ASTROEDU

Peer-reviewed Astronomy Education Activities

Counting Sunspots

Counting the Sunspots using real solar images and data.

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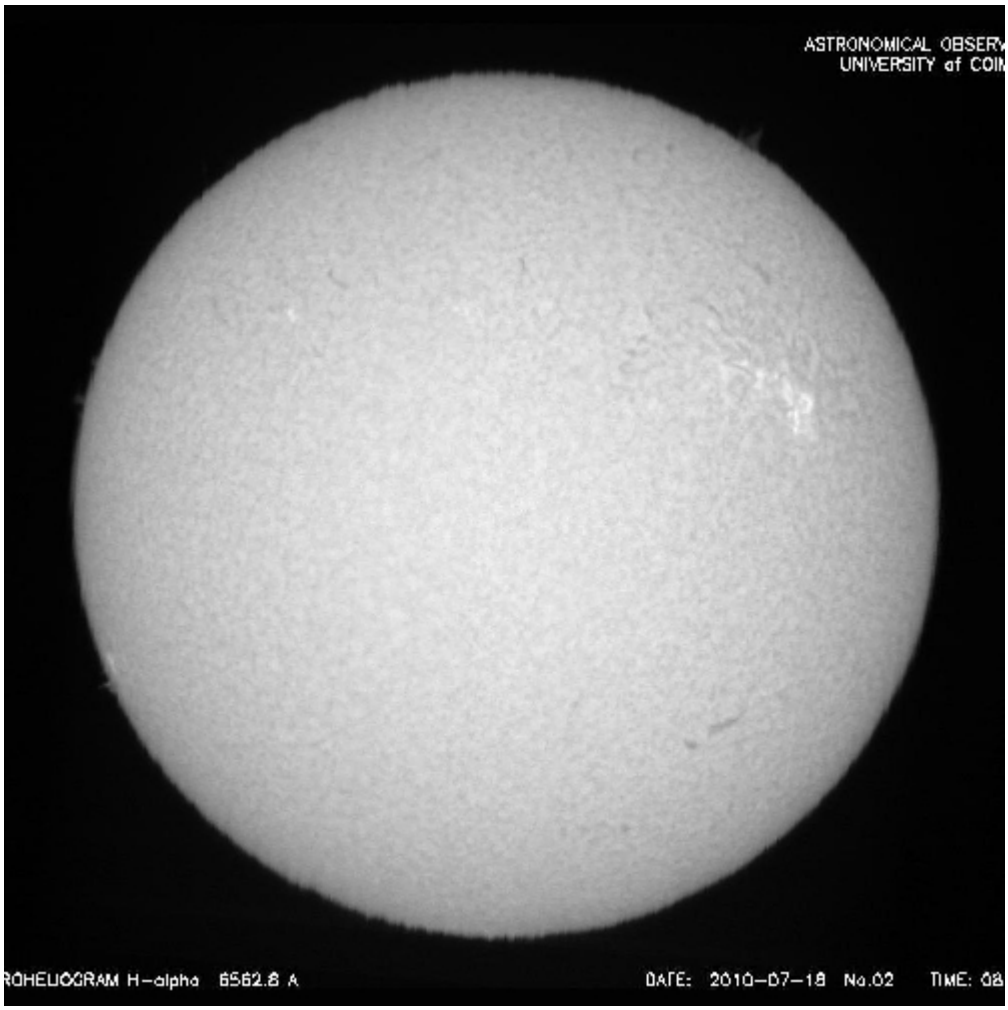
ASTRONOMICAL OBSERV
UNIVERSITY of COIM
ROHELIOGRAM H-alpha 6562.8 A
DATE: 2010-07-18 No.02 TIME: 08

AGE

16 - 19

LEVEL

Secondary

TIME

1h

GROUP

Group

SUPERVISED

No

COST PER STUDENT

Low Cost

LOCATION

Small Indoor Setting (e.g. classroom)

CONTENT AREA FOCUS

Astronomy

ASTRONOMY CATEGORIES

Astrometry and celestial mechanics, The Sun

CORE SKILLS

Analysing and interpreting data, Using mathematics and computational thinking, Constructing explanations

TYPE(S) OF LEARNING ACTIVITY

Observation based

KEYWORDS

Sun, Sunspots, Data analysis

GOALS

- Notice the existence of sunspots on Sun’s surface.
- Verify that the number of detected sunspots may change through the days.

LEARNING OBJECTIVES

- Students will note the existence of sunspots on the Sun’s surface and describe their appearance.

- Students will be able to describe the change in number of sunspots through the days.

EVALUATION

- Ask the students to describe what is happening to the sunspots over the period of observation. They should note that the number, size and position of sunspots can change.
- Ask the students to suggest explanations for these changes (Sun's rotation period varies from 25 days at the equator to 36 days at its poles) and whether they would expect more variation over a longer time period, e.g. 1, 10, 100 years. This can then be linked to the sunspot cycle and the butterfly diagram (GCSE Astronomy curriculum Unit 1.1.3g,h).

MATERIALS

- Computer with internet
- Excel file for Counting sunspots
- Spectroheliograms data file

BACKGROUND INFORMATION

The Sun is a star. It is a rather ordinary star - not particularly big or small, not particularly young or old. It is the source of heat which sustains life on Earth, and controls our climate and weather. It is the closest star to Earth, and the most closely studied. From it we have learned a great deal about the physical processes which determine the structure and evolution of stars in general.

It is almost perfectly spherical and consists of hot plasma interwoven with magnetic fields. It has a diameter of about 1,392,684 km (865,374 mi), around 109 times that of Earth, and its mass (1.989×1030 kilograms, approximately 330,000 times the mass of Earth) accounts for about 99.86% of the total mass of the Solar System. Chemically, about three quarters of the Sun's mass consists of hydrogen, while the rest is mostly helium. The remainder (1.69%, which nonetheless equals 5,600 times the mass of Earth) consists of heavier elements, including oxygen, carbon, neon and iron, among others.

When observing the Sun with appropriate filtration, the most immediately visible features are usually its sunspots, which are well-defined surface areas that appear darker than their surroundings because of lower temperatures. Sunspots are regions of intense magnetic activity where convection is inhibited by strong magnetic fields, reducing energy transport from the hot interior to the surface.

The magnetic field causes strong heating in the corona, forming active regions that are the source of intense solar flares and coronal mass ejections. The largest sunspots can be tens of thousands of kilometers across.

FULL ACTIVITY DESCRIPTION

- Download Sun4All Guide book and Sun4All Appendix.
- Go to Astronomical Observatory of the University of Coimbra website.
- In the “Arquivo Obs. Solares” menu pick the dates from 01/2002 to 01/2002 and K1-v. This way you will get all the spectroheliograms of January 2002.
- Download and open the Excel file.
- Select each of the resulting images at a time and count the sunspots, inserting the number of individual sunspots and number of the groups of sunspots into the yellow columns. The Wolf’s index will be automatically calculated in the red column.
- Interpret the results to understand the change in number of sunspots through the days.

CURRICULUM

Country | Level | Subject | Exam Board | Section
— | — | — | —
UK | GCSE | Astronomy | Edexcel | Unit 1: 1.3e, f

ADDITIONAL INFORMATION

- “What are Sunspots” video by New Scientist.
- Daily images of Sunspots through NASA Soho.
- More Sun related activities with Sun4All using the data from Astronomical Observatory of the University of Coimbra.

CONCLUSION

This activity concludes when the students verify that the number of detected sunspots may change through the days.

CITATION

Fernandes, J., 2013, *Counting Sunspots*, astroEDU, , doi:10.14586/astroedu.1301