

# Unit 09 – Our Sun: The Living Star

**Duration:** 60 Minutes

**Goal:** To understand the Sun's internal anatomy, its magnetic "temperament," and how it creates the environment for life on Earth.

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## I. Introduction: The Ordinary Miracle (5 Minutes)

- **A Yellow Dwarf:** Why our Sun (-type star) is actually "average" in the galaxy, but perfect for life.
- **Scale and Mass:** The Sun contains **99.8%** of the mass of the entire Solar System. If the Sun were a front door, Earth would be the size of a nickel.
- **Energy Output:** In one second, the Sun emits more energy than humans have used in the entirety of civilization.

## II. Anatomy of a Star: The Layer Cake (15 Minutes)

- **The Core:** Where **Nuclear Fusion** happens. Temperatures reach **15 million °C**. Hydrogen atoms are crushed into Helium, releasing photons.
- **The Radiative Zone:** Energy travels as light, but it's so dense that a single photon can take **100,000 years** to bounce its way out.
- **The Convective Zone:** Hot plasma rises, cools, and sinks, much like a boiling pot of oatmeal.
- **The Photosphere:** The "surface" we see. It's actually quite cool—only about **5,500°C**.

## III. The Atmosphere & The Solar Wind (12 Minutes)

- **The Chromosphere:** The "inner atmosphere" that glows red during eclipses.
- **The Corona:** The "Crown."
  - **The Temperature Paradox:** The Corona is millions of degrees hotter than the surface. (Imagine standing next to a campfire, but it gets hotter as you walk *away*).
- **Solar Wind:** A constant stream of charged particles (protons and electrons) flying off the Sun at **1.6 million km/h**.

#### IV. Magnetic Temperament: Sunspots & Flares (15 Minutes)

- **Magnetic "Rubber Bands":** The Sun's magnetic fields get twisted because the equator spins faster than the poles (**Differential Rotation**).
- **Sunspots:** Darker, cooler regions where magnetic fields have "kinked" and blocked the flow of heat.
- **The 11-Year Cycle:** The Sun's magnetic poles flip every 11 years.
  - (2025–2026 is a "Solar Maximum," meaning more spots and activity).
- **Solar Flares & CMEs: \* CME (Coronal Mass Ejection):**
  - A billion-ton "burp" of solar plasma.
  - **The Impact:** How these cause Auroras (Northern Lights) and
  - why they threaten our GPS and power grids.

#### V. The Sun's Life Story: Past & Future (8 Minutes)

- **Middle Age:** The Sun is 4.6 billion years old—roughly halfway through its life.
- **The Red Giant Phase:** In another 5 billion years, the Sun will expand, likely swallowing Mercury, Venus, and possibly Earth.
- **The White Dwarf:** Its final form—a cold, dense core the size of Earth.

#### VI. Q&A and Observation (5 Minutes)

- **Solar Safety:** Discussing the importance of never looking at the Sun without proper filters.
- **Discussion:** "If the Sun were to go out right now, we wouldn't know for 8 minutes and 20 seconds. How does that change your feeling of connection to it?"

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### Fast Facts Handout: Our Parent Star

<b>Distance to Earth</b>	~93 Million Miles (1 AU)
<b>Core Temperature</b>	15,000,000°C
<b>Surface Temperature</b>	5,500°C
<b>Composition</b>	73% Hydrogen, 25% Helium
<b>Rotation Speed</b>	25 days (Equator) to 35 days (Poles)

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