# Differential Rotation of the Sun's Chromosphere

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**Context:**

Astronomers at the **Kodaikanal Solar Observatory** have **mapped variation in the rotation speed of the Sun's chromosphere**, from the equator right up to its polar regions for the first time using 100 years of daily records of the Sun.

**Key Findings from the Mapping of Sun's Chromosphere**

**Chromosphere:**The chromosphere is a thin layer of**plasma**that lies**between**the**Sun's visible surface (the photosphere)**and the**corona (the Sun's upper atmosphere)**

- It extends for **at least 2,000 km (1,200 mi.)** above the surface
- It**appears bright red**because the hydrogen in the Sun emits a reddish-coloured light at high temperatures.

- **Differential Rotation Rates:**The Sun**rotates faster at the equator**(13.98 degrees per day) and**slower towards the poles**(10.5 degrees per day at 80 degrees latitude).
- **Similar Rotation of Features:****Plages and network** features**exhibit similar rotation rates**, suggesting a shared origin deep within the Sun.
- **First Mapping Achievement:**This study is the**first**to successfully use**chromospheric network cells to map the Sun's rotation from the equator to the poles.**

**About Differential Rotation**

- **Definition:**The**difference in rotation speed**between the**Sun's equator and poles**is known as differential rotation.
- **Earth vs. Sun's Rotation**
- **Earth's Uniform Rotation:**Earth rotates as a rigid body,**completing a full rotation every 24 hours,**with **uniform rotationspeed from equator to poles.**
- **Sun's Differential Rotation:**The**Sun**, **made of plasma**,**rotates at different speeds based on latitude.**
- The Sun's equator spins much faster than its poles.
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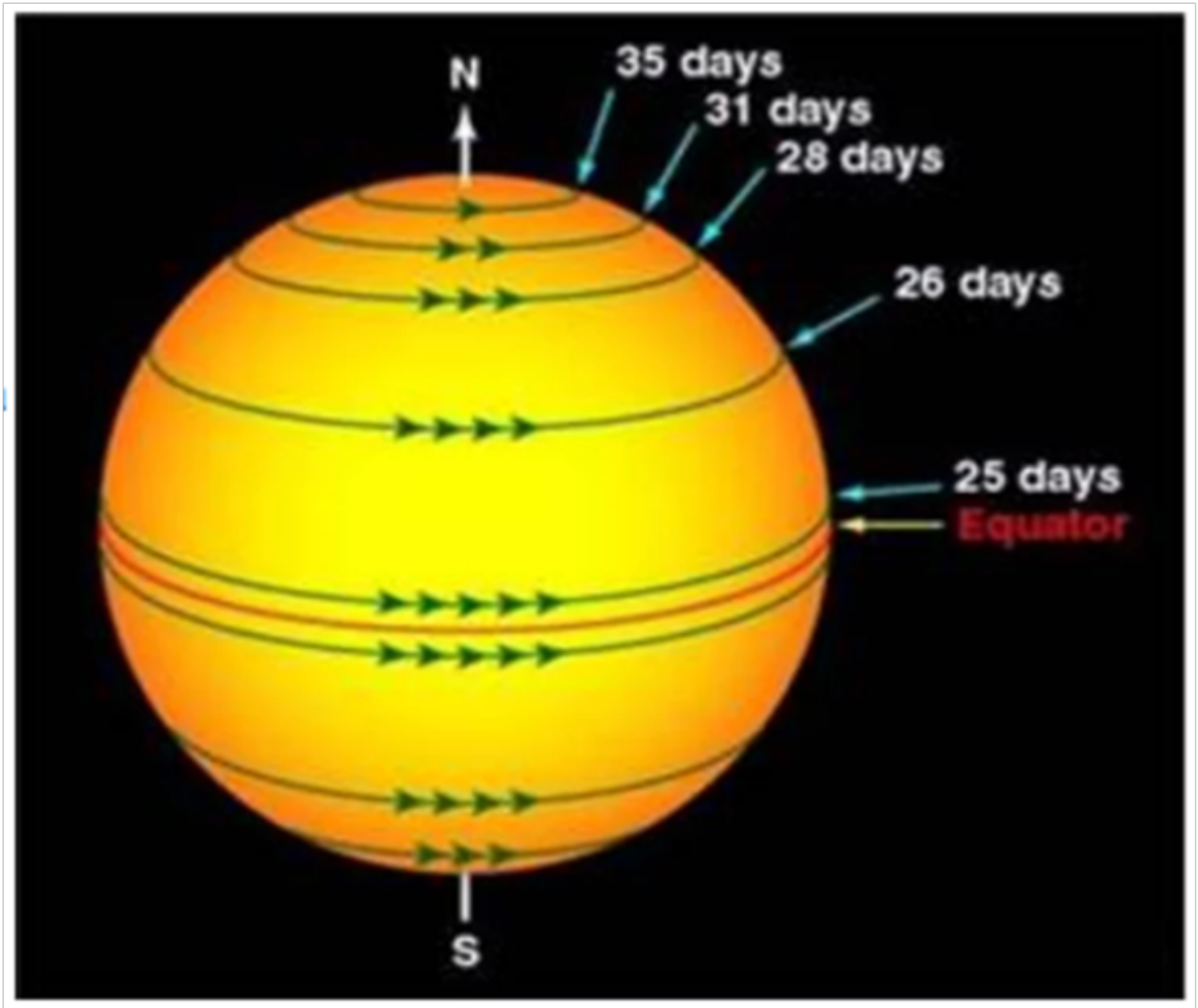
- It takes the equatorial region**only about 25 days**to complete one rotation, while the**poles take a leisurely 35 days. (**Diagram represents the Sun's differential rotation, where surface regions at various latitudes rotate at different speeds.)

**Kamaraj IAS Academy**
Plot A P.127, AF block, 6 th street, 11th Main Rd, Shanthi Colony, Anna Nagar, Chennai, Tamil Nadu 600040
Phone: **044 4353 9988 / 98403 94477** / Whatsapp : **09710729833**




- **Significance of Differential Rotation**
- Understanding the intricacies of the variation in rotation speed, as a function of latitude as well as time, is crucial to**understand the Sun itself.**
- It**drives the solar dynamo**, the 11-year solar cycle, and**periods of intense solar activity**that can trigger magnetic storms on Earth.

**Discovery of Differential Rotation**: The discovery of differential rotation **dates back to Carrington in the 19th century**, who observed that ***sunspots on the visible surface of the Sun rotate at different speeds depending on their latitude.***

**Challenges of Relying on Sunspot Observations** for Differential Rotation:

**Limited Latitude Coverage**: **Sunspots do not appear above 35 degrees latitude**, restricting their use in measuring the Sun's rotation closer to the poles.

**Infrequency at High Latitudes**: Sunspots occur **rarely at higher latitudes**, making data collection **sparse and unreliable for studying** the Sun's full rotational dynamics. This necessitated alternative methods

**Inadequate for Time-Dependent Studies**: **Sunspot-based methods are insufficient for tracking** how differential rotation varies over time, such as across the solar cycle, due to limited and sporadic data.