Finding our way around the night sky

Chaddleworth St. Andrew's & Shefford C of E School

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To the naked eye (the astronomical term for look without optical aid) all the stars look very similar. Some stars look brighter than others a some of the brighter stars may show a hint of colour but it is very subtle.

One thing we will notice is some stars appear to form a loose pattern or group. We as humans do have an ability to make patterns, groups or shapes out as we look around us. Some examples are seeing rocks that look like an animal or a human head or face. We also se the shapes of animals in the clouds on a bright day. So it is not surprising that we see patterns in the night sky. The picture above shows the night sky with the ‘naked eye’ stars in their relative positions.

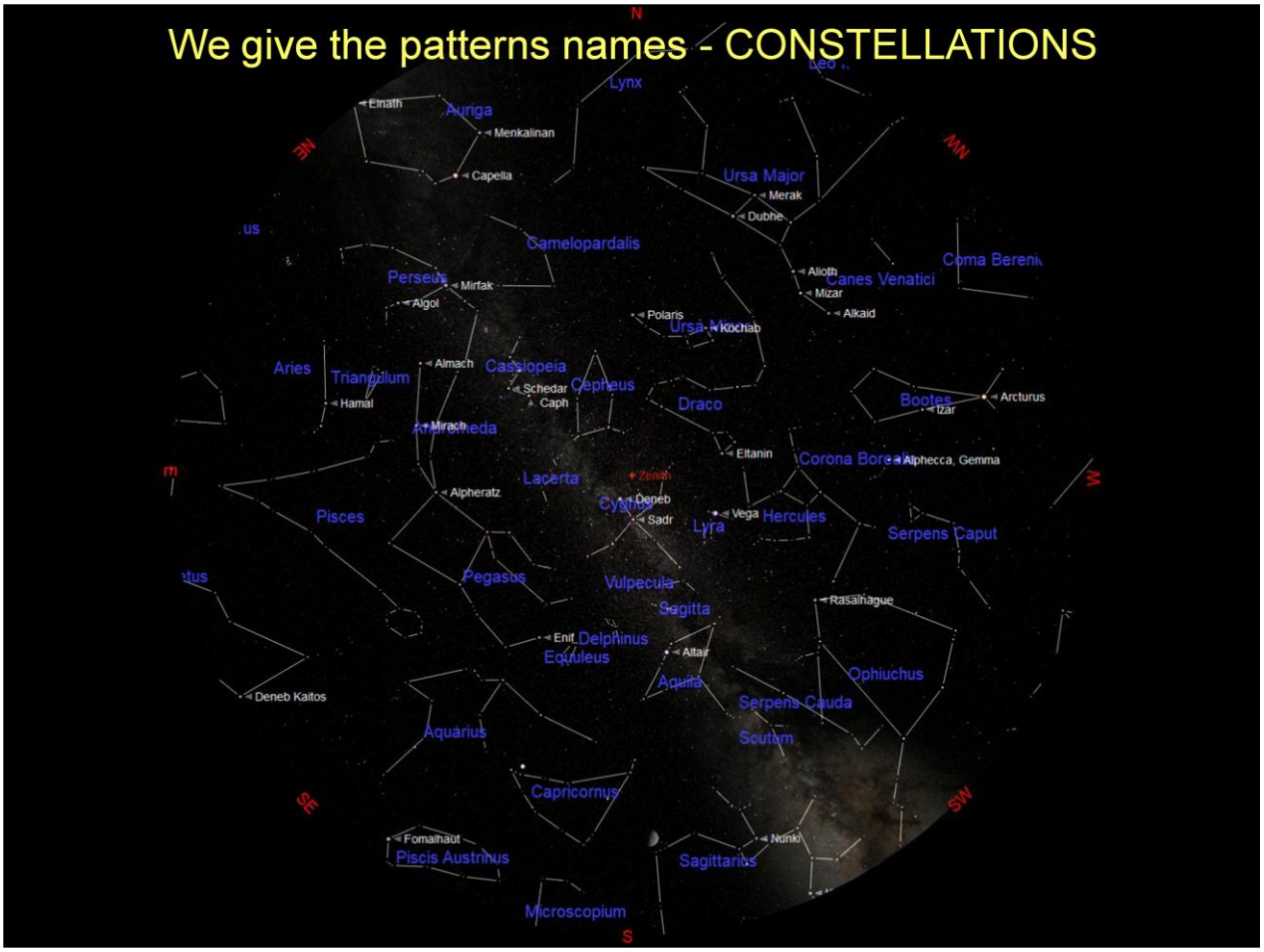
The misty band that stretches diagonally across the sky is the Galaxy that our star the Sun resides in and we call the Milky Way. Our Sun is just one of the 200 billion stars that comprise the Milky Way which is classified as a Giant Spiral Galaxy.

The view we see here is as if we are looking straight up to the point directly overhead that we call ‘the Zenith’. The Northern Horizon is at the top of the chart, South is at the bottom, East on the left and West to the right.

We give the brightest stars names so we can identify them.

Most names are very old and from ancient Greek, Roman or Arabic.

If we join up the stars that appear to form a group with ‘dot to dot’ lines we can make out 88 internationally accepted patterns that we call ‘CONSTELLATIONS’.



The names of the constellations are also mainly very old.

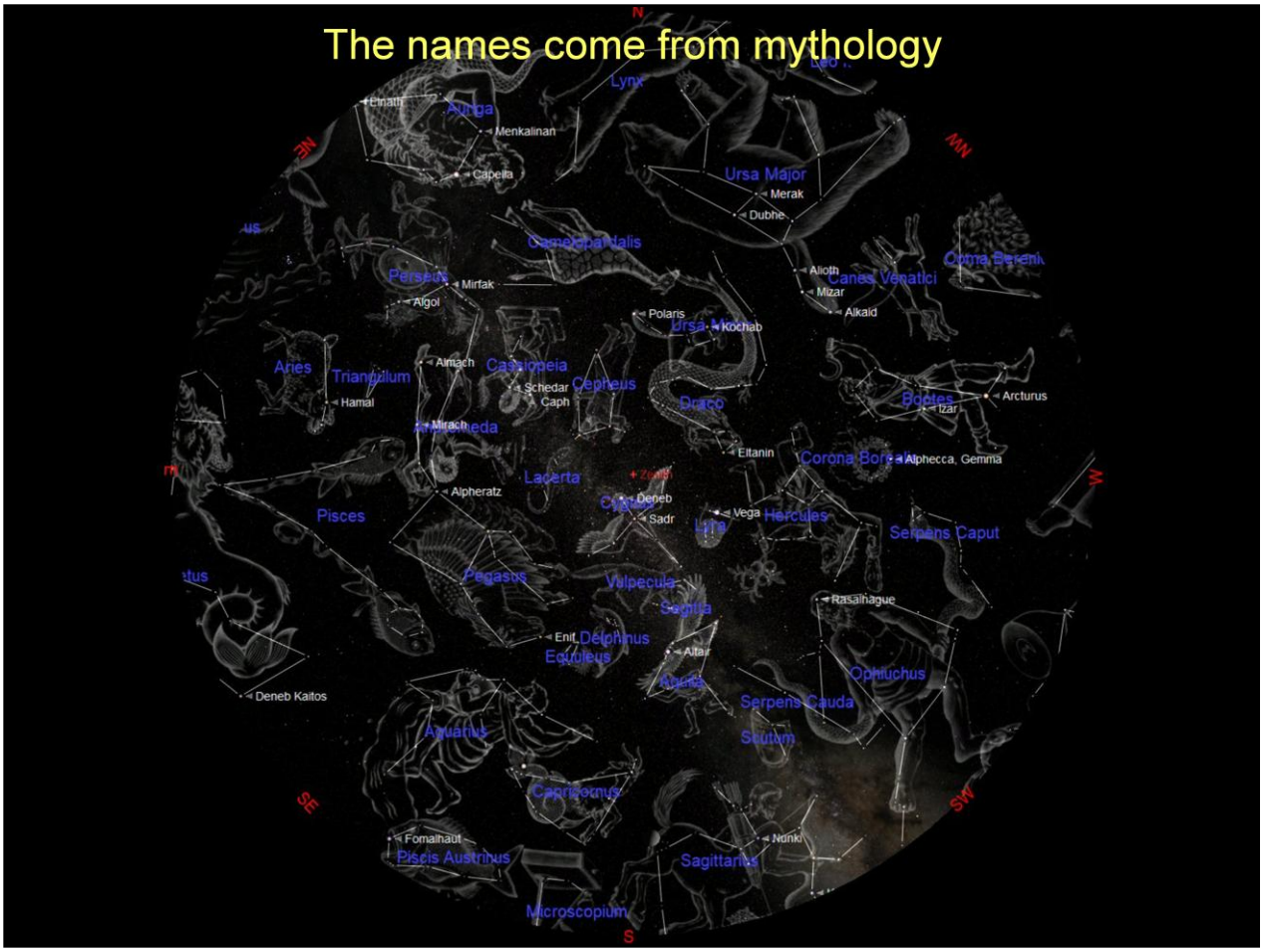
Constellations help us identify areas of the night sky.

They are rather like the counties on maps of England.

Ursa Major, shown at the top right of the chart above is one of the best known.

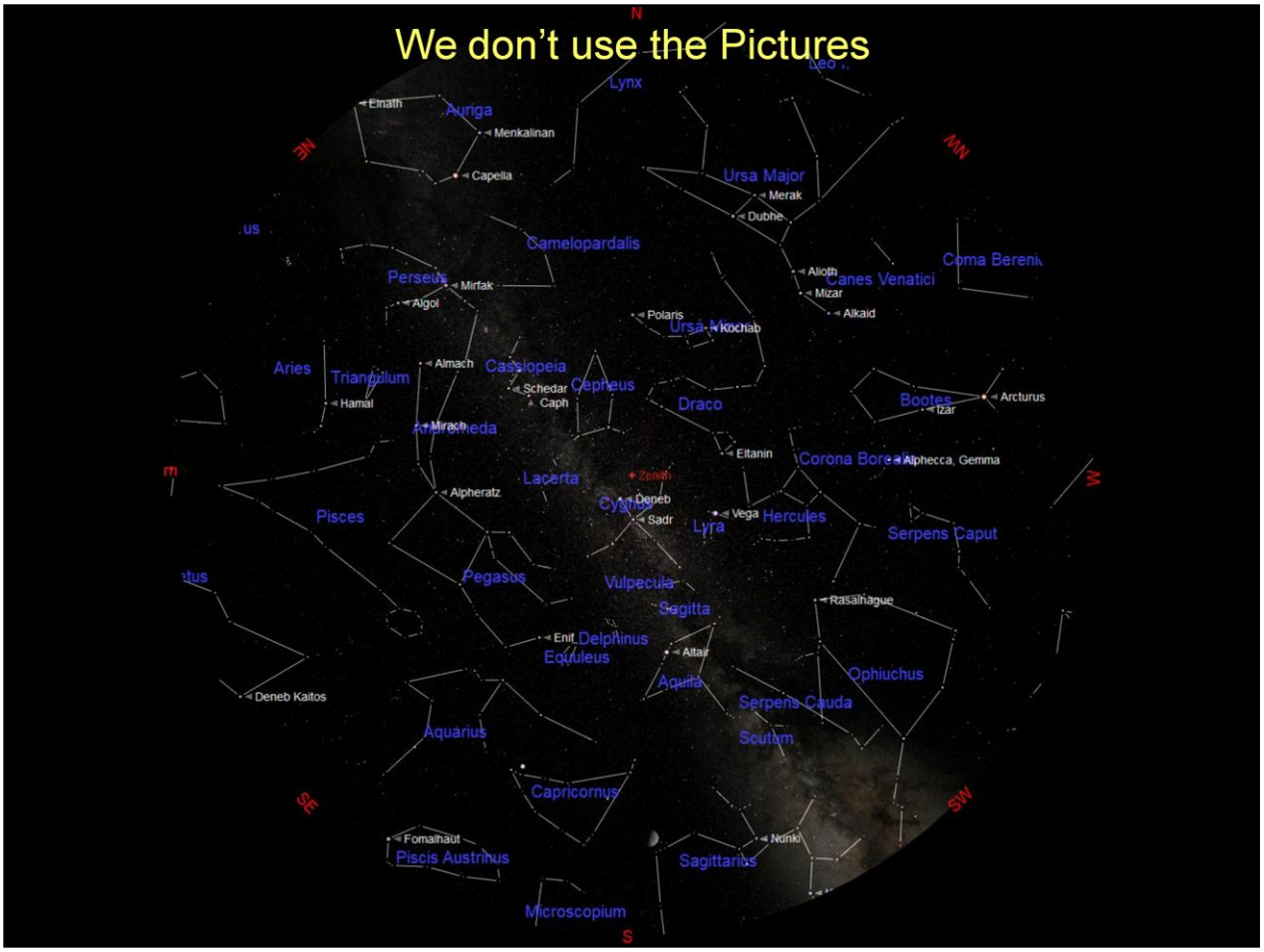
It is also called the ‘Plough’ or the ‘Big Dipper’ by the Americans.

The main shape (asterism) does look remarkably like a Saucepan..



In the past star charts were very artistically drawn. They we lovely to look at but scientifically they were not much use. Some artists even moved the position of the stars to fit their elaborate chart better. The chart above has illustrations superimposed on the modern stick-man constellation figures. It can be seen that very few illustrations look anything like the star pattern it is supposed to represent. Having said that it can also be seen that the stick figures are not much better.

However the stars on modern charts are in the proper position relative to all the other stars. The stick figures just join the brighter stars to make the recognised grouping easier to remember and do not necessarily resemble the mythological character that they represent. Stick figures are not so ‘pretty’ but they are more scientific.



The Constellation names are generally taken from mythology so many have existed since ancient times.

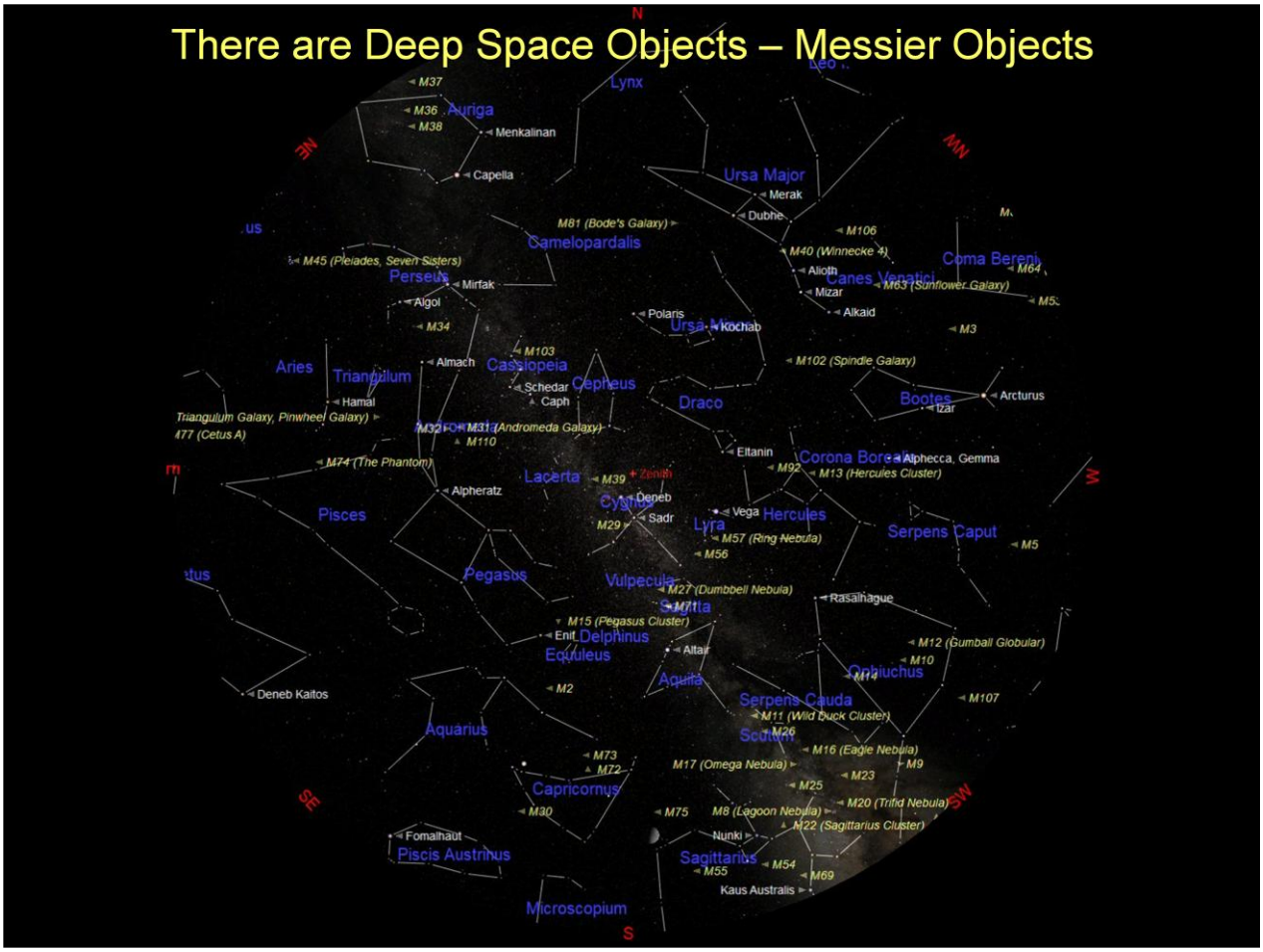
Some constellations are well known and easy to recognise.

Another well known constellation with a recognisable shape is Cygnus shown at the centre of the chart.

Cygnus has a bright star called Deneb which is almost directly overhead at this time of the year. It is sometimes called 'The Northern Cross'.

It is located at one corner of an obvious triangle of three bright stars.

The other stars are Vega in the constellation of Lyra and Altair in Aquila.



We need to be able to recognise the brightest constellations then we can use them to find the fainter constellations.

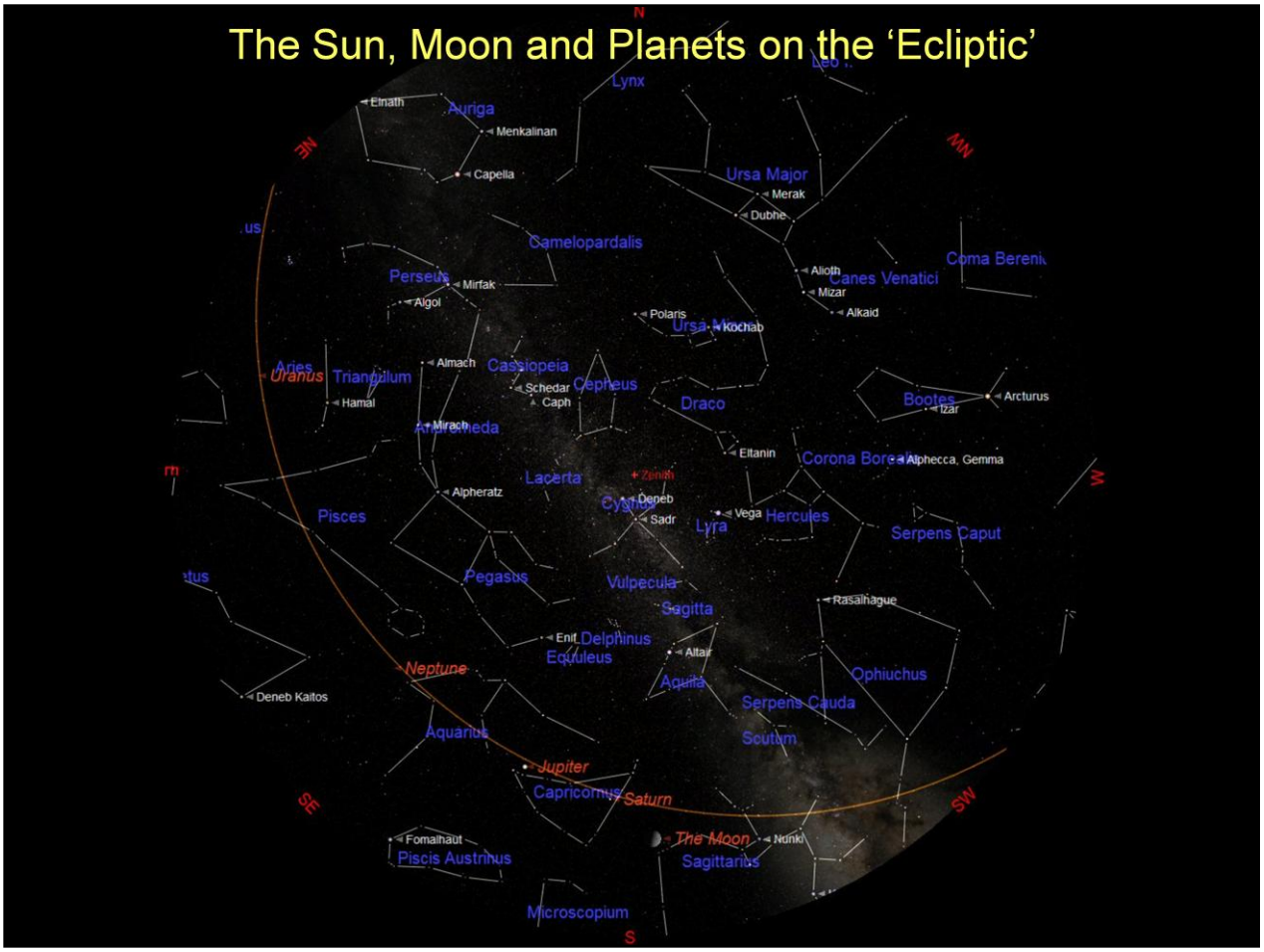
We then use the constellations to find the interesting Deep Sky objects.

These are the objects that reside outside of our Solar System.

These objects include Galaxies, Star Clusters and Nebulae.

The brightest and easiest of these object are listed in the Messier Catalogue and are labelled as Messier 31 or (M31) for example.

Messier Objects are the first Deep Sky Objects to look for using a telescope.



There is an imaginary line that the Sun, Moon and Planets appear to move along as they cross the sky.

We call this imaginary line the 'Ecliptic' it is also known as the Zodiac.

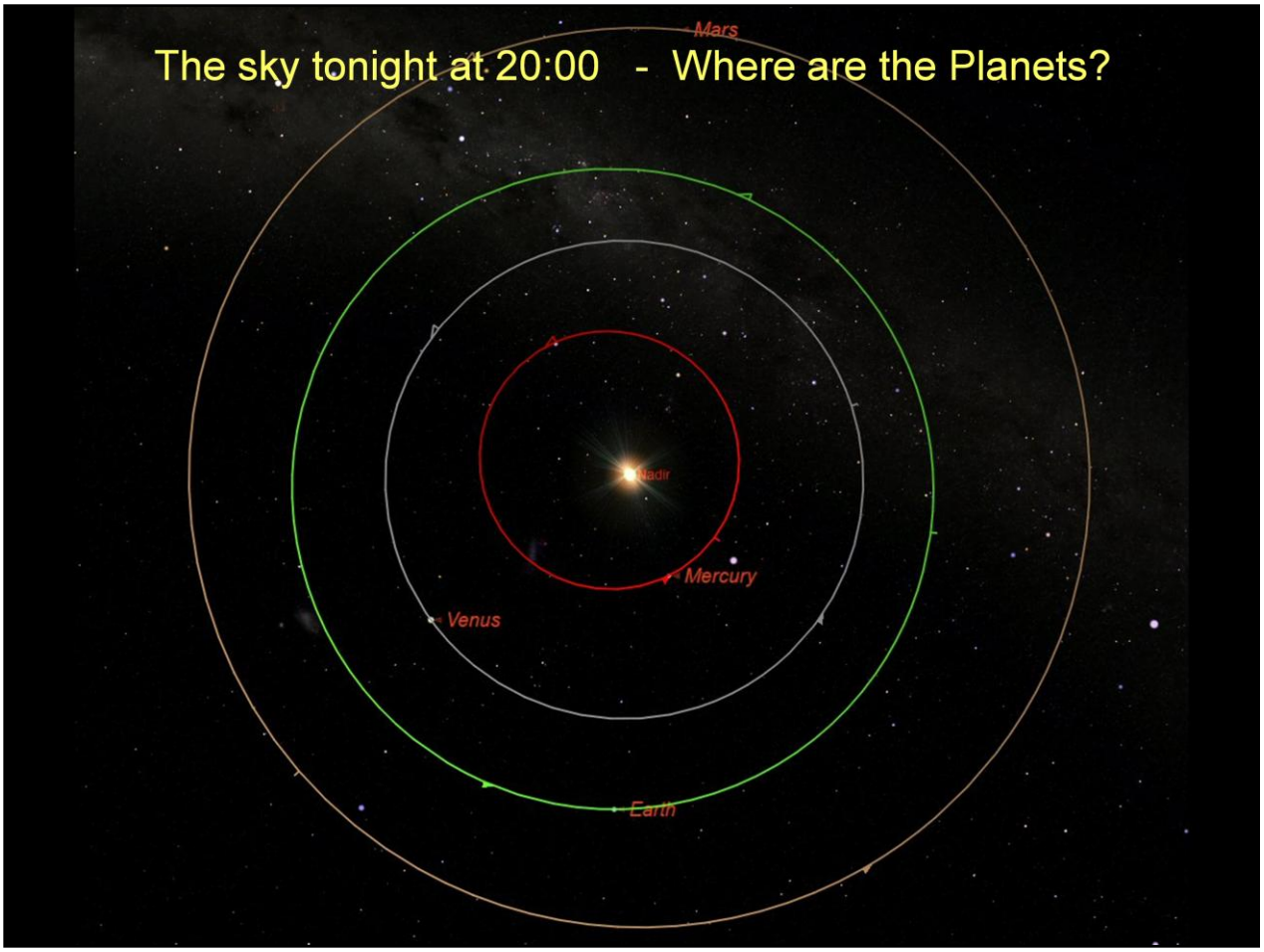
It is the line that represents the plane where the planets move around the Sun around their orbits.

Our planet Earth rotates on an axis (North and South poles) that is tilted over at 23.4º compared to the Sun's axis and the orbital plane of the planets.

So our view of the sky from Earth is tilted and this causes the Ecliptic to appear to move up and down as we orbit the Sun giving us our Seasons.

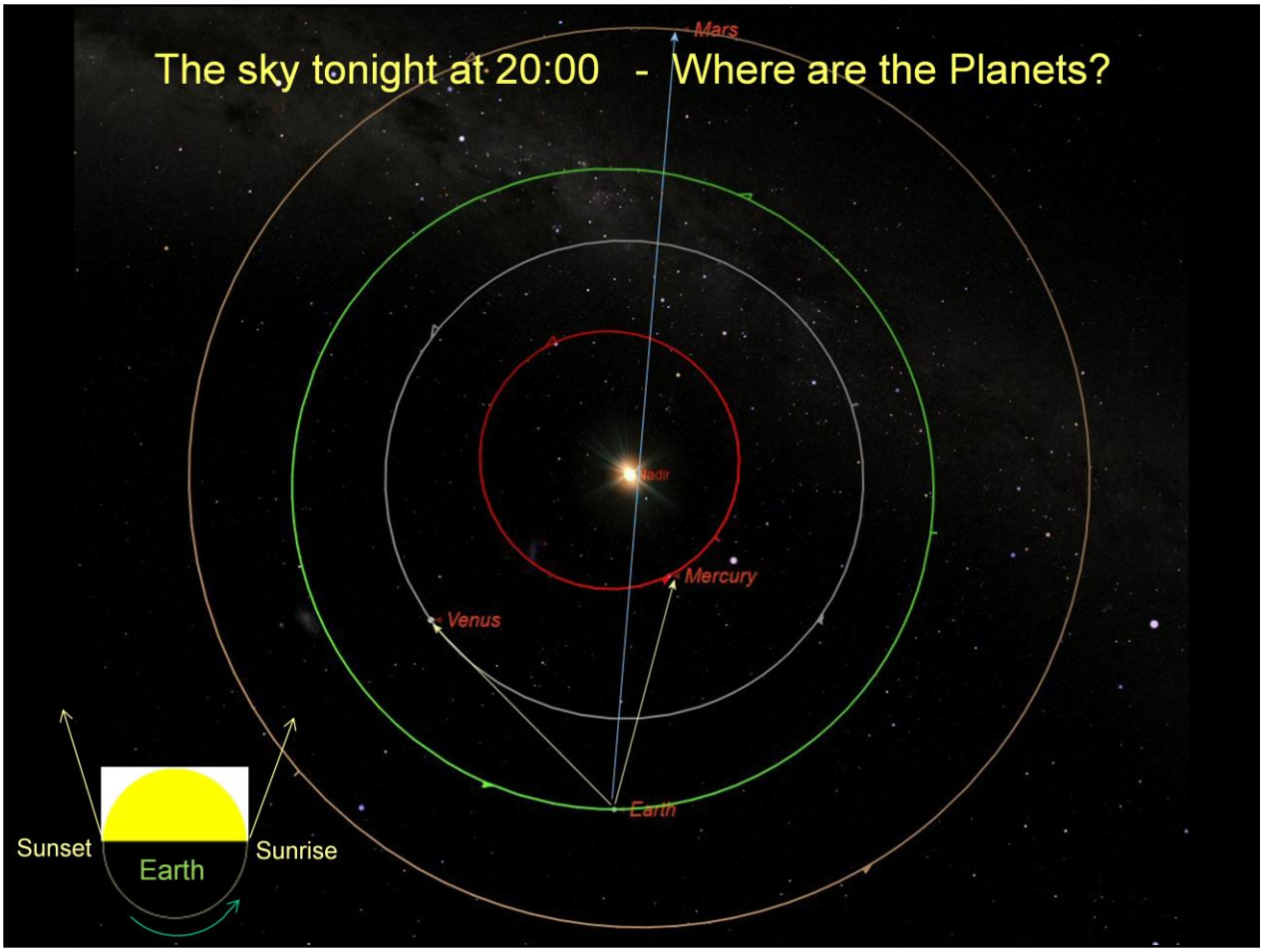
This is why the Sun is higher in the sky during the summer and lower during the winter.

We can see the planets Saturn, Jupiter, Neptune and Uranus and where they appear in the night sky on the chart above.



The chart above shows the orbits of the inner four planets that are called the 'Terrestrial' (meaning 'Rocky') planets of our Solar System.

Mercury (red), Venus (grey), Earth (green) and Mars (orange).



The chart above shows where the inner planets are located compared to Earth.

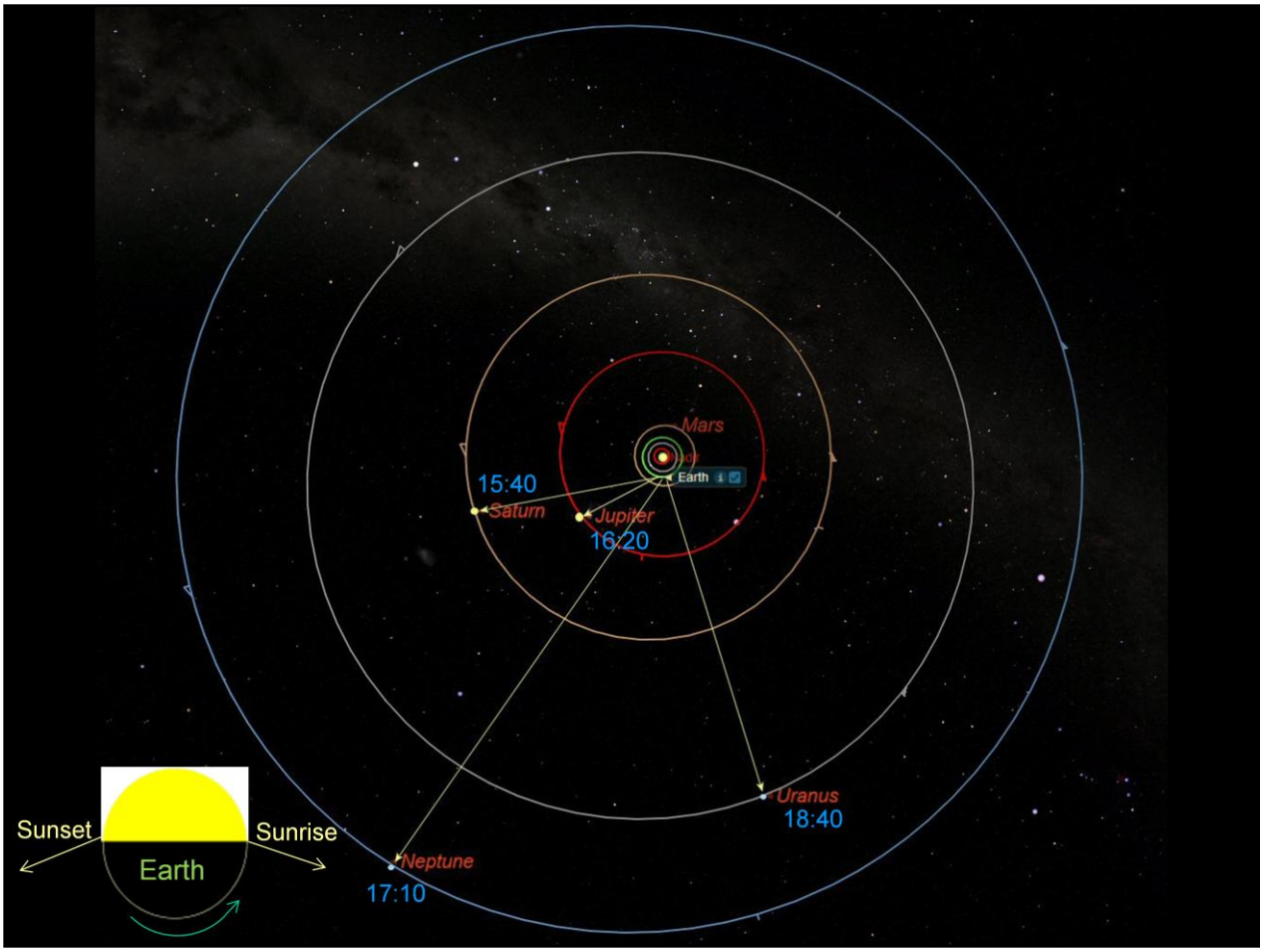
As shown on the chart the side of Earth facing the Sun is in daylight.

So we can only see planets that are closer to the Sun in the morning or evening sky.

This means they only appear when the Sun is below the horizon and the sky is beginning to darken.

So as Earth rotates clockwise, as we are looking down on the chart, sunset will be on the left side of Earth and Sunrise will be on the right. At sunset when the Sun has gone below the western horizon we can see Venus in the evening sky. In the morning before the Sun rises over the eastern horizon we can see Mercury above the horizon.

Mars is too close to the Sun and cannot be seen.



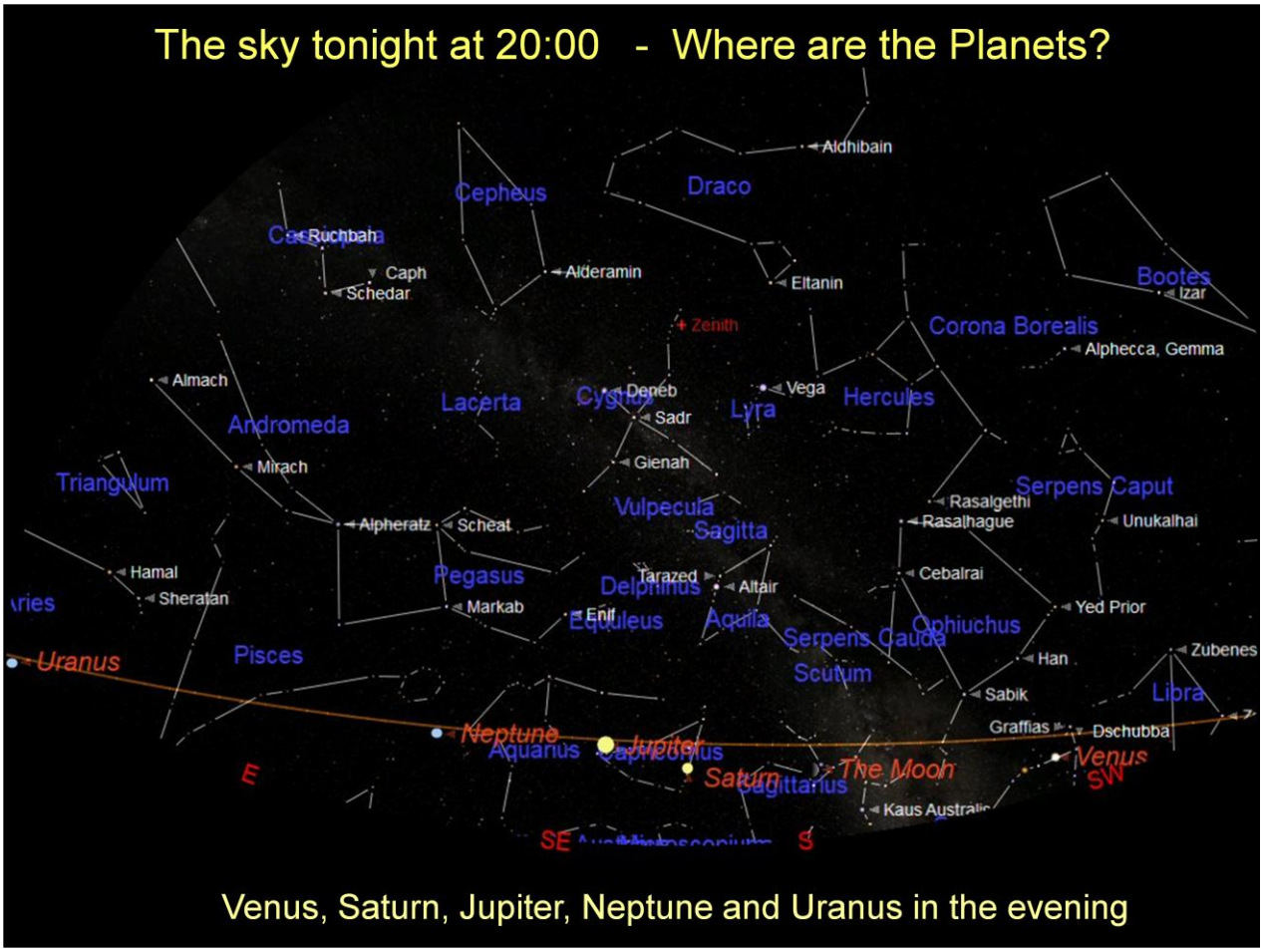
The chart above shows where the outer planets are located compared to Earth.

As shown on the chart the side of Earth facing the Sun is in daylight.

So we can only see planets that are closer to the Sun in the morning or evening sky.

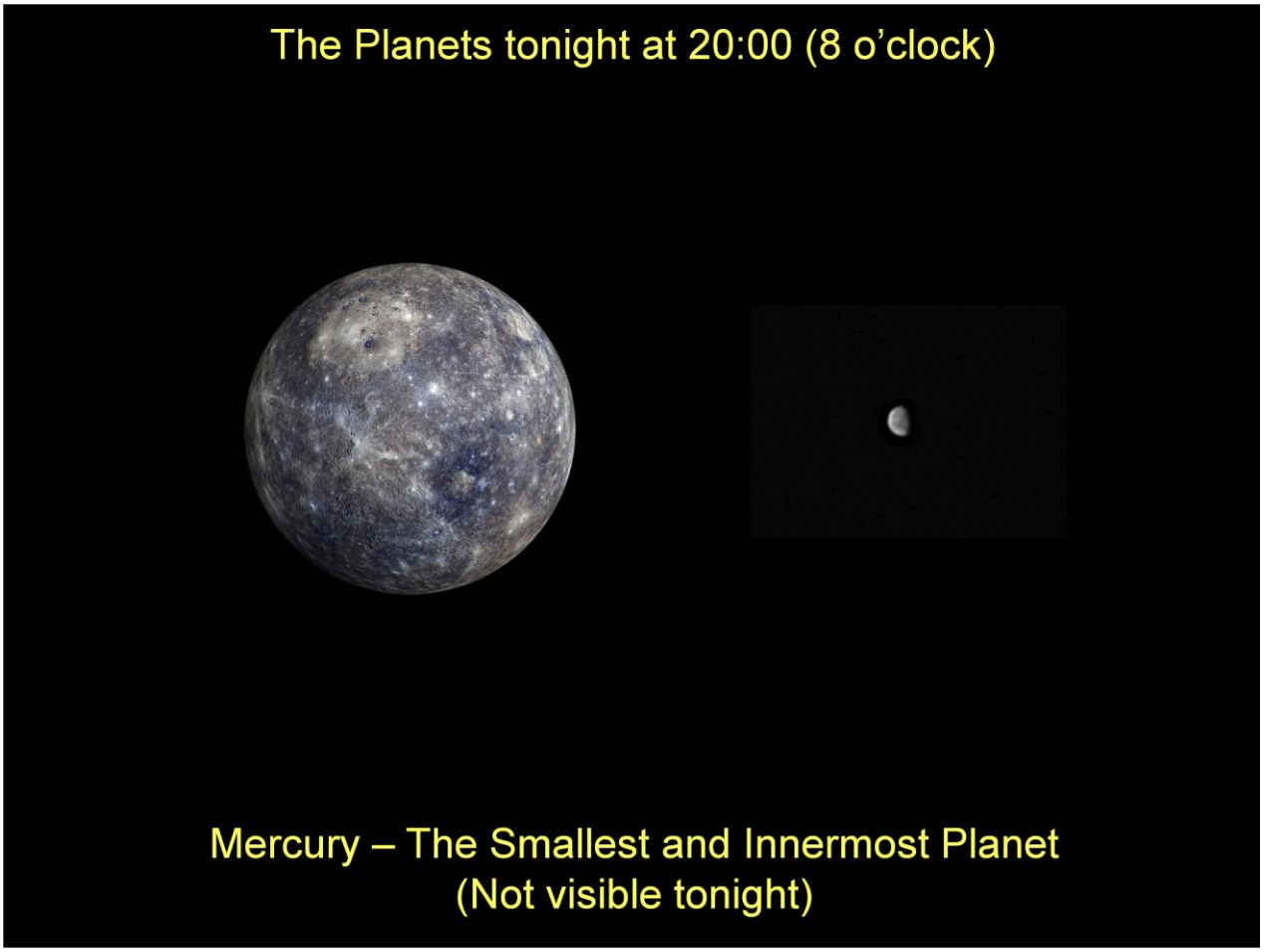
This means we can see any planets that are in the sky on the dark side of Earth.

So as Earth rotates clockwise, as we are looking down on the chart, sunset will be on the left side of Earth and Sunrise will be on the right. After sunset when the Sun is moving over the western horizon we can see Saturn first in the eastern evening sky. We can then see bright Jupiter rising up over the eastern horizon followed by the faint Neptune and finally Uranus rises over the eastern horizon.



We can see Saturn, Jupiter, Neptune and Uranus as they appear to move along the Ecliptic from east to west as Earth rotates fro west to east. This is rather like looking out of a train window as the train begins to move out of the station. If you are not aware that the train is about to move then it may appear to be the station is moving. As we (on Earth) are moving from west to east (right to left) the sky appears to move from east to west (left to right).

The planets will begin to disappear over the western horizon, Saturn first at midnight and followed by Jupiter at 01:00. Neptune sets at 04:30 and finally Uranus sets at 09:35 in the morning in daylight.



Mercury is the smallest of the eight main planets in our Solar System.

It is 4,879 kilometres in diameter which is just 0.38 of the diameter of Earth (12,756 kilometres) and not much bigger than our Moon (3476 kilometres).

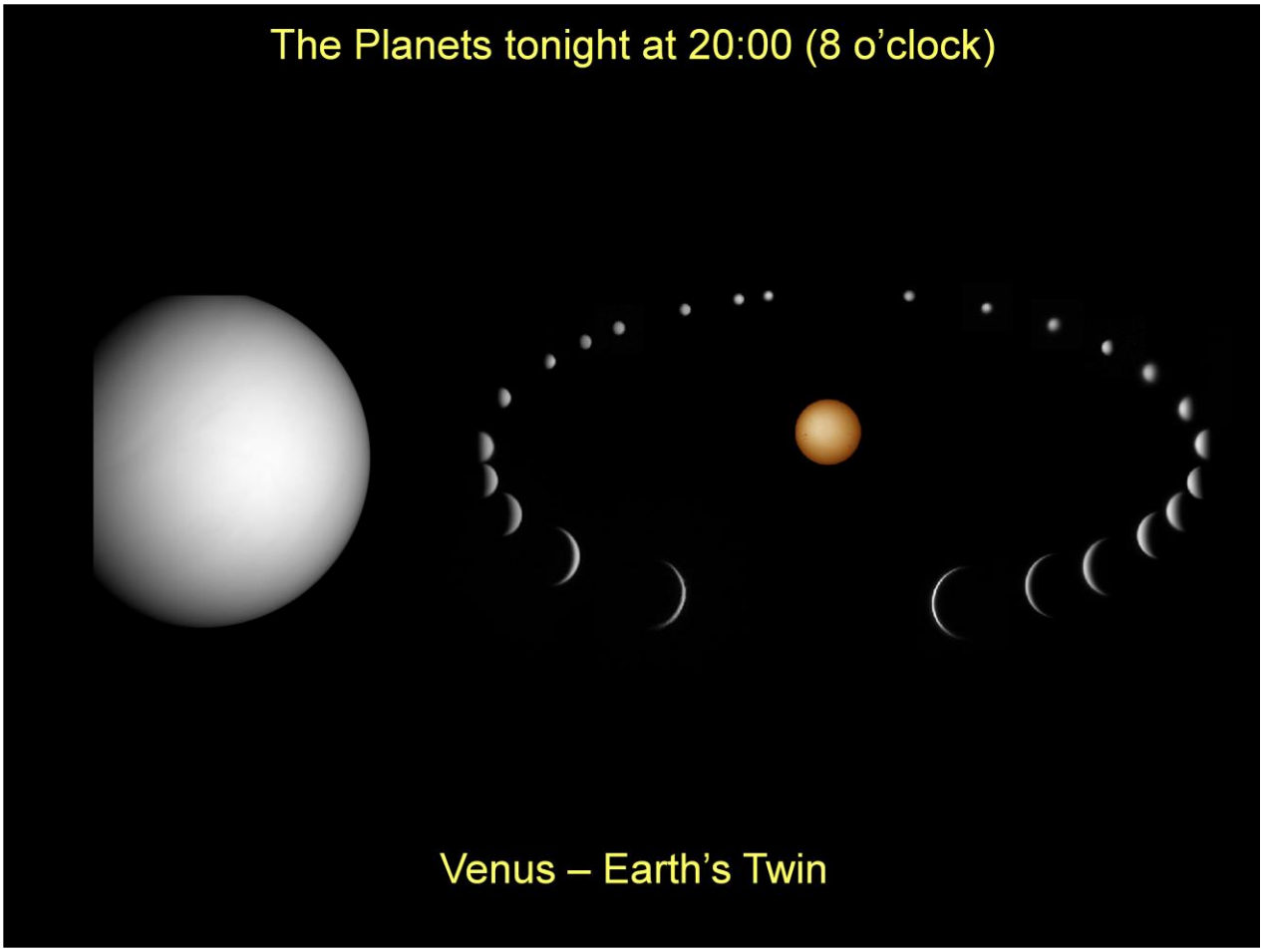
This smallest planet does not have any moons.

Mercury is also the planet with the closest orbit to the Sun and is just 57.9 million kilometres from the Sun.

Being the closest planet to the Sun it also has the shortest orbit that is 0.24 Earth years or about 87.6 Earth days.

Its rotation (day) is surprisingly long at 58.6 Earth days. This means its day is not much shorter than its year.

It rotates three times for every two of its orbits around the Sun.



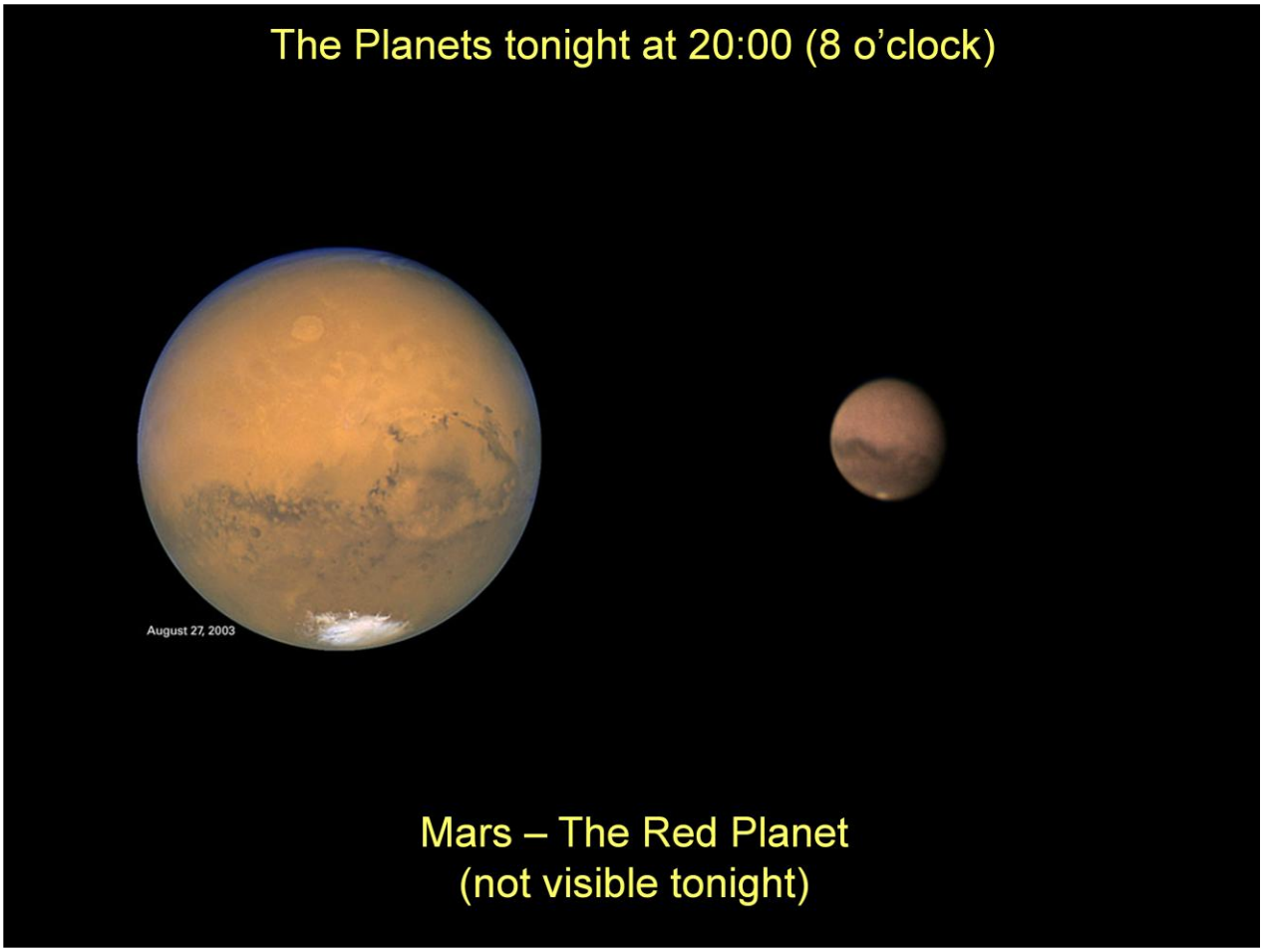
Venus is 12,104 kilometres in diameter so is slightly smaller than Earth that is 12,756 kilometres in diameter.

It orbits 108.2 million kilometres from the Sun compared to Earth's orbit 149.6 million kilometres from the Sun.

It is thought that the two planets have similar composition with one exception being the amount of water they have.

The amount of water may have been similar in the past but Venus appears to have lost the majority of its water.

Venus is closer to the Sun and appears to have suffered a 'runaway greenhouse effect'. The additional heat from the Sun may have caused the surface temperature to rise and the Carbon that is trapped in the rocks on Earth was released into the atmosphere on Venus to form Carbon Dioxide (CO_2). The Carbon Dioxide allows the heat from the Sun to reach the surface but prevents it from being radiated back into space. The temperature then steadily increased in a runaway manner until it reached the 467°C surface temperature we see on Venus today.



Mars is the fourth planet from the Sun and the second smallest planet in the Solar System after Mercury.

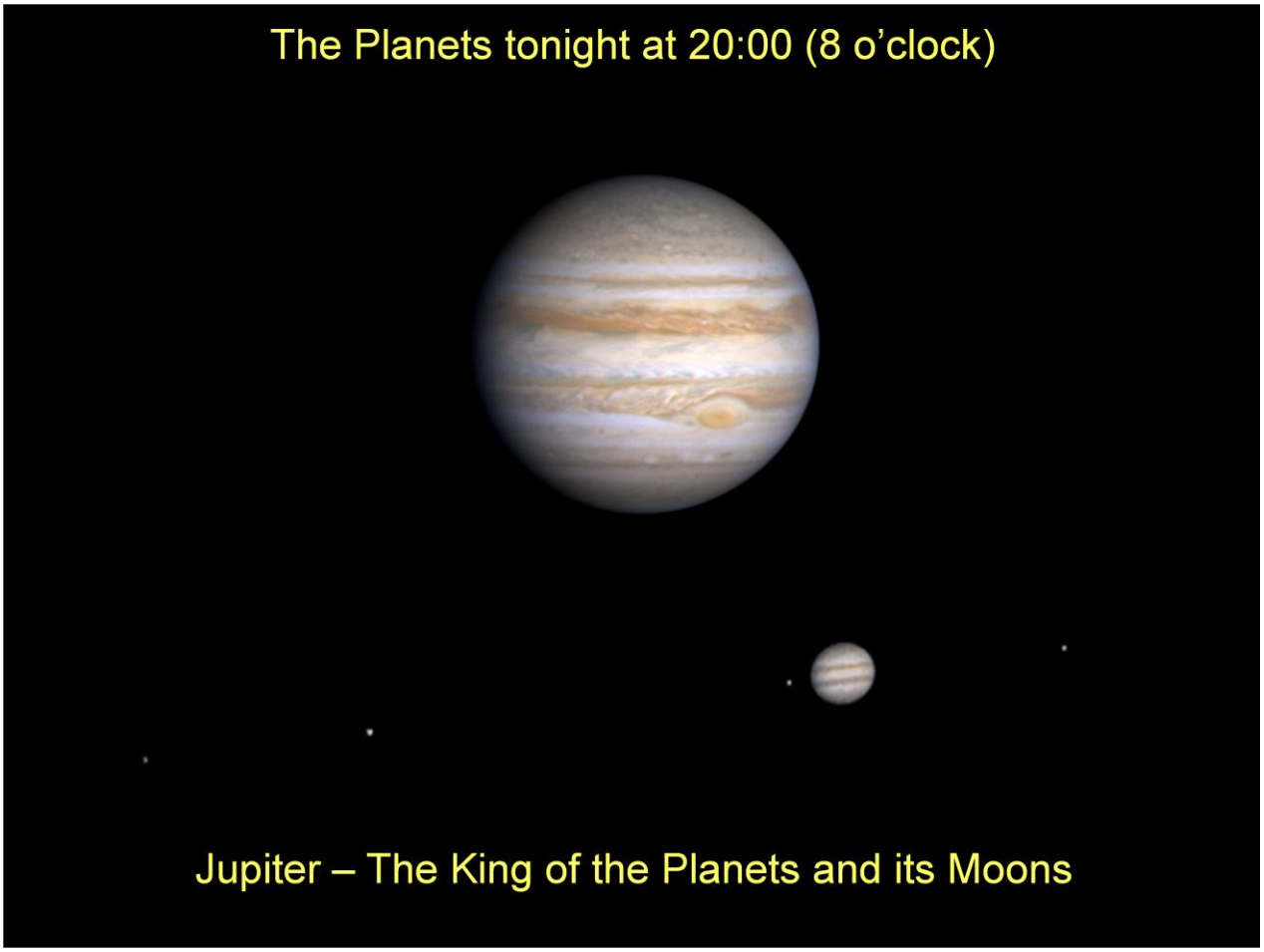
It is about half of Earth's diameter at 6,794 kilometres and has an orbital period (year) of 686.7 Earth days. A day on Mars is equivalent to 23.9 hours.

Mars is called the 'Red Planet' because of the reddish iron oxide prevalent on its surface. This gives it a reddish appearance that is distinctive among the astronomical bodies visible to the naked eye.

Mars is a terrestrial (rocky) planet with a thin atmosphere, having surface features reminiscent both of the impact craters of the Moon and the valleys, deserts and polar ice caps of Earth.

The rotational period and seasonal cycles of Mars are similar to those of Earth, as is the tilt that produces the seasons.

Mars has two moons: Phobos and Deimos both are small and irregularly shaped. These may be captured asteroids that have ventured too close to Mars.



For those who are lucky enough to have a larger telescope a closer study of the features in Jupiter's cloud system can be achieved.

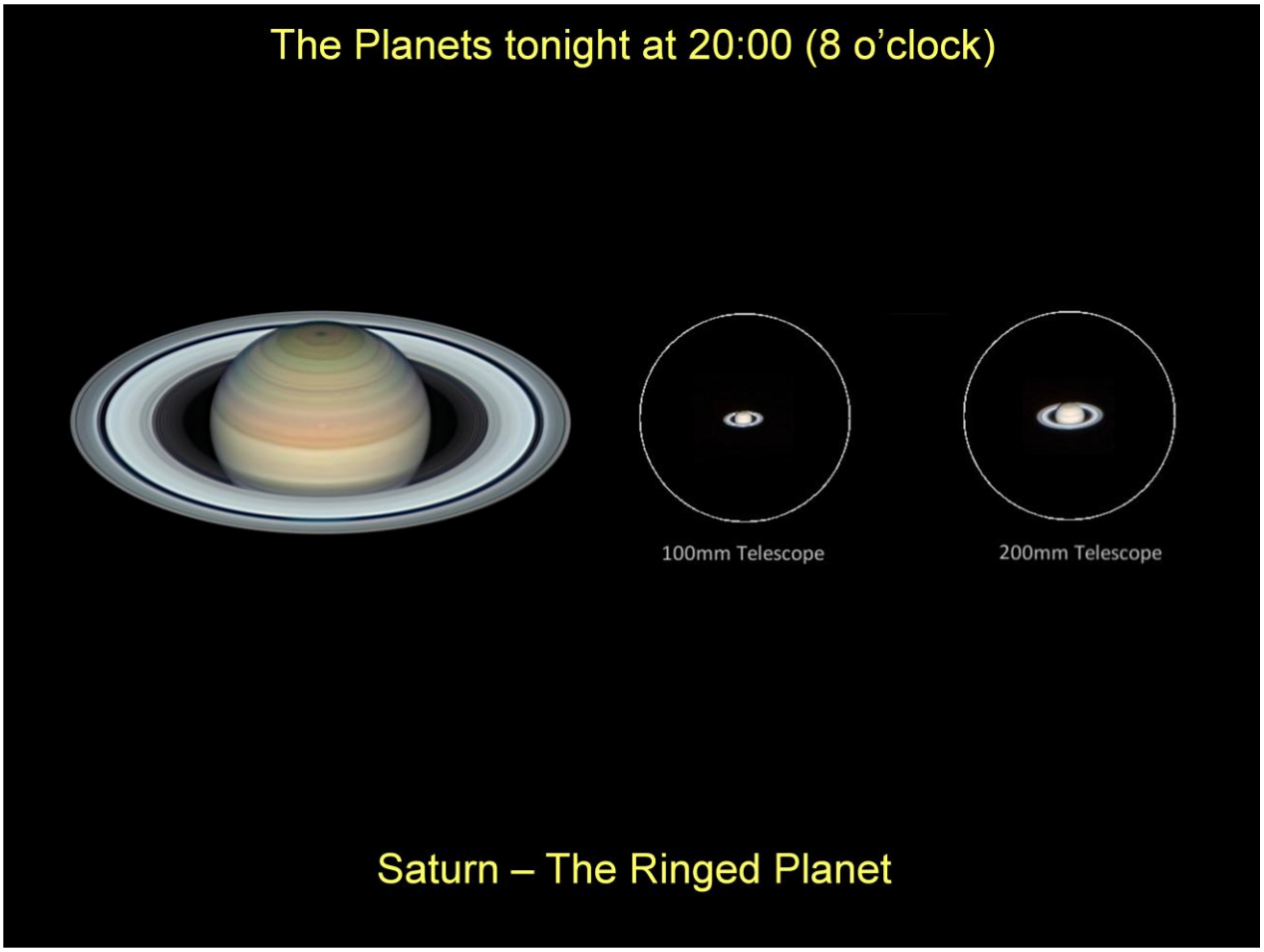
The darker bands on the clouds are known as 'Belts' and the lighter ones known as 'Zones'.

The most famous feature in the cloud system is the 'Great Red Spot' (GRS). This huge storm has been raging for at least 350 years.

The four largest and brightest moons called Io, Europa, Ganymede and Callisto can also be seen as they orbit the planet.

It is interesting to just monitor their positions and how the move around Jupiter.

They can also be seen to pass behind Jupiter or pass in front where they cast their shadows on to the surface of Jupiter..



Saturn is the second largest planet in our Solar System and is a Gas Giant like Jupiter.

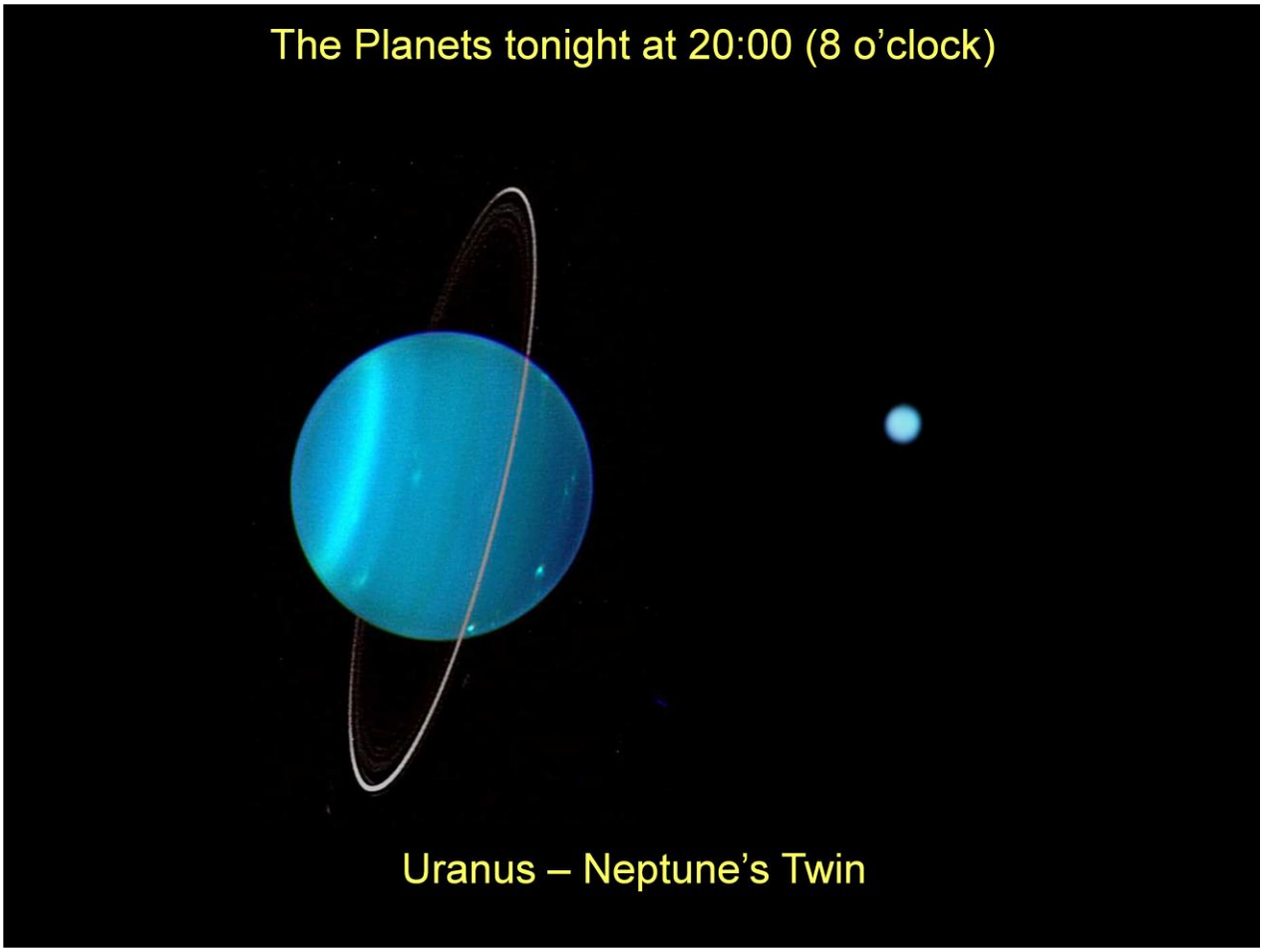
The planet itself is 120,000 km in diameter at the equator but is flattened to 108,000 km at the poles due to its rapid rotation.

The rings are 275,000 km (170,000 miles) across but are mostly less than 30 metres thick.

The rings are made up of millions of small pieces of mainly water ice and varying in size from a few millimetres to a few metres across.

Saturn is approximately ten times further out from the Sun than Earth therefore we always see Saturn fully illuminated and never see phases.

However we do see the rings from a different aspect over the course of Saturn's 29.46 (Earth) years orbit around the Sun.



The outer most planets are Uranus and Neptune that are known as the Ice Giants.

Jupiter and Saturn are over ten times the diameter of Earth but Uranus and Neptune are about four times the diameter of Earth so are still regarded as giants.

Both of the Ice Giants appear blue using a telescope but look more like ‘fuzzy stars’ than the other planets.

Uranus is 51,118 km in diameter this is about 4 times the diameter of Earth. It orbit is 2,875million km from the Sun and takes 84 Earth years to complete one orbit.

Uranus has a very odd tilt on its axis, it is actually tilted over almost 90° on to it side compared to all the other planets.

This gives a very strange combination of days and seasons on the planet. Each pole (north and south) face directly towards the Sun once a year, (every 84 Earth years).

Like Uranus, Neptune is composed mainly of Hydrogen with rock and metal core and an atmosphere approximately 10,000 km deep.

Neptune is the densest of all the giant planets with a density of 1,640 kg/m^2.

Surprisingly the atmosphere of Neptune is much more turbulent than that of Uranus despite receiving less than a quarter of the heat and light from the Sun.

It is thought that there is a heat source in the core that drives the weather systems.

Despite the extremely cold atmosphere at -214°C, Neptune has some of the most violent storms in the solar system, with winds in the storms reaching speeds of over 300km per hour.

Beginner's Website:

naasbeginners.co.uk