

Unit 08: Dwarf Planets, Asteroids, and Comets: Wanderers of the Dark

Duration: 60 Minutes

Goal: To distinguish between dwarf planets, asteroids, and comets, and understand their roles as "Time Capsules."

I. Introduction: The Solar System's "Leftovers" (5 Minutes)

- **Defining the "Small Bodies":** Why size isn't the only thing that matters.
 - **Asteroids:** The "Inner City" (mostly rock/metal).
 - **Comets:** The "Suburbs & Beyond" (mostly ice/dust).
 - **Dwarf Planets:** The "Local Celebrities" that didn't quite make it to the Big Leagues.
- **The Vera Rubin Update (2026):** Mention that as of early 2026, the Rubin Observatory is discovering thousands of new objects every night, nearly doubling our known catalog.

II. Dwarf Planets: The "Almost" Worlds (15 Minutes)

- **The 2006 Definition Crisis:** * Why Pluto was reclassified
 - (it hasn't "cleared its neighborhood").
- **The Five Titans:**
 - **Ceres:** The only one in the Asteroid Belt. It holds 1/3 of the entire belt's mass.
 - (Recent findings: brine oceans beneath its surface). 25% is water ice!
 - **Pluto:** Complex geology with a "heart" made of nitrogen ice (Sputnik Planitia).
 - **Eris:** More massive than Pluto; the "Discord" that forced the redefinition.
 - **Haumea:** Shaped like a football because it spins every **4 hours**.
 - It also has its own rings!
 - **Makemake:** A red-brown world covered in frozen ethane and methane.

III. Asteroids: The Rocky Remnants (12 Minutes)

- **The "C-S-M" Classes:**
 - **C-type (Carbonaceous):** Dark, clay-like. 75% of asteroids. They likely brought water to Earth.
 - **S-type (Siliceous):** Stony/rocky.
 - **M-type (Metallic):** Pure iron-nickel. *Special mention:* The **Psyche Mission** (currently en route) to study a potential exposed planetary core.

- **The Rubble Pile Theory:** Many asteroids (like Bennu) aren't solid rocks—they are "ball pits" held together by weak gravity.
- **The Fastest Spinners:** Mention the 2026 discovery of asteroids rotating in under 2 minutes.

IV. Comets: Dirty Snowballs & Interstellar Guests (15 Minutes)

- **Anatomy of a Comet:**
 - **Nucleus:** The "dirty snowball" core.
 - **Coma:** The gas cloud created when ice sublimates.
 - **Two Tails:** One of dust (white/curved) and one of ions (blue/straight, always points away from the Sun).
- **The Reservoirs:**
 - **Kuiper Belt:** Short-period comets (like Halley).
 - **Oort Cloud:** A giant spherical shell 100,000 AU away; the home of long-period comets.
- **Interstellar Visitors (Update 2026):** Discuss **3I/ATLAS**, the third interstellar object ever discovered, which is currently swinging through our neighborhood (late 2025–early 2026).

V. Threats & Triumphs (8 Minutes)

- **Planetary Defense:** The DART mission proved we can "nudge" an asteroid.
 - **Sample Returns:** Discuss OSIRIS-REx and Hayabusa2—we now have physical pieces of these "time capsules" in labs on Earth.
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