

Moon phases

**Carme Alemany, Rosa M. Ros, Ricardo Moreno,
Corina Toma**

International Astronomical Union

CEIP El Roure Gros, Spain

Poliechnical University of Catalonia, Spain

Colegio Retamar de Madrid, España

Colegiul National Pedagogic “Gheorghe Lazar”, Romania



Justification

- This material is designed for teachers of children before starting primary school. Some content is presented to give the teacher more resources, although they may be too ambitious for such young children, but the questions that they may sometimes ask require more extensive knowledge to be able to properly explain the issues that may arise.

Goals

- Understand the movement of the Moon around the Earth.
- Study the phenomenon of the phases of the Moon.
- See and distinguish the main features on the lunar surface.



Moon phases

We observe the Moon during the day and at night, with the naked eye, with binoculars, with a telescope...



Moon phases

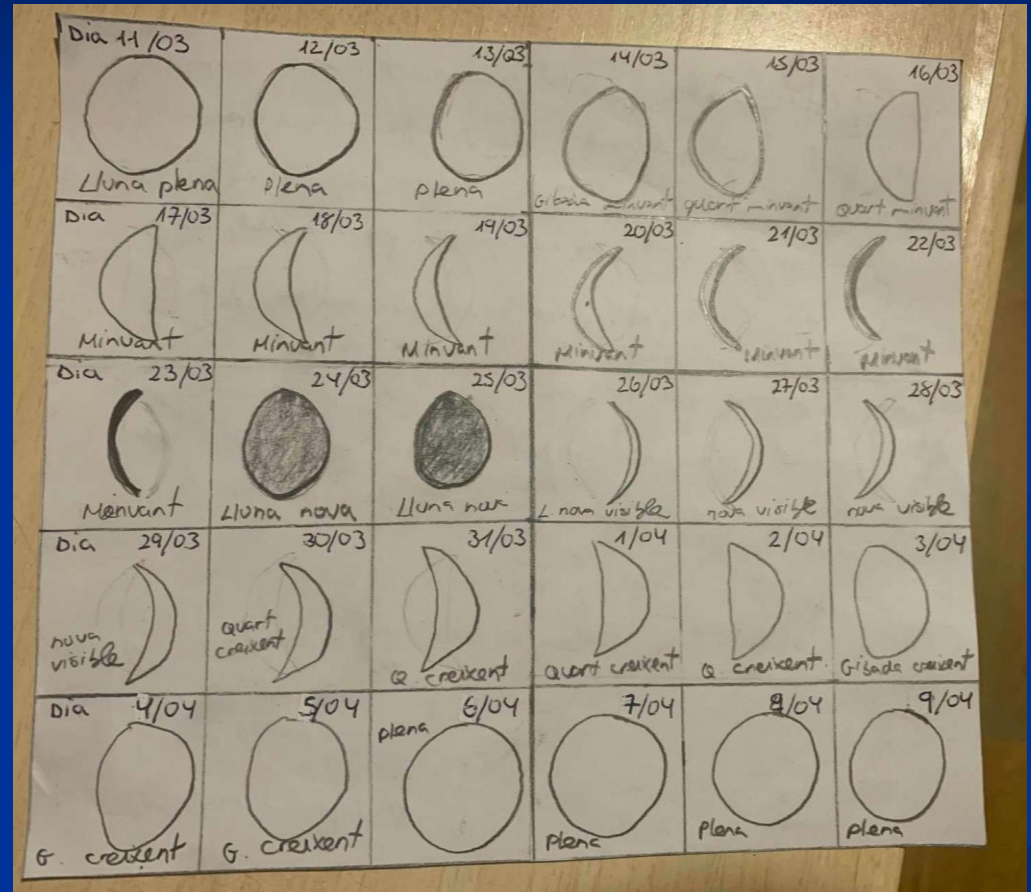
With systematic observation of the Moon for several weeks, we realize its phases and its surface morphology, with craters and seas.



Activity 1: Observe Phases of the Moon

We observe the Moon for several weeks and draw the apparent change in its shape (Moon phases).

We also realize that the Moon is seen some days during the day and others at night, at different times and positions on the sky.



Moon observation from March 11 to April 9 (from full Moon to full Moon).
Credit: Carme Alemany



Moon phases

The Moon is seen day and night

The **Crescent Moon**, or 7-day Moon, can be seen in the afternoon.

The **Full Moon**, Moon of 14 days, we can see it all night.

The **Waning Moon**, Moon of 21 days, can be seen in the morning.

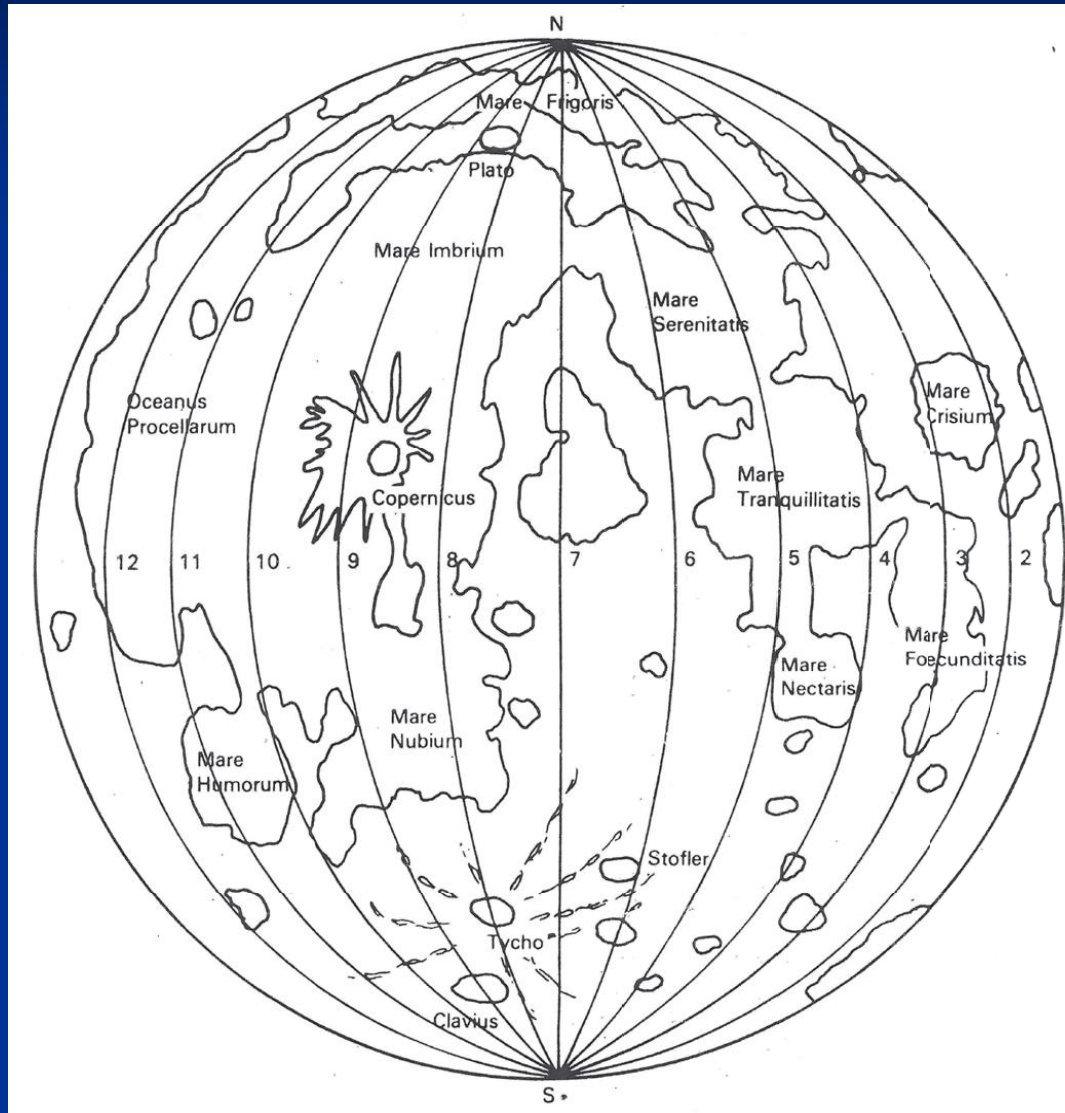
The **New Moon**, Moon of 28 days, we cannot see it



Waning Moon
(Credit: S. Meunier)



Lunar surface with Moon phases by day



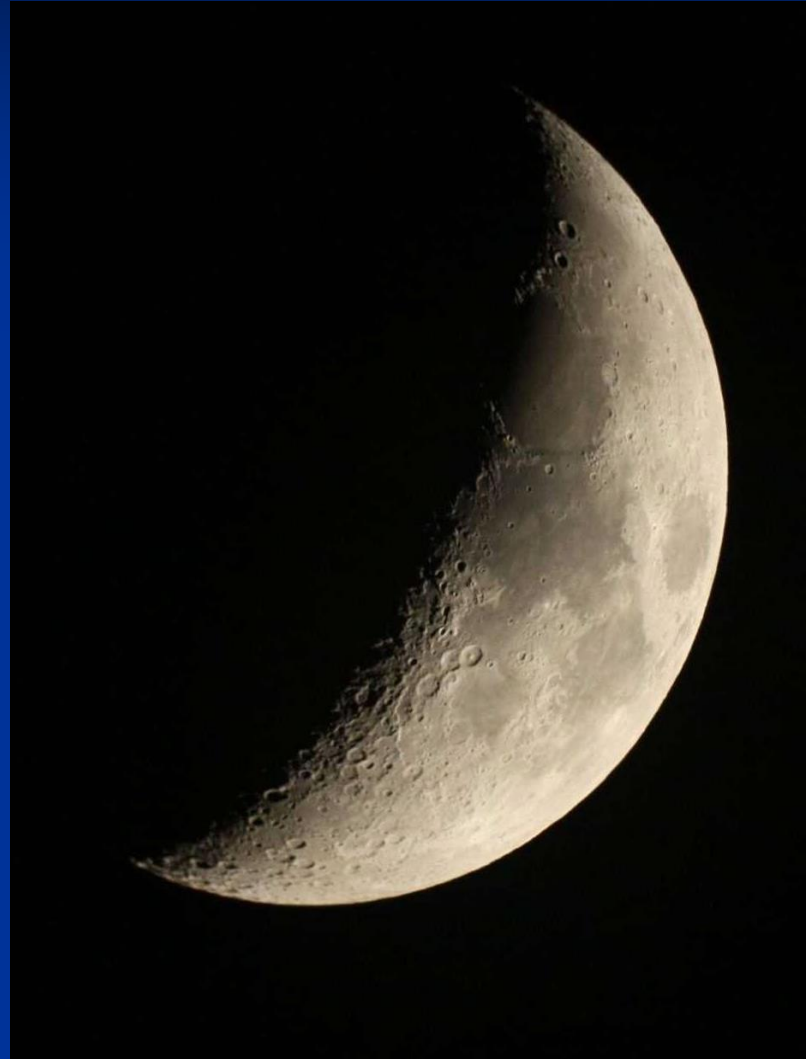
Invierno en el hemisferio Norte

Primavera en el hemisferio Norte



Moon phases

Let's look at several examples to understand that the phases of the Moon are an effect of the Sun's illumination on it and how they happen.



Activity 2: Phases in a shoebox

Cut a window on each of the 4 sides of a cardboard box.

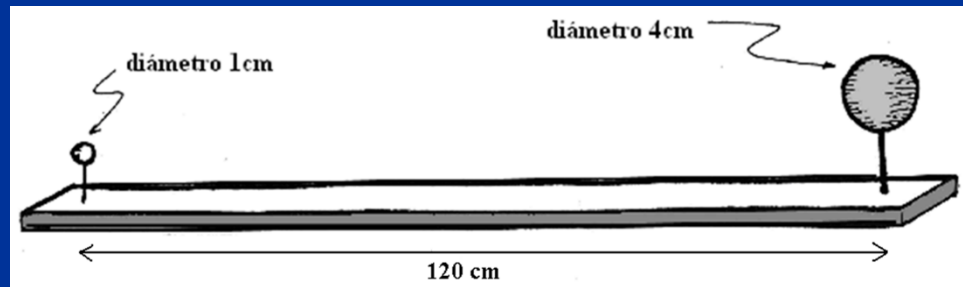
Hang a polystyrene ball from the top lid of the box so it can be seen from all the windows. Send the light from a flashlight to one of the windows so that it illuminates the ball very well.



Observe the illumination of the ball from each window.

Activity 3: Phases with a stick and 2 balls

In a scale model, if we consider the diameter of the Moon to be 1 cm, then the Earth is 4 cm, and the distance from the Earth to the Moon is 120 cm. We prepare a stick with two balls of those sizes, one at each end, separated by 120 cm.



We go outdoors in a sunny day, when the Moon is visible (in the afternoon if there is a waxing Moon or in the morning if there is a waning Moon).

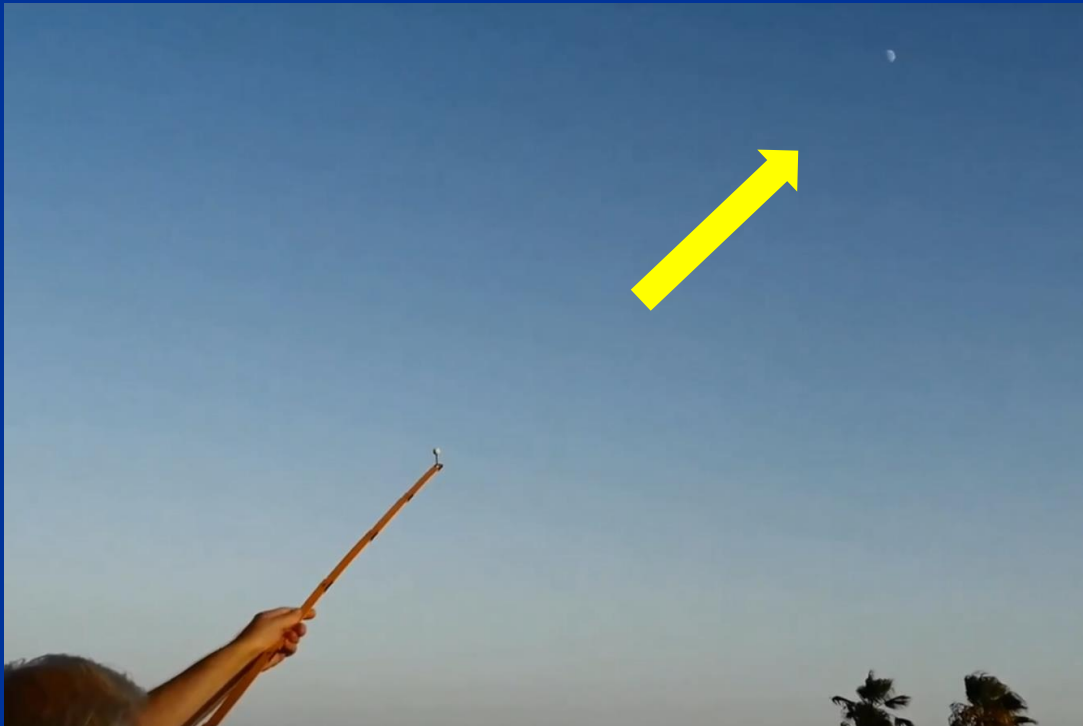
Activity 3: Phases with a stick and 2 balls

As the size - distance relationship of the model is to scale, we will see the ball of the Moon of the same apparent size as the real Moon, and equally illuminated.



Activity 3: Phases with a stick and 2 balls

We point the end of the stick that simulates the Moon, towards the Moon, we look from the end of the stick where the Earth is.



Activity 3: Stick with two balls

The Sun illuminates the Moon of the model in the same way as the real Moon and we will have managed to reproduce the phase of the Moon exactly.



Moon phases

LUNAR PHASES OF NORTH HEMISPHERE

WEEK 1

New



WEEK 2

1/4



WEEK 3

Full



WEEK 4

3/4



WEEK 5

New



Crescent

Waxing

LUNAR PHASES OF SOUTH HEMISPHERE

WEEK 1

New



WEEK 2

1/4



WEEK 3

Full



WEEK 4

3/4



WEEK 5

New



Crescent

Waxing

Moon phases

In the Northern Hemisphere, when we see the Moon in the shape of a “D”, the Moon is crescent (or waxing). When we see it in the shape of a “C”, the Moon is decreasing (or waning).

In the Southern Hemisphere, the Moon is D-shaped if it is decreasing and C-shaped if it is waxing.

In the equatorial zone the waxing Moon looks like a “U” and the waning Moon looks like an “n”.

But in all countries of the world the Moon shows the same phase at the same time, regardless of its position on the horizon.



Activity 4: Moon according to Hemisphere

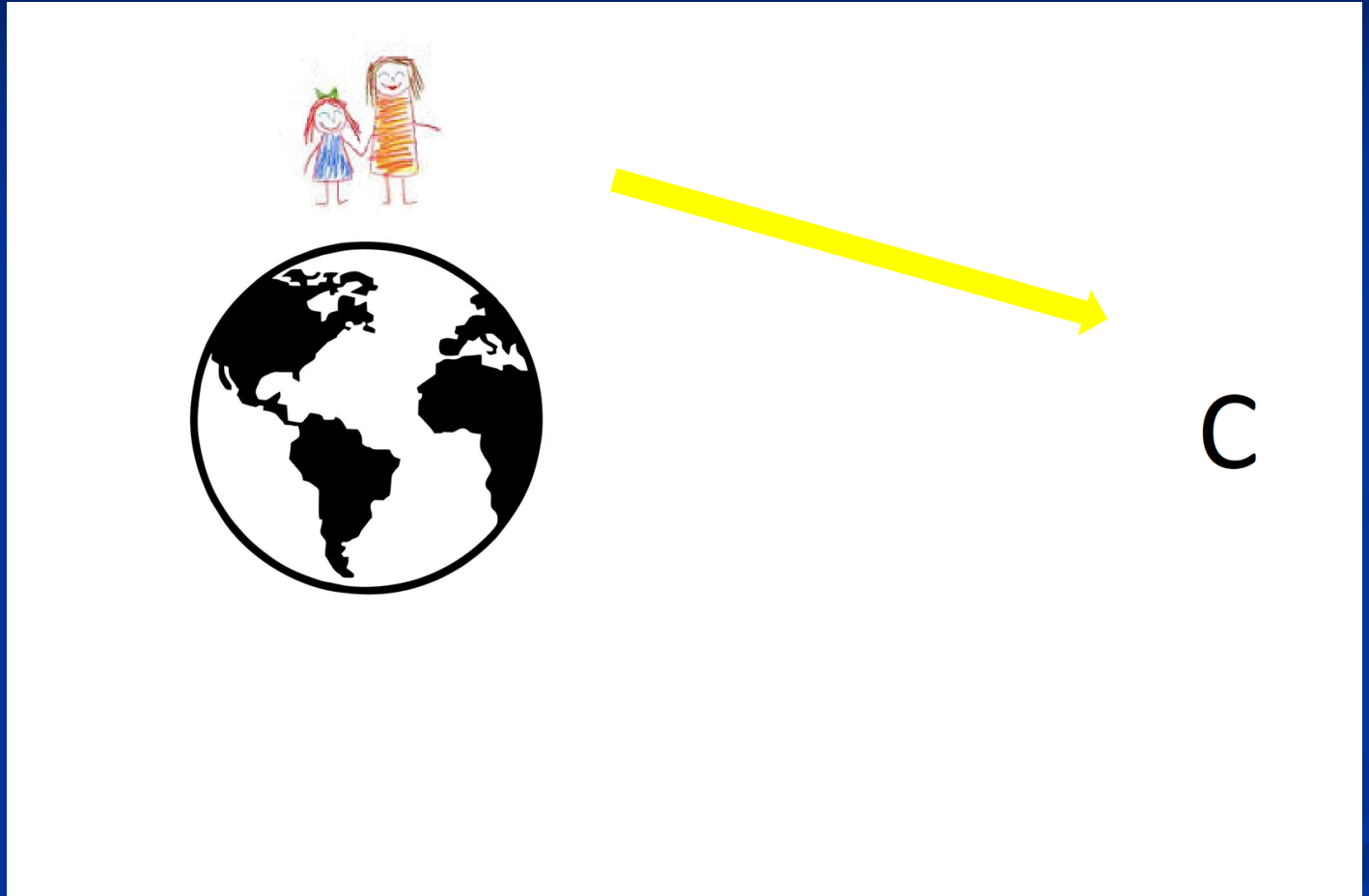
We represent the Earth on the left and we draw a C-shaped Moon on the right. (We can prepare another model with a D-shaped Moon too)



We draw and cut a group of children that we will place in different parts of the Earth.



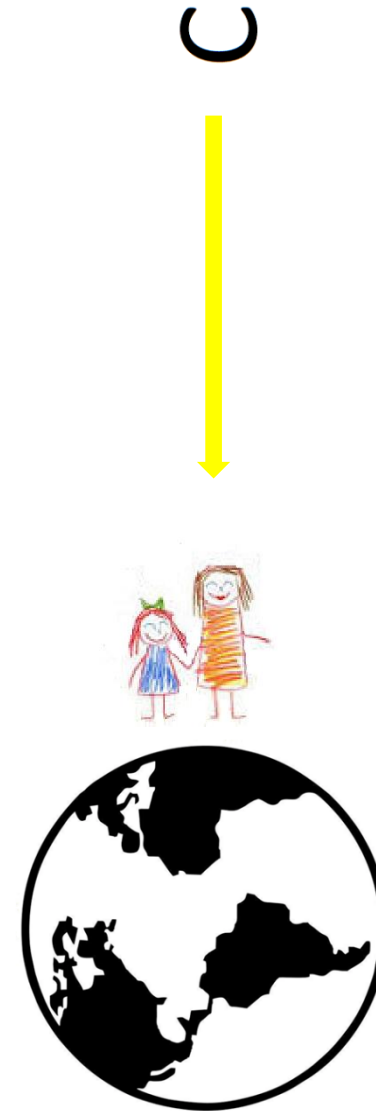
Activity 4: Moon according to Hemisphere



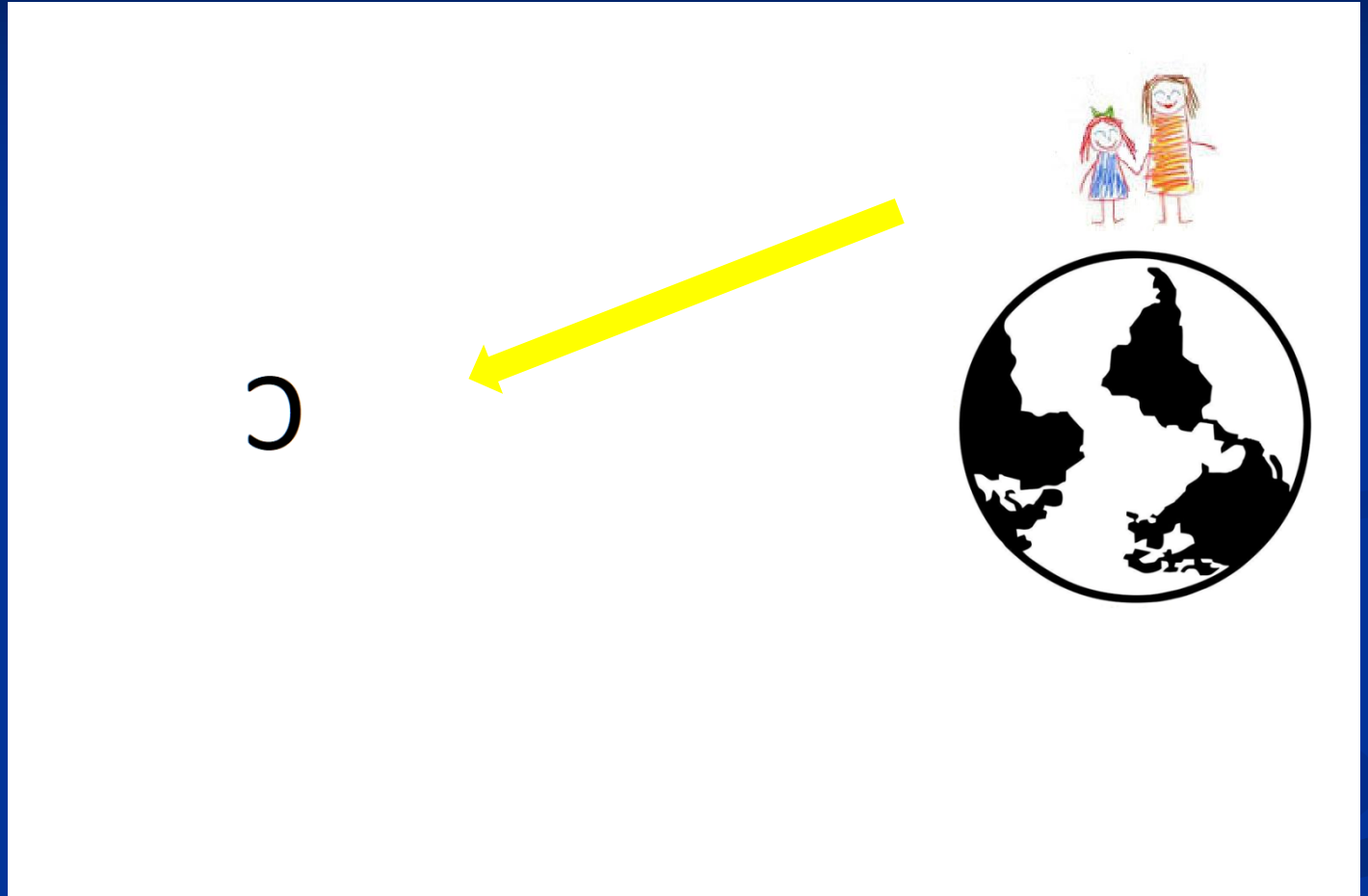
If the children are in the North Pole, they see the Moon as a “C”

Activity 4: Moon according to Hemisphere

If the children are in the equatorial zone they see the Moon as a “U”



Activity 4: Moon according to Hemisphere



If the children are in the South Pole, they see the Moon as a “D”

Activity 4: Moon according to Hemisphere



Beatriz García 33°S
Mendoza, Argentina



Alvaro Cano 6° N
Guarne, Colombia



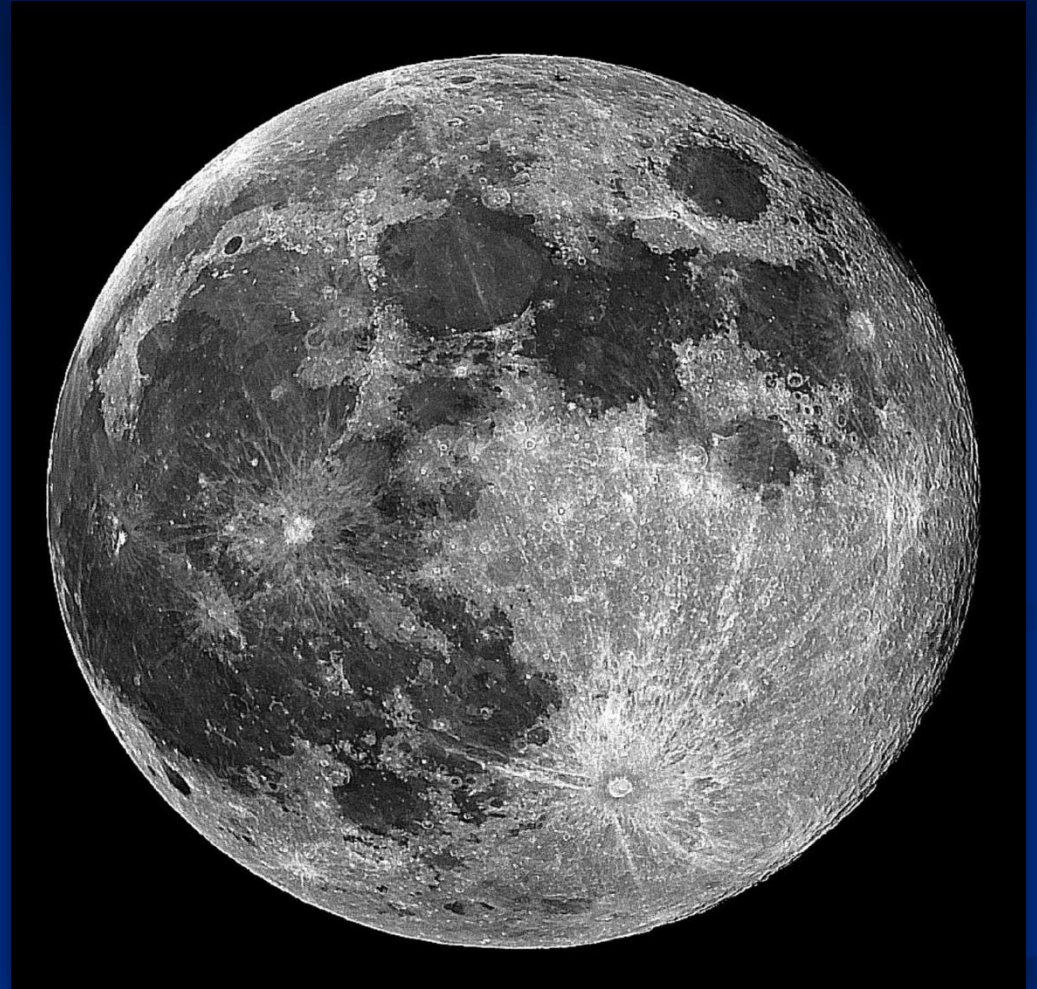
Ricardo Moreno 40° N
Madrid, Spain

Real photos. There is some inclination because the photos have not been taken while passing through the meridian and also the latitudes are intermediate.



Moon Surface

There are some dark areas, the SEAS, named after the first astronomers, who compared them to the Earth's oceans. They really are large, fairly flat basaltic expanses.



There are CRATERS caused by the impact of meteorites.



Activity 5: Making lunar craters



In a tray, put a few centimetres thick layer of flour on the bottom and spread a thin layer of cocoa on top with a sieve.

Activity 5: Making lunar craters

We drop balls of different sizes and weights from different heights and with different forces.



It is better to add spoonfuls of cocoa or flour instead of balls because in that case the spoonfuls contents mix with the surface and the result is much more realistic, but with small children it is better to use balls so that they can carry out the experiment themselves.

Activity 5: Making lunar craters

When the balls fall on the flour, craters similar to those we see on the Moon are formed. The white material underneath rises to the surface in a radial pattern.



Seas on the Moon's Surface

The Seas were possibly formed by the impact of giant meteorites that pierced the lunar crust and caused the release of the rocky mantle that was still in a liquid state (lava). The lava covered craters and extensive areas of the Moon that we see dark from Earth.



Activity 6: Generating seas on the Moon

To simulate these lava fountains on the lunar surface we will use a carbonated soft drink to which we will add a spoonful of sugar...



...and we will let a foam flow that will cover the surface of the Moon where we had the craters.

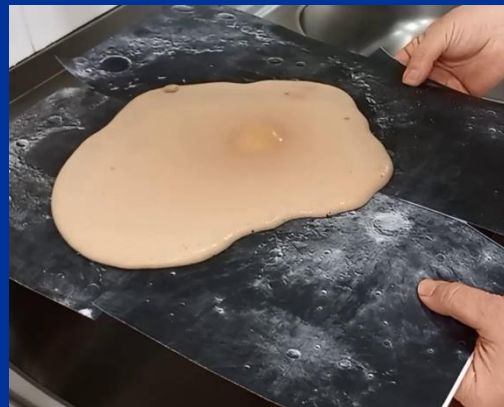


Activity 6: Generating seas on the Moon



On a cardboard we **paste photos of the lunar surface and** make a hole through which the bottle with carbonated drink protrudes a little. When you add a spoonful of sugar ...

Actividad 6: Generando mares en la Luna



... foam comes out, which simulates the “lava” that fills the craters in the nearby area.

Activity 6: Generating seas on the Moon



It is important to avoid the volcano shape, there are no volcanoes on the Moon



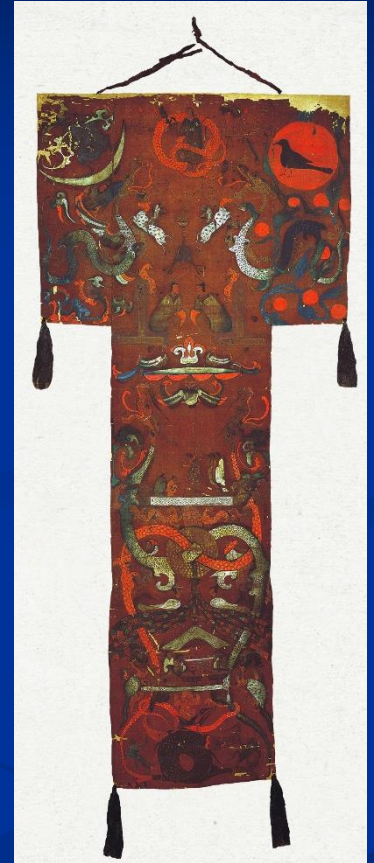
A rabbit on the lunar surface

The Mayans, Mexicans and Aztecs could see a rabbit on the surface of the Moon with the naked eye. This rabbit was sometimes seen in full and sometimes only partially, depending on the moon phase. These people believed that the rabbit was inside a vessel, and depending on the position of the mouth of the vessel as observed from Earth, the rabbit was seen whole or only partially.



The moon with a toad and a rabbit

In the T - shaped silk painting unearthed in 1972 from Tomb No. 1 of Mawangdui in Changsha, China, belonging to Xin Zhui of the Early Western Han Dynasty, the moon is depicted with a toad and a rabbit on it.



Credit: Hunan Museum, China



The seas of the Moon

We identify the ears, the seas of Nectar (M. Nectaris) and of Fecundity (M. Foecunditatis). The head is the sea of Tranquility (M. Tranquilitatis). The torso is the sea of Serenity (M. Serenitatis). And the rest of the body the sea of Rain (M. Imbrium), the ocean of Storms (Oceanus Procellarum), the sea of Clouds (M. Nubium) and the sea of Moisture (M. Humorurum).

We can see the Sea of Crisis (M. Crisium), next to the ears... could it be the cabbage that the rabbit is going to eat?



(Credit: E. Herrero)



Activity 7: Drawing the rabbit

Can you
see the
rabbit?



Lunar surface

When the meteorites were smaller in size, they gave birth to craters where the edges can also be distinguished, and in the more recent craters you can even distinguish the radial traces resulting from the strong impact.

Tycho is a relatively young crater, it has well-defined edges and is surrounded by a radial system that makes it easily recognizable. It is under the rabbit's hind legs.



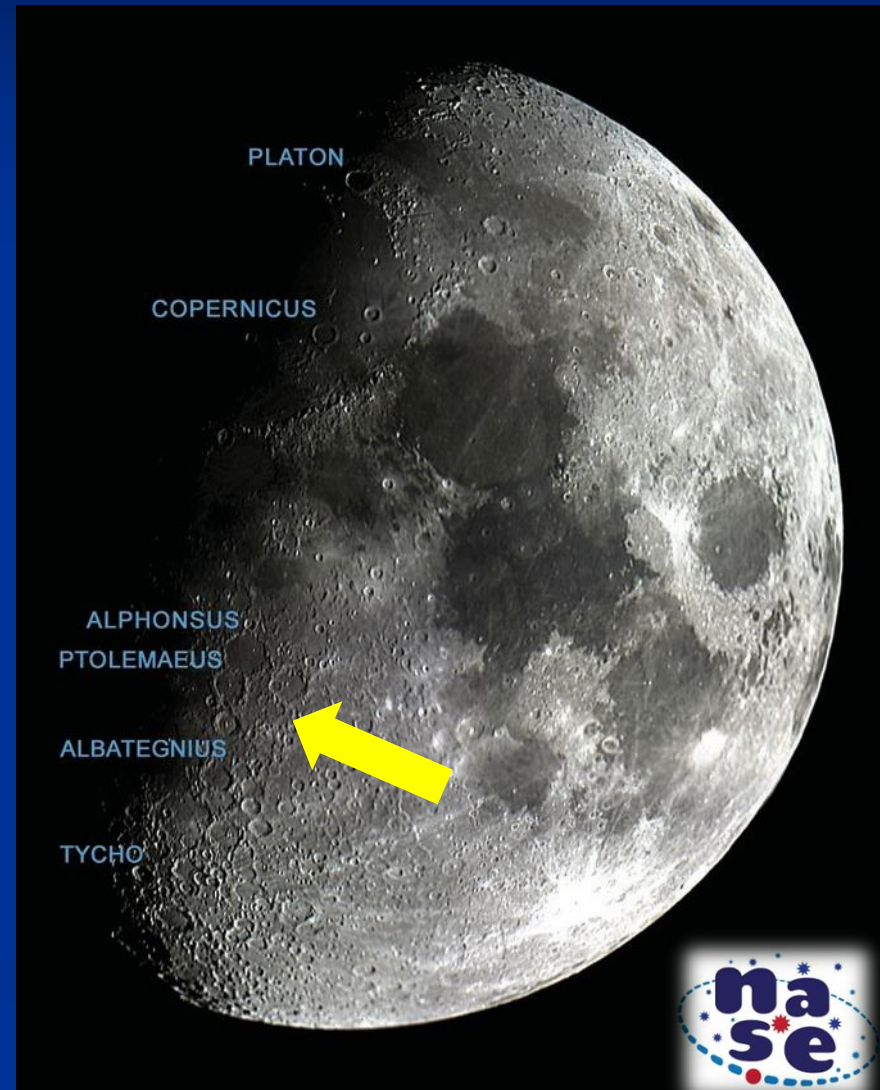
(Crédito: Wikipedia)

Primavera en el hemisferio Norte



Lunar surface

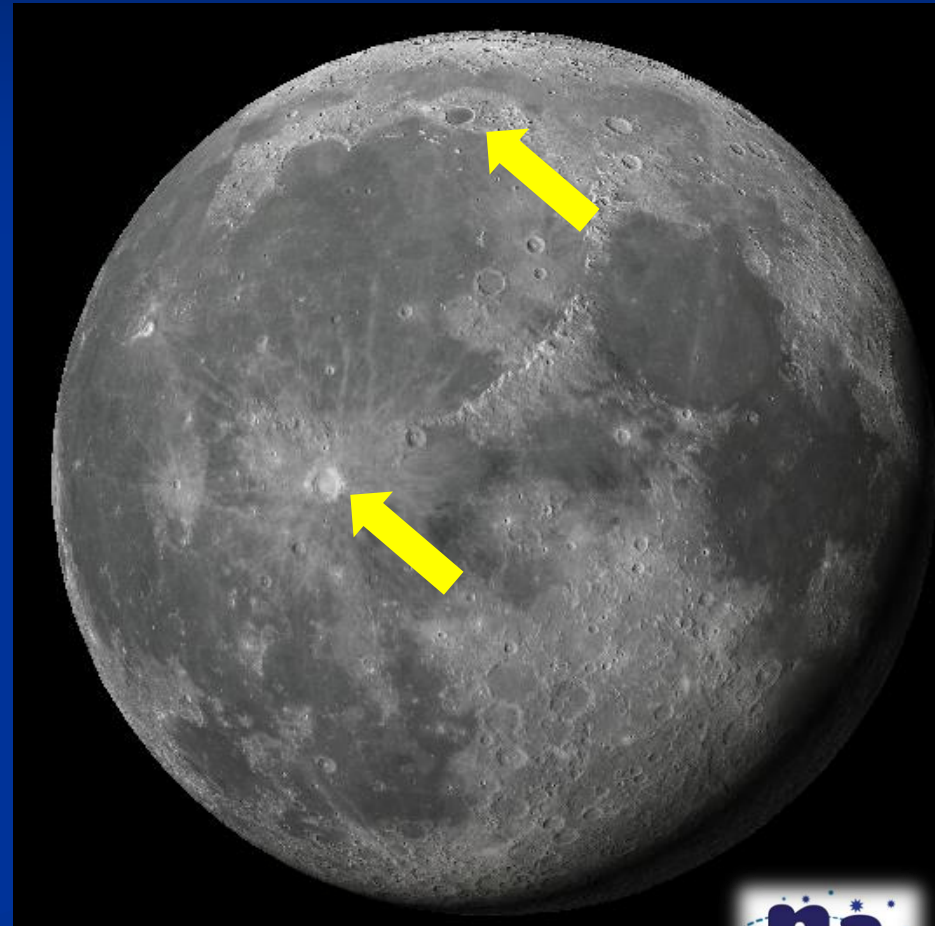
It is beautiful, to observe with binoculars, the area of the three craters Alphonsus, Ptolemaeus and Albategnius, practically in the center of the lunar disk. They are easily distinguished because all three are close to each other, and also one below the other.



Lunar surface


Another crater visible on the "ass" of the rabbit; it is Plato's crater.

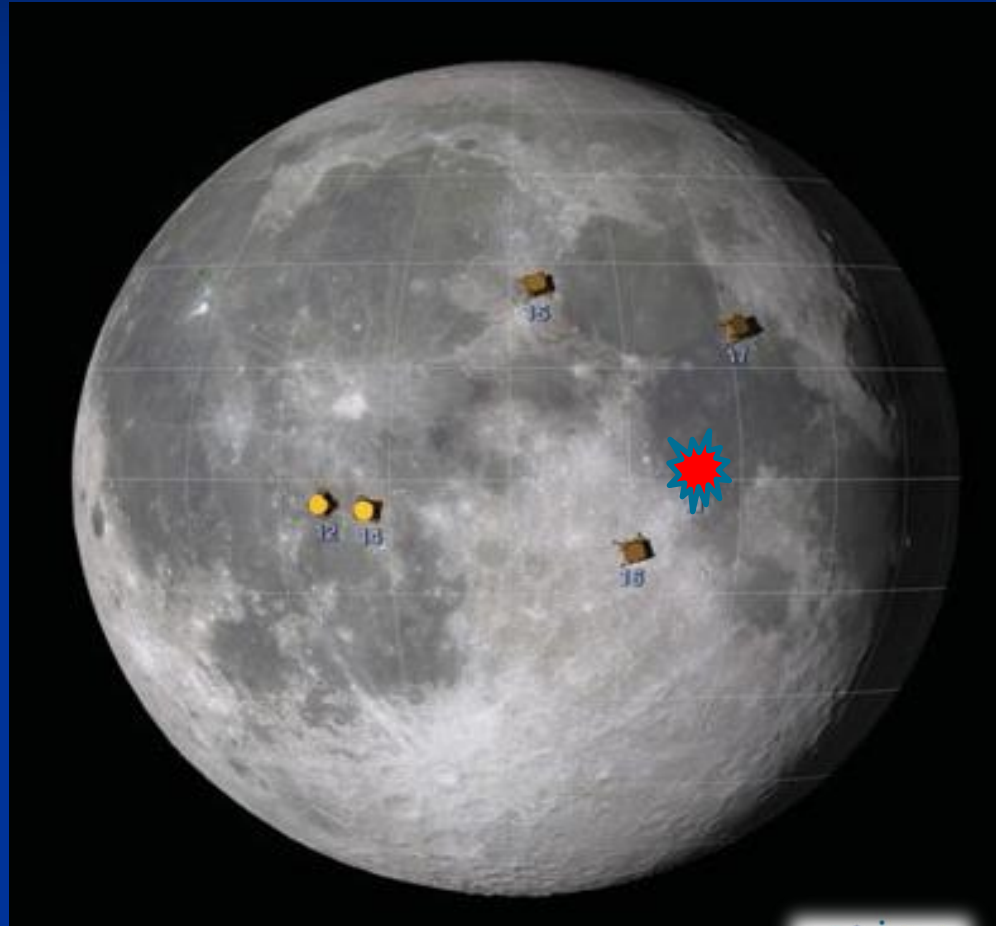
Inside the body of the rabbit (near the upper legs) a crater with well-defined edges is clearly visible, the Copernicus crater



Activity 8: Observation of Apollo 11 moon landing site

The human being
reached the Moon with
NASA's Apollo 11 in 1969.

We propose to observe with
binoculars the Sea of
Tranquility (the rabbit's
head), and the site where
Apollo 11 landed on the
Moon, marked with a 



Conclusions

- The phases of the Moon are motivated by its illumination from the Sun as the Moon moves around the Earth.
- We have distinguished and named some seas and craters on the lunar surface.



¡Muchas gracias
por su atención!

