

Galaxies

Human understanding of the immensity of the universe took a giant step forward when it was realized that the smudges of light that were then visible in powerful telescopes were actually distant galaxies much like our own Milky Way galaxy. Suddenly we realized that what we thought was the entire universe (our galaxy) was merely a single island of stars amongst many other islands of stars in a vast, vast ocean of space in a universe that is breathtakingly enormous compared to what we previously thought.

Further developments in telescopes helped us to observe a fantastic variety of galaxies in much more detail. This led to many questions, which are still actively being researched today. How were galaxies formed? When were they formed? How are they organized in space? What is the significance of this mysterious organization?

The following questions will guide your reading of this unit. The relevant part of the textbook is Chapter 17.

1 Classification of Galaxies

- Explain the classification scheme for galaxies, based on visual appearance.
- Describe the main properties of E galaxies. What are the sub-categories of E galaxies, and how do they differ?
- Describe the main properties of S galaxies. What are the sub-categories of E galaxies, and how do they differ?
- Describe the main properties of Irr galaxies.

2 Determining Distances to Galaxies

- Describe the method of Cepheid variables as it is used to determine the distances to galaxies. What is the maximum distance that can be determined in this way?
- Describe the method of globular clusters as it is used to determine the distances to galaxies.

3 Hubble's Law and the Expansion of the Universe

- What is Hubble's law?
- What was Slipher's role in the discovery of Hubble's law?
- What was the role of the Doppler effect in Hubble's law?
- What is the significance of Hubble's law for our understanding of the universe?

4 Cosmological Redshift; The Distribution of Galaxies

- How does the expansion of the universe result in a cosmological redshift in the spectra of galaxies?
- Explain the reasoning that supports the use of Type Ia supernovae in determining the distances to distant galaxies.
- How are galaxies distributed in the universe?

5 Galaxy Collisions/Interactions; Seyfert Galaxies

- How likely are collisions between galaxies? How does this compare with the likelihood of collisions between individual stars?
- What are some of the consequences of galaxy collisions or other interactions between galaxies?
- Are galaxy collisions/interactions more common in rich galaxy clusters or in poor galaxy clusters? What observational evidence supports this conclusion?
- How are galaxy clusters organized into larger structures in the universe?

6 Radio Galaxies and Quasars

- What is an active galaxy? What is an active galactic nucleus? How are active galaxies detected?
- What is a Seyfert galaxy?
- Why is the time during which an astronomical source varies (i.e., its period) related to the size of the astronomical object that is emitting the detected electromagnetic radiation?
- What is a radio galaxy? How does a radio galaxy emit such an enormous intensity of radio waves?
- What is a quasar? What is a current hypothesis for the mechanism through which quasars emit such an enormous intensity of electromagnetic radiation?