Physics 16: The Origin and Development of the Cosmos
Course Syllabus - Summer 2016

Instructor: Dr. Maria Elena Monzani (monzani@slac.stanford.edu)
Office: 242 Physics and Astronomy Building
Office hours: Tuesdays, 2:30-4:00 PM and by appointment

Lectures: Tuesdays and Thursdays, 11:30 AM - 1:20 PM, Hewlett 102
Discussion Sections: to be scheduled. TAs: to be assigned.

Course Website: The course website can be found at http://canvas.stanford.edu. You need to register for the course with AXESS to be able to access the Physics 16 site. All the handout material will be posted on the website. This site will also be used to post all notices, assignments, corrections, changes, etc., so you should view it regularly.

Text(s): The Cosmic Perspective: Stars, Galaxies & Cosmology, 8th Edition (Authors: Bennett, Donahue, Schneider & Voit). Note: You may also use other versions of this book, including:
- The Essential Cosmic Perspective (used for Physics16, Winter Quarter)
- Cosmic Perspective (used for Physics 15, Fall Quarter)
- Older editions of any textbook in the list above.
The textbook is recommended but not mandatory. It will be used as reference material.

About the course:

How did the present Universe come to be? The last few decades have seen remarkable progress in understanding this age-old question. The course will cover the history of the Universe from its earliest moments to the present day, and the physical laws that govern its evolution. Specifically, we will discuss: the early Universe including inflation and the creation of matter and the elements; recent discoveries in our understanding of the makeup of the cosmos, including dark matter and dark energy; evolution of galaxies, clusters, and quasars, and the Universe as a whole; implications of dark matter and dark energy for the future evolution of the cosmos.

**Conceptual and quantitative understanding:** Intended to be accessible to non-science majors, the material is explored quantitatively with problem sets using basic algebra and numerical estimates. Homework problems will concentrate somewhat more on the quantitative aspects of the topics covered. The exams will test both conceptual and quantitative knowledge.

**Math:** This course will use math at the level of the SAT – algebra, trigonometry and so on. We will attempt to avoid having to memorize specific numbers or long formulas. The point is not to be able to regurgitate these things but rather to understand and use them.
Physics 16 Summer 2016 Requirements:

**Attendance:** Attendance at the lectures is mandatory. Attendance at the discussion sections is optional, and you may go to either discussion section in any given week, regardless of which one you are officially signed up for.

**Class participation:** Everyone gets more out of an experience if they are actually involved. In most lectures I will be presenting questions on the material for you to figure out in groups, pairs, or alone. I will be calling on people to discuss their answers and their reasons. In these exercises it is more important to be engaged than to get the correct answer!

**Homework:** Homework is due at the beginning of lecture every Thursday. I will assign it the preceding Thursday. You are allowed to work together on homework, but everyone has to turn in his or her own work. In addition, there will be one fun and easy stargazing assignment to look at the night sky and report what you see.

**Exams:** There will be one in-class midterm exam on 7/14/2016 during the normal class time and one final exam on 08/12/2016 at 12:15-3:15pm. The exams will have both questions to test qualitative/conceptual understanding, and to test quantitative/mathematical understanding. You can find the complete schedule of finals for the Summer Quarter at the University Registrar’s website. Please do not register for classes with conflicting final exams, because we may not be able to accommodate such conflicts.

**Observatory trip:** We will be making one visit to the Stanford observatory, where we will use the telescope to look at astronomical objects. Dates will be announced as soon as they are known.

**Textbook:** The pedagogy relies primarily on the instructor’s expertise as communicated in the lectures, rather than on the textbook, which is supplemental. Slides from the lectures will be posted to the class website after they are given.

**Honor code:** The Honor Code is the university's statement on academic integrity written by students in 1921. All Stanford students are expected to read this document and abide by its rules. The document is linked from the canvas site, under “Syllabus”.

*Please don’t be late to the lectures, and please turn cell phones off.*

**Grading:**

40% Final Exam  
20% Midterm Exam  
30% Homework  
10% class participation
Physics 16 Tentative Schedule:

1. **Tu 6/21/16**  Class organization; preview of the Universe
   Corresponding textbook chapters: 1, 3

2. **Th 6/23/16**  The modern view of the Universe
   Corresponding textbook chapters: 2, S1

3. **Tu 6/28/16**  Gravity and motion of the planets
   Corresponding textbook chapter: 4

4. **Th 6/30/16**  The key to astronomy: Light of all kinds
   Corresponding textbook chapters: 5, S2

5. **Tu 7/05/16**  The key to astronomy: Telescopes
   Corresponding textbook chapter: 6, S2

6. **Tu 7/07/16**  The Sun; How stars shine
   Corresponding textbook chapters: 14, 15

7. **Th 7/12/16**  The lifecycle of stars; the death of stars
   Corresponding textbook chapters: 16, 17

*** **Th 7/14/16**  In-class Midterm Exam (Chapters 1 through 16)

8. **Tu 7/19/16**  Black Holes; Gravitational Waves
   Corresponding textbook chapter: 18, S3

9. **Th 7/21/16**  The Milky Way and other galaxies
   Corresponding textbook chapters: 19, 20

10. **Tu 7/26/16**  Powerhouses of the Universe: Pulsars, GRBs, Active Galaxies
    Corresponding textbook chapters: 18, 21

11. **Th 7/28/16**  Hubble’s Law; the Distance Ladder
    Corresponding textbook chapter: 20, 21

12. **Tu 8/02/16**  The Early Universe; Big Bang; Inflation
    Corresponding textbook chapter: 22, S4

13. **Th 8/04/16**  Big Bang Nucleosynthesis; Dark Matter
    Corresponding textbook chapter: 23

14. **Tu 8/09/16**  Dark Energy and Structure Formation
    Corresponding textbook chapter: 23

15. **Th 8/11/16**  Revision Session and Open Questions

*** **Fri 8/12/16**  Final Exam (12:15pm - 3:15pm, room TBA)

This schedule may change as it depends on the progress of the class. Please check the course website for detailed and up-to-date readings and assignments.