



Udaipur Solar Observatory

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Overview

- What is the Sun?
- Physical properties of the Sun
- What is the internal and external structure?
- What is the source of energy?
- How it affects our environment?
- Importance of the Sun... (why to study?)
- MAST: a new telescope in Udaipur

Location of the Sun

This is where you live in our Solar system!



We measure the distance in light years rather than kilometers! One light year is equal to distance traveled by light in one year. Speed of light (c) = 3×10^8 m/sec

Earth is about approximately 8 min away from the Sun (150 X 10⁶ km).

Source: Wikipedia

Sun's location: The Milky Way Galaxy

100,000 light years across 1,000 light years thick 200 billion stars







Location of the Sun



The Sun



Properties of Sun



- Composition: 74% H, 25% He and 1% other gases.
- Diameter: 1.5 million km (109 times of Earth)
- Mass: 2×10³⁰ kg
 (330,000 times of Earth)
- Density: **1.4 g/cm³** (1.4 times of water)
- Surface temperature : **5800 K**
- Distance: 150 million km (~ 8 light minutes)

Structure of Sun



Nuclear Fusion: source of energy

• The Sun is powered by thermonuclear fusion, which converts Hydrogen into Helium (P-P chain reaction).



Mass of 4 H Atoms = 6.693×10^{-27} kg Mass of 1 He Atom = 6.645×10^{-27} kg Difference (Δm) = 0.048×10^{-27} kg

Mass "lost" is converted to Energy:





Solar energy on Earth

- About 30% of the sun's energy is blocked before it reaches earth
- Shielded by:
 - Atmosphere
 - Clouds



Solar features

• Magnetic field governs different features on the Sun.





Magnetic field on Sun

- Sun's magnetic field creates different features:
 - Sunspots: concentrated areas of magnetic field on photosphere.
 - Prominences: loop over sunspots
 - Flares: eruptions of plasma particles
 - Coronal Mass Ejections (CME): release huge amount of plasma

Sunspots



- Areas of high magnetic fields.
- Dark color because they are cooler than photospheric gas (4500K in darkest parts).
- Typically about 10000 km across.
- Each spot can last from a few days to a few months.
- They are the main source of solar disturbances (flares, CME etc.)

Solar prominence

- Ionized gases trapped by the magnetic fields lines.
- Sometimes these gases are ejected into space (Flares)





Coronal Mass Ejections (CMEs)



Earth directed CMEs and solar storms can cause:

- disruptions of electronic communications on Earth, pushing spacecraft around, etc.
- Failure of power grids
- Aurora

Aurora

 Aurora caused by energetic charge particles (solar wind) hitting Earth's magnetosphere.



How to observe the Sun





• Recently, new Solar Telescope has been installed at Udaipur Solar Observatory.

Multi-application Solar Telescope (MAST)



Observations from the MAST





Chromospheric (left) and photospheric (right) images of sunspot observed form the MAST telescope on 04 June 2015, 05:13 UT (AR # 12356).

Summary

- 1. The Sun is an ordinary middle-sized star
- 2. The sun creates energy by nuclear fusion in its core
- 3. The visible surface of the Sun is called the photosphere
- 4. A very thin but very hot outer layer is called the corona
- Features of the sun include sunspots, prominences, flares and CMEs
- Disturbances on the sun affect electrical and electronic equipment on Earth