Astr 450: Astrophysics of Star Systems Fall 2022

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

Office Hours: Tu, Th 13:00–14:00, P 243

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

Class time and room: Tu, Th 14:00–15:30, PS 256

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 in a "flipped-classroom" mode where students are expected to watch 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. Regular class periods will allow me to amplify on the material and to answer any questions from students 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

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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 and a Distance Scale Project term paper.

FINAL EXAM: Thursday December 15, 2022 from 1300 - 1500

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.

Essential Student Information:

For essential information about student academic success, please see the SDSU Student Academic Success Handbook: https://studentsuccess.sdsu.edu/

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.