minutes) will be given to start most classes. Some will test basic concepts from previous lectures and readings. Others will be ungraded (i.e. full credit will be given for any attempt) and will be used to assess background knowledge before beginning a new topic. The lowest 3 quiz scores will be dropped (including quizzes missed for absences without prior arrangements).

**Midterm Exam:** There will be a midterm exam in class on Thursday October 8 (subject to change due to COVID-19). You will be allowed access to hand-written notes and a scientific calculator. Graduate students will have more challenging problems than undergraduate students for the midterm exam.

**Final Paper (Undergraduates):** There will be no final exam for undergraduate students. Instead, undergraduates will be asked to complete a research paper on a topic of their choosing related to modern cosmology. The paper should be 8-12 pages with double-spaced 12pt font. A topic must be chosen and approved by the instructor no later than Thursday November 5, a rough draft submitted by Thursday November 19, and the final paper by Thursday December 3.

Grading criteria for rough draft:

- Well-reasoned plan for paper:
  - Is the topic and scope interesting and tractable?
  - Does it relate to the course material?
  - Has reference material been found and selected?
- Follows guidelines (8-12 pages double spaced, on previously approved topic, etc.)
- Submitted on time

Grading criteria for final draft:

- Improvement from rough draft:
  - Has the project been appropriately fleshed out?

- Was feedback addressed?
- Does the final paper have a coherent narrative flow?
- **Content:**
  - Is the material presented accurate?
  - Does the paper contain some depth on the chosen topic?
  - Is the level of presentation appropriate?
- **Overall impression:**
  - Informative
  - Interesting
  - Readable
  - Free from grammatical/spelling errors, etc.
- Follows guidelines (8-12 pages double spaced, on previously approved topic, etc.)
- Submitted on time

**Final Exam (Graduates):** There will be a cumulative final exam for graduate students. (To be held online due to COVID-19.) As with the midterm exam, you will be allowed access to hand-written notes and a scientific calculator.

**Disability Accommodations:** Students needing academic accommodations for a disability must first register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visit <http://www.smu.edu/Provost/SASP/DASS> to begin the process. Once approved and registered, students will submit a DASS Accommodation Letter to faculty through the electronic portal DASS Link and then communicate directly with each instructor to make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

**Religious Observance:** Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. ([See University Policy No. 1.9](#))

**Excused Absences for University Extracurricular Activities:** Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (See [2018-2019 University Undergraduate Catalogue](#))