ASTR A104: GALACTIC ASTRONOMY

Item	Value
Curriculum Committee Approval Date	10/16/2024
Top Code	191100 - Astronomy
Units	3 Total Units
Hours	54 Total Hours (Lecture Hours 54)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S), • Pass/No Pass (B)
Associate Arts Local General Education (GE)	• Area 5 Physical and Biological Sciences, Scientific Inquiry, Life Science (OB)
Associate Science Local General Education (GE)	• Area 5 Physical and Biological Sciences, Scientific Inquiry, Life (OSB)
California General Education Transfer Curriculum (Cal-GETC)	• Cal-GETC 5A Physical Science (5A)
Intersegmental General Education Transfer Curriculum (IGETC)	• IGETC 5A Physical Science (5A)
California State University General Education Breadth (CSU GE-Breadth)	• CSU B1 Physical Science (B1)

Course Description

An overview of the origin, structure, and dynamical nature of the Milky Way. An emphasis on the different types of galaxies and their evolution through time. Observational techniques used to study galaxies and the evidence for supermassive black holes, quasars, and dark matter. Transfer Credit: CSU; UC.

Course Level Student Learning Outcome(s)

1. Apply physical principles to explain the composition, structure, and dynamics of the Milky Way and other galaxies.
2. Assess the observational evidence for supermassive black holes and dark matter and evaluate their importance in models of galaxy formation and evolution.
3. Strengthen scientific literacy and numeracy skills by interpreting data and key results in galactic astronomy.

Course Objectives

- 1. Trace the historical development of our understanding of the Milky Way.
- 2. Locate major features of the Milky Way on a diagram.
- 3. Classify galaxies according to the Hubble tuning fork scheme.
- 4. Explain the physical processes behind active galactic nuclei.
- 5. Explain how galaxy rotation curves provide evidence for dark matter.
- 6. Compare and contrast the features of galaxies in the early Universe with galaxies today.
- 7. Describe the hierarchical nature of large-scale structure in the Universe.
- 8. Identify the observational technique(s) needed to study a given characteristic of galaxies.

Lecture Content

Nature of science Size and scale of the Universe Scientific method Scientific literacy The Milky Way Historical/multicultural mythology Structure Stars in disk, bulge, halo Gas and dust (interstellar medium) Spiral structure (density waves) Dynamics of the disk, bulge, halo Life cycle Gas in the Galaxy (interstellar medium, 21-cm line) Galactic triggers for star formation Evolution of star clusters Stellar populations Open and globular clusters Location of Pop I, II, III stars in the Galaxy The galactic center Evdence for a supermassive black hole Using Kepler's third law to determine mass Rotation curve and evidence for dark matter The galactic habitable zone Extragalactic astronomy The Great Debate Types of galaxies and their properties The Hubble tuning fork Ages of stars, gas content, stellar dynamics Observational techniques Galaxy catalogs Telescopes Photometry and spectroscopy Multi-wavelength observations Galaxy surveys and citizen science The distance ladder Cepheid variable stars Tully-Fisher and Faber-Jackson relations Type Ia supernovae Galaxy redshifts Dark matter in galaxies Galaxy evolution Formation of galaxies Changes in galaxy properties with time Active galactic nuclei Types (quasars, blazars, Seyfert galaxies, etc.) Their role in galaxy evolution Large-scale structure The Local Group Galaxy groups, clusters, and superclusters Galactic cannibalism (mergers)

Method(s) of Instruction

- Lecture (02)

Instructional Techniques

Instructional techniques include lectures, group work and discussions, class presentations.

Reading Assignments

Outside assigned reading in the textbooks (2 hours per week)

Writing Assignments

Brief essays on course topics, semester research papers (2 hours per week)

Out-of-class Assignments

Homework assignments reviewing course content, preparing group presentations (2 hours per week)

Demonstration of Critical Thinking

Assignments and exams require students to synthesize concepts discussed in class. Students think scientifically as they interpret observational data in light of the physical principles covered in class.

Required Writing, Problem Solving, Skills Demonstration

Written reports and group presentations (including written and oral components) based on course content and extensions of the material.

Eligible Disciplines

Physics/Astronomy: Master's degree in physics, astronomy, or astrophysics OR bachelor's degree in physics or astronomy AND master's degree in engineering, mathematics, meteorology, or geophysics OR the equivalent. Master's degree required.

Textbooks Resources

1. Required Harvey-Smith, L.. When Galaxies Collide, ed. Melbourne University Press, 2018 2. Required Waller., W. H.. The Milky Way: An Insider's Guide, ed. Princeton University Press, 2013 Rationale: This book covers the content related to the Milky Way galaxy. 3. Required Fraknoi, A., Morrison, D., Wolff, S.. Openstax Astronomy, ed. Rice University, 2018