ASTROEDU

Peer-reviewed Astronomy Education Activities

Make your own Sun!

Let's build a model of the Sun with plasticine and get to know our star!

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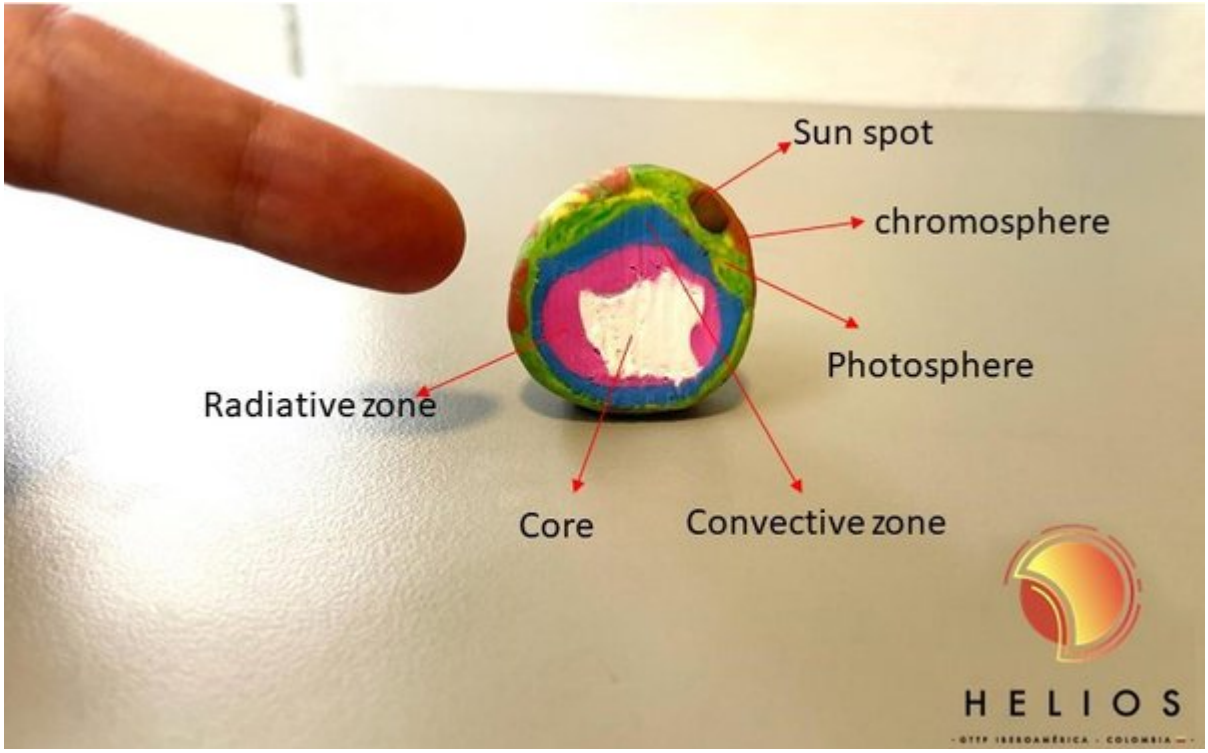


KEYWORDS

Sun model, hands-on, Galileo teachers, sun

CATEGORY

The Sun, Stars

LOCATION

Small Indoor Setting (e.g. classroom)

AGE

6 - 12

LEVEL

Primary

TIME

1h 30m

GROUP

Group

SUPERVISED

Yes

COST

Low Cost

SKILLS

Asking questions, Developing and using models, Communicating information

TYPE OF LEARNING

Guided-discovery learning, Modelling, Fun activity

GOALS

- Experience astronomy as a playful and hands-on activity.
- Raise interest in the Sun and it's connection with the environment.
- Allow children access to astronomical knowledge.

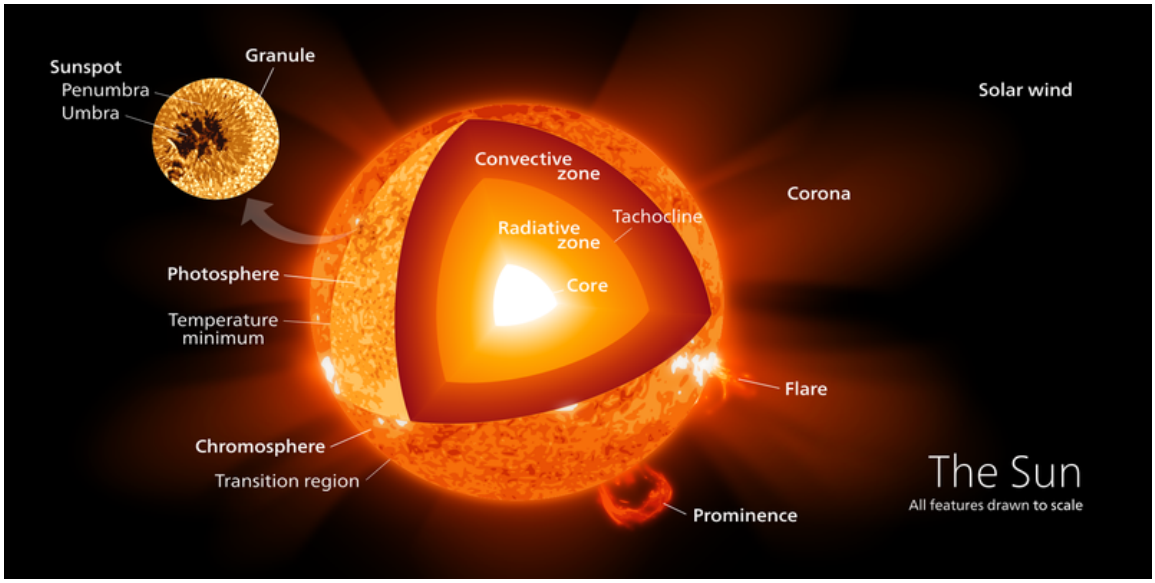
LEARNING OBJECTIVES

- Learn about the Sun's structure.
- Explain how the Sun works.
- Illustrate the different layers of the Sun: core, radiative zone, convective zone, photosphere, chromosphere, corona and phenomena such as sunspots, flares and granulation.
- Practice motor skills.

BACKGROUND

Basic information about the Sun

The Sun is the star at the center of the Solar System. With a diameter of 1.4 million kilometers, it could hold 109 planets on its surface. If it were hollow, more than a million Earths could fit inside it.
It is filled with hot gases, mostly hydrogen and helium, that account for more than 99.8 percent of the total mass of the solar system.



The Sun, as shown by the illustration above, can be divided into different layers that can be described as follows, from the center out.
In the **Sun's core**, fusion reactions take place in which hydrogen is transformed into helium, which generates the energy. Every second, the Sun's core fuses about 600 million tons of hydrogen into helium, and in the process converts 4 million tons of matter into energy.

Above the core, we can think of the Sun's interior as being like two nested spherical shells that surround the core. In the innermost shell, right above the core, energy is carried outwards by radiation. This is the **radiative zone**. Here, radiation does not travel directly outwards. In this part of the Sun's interior, the plasma density is very high, and the radiation gets bounced around countless numbers of times, following a zig-zag path outward.It takes several hundred thousand years for radiation to make its way from the core to the top of the radiative zone!

The next shell is called **convective zone**: here temperature drops below 2,000,000 K (3.5 million degrees F) the plasma in the Sun's interior is too cool and opaque to allow radiation to pass. Instead, huge convection currents form and large bubbles of hot plasma move up towards the surface, similar to a boiling pot of water that is heated at the bottom by a stove. Compared to the amount of time it takes to get through the radiative zone, energy is transported very quickly through the outer convective zone.

Then, the Sun's surface, or atmosphere, is divided into three regions: the **photosphere, the chromosphere, and the solar corona**. The photosphere is the visible surface of the Sun that is at a temperature of “only” about 5,800 K (10,000 degrees F). On the photosphere, many "surface features" can be seen suche as solar flares and sunspots.
Just above the photosphere is a thin layer called the chromosphere. The name chromosphere is derived from the word chromos, the Greek word for color. Going outward, we find next the corona, made of hot plasma, at about 2 million K (3.6 million degrees F), much hotter than the visible surface. Why the temperature raises from photosphere going outward is a mystery that scientists are trying to solve.
The chromosphere and the corona can only be seen with special telescopes and during solar eclipses, when the moon passes between the Earth and the Sun.

In addition to light, the Sun also radiates a steady stream of charged particles known as **solar wind.** The wind blows at about 450 kilometers per second through the solar system. Occasionally, some particles can explode in a **solar flare**, which can cut off satellite communications and power to Earth. Flares usually come from the activity of sunspots, cool regions of the photosphere related to the magnetic field of the Sun's interior.

Information readapted from: SOHO webpage

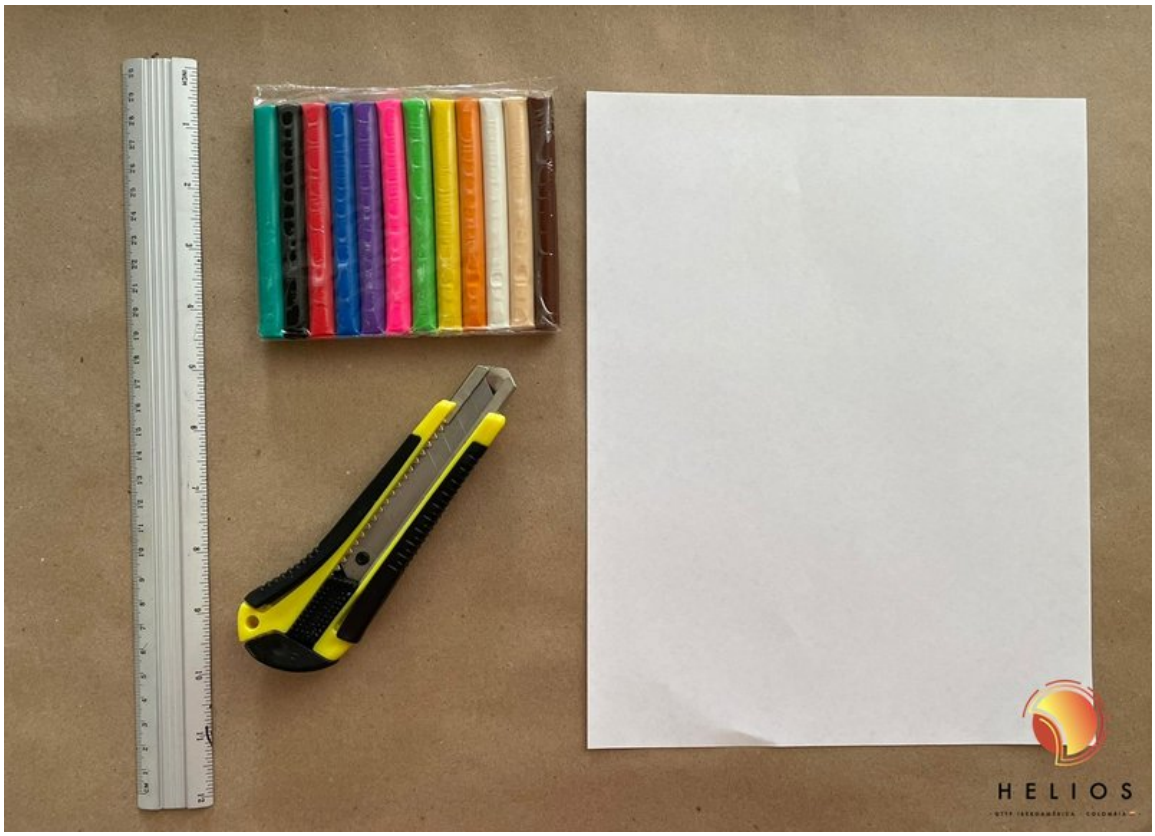
For more information about the Sun, its structure, temperature, size and its influence on the planet:
visit https://en.wikipedia.org/wiki/Sun
watch the suggested video https://youtu.be/mvPH_gDMarw
visit https://solarscience.msfc.nasa.gov/

MATERIALS

- Paper to work on, so as not to dirty the workplace.
- Plasticine of various colors to distinguish the different layers of the Sun.
- Scalpel or sharp-edged ruler, which will be used to cut the model in half. Participants should be careful and be assisted in the use of these elements.

FULL DESCRIPTION

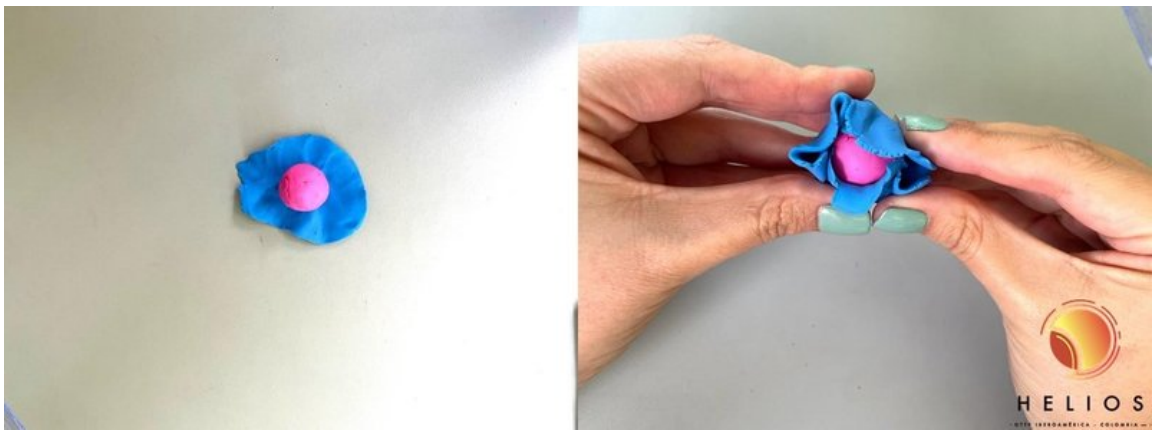
- Organize a group of 10 to 20 children between the ages of 6 and 11 years old.
- Begin the activity by first asking participants what they know about the Sun or what they think it is.
- Learn about the layers of the Sun. You can research information and illustrative images with your students to involve them in the inquiry and information-gathering process.
- Prepare all the material as in image below.



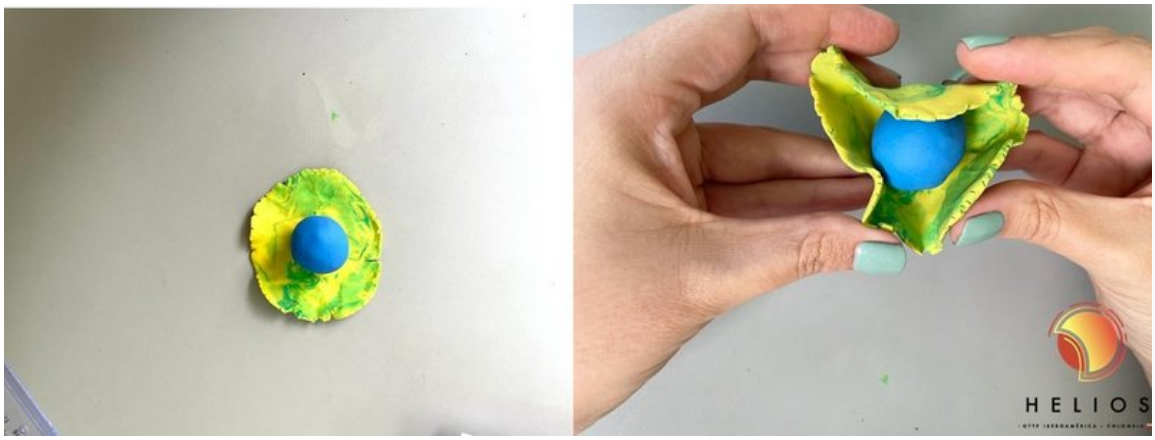
- For the Sun modeling, knead a ball of plasticine of approximately 1 cm in diameter to shape the **Sun's core**. It can be any color you wish. Colors such as white are suggested to represent high energies. See image below.

- Knead a larger amount of violet plasticine, stretch it and flatten it so you can wrap it around the core. This is the **radiative zone**. See image below.

- Knead a larger amount of blue plasticine, stretch it and flatten it so you can wrap it around the core. This is the **convective zone**. See image below.

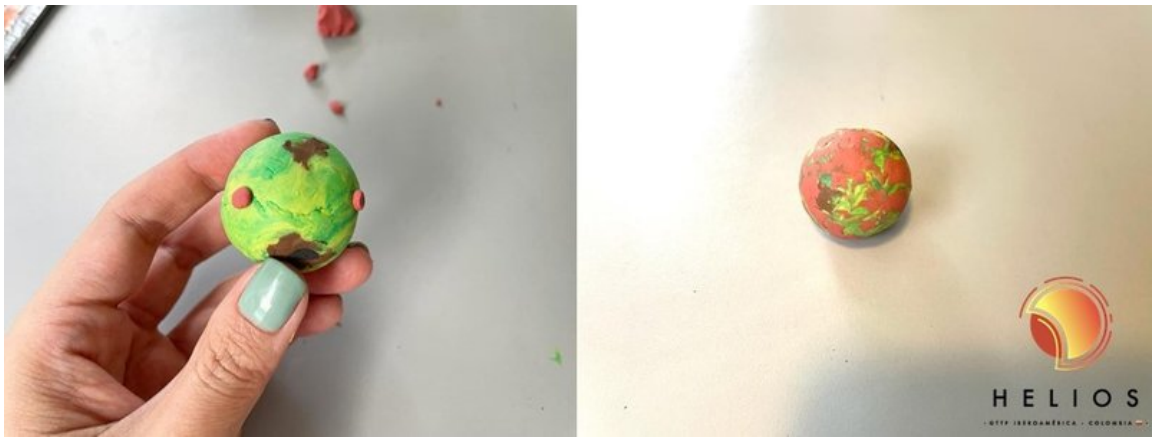


- Knead a larger amount of yellow plasticine mixed with a pinch of green (suggested). Stretch it out and flatten it so that you can wrap it around the model. This is how the **photosphere** is modeled. See image below.



- Paste black and brown plasticine freckles on the greenish yellow layer. They are the **sunspots and faculae**. Up to this point this is what we see with the naked eye on the Sun with the help of telescopes or binoculars, using filters or through projection. See image below.

- Over the Sun there are layers that can only be seen during eclipses or using a coronagraph. Knead a larger amount of red plasticine with a pinch of blue. Take little pieces of it and smear it over the photosphere with its spots and faculae. You can add spikes of the same color to this layer. Up to this point we have built the core, radiative and convective zones, photosphere and chromosphere. See image below.



- To better see the interior, slice the model in half using a sharp-edged ruler or scalpel, being careful not to crush the model while cutting it. See image below.

EVALUATION

Understanding of basic concepts will be evidenced by asking students key questions such as:

1. What is and where is the Sun located within the solar system?
2. In what layer of the Sun do sunspots form?
3. How long ago did the Sun form?

Observing how participants model the Sun's structure by following instructions and asking probing questions such as: Why will the corona have a higher temperature than the photosphere? What might happen on earth if there is a powerful explosion on the Sun? What would happen in the solar system if the Sun increased in size and could this happen at some point in it's life cycle?

In addition, it is proposed to ask open questions during the discussion or future inquiry: Do you know what the little ice age was? Until what time will life on Earth be sustainable based on the Sun's activity? Have Sun-like stars been discovered near us? If so, is it viable for humans to relocate there if we deplete our ecosystems?

CURRICULUM

Science courses, ecology and arts.

CONCLUSION

Through this activity, participants will learn the basic concepts about the Sun's structure. They acknowledge its importance for planet Earth and the close correlation between the Sun's activity and the balance of our ecosystems.

Participants can then replicate this activity with their families and friends, contributing to the dissemination of astronomy.

FURTHER READING

Jenkins,Jamey L. The Sun and How to Observe It (Astronomers' Observing Guides). Springer Editorial. 2009.

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Schatz. Dennis, Fraknoi Andrew. Solar Science - Exploring Sunspots, Seasons, Eclipses, and More. NSTA Press. 2015.

Bullon Lahuerta, Joan Manuel. del Castillo Alarcos, María Angela. Observación Solar. Publicaciones de ApEA. 2010.

Vargas Domínguez, Santiago. Mi Primer Libro del Sol. Universidad Nacional de Colombia. 2019.

Vázquez Abeledo, Manuel. El Sol, Algo Más Que Una Estrella. Equipo Sirius. 2004.

Online resources for more information about the Sun and its observation:

https://solarscience.msfc.nasa.gov/
https://sdo.gsfc.nasa.gov/
https://www.spaceweather.com/
https://www.iac.es/es/observatorios-de-canarias/observatorio-del-teide/telescopios-y-experimentos
https://sohowww.nascom.nasa.gov/
https://www.bbso.njit.edu/
https://www.est-east.eu/

For more educational resources on astronomy, you can visit the following sites:

Galileo Teacher Training Program/Programa Galileo para Profesores http://galileoteachers.org/resources/

Las Cumbres Observatory/Observatorio Las Cumbres https://lco.global/education/resources/

Hands on Universe Spain/España https://www.houspain.com/gttp/doku.php?id=start

CITATION

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