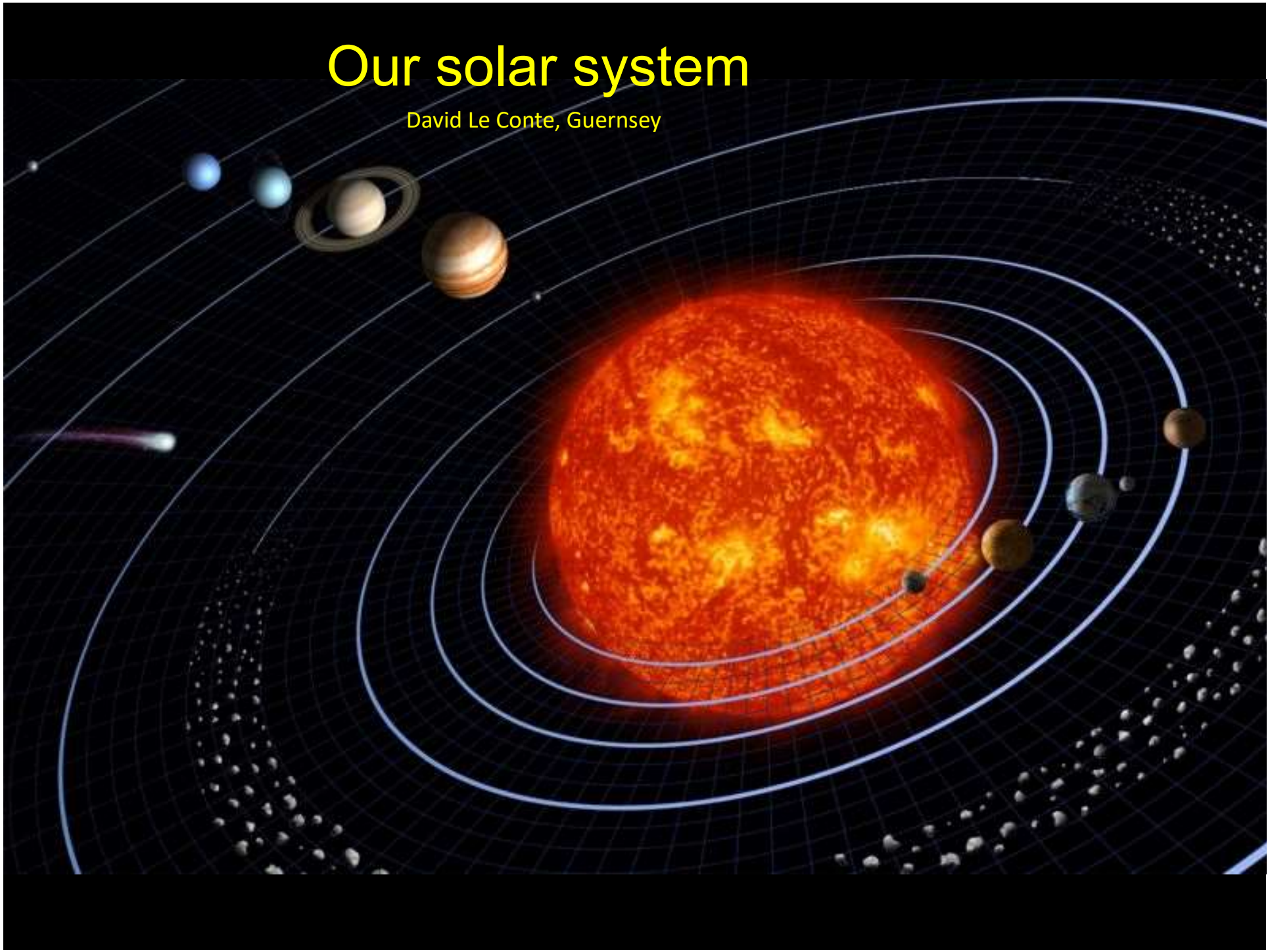
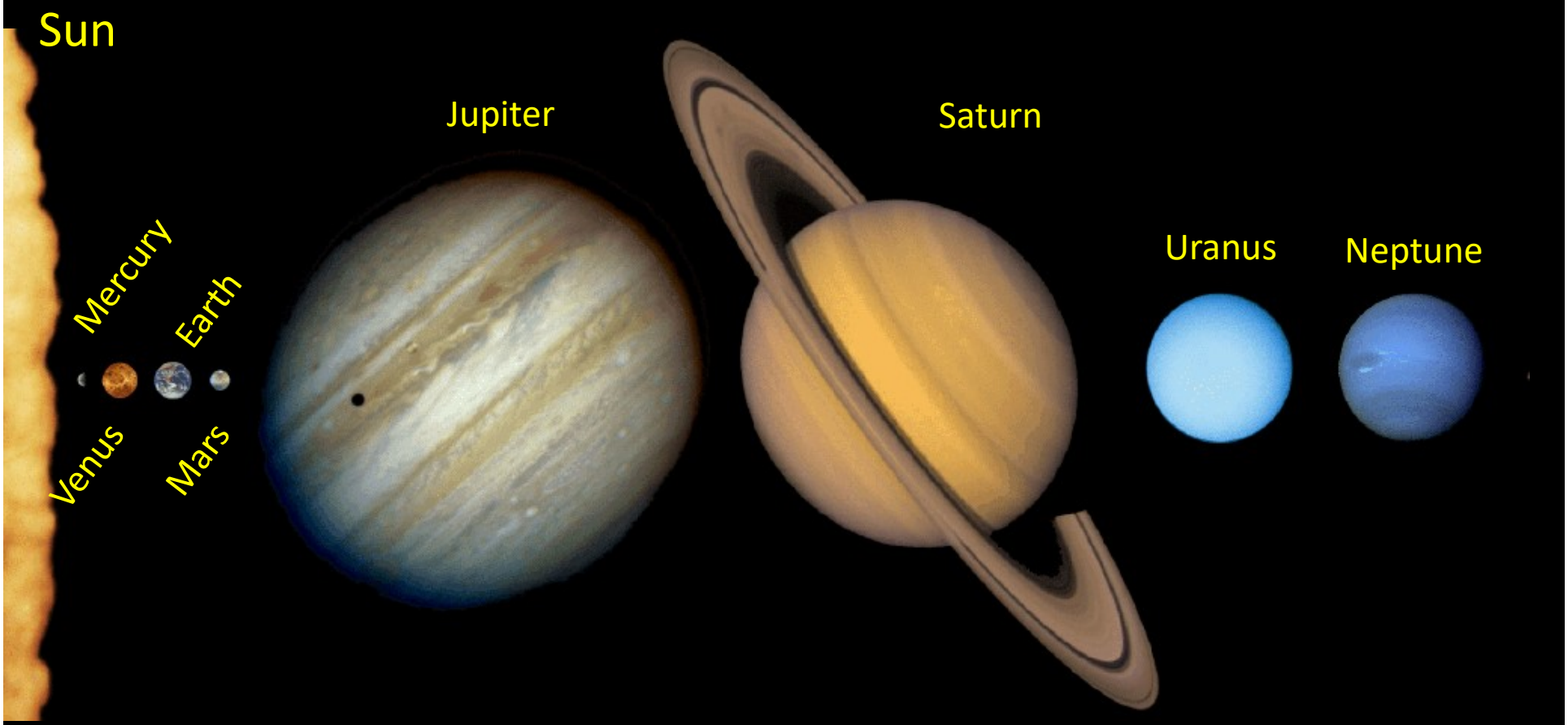
Our solar system

David Le Conte, Guernsey

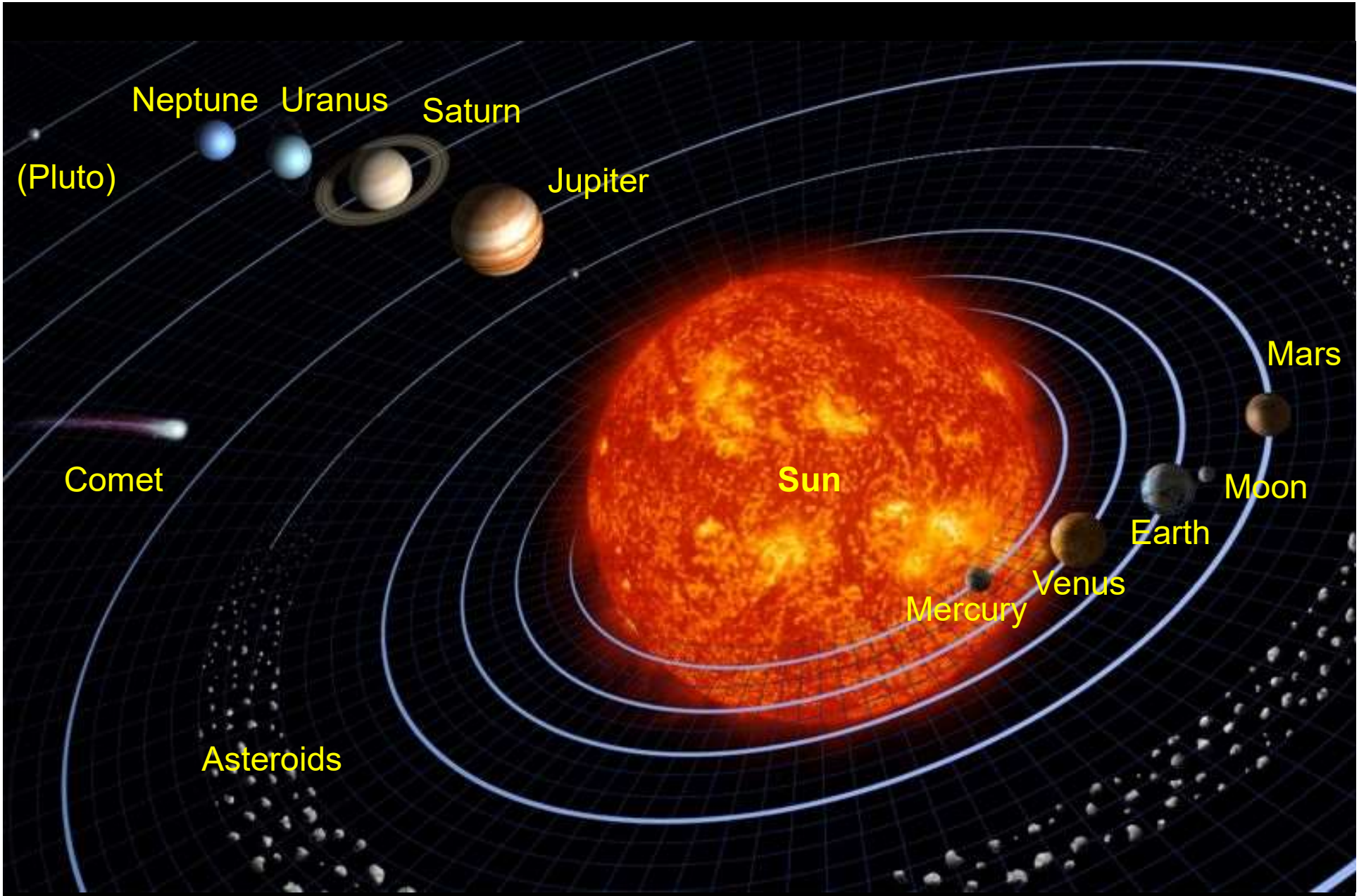


Our solar system consists of the Sun and eight planets.

In this diagram the sizes are to scale, but the distances are not to scale.

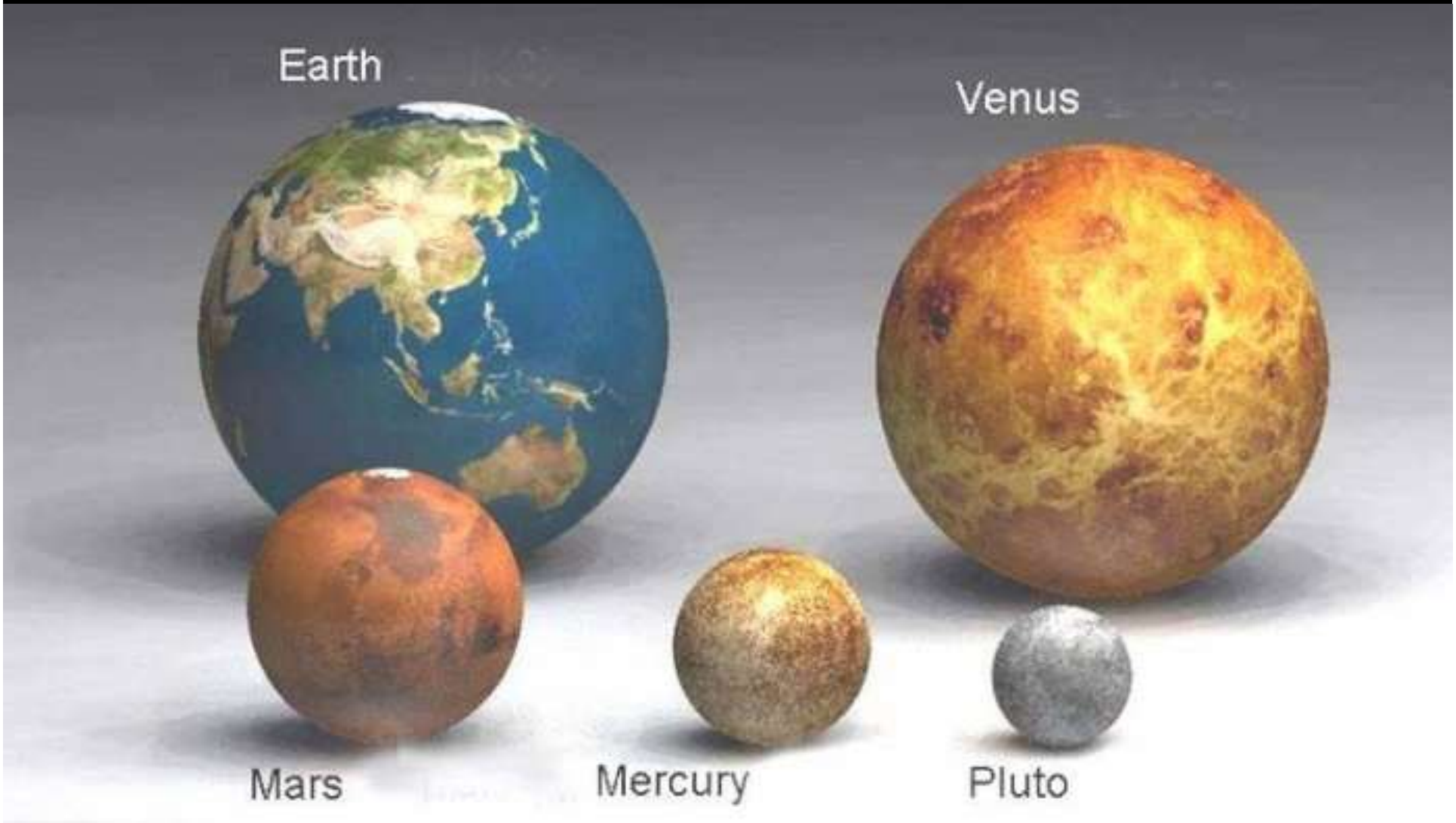


The four planets closest to the Sun are small and rocky, like the Earth,
but the four outer planets are gas giants.
You can remember the order of the planets with a ‘mnemonic’ like:
My Very Easy Method: Just Stay Up Nights!



As well as planets the solar system also contains comets, asteroids, and dwarf planets like Pluto.

Here are the relative sizes of the solar system objects.



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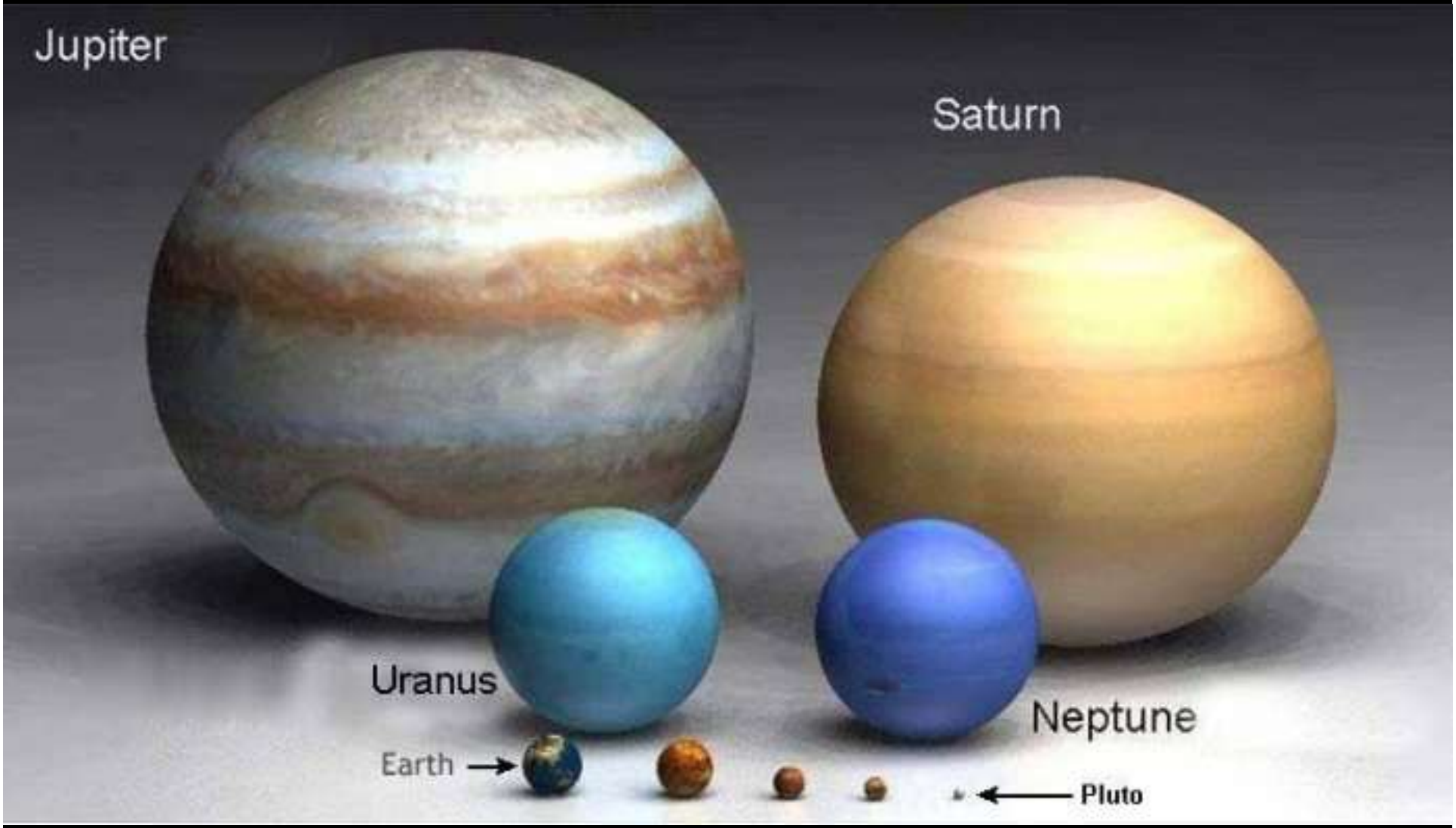

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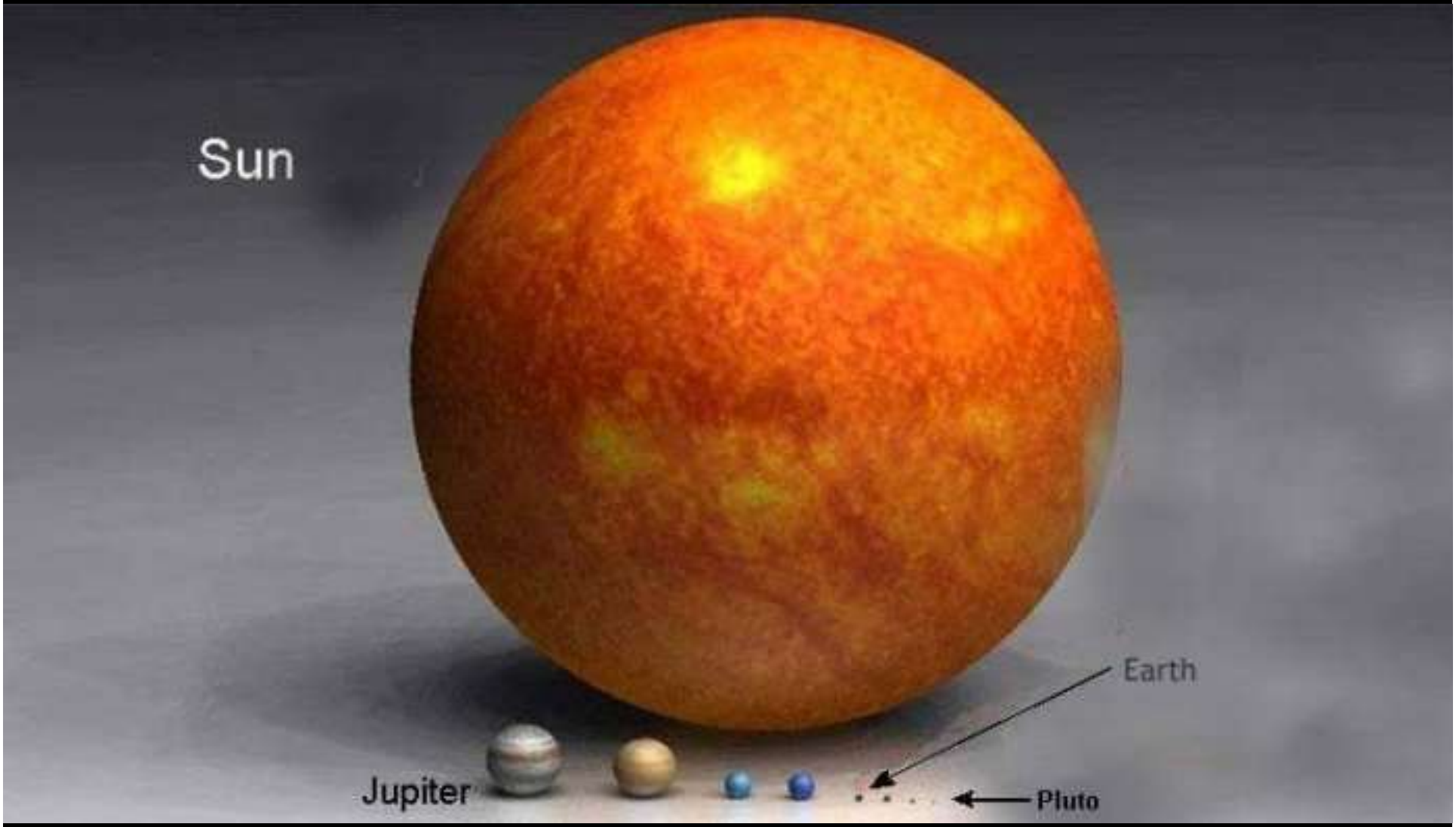
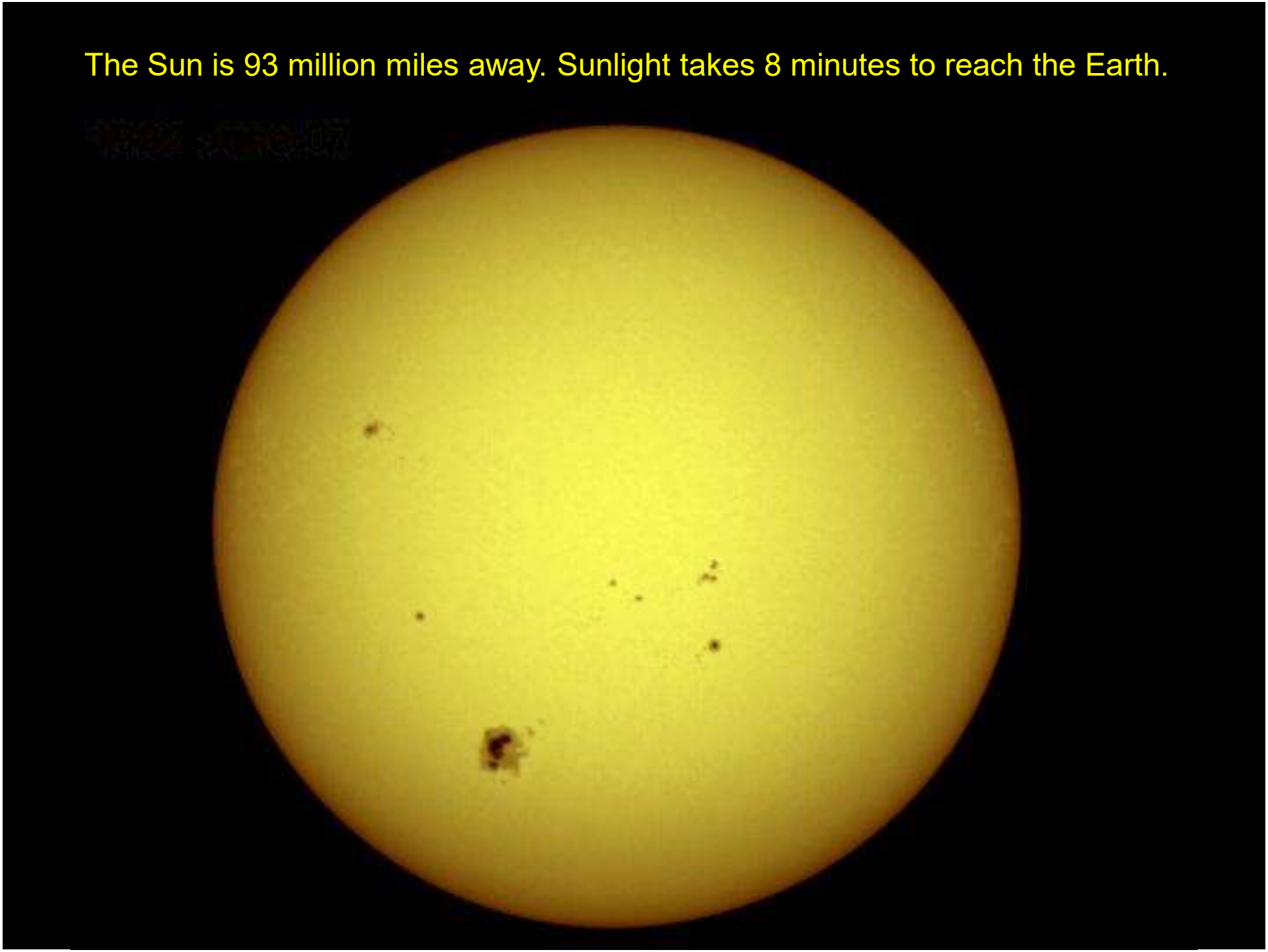
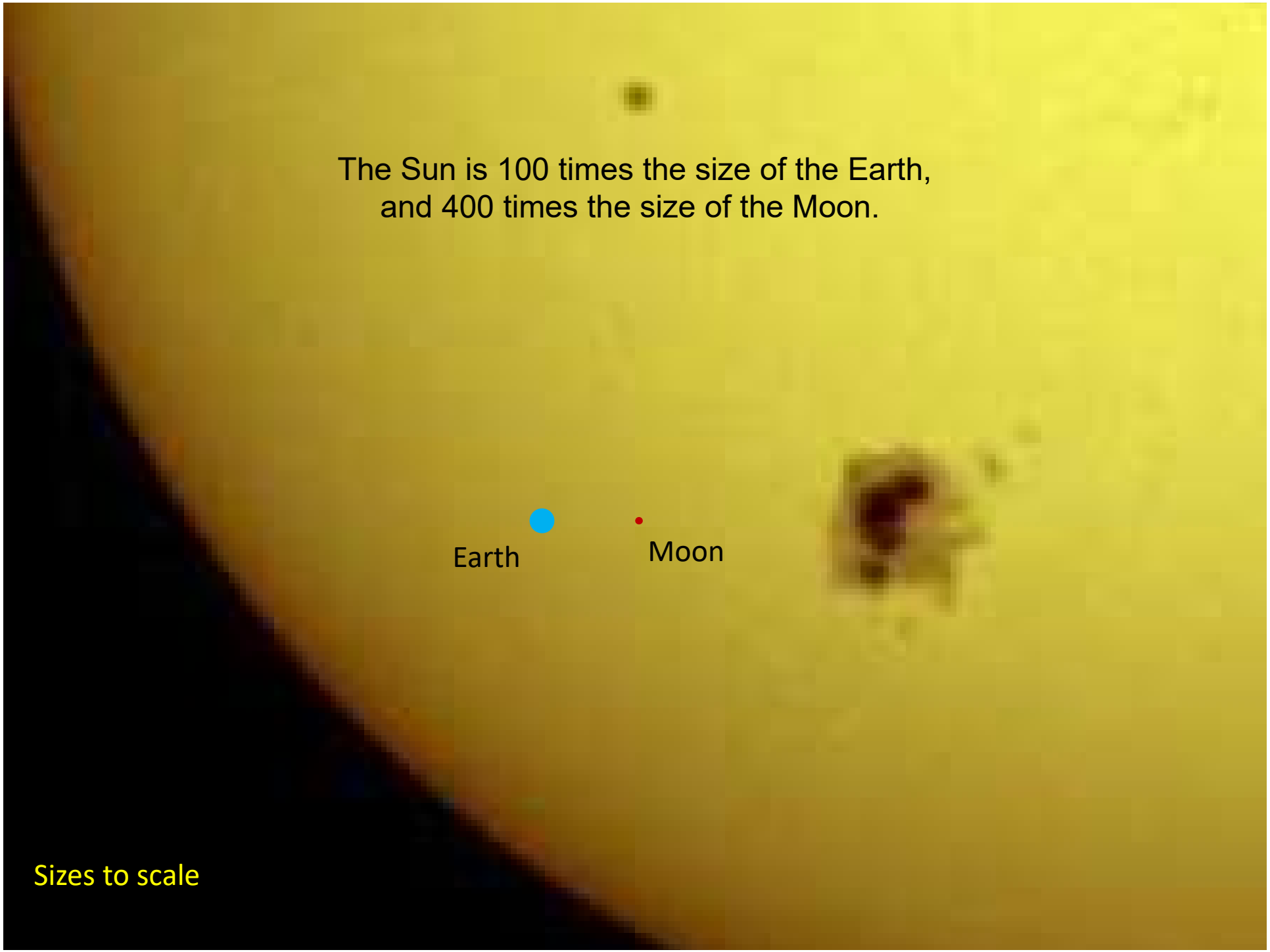


The Sun is 93 million miles away. Sunlight takes 8 minutes to reach the Earth.




The Sun is 100 times the size of the Earth,
and 400 times the size of the Moon.
Earth
Moon
Sizes to scale

An eclipse of the Sun happens when the Moon passes in front of it.
This is a partial eclipse.

David Le Conte, Guernsey 1996

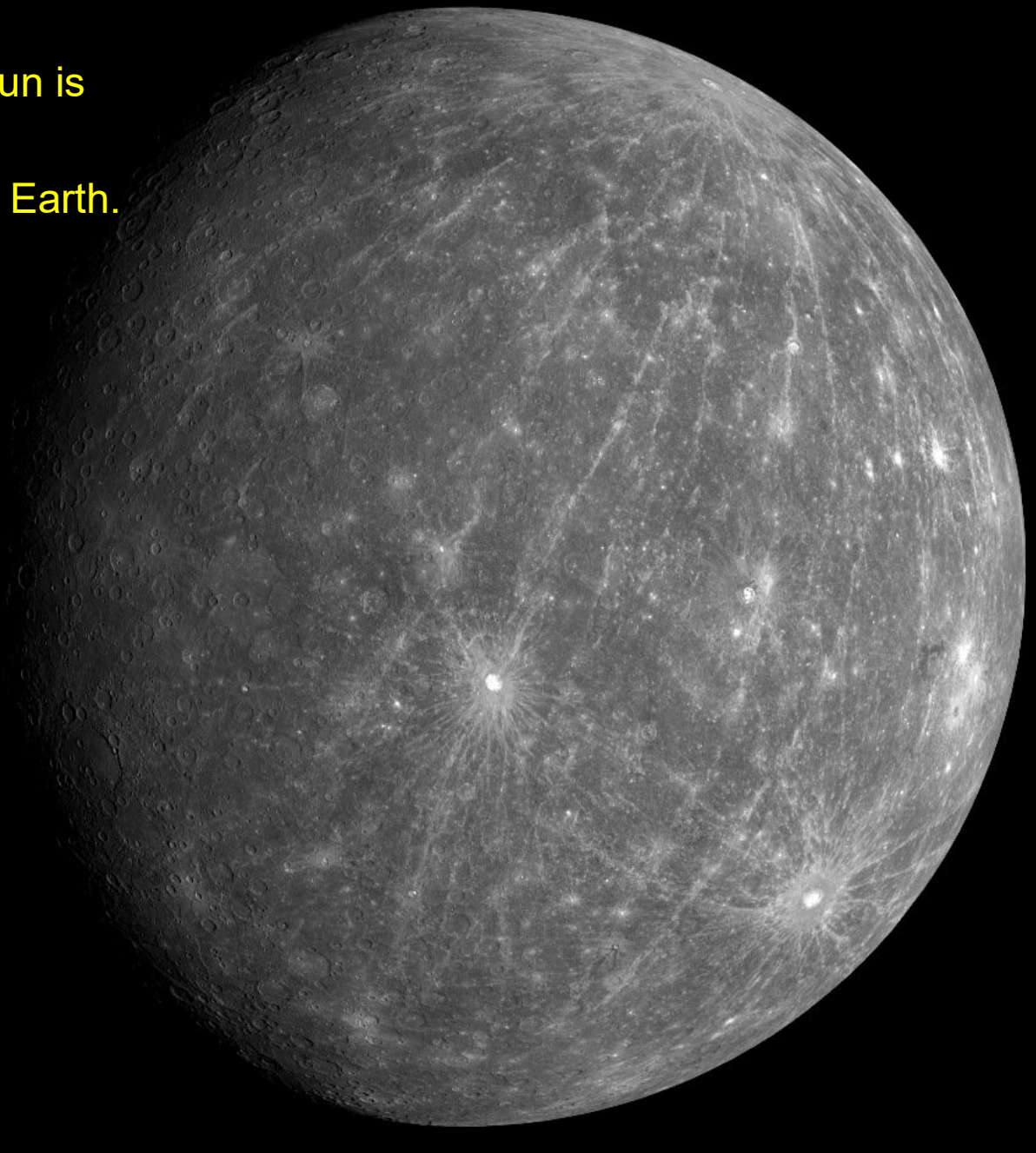
And this is a total eclipse of the Sun.
Only then can we see the Sun's outer atmosphere – the corona

David Le Conte / Jean Dean
Wyoming, USA, 2017

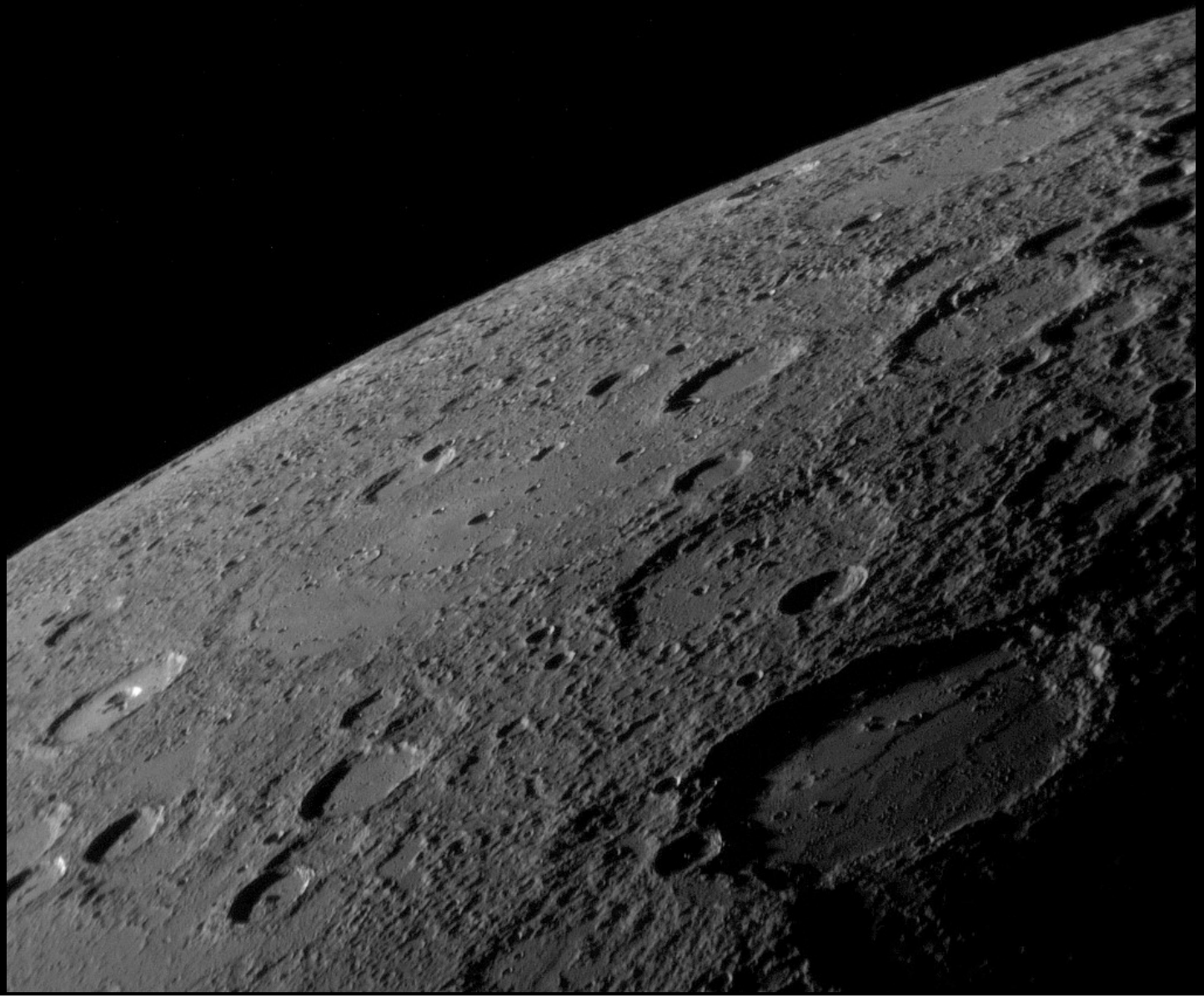
The planet closest to the Sun is

Mercury.

Less than half the size of the Earth.



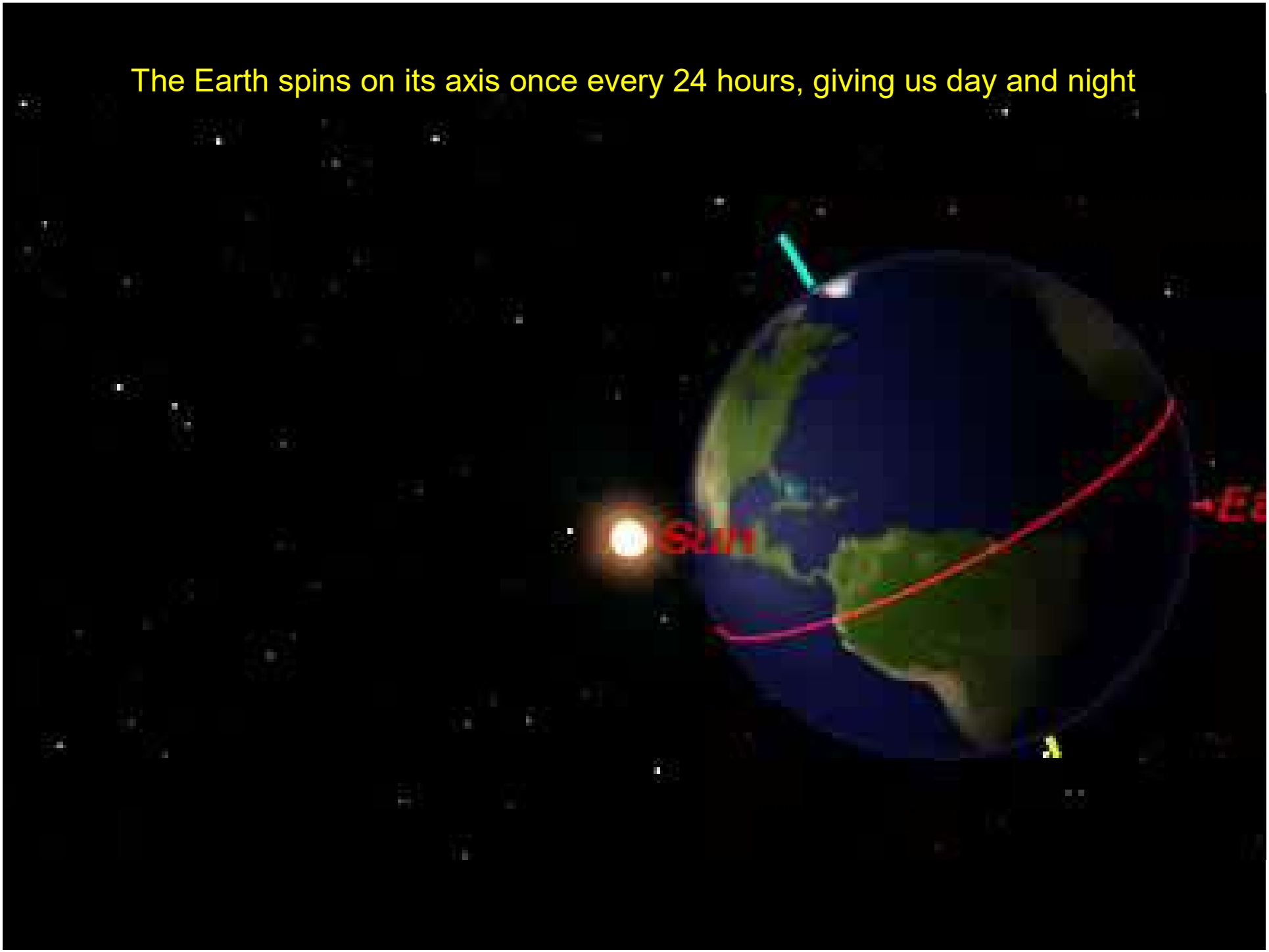
Mercury looks remarkably like the Moon.



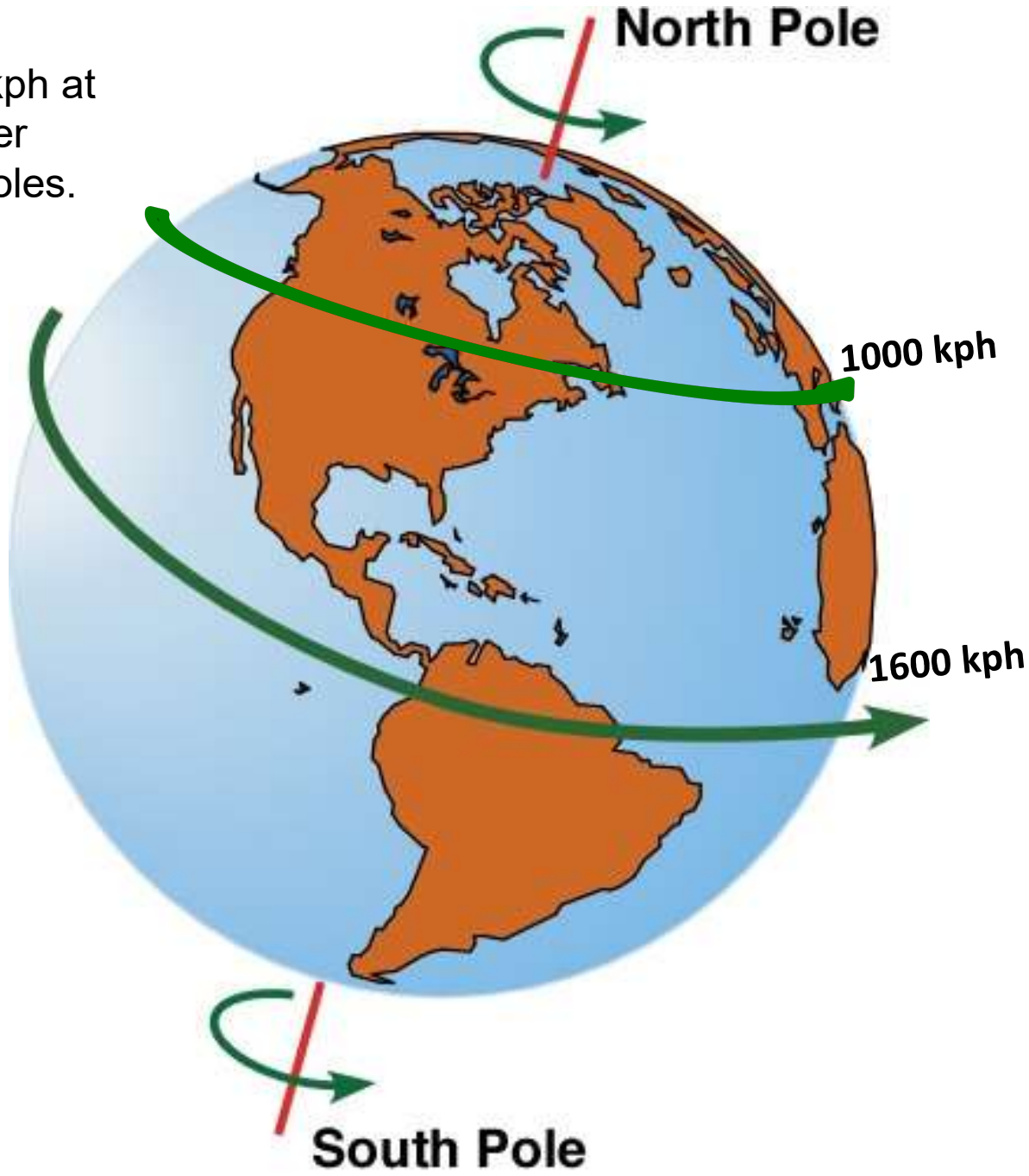
Venus is about the same size as the Earth but is permanently covered in cloud.
Its surface is very hot (over 450 degrees).
The atmospheric pressure is over 90 times that of the Earth, and it rains sulphuric acid. Not a nice place to go on holiday!

The Earth is the third planet from the Sun.
It is about 12,700 km wide, and has a thin atmosphere.
It is (so far) the only place we are certain life exists.

The Earth spins on its axis once every 24 hours, giving us day and night

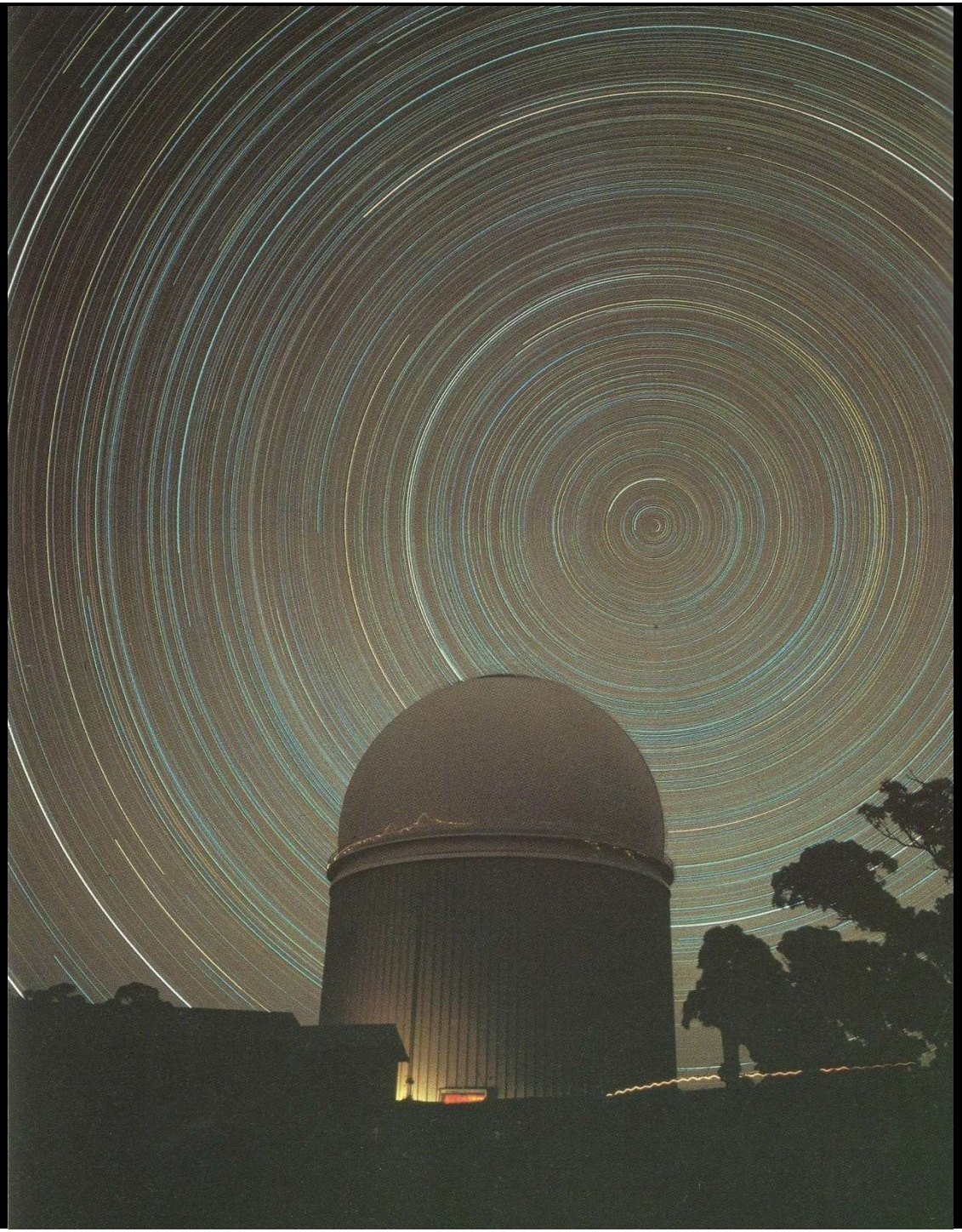


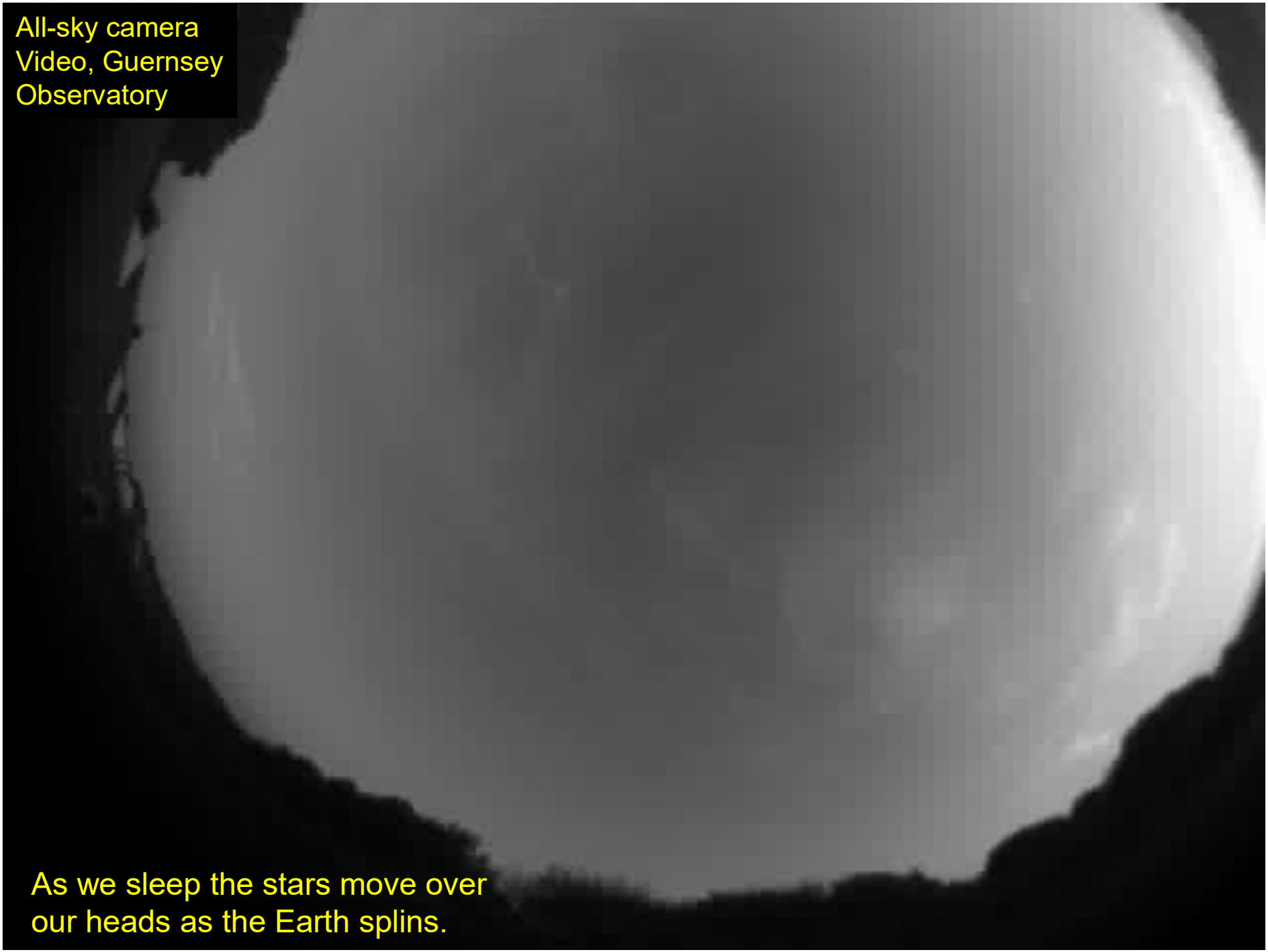
The surface speed is 1600 kph at the equator, less at higher latitudes, and zero at the poles.

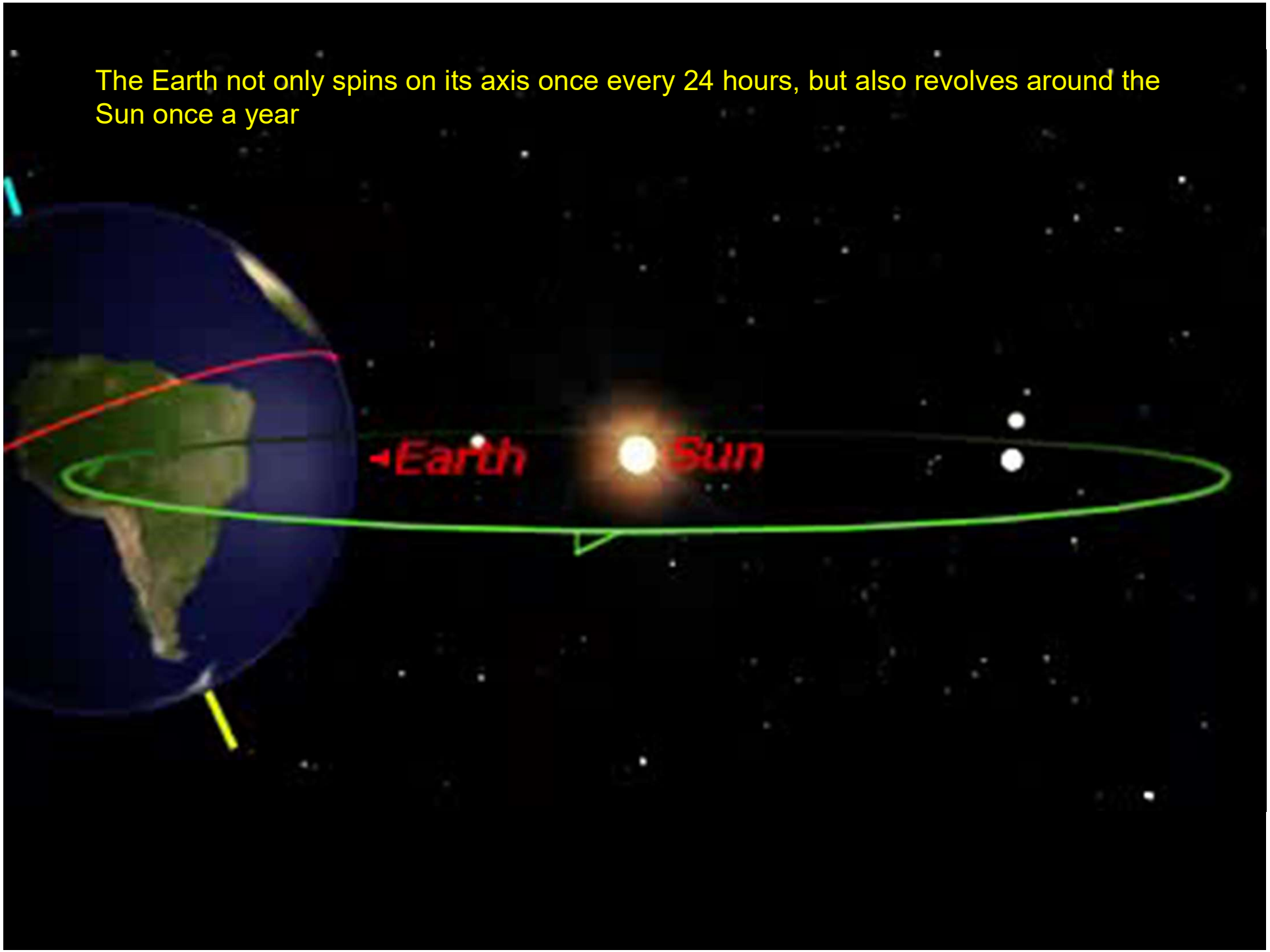


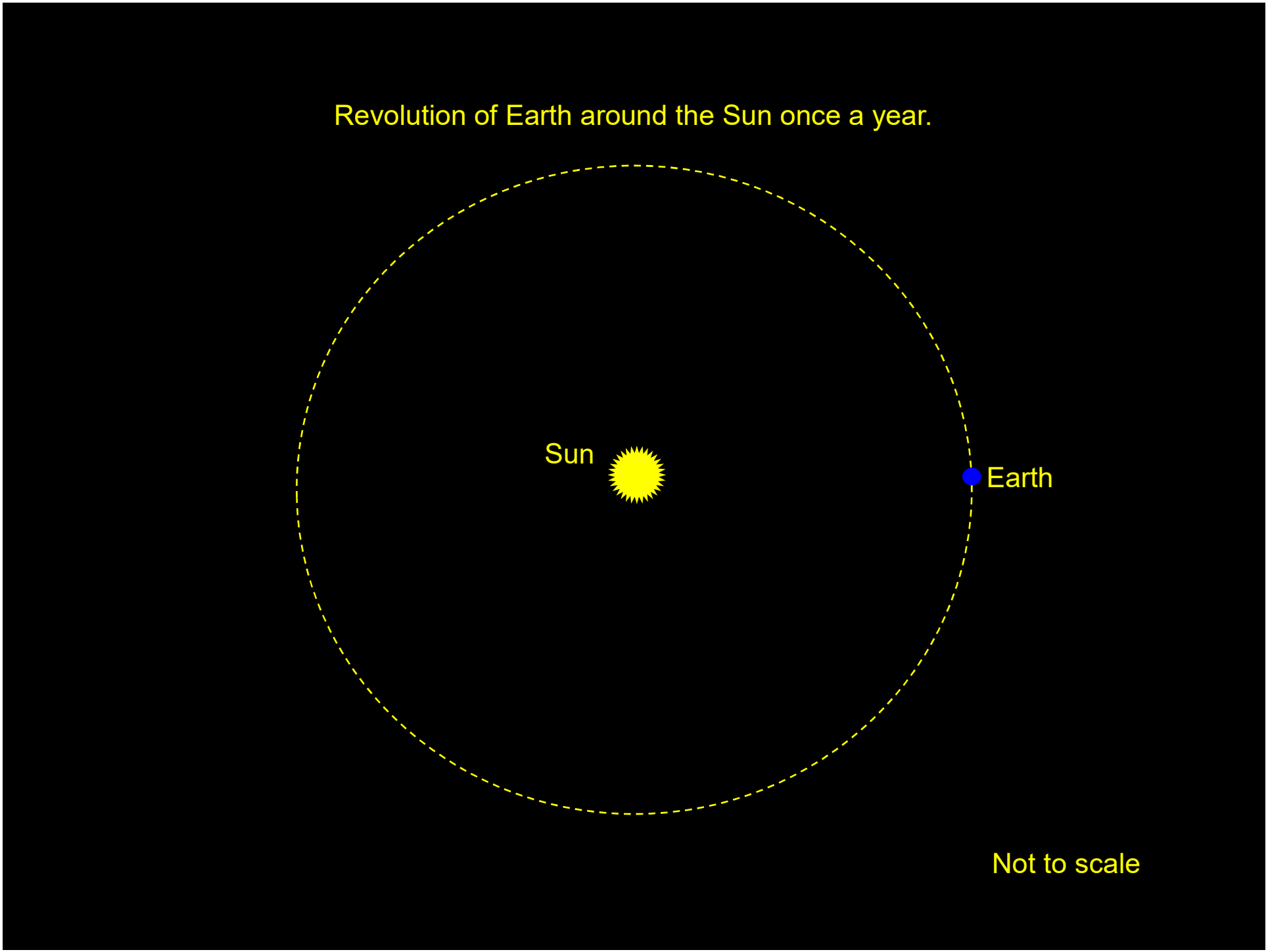
The spin of the Earth not only makes the Sun and Moon rise and set, but also makes the stars appear to rotate.

Note the different colours of the stars in this long time exposure photograph.




All-sky camera
Video, Guernsey
Observatory
As we sleep the stars move over
our heads as the Earth splins.


The Earth not only spins on its axis once every 24 hours, but also revolves around the Sun once a year
Earth
Sun

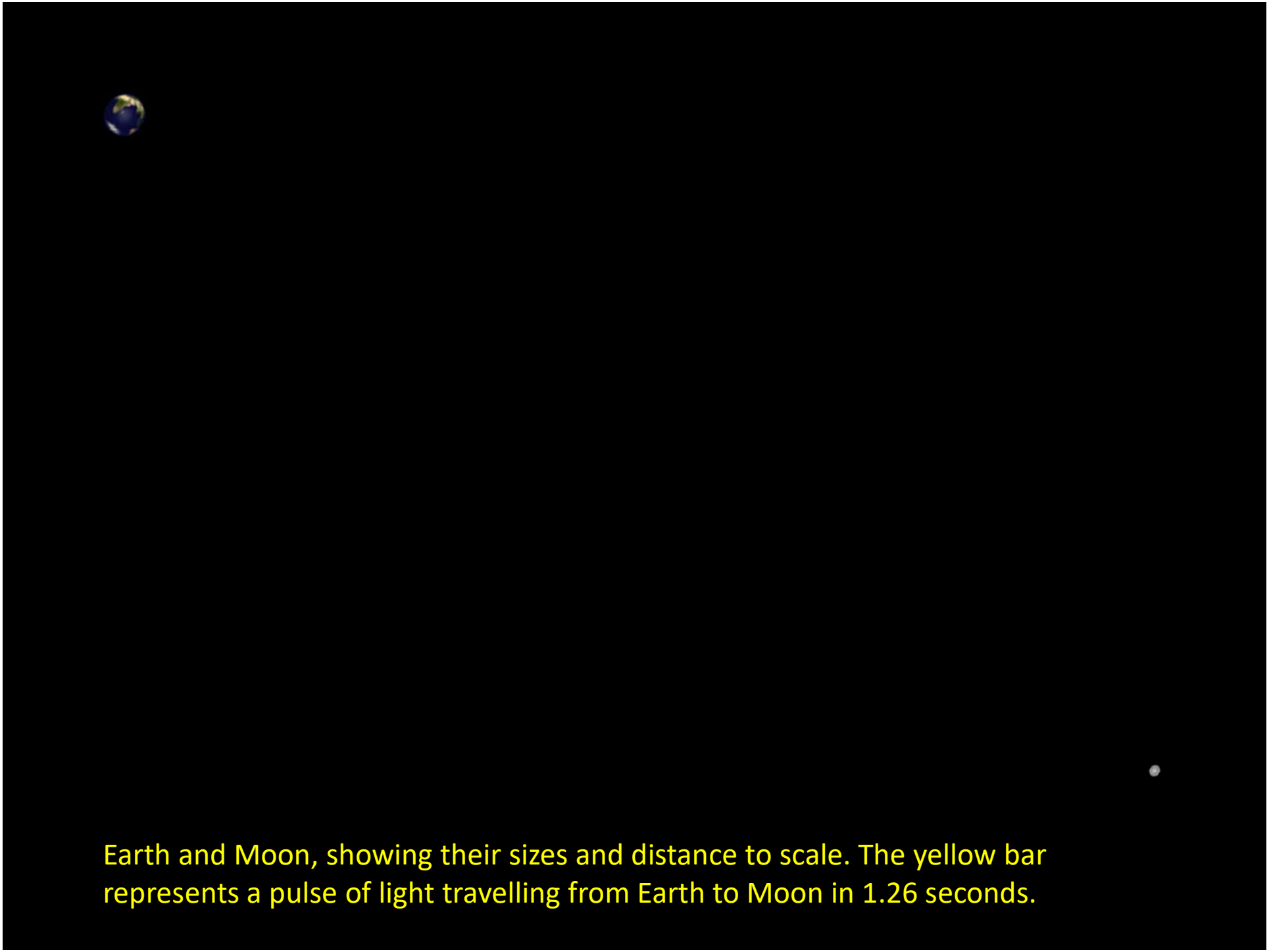

Revolution of Earth around the Sun once a year.
Sun
Earth
Not to scale

The Earth is accompanied by the Moon.

The Moon is a quarter the size of the Earth.

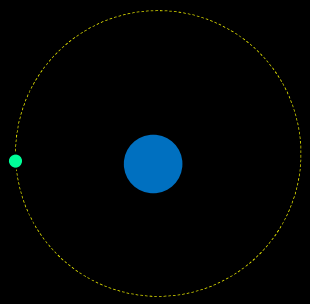
Earth

Moon



Earth and Moon, showing their sizes and distance to scale. The yellow bar represents a pulse of light travelling from Earth to Moon in 1.26 seconds.

The Moon revolves about the Earth (with respect to the Sun) once every 29½ days.
This produces the phases of the Moon.



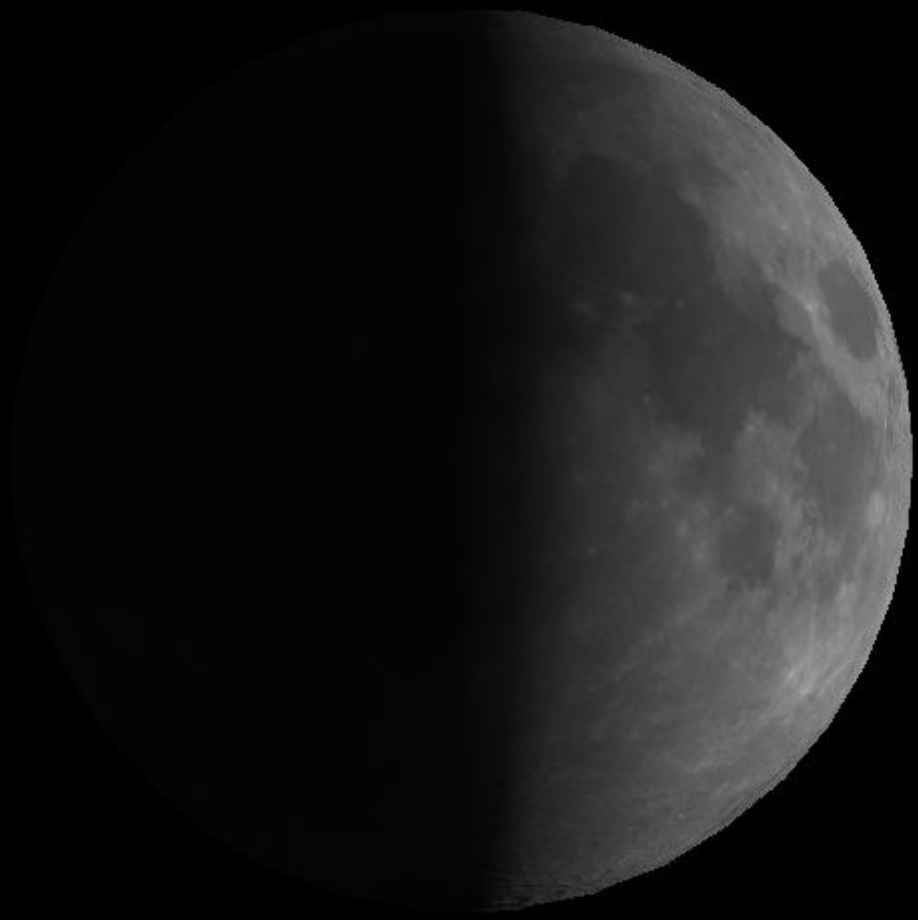
Sunlight

SUN

Not to scale

At ‘New Moon’ we cannot see because it is backlit by the Sun.

A week later there is First Quarter Moon.



After another week there is Full Moon.

And a week later Last Quarter Moon.

And then ‘New Moon’ again.

The Moon's orbit is not exactly circular
so sometimes it appears larger and sometimes smaller.

Moon at closest ('perigee')

363,100 km

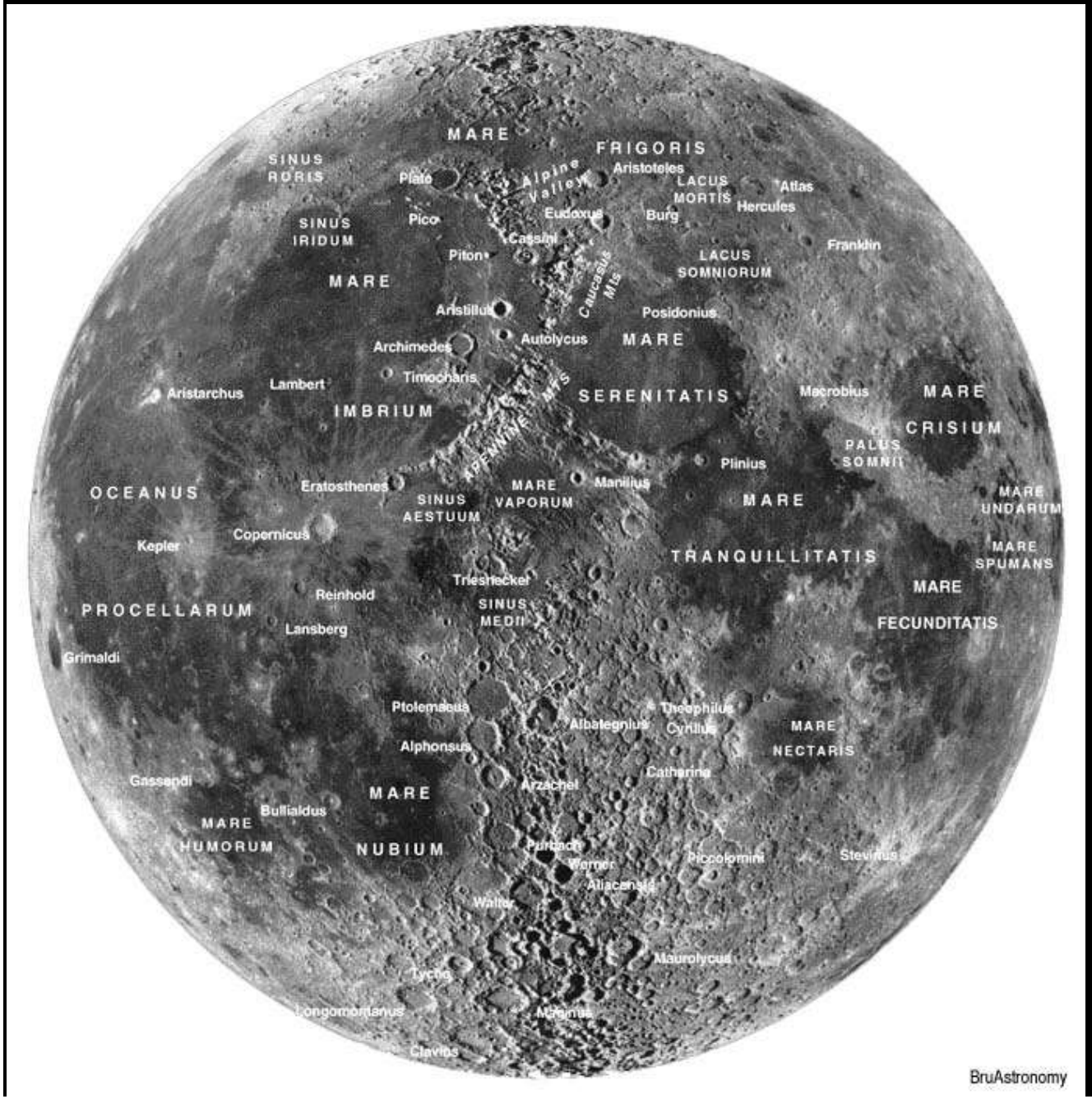
Moon at furthest ('apogee')

405,700 km

At perigee the Moon is 14% larger and 30% brighter than at apogee.

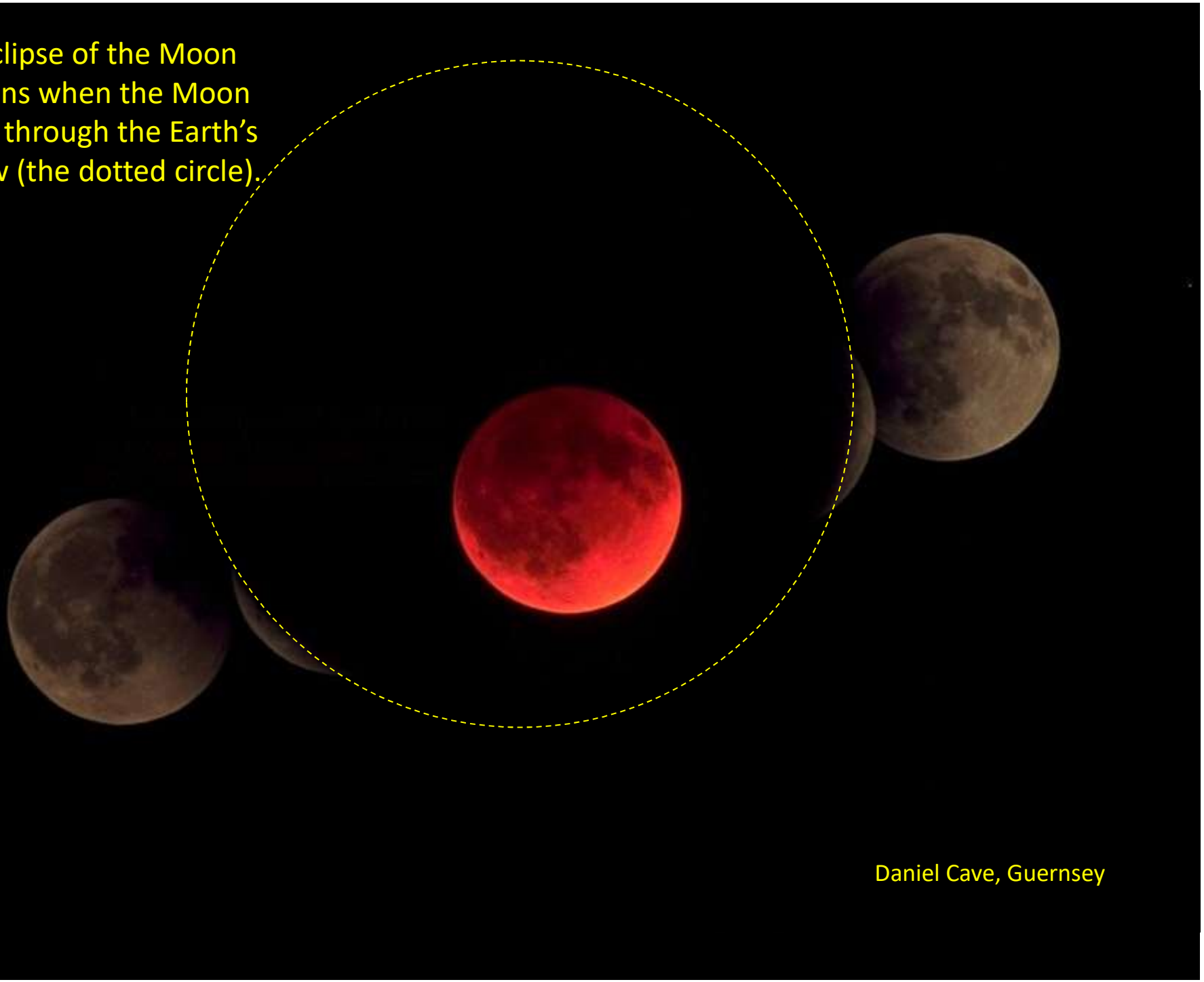

The Moon’s surface has lots of craters, formed by meteorites, and large flat areas of volcanic lava.

Here is a detailed map of the Moon.



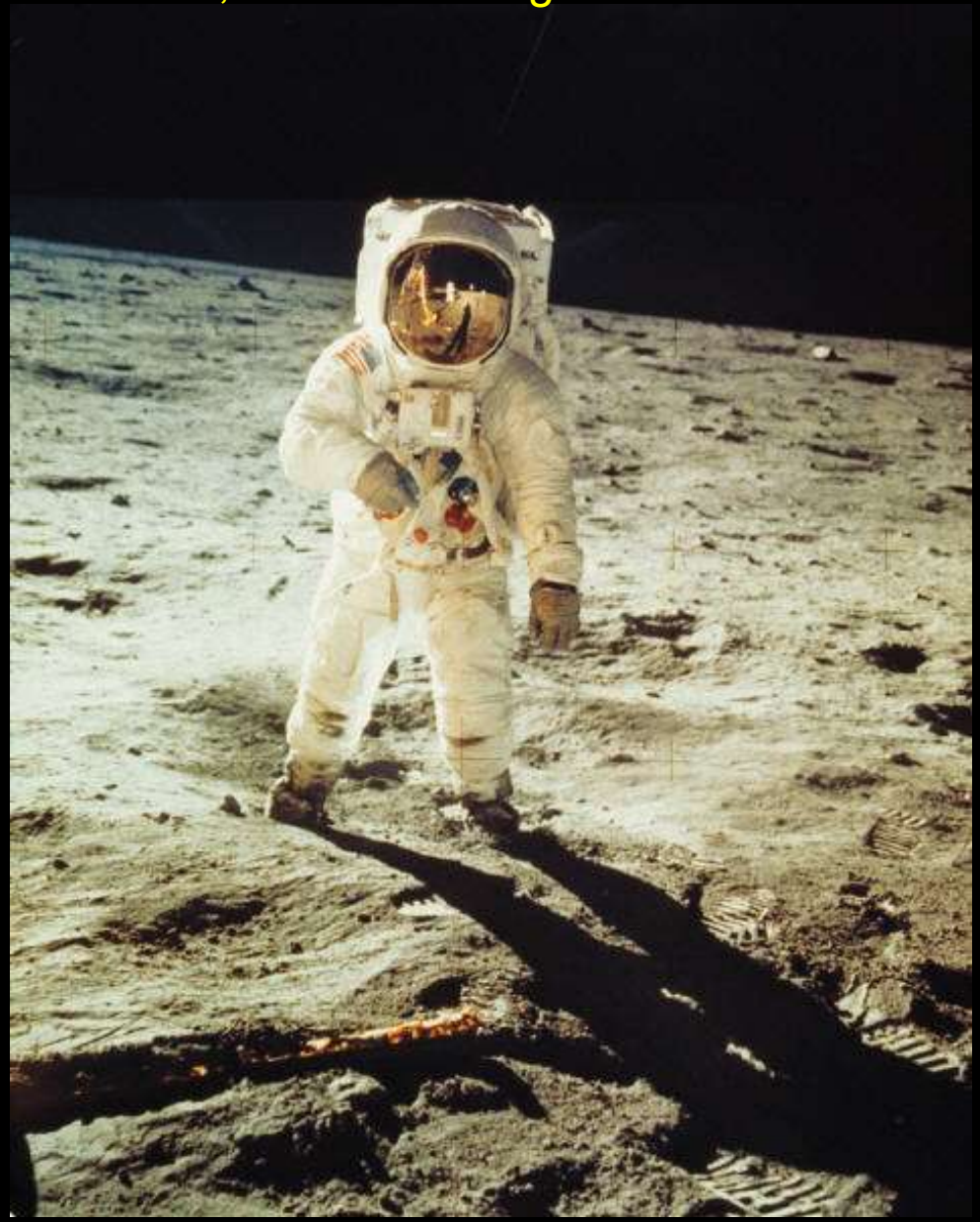
Because of the Moon's rotation rate we only ever see one side of it. We can never see the back side of the Moon (unless we go in a spacecraft around it!).

An eclipse of the Moon happens when the Moon passes through the Earth's shadow (the dotted circle).



Daniel Cave, Guernsey

In July 1969 two of the Apollo 11 astronauts, Neil Armstrong and Buzz Aldrin first stepped onto the Moon.



How many mistakes are there in the following statement?

As the astronaut walked cautiously over the Moon's rugged surface, he looked up and saw thousands of stars twinkling brightly in the black night sky. To the west, a few wispy clouds were floating, and a light breeze was blowing moon-dust against the face of his helmet.

A loud banging sound made him turn around to see what had happened. His companion had just split a large moon rock in half by hitting it with a hammer.

In the east the Earth was almost "new" – hanging low in the sky like a cutting from a gigantic bluish-white fingernail. Inside the arms of the Earth's shining crescent he could see several small stars.

Five mistakes:The Moon does not have an atmosphere, so stars do not twinkle, there are no clouds, wind or sound. And the Earth blocks stars behind it.

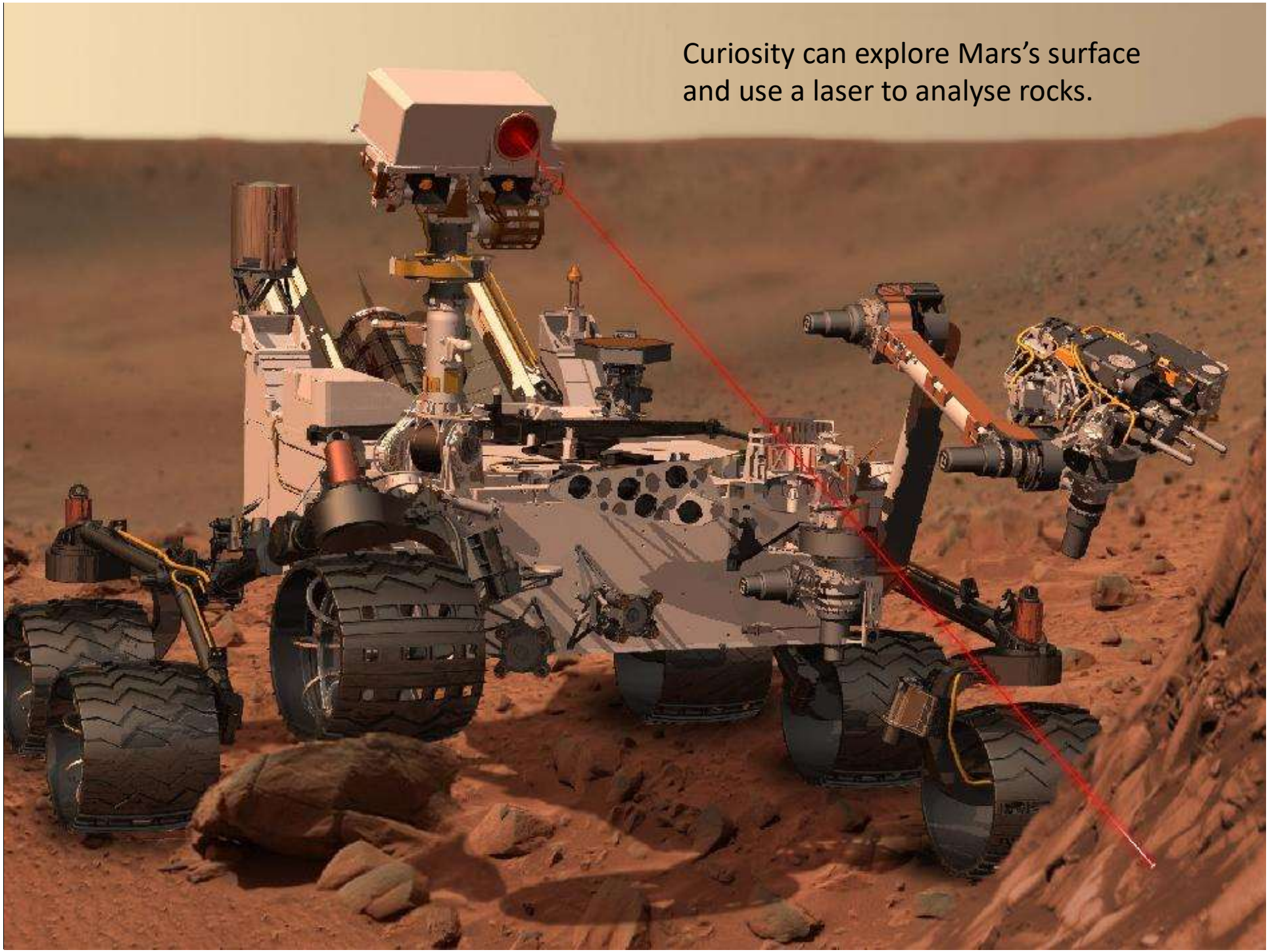
Mars is the fourth planet from the Sun.
It is distinctly red, and has polar ice caps.

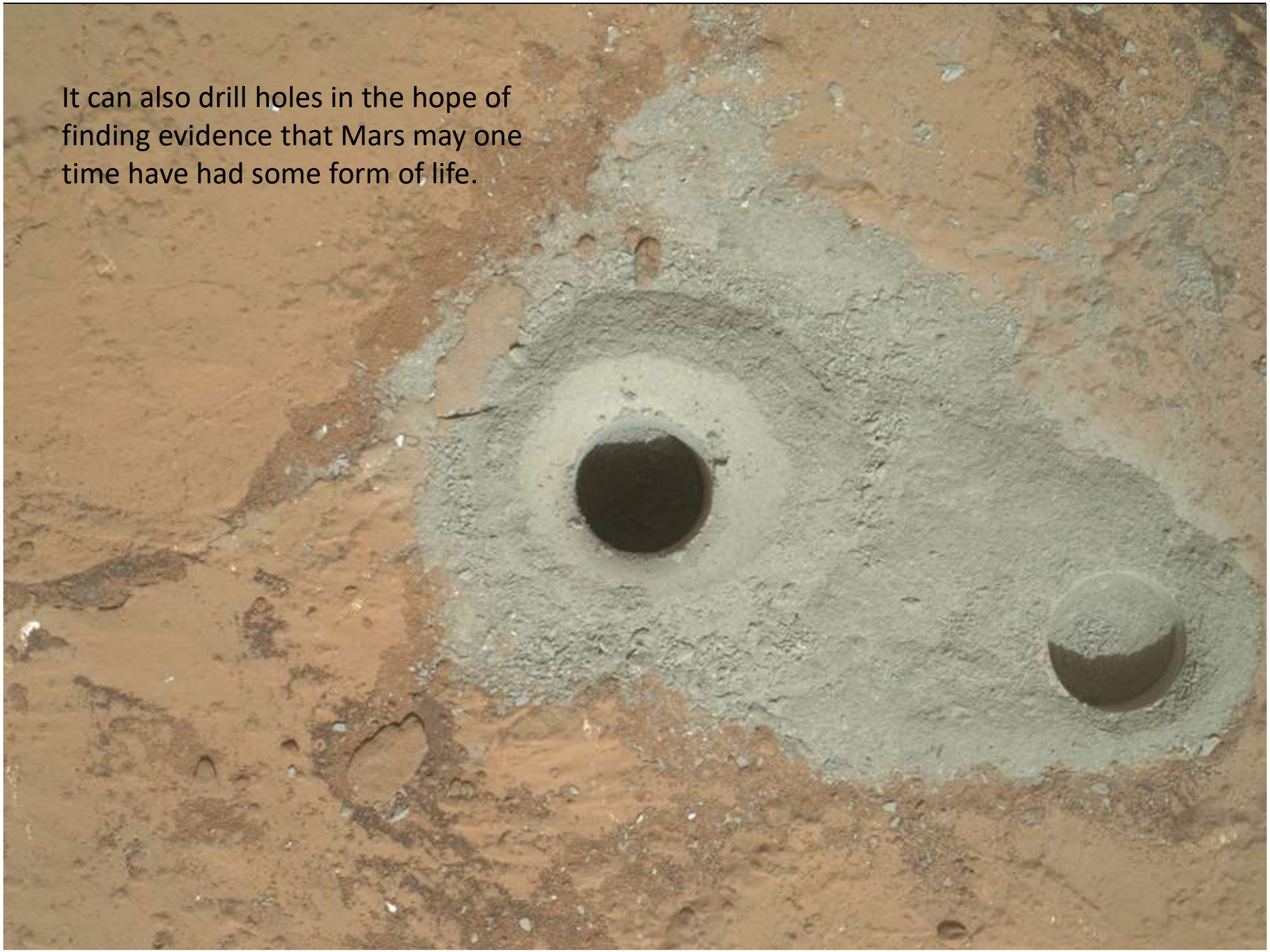
Mars is about half the size of the Earth.

Earth

Mars

Many spacecraft have been sent to Mars, some to orbit it and some, like this ‘Curiosity’ rover, to land on it.


Curiosity can explore Mars's surface
and use a laser to analyse rocks.


It can also drill holes in the hope of finding evidence that Mars may one time have had some form of life.

Pictures taken by the rovers show that Mars has a remarkably Earth-like surface.

There is evidence that Mars once had a lot of water on its surface.

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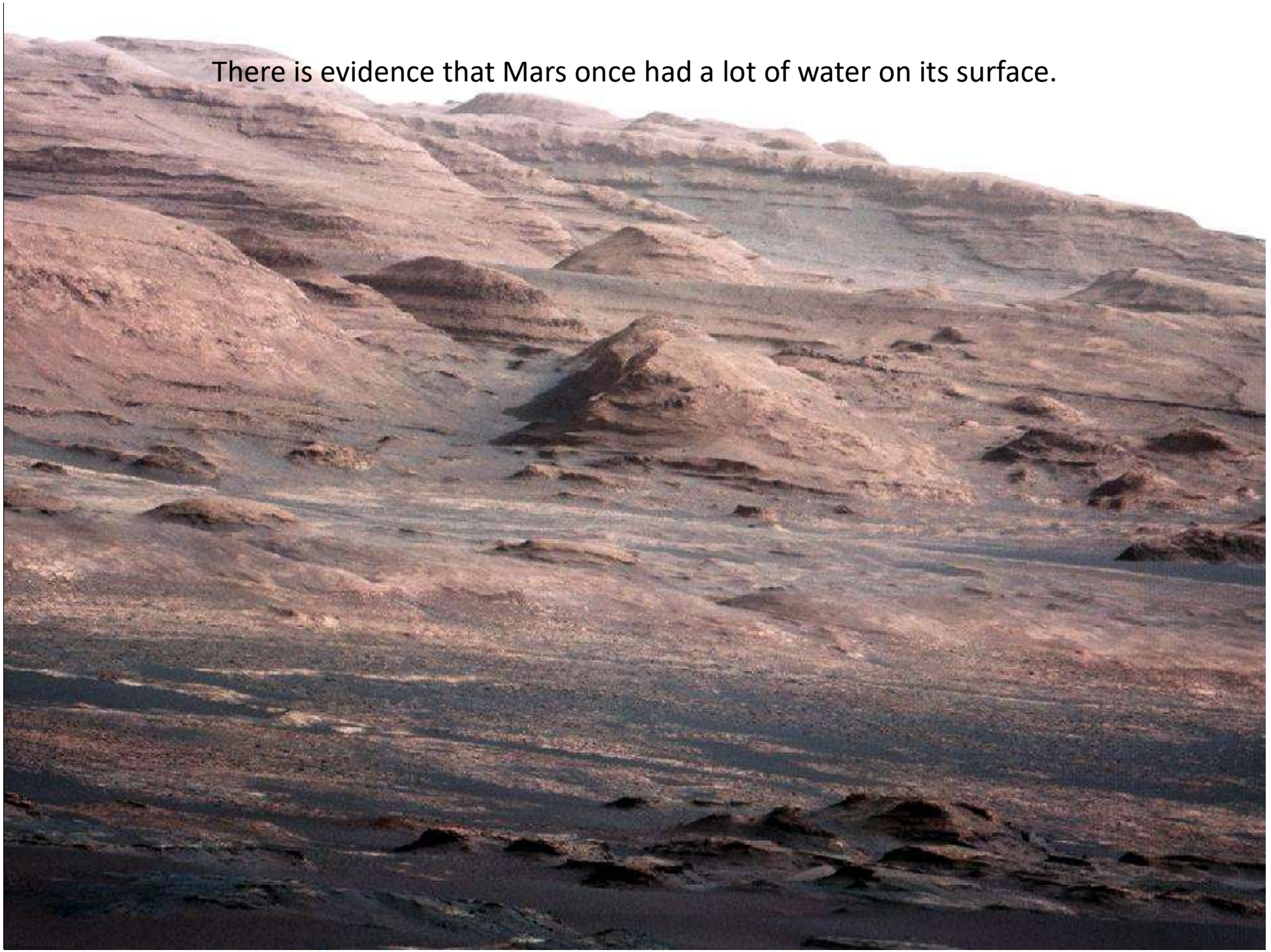
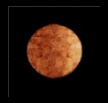


The solar system's four inner planets are all rocky, like the Earth:

Mercury



Venus

Earth

Mars

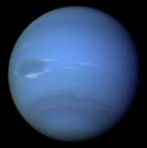
but the four giant outer planets are mainly hydrogen gas.

Jupiter

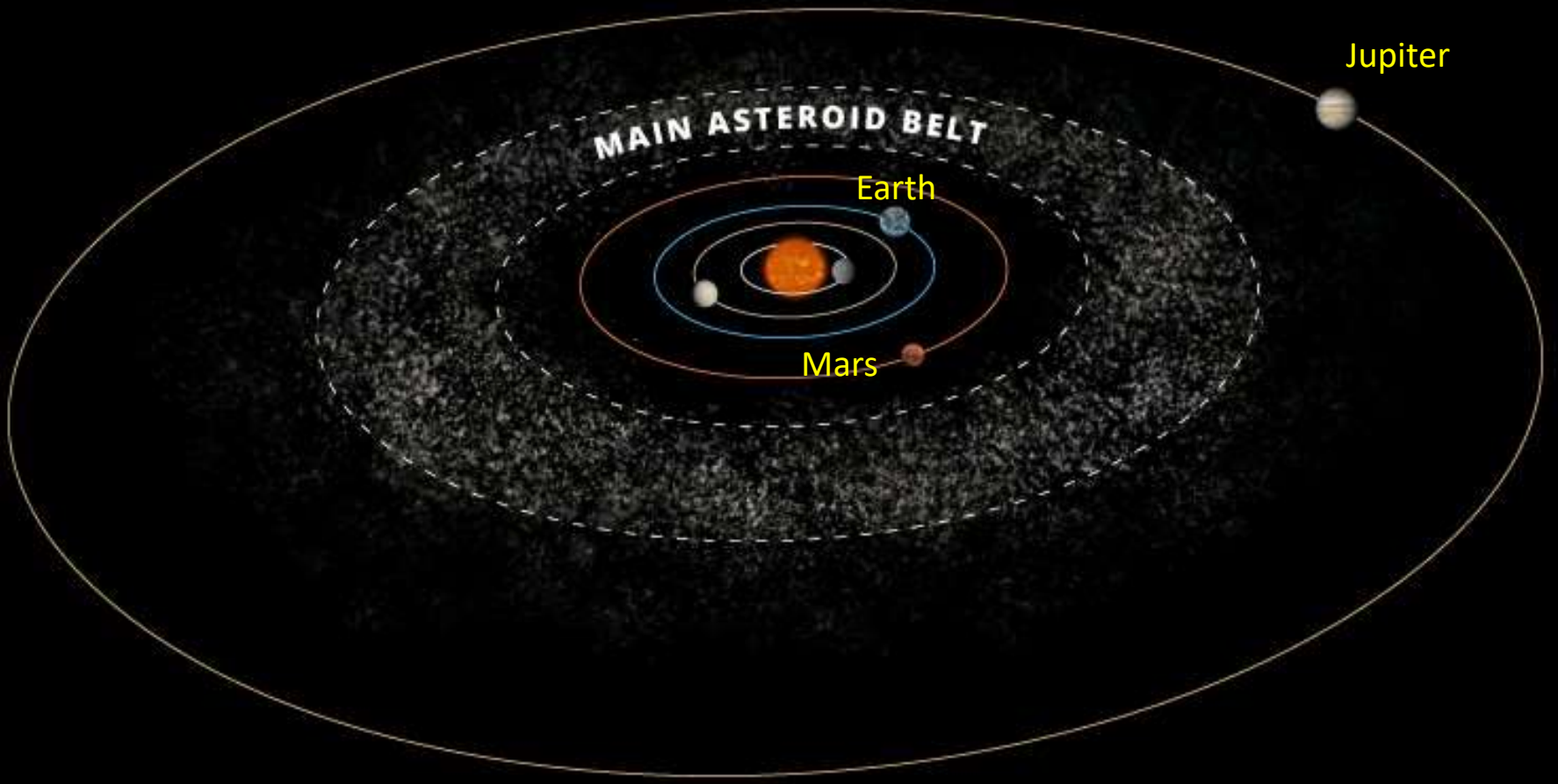
Saturn

Uranus

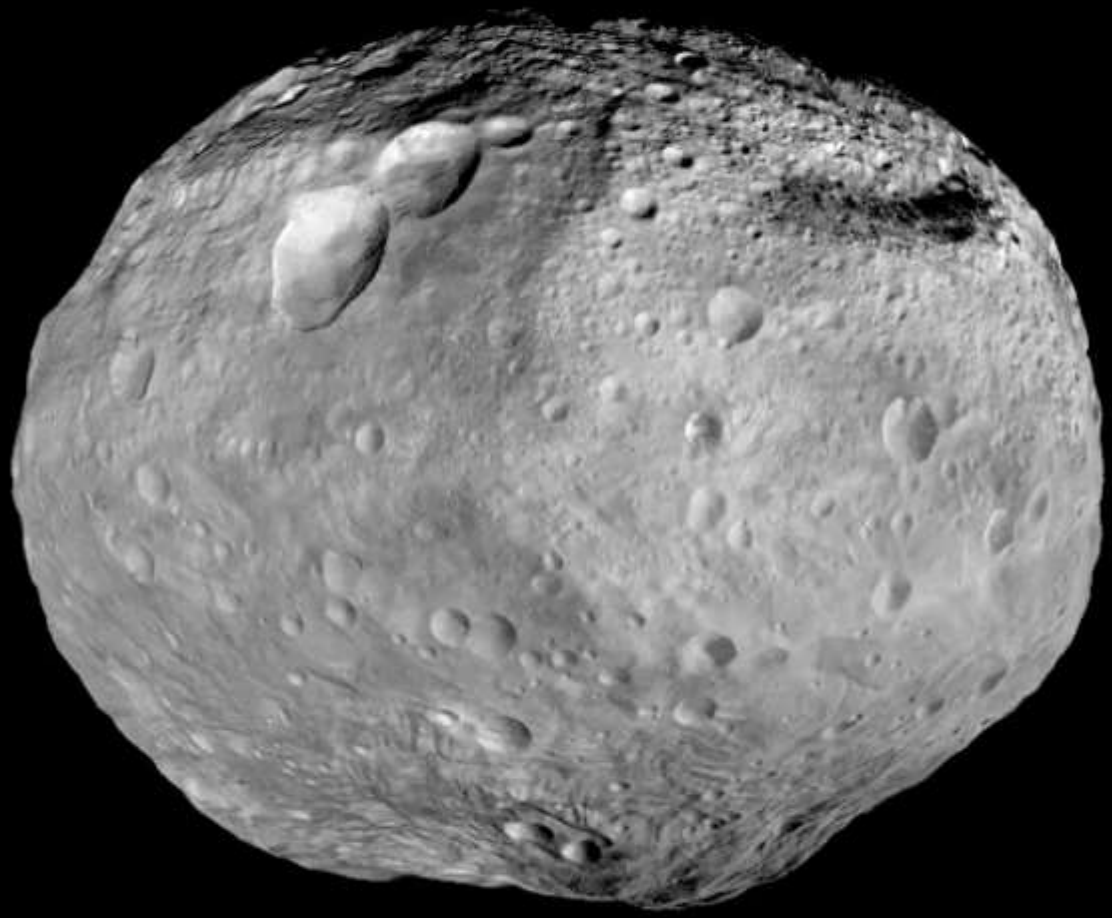
Neptune



Between the orbits of Mars and Jupiter is a belt of thousands of asteroids, pieces of rock ranging from tiny to almost 1000 km in size.



This is asteroid Vesta, the second largest (525 km) and brightest.



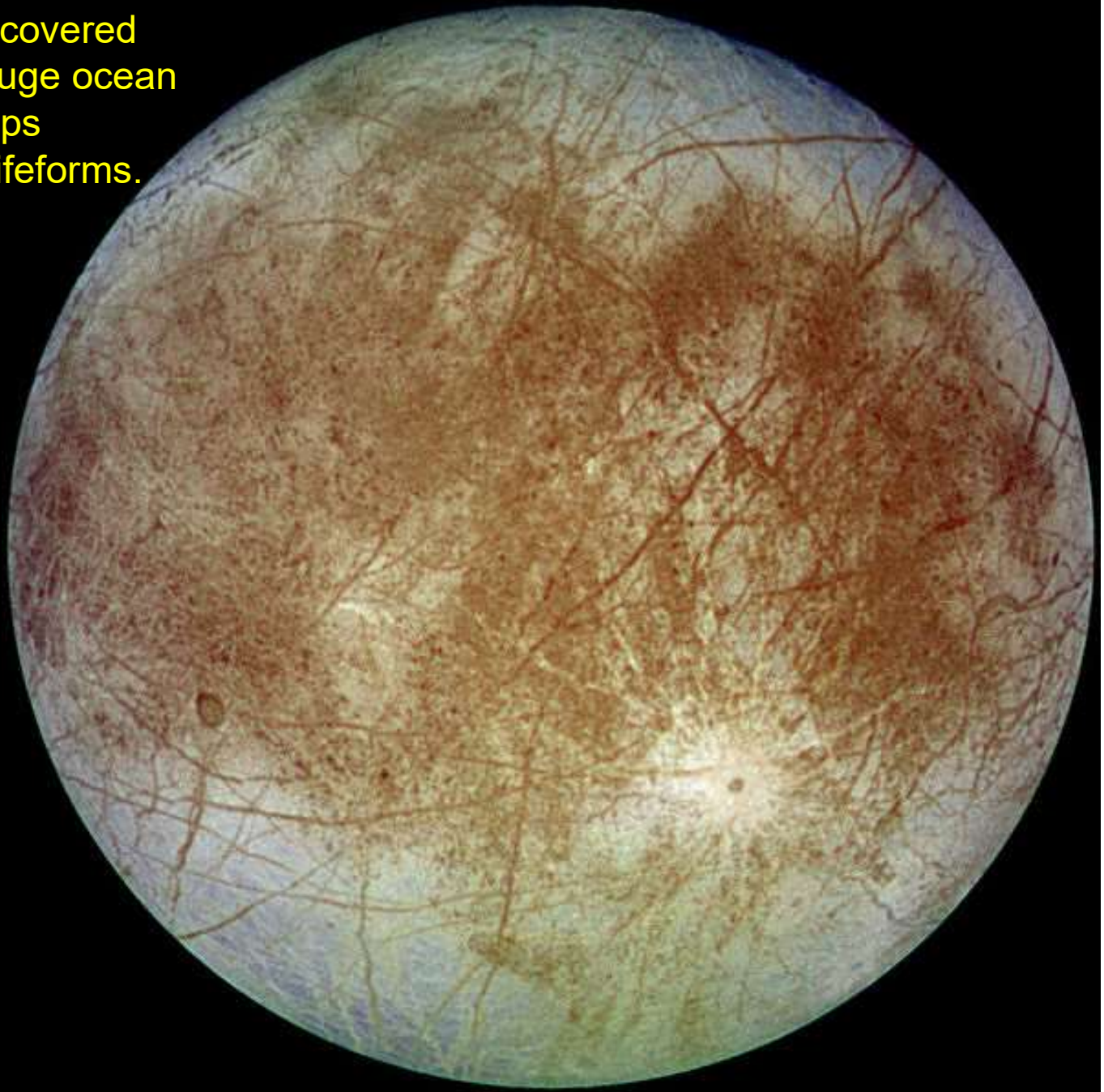
NASA

Jupiter is over ten times the size of the Earth, more massive than all the other planets put together, and rotates rapidly: once every ten hours.

Its atmosphere has a giant red storm spot, which has been there at least 300 years!

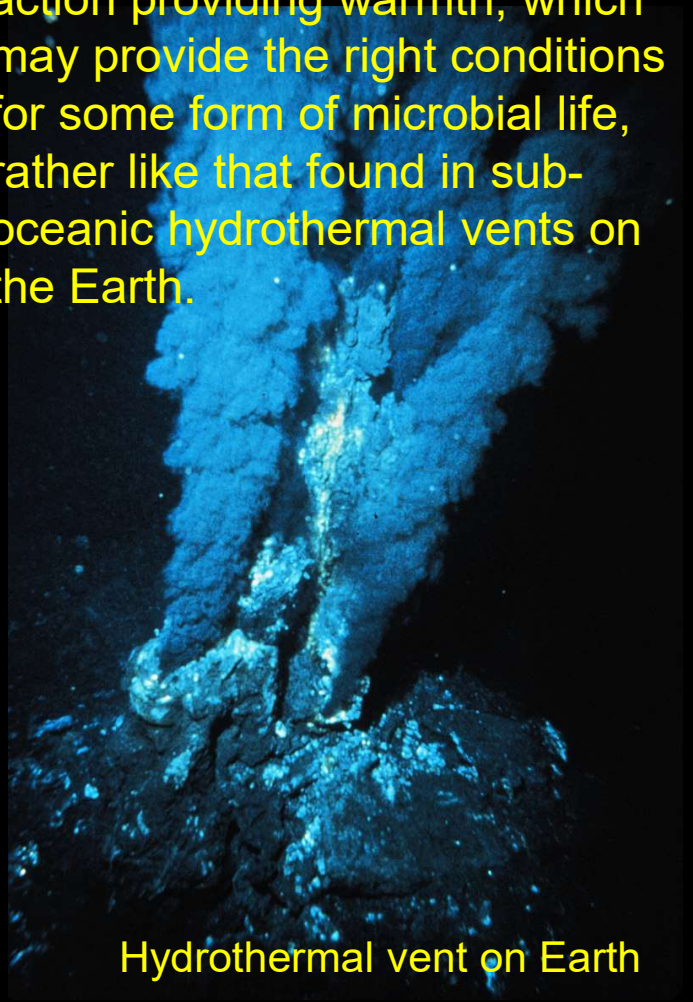
Jupiter has 79 known moons, most very small. Here are the four largest ones.
Ganymede is the largest moon in the solar system.

Jupiter's moon Europa is covered with ice, with possibly a huge ocean of water beneath it, perhaps containing tiny microbial lifeforms.



Simulation

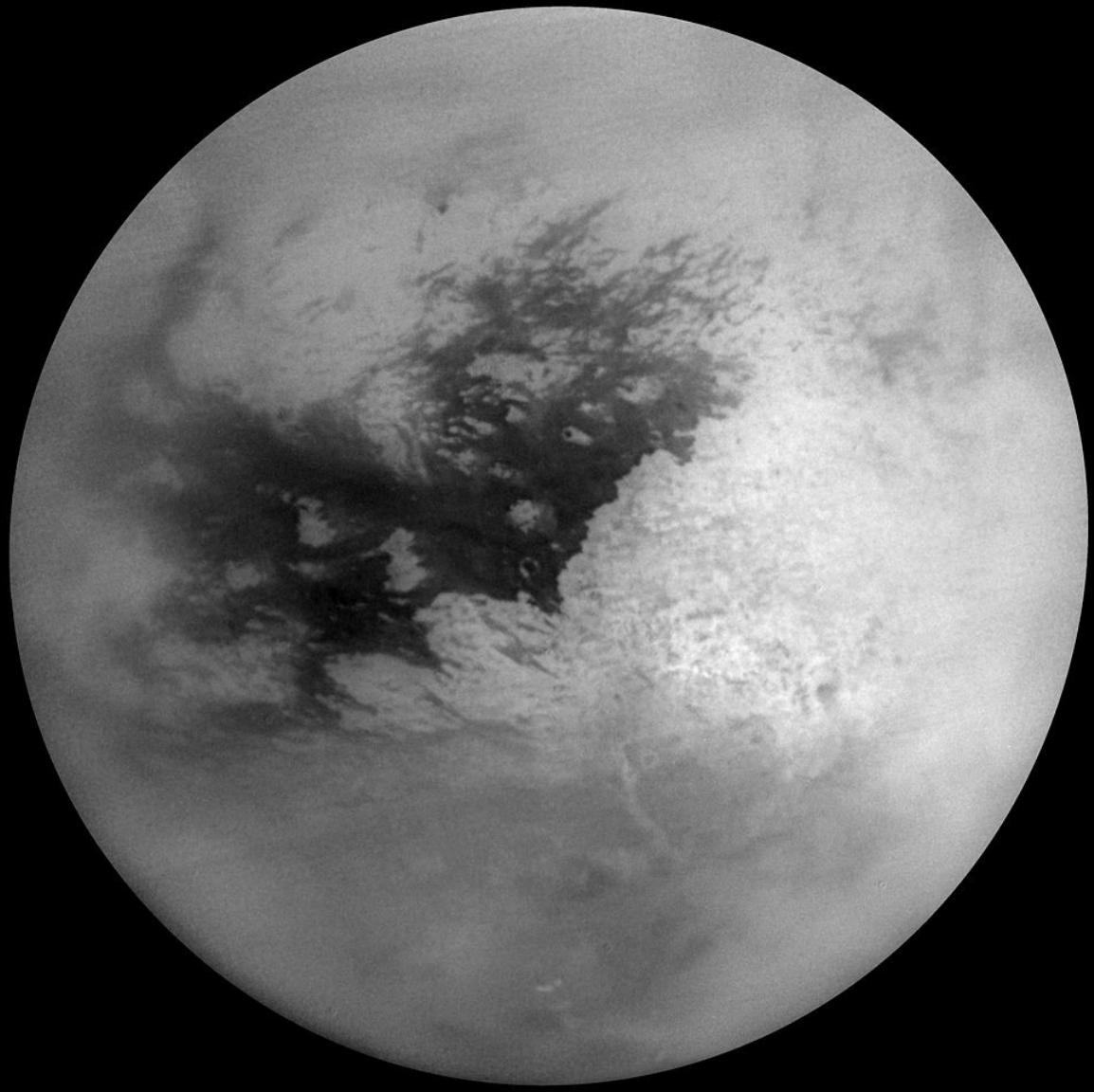
Europa's ice is covered in cracks, and there is some evidence of plumes of water being vented from under the ice. This points to thermal activity, with volcanic action providing warmth, which may provide the right conditions for some form of microbial life, rather like that found in sub-oceanic hydrothermal vents on the Earth.



Hydrothermal vent on Earth

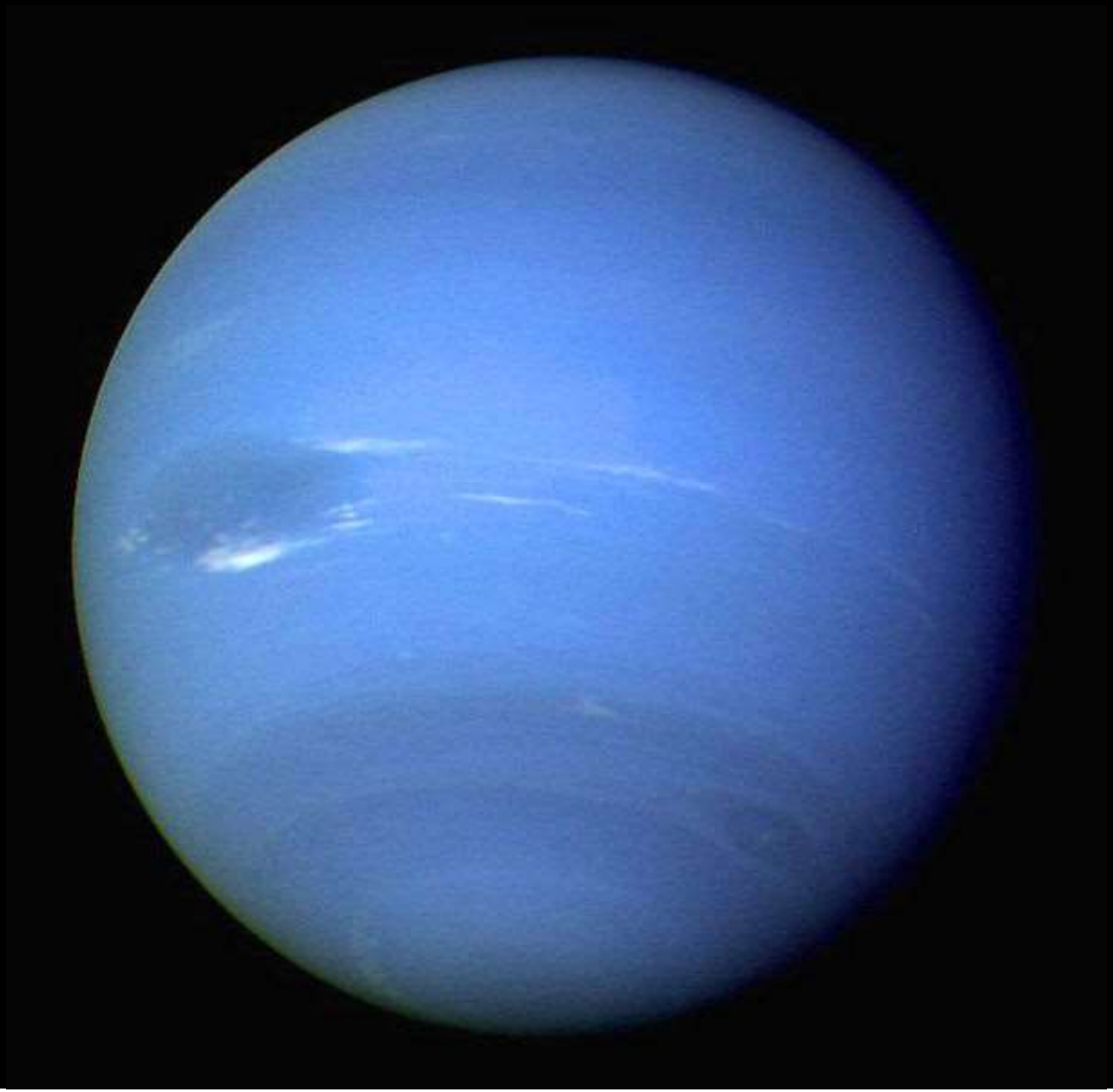
The giant planet Saturn has a beautiful ring system. The rings are made up of ice rocks, perhaps the result of a destroyed moon, or from material left over after the formation of the planet.

Saturn’s largest moon, Titan, has a nitrogen atmosphere (like the Earth), but also contains methane, which might indicate the presence of some kind of life.



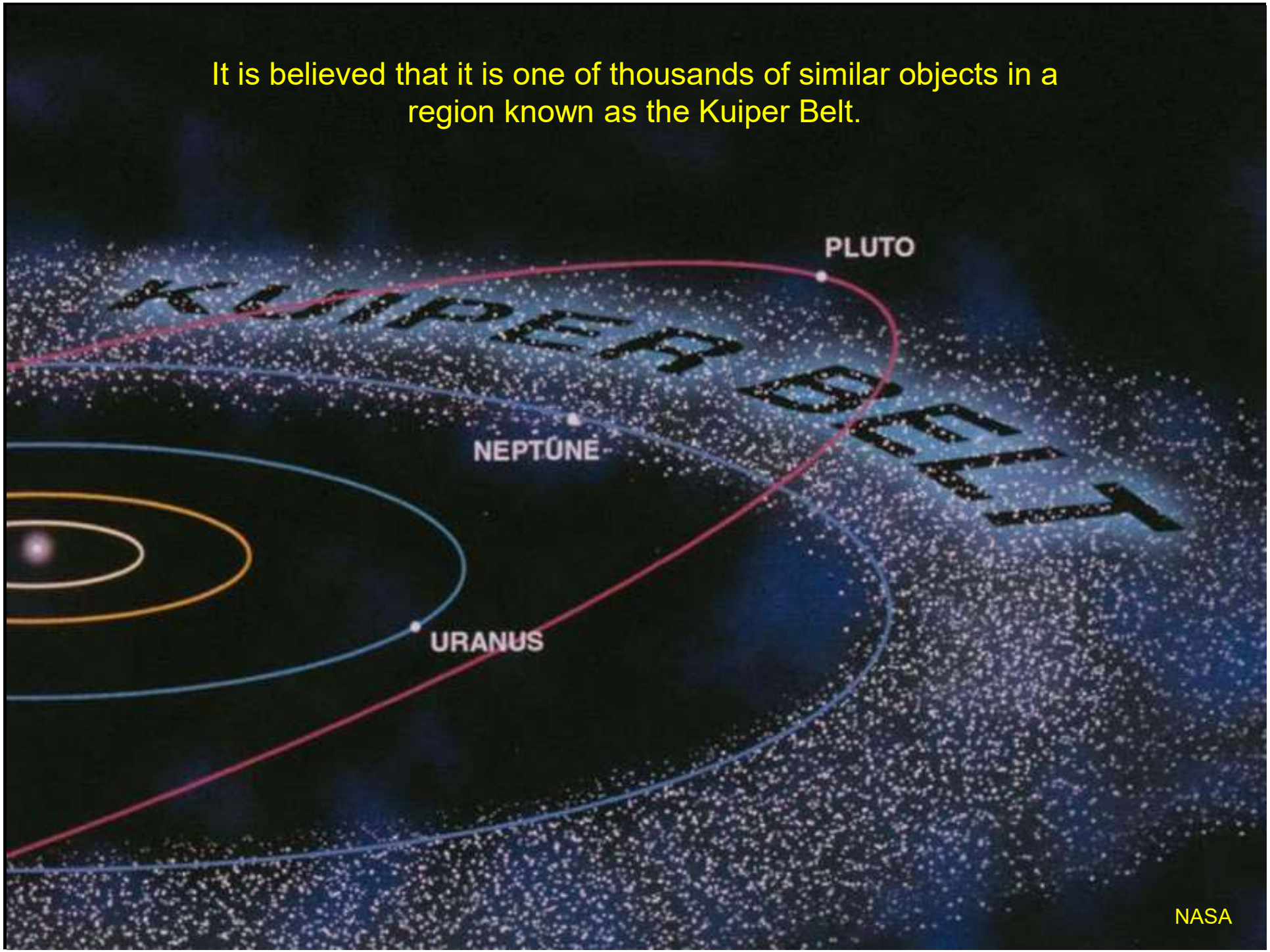
Uranus is another gas giant, with few surface features.

The outermost planet, Neptune, has active weather patterns.



Pluto is classed as a dwarf planet. It is less than 2400 km wide.

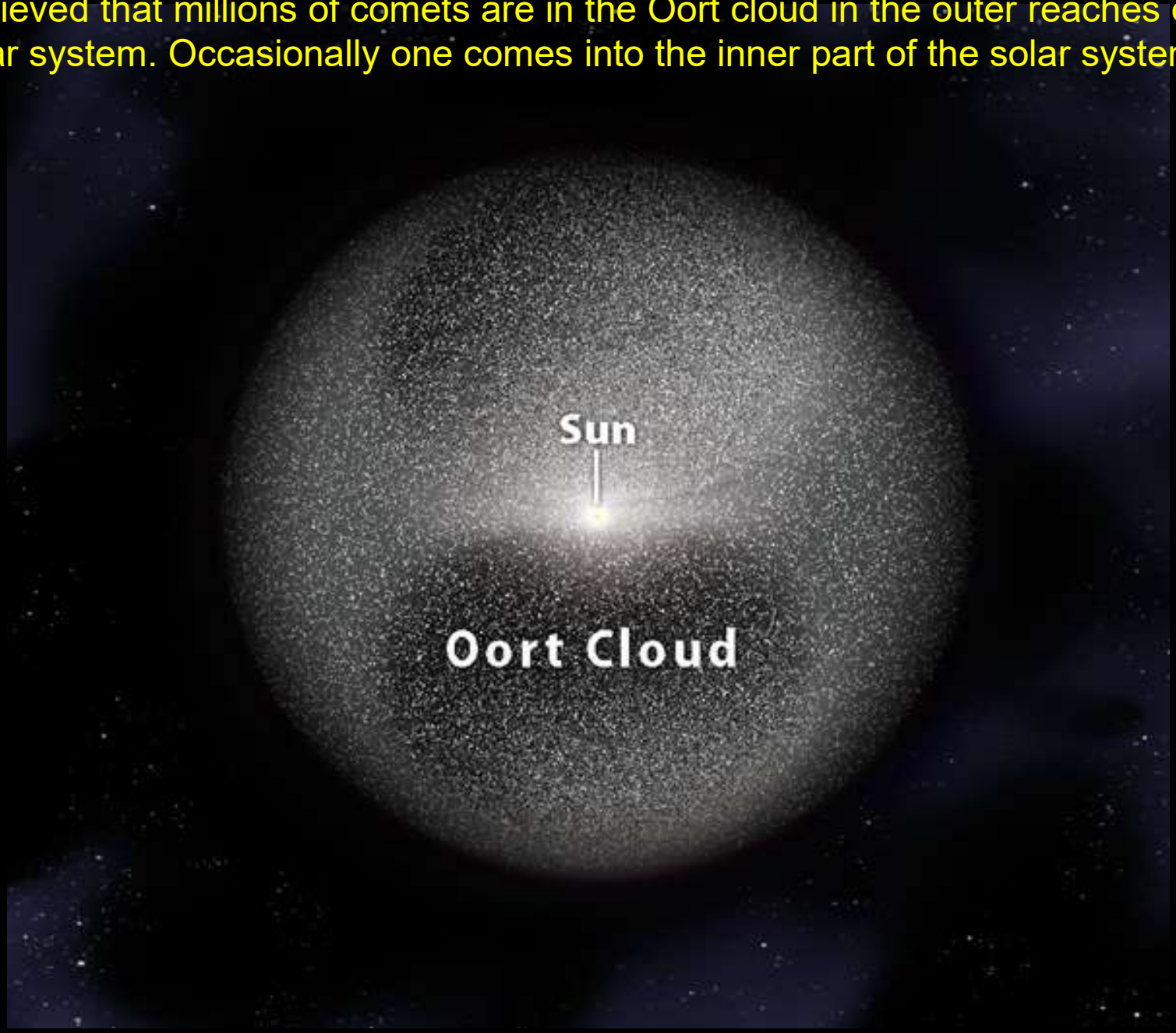
NASA


It is believed that it is one of thousands of similar objects in a region known as the Kuiper Belt.
PLUTO
KUIPER BELT
NEPTUNE
URANUS
NASA

Comets are regular intruders into the inner solar system.
They are giant dirty snowballs, which release gas and dust as they approach the Sun, producing beautiful tails.

Comet Hale-Bopp, David Le Conte, 1997

It is believed that millions of comets are in the Oort cloud in the outer reaches of the solar system. Occasionally one comes into the inner part of the solar system.



We are so fortunate to live in our wonderful solar system ...

… on a beautiful Earth. Let's take care of it!

Earth – The 'Blue Marble'
NASA, Apollo 17, 1972

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