

# Unit 12: The Milky Way – Our Cosmic Metropolis

**Duration:** 60 Minutes

**Goal:** To understand the structure, scale, and movement of our home galaxy and our specific place within it.

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## I. The Big Picture: What is the Milky Way? (10 Minutes)

- **The Name:** From the Greek *galaxias kyklos* (milky circle). Explain why it looks like a "spilled path of milk" from Earth (we are looking into the edge of the disk).
  - **Galactic Type:** We are a **Barred Spiral Galaxy**.
  - **Dimensions:**
    - **Width:** 100,000 light-years.
    - **Thickness:** Only about 700 light-years in the disk
      - Bulge is about 3,000 light-years
      - (like a giant thin pancake with a bulge in the middle).
  - **The Population:** – 100 - 400 billion stars and about that many planets.
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## II. You Are Here: Our Galactic Address (12 Minutes)

- **The Orion Arm:** We aren't in the crowded center or the lonely edge. We are on a minor "spur" called the Orion Arm.
  - **The Distance:** We are about 25,000 light-years from the center.
  - **The Galactic Year:** The Sun travels at **500,000 mph**, yet it still takes **230 million years** to complete one orbit around the center.
    - *Fun Fact:* The last time Earth was in this exact spot in the galaxy, dinosaurs were just beginning to appear.
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### III. The Heart of the Beast: Sagittarius A (15 Minutes)\*

- **The Galactic Center:** Located in the direction of the constellation Sagittarius. It is packed with stars (densities million times higher than our neighborhood).
  - **The Supermassive Black Hole: Sagittarius A\*** (pronounced "A-star").
    - **Mass:** million times the mass of our Sun.
    - **The 2022 Proof:** Discuss the Event Horizon Telescope image which proved it exists.
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  - **The "Bar":** Explain the central bar of stars that funnel gas toward the center, acting as a fuel line for star formation.
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### IV. The Hidden Galaxy: Dark Matter & The Halo (13 Minutes)

- **The Galactic Halo:** A spherical region surrounding the disk containing **Globular Clusters** (ancient groups of million+ stars).
  - **The Missing Mass Problem:** Stars at the edge of the galaxy rotate just as fast as stars near the center. Physics says they should fly off into space.
  - **Dark Matter:** The invisible "glue." It makes up **85-90%** of the galaxy's mass. We can't see it, but its gravity holds the "pancake" together.
  - **The Fermi Bubbles:** Mention the two massive bubbles of high-energy gas "burped" out by the center, extending light-years above and below the disk.
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### V. The Future: The Great Galactic Collision (10 Minutes)

- **Andromeda is Coming:** Our neighbor, the Andromeda Galaxy (), is heading toward us at **250,000 mph**.
  - **"Milkomeda":** In about billion years, the two will merge.
  - **The "Empty" Collision:** Because stars are so far apart, it is unlikely that even *two* stars will actually hit each other. The galaxies will simply pass through each other and eventually settle into one giant elliptical galaxy.
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# Fast Facts Handout: The Milky Way

Metric	Measurement
Total Mass	~1.5 Trillion Solar Masses (including Dark Matter)
Star Count	100 - 400 Billion
Age	~13.6 Billion Years (almost as old as the Universe)
Rotation Speed	~220 km per second

## Scientific "Deep Dives"

- **Galactic Cannibalism:** The Milky Way is currently "eating" several smaller dwarf galaxies (like the Sagittarius Dwarf). We can see "streams" of stars from these former galaxies being shredded by our gravity.
- **The Zone of Avoidance:** Why we can't see the other side of the galaxy well. The dust and gas in the disk block our view of the "Great Beyond" in that specific direction.
- **Gaia Mission Data:** As of 2024-2026, the Gaia spacecraft has mapped the positions of nearly **2 billion stars**, giving us the most accurate "GPS" of our galaxy ever created.

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## Discussion Prompts for Seniors:

1. **Our "Smallness":** "Knowing there are 400 billion stars in just our galaxy, and there are 2 trillion galaxies in the universe, does it make you feel insignificant, or does it make our 'perfect' Earth feel more precious?"
  2. **The Galactic Year:** "If the Sun takes 230 million years to orbit the galaxy, Earth has only had about 20 'birthdays' since it was formed. Does that change how you think about the age of our world?"
  3. **The Night Sky:** "In cities, we can only see a few dozen stars. In a dark sky, we see the 'Milk' of the galaxy. Do you think we've lost a piece of our human heritage by losing our view of the Milky Way to light pollution?"
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