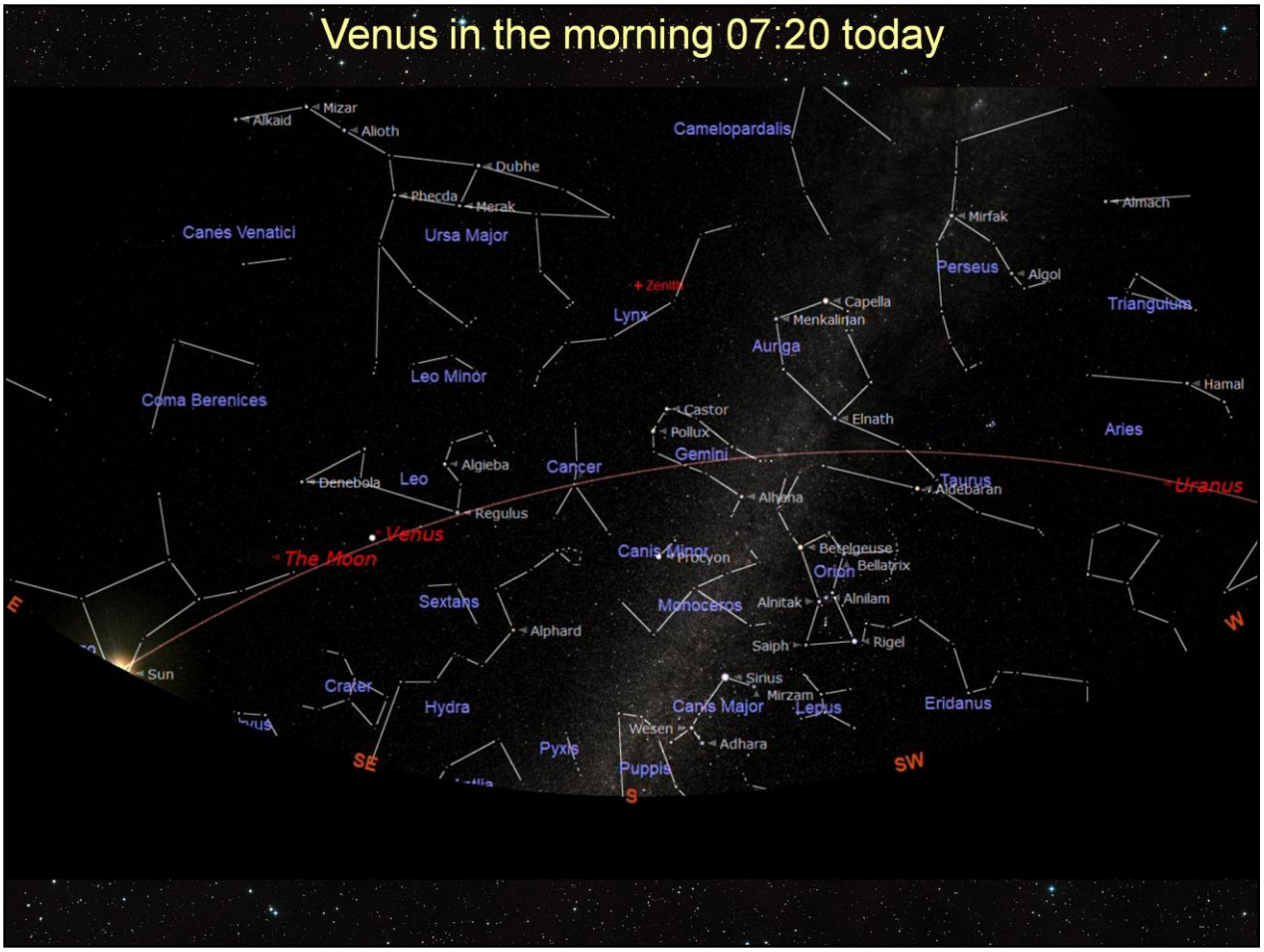
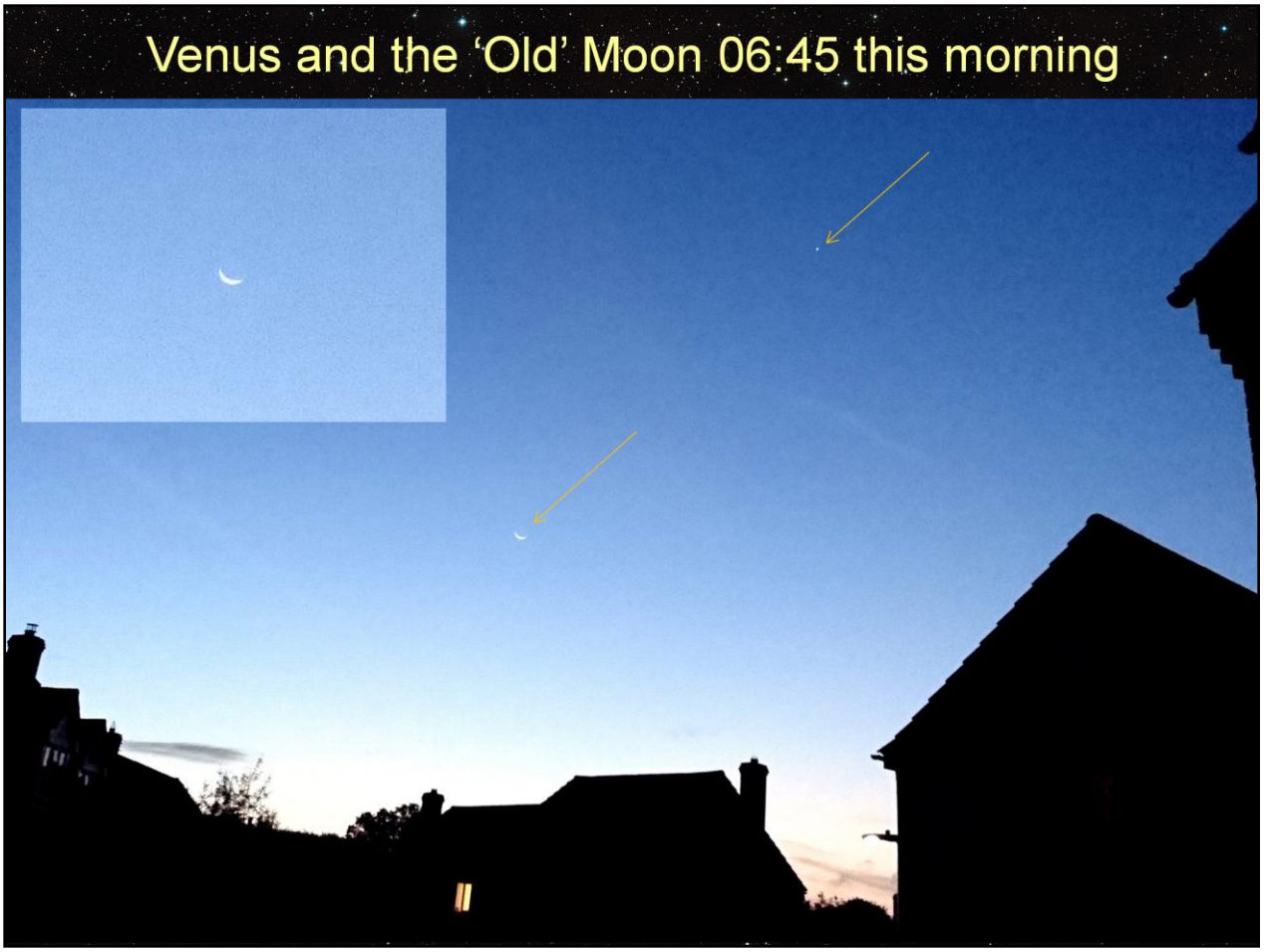
This presentation was given to the Newbury Astronomical Society Beginners Meeting.

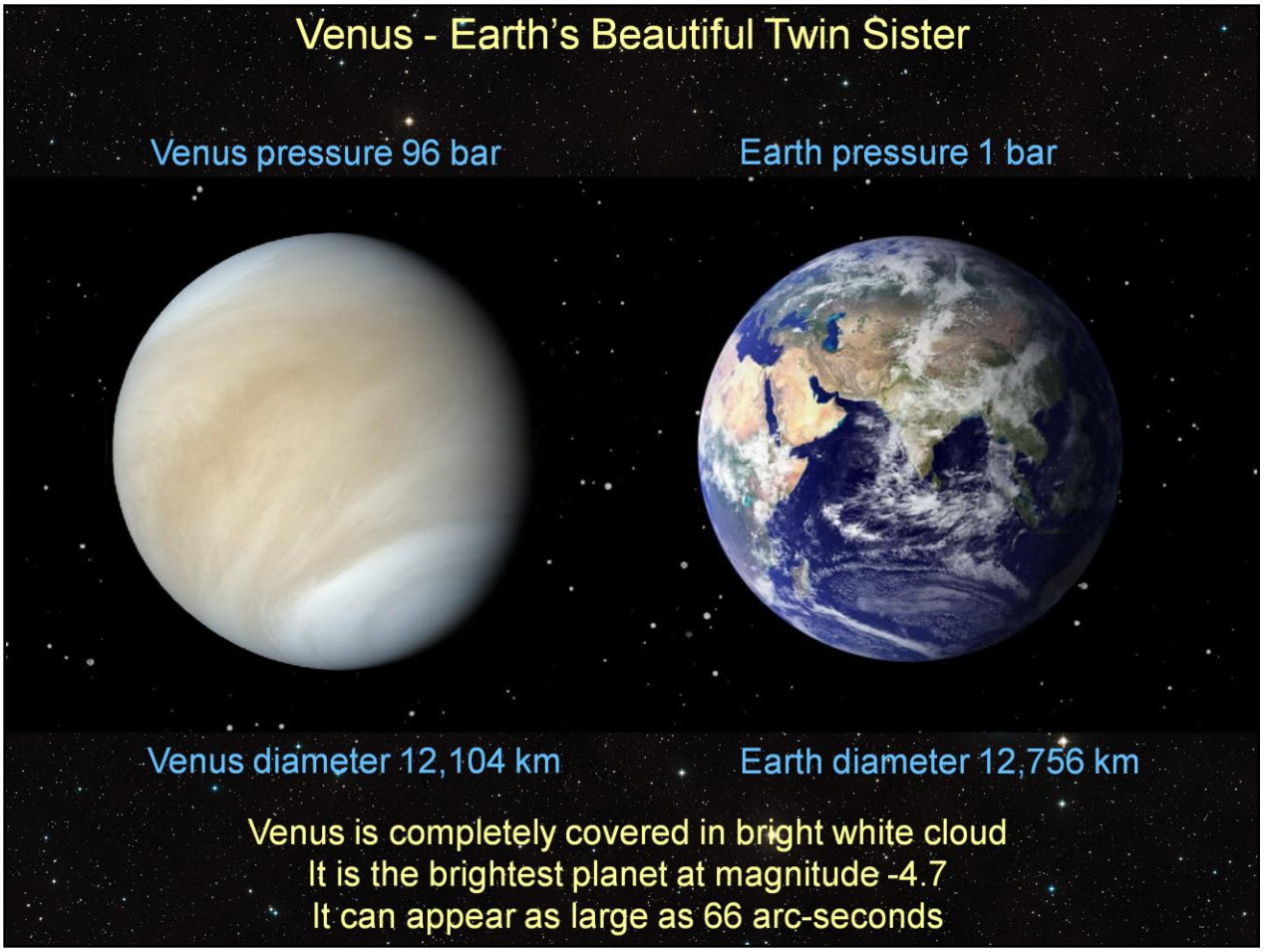


The chart above shows the position of Venus at the moment and as it will be seen at 07:20 as the Sun is rising over the eastern horizon. This means Venus is best seen early in the morning before the dawn sky has brightened too much. A clear view to the east is required to see Venus.



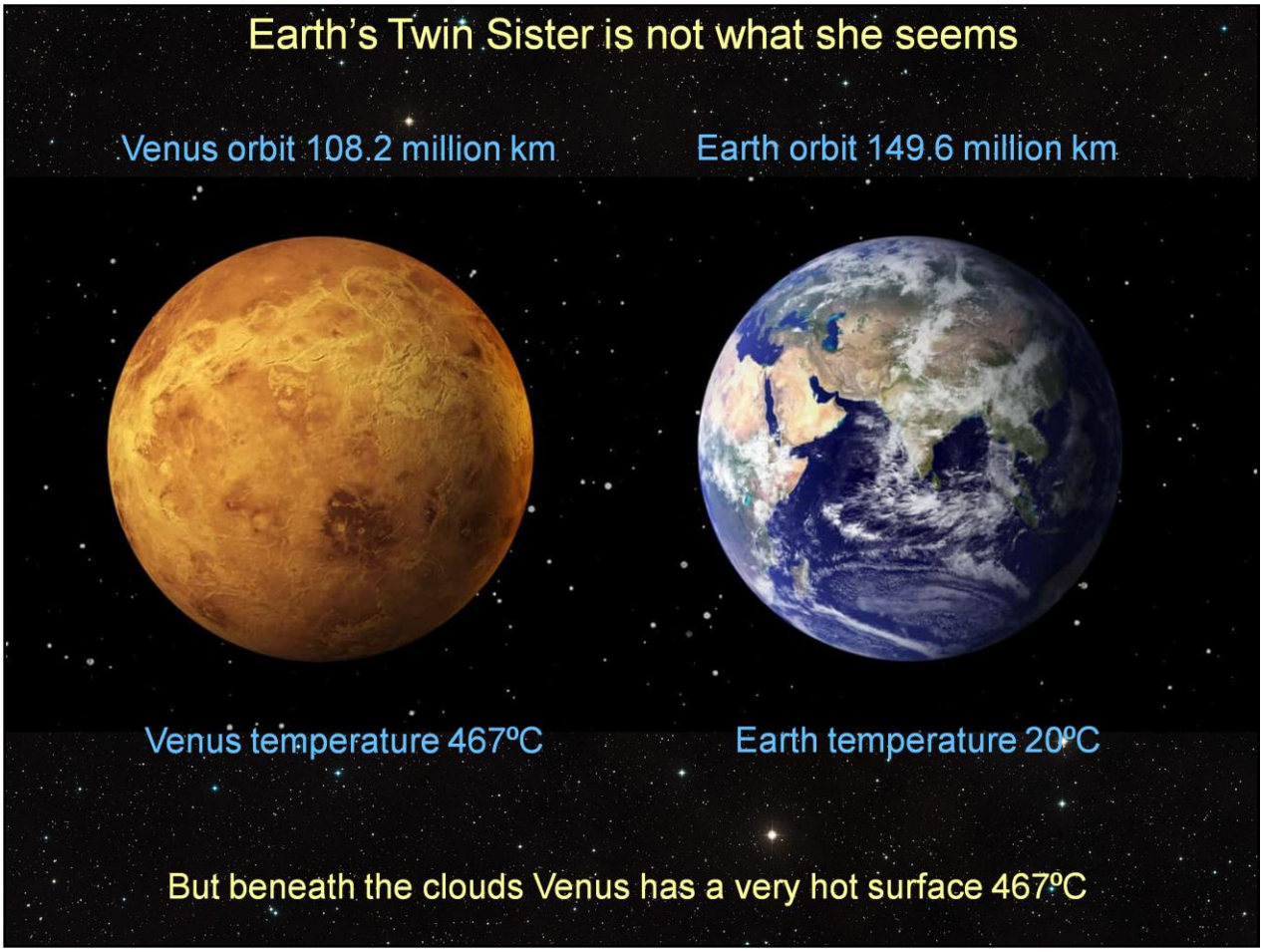
Venus was shining very brightly on the morning of Wednesday 14th October 2020 in the east just before sunrise. The ‘Old' Moon was close by making a perfect pose for a picture. The picture was taken using a hand held and unsupported mobile phone camera and not zoomed but came out surprisingly good. Venus is arrowed upper right and the Moon towards the centre and enlarged. The enlargement shows the ‘Old' Moon on its last day in the morning sky before moving in front of the Sun.

The New Moon always appears in the west at sunset and has the right side illuminated by the setting Sun. In the picture the left side of the Moon is illuminated by the rising Sun in the east. The Moon passed by the Sun the next day and re-appeared as the New Moon in the west at sunset in a couple of days later. We usually don’t notice the 'old' Moon in the early morning, it is a shame as it looks just as beautiful as the new Moon.



Venus is the second planet out from the Sun and in many ways the twin of our planet Earth. 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.

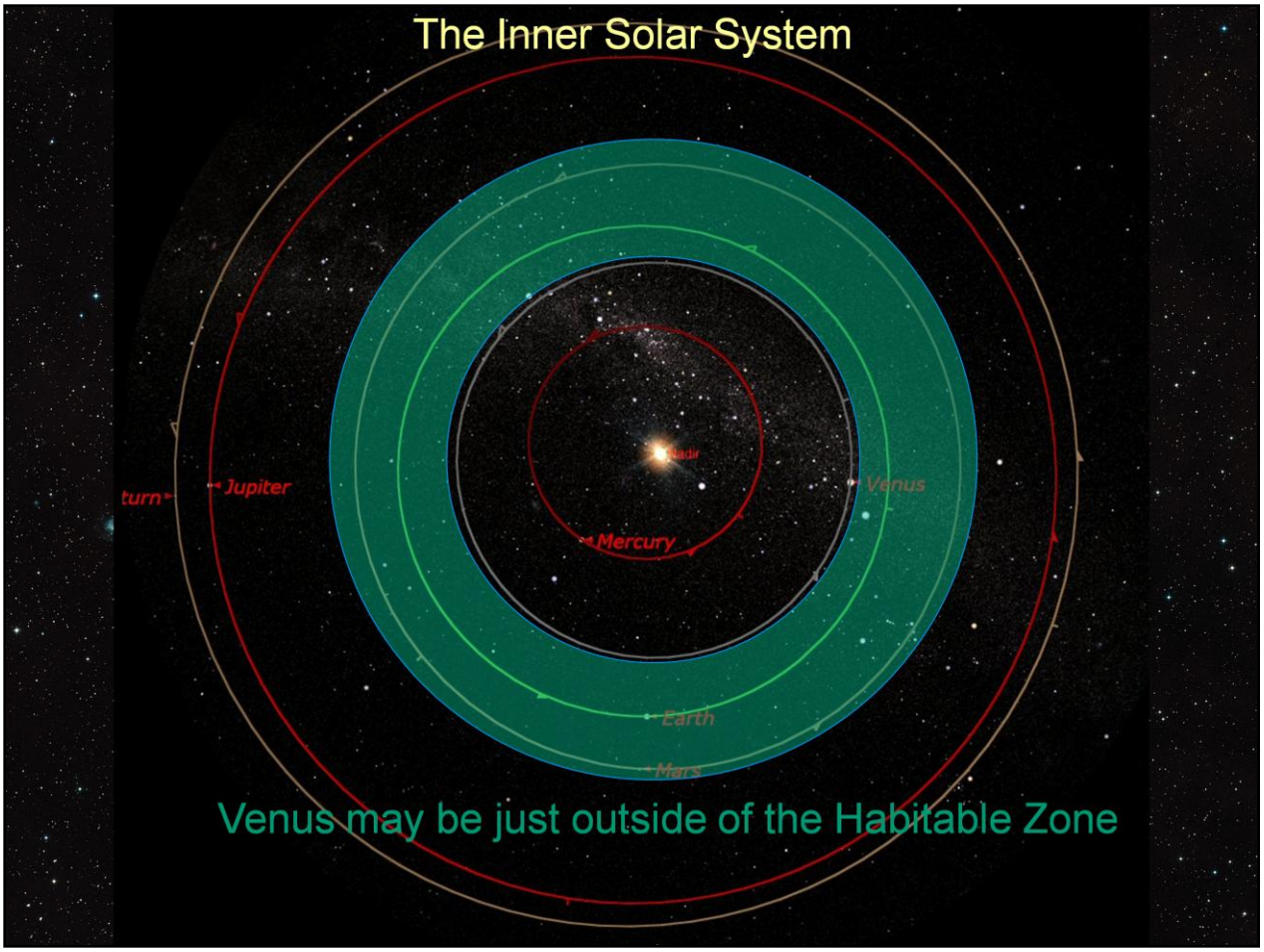
Venus is completely covered with a thick white atmosphere of Carbon dioxide gas (CO_2) that completely obscures the surface. The white cloud also reflects the sunlight and causes to shine very brightly.



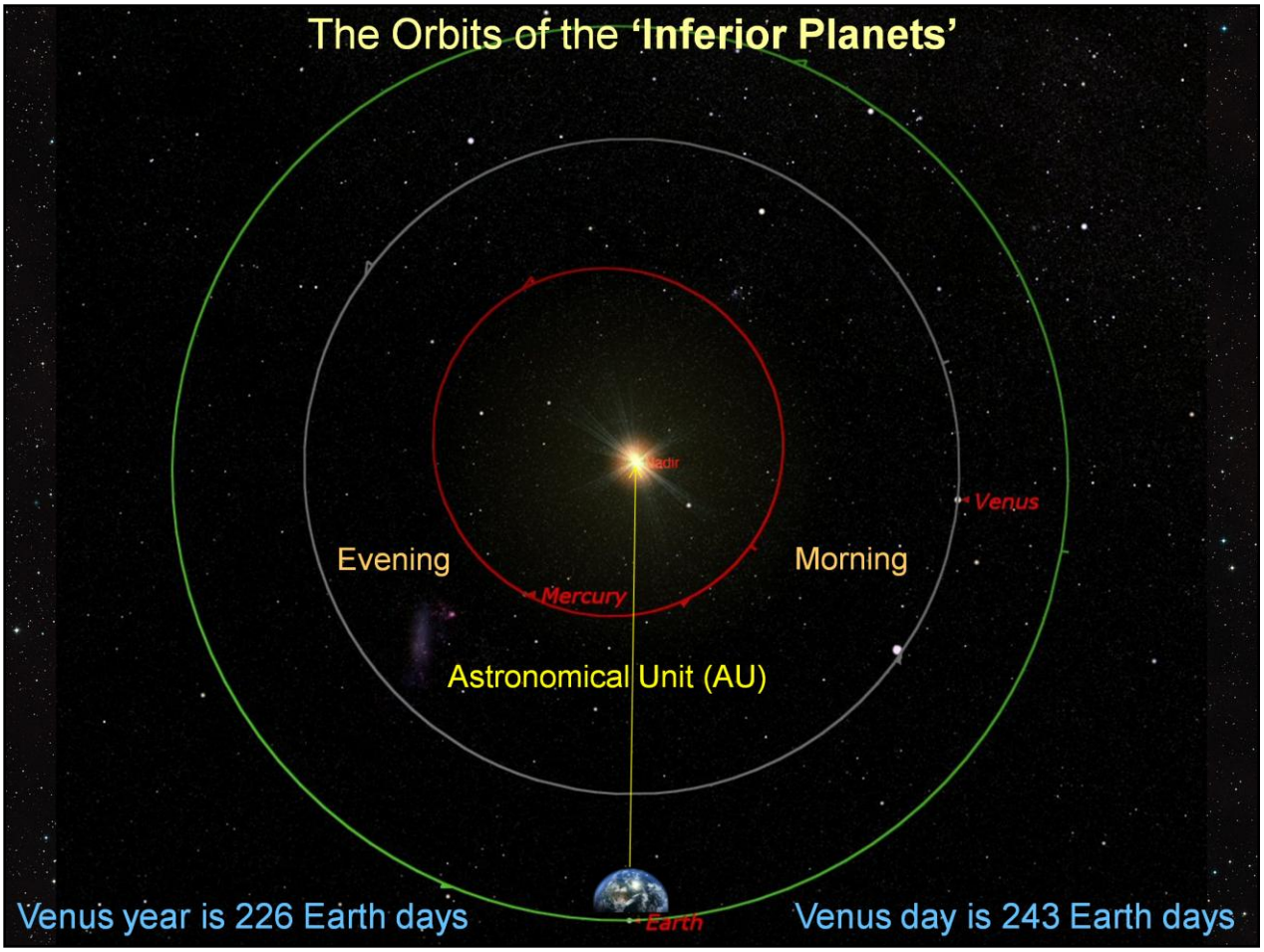
Venus is closer to the Sun and appears to have suffered a 'runaway greenhouse effect'. The additional heat from the Sun may have caused the surface temperature to rise and the Carbon that is trapped in the rocks on Earth was released into the atmosphere on Venus to form Carbon Dioxide (CO_2). The Carbon 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.

The Carbon Dioxide (CO_2) atmosphere on Venus is not only hot but is very thick as well. The atmospheric pressure at the planet's surface is 92 times that on Earth, or roughly the pressure found 900m (3,000ft) underwater on Earth. If it was possible to stand on the surface of Venus (which it is not, it is far too hot) the view would be very odd because the refraction of light would cause large distortions compared to our atmosphere.

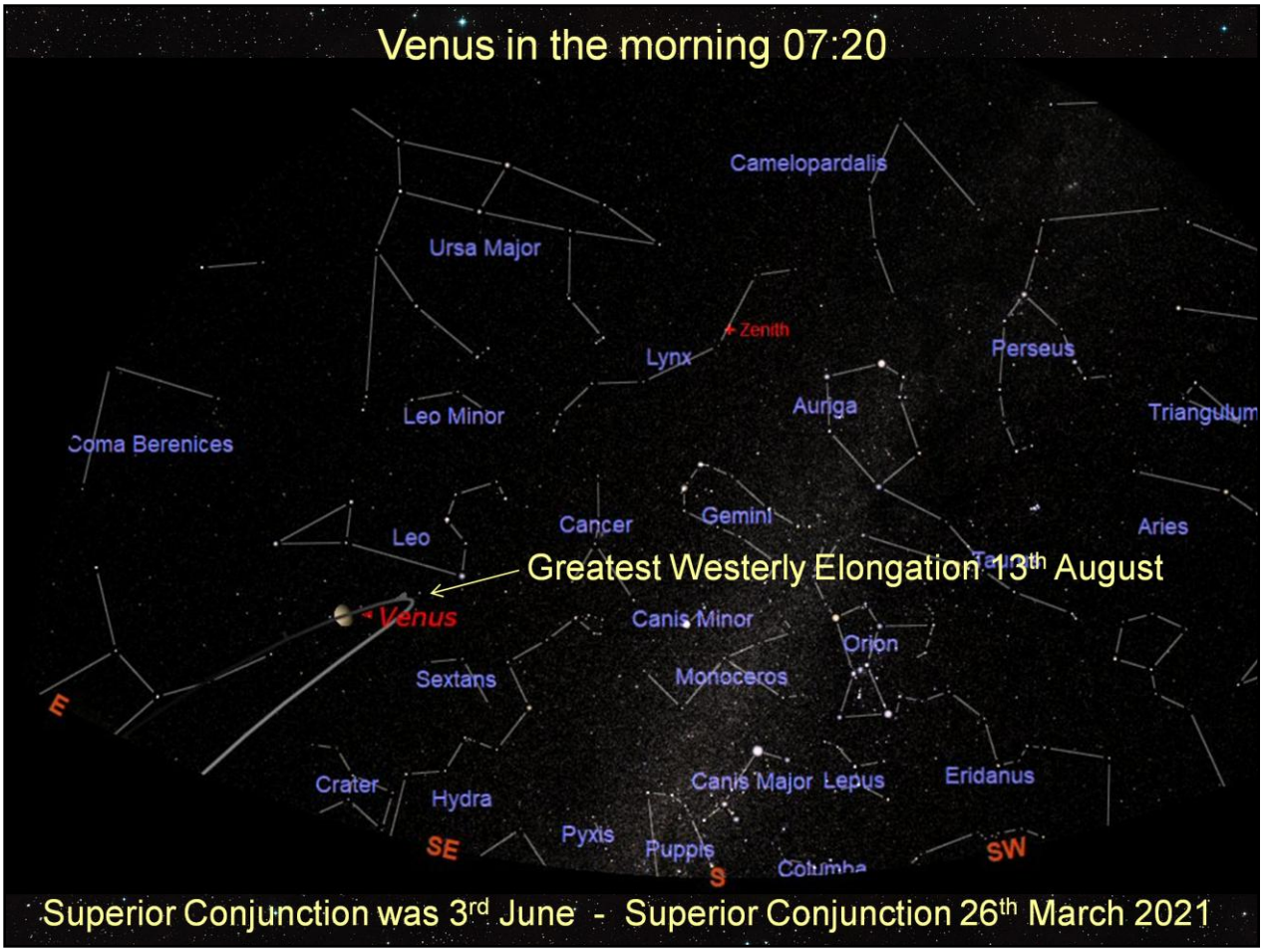
Venus is also thought to have Sulphuric Acid rain.



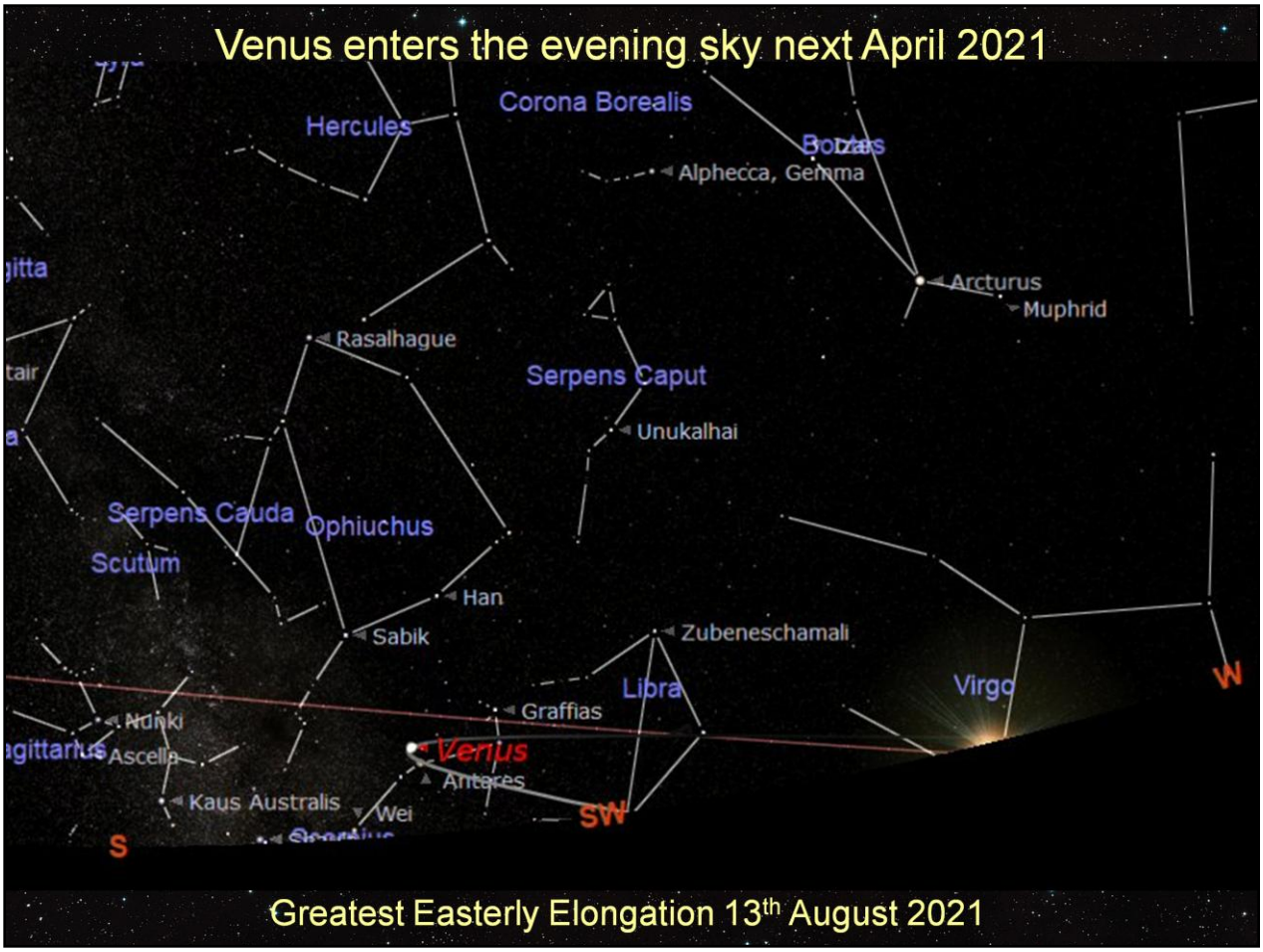
Venus has an orbital period (year) equivalent to 226.5 Earth days but its axial rotation (day) is equivalent to 243 Earth days. This means a day on Venus is longer than its year. Not that this makes any difference on the surface because the Sun is never visible due to the very thick Carbon Dioxide (CO_2) clouds. Venus may have its orbit just a little bit closer to the Sun that the inner edge of the Habitable Zone. This is the zone that is far enough from a star to provide the right temperature range for water to be liquid and for life (as we know it) to develop.



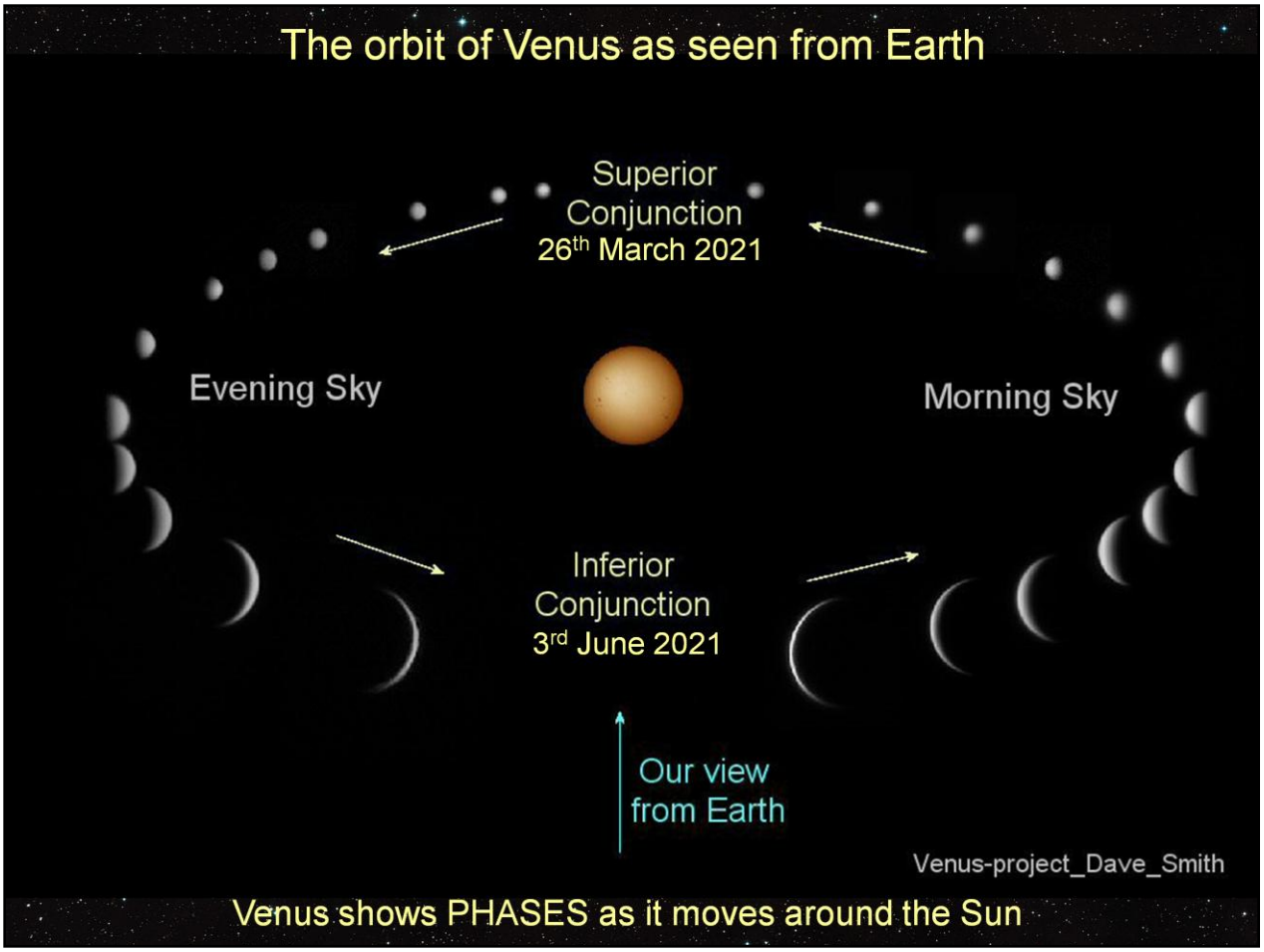
The two innermost planets: Mercury and Venus are called the Inferior Planets not because they are less important but because their orbits are inside the orbit of Earth. Therefore they always appear towards the Sun and are the only planets that pass between Earth and the Sun. Venus is a little weird because its day (rotation period) is longer than its year (orbital period).



The chart above shows the orbital path of Venus in the morning sky. It passed in front of the Sun on 3rd June and then appeared over the eastern horizon and into the early morning sky. It climbed higher in the morning following the thicker part of the orbital path shown on the chart. It reached its apparent furthest position from the Sun on 13th August this is called: Greatest Western Elongation. Venus is now moving back towards the Sun and will pass behind the Sun on 26th March 2021 when it will be in Superior Conjunction with the Sun.

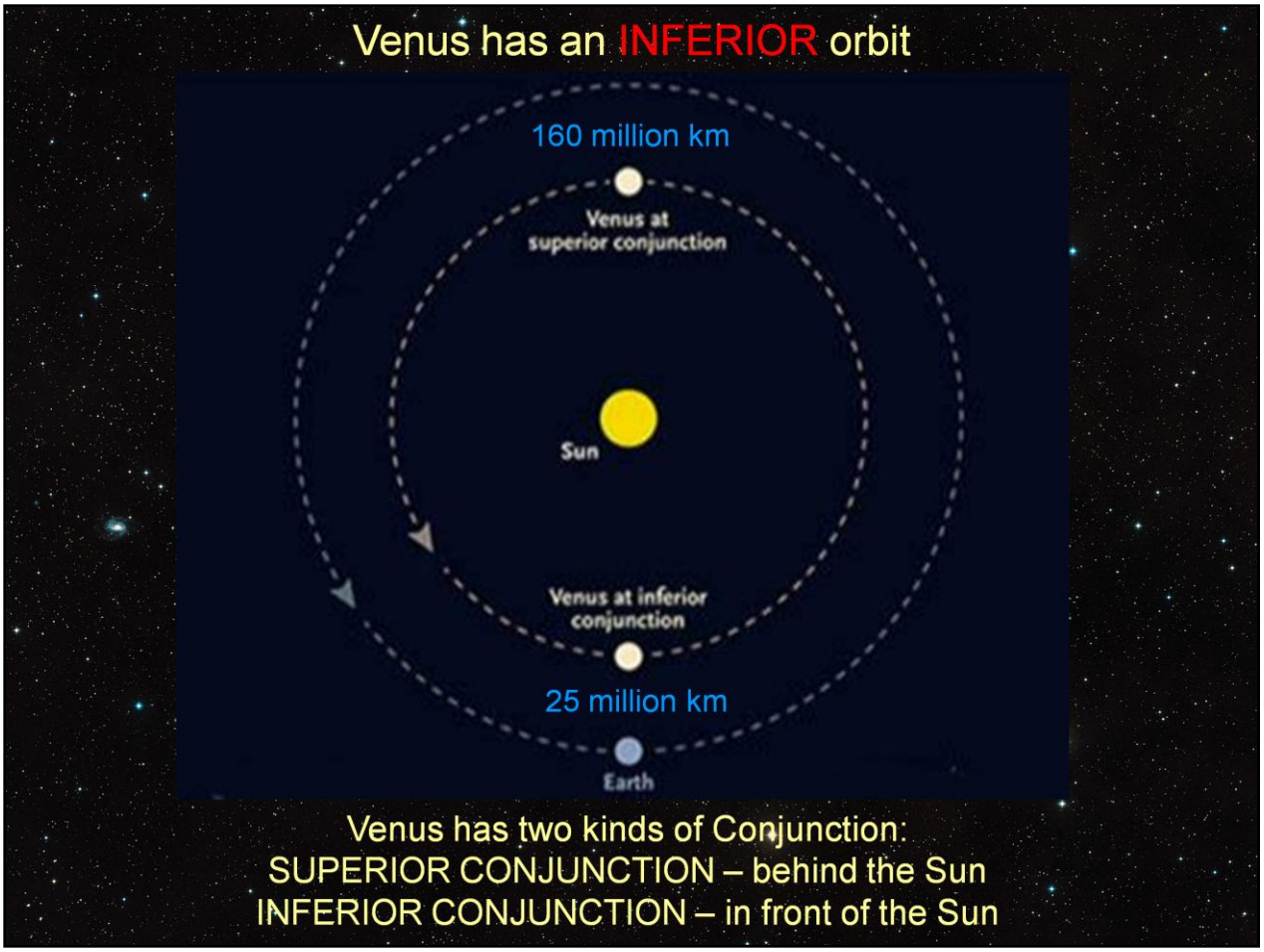


The chart above shows the orbital path of Venus in the early evening sky. It will have passed in behind the Sun on 26th March 2021 when it will have been in Superior Conjunction with the Sun. Venus will then appear in the early morning sky in the west at sunset shown by the thicker part of the orbital path on the chart. It will reach its apparent furthest position from the Sun on 29th October 2021 this is called: Greatest Eastern Elongation.

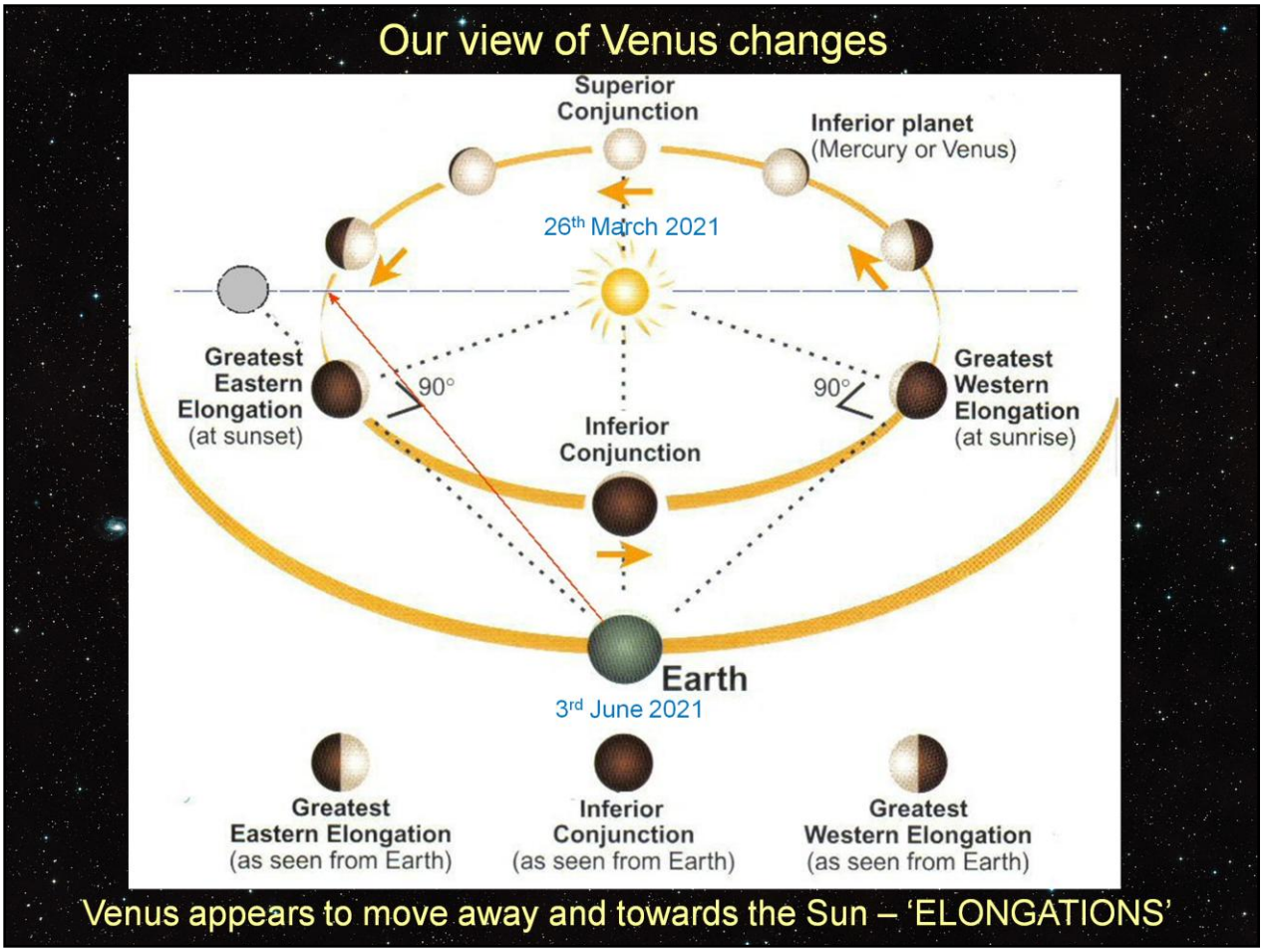


The chart above shows how the appearance of Venus changes as it orbits the Sun. In the evening sky it appears small and full as it climbs over the eastern horizon after passing behind the Sun in its Superior Conjunction. As it moves around its orbit it moves closer to Earth and appears to become larger. It initially appears 'full' because the illuminated face of Venus is towards us. When Venus reaches about half way towards us just the side facing the Sun is illuminated and we see half of Venus illuminated (like the Half Moon). As Venus moves even closer towards Earth it continues to appear larger but as a narrowing crescent

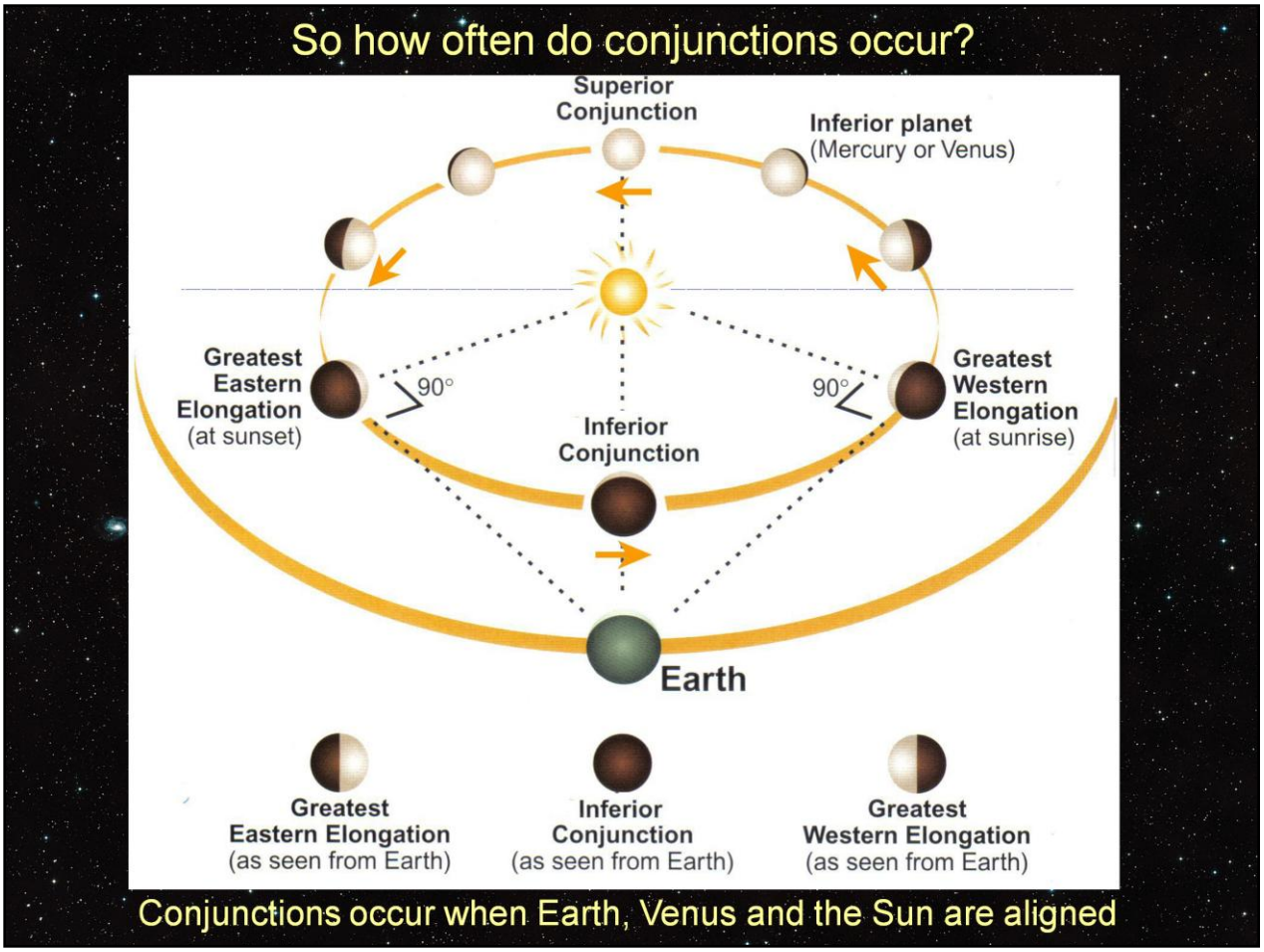
As Venus approaches Inferior Conjunction it will appear large in diameter and as a very thin crescent before it disappears into the brightening dawn sky. It will then emerge from its Superior Conjunction with the Sun to reappear in the early evening sky in the west at sunset. It will initially appear large and as a thin crescent but will become smaller and wider as it loops out from the Sun and back again in the early morning sky.



It can be seen from the diagram above why Venus appears smaller when it is close to Superior Conjunction and smaller when close to Inferior Conjunction. When the Sun is on the opposite side of the Sun to Earth it is about 160 million kilometres away from us. However at Inferior Conjunction it can be as close as just 24 million kilometres from us at its closest approach.



Greatest Elongation does not actually occur when Venus is at the same distance away from us as the Sun. Greatest Elongation occurs when the angle subtended between Earth, Venus and the Sun as shown on the diagram above is 90º. So Venus appears a crescent rather than Half Moon shaped at Greatest Elongation.



Greatest Elongation does not actually occur when Venus is at the same distance away from us as the Sun. Greatest Elongation occurs when the angle subtended between Earth, Venus and the Sun as shown on the diagram above is 90º. So Venus appears a crescent rather than Half Moon shaped at Greatest Elongation.

Sidereal and Synodic (orbital) Periods

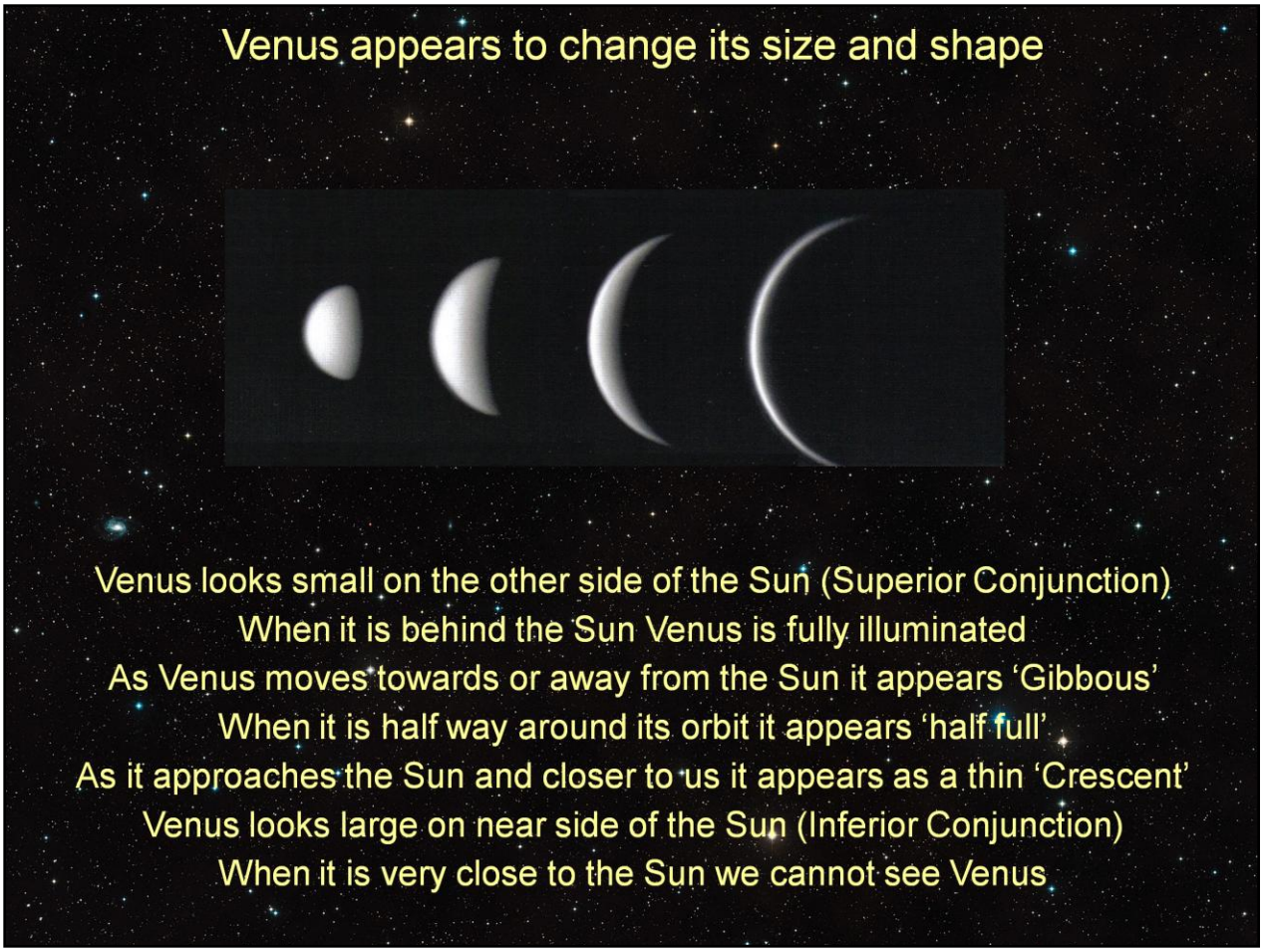
PLANET	SIDERIAL PERIOD	SYNODIC PERIOD
Mercury	88 days	116 days
Venus	225 days	584 days (1.5 y)
Earth	1.0 year	--
Mars	1.9 years	780 days (2.14 y)
Jupiter	11.9 years	399 days (y + 34d)
Saturn	29.5 years	378 days (y + 13d)
Uranus	84.0 years	270 days (y + 6d)
Neptune	164.8 years	268 days (y + 3d)

SIDEREAL PERIOD – Time taken to orbit the Sun

SYNODIC PERIOD – Time taken to catch up with Venus

We have a Venus conjunction every 292 days (1 Inf & 1 Sup)

The Inferior and Superior Oppositions of Venus repeat every 584 Earth days (about 1½ Earth years). This may seem a little odd as the time taken for Venus to complete one orbit of the Sun is 225 Earth days called its SIDEREAL PERIOD. The reason for this is when Earth returns to the location of the previous opposition, Venus will have passed the location (in 225 days) and moved on around its orbit. It takes Venus 584 Earth days (2.6 Venus years) to catch up with Earth for its next opposition. This period is called the Venus / Earth SYNODIC PERIOD.



Venus has a very thick and clouded atmosphere that covers the whole surface. Consequently there are no surface features to see. All that is visible on Venus is the top of the thick white clouds. Some faint features can be seen in the clouds but special filters are required to see them.

The main interest for amateur astronomers when observing Venus is to follow the progress of the phases. The two inner planets Mercury and Venus (known as Inferior Planets) are the only planets to show phases. Phases occur when these planets (and our Moon) are partially illuminated by the Sun. The phases change as the planets move around the Sun on their orbits.

A telescope is needed to see Venus as a disc and the larger the telescope the bigger Venus will appear. Venus often appears low in sky and in the murky and turbulent air close to horizon. It is best to start with a low power eyepiece (25mm) when observing Venus then use a higher power (magnification) eyepiece (10x) to have a good look. If the image is too bright then a Moon filter can be used or the Dust cap can be fitted to the telescope and the small 'Moon' cap removed to reduce the glare. A card 'mask' with a ~50mm hole cut in it can also be used to reduce the glare.

If the image looks good then a Barlow Lens can be used to effectively double the magnification of the 10mm eyepiece. When Venus is low in the sky and we are looking through more of the atmosphere some colour distortion can be seen as red and blue fringes . This is caused by the refraction of the light as it passes through our atmosphere.


Beginner's Website:
naasbeginners.co.uk