

Galaxies: Spiral Galaxies, Elliptical Galaxies & Milky Way

Galaxy

- A galaxy is a massive system of **millions to billions of stars**, along with **gas and dust**, held together by **gravity**.
- Galaxies are the **basic building blocks of the universe**.
- Smallest galaxies have **~1 lakh stars**, while the largest have up to **3000 billion stars**.

Types of Galaxies

Broadly classified into:

1. **Regular Galaxies**
2. **Irregular Galaxies**
 - About **1/10th** of all galaxies
 - Contain **very old stars**

Regular Galaxies

1. Spiral Galaxies



- **Disc-shaped with a central bulge and spiral arms**
- **Non-uniform distribution of stars**
- **Old stars concentrated at the centre**
- **Young, bright stars are found in spiral arms**
- **Rich in interstellar gas and dust**
- **Active star formation occurs**
- **The Milky Way is a spiral galaxy**

2. Elliptical Galaxies



- *Smaller and less bright than spiral galaxies*
- *Contain mostly old stars*
- *Very little gas and dust*
- *No new star formation*
- *Among the brightest galaxies in the universe*

Dark Matter

- *Outer arms of spiral galaxies (including the Milky Way) rotate faster than expected*
- *This indicates the presence of extra unseen mass → Dark Matter*
- *Accounts for ~85% of the total matter in the universe*
- *Does not interact with light*
- *Detected only through its gravitational effects*
- *Dark matter and dark energy ≈ 95% of the universe*

Why “Dark” Matter?

- *Does not emit, absorb, or reflect electromagnetic radiation*
- *Invisible across the electromagnetic spectrum*
- *Interacts only through gravity*

Our Galaxy – The Milky Way



- *Hosts our Solar System*
- *A disc-shaped spiral galaxy with a central bulge*
- *Diameter: 1,50,000–2,00,000 light-years*
- *Thickness:*
 - *Nucleus: ~10,000 light-years*
 - *Disc: 500–2,000 light-years*

Key Features of the Milky Way

- *Contains 100–400 billion stars*
- *Supermassive black hole – Sagittarius A* at the centre*
- *The Solar System lies in the Orion Arm*
- *Distance of Solar System from centre: ~26,000 light-years*
- *Red dwarfs are the most common stars*
- *Sun-like stars are rare*

Motion of the Sun

- *Completes one revolution around the Milky Way in ~220 million years*

- Orbital speed: ~285 km/s

Neighbouring Galaxy

- **Andromeda Galaxy**
- Closest large galaxy to the Milky Way
- Distance: ~2 million light-years

MCQs

Q1. With reference to spiral galaxies, consider the following statements:

- I. They are rich in interstellar gas and dust.
- II. Active star formation takes place mainly in their spiral arms.
- III. They consist only of old stars with no new star formation.

Which of the statements given above are correct?

- A. I and II only
- B. II and III only
- C. I and III only
- D. I, II, and III

Answer: A

Q2. The Milky Way galaxy is best described as:

- A. An elliptical galaxy with uniformly distributed stars
- B. A disc-shaped spiral galaxy with a central bulge
- C. An irregular galaxy with no defined structure
- D. A dwarf galaxy dominated by young stars

Answer: B

Q3. Consider the following statements regarding Dark Matter:

- I. It does not interact with electromagnetic radiation.
- II. It accounts for about 85% of the matter in the universe.
- III. It can be directly observed using optical telescopes.

Which of the statements given above are correct?

- A. I and II only
- B. II and III only
- C. I and III only
- D. I, II, and III

Answer: A

Q4. Which one of the following is the closest large galaxy to the Milky Way?

- A. Large Magellanic Cloud*
- B. Small Magellanic Cloud*
- C. Andromeda Galaxy*
- D. Triangulum Galaxy*

Answer: C

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