

**Astr 450: Astrophysics of Star Systems**      Fall 2020

**Instructor:** A. W. Shafter (ashafter@sdsu.edu)

**Prerequisites:** Credit or concurrent registration in Mathematics 342A and Physics 354, or consent of the Instructor.

**Required Textbook:** None

**Brief Course Description:**

The purpose of this course is to provide students with a brief introduction to extragalactic astronomy. Roughly the first one-third of the course will be devoted to a brief review of basic astronomy, the historical development of extragalactic astronomy, including a discussion of the nature of spiral nebulae, followed by a discussion of galaxy classification and morphology. The middle third of the course will describe the extragalactic distance scale, and how distances to individual galaxies are determined. The final third of the course will cover observational cosmology – the origin and evolution of the Universe on large scales.

The course will be conducted on-line and presented as a series of pre-recorded lectures augmented by supplemental material. Students are free to move at their own pace through the lectures as they are posted online. I plan to hold **weekly virtual office hours (Time: Tuesdays 1400 - 1500)** to answer any questions that arise from the lectures.

**Broad Course Outline:**

**I. The Nature of Spiral Nebulae**

- A. Historical Background
- B. Properties of Stars Review

**II. Galaxy Morphology: Structure and Content**

- A. Classification
- B. Stellar Populations

### **III. Interstellar Material**

- A. Interstellar Extinction
- B. HII Regions & Nebulae

### **MIDTERM**

### **IV. Galaxies & The Extragalactic Distance Scale**

- A. Distances within the Milky Way
- B. Standard Candles
- C. Distances to Local Group and Nearby Galaxies

### **V. An Introduction to Observational Cosmology**

- A. Newtonian Cosmology
- B. Big Bang

### **Key Student Learning Outcomes:**

- Describe the birth of Extragalactic Astronomy
- Describe the properties of Spiral, Elliptical and Irregular galaxies.
- Discuss how distance to galaxies are determined using a variety of extragalactic distance indicators (Cepheid stars, Novae, Supernovae, Tully-Fisher, Brightest Stars).
- Describe Hubble's Law, the Big Bang, Big Bang nucleosynthesis, and the cosmic microwave background (CMB) radiation.
- Explain the origin of cosmic structure, the cosmological constant, dark energy and the accelerating universe, and the ultimate fate of our universe.

### **Grading:**

Grading will be based on a midterm (25%), and a comprehensive final exam (40%). The remaining 35% of the grade will be based on Homework & a Distance Scale Project term paper.

**FINAL EXAM: Tuesday December 15, 1300 - 1500**

**Statement on Student Disability:**

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Disability Services at (619) 594-6473. To avoid any delay in the receipt of your accommodations, you should contact Student Disability Services as soon as possible. Please note that accommodations are not retroactive, and that accommodations based upon disability cannot be provided until you have presented your instructor with an accommodation letter from Student Disability Services. Your cooperation is appreciated.

**Statement on Academic Dishonesty:**

Students must work independently on all assignments and exams. All work turned in must be in the student's own words. Plagiarism in any form will not be tolerated, and will result in a zero for the assignment. A second offense will result in a failing grade for the course.

**FERPA Statement:**

**Student Privacy and Intellectual Property:** The Family Educational Rights and Privacy Act (FERPA) mandates the protection of student information, including contact information, grades, and graded assignments. I will use Blackboard to communicate with you, and I will not post grades or leave graded assignments in public places. Students will be notified at the time of an assignment if copies of student work will be retained beyond the end of the semester or used as examples for future students or the wider public. Students maintain intellectual property rights to work products they create as part of this course unless they are formally notified otherwise.