EARTH, OUR SOLAR SYSTEM & IT'S PLANETS, OUR MILKY WAY GALAXY AND OUR PLACE IN IT ALL

COMPILED BY HOWIE BAUM

THE PAST

CREATION OF THE UNIVERSE, LEADING UP TO TODAY

THE ELEMENTS

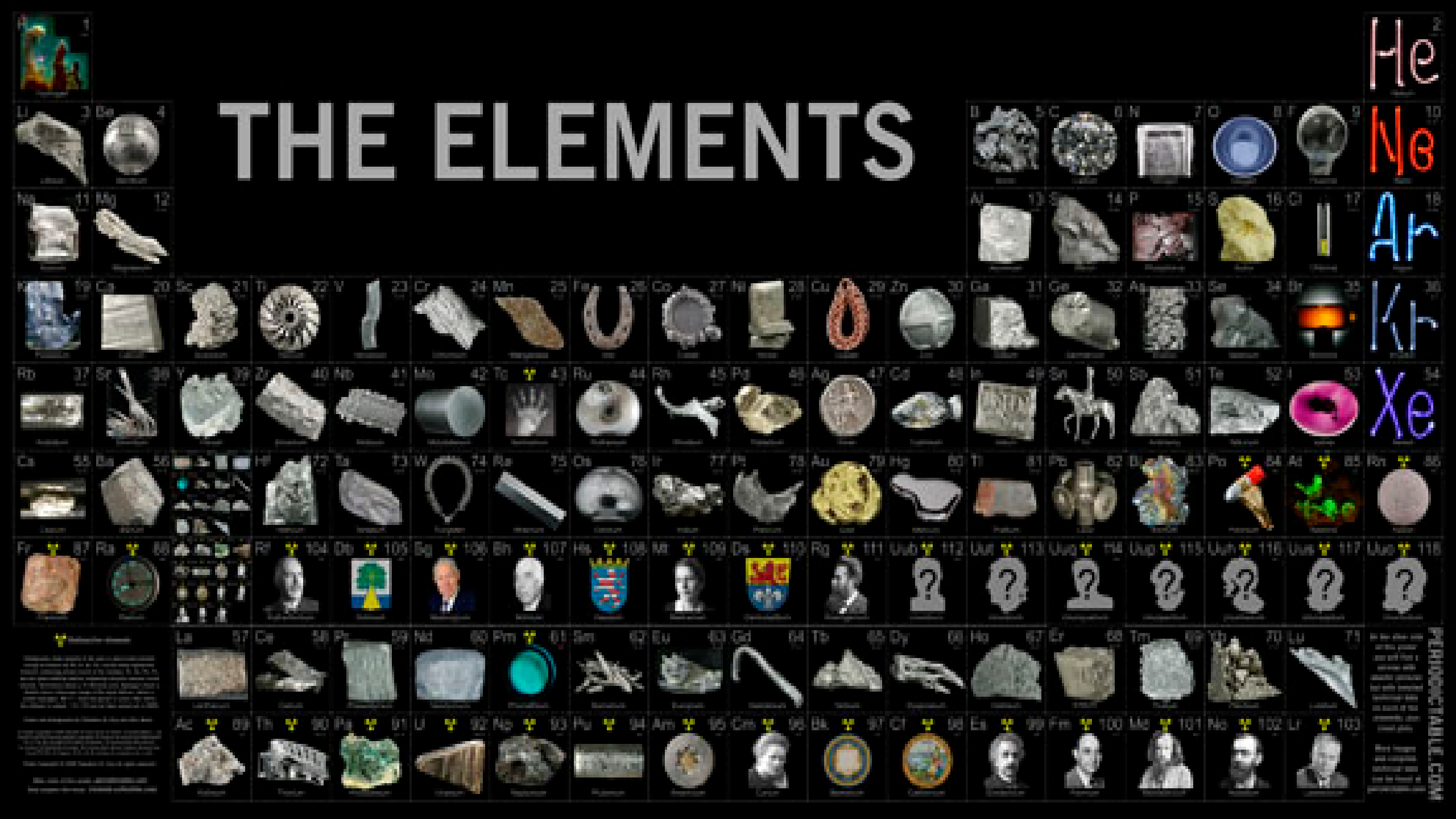
Chemical elements constitute all of the ordinary matter of the universe and 94 of them occur naturally on Earth.

The two lightest elements, hydrogen and helium, were mostly formed in the Big Bang and are the most common elements in the universe.

Small amounts of Lithium and Beryllium metal were also formed then.

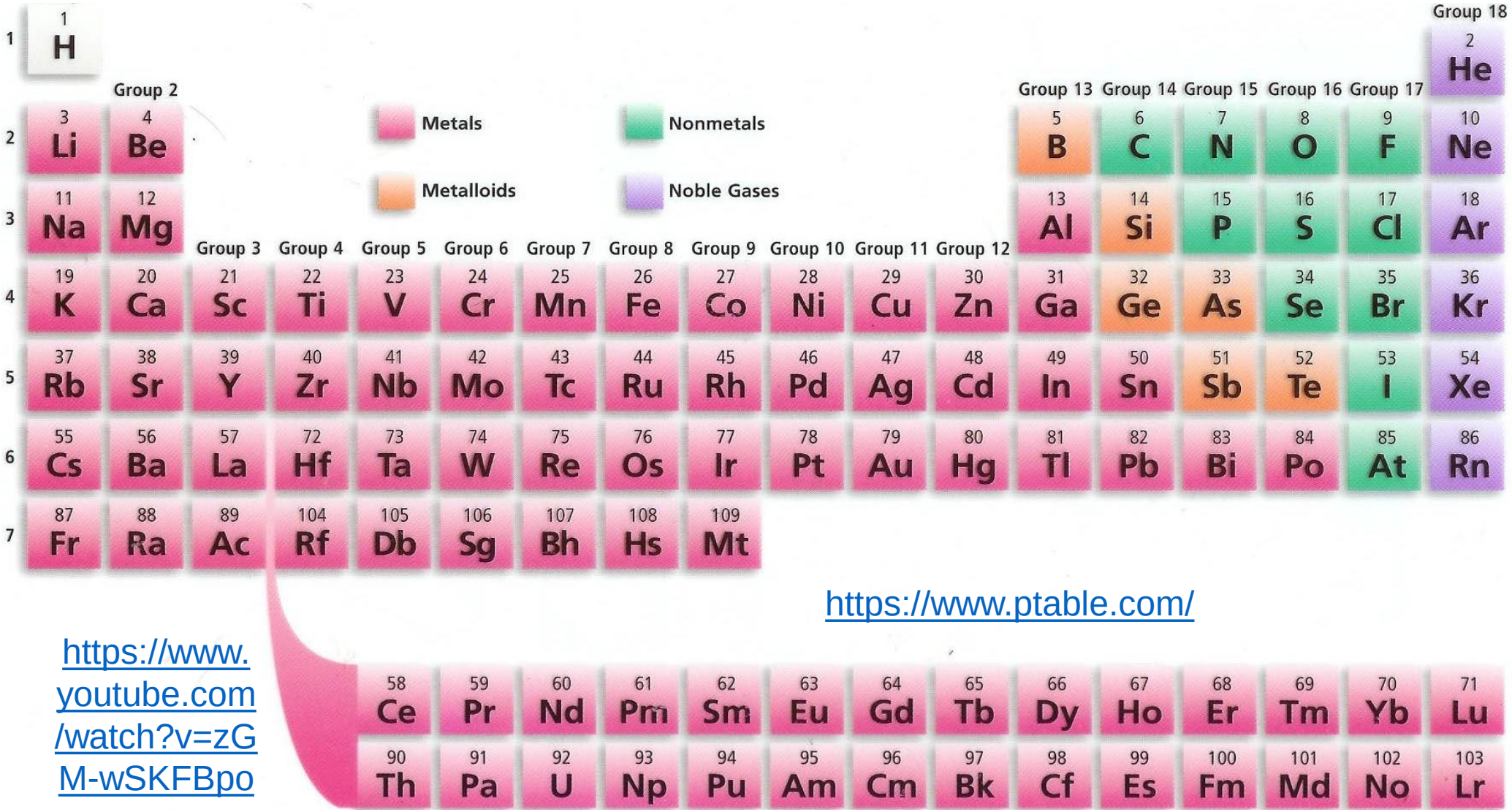
"IN THE BEGINNING", PER THE SCIENTIFIC VIEW, OUR UNIVERSE WAS BORN 13.8 BILLION YEARS AGO WITH THE "BIG BANG"

THE ELEMENTS



How are Elements Classified?

Four Regions: metals, nonmetals, metalloids, & inert gases. 75% or more of all of the elements are metals !!!



https://www.ptable.com/

https://www.youtube.com/watch?v=zGM-wSKFBpo

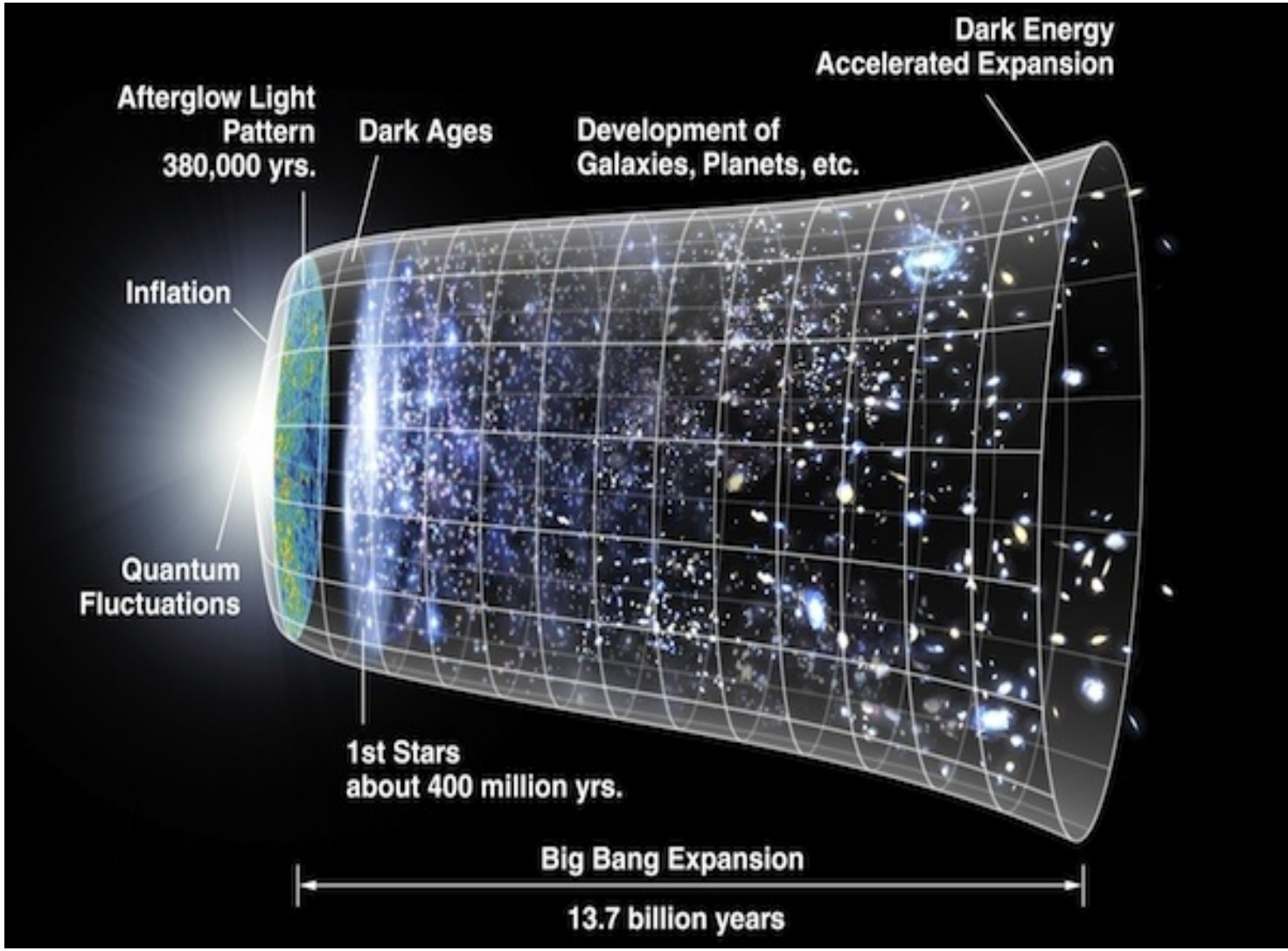
•THE EXPANSION OF THE UNIVERSE IS INCREASING !

•In 1998, with the use of the Hubble Telescope, it was found that the Universe is expanding faster than it did than when it was formed !

• The really amazing thing is that roughly 68% of the **universe** is **dark energy**.

• **Dark matter** makes up about 27% of the Universe.

• The rest - everything on Earth,planets, Galaxies and everything ever observed with all of our instruments, all normal **matter** - adds up to less than 5% of the **universe !**



WHERE DID ALL OF THE OTHER ELEMENTS COME FROM ?

This is a cutaway diagram of the interior of a highly evolved star of large mass.

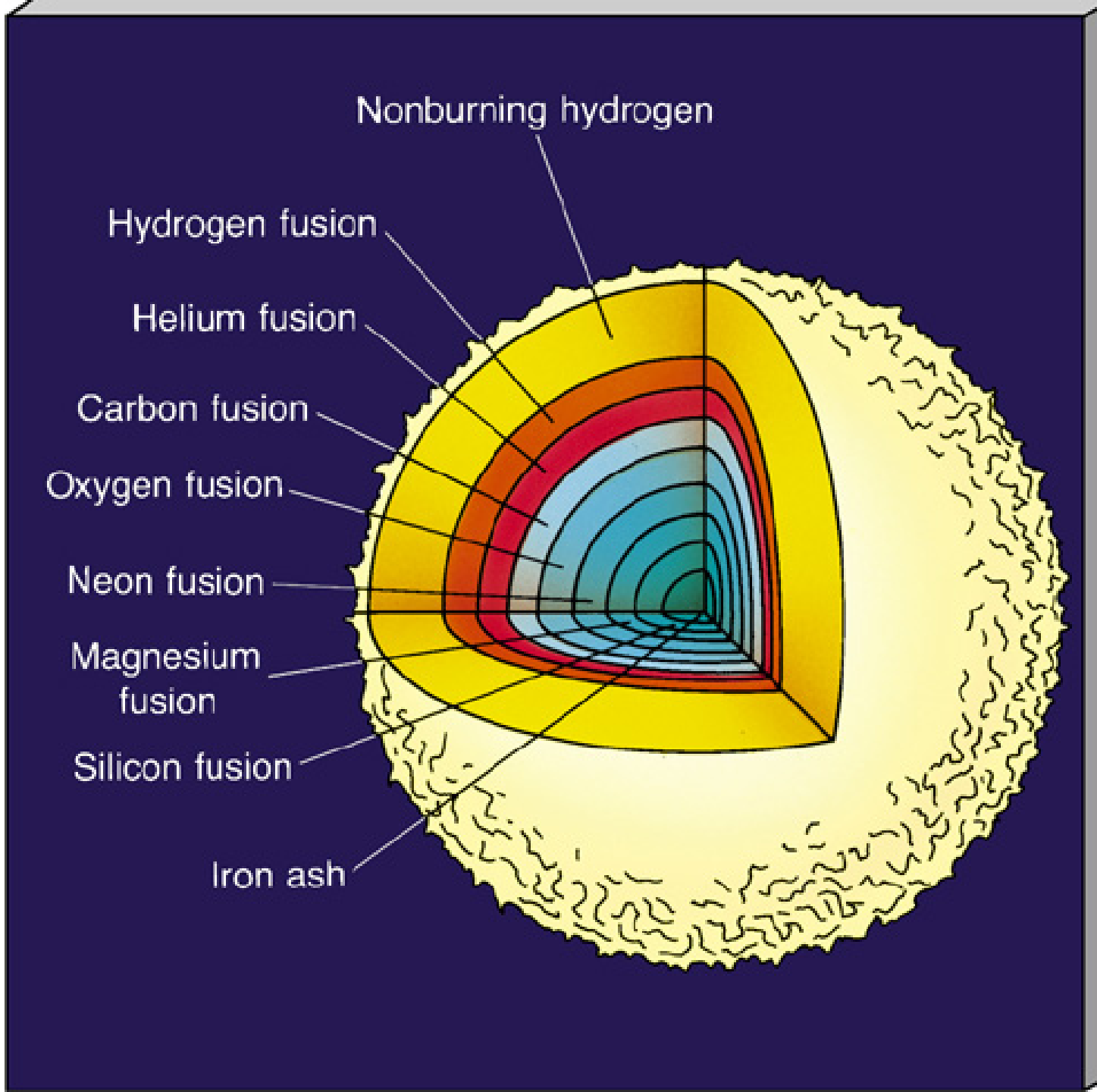
Note the numerous layers where various nuclei burn.

As the temperature increases with depth, the ash of each burning stage becomes the fuel for the next stage.

At the relatively cool outside surface, hydrogen fuses into helium.

In the intermediate layers, shells of helium, carbon, and oxygen burn to form heavier elements !

Deeper down reside neon, magnesium, silicon, and other heavy elements, all produced by nuclear fusion in the layers overlying the core. The core itself is composed of iron.



STARS THAT GO SUPERNOVA

Before the early 17th century (when telescopes became available), there were only 7 recorded supernovae.

What we know today as the Crab Nebula is the most famous of these.

Chinese and Korean astronomers recorded this star explosion in their records in the year 1054, and southwestern Native Americans may have seen it as well (according to rock paintings seen in Arizona and New Mexico).

The supernova that formed the Crab Nebula was so bright that astronomers could see it during the day.

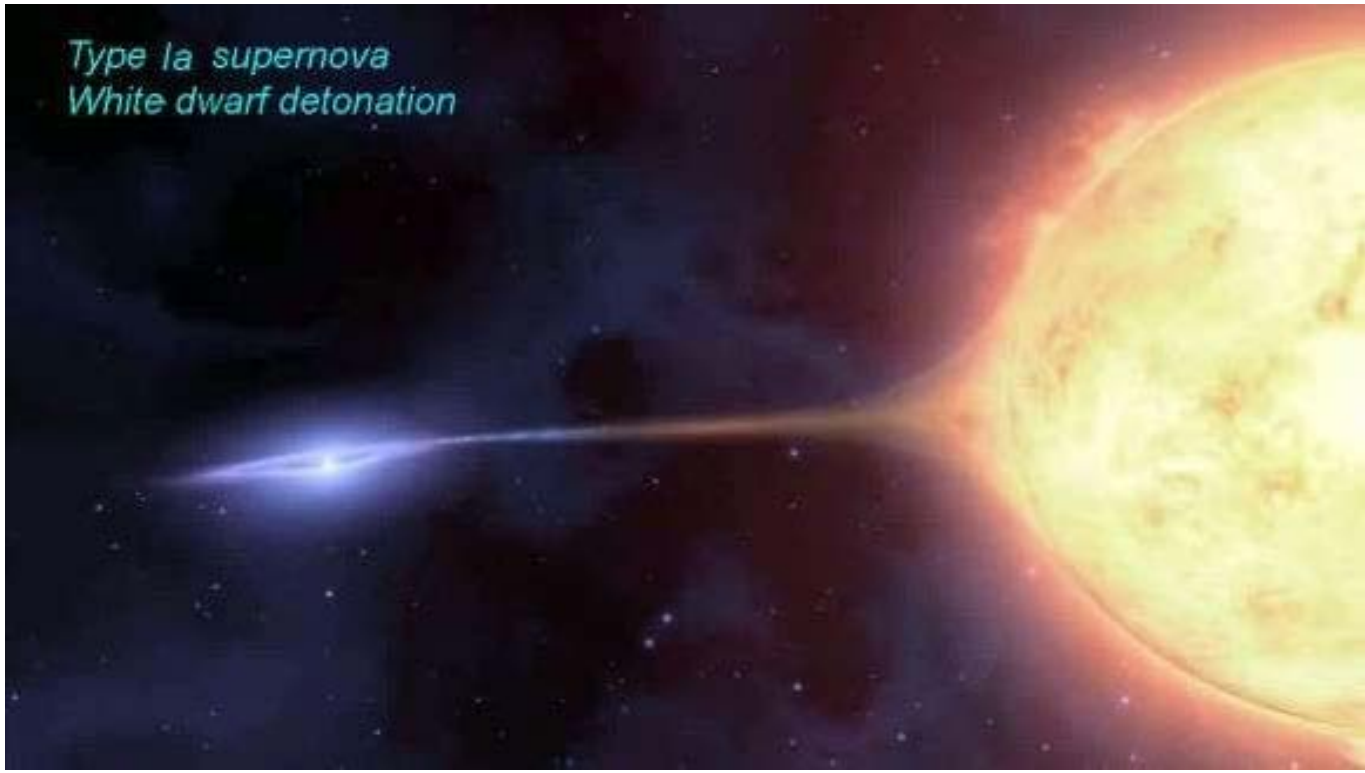
Supernovae are stars that suddenly increase drastically in brightness (billions of times more luminous than the Sun), outshining their own galaxies.

They reach this brightness in just a few hours and take from weeks to months to fade.

Supernovae are divided into two basic physical types:

Type Ia. These result from some binary (double) star systems in which a carbon-oxygen white dwarf is taking matter from its companion star.

So much mass piles up on the white dwarf that its core reaches a critical density which is enough to result in an uncontrolled fusion of carbon and oxygen, thus detonating the star.

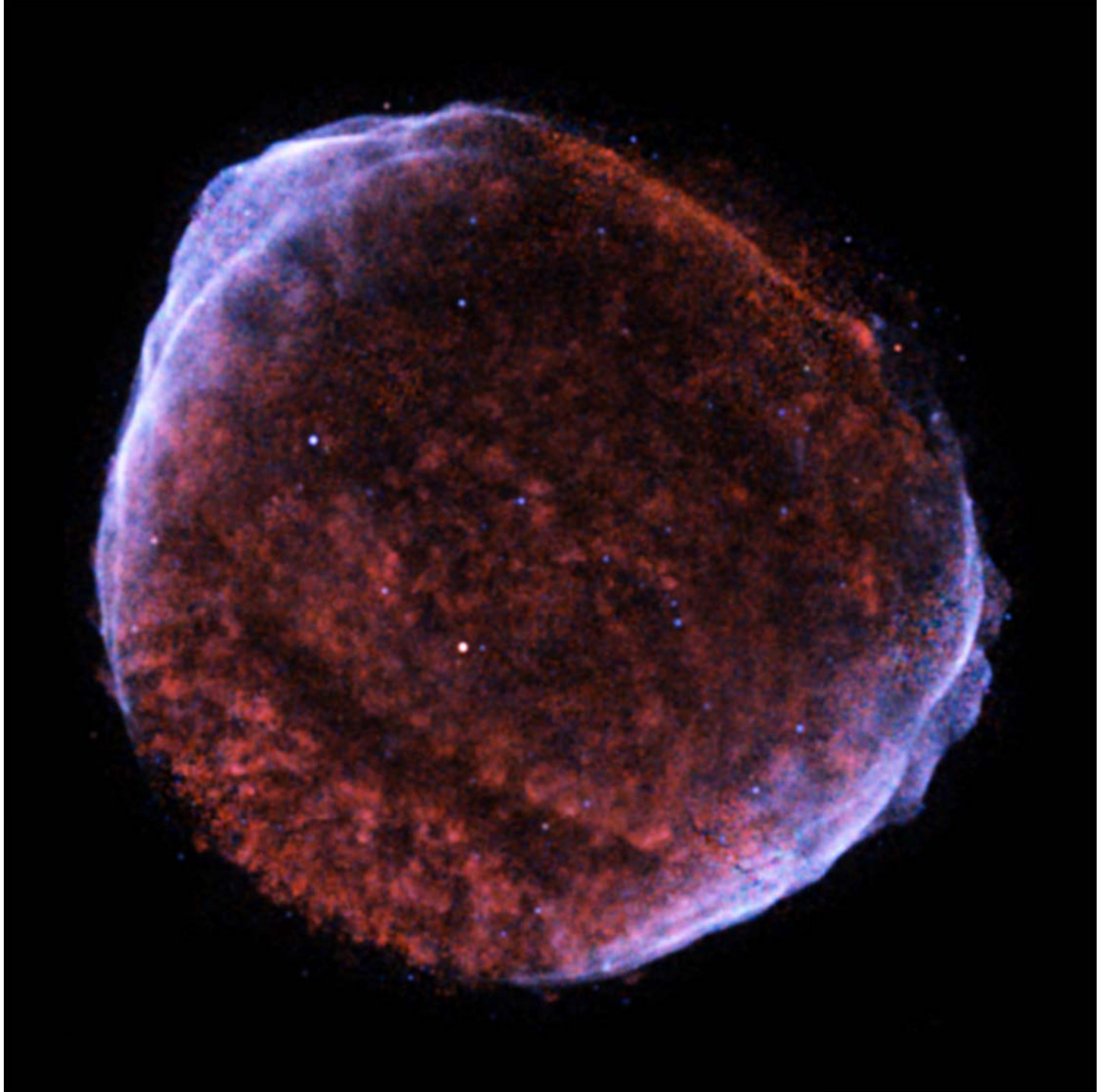


SN 1006 was a Type 1a supernova that is likely the brightest observed stellar event in recorded history and was more than 16 times the brightness of Venus.

Appearing between April 30 and May 1, 1006 AD in the constellation of Lupus, this "guest star" was described by observers across China, Japan, Iraq, Egypt, and the continent of Europe, and possibly recorded in North American petroglyphs.

Some reports state it was clearly visible in the daytime.

Modern astronomers now consider its distance from Earth to be about 7,200 light-years.

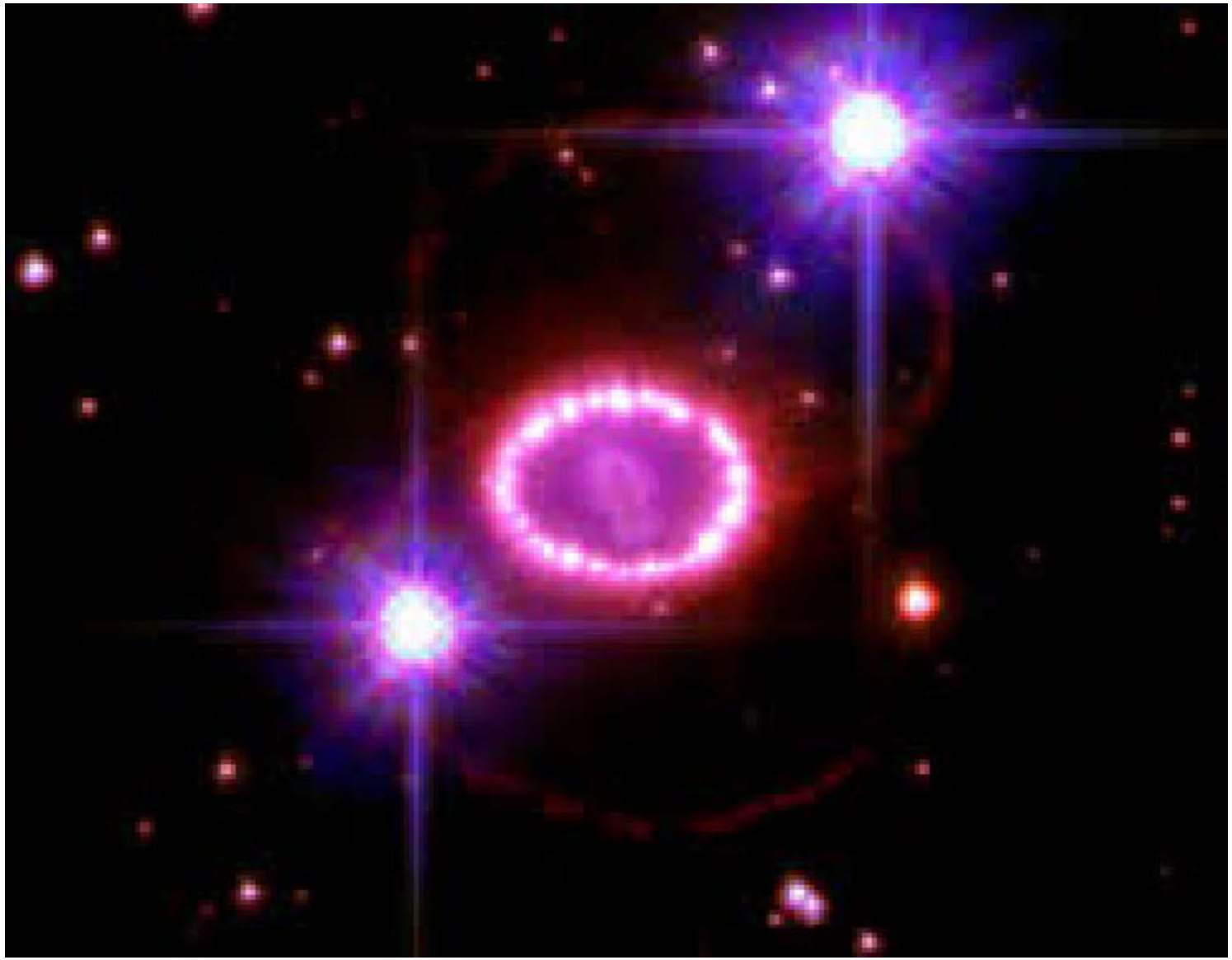


The other is a Type II Supernova

For a star to explode as a Type II supernova, it must be several times more massive than the sun (estimates run from eight to 15 solar masses).

These supernovae occur at the end of a massive star's lifetime, when its nuclear fuel is used up and it is no longer supported by the release of nuclear energy.

If the star's iron core is big enough, it will collapse and explode to become a supernova.



SUPERNOVA 1987A

AN EXAMPLE OF A TYPE 2 SUPERNOVA

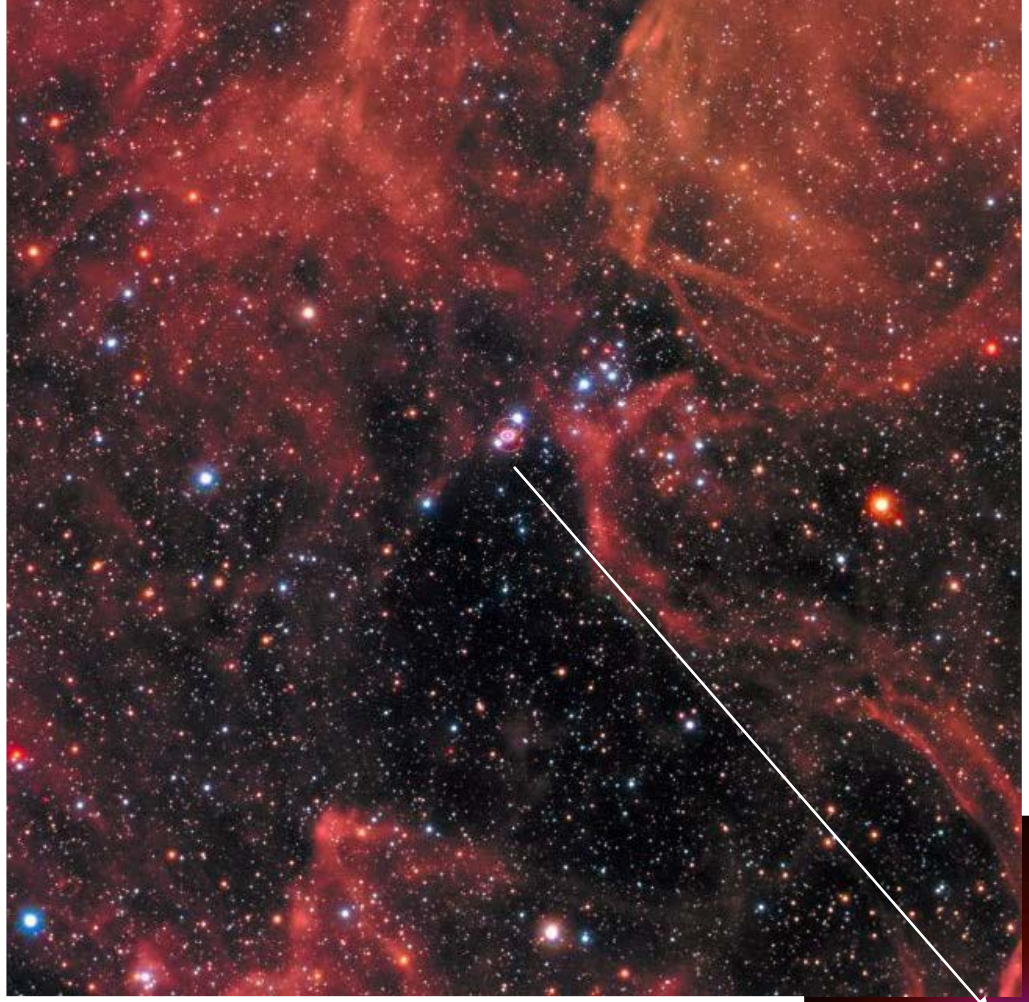
THE FIRST TIME WE COULD SEE BEFORE, DURING, AND AFTER A STAR WENT SUPERNOVA

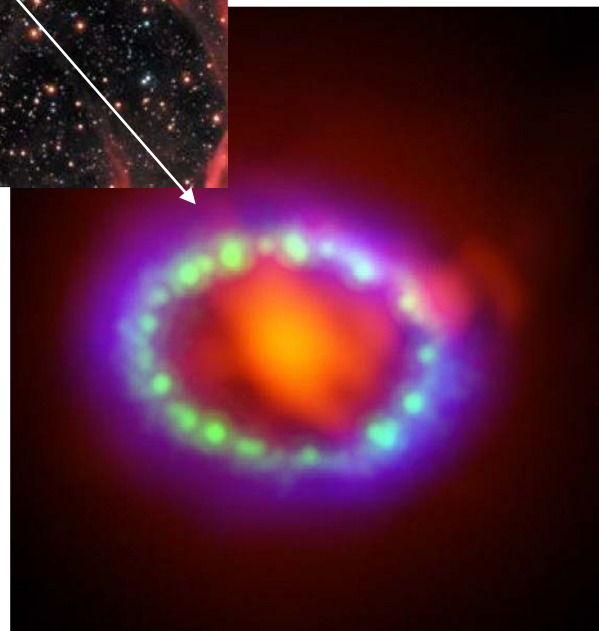
The strikingly bright shock waves from a massive star explosion first observed in 1987 can still be seen today, 33 years later.

This brilliant star explosion, called Supernova 1987A, occurred only 160,000 light-years from Earth in a satellite galaxy of the Milky Way known as the Large Magellanic Cloud.

(What we see now, happened 160,000 years ago when the first humans were just beginning in East Africa !)

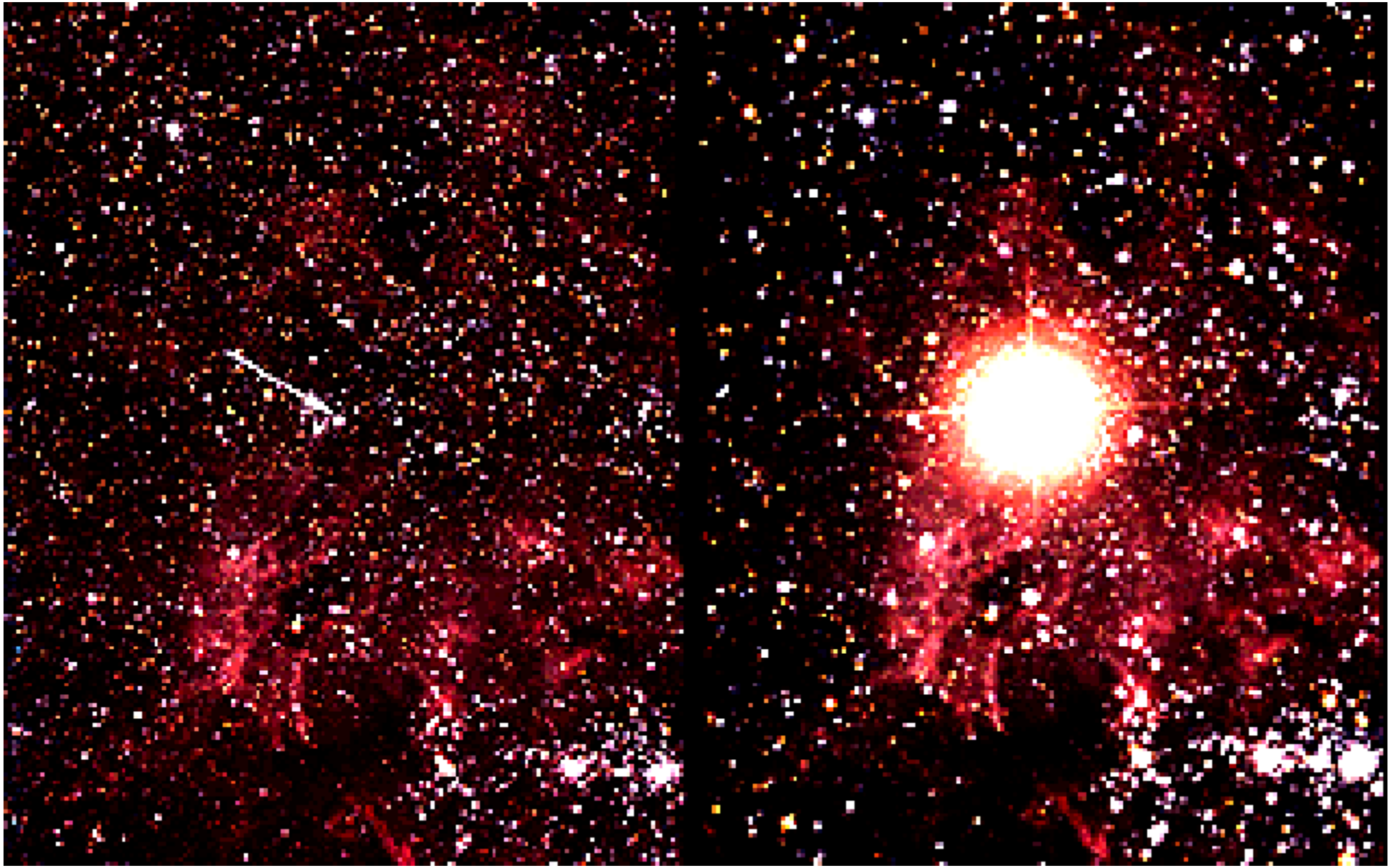
The supernova was one of the brightest observed and closest to Earth, providing astronomers with a unique opportunity to study the phases before, during, and after the death of a star





https://www.youtube.com/watch?v=l0mPOXVkpiQ

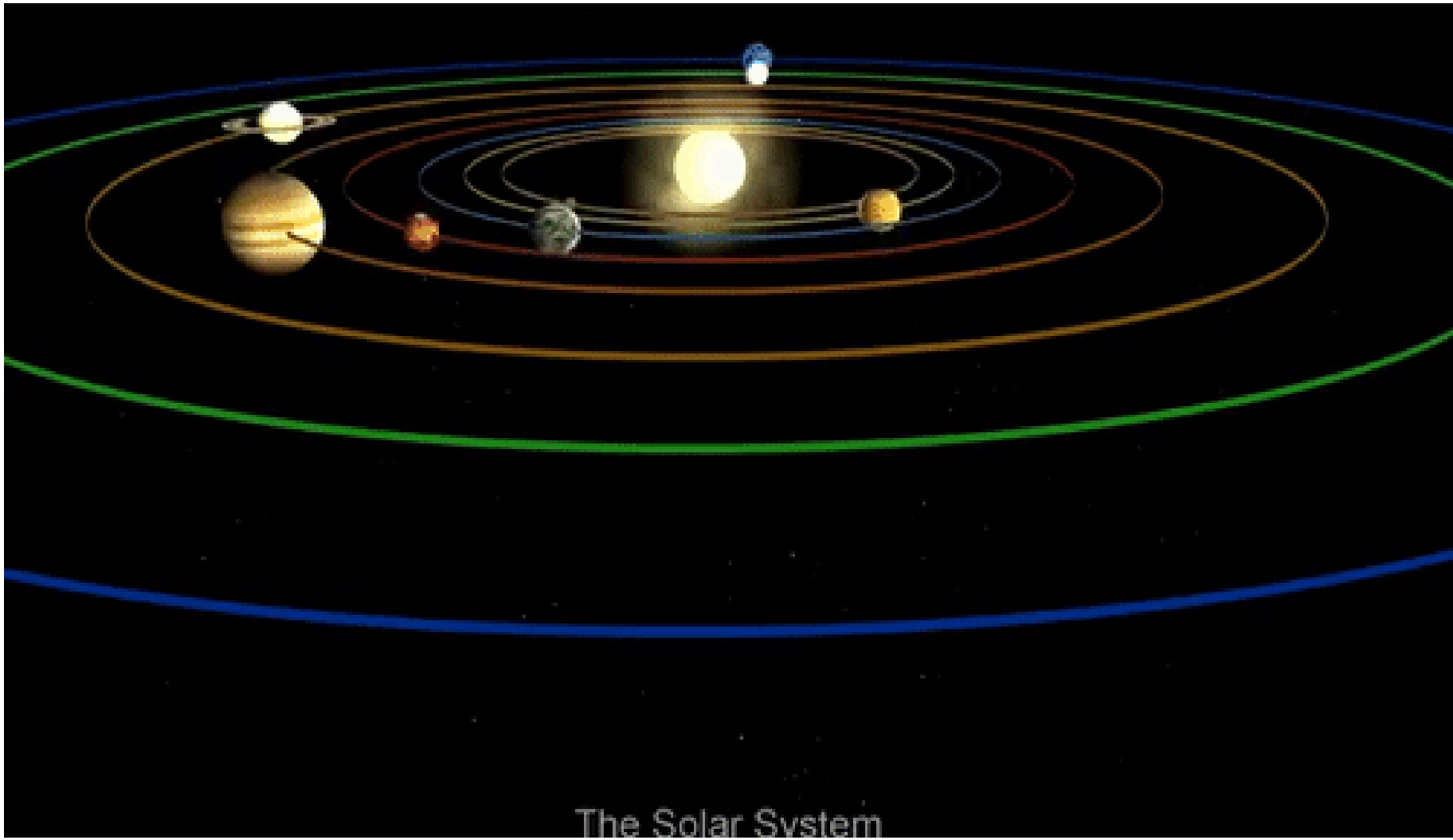
BEFORE AND AFTER OF THE SUPERNOVA 1987 A



THE SOLAR SYSTEM

Our solar system consists of our star, the Sun (which would be a lot bigger in the diagram), and everything bound to it by gravity.

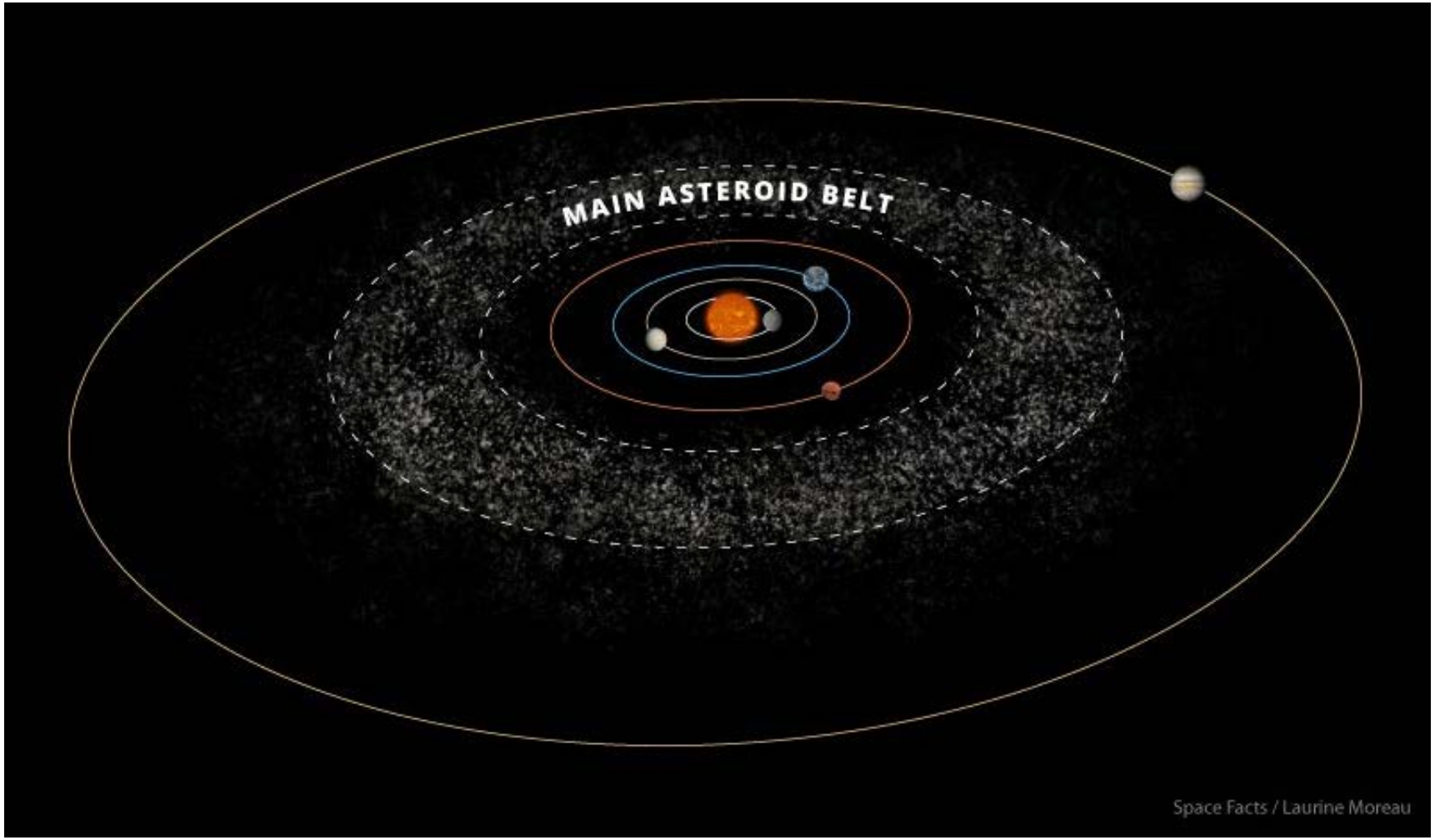
The planets Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune, dwarf planets such as Pluto, dozens of moons and millions of asteroids, comets and meteoroids.

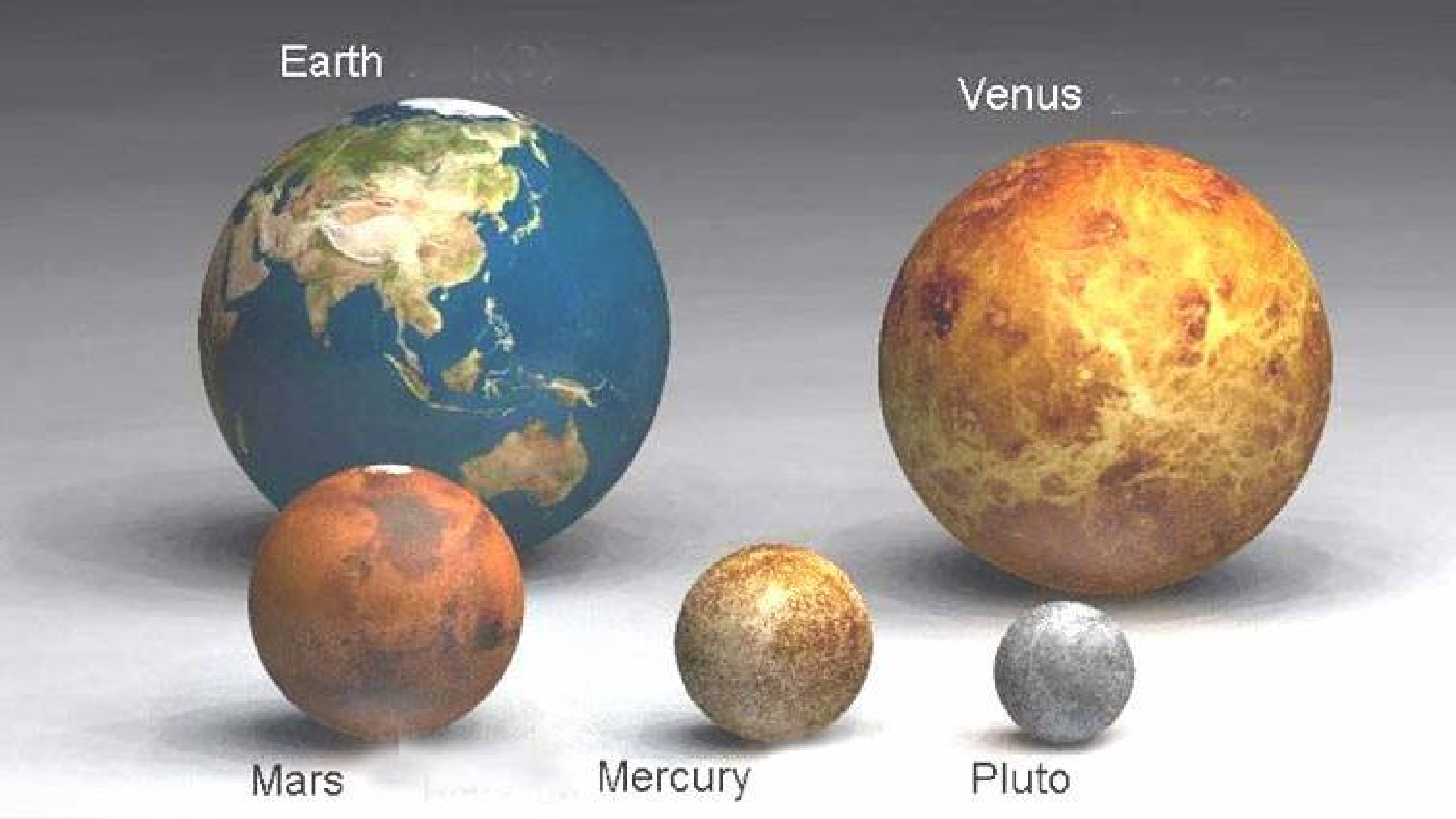


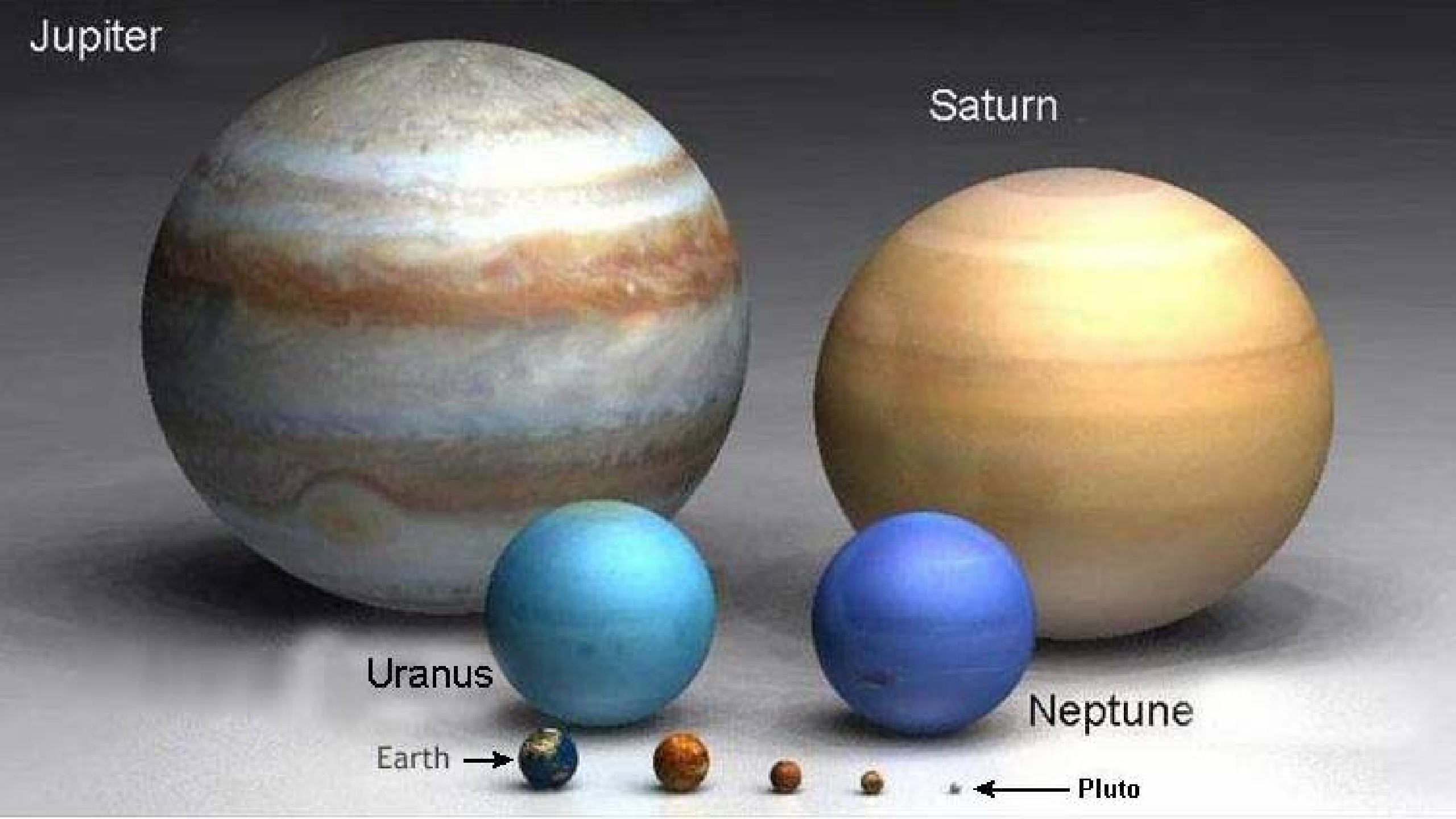
HOW THE SOLAR SYSTEM WAS FORMED
https://www.youtube.com/watch?v=Uhy1fucSRQI

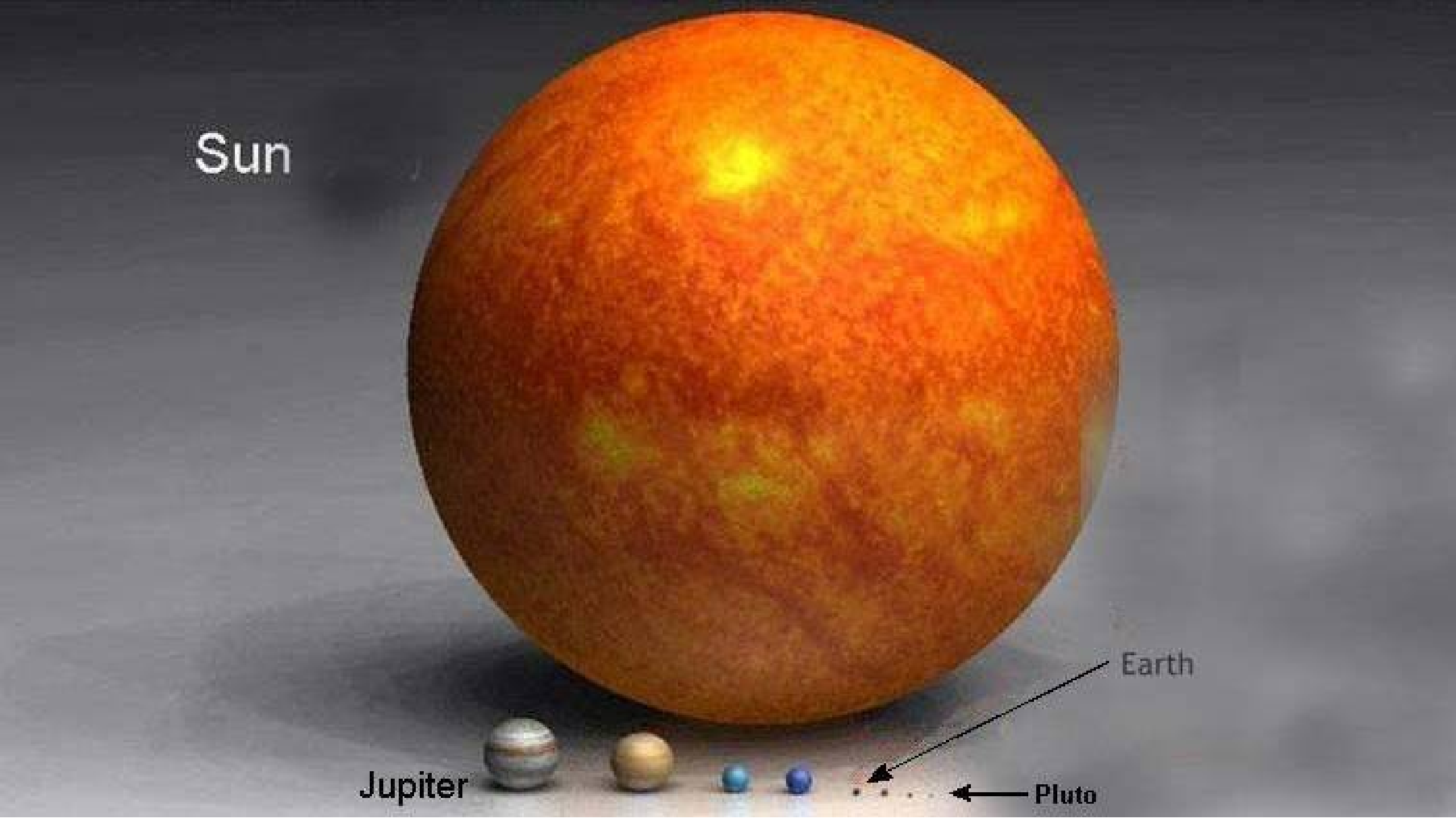
ASTEROID BELT

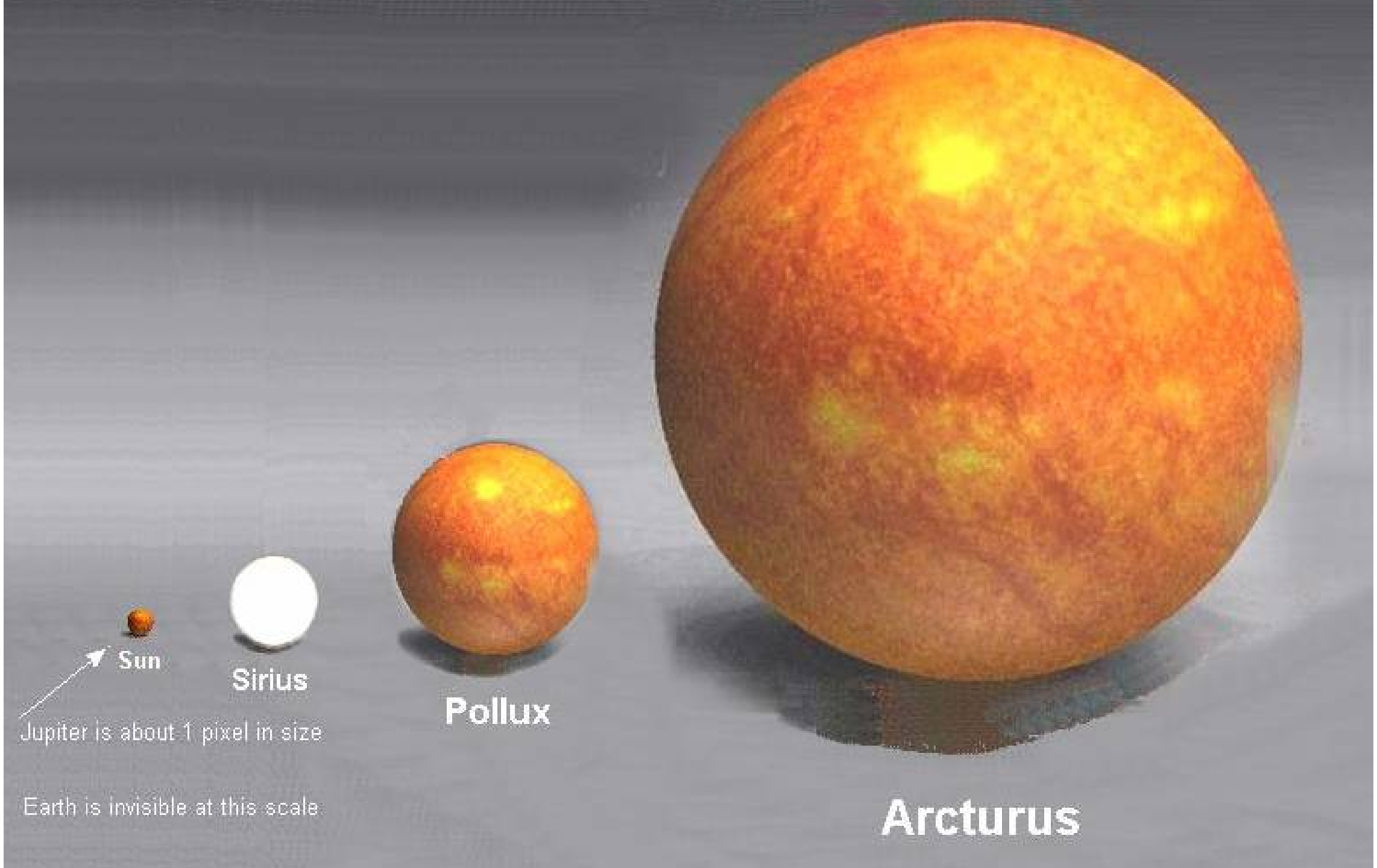
The asteroid belt is a torus-shaped region in the Solar System, located roughly between the orbits of the planets Jupiter and Mars, that is occupied by a great many solid, irregularly shaped bodies, of many sizes but much smaller than planets, called asteroids or minor planets




Earth
Venus
Mars
Mercury
Pluto

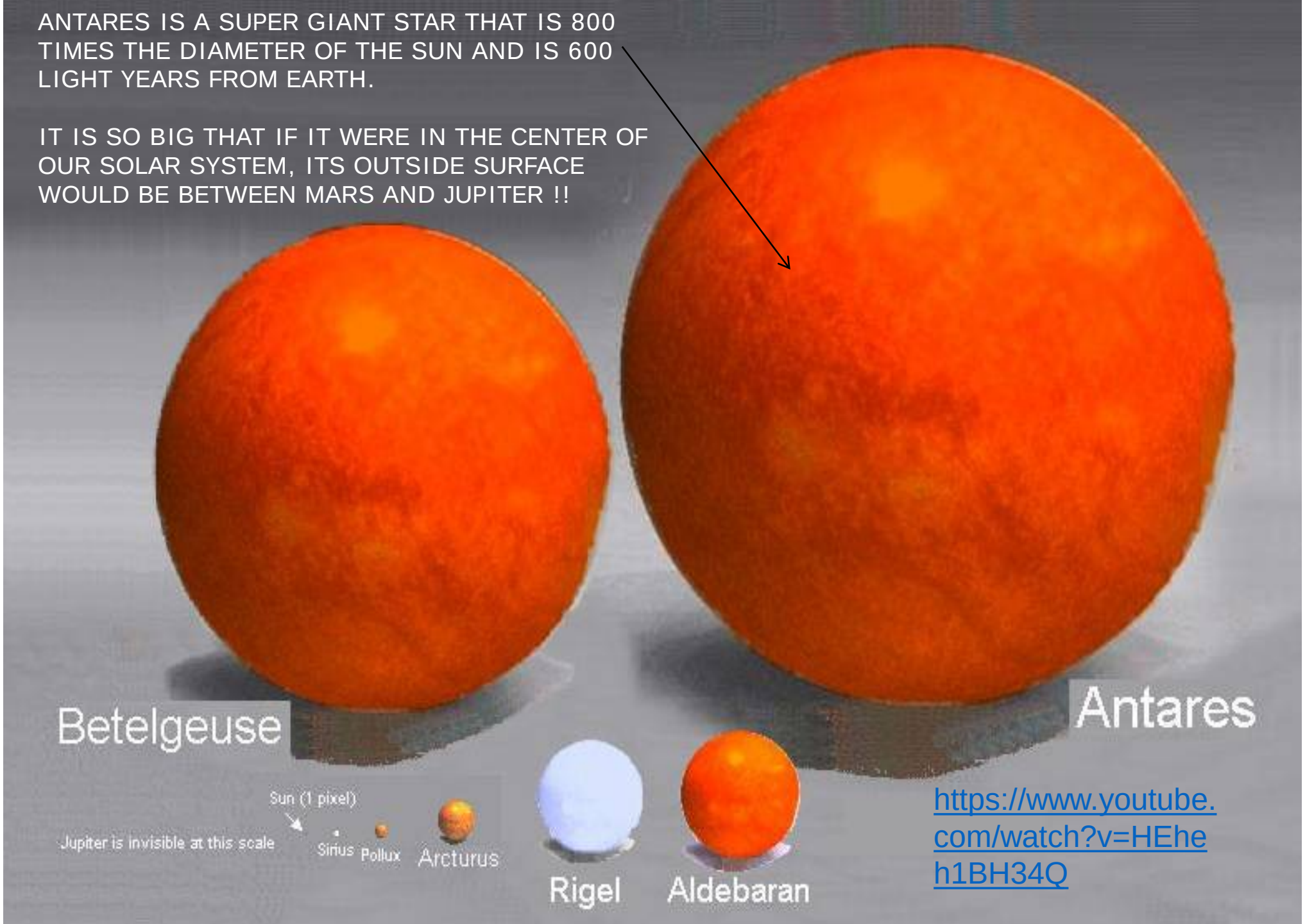

Jupiter
Saturn
Uranus
Neptune
Earth
Pluto


Sun
Earth
Jupiter
Pluto


Sun
Sirius
Pollux
Arcturus
Jupiter is about 1 pixel in size
Earth is invisible at this scale

ANTARES IS A SUPER GIANT STAR THAT IS 800 TIMES THE DIAMETER OF THE SUN AND IS 600 LIGHT YEARS FROM EARTH.

IT IS SO BIG THAT IF IT WERE IN THE CENTER OF OUR SOLAR SYSTEM, ITS OUTSIDE SURFACE WOULD BE BETWEEN MARS AND JUPITER !!



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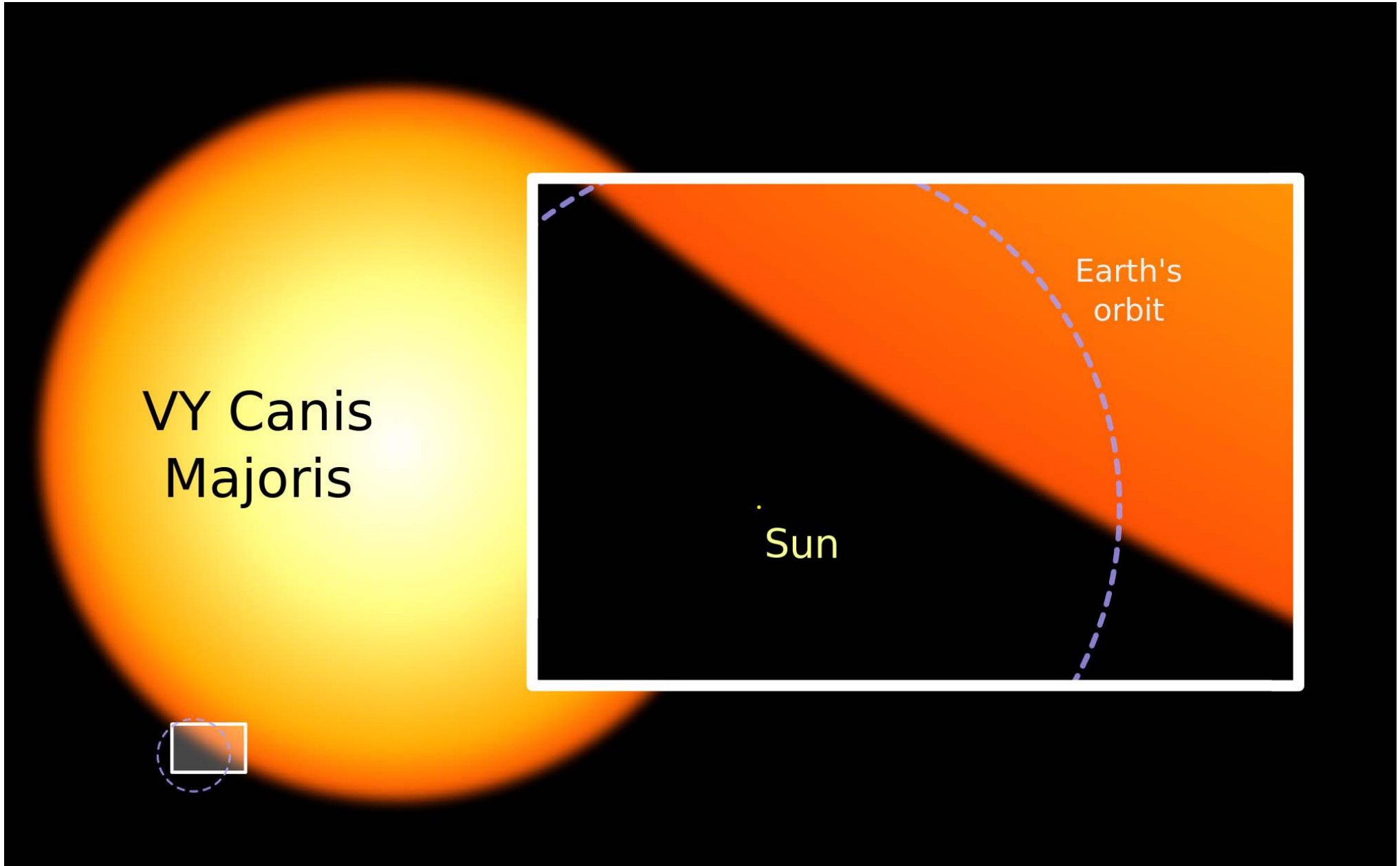
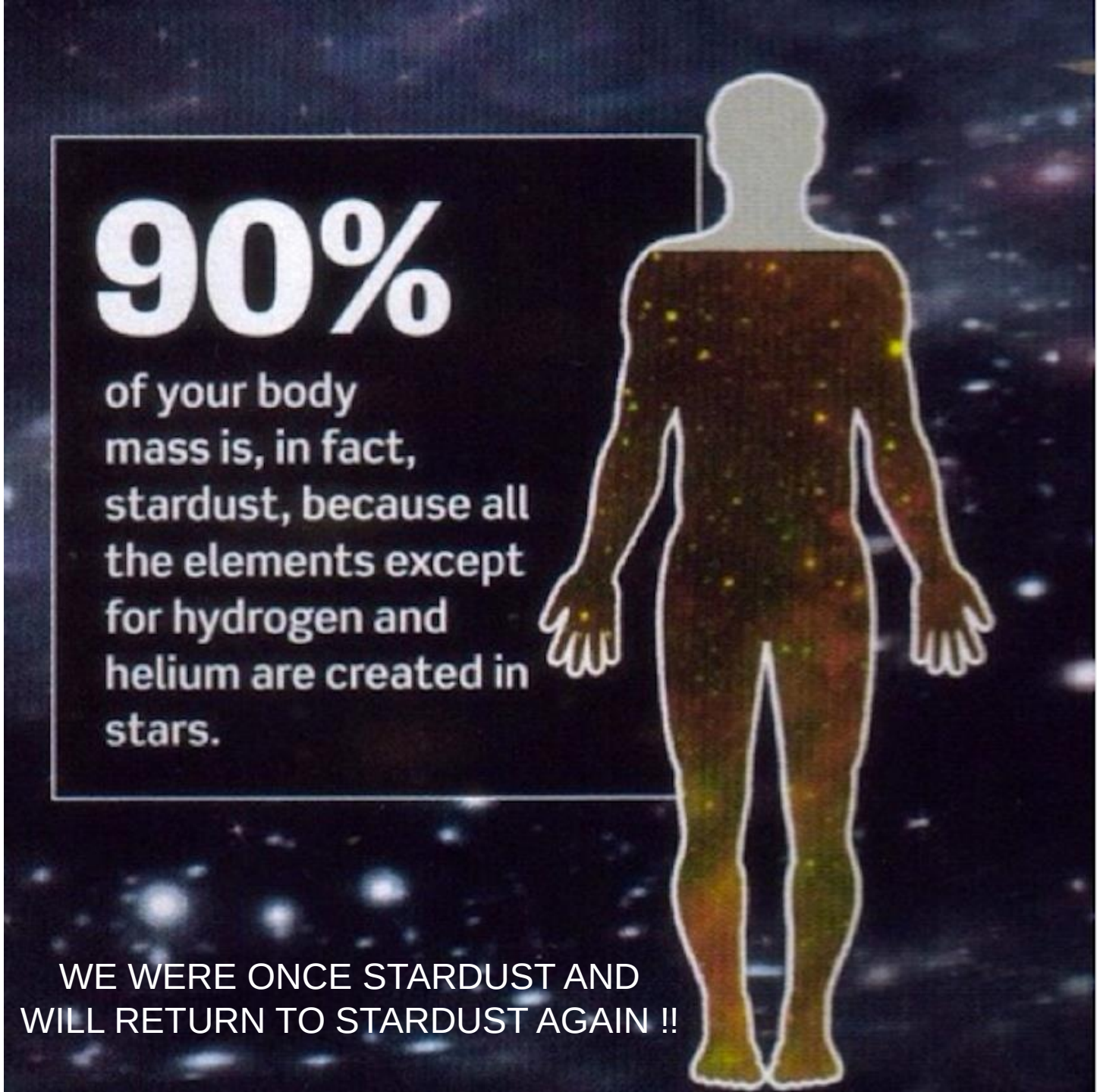
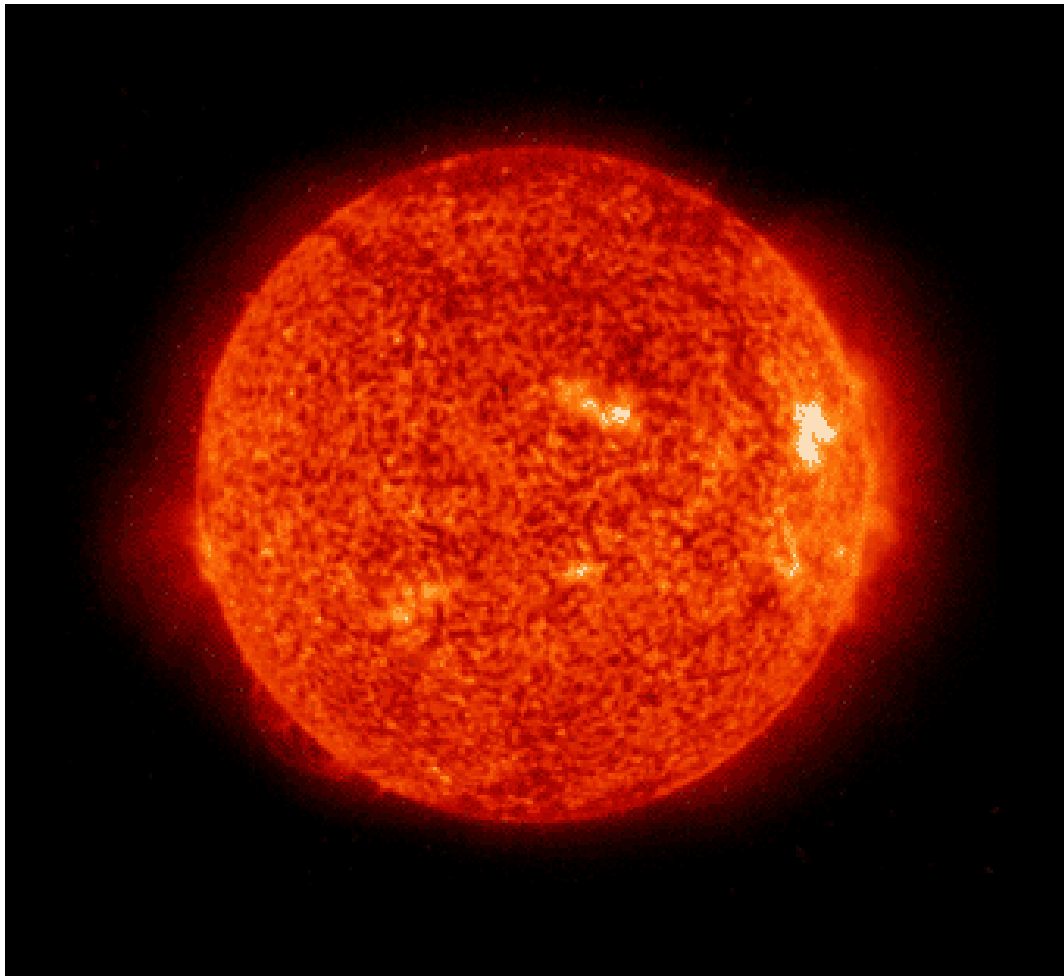
COMPARISON OF THE LARGEST KNOWN STAR AND THE SUN !!




90%
of your body mass is, in fact, stardust, because all the elements except for hydrogen and helium are created in stars.
WE WERE ONCE STARDUST AND
WILL RETURN TO STARDUST AGAIN !!

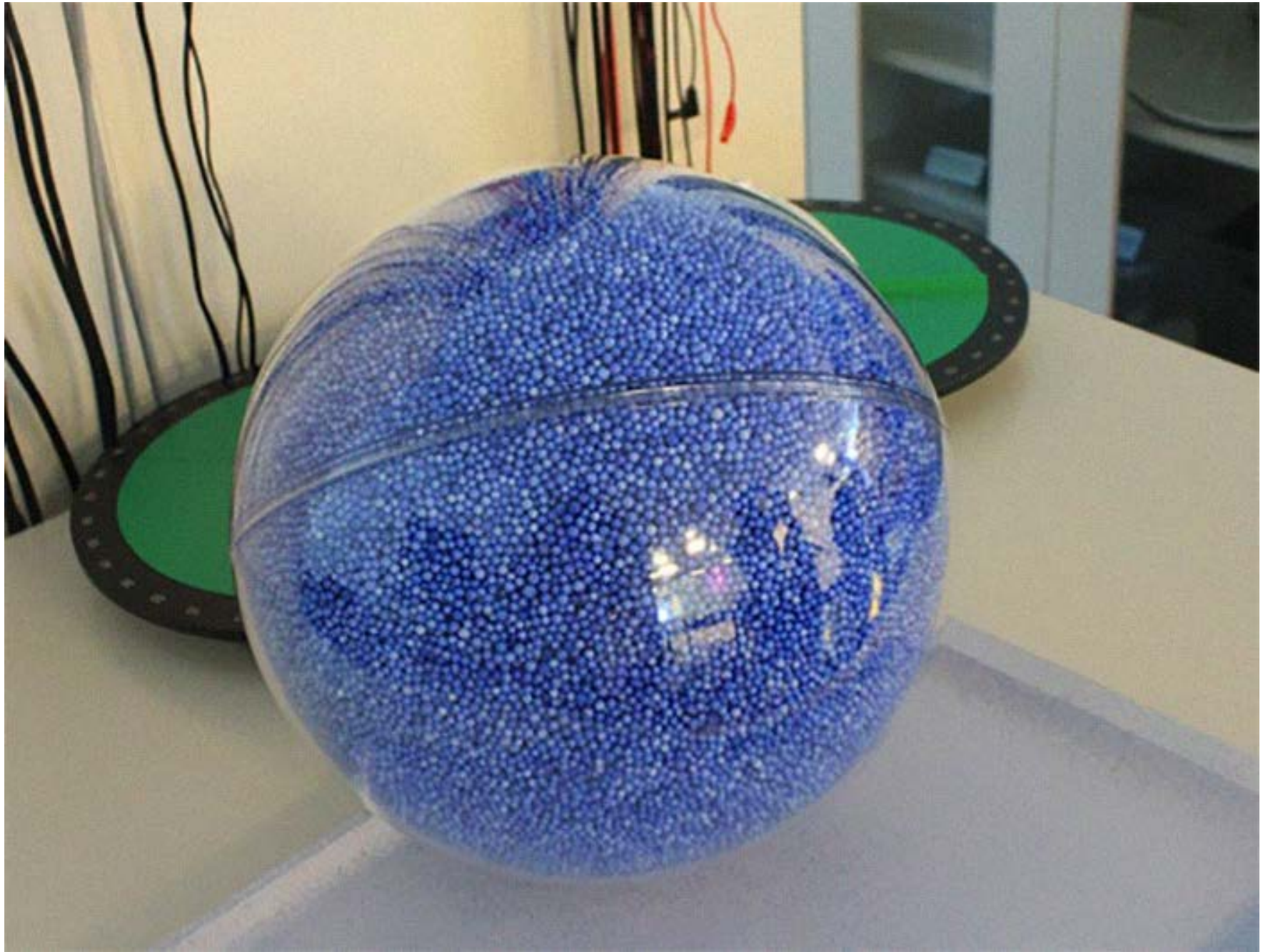
THE SUN

- **It is the heart of our solar system, a yellow medium-sized star, and is 93 million miles from Earth.**
- **It is a ball of hot gas (92.1 percent hydrogen and 7.8 percent helium) held together by its own gravity.**
- **Its energy comes from nuclear fusion, where hydrogen is converted to helium within its core.**
- **This energy is released from the sun in the form of heat and light.**
- Its gravity also holds the solar system together, keeping everything from the biggest planets to the smallest particles of debris, in their orbit around it.
- **Electric currents in the Sun generate a magnetic field that is carried out through the solar system by the solar wind—a stream of electrically charged gas blowing outward from the Sun in all directions.**



https://www.youtube.com/watch?v=2HoTK_Gqi2Q (5 minutes)

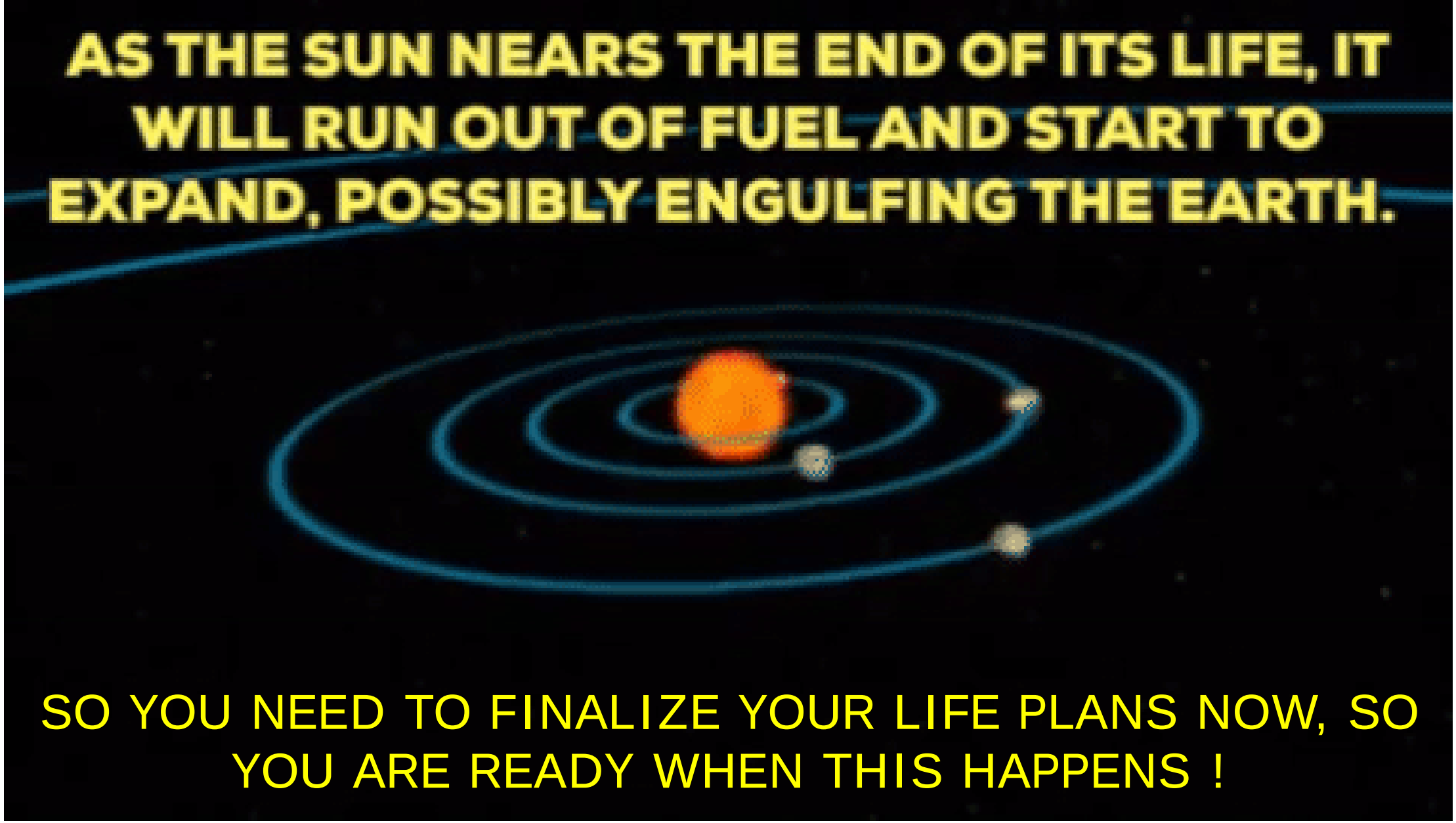
This is how many Earths could fit inside the Sun !!



Our Sun is a perfectly normal example of a G-type main-sequence star, described as a yellow dwarf.

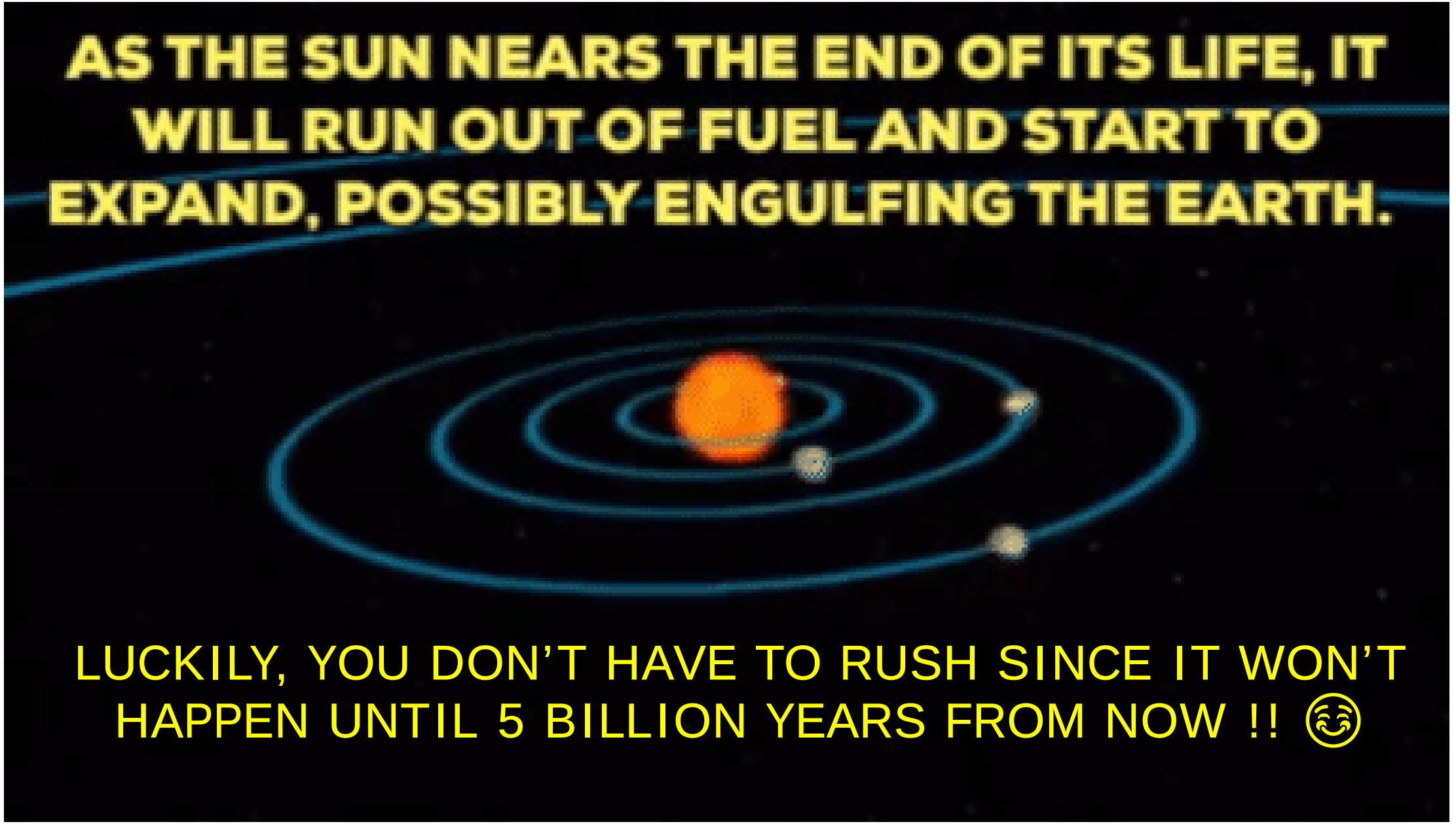
Its lifespan began roughly 4.6 billion years ago and will continue for about another 4.5 – 5.5 billion years.

Towards the later stage of its life, it will first become a red giant star by increasing its size and then it will deplete its supply of hydrogen, helium, and collapse into a white dwarf.



THE SUN AS THE END OF ITS LIFE !

https://www.youtube.com/watch?v=ATXjwABpKYQ



THE SUN AS THE END OF ITS LIFE !

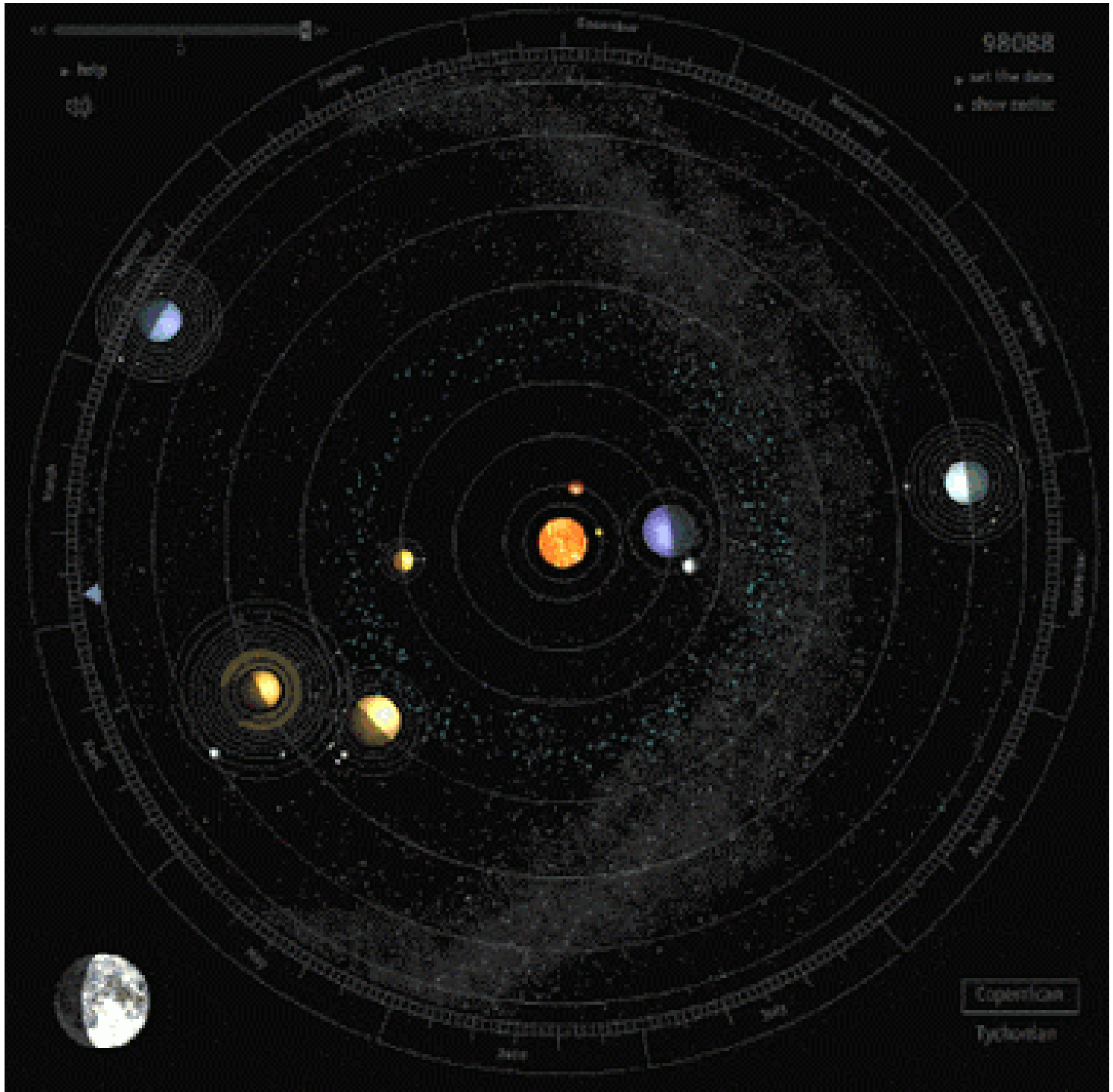
https://www.youtube.com/watch?v=ATXjwABpKYQ

TRADITIONAL SOLAR SYSTEM VIEW

As you remember, the planets all move around the Sun in their orbits and most of them are almost in the same plane – the Ecliptic.

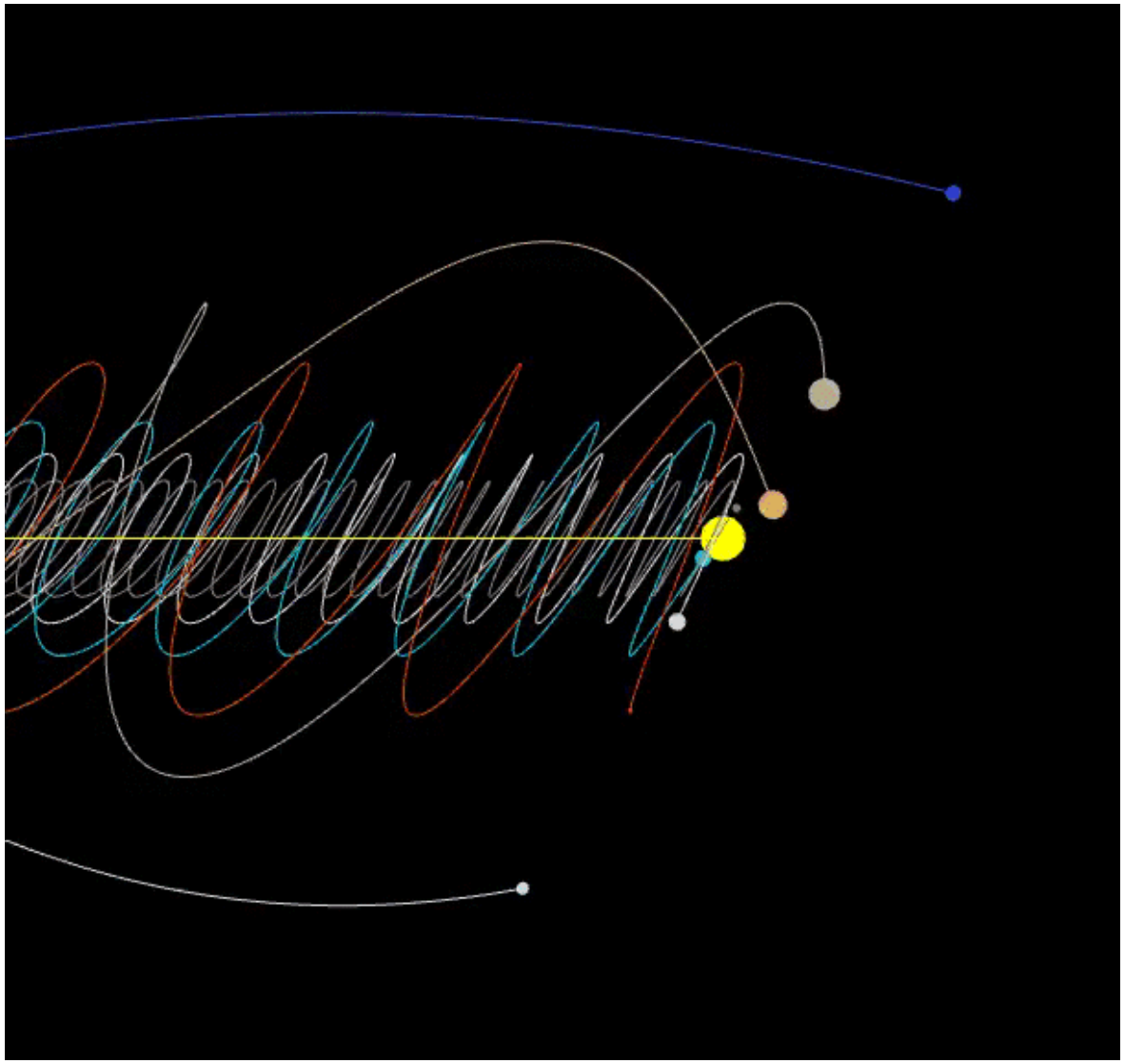
This is the traditional view of how the solar system is arranged.

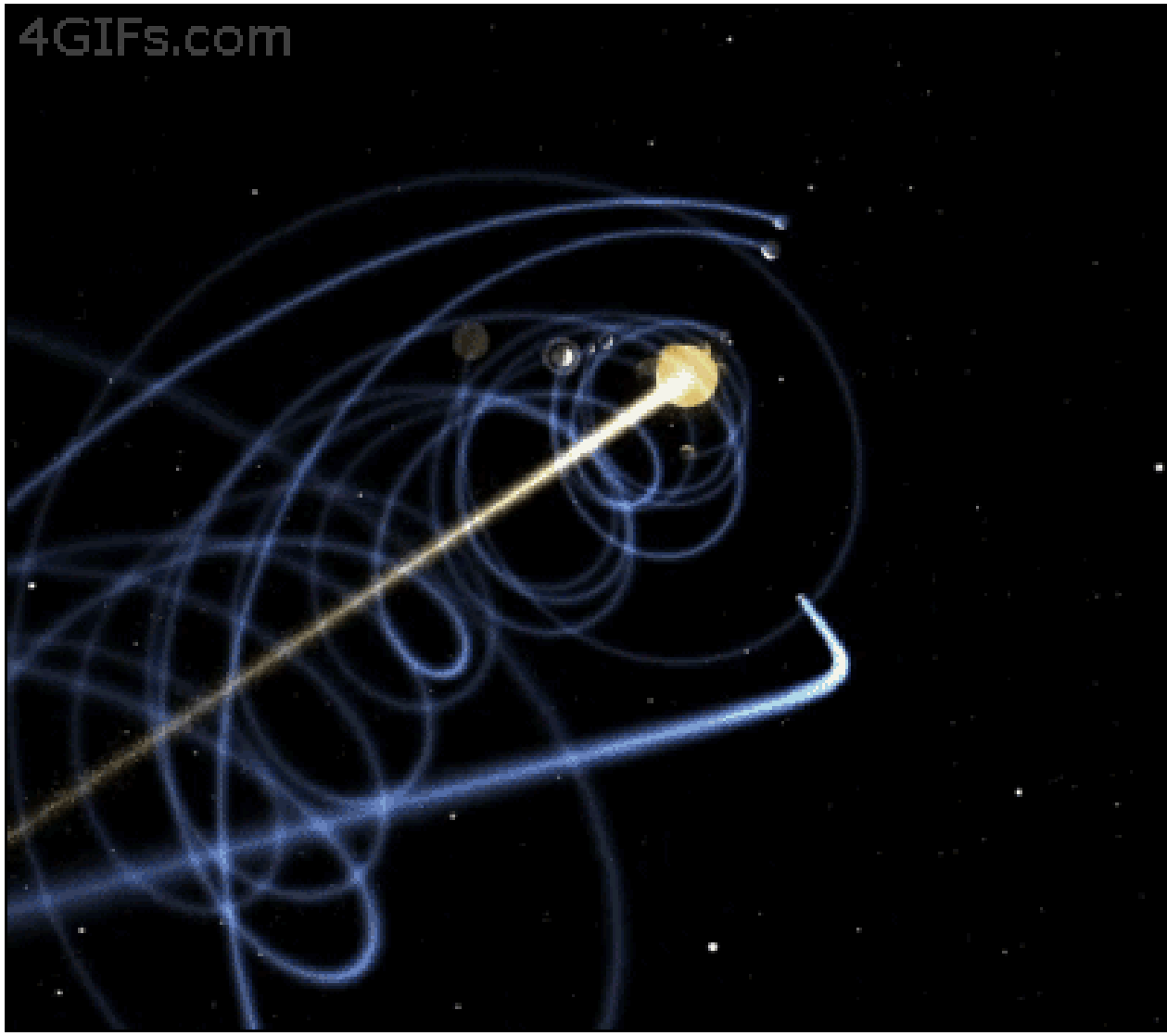
The next slide shows the way it actually looks because the Sun and Solar System are moving through space at a speed of 50,000 miles per hour, !



The solar system moves through a local galactic cloud at a speed of 515,000 miles per hour and the planets rotate around it, as it moves.

Here are 2 views of how it all moves in one big set of spiral patterns:



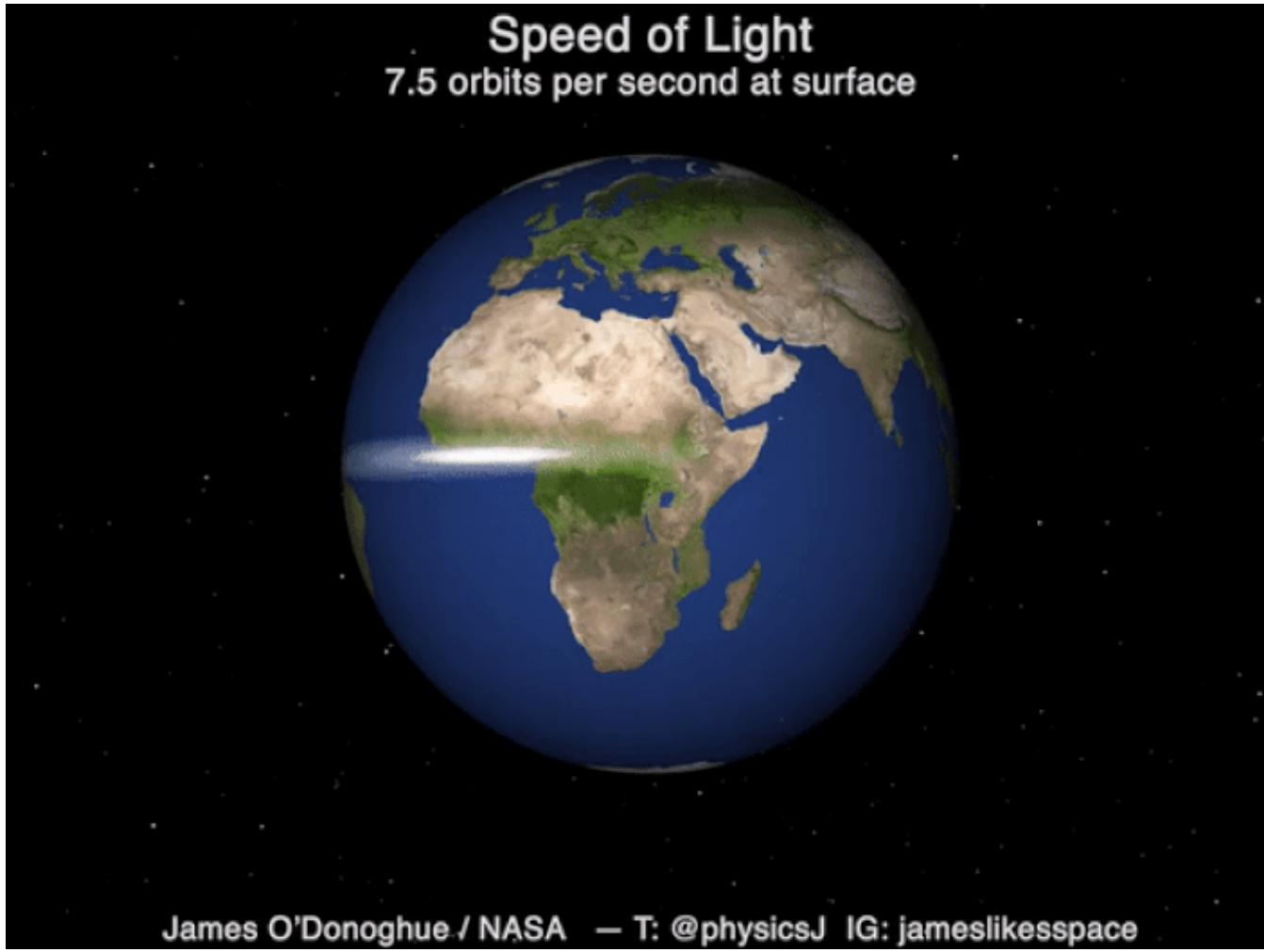


TERMS FOR THE HUGE DISTANCES IN SPACE

Because outer space is so large, astronomers have had to use different ways to measure them, rather than miles or kilometers.

One of these terms is the light-year which is the distance that light moving at 186,300 miles per second, travels in one year, which rounded off is 6 trillion miles – 6,000,000,000,000 miles !!

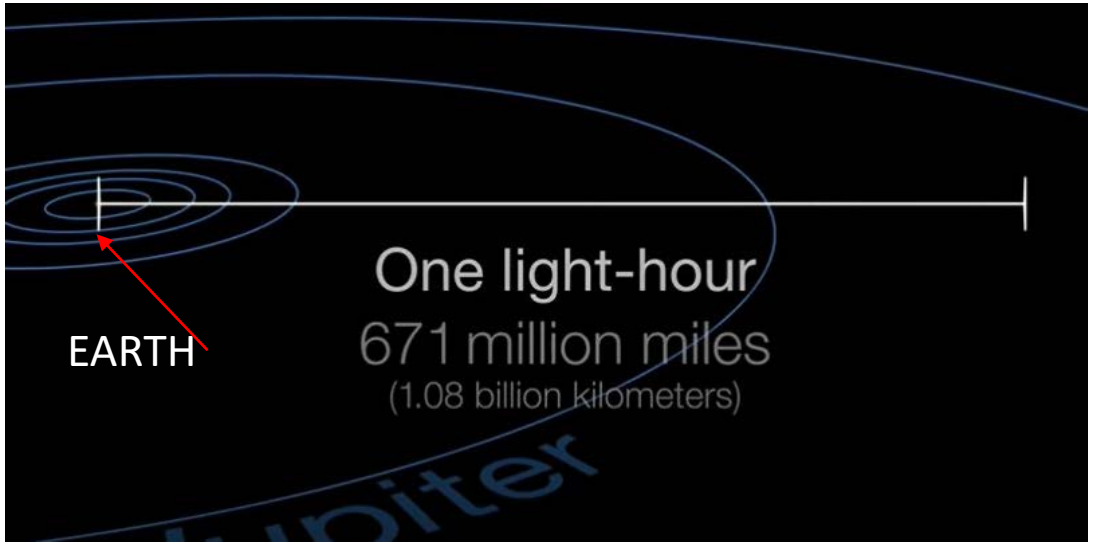
The other way to describe distances is using an AU or Astronomical unit which is the distance from Earth to the Sun, which is 93 million miles.

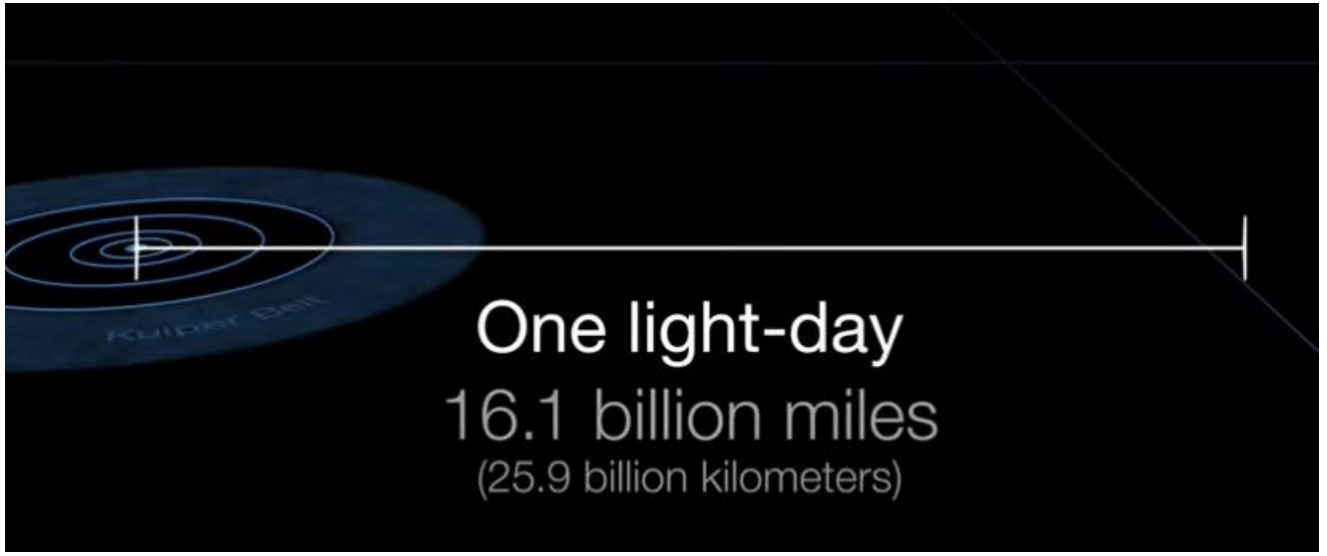


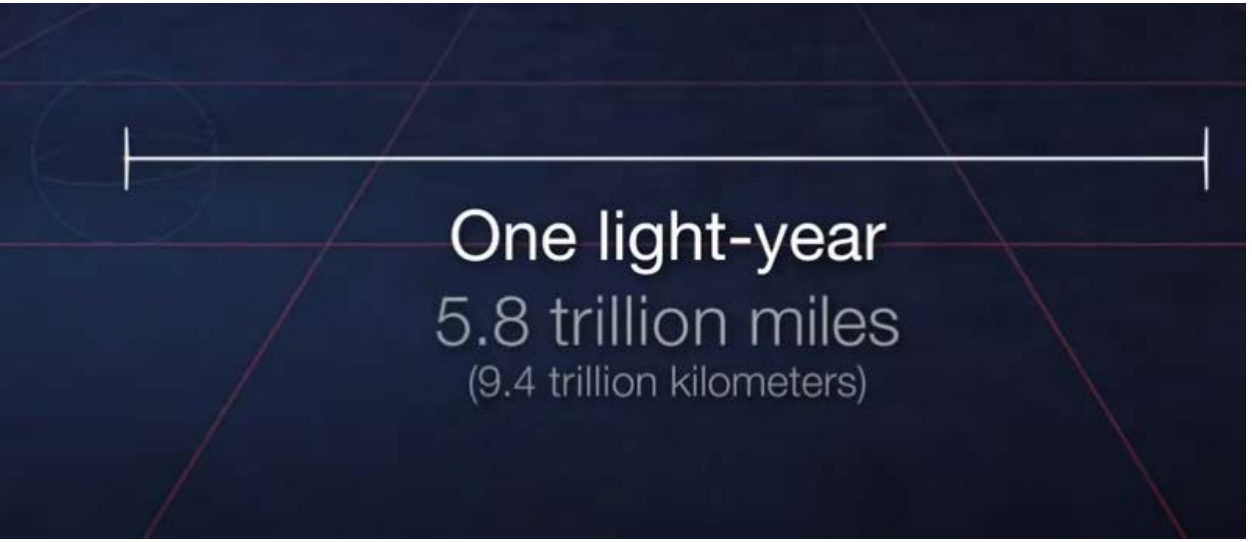
https://www.youtube.com/watch?time_continue=8&v=MX3PIkbTQwQ&feature=emb_logo


One light-second
186,000 miles
(300,000 kilometers)


One light-minute
11,160,000 miles
(18,000,000 kilometers)


EARTH
One light-hour
671 million miles
(1.08 billion kilometers)


Kuiper Belt
One light-day
16.1 billion miles
(25.9 billion kilometers)



THE SUN AND OUR SOLAR SYSTEM

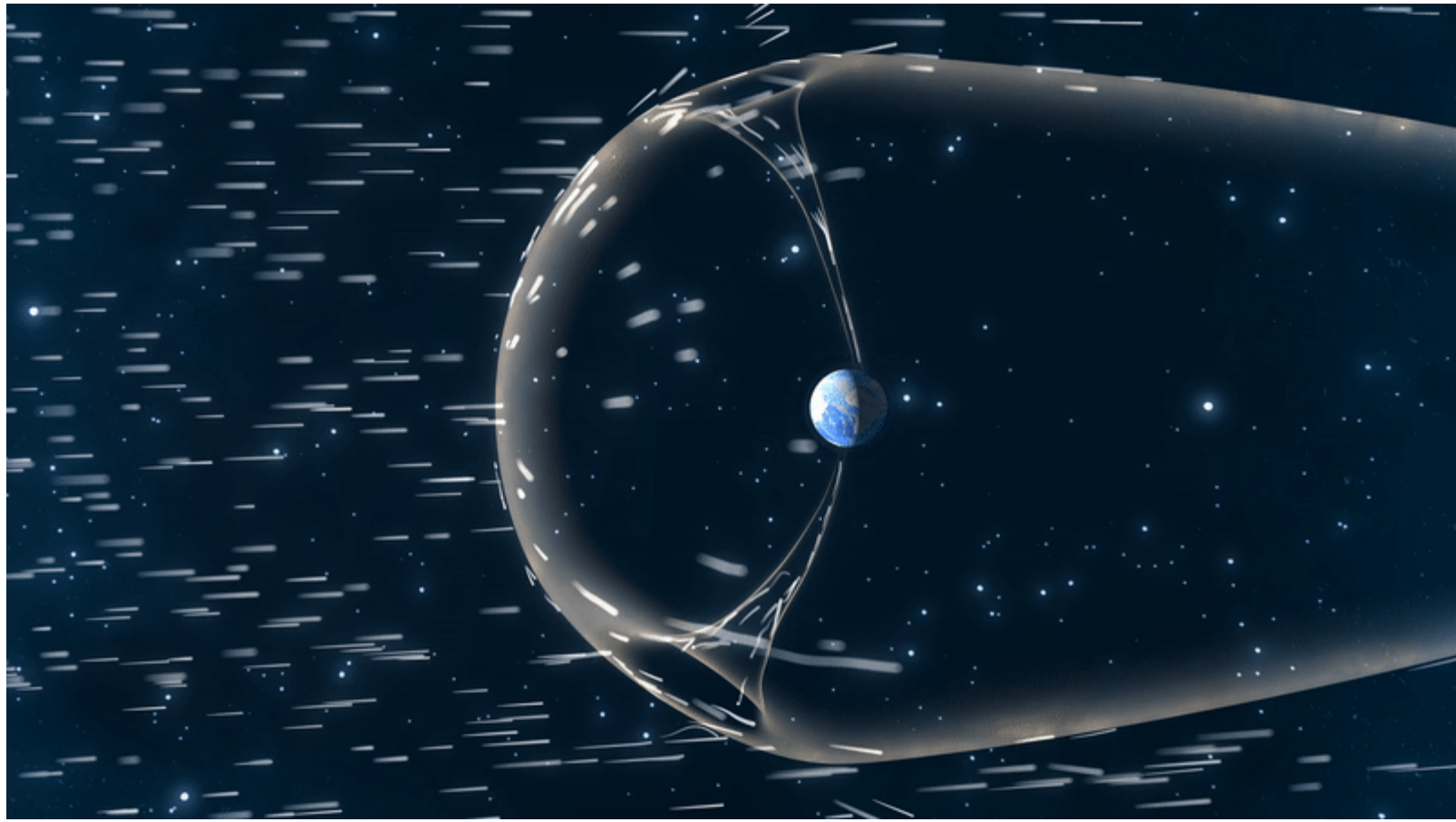
THE SOLAR WIND

The solar wind is a stream of charged particles released from the upper atmosphere of the Sun, called the corona and moves out around 1-2 million miles an hour !!

It goes around the Earth because of the Earth's magnetic lines of force, which keeps us safe from the Sun's radiation.

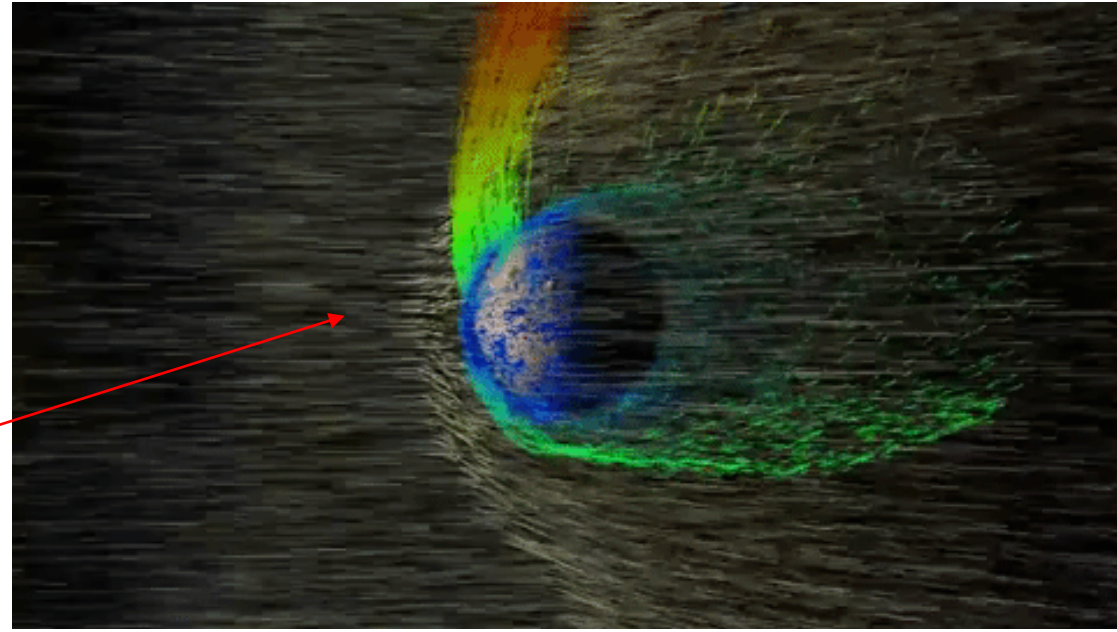
These particles have gained enough energy to fill the heliosphere, a region of space that extends well past the orbit of Pluto.

Though the Sun can lose more than a million tons of material each second, the amount is still negligible compared to the Sun's total mass.



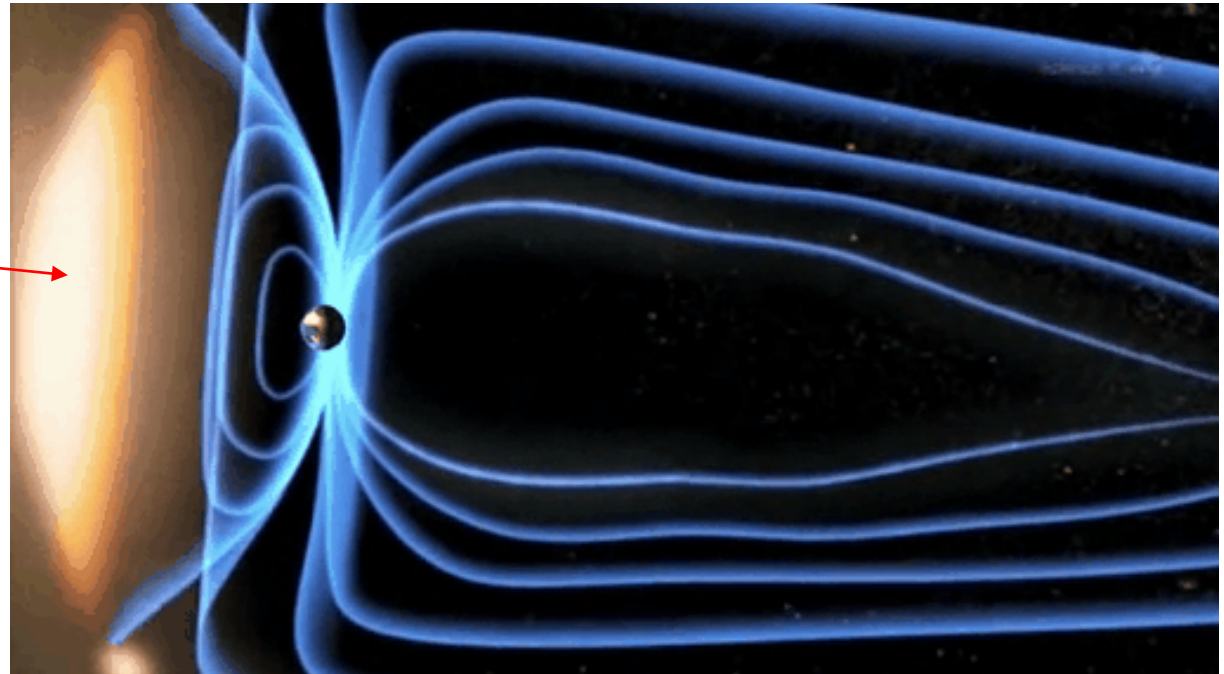
Because the Earth contains a huge iron core, it creates a magnetic field that protects our planet and us, carving out a cavity in the solar wind called the magnetosphere.

Because of the solar wind's pressure on the magnetic field, the magnetosphere is compressed on the Sun-facing side.

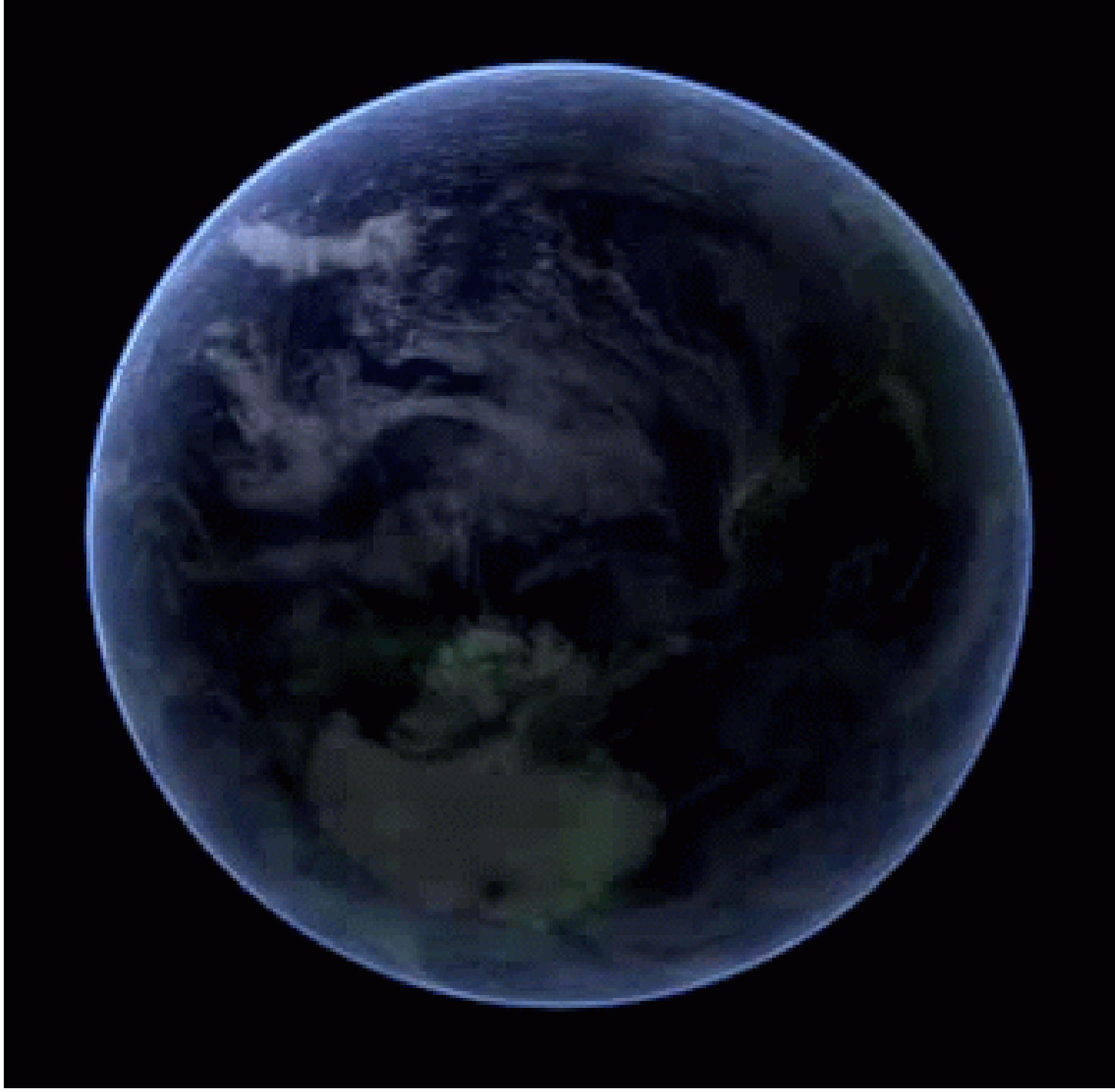


On the opposite side, it stretches out into a magneto-tail.

Occasionally, the Sun's charged particles find their way into Earth's magnetosphere, and spiral along magnetic field lines toward the poles, where they interact with particles in the Earth's upper atmosphere to create auroras.

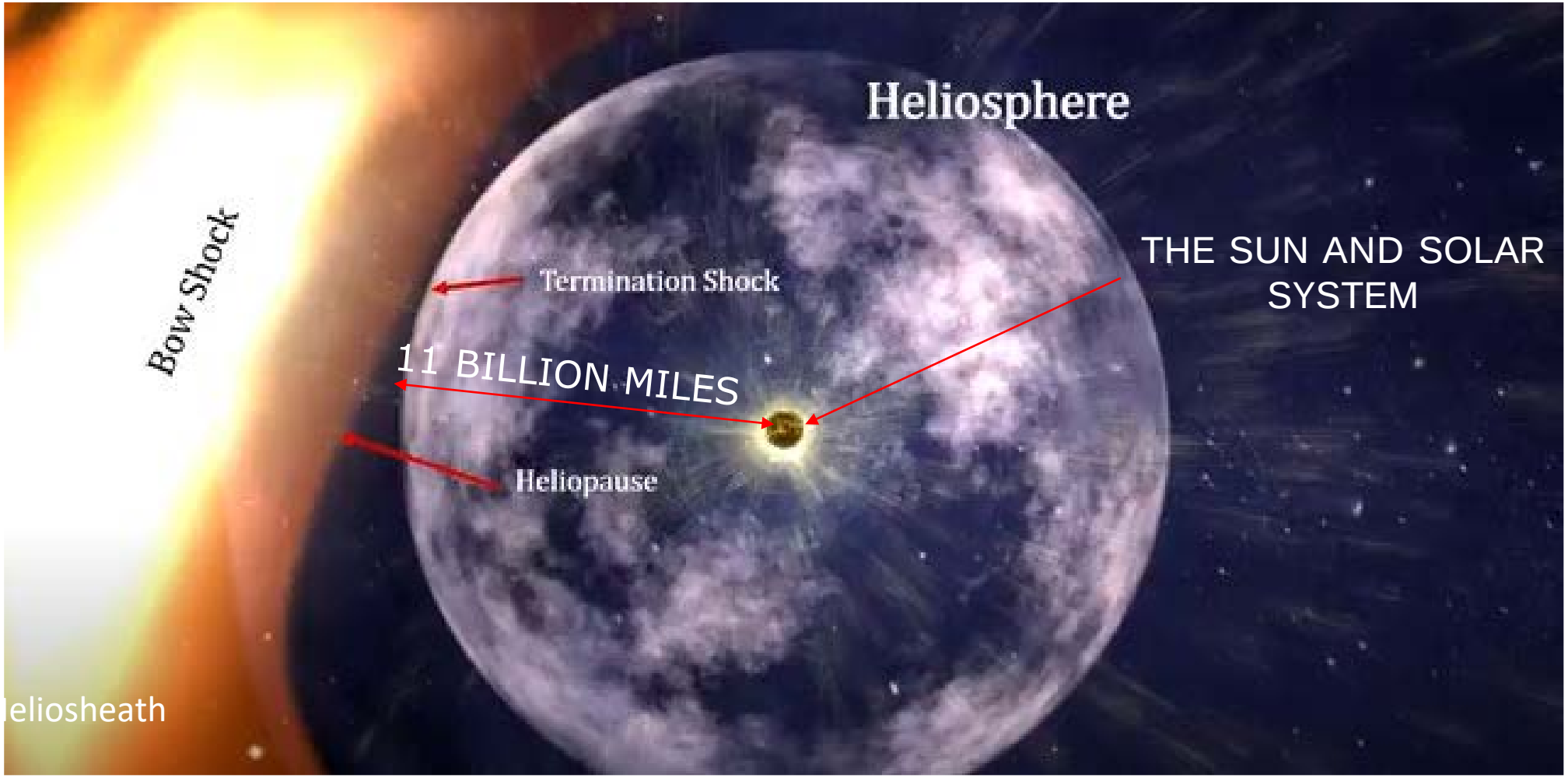


BEAUTIFUL AURORAE AROUND AUSTRALIA



The Heliosphere is a sphere around the sun and our solar system, that is the distance that the solar wind extends from our Sun.

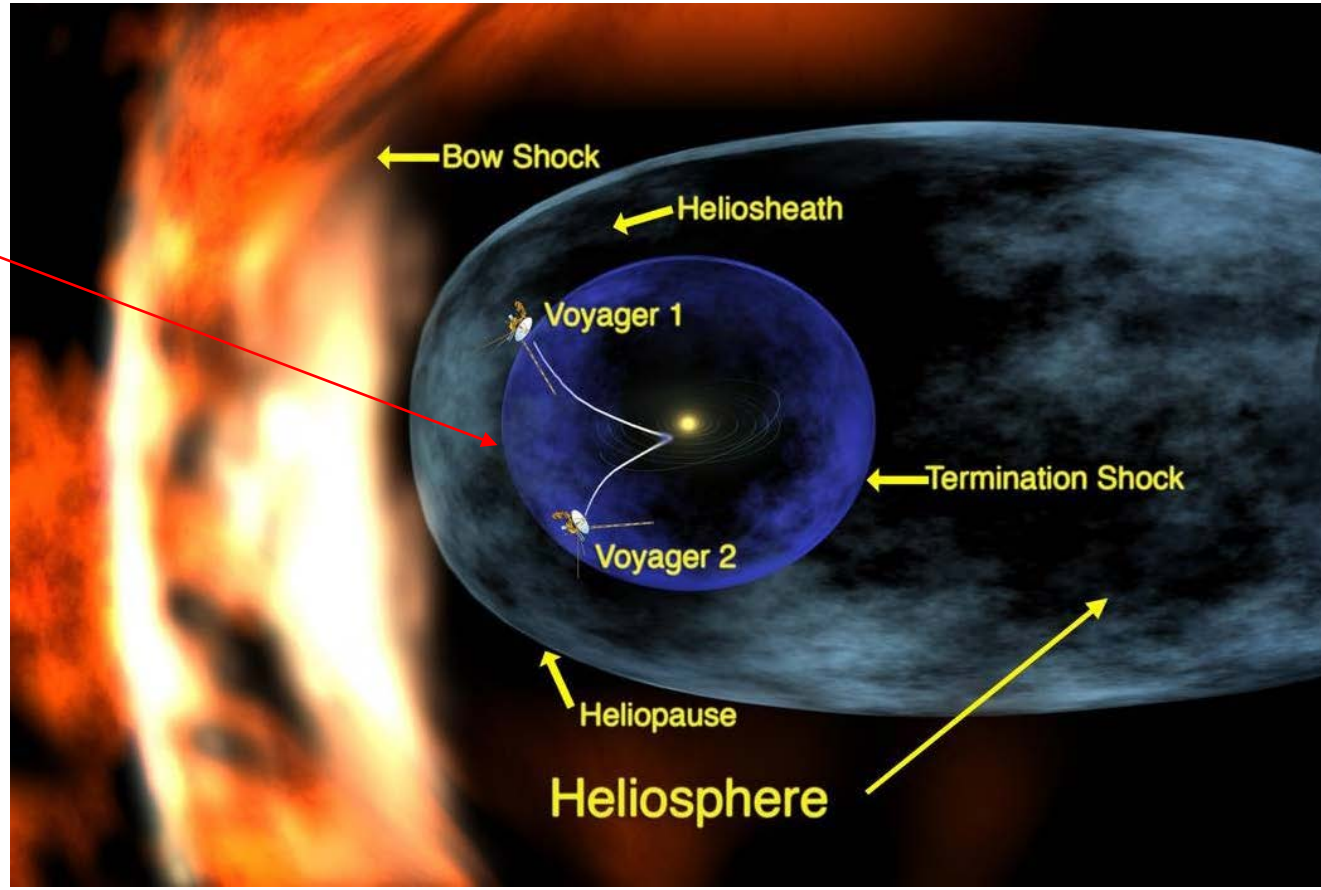
It has a radius of 11 billion miles !!



THE HELIOSPHERE AND ITS SECTIONS

Termination Shock:
Blowing outward billions of kilometers from the Sun is the solar wind, a thin stream of electrically charged gas. This wind travels at an average speed ranging from 700,000 - 1,500,000 miles per hour until it reaches the termination shock. At this point, the speed of the solar wind drops abruptly as it begins to feel the effects of the interstellar wind.

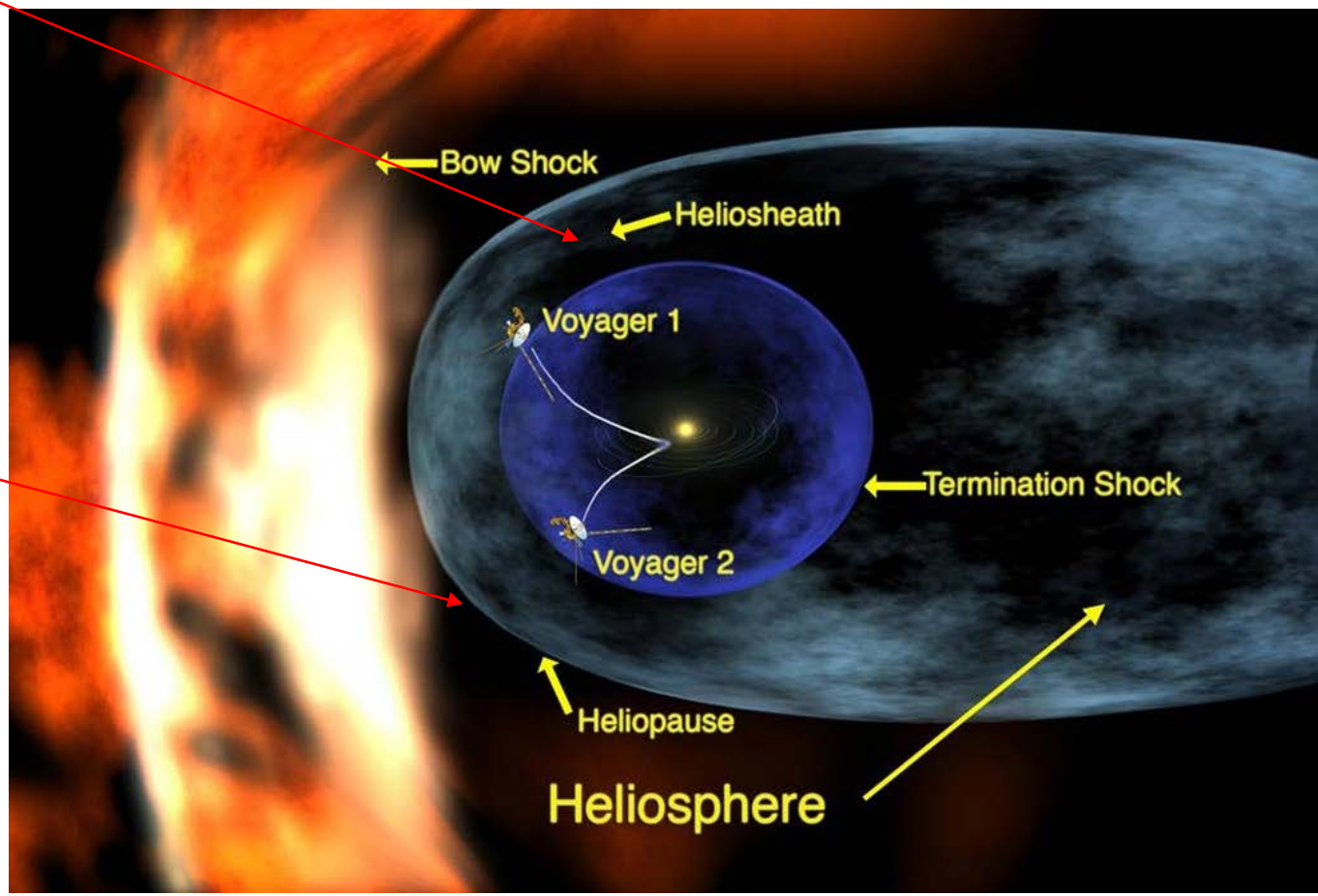
Heliosphere:
The solar wind, coming from the Sun, creates a bubble that extends far past the orbits of the planets. This bubble is the heliosphere, shaped like a long wind sock as it moves with the Sun through interstellar space.



Heliosheath:
The heliosheath is the outer region of the heliosphere, just beyond the termination shock, the point where the solar wind slows abruptly, becoming denser and hotter. The solar wind piles up as it presses outward against the approaching wind in interstellar space.

Heliopause:
The boundary between solar wind and interstellar wind is the heliopause, where the pressure of the two winds are in balance. This balance in pressure causes the solar wind to turn back and flow down the tail of the heliosphere.

Bow shock:
As the heliosphere plows through interstellar space, a bow shock forms, similar to what forms as a ship plowing through the ocean.



VOYAGER 1 AND 2

The Voyager 1 and 2 probes departed from Earth in 1977 to go past the planets at the outer Solar System and into the space beyond – going where no spacecraft had ever gone before.

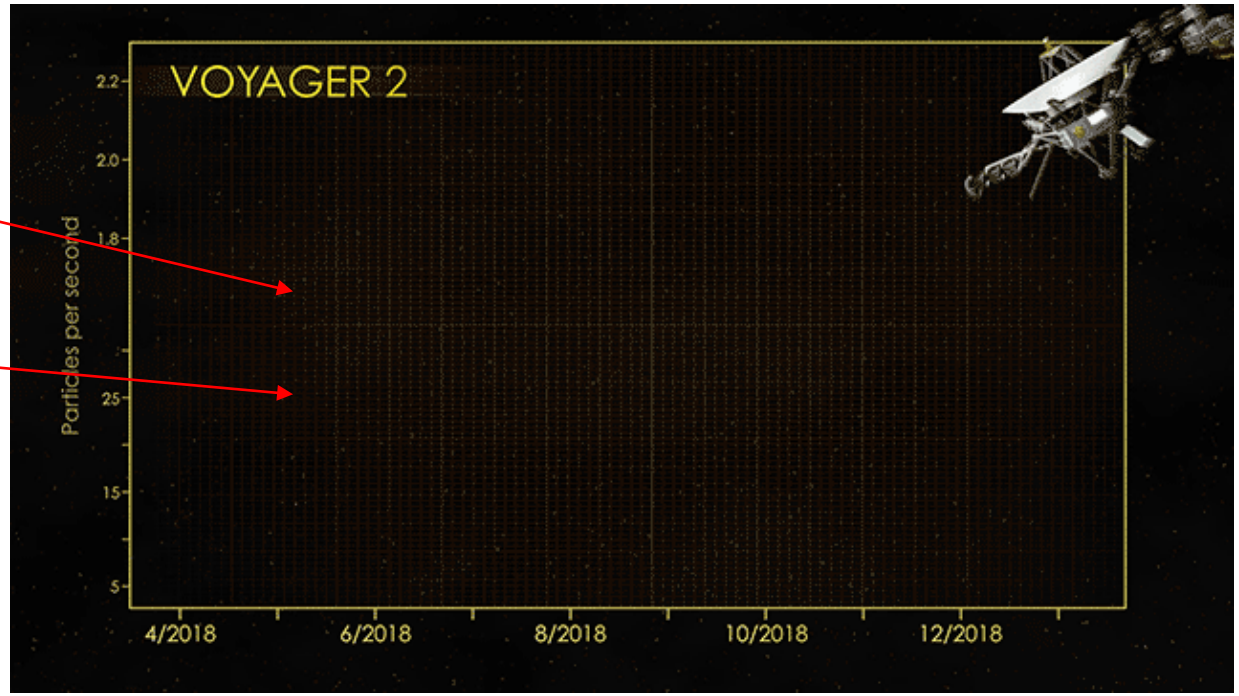
On August 25th, 2012, the Voyager 1 spacecraft, after exploring Uranus, Neptune, and the outer reaches of the Solar System, entered interstellar space.

On November 5, 2018, Voyager 2 spacecraft also crossed the outer edge of the heliopause – the boundary between our Solar System and the interstellar medium – and has joined Voyager 1 in interstellar space.

We know that the 2 Voyager spacecraft have left the outside of the Heliosphere and passed into Interstellar space.

On December, 2018, Voyager 2 detectors found **an increase in Cosmic rays** coming in from far away places in Outer Space and a **large reduction in the force of the Solar Wind** from the Sun!

The traces of these signals are shown to the right.



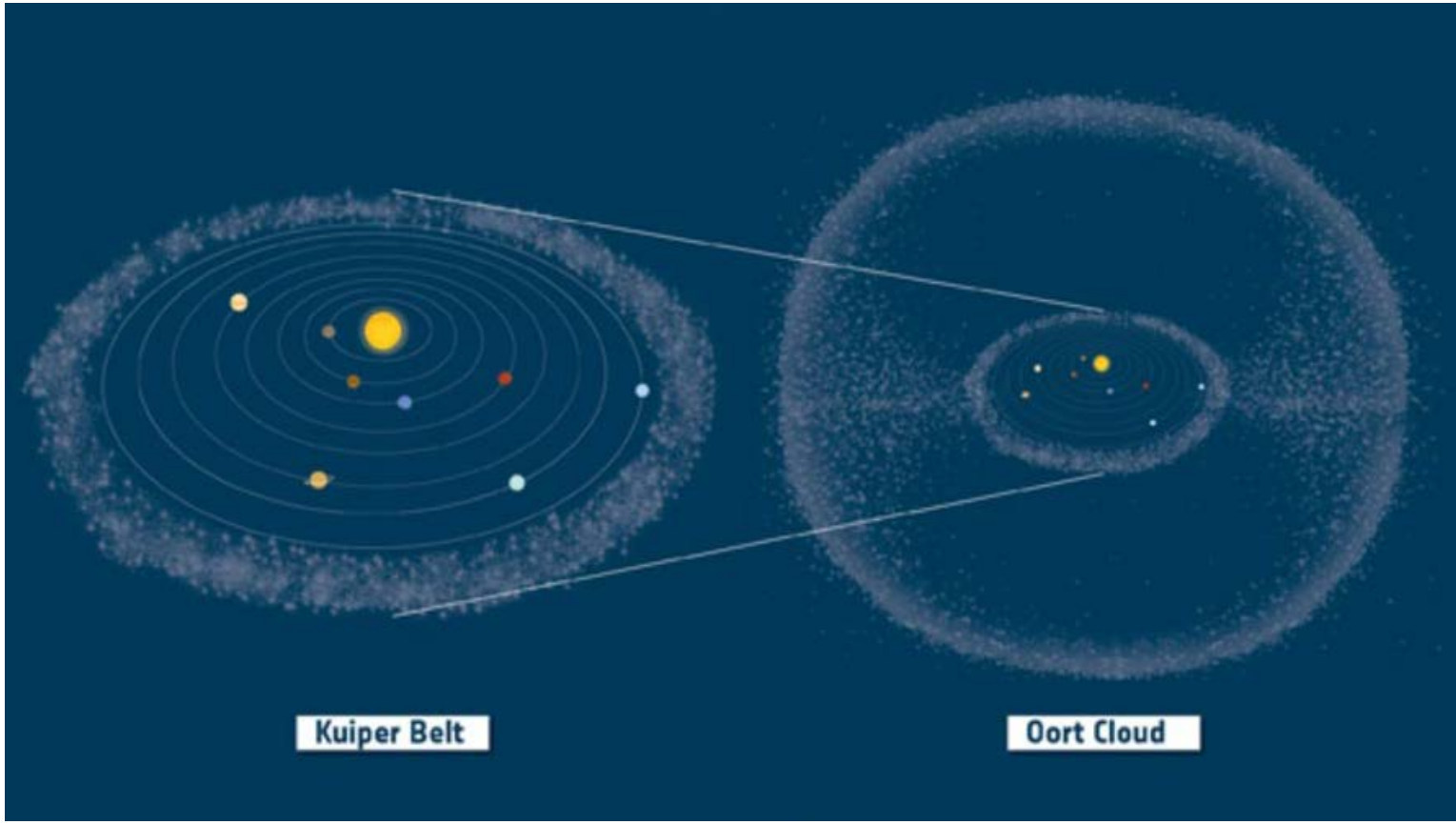
THE OORT CLOUD

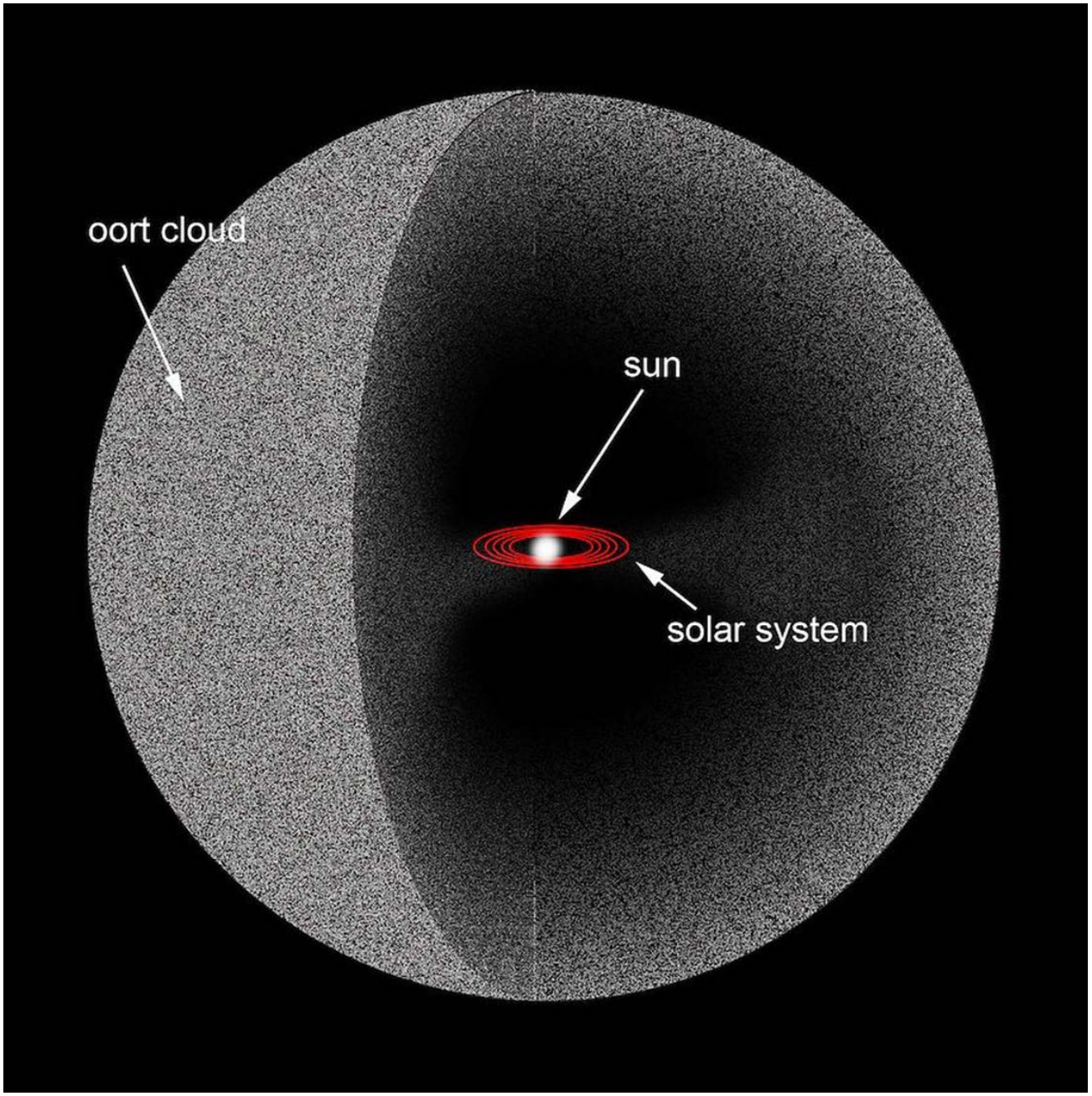
The Oort cloud is speculated to start from roughly 180 billion miles out, almost 70 times farther out than Neptune and past the Kuiper Belt or around 2,000 times the distance from the Earth to the Sun.

It is believed to extend up to 1 light year, or around 6.2 trillion miles.

Unlike the orbits of the planets and the Kuiper Belt, which lie mostly in the same flat disk around the Sun, the Oort Cloud is believed to be a giant spherical shell surrounding the rest of the solar system.

It is like a big, thick-walled bubble made of icy pieces of space debris the sizes of mountains and sometimes larger. The Oort Cloud might contain billions, or even trillions, of objects.





Voyager 2 present location is about 11.5 billion miles from Earth and it is moving at roughly 34,000 miles per hour.

Voyager 1 is further and faster still, at almost 14 billion miles and traveling 36,700 miles per hour.

While the probes are technically in interstellar space, it is important to note that they have not left the Solar System just yet.

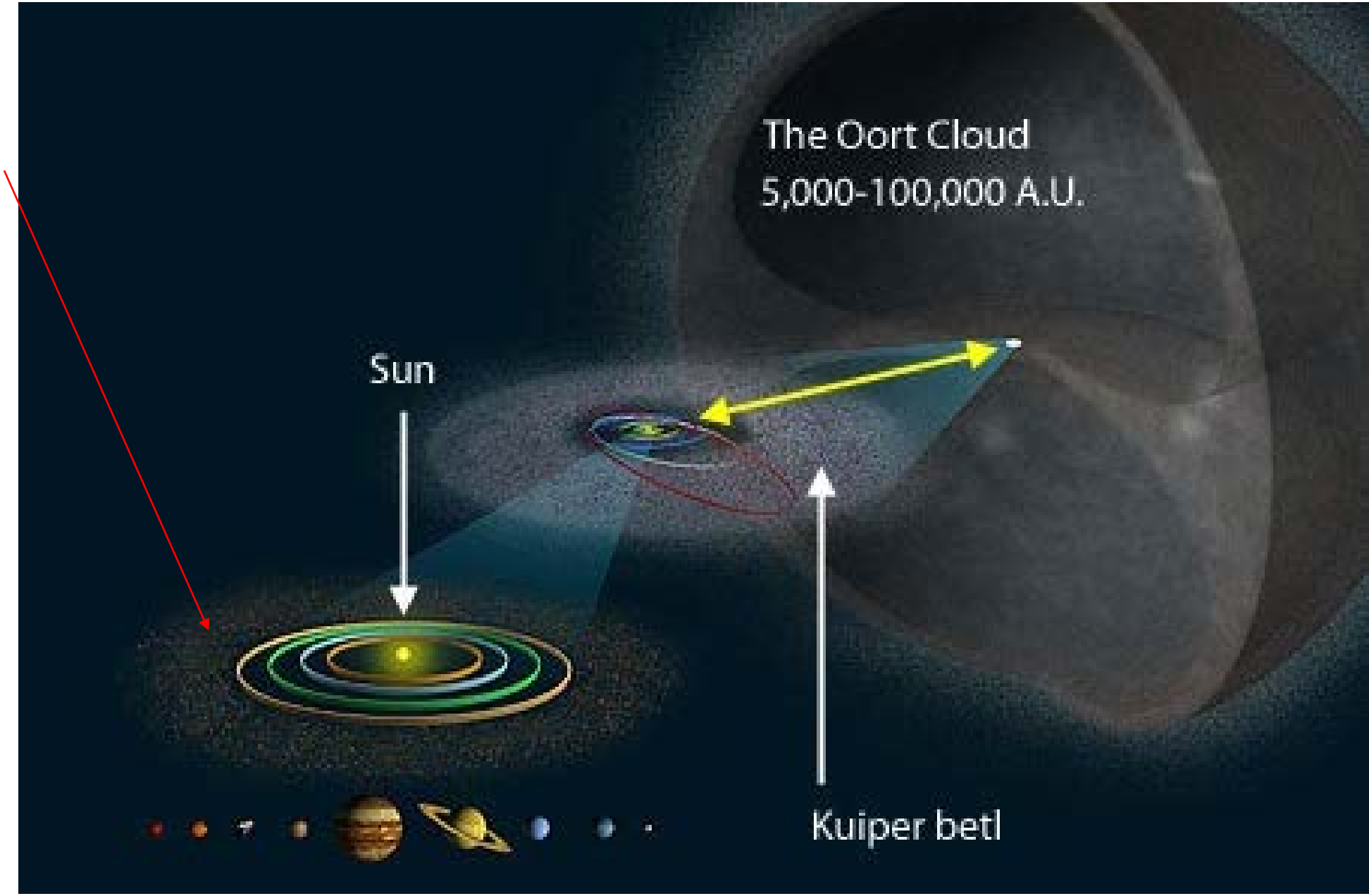
The outermost boundary of our Solar System is considered to be where the Oort Cloud begins, which the Voyager spacecraft will reach in about 300 years.

At their current speed, it will be roughly 300,000 years before they pass beyond it.

THE KUIPER BELT AND THE OORT CLOUD

The Kuiper belt is a huge plane of small rocks and dust that are outside of the orbit of Neptune.

The Oort cloud is a huge sphere of rocks and dust outside the orbit of Neptune, at the outside of our Solar System.

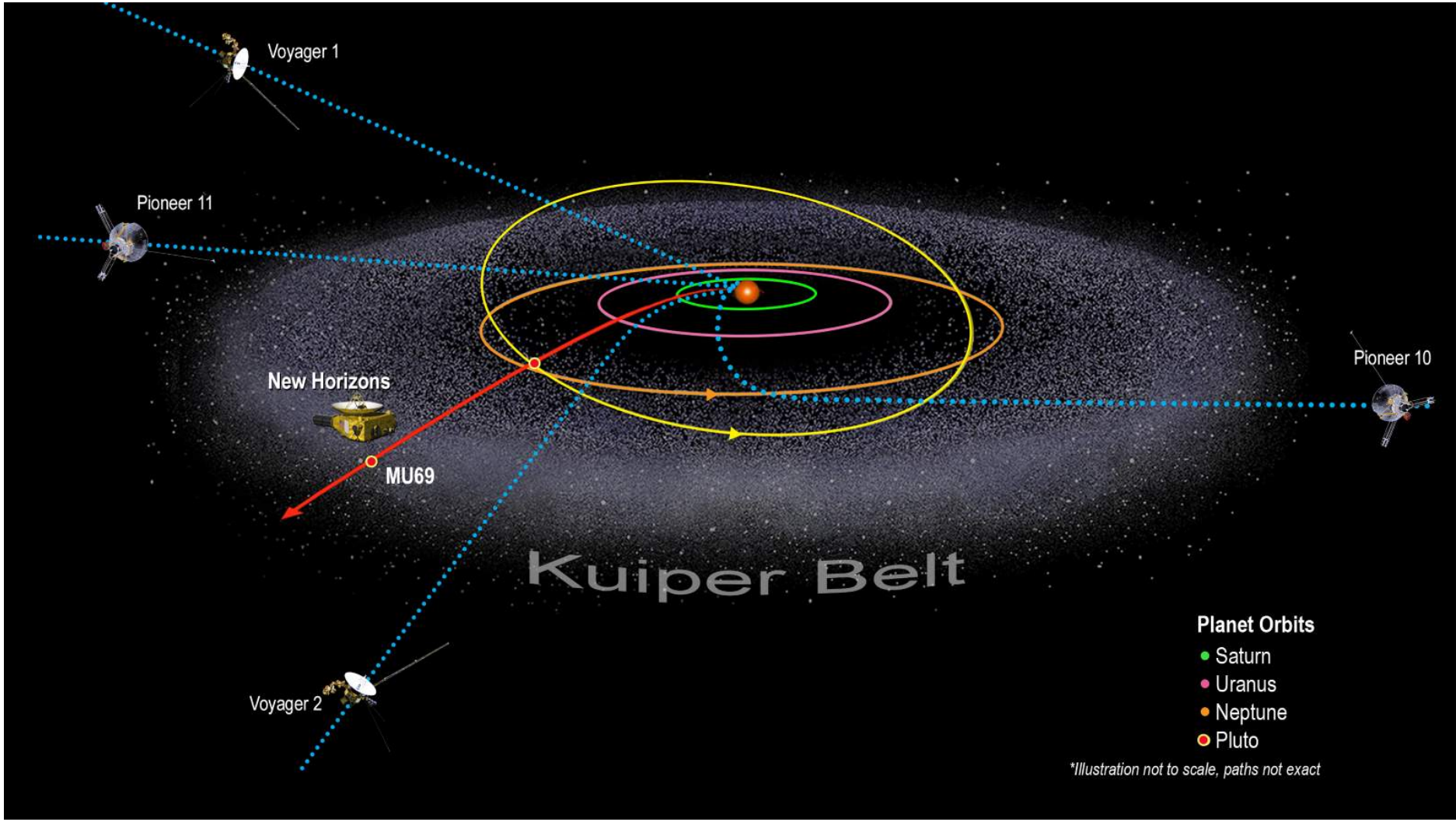


In 2019, five space probes left the solar system:

Pioneer 10, Pioneer 11, Voyager 1, Voyager 2 and New Horizons.

The Voyagers already left the solar system and entered the interstellar space (Voyager 1 on August 25, 2012, and Voyager 2 on November 5, 2018.

The others also will leave the heliosphere and reach the interstellar space in a few years.

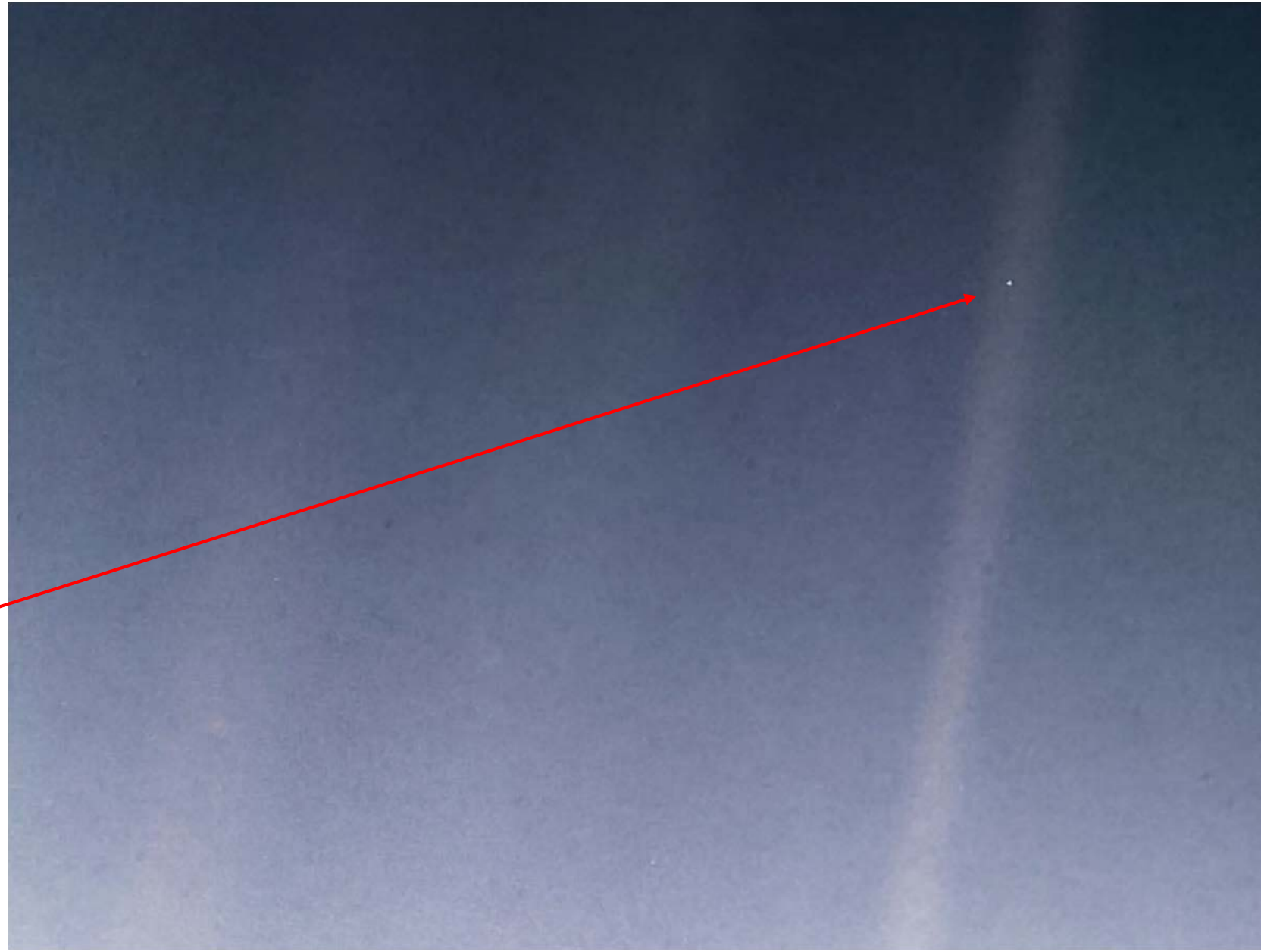


Back in 1990, in order to save power, engineers turned off the Voyager 1's camera.

Before that, a signal was sent to it, to turn its camera around and to take a photograph of Earth across the great expanse of space, at the request of Carl Sagan.

Taken from a record distance of about 3.7 billion miles, or 40 Astronomical Units from Earth, the photo known as the Pale Blue Dot.

In the photograph, Earth is shown as a fraction of a pixel (0.12 pixel in size) against the vastness of space.

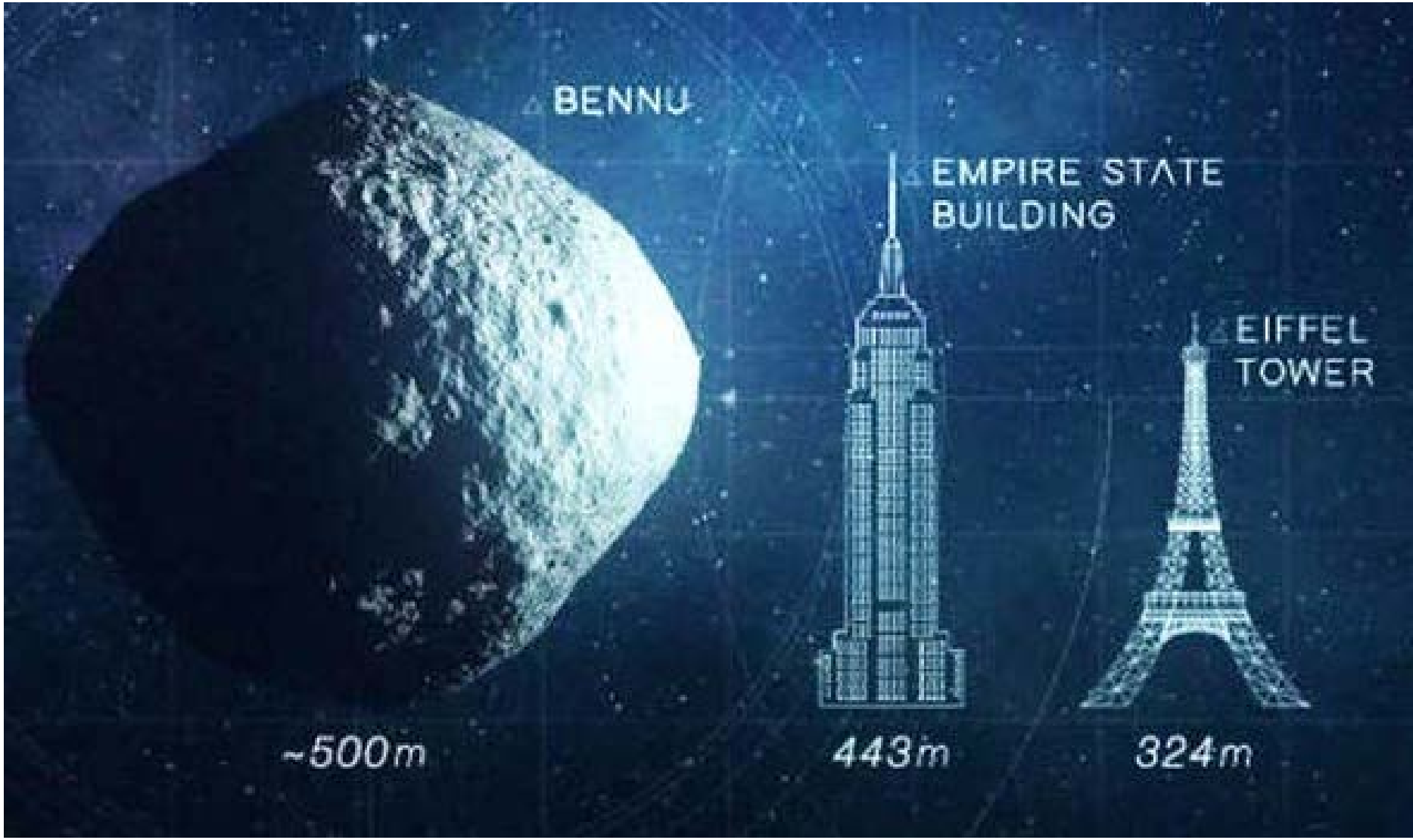


BENNU

Bennu is an asteroid that is about 300 miles across and is presently located **143,607,671 miles from** earth, travelling at a speed of **735 miles per hour.**

The Osiris-Rex spacecraft arrived at it on December 3rd, 2019 and will sample material from it on August 25th , 2020, after several practice attempts which are going on now.

A delivery system on the spacecraft is scheduled to be returned to Earth on Sept. 24, 2023.

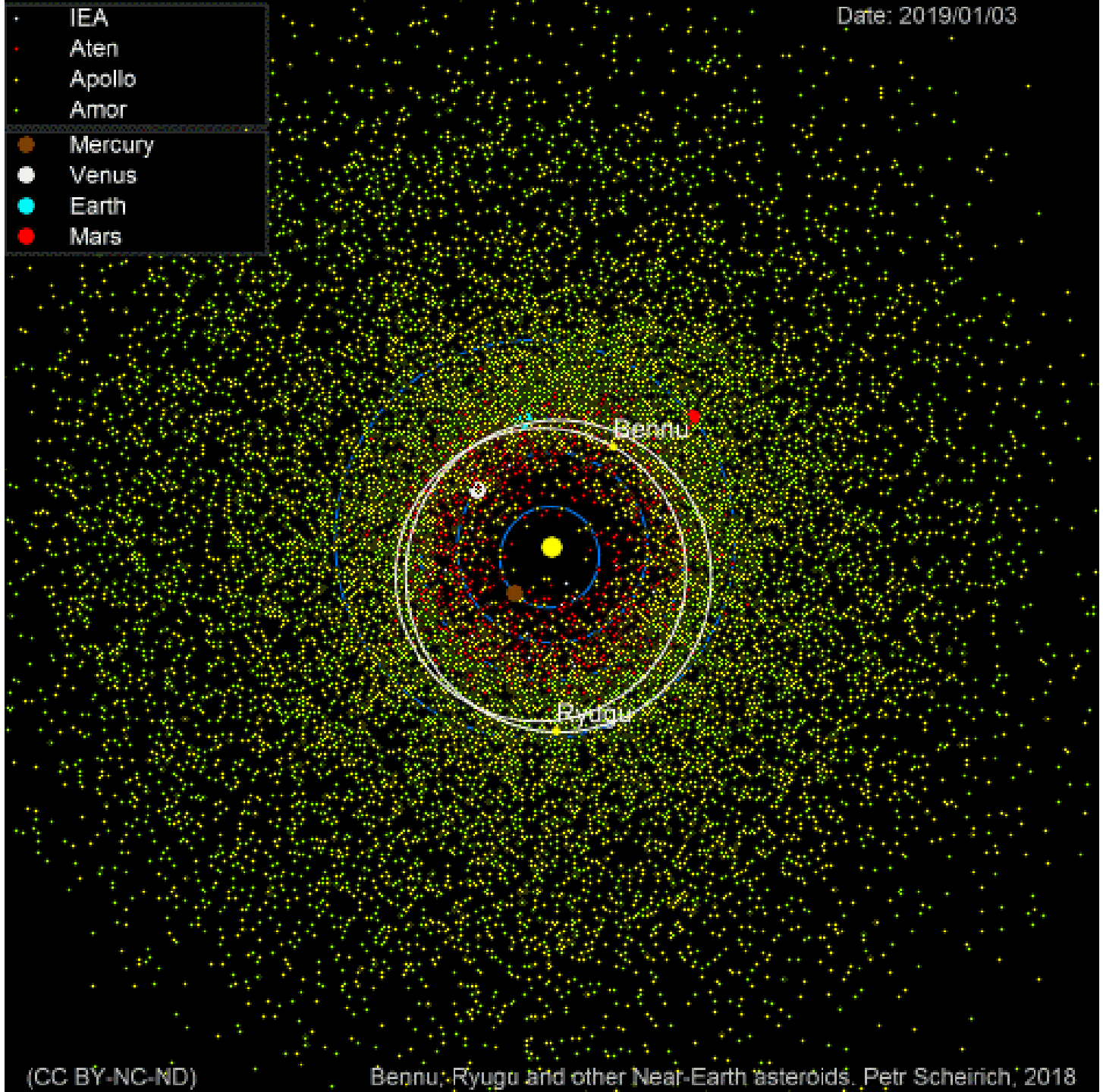


The reason for sampling the material from it is that it is estimated to be 4.6 billion years old, the same age as our Solar system and the Earth.

The purpose of the sampling of Bennu is because it is one of the original asteroids from when the Solar System formed, 4.6 billion years ago and may hold clues to whether any organic molecules were in these ancient bodies.

The diagram shows the rotation of Bennu and the 4 inner planets along with the yellow spots that are small asteroids in space and in the asteroid belt which is in between the orbits of Earth and Mars.

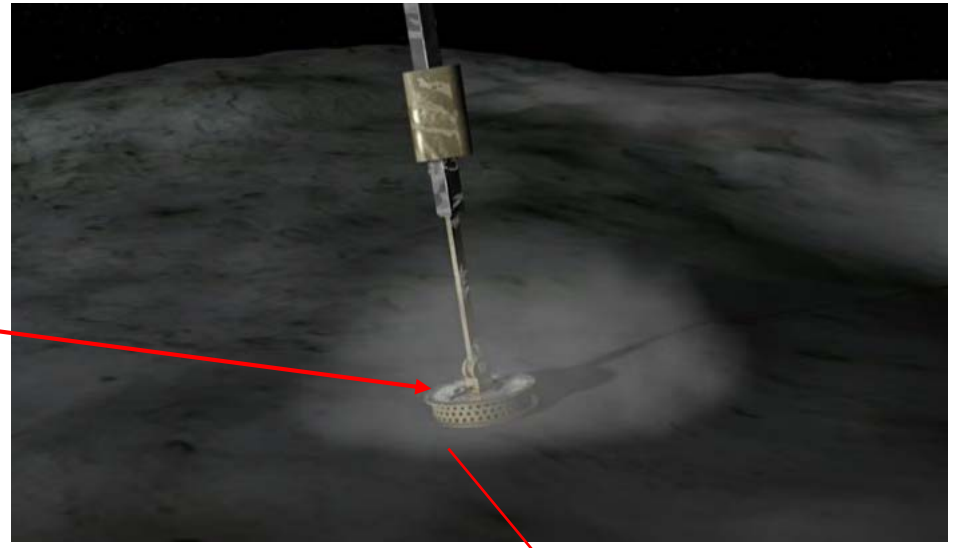
https://www.youtube.com/watch?v=T0FxDxs7lyw (3.7 minutes)

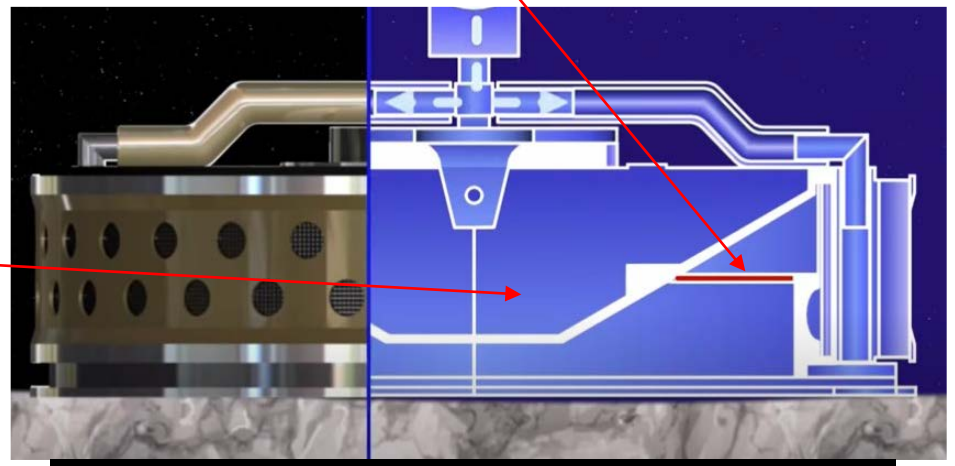


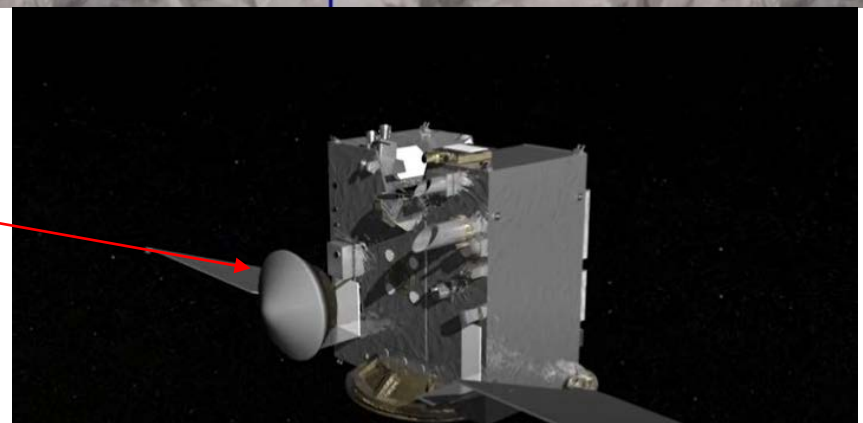
The Osiris-Rex spacecraft has a probe on a shaft with a spring that will be put against the surface of Bennu for 5 seconds, collect a material sample, and then bounce away.

Nitrogen gas will be blown against the bottom surface of the probe, which will push some of the surface material into a container with a filter inside, to hold the dust.

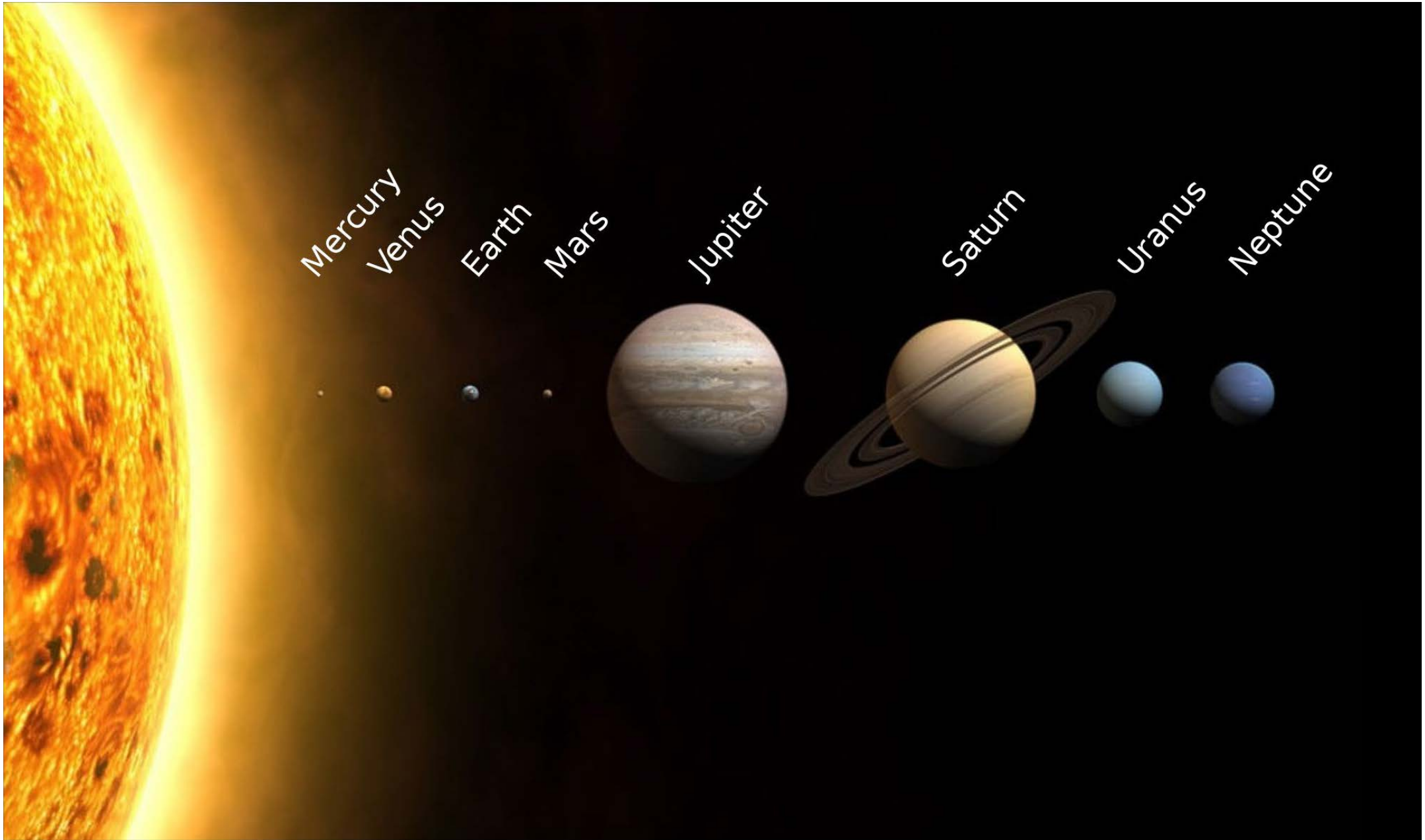
The sealed container of dusty materials will then be sent back to earth to evaluate the material that was captured.



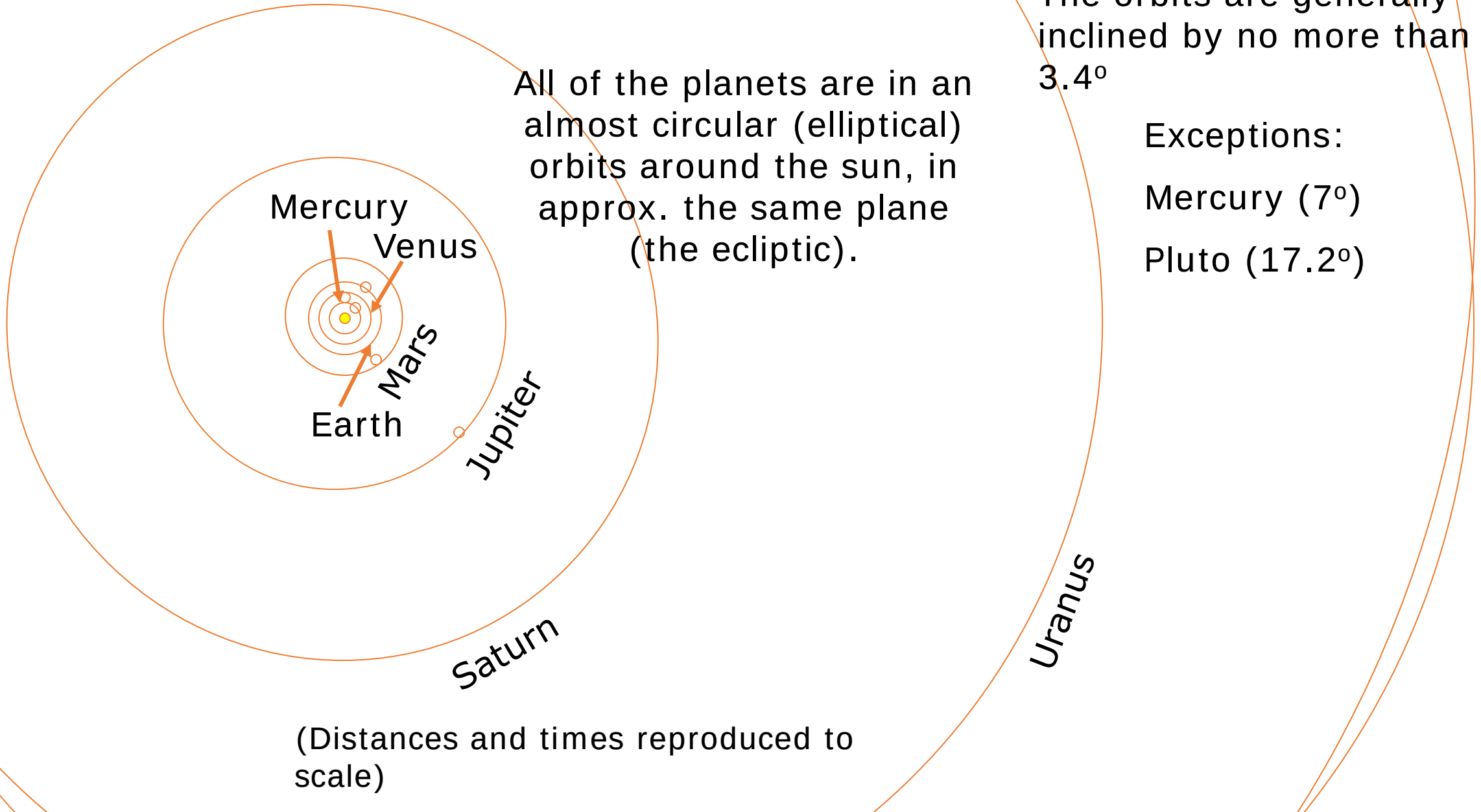




THE SOLAR SYSTEM



Planetary Orbits



All of the planets are in an almost circular (elliptical) orbits around the sun, in approx. the same plane (the ecliptic).

The orbits are generally inclined by no more than 3.4º

Exceptions:

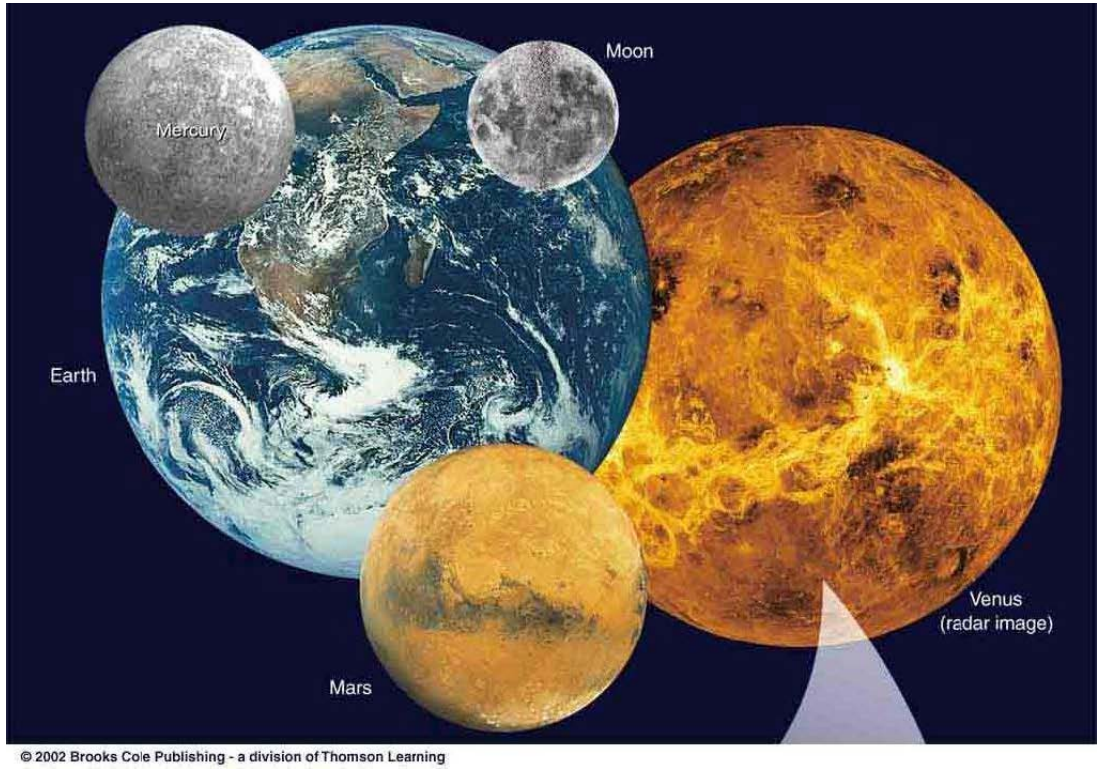
Mercury (7º)

Pluto (17.2º)

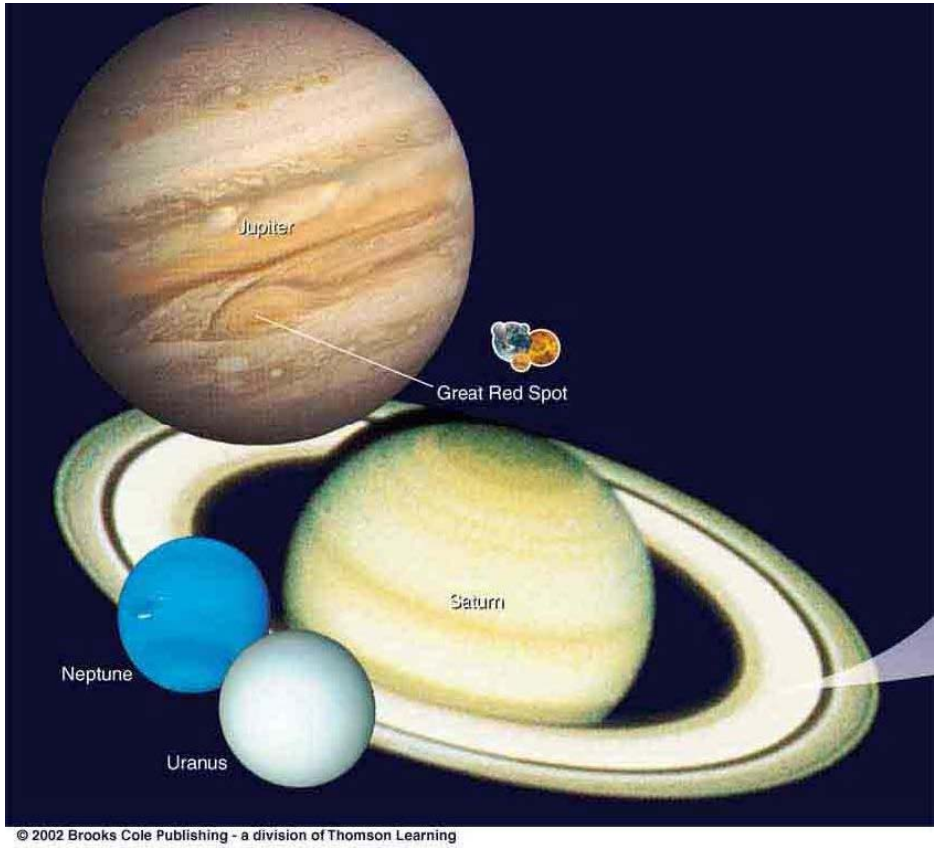
(Distances and times reproduced to scale)

Two Kinds of Planets

Planets of our solar system can be divided into two very different kinds:



Terrestrial (earthlike) planets: Mercury, Venus, Earth, Mars



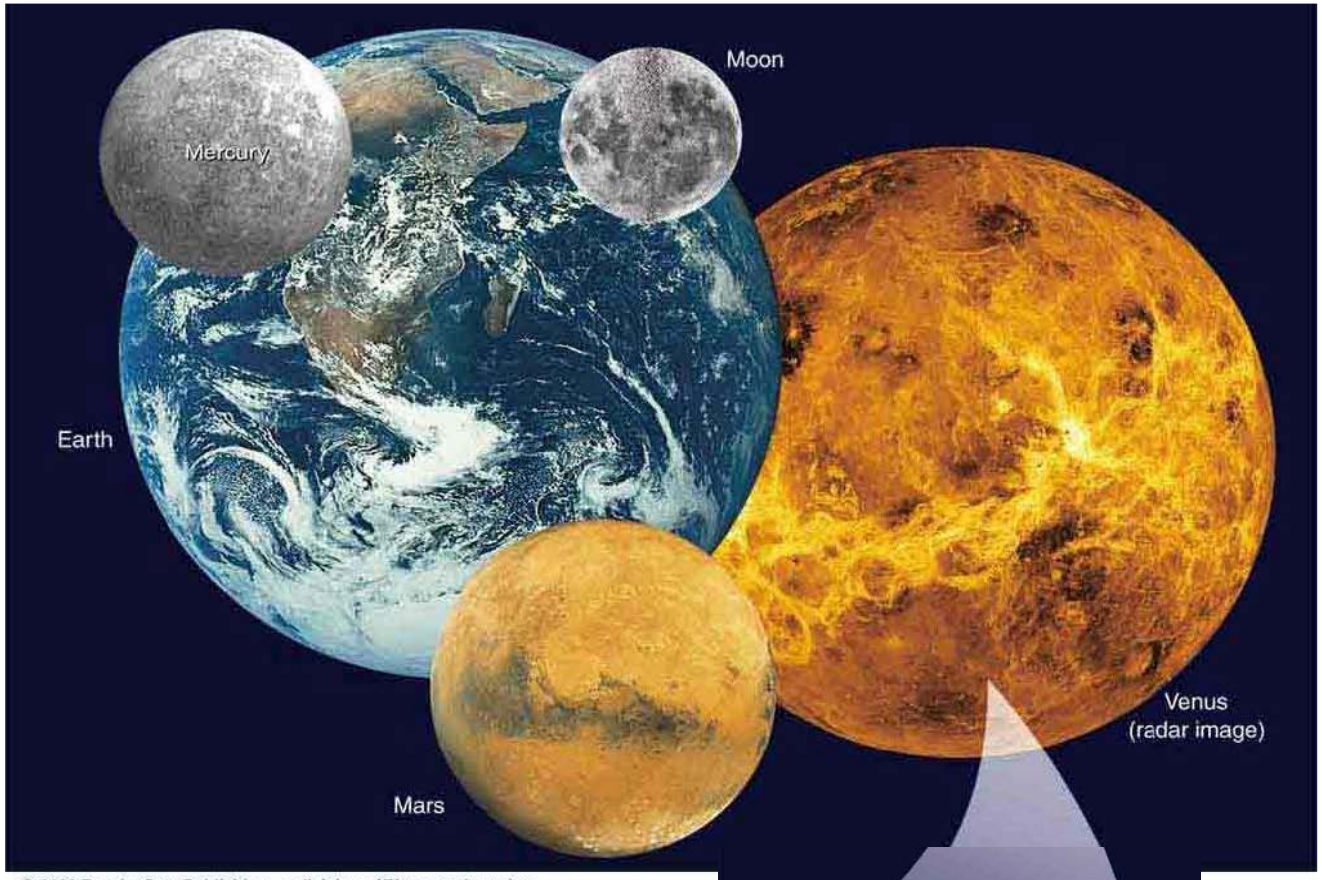
Jovian (Jupiter-like) planets: Jupiter, Saturn, Uranus, Neptune

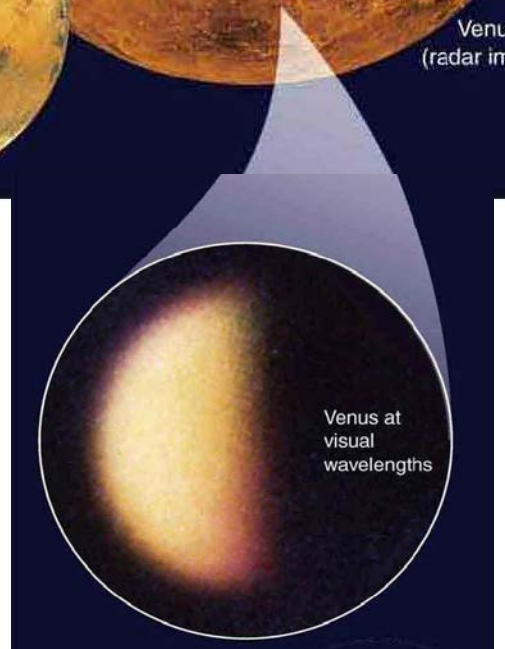
TERRESTRIAL PLANETS

Four inner planets of the solar system

Relatively small in size and mass (Earth is the largest and most massive)

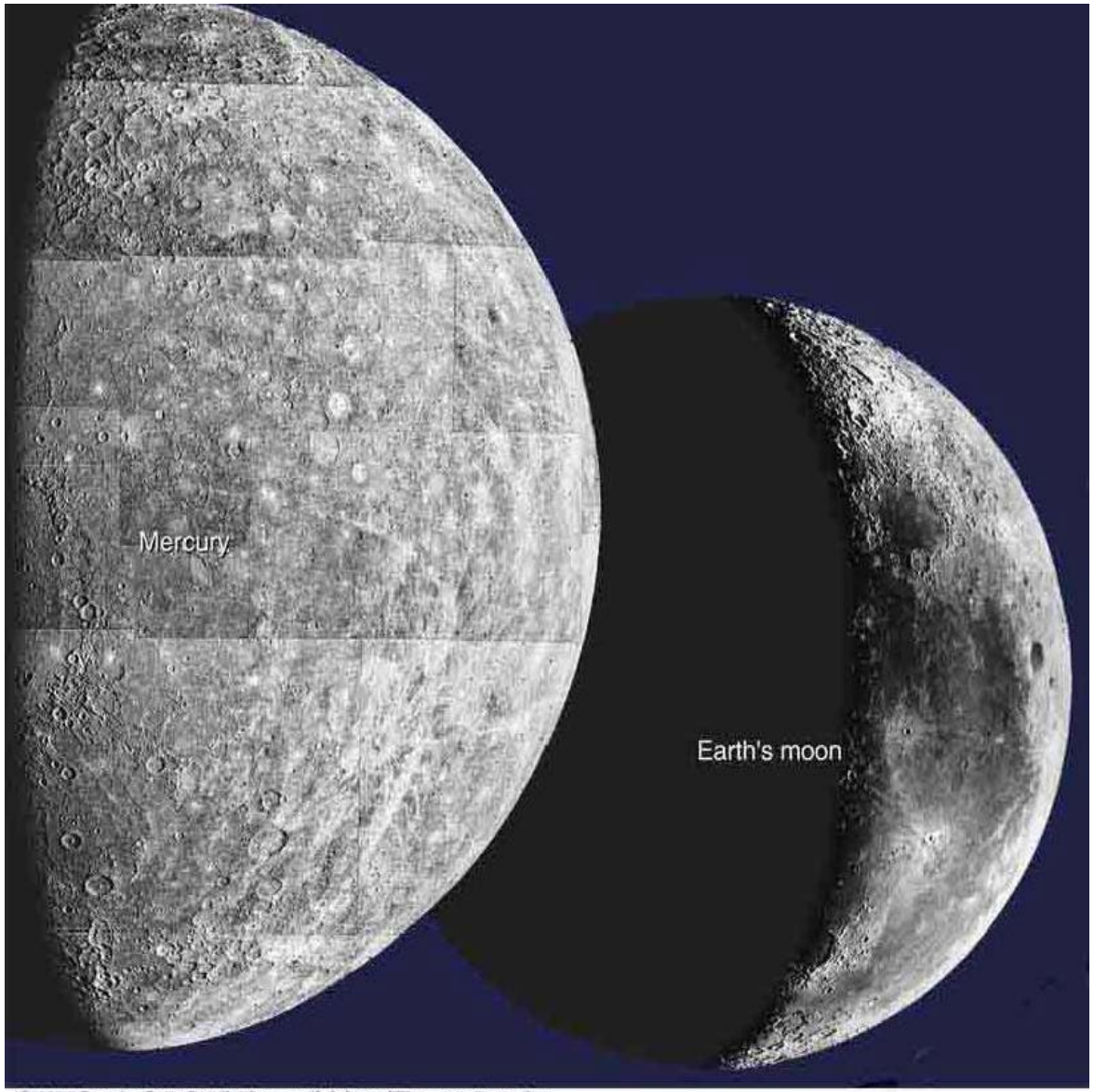
Rocky surface





Surface of Venus cannot be seen directly from Earth because of its dense cloud cover.

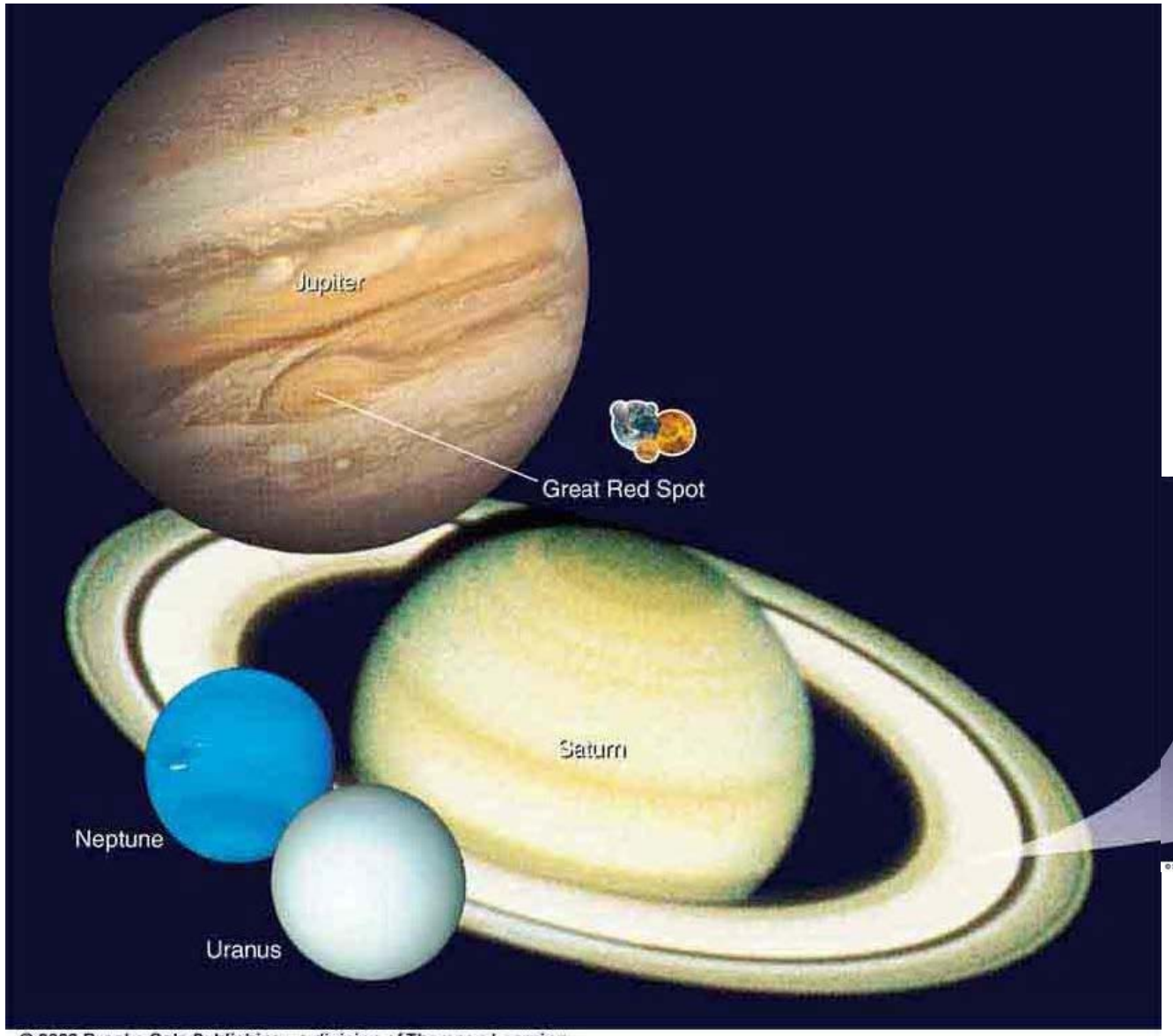
CRATERS ON PLANETS' SURFACES



Craters (like on our Moon's surface) are common throughout the Solar System.

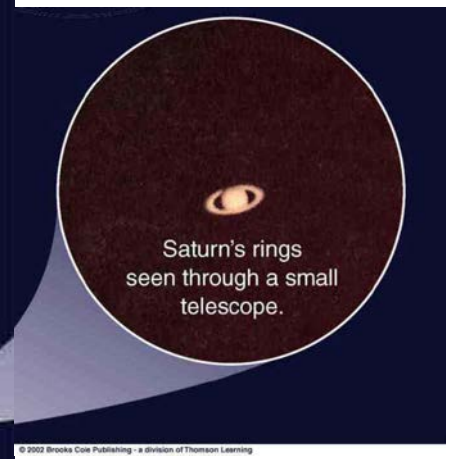
Not seen on Jovian planets because they don't have a solid surface.

The Jovian Planets



Much lower average density

All have rings (not only Saturn!)

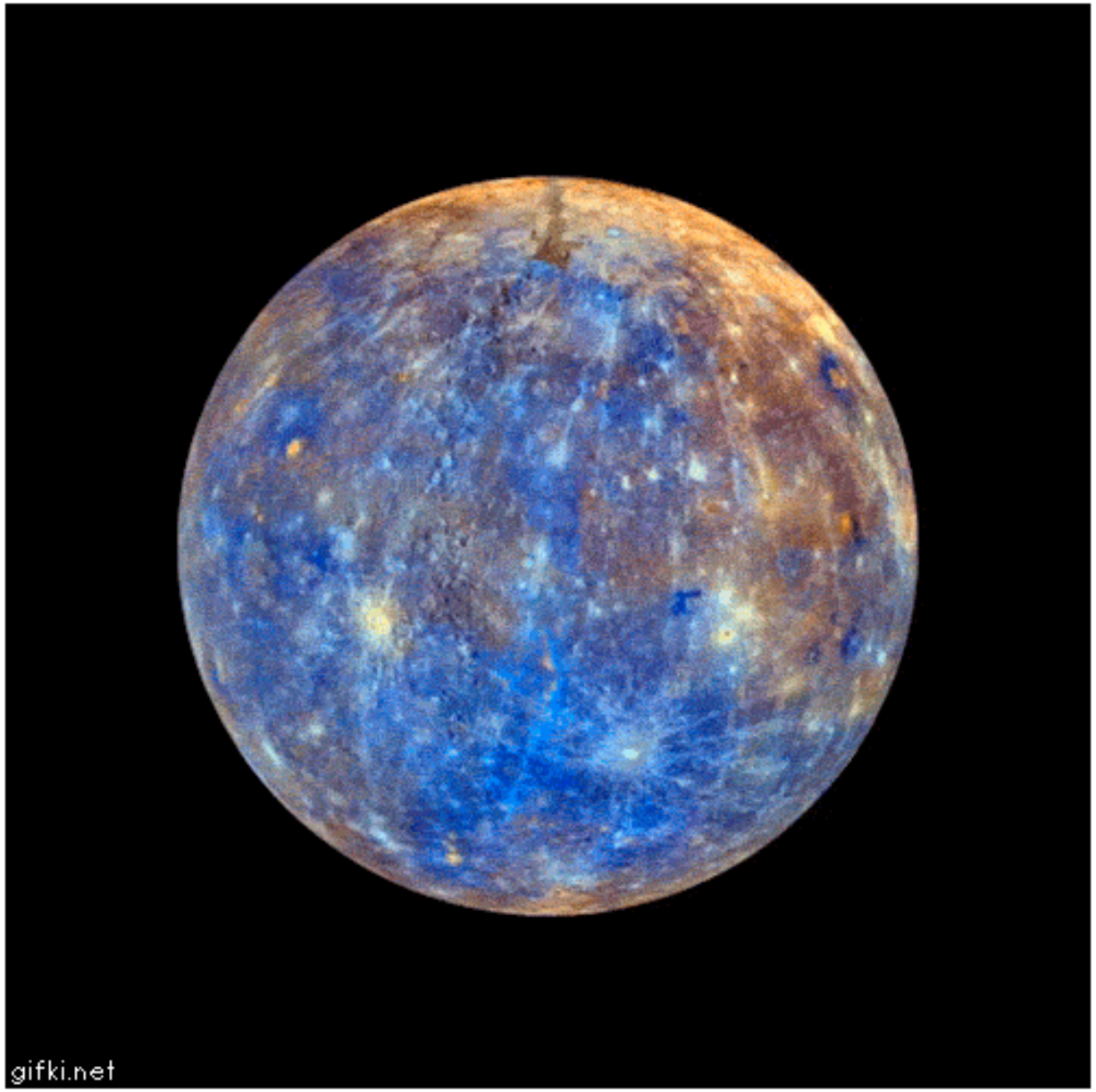


Mostly gas; no solid surface

Comparison of the rotation speed and angle of the axis of all 8 planets !!

https://www.youtube.com/watch?v=my1euFQHH-o

Mercury



- Mercury has a revolution period of 88 days. It has extreme temperature fluctuations, ranging from 800°F (daytime) to -270°F (nighttime).
- Even though it is the closest planet to the sun, scientists believe there is ICE on Mercury!
- The ice is protected from the sun’s heat by crater shadows.

Venus

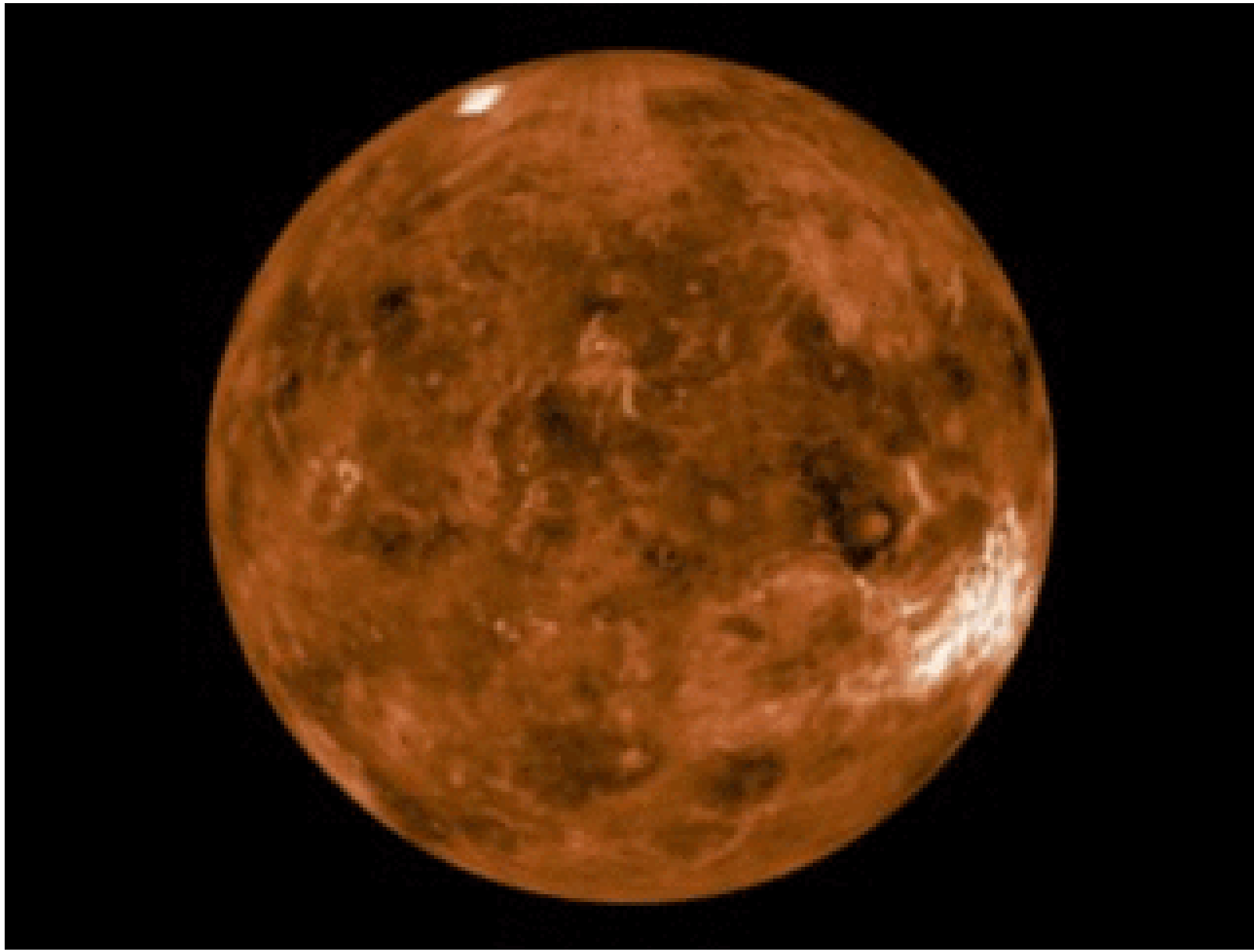
- Venus is the brightest object in the sky after the sun and moon because its atmosphere reflects sunlight so well.

  People often mistake it for

  a star.

- Its maximum surface temperature may reach 900°F.

- Venus has no moons and takes 225 days to complete an orbit around the Sun.



EARTH

- Earth is the only planet known to support living organisms.

- Earth's surface is composed of 71% water.

  Water is necessary for life on Earth.

  The oceans help maintain Earth's stable temperatures.

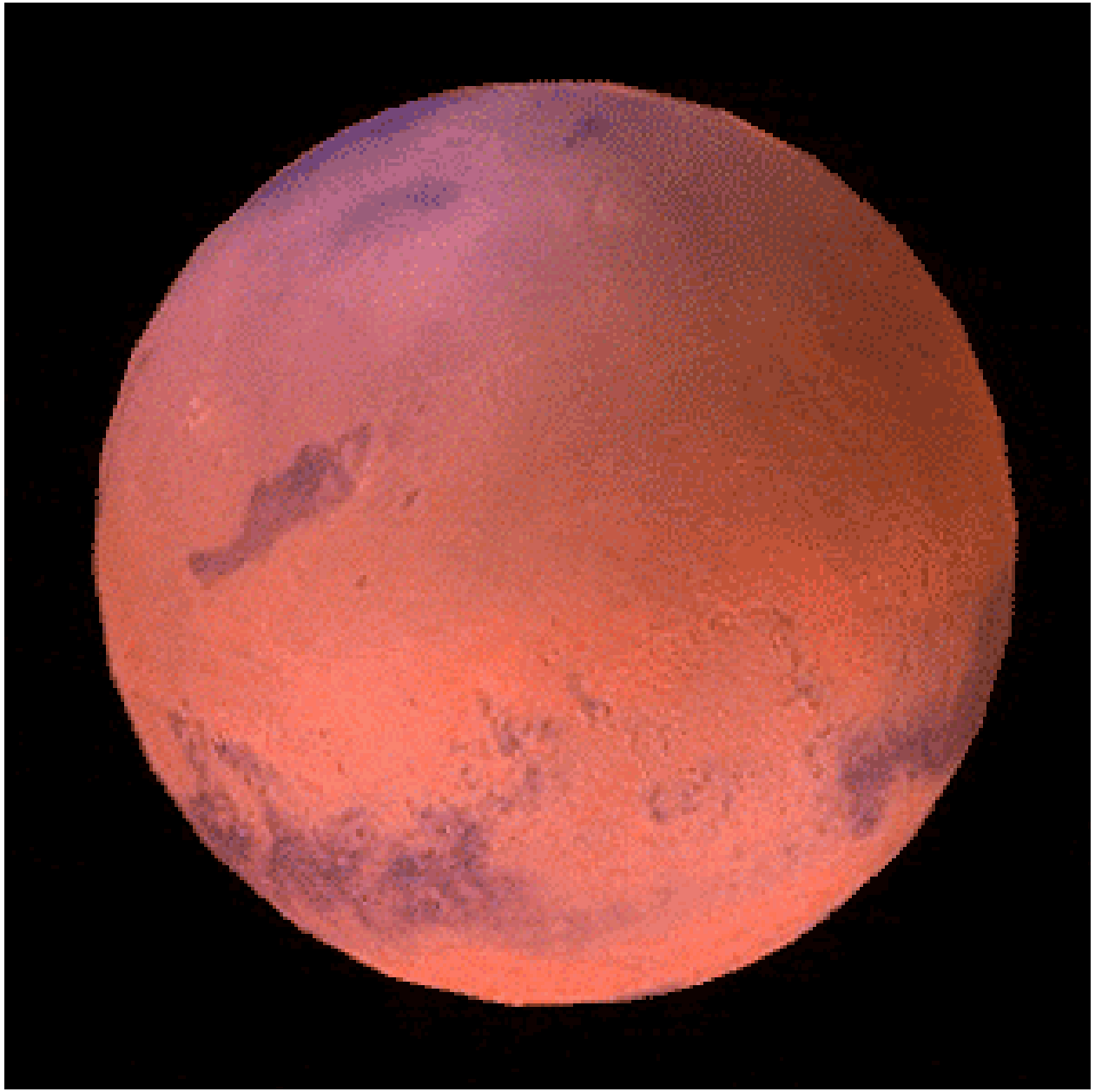
- Earth has one moon and oxygen

Earth's Moon

- It takes the moon approximately 29 days to complete one rotation. The same side of the moon always faces us.
- The moon's surface is covered in dust and rocky debris from meteor impacts.
- It has no water or atmosphere.
- The moon reflects light from the sun onto the earth's surface.

Mars

- Like Earth, Mars has ice caps at its poles.
- Mars has the largest volcano in our solar system: Olympus Mons.
- Olympus Mons is approximately 15 miles high.
- Mars appears red because of iron oxide, or rust, in its soil.
- Mars has two moons and takes about two years to complete an orbit.

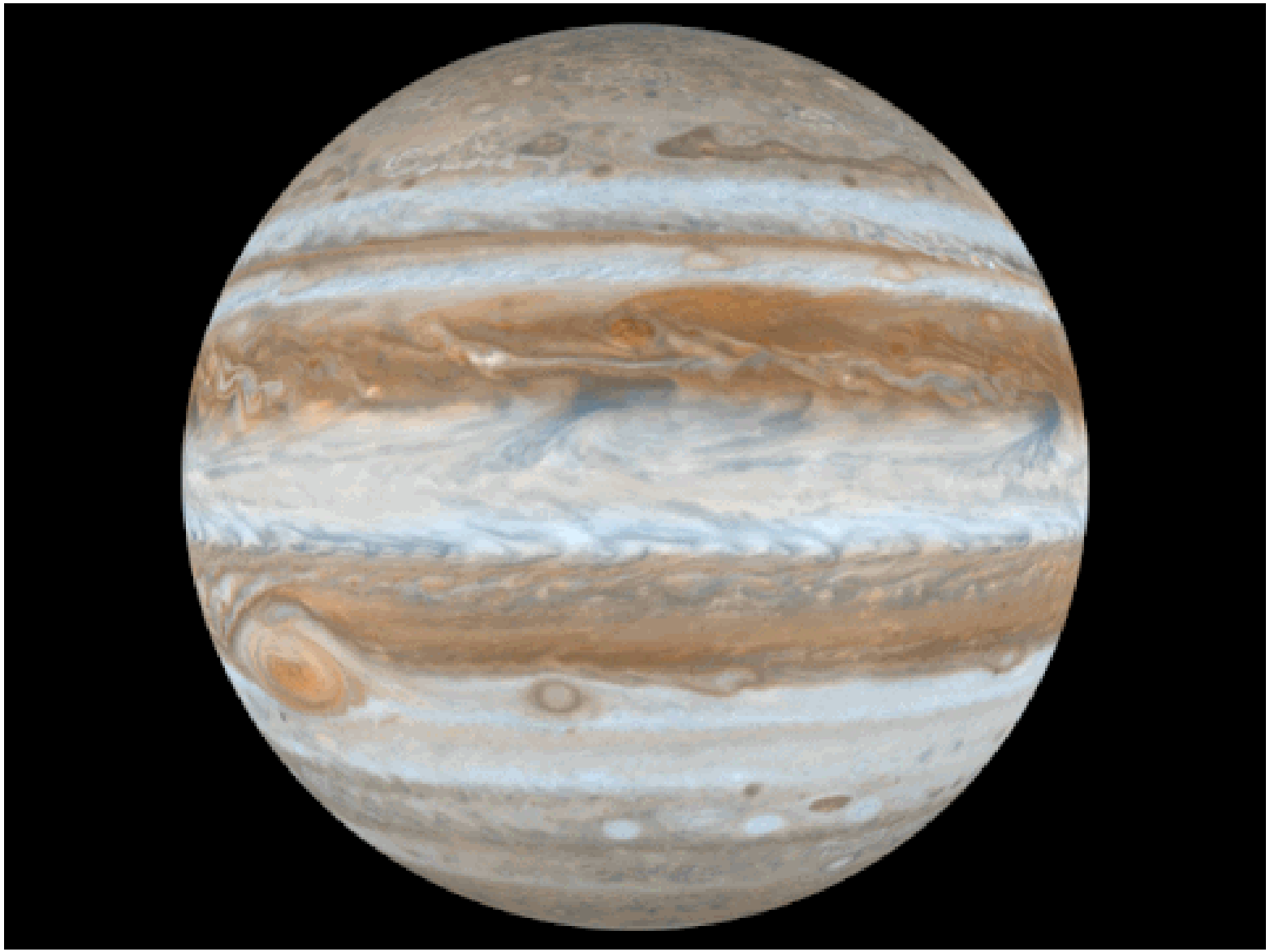


Characteristics of Gas Giants

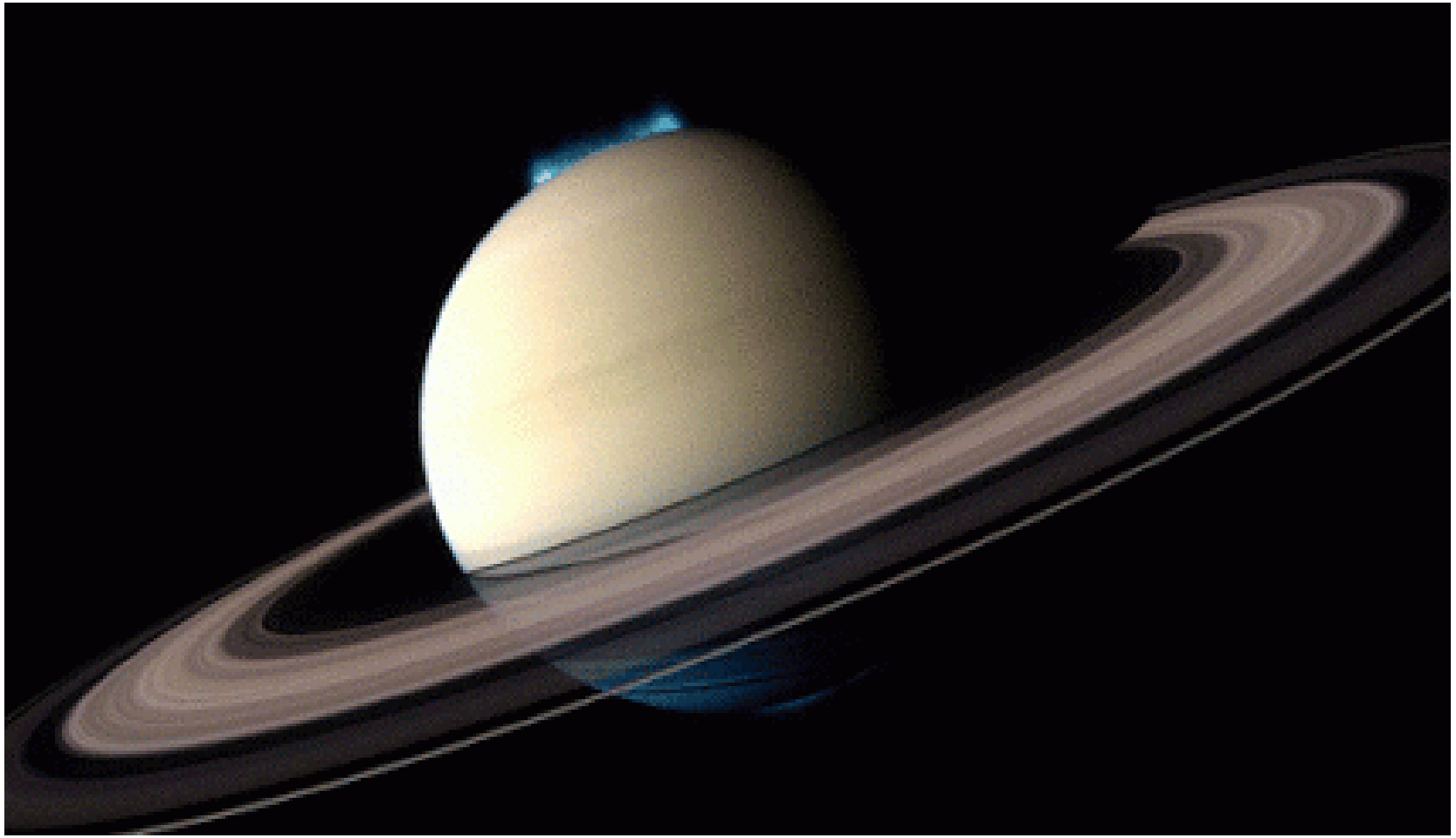
- They are made up mostly of gases (primarily hydrogen & helium).
- They are very light for their size.
- They move quickly in space.
- They have rings and many moons.
- They have a diameter of less than 28,800 miles.

Jupiter

- Jupiter is the largest and most massive planet.
- Its diameter is 11 times bigger than that of the Earth’s.
- It takes about 12 years for Jupiter to orbit the sun.
- Jupiter has 16 known moons.



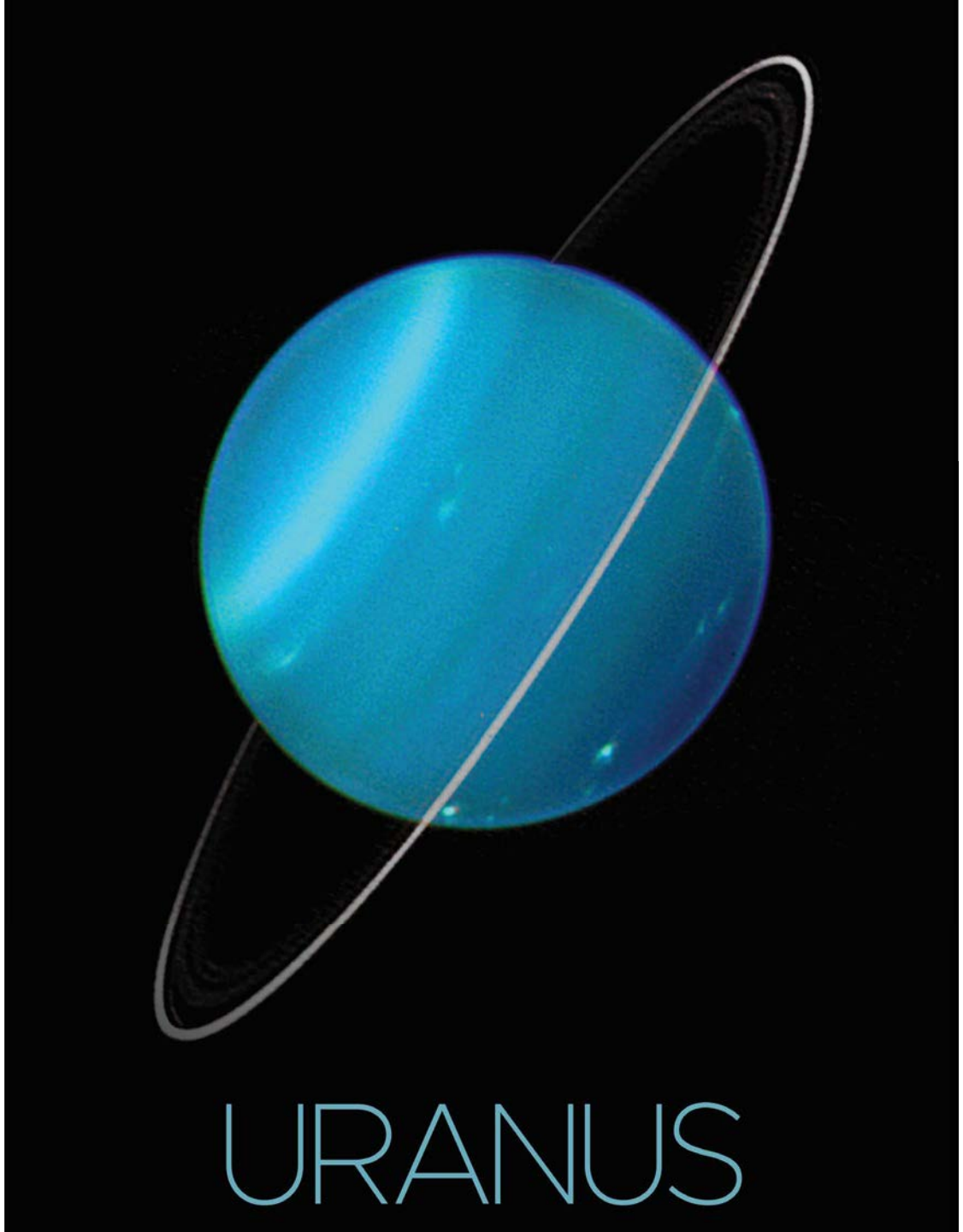
SATURN



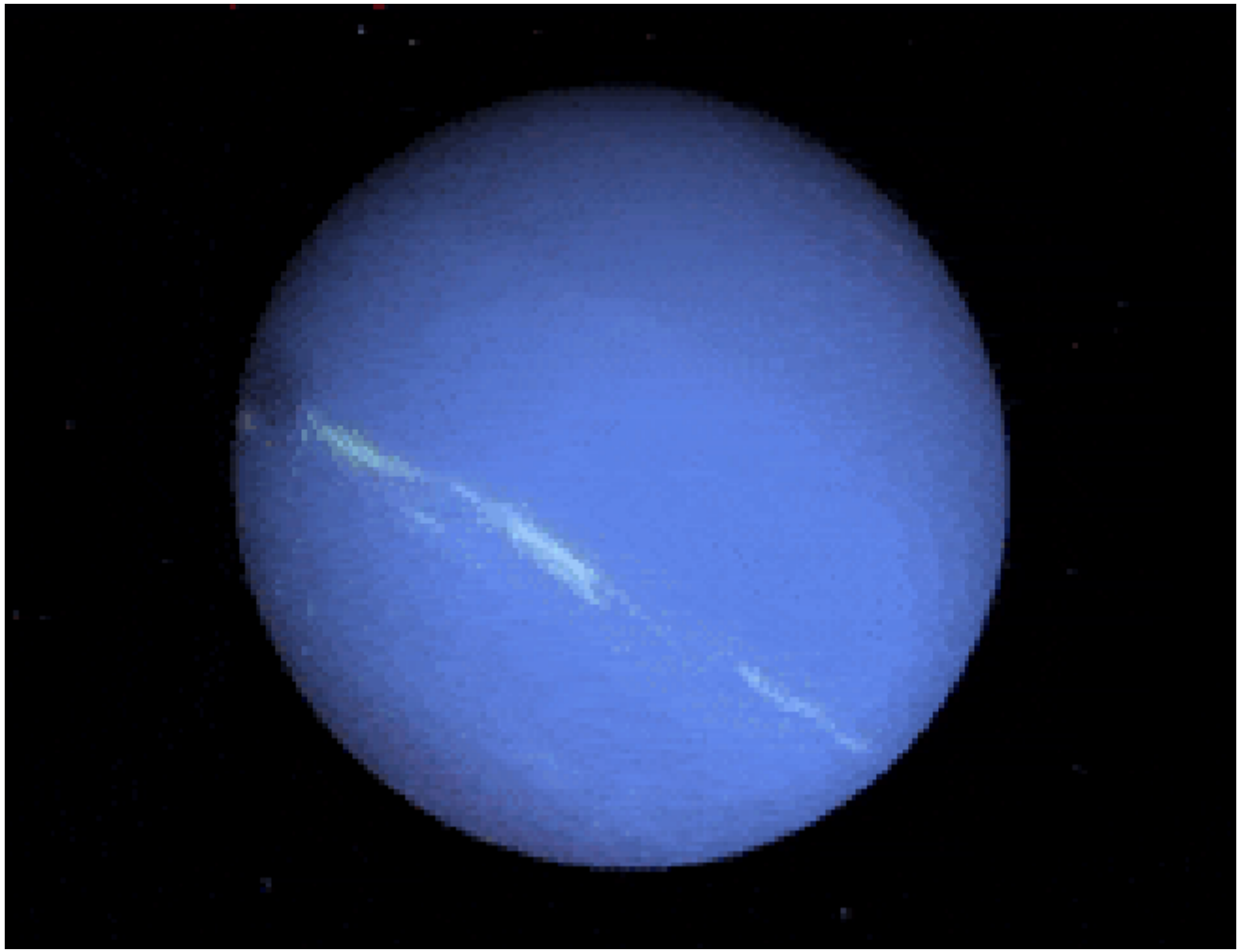
- Saturn is composed almost entirely of hydrogen and helium.
- It has many rings made of ice which are very wide.
- They extend outward to about 260,000 miles from the surface but are less than 1 mile thick.
- Saturn has 18 known moons, some of which orbit inside the rings!
- It takes Saturn about 30 years to orbit the sun.
- It has bright auroras at it’s North and South poles

Uranus

- Uranus is blue in color due to methane gas in its atmosphere.
- It has 11 dark rings surrounding it.
- It also has 21 known moons and takes 84 years to complete one orbit around the Sun.
- Its spin axis is tilted by a large 98 degrees, meaning it essentially spins on its side.
- No other planet has anywhere near such a tilt. Jupiter is tilted by 3 degrees, for example, and Earth by 23 degrees.



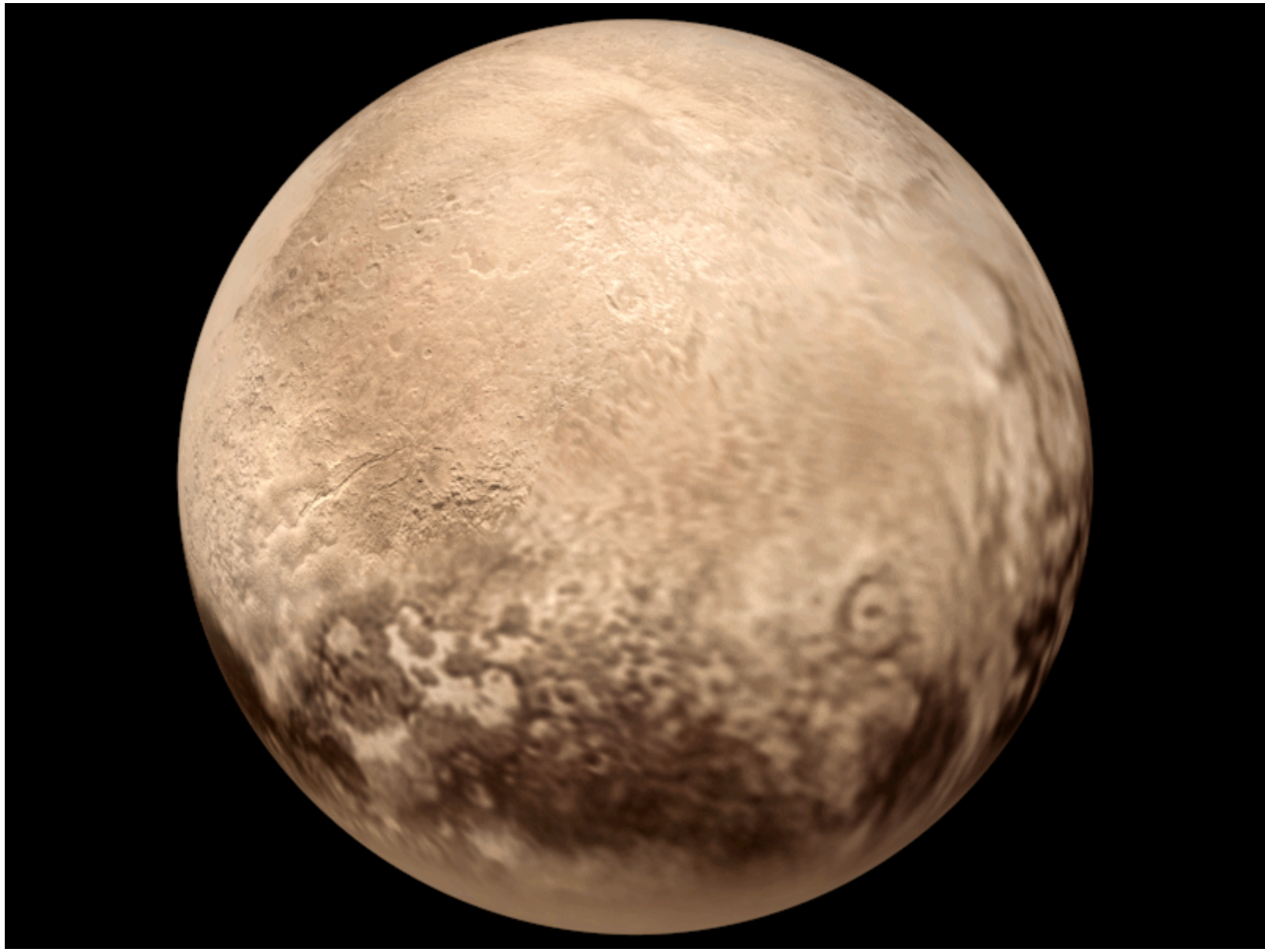
Neptune



- Neptune has the fastest winds in the solar system: up to 1,200 miles per hour.
- Neptune is blue in color due to methane gas in its atmosphere.
- Neptune takes 165 years to orbit the sun and has 8 moons.

Pluto

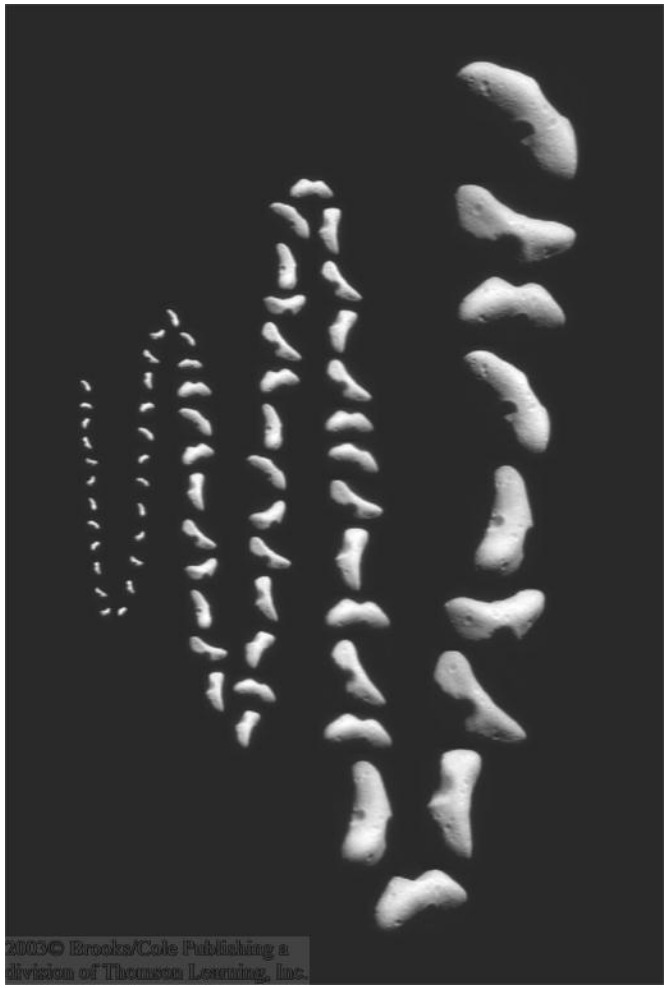
- Pluto has only one moon and takes about 249 years to orbit the sun.
- Part of Pluto's orbit passes inside that of Neptune, so at times Neptune is the planet farthest from the sun.
- Pluto was located and named in 1930, but today it is no longer considered a planet but is called a Proto-planet.



Space Debris

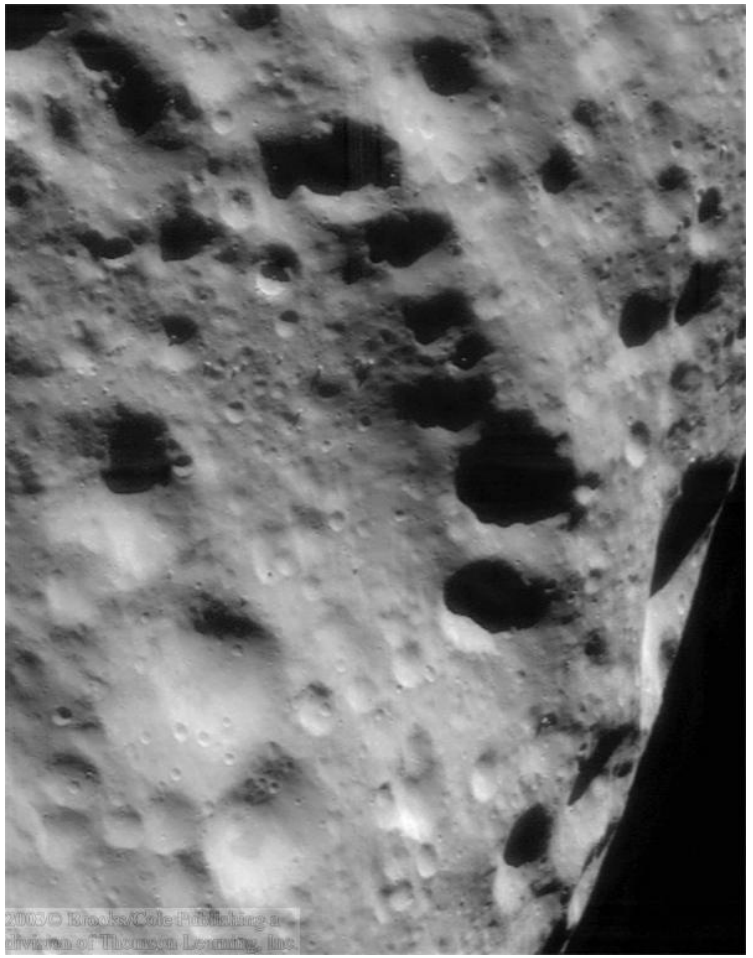
In addition to planets, small bodies orbit the sun:

Asteroids, comets, meteoroids



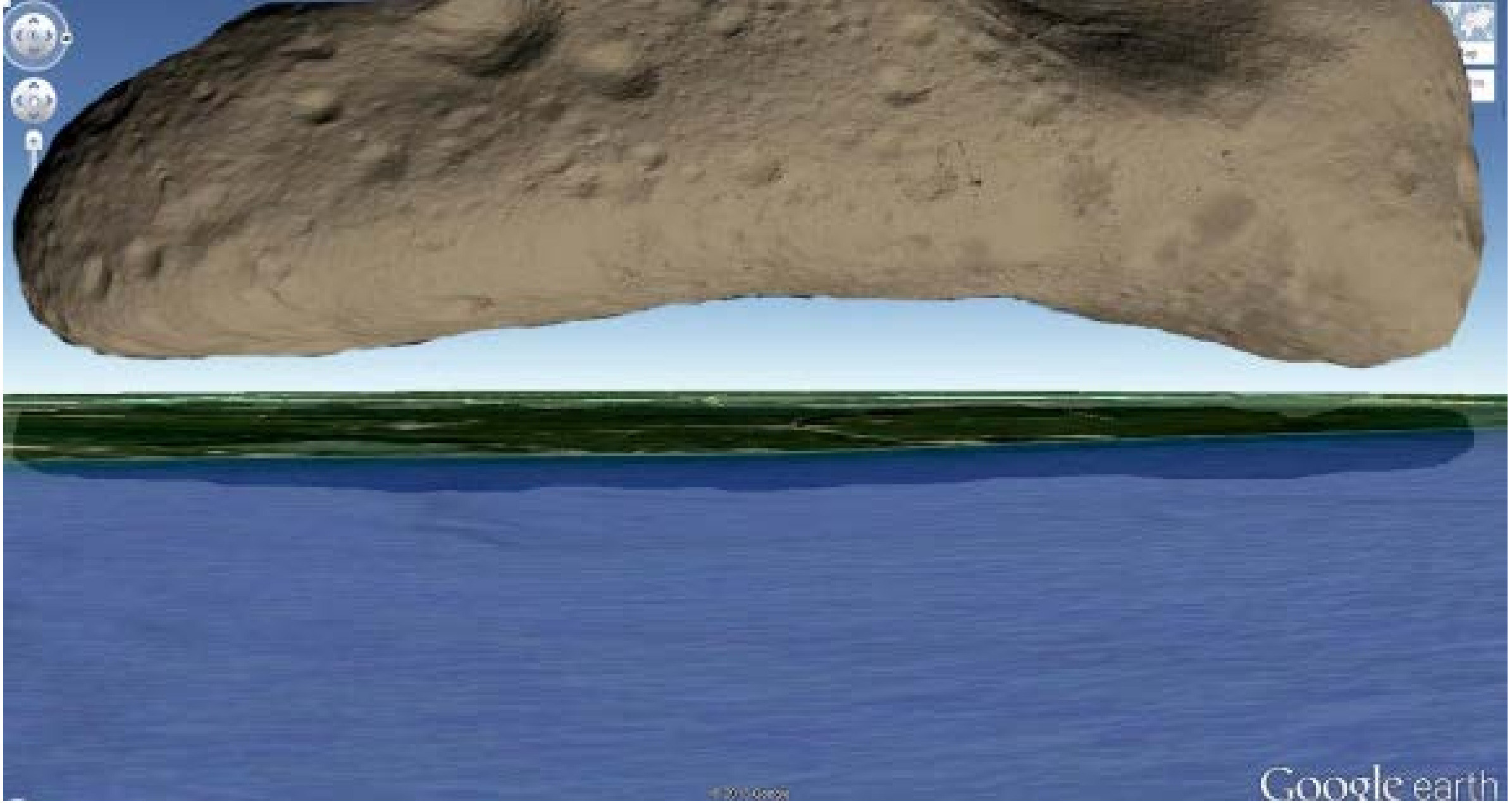
Asteroid Eros, imaged by the NEAR spacecraft

https://www.youtube.com/watch?v=bSkPNMjRRio 2.7 minutes



Asteroid Dionysus, compared to the Golden Gate bridge.

Asteroid Ryugu on top of New York city



Asteroid 433 Eros over Kennedy Space Center, Florida.

Asteroid Phoebe (Saturn IX) hovering over central Florida.

How Mars moon Deimos would look if it hovered over Paris, France.

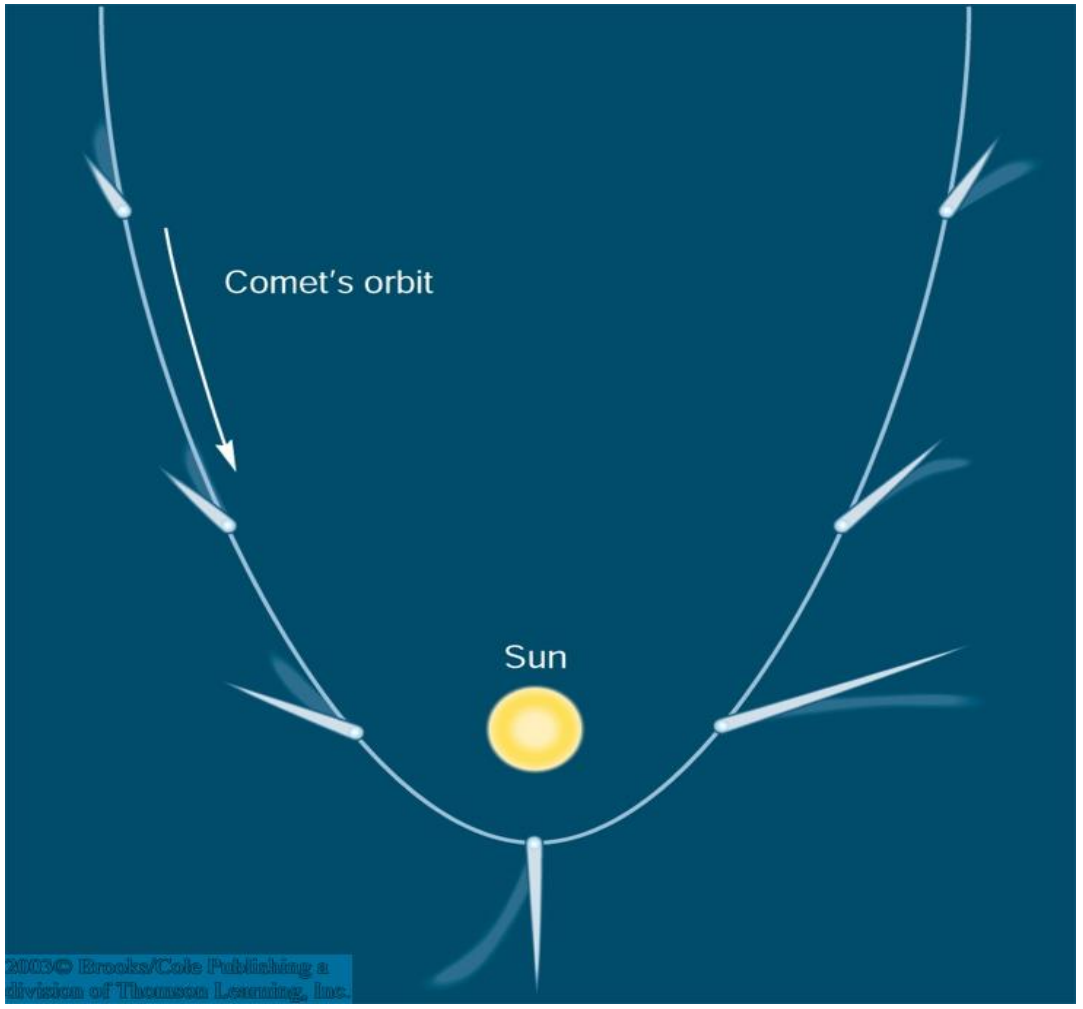
Credit and copyright: Ciro Villa

Comet 67/P, on top of Raleigh, North Carolina

The Comet 67P/Churyumov–Gerasimenkos on top of Los Angeles!!

COMETS

Icy nucleus, which evaporates and gets blown into space by solar wind pressure.



Mostly objects in highly elliptical orbits, occasionally coming close to the sun.

METEOROIDS

Small (mm – mm sized) dust grains throughout the solar system

If they collide with Earth, they burn up in the atmosphere.

Visible as streaks of light: meteors.

The **Universe** is all of space and time and their contents, including planets, stars, galaxies, and all other forms of matter and energy.

While the size of the entire Universe is unknown, it is possible to measure the size of the observable universe, which is currently estimated to be 93 billion light years in diameter.

Light is the fastest-moving stuff in the universe. One light year is the time it takes light traveling at 186,282 miles per second, to move for 1 year. Its distance is almost 6 trillion miles !!

The Andromeda galaxy is our closest neighbor galaxy and is over 2 million light-years from Earth!

117,572,510,821,000 or
117 trillion miles !!

This video gives you and idea of how big the Universe is and to see all of the small cells and other things, inside us !!

https://www.youtube.com/watch?v=8Are
3 MINUTES

The Sun is one of hundreds of billions of stars in the Milky Way galaxy, which is one of at least hundreds of billions of galaxies in the Universe.

Many of the stars in our galaxy have planets. **As of June 1st, 2019, there are 4,071 confirmed exo-planets** in 3,043 star systems, with 659 star systems having more than one planet.

All the largest scale galaxies are distributed uniformly and the same in all directions, meaning that the Universe has neither an edge nor a center.

At smaller scales, galaxies are distributed in clusters and superclusters which form immense filaments and voids in space, creating a vast foam-like structure.

A simulated view of our Milky Way Galaxy and where the Earth is located, towards the outside.

	DISTANCE FROM THE SUN (MILES)	JET AIRPLANE FLIGHT TIME FROM THE SUN AT 575 MILES/HOUR	SPACECRAFT FLIGHT TIME AT 25,000 MILES PER HOUR (FROM THE SUN)
Mercury	35,397,000	7.02 YEARS	.16 YEAR
Venus	66,991,000	13.3 YEARS	.30
Earth	93,505,000	18.6 YEARS	.42
Mars	135,290,000	26.9 YEARS	.61
Jupiter	482,290,000	95.7 YEARS	2.20
Saturn	929,840,000	184.6 YEARS	4.24
Uranus	1,840,900,000	365.5 YEARS	8.40
Neptune	2,781,800,000	552.3 YEARS	12.7
Start of Kuiper Belt	2,790,000,000	554 YEARS	12.74
End of Kuiper Belt	4,650,000,000	923 YEARS	21.23
Start of Oort Cloud	292,950,000,000	58,160 YEARS	1,338
End of Oort Cloud	13,950,000,000,000	2,769,506 YEARS	63,711
Distance to our Closest star – Proxima Centauri (4.3 light years away)	25,277,549,213,100	5,017,677 YEARS	115,429
Distance to the Andromeda Galaxy (2.9 million light years away)	17,047,649,469,300,000,000	3,384,484,707,828 YEARS	77,857,941,289

HOW FAST ARE YOU MOVING THROUGH SPACE ?

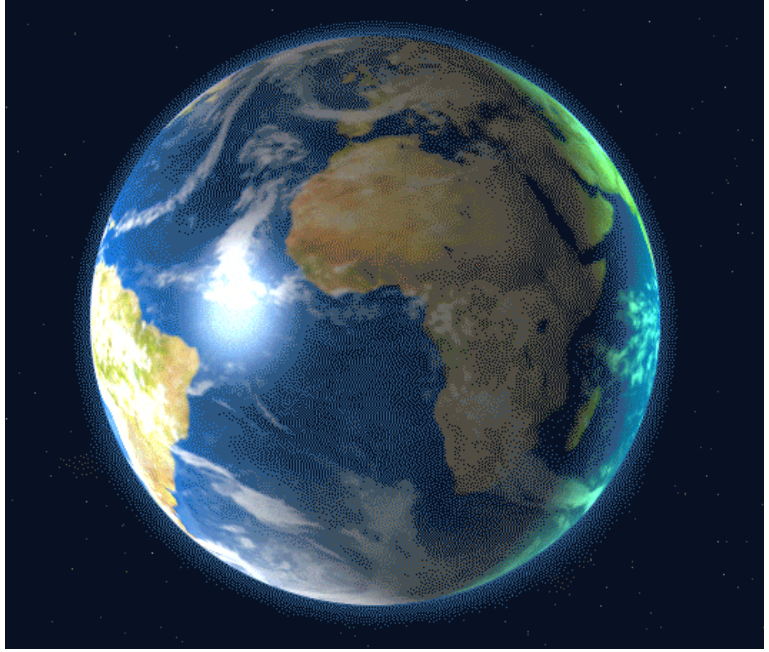
Chances are that you are sitting in a chair right now, so it seems like you are stationary.

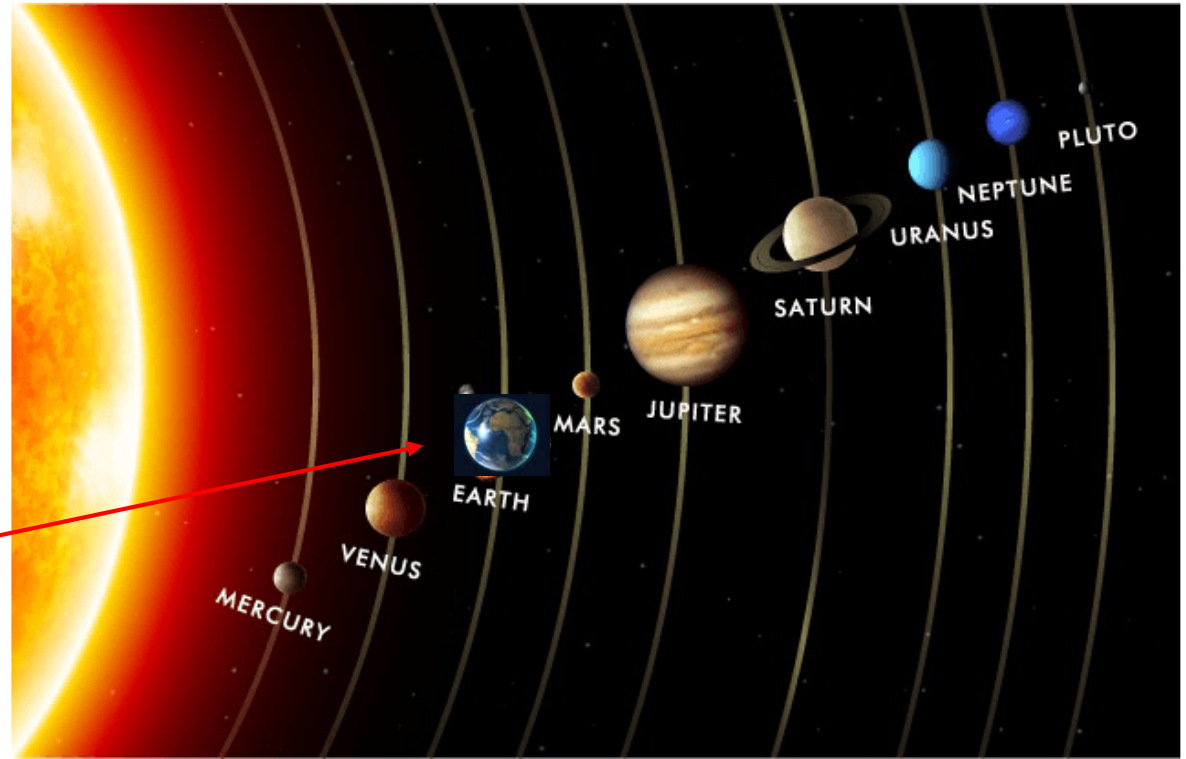
But in fact you are moving through the universe at a tremendous speed.

Let's take a look at where all that motion is coming from.

- The first thing to consider is the earth's rotation. If we assume we are sitting somewhere in South Florida , then we are moving at about 1,000 miles per hour.

- **The Earth also makes one orbit around the <u>sun</u>** every year. That works out to 66,666 miles per hour.





Our **solar system itself is also moving** in an orbit around the galactic core, which gives the solar system a speed close to 515,000 miles per hour.

Our galaxy and neighbors are moving in the direction of the constellation Hydra at a speed of 2,237,000 miles per hour.

Adding it all up, you get:

1,000 + 66,666 + 515,000 + 2,237,000 = 2,819,666 miles per hour

In other words, you are hurling through space at over 2.8 million miles per hour, even though it feels like you are sitting still !!

So the next time someone in your family or group of friends calls you lazy for just sitting there, you can politely remark that, although it may look as if you are just sitting, you are actually moving at

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THE END