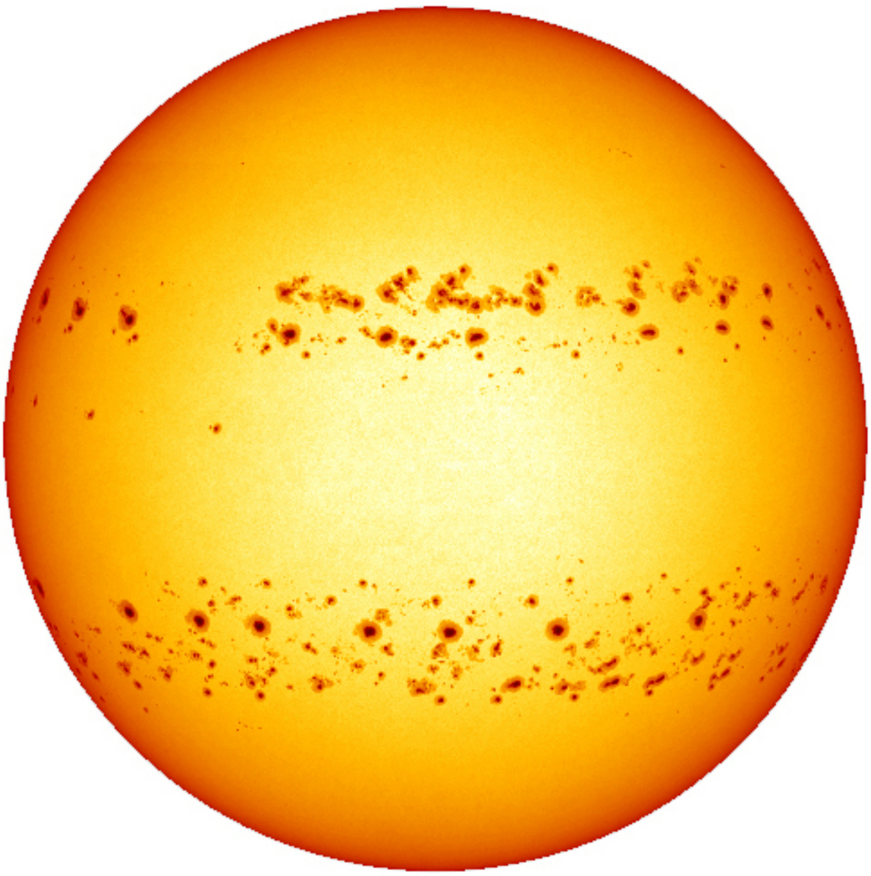
Sun's rotation period

Student's Guide – Basic Level

CESAR's Science Case



Introduction

Like the Earth, the Sun moves. Sun's main movement is a rotation over its axis. In this science case we will look at Sun images and try to determine how fast does it rotate. To do so we will track sunspots in time-spaced images.

Material

What will you need?

- The "Sun's rotation period" Student's Guide.
- Computer with Web Browser and Internet Connection.
- Access to CESAR web tools.

Background

The Earth constantly rotates about it's axis, in the same way as a carousel does. This rotation is the reason for day and night. Check it in this video. youtube.com/watch?v=GI3rBwqwDbw Like the Earth, the Sun rotates too. You can see it in this other video. youtube.com/watch?v=oaBjfsoulao

The features in Sun's surface rotate together with the Sun, so if we measure how fast this features rotate, we will know how fast the Sun rotates. Once we know how fast it rotates, the CESAR web tool can calculate the rotation period. **The rotation period is the time that takes to complete one rotation, if you know how fast an object rotates its easy to obtain the rotation period.**

Laboratory Execution

In science, we usually have some predictions of what we expect to measure before we do the actual measurements. Let's try to get a prediction: We know that small objects such as peg-tops or spinners rotate really fast, tens of revolutions every second. Bigger objects like the Earth, need 24h to rotate only once. This does not necessarily mean that bigger objects rotate slower, for example, pulsars are neutron stars that can rotate as fast as a spinner. Still, in most of the cases, when the difference in size of two rotating objects is very big, the biggest object usually rotates slower. Knowing this, how fast do you think the sun rotates? How much does it take to the Sun to complete one complete rotation? Once you have a prediction, you are ready for the measurements.

We are calculating the rotation speed of the Sun by measuring the speed of sunspots in Sun's surface. In the CESAR web tool, you must use the displayed calendar to look through different days until you find a picture that has a noticeable sunspot at the equator. Once located, you will calculate its speed (which is also the rotation speed of the Sun).

The Sun is always moving, so once you locate a sunspot, you will realise that if you choose an image from the previous day, the sunspot will appear moved to the left. In the same way, if you choose an image from the next day, the sunspot will move to the right. What we actually want to do, is select two images, separated by two or more days, so that in one of them the sunspot is at the left, and in the other one in the right. **By measuring how much the sunspot moved in those days, we will know how fast it is moving:** Mark the positions of the sunspot in each day and the program will calculate the speed of the sunspot. Then the program will automatically obtain rotation period of the Sun.

Conclusions

In this laboratory you have studied Sun's rotation. You've calculated Sun's rotation period. For doing so you tracked the movement of a sunspot in time-spaced images and calculated its speed by measuring how much it moved between the images.

Do your results make sense? Do your results agree with what you expected? When the results agree with the prediction, both are usually correct.

If you do have obtain a consistent value, lets go one step further and try to use the results. Let's say we locate a big solar flare at the left-edge of the Sun, this solar flare may cause solar wind which could produce a geomagnetic storm if it reaches Earth. Using your calculations of Sun's rotation period, estimate how long would it take to the solar flare to be pointed at Earth.