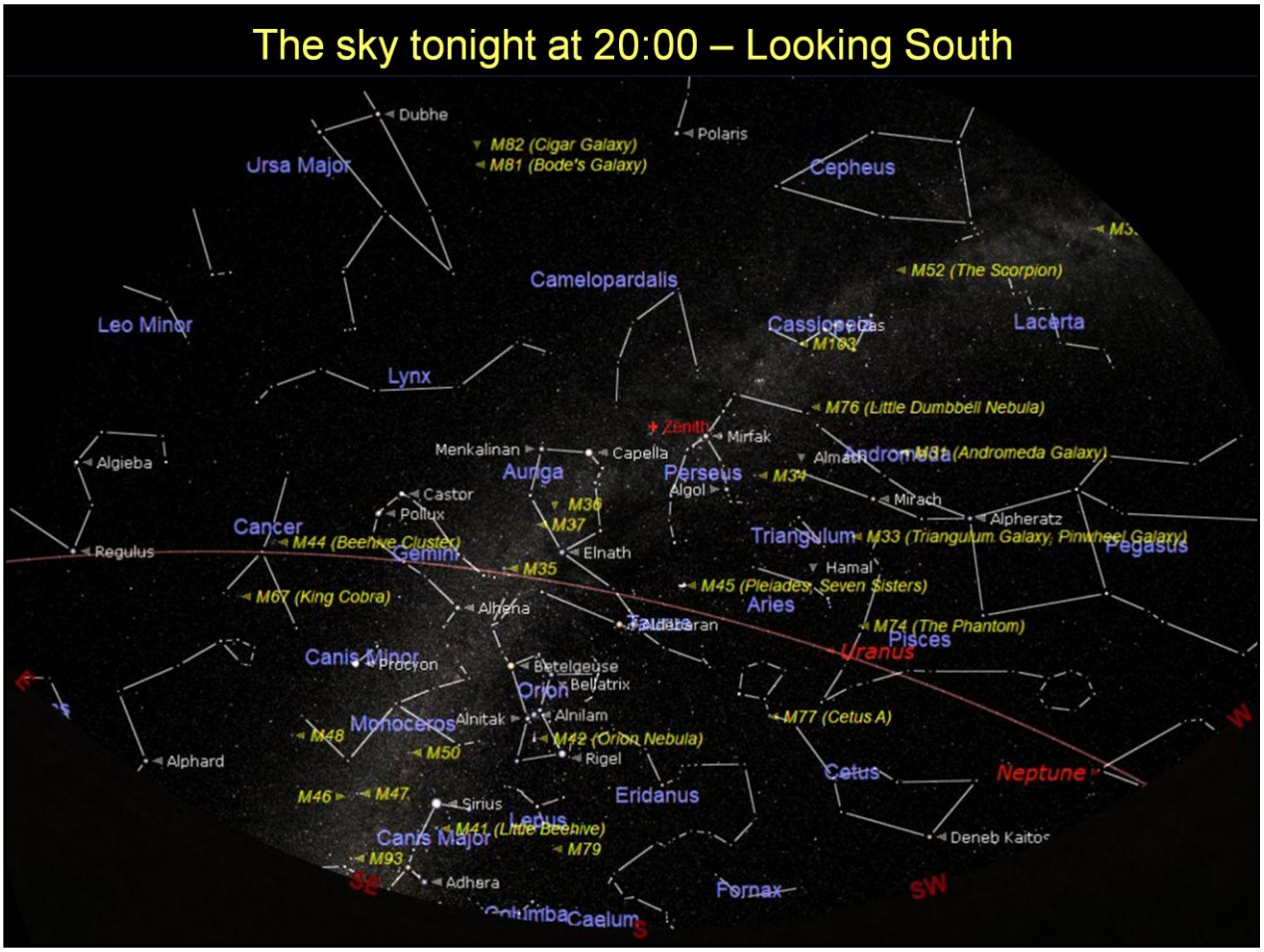
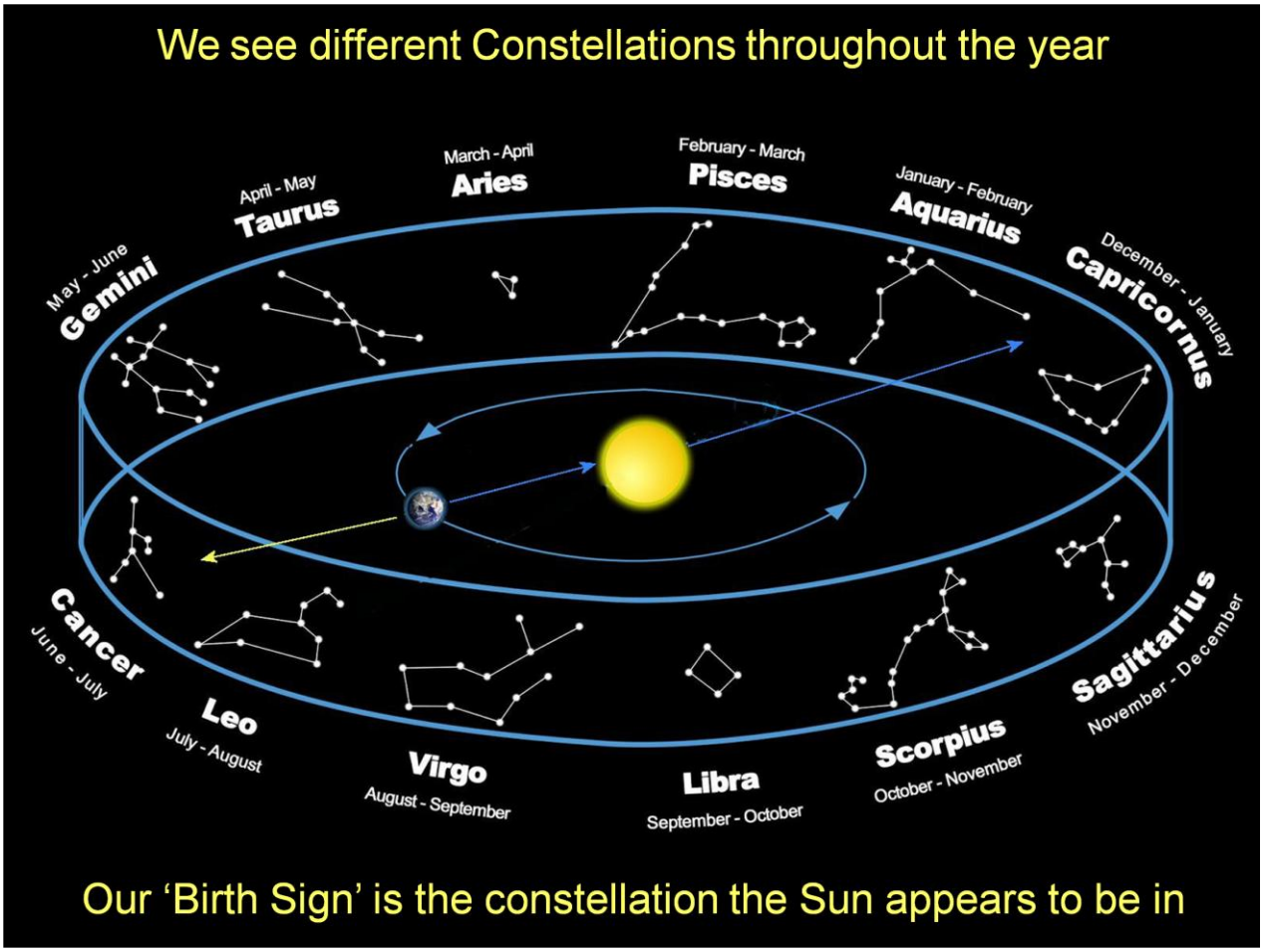
This session 2019 -2020 we intend to present talks designed to provide an introduction to some of the skills that are needed when starting astronomy as a hobby. This month (January) the presentation is another beginner's guide to the night sky. Although the stars are in fixed positions in the sky, the sky does change slightly from night to night due to the movement of Earth as it orbits the Sun once a year.

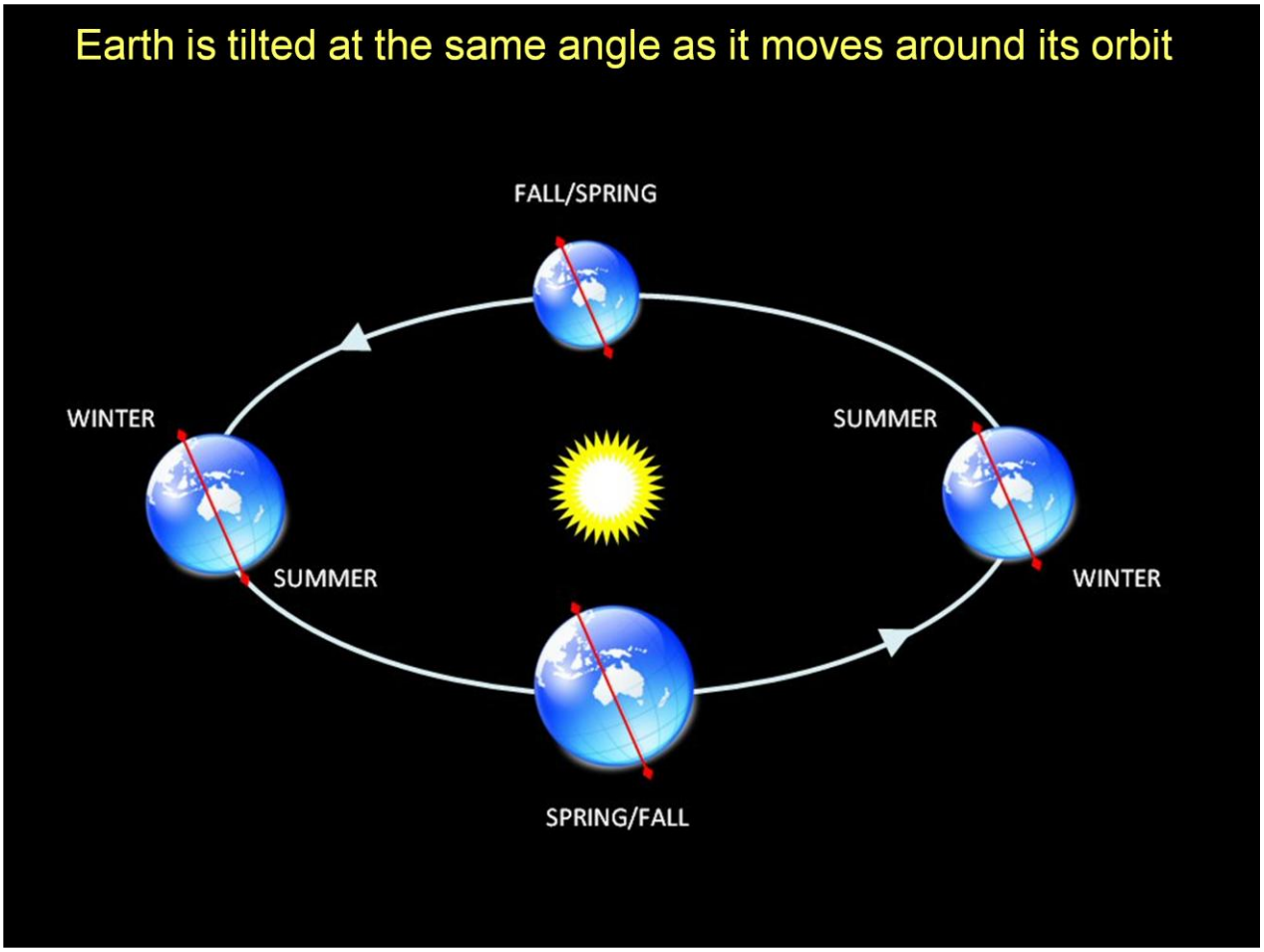


The chart above shows the night sky looking to the south on 15th January 2020 at about 8 o'clock in the evening. It shows the brightest stars (labelled white), the constellations (labelled blue), the Planets visible tonight (labelled red) and interesting deep sky objects (labelled yellow). The point in the sky directly overhead (above the observer) is called the 'Zenith' and is marked with a red cross '+'. The curved line across the lower part of the chart is the 'Ecliptic of Zodiac' (the imaginary line along which the Sun, Moon and planets appear to travel across the sky).

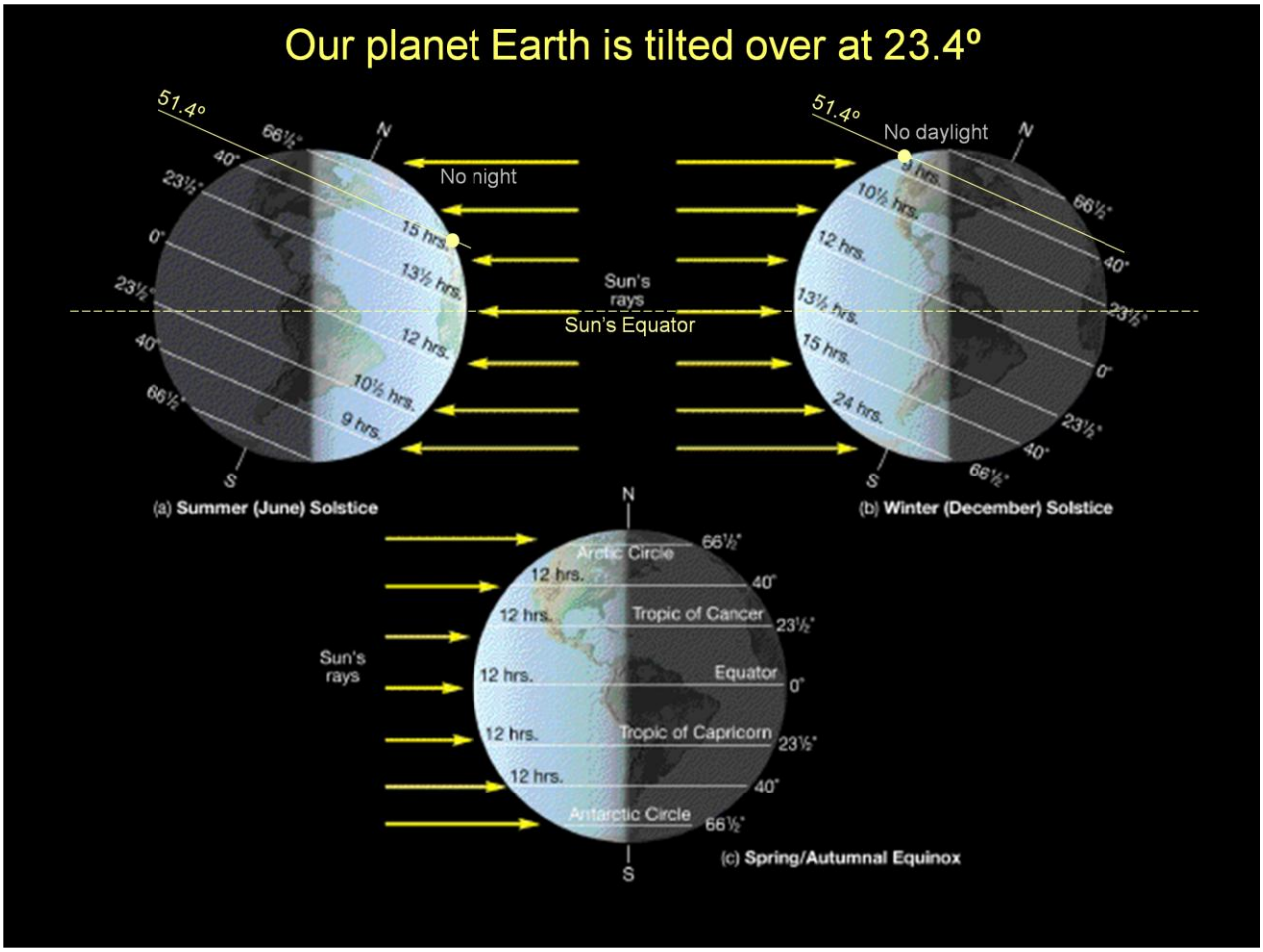


Our planets orbit the Sun anti-clockwise when view from above the north pole of the Sun. So this creates the impression that the sky is moving from east (left) to west (right) and we see the whole panorama of the night sky pass by during the course of one orbit of Earth around the Sun, one year. On the diagram above we see Earth in it relative position in its orbit during January. The blue arrows show our view towards the Sun at midday and the constellation in which the San appears to be. This dictates our Star Sign of the Zodiac (the month in which we were born) so a person born in January will have the star sign of Capricorn or Aquarius. The yellow arrow is pointing to the constellation that is due south at midnight in January and that is Cancer.

The planets also rotate and our planet Earth also rotates anti-clockwise when viewed from above its north pole. The night sky appears to pass from east to west as earth rotates once a day from west to east.



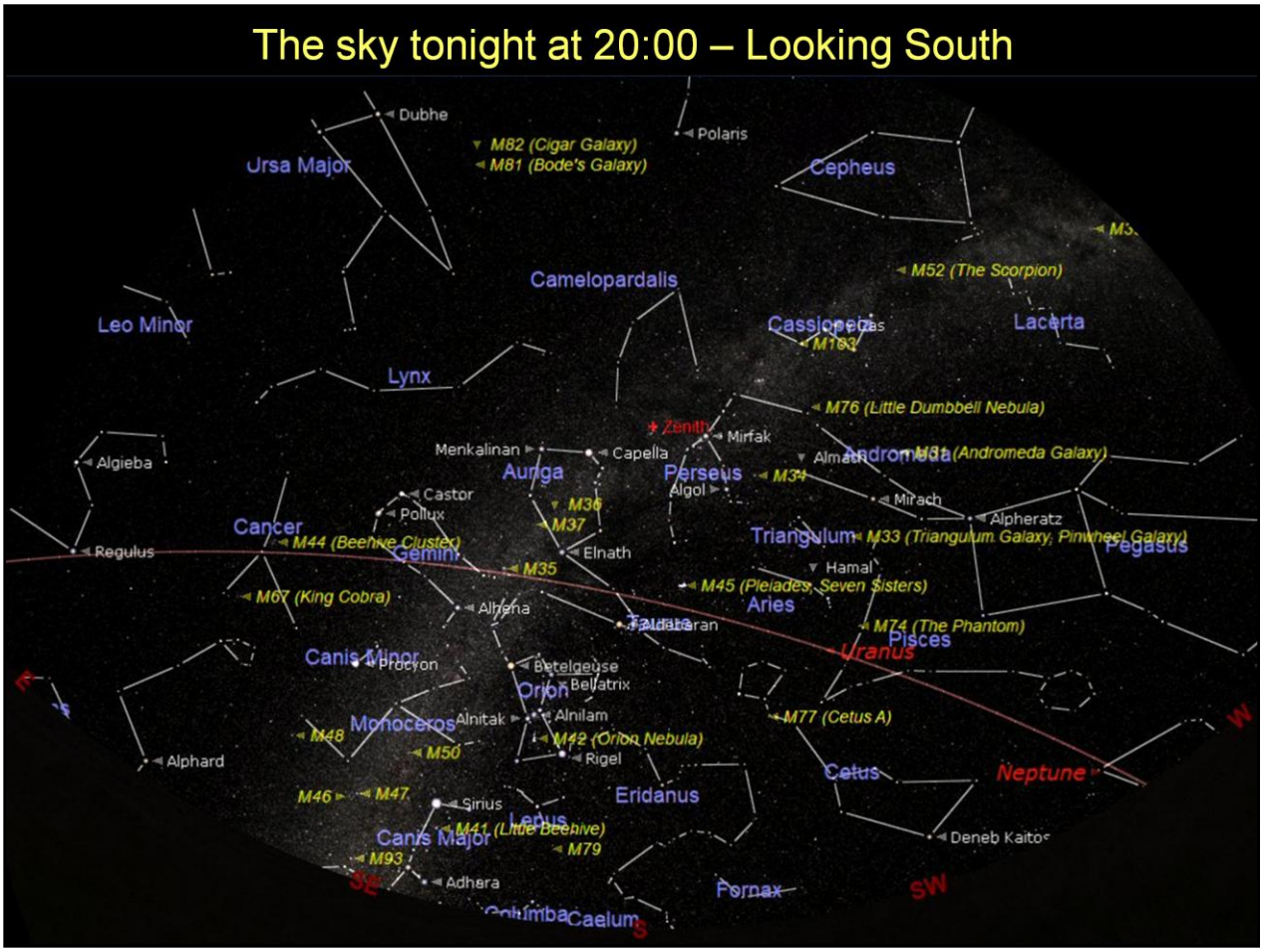
Our planet 'Earth' has its rotational axis tilted at an angle of 23.4º. This tilt is always in the same direction as Earth orbits the Sun. Although we often do not notice that our planet is tilted over it does have a major effect on the planet and our lives. It is the tilt that gives us our seasons.



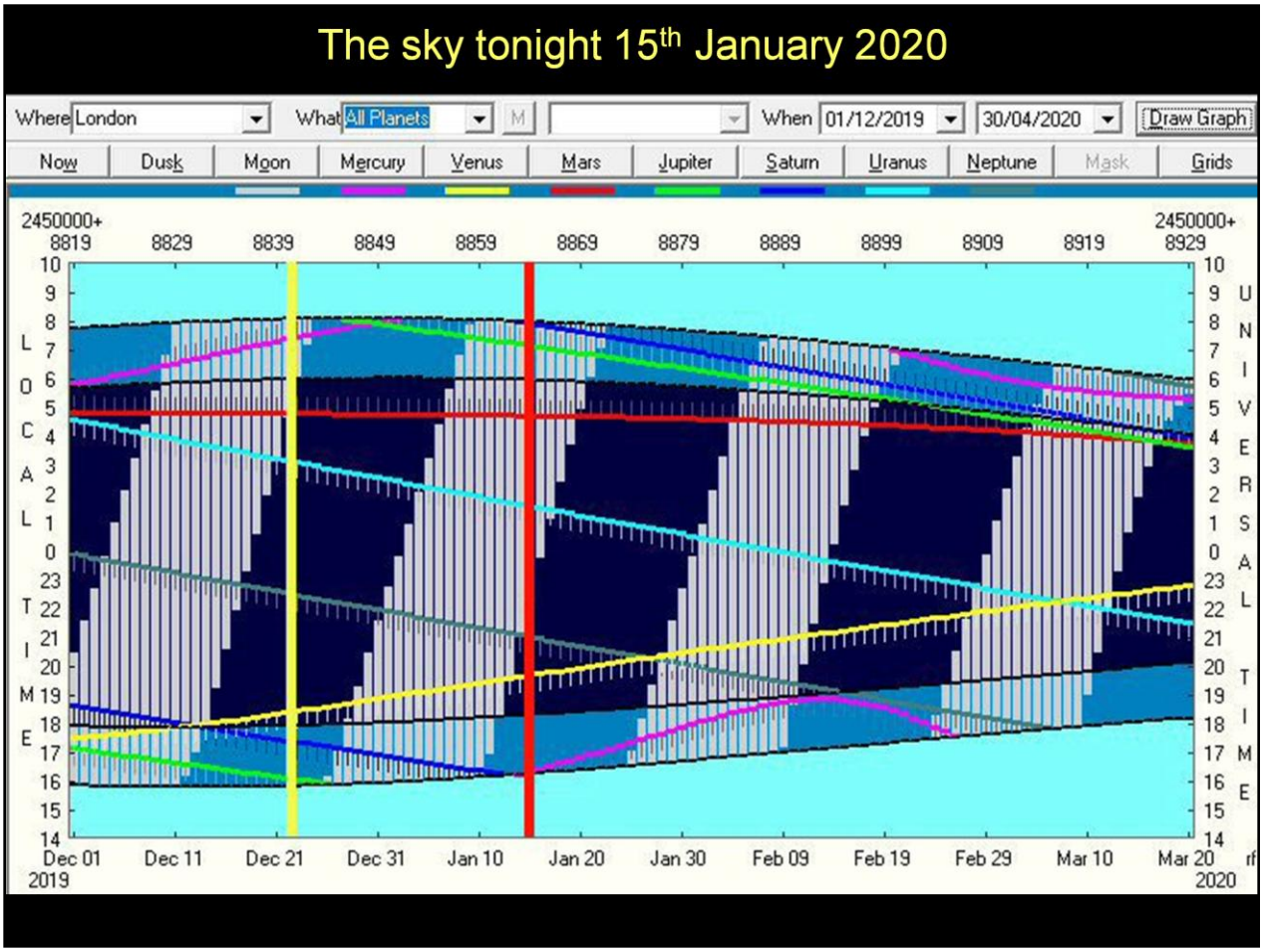
The diagram above shows how the tilt creates our seasons. At the top of the diagram the image of Earth, on the left shows the position of Earth at midsummer and midwinter on the right with the Sun in the centre. In the Summer the north pole is tilted towards the Sun so locations in the northern hemisphere are tilted towards the Equatorial Plain of the Sun and Solar System (dotted line). Newbury in the UK is located at 51.4º north of Earth's Equator so it is just above the 40º line on the upper left diagram.

On midsummer day our day is 18 hours long and our night is just 8 hours. By comparing the right and left diagrams it can be seen that the position of Newbury (indicated by the yellow dot) is closer to the Sun's Equator during the day in summer (on the left) and further north during the day in winter (on the right). Consequently the Sun appears higher in the sky in summer (so it is warmer) and lower in the sky in winter (and colder).

The lower view shows the Spring and Autumn Equinoxes which are half way between midwinter and midsummer when day and night are equally 12 hours long.



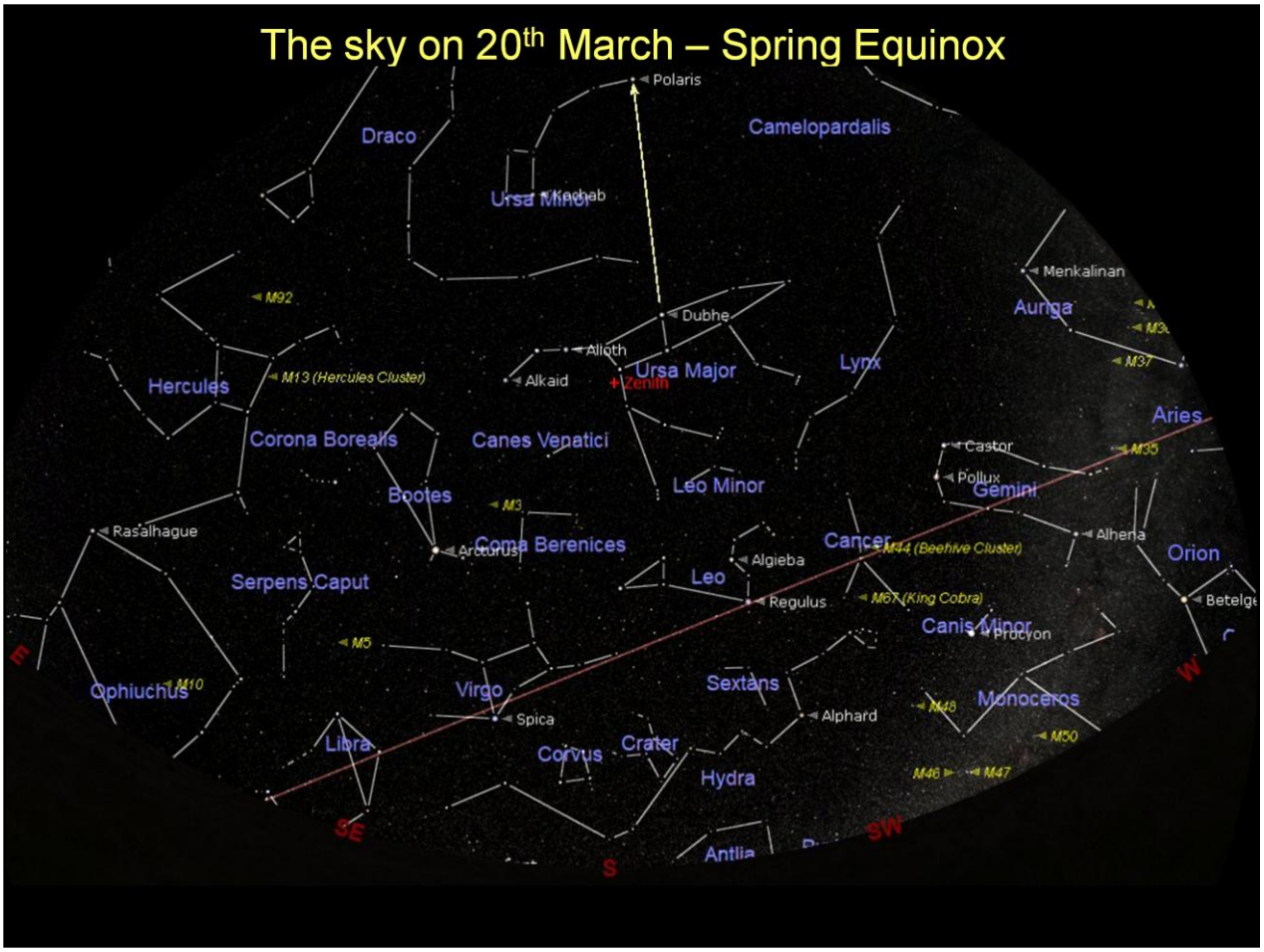
Midwinter day was on 22nd December 2019 so tonight, on 15th January 2020, we are about one month after midwinter but still in winter time. During winter the ecliptic appears low in the sky and as the Sun appears to follow the ecliptic across the sky it also appears low in the sky. Conversely at night the ecliptic appears high so the Moon and planets are high and in their best position for observing. However only Uranus and Neptune are visible at the moment.



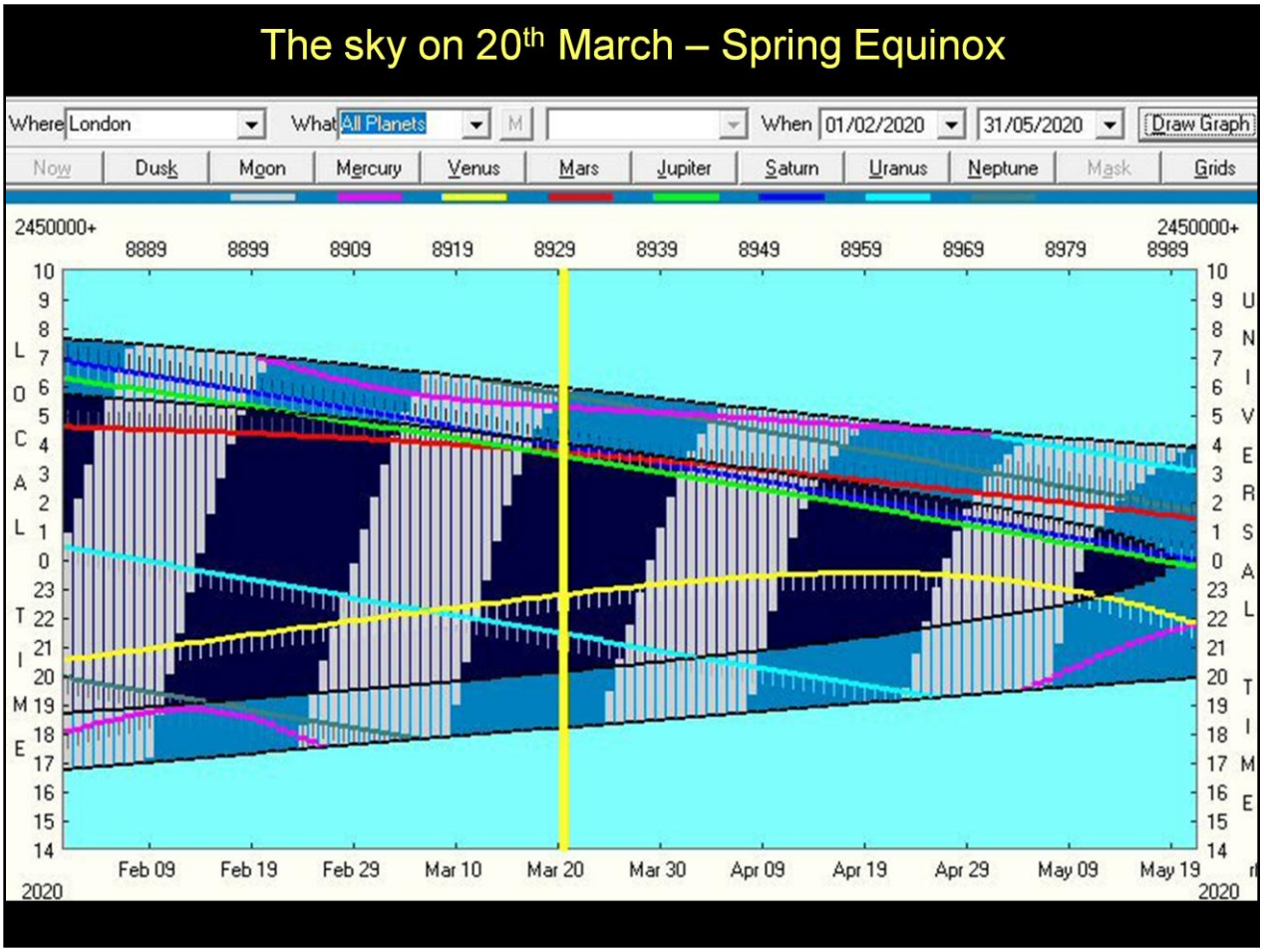
The diagram above is taken from Richard Fleet's Graphdark application. It shows graphically how dark the sky will appear and where the planets will be every night. Dates are shown along the bottom of the graph and the time during the night is shown on the left. The sloping white bands are the times when the Moon is in the sky and the vertical columns appearing on the white are the days. The yellow column is 22nd December 2019 midwinter day and the red column is the 15th January 2020 (the Beginners Meeting).

Planets are shown by the coloured lines across the diagram with the colour key at the top. On the chart where the sky light blue is daylight, dark blue is twilight and black is completely dark night. The sloping white bands show when the Moon is in the sky.

The planets on 15th January from sunset at the bottom are: Mercury and Saturn (not observable) Venus, Neptune and Uranus observable up to the line (bars below the line) Mars from the line until sunrise (bars above the line), Jupiter and Saturn in dawn twilight.



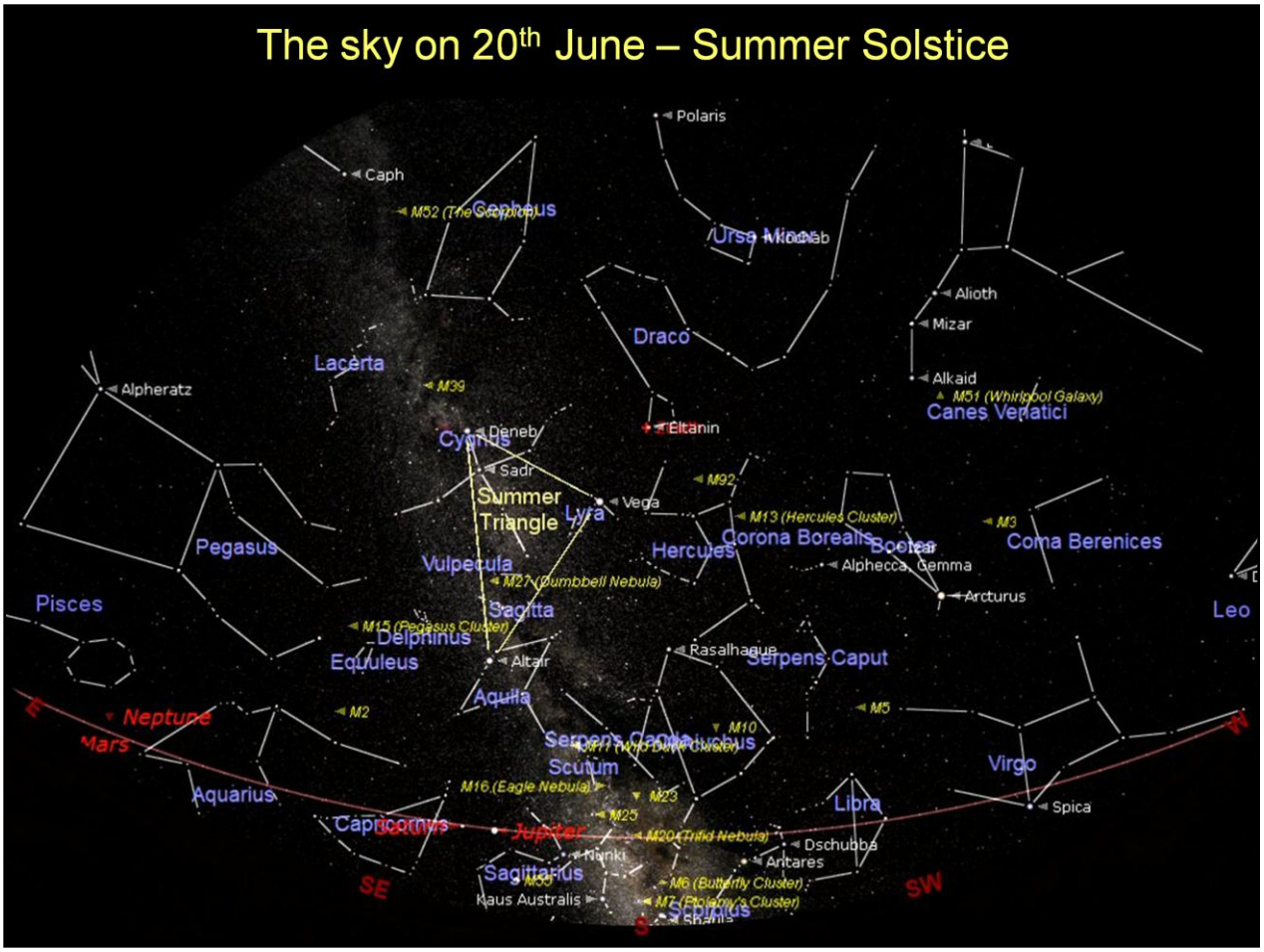
The chart above shows the night sky on 20th March 2020 – the Spring Equinox. On this day it will be half way between midwinter and midsummer and when the day and night will be equally 12 hours long.



The Graphdark chart above shows the sky from the beginning of February 2020 through to the middle of May 2020 with the Spring Equinox shown as the vertical yellow column on 20th March 2020. The night (and day) will be exactly 12 hours long, from about 18:00 through midnight to about 06:00 (time shown on the left of the chart). Full darkness will be from 20:00 until 05:00.

Planets visible are Uranus and Venus up to their lines (with bars below) with Jupiter, Mars and Saturn from their lines (bars above) until dawn with Mercury and Neptune in the twilight and very difficult to see.

There will be no Moon on this night as shown by the yellow column being totally in the black band (no Moon).



The chart above shows the night sky on midsummer day (summer solstice) 20th June 2020. It can be seen that the Ecliptic is very low and close to the southern horizon. Unfortunately this means the planets will be in the thick, turbulent and murky air close to the horizon as they appear to move along the ecliptic.

The Sun will be at its highest point in the sky at midday 12:00 GMT (13:00 BST).

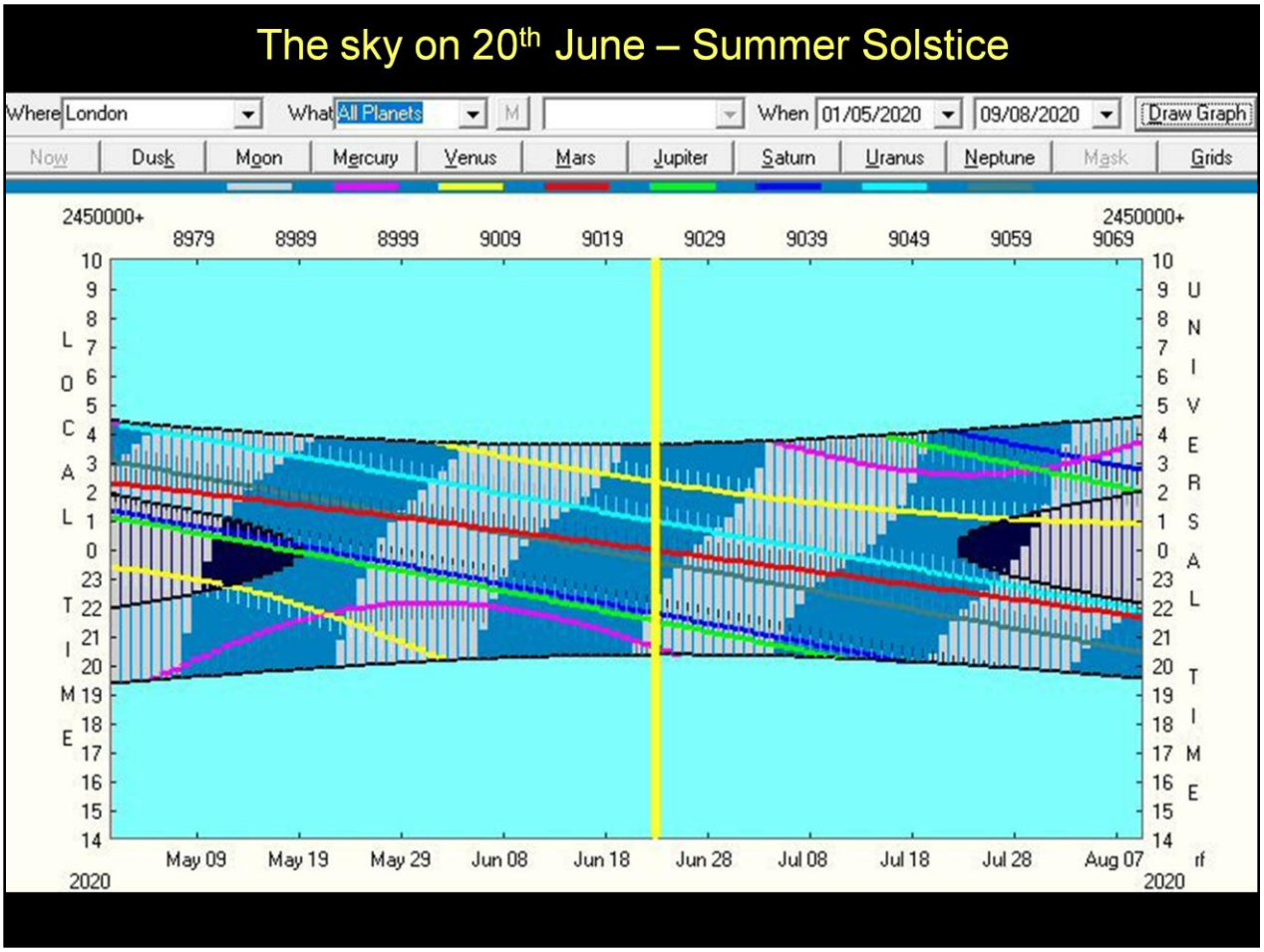
This day, being the Summer Solstice, will be the longest day of the year with 16 hours of daylight and only 8 hours of night. The summer constellations are now in full view.

As the Moon appears to move along the Ecliptic it too will appear very low in the sky and close to the horizon. The Full Moon will rise over the eastern horizon when the Sun is setting over the western horizon.

As the Full Moon rises in the east it appears close to familiar objects such as hills and buildings and this has an interesting effect. Objects towards the horizon seem a long way away to us and appear small. However the Moon which is very far away always appears the same size. Our eyes and brain try to compare the size of the Moon to those familiar objects that look small because they are far away. Consequently we experience an optical elusion that makes us think the Moon looks large compared to those distant objects and we think the Moon looks very large.

Actually the Moon is always about the same size 30 arc-minutes (half a degree). This is the width of our little finger (pinkie) when held out at a full arm length.

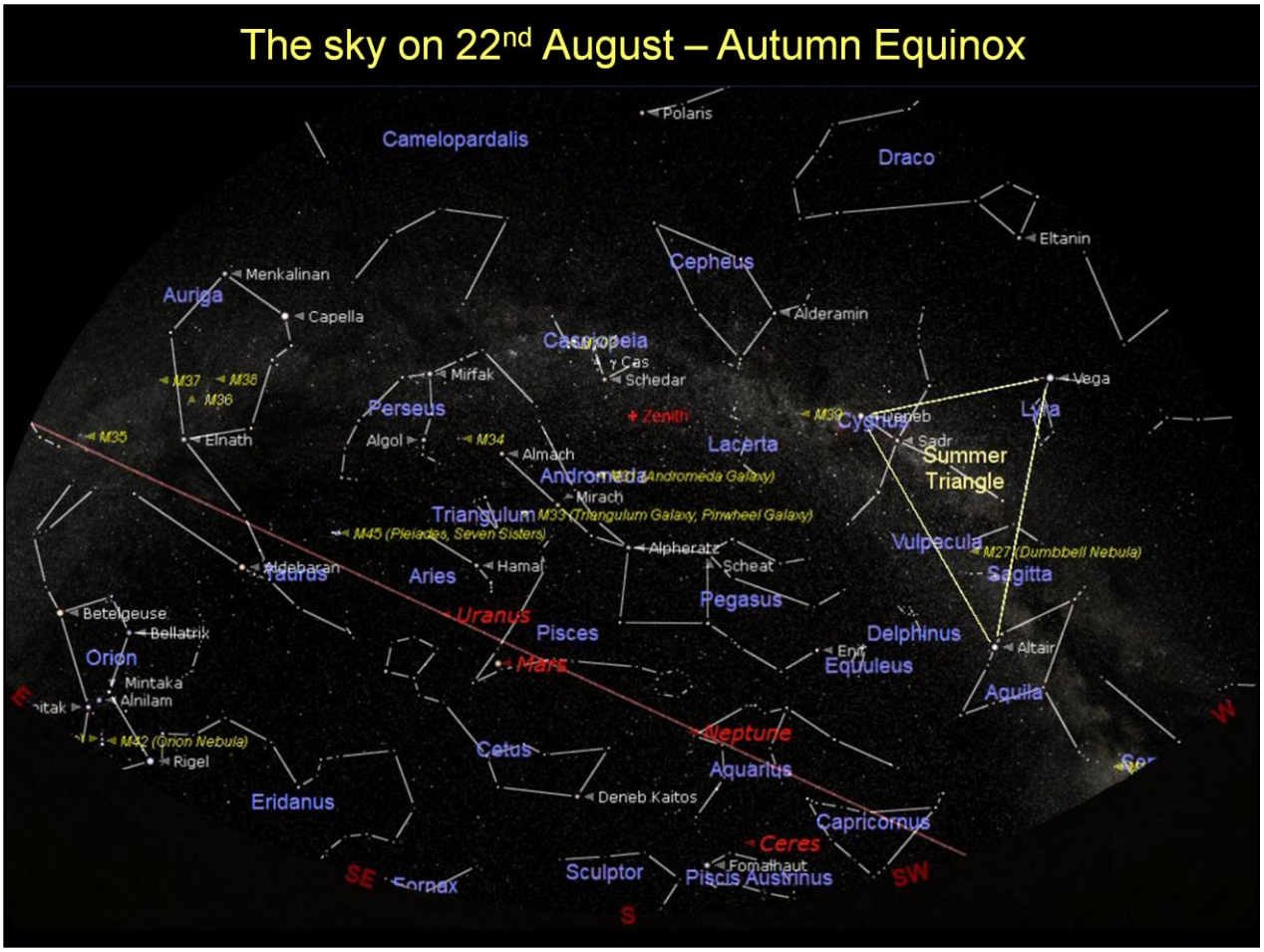
The diameter of the Moon can change by up to 14% due to its elliptical orbit around Earth but this is not normally noticeable to us.



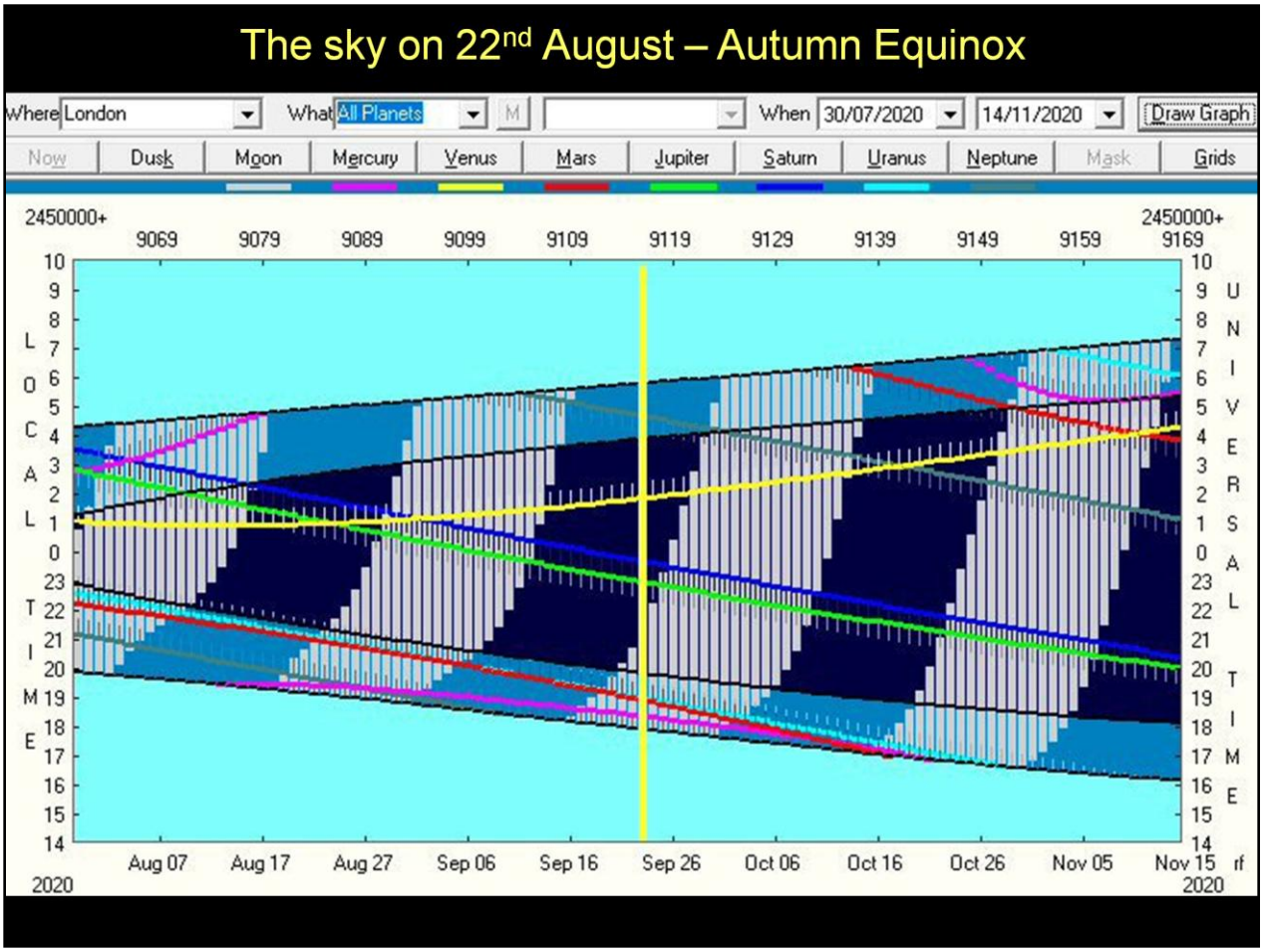
The Graphdark chart above shows the sky from the beginning of May 2020 through to the beginning of August 2020 with the Summer Solstice, on 20th June shown as the vertical yellow column. The night will be 8 hours long, from about 20:00 through midnight to about 04:00 (time shown on the left of the chart). This means the day will be 18 hours long the longest day of the year.

It can be seen that there are no black bands to indicate complete darkness during the night. This is because the Sun is only just below the northern horizon and the sky does not become completely dark and it is effectively twilight all night. This means it is more difficult to observe the faint deep sky objects such as galaxies, nebulae and star clusters due to the lower contrast with the light sky.

The planets visible are Mercury (very difficult), Jupiter, Saturn, Neptune, Mars, Uranus and Venus until dawn (bars above the lines).

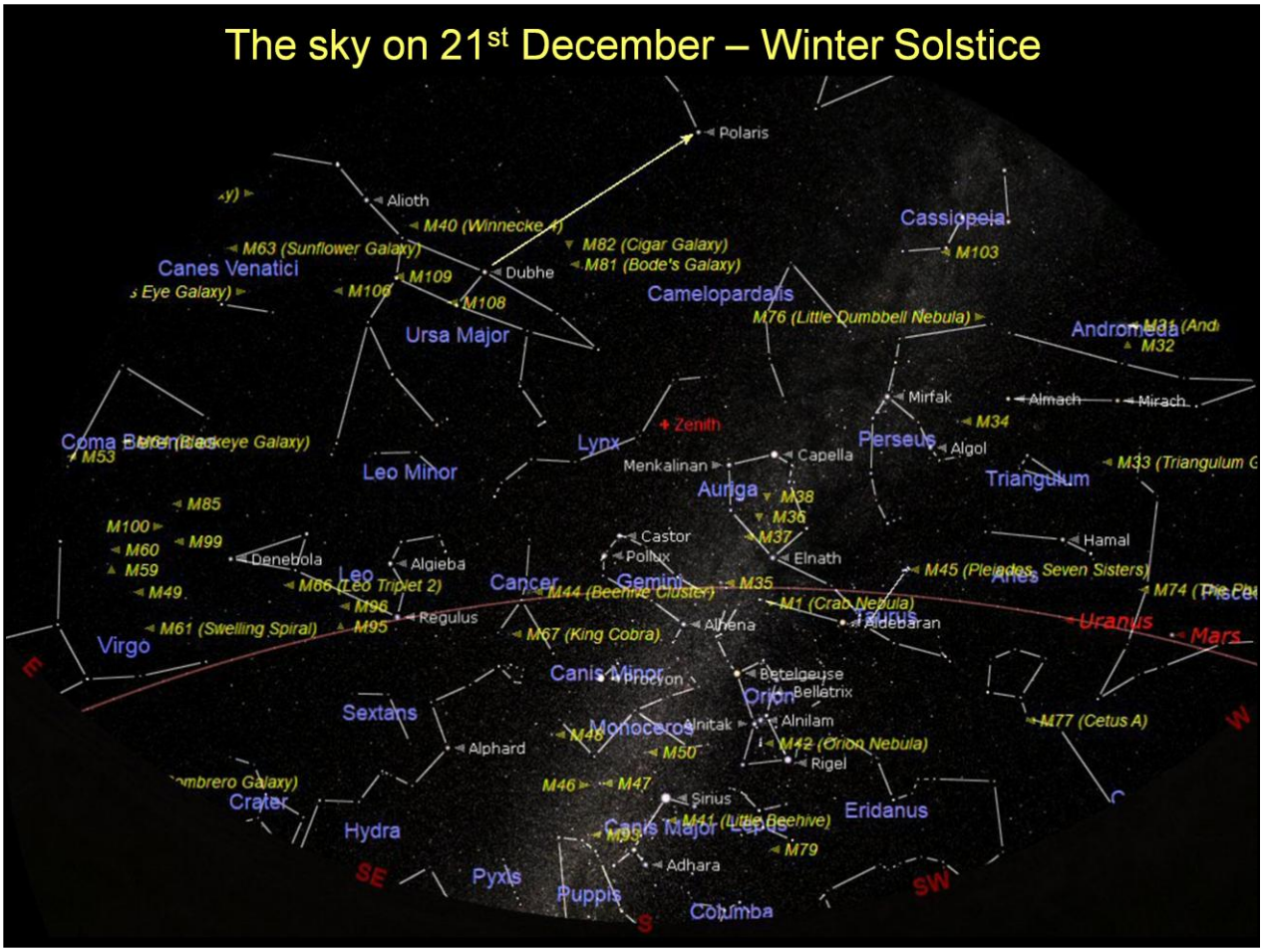


The chart above shows the night sky on 22nd August 2020 – the Autumn Equinox. On this day it will be half way between midsummer and midwinter and when the day and night will be equally 12 hours long.



The Graphdark chart above shows the sky from the beginning of August 2020 through to the middle of November 2020 with the Autumn Equinox shown as the vertical yellow column. The night will be exactly 12 hours long, from about 18:00 through midnight to about 06:00 (time shown on the left of the chart). Full darkness will be from 20:00 until 04:00.

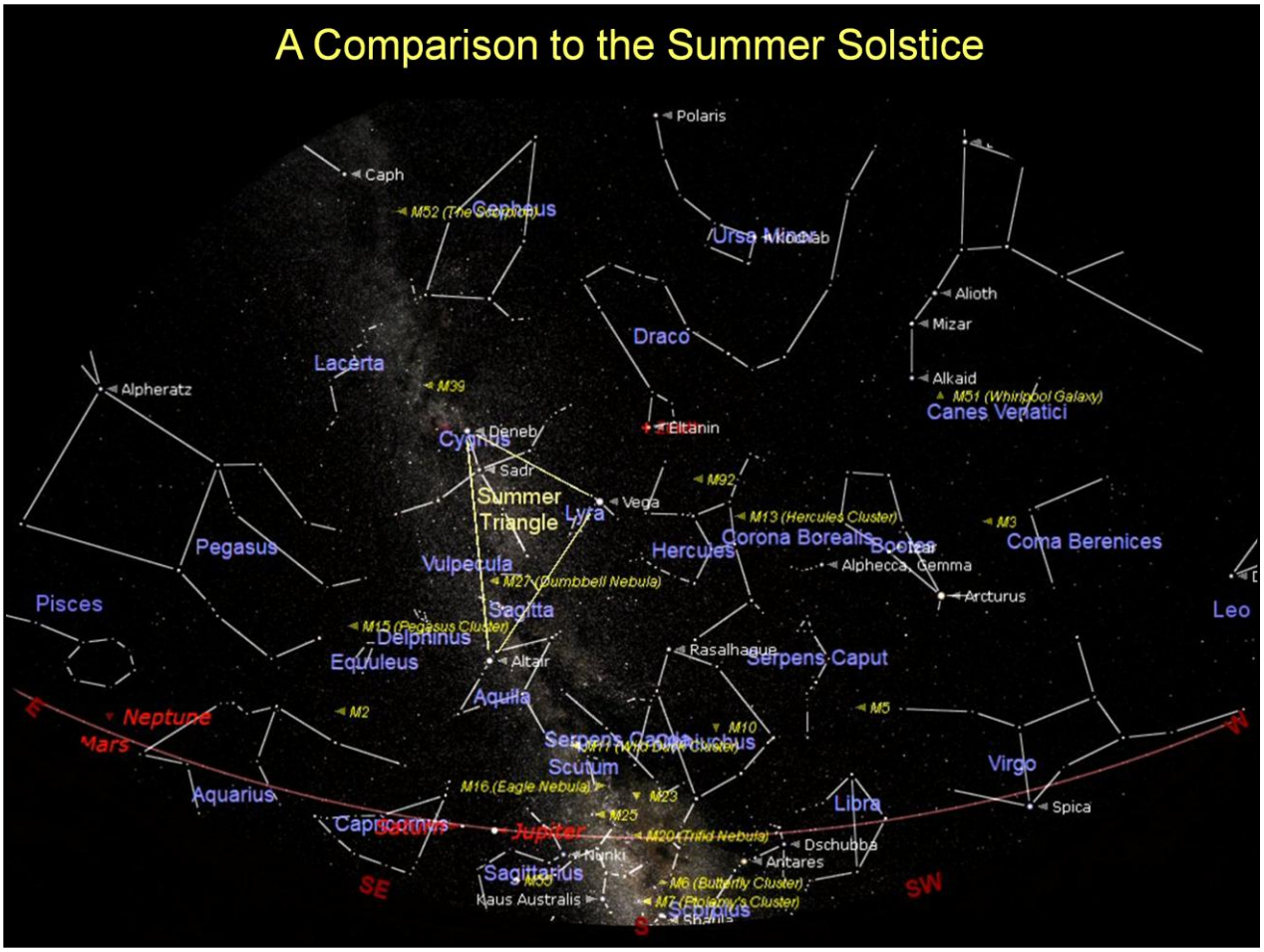
Planets visible are: Mercury (very difficult in the evening), Mars and Uranus all night (bars above their lines), Jupiter and Saturn up to their lines (bars below lines) and Venus from its line until sunrise (bars above line). Neptune will be in view all night (bars below line).



The chart above shows the sky on the night of the Winter Solstice (the longest night of the year) on 21st December 2020. It can be seen that the Ecliptic is very high in the sky. This means the planets will be in the steady, and clearer air far above the horizon with its murky and turbulent air. So it is a good time for observing the planets and deep sky objects.

This day, being the Winter Solstice, will be the shortest day of the year with 8 hours of daylight and 18 hours of dark night. The winter constellations are now in full view.

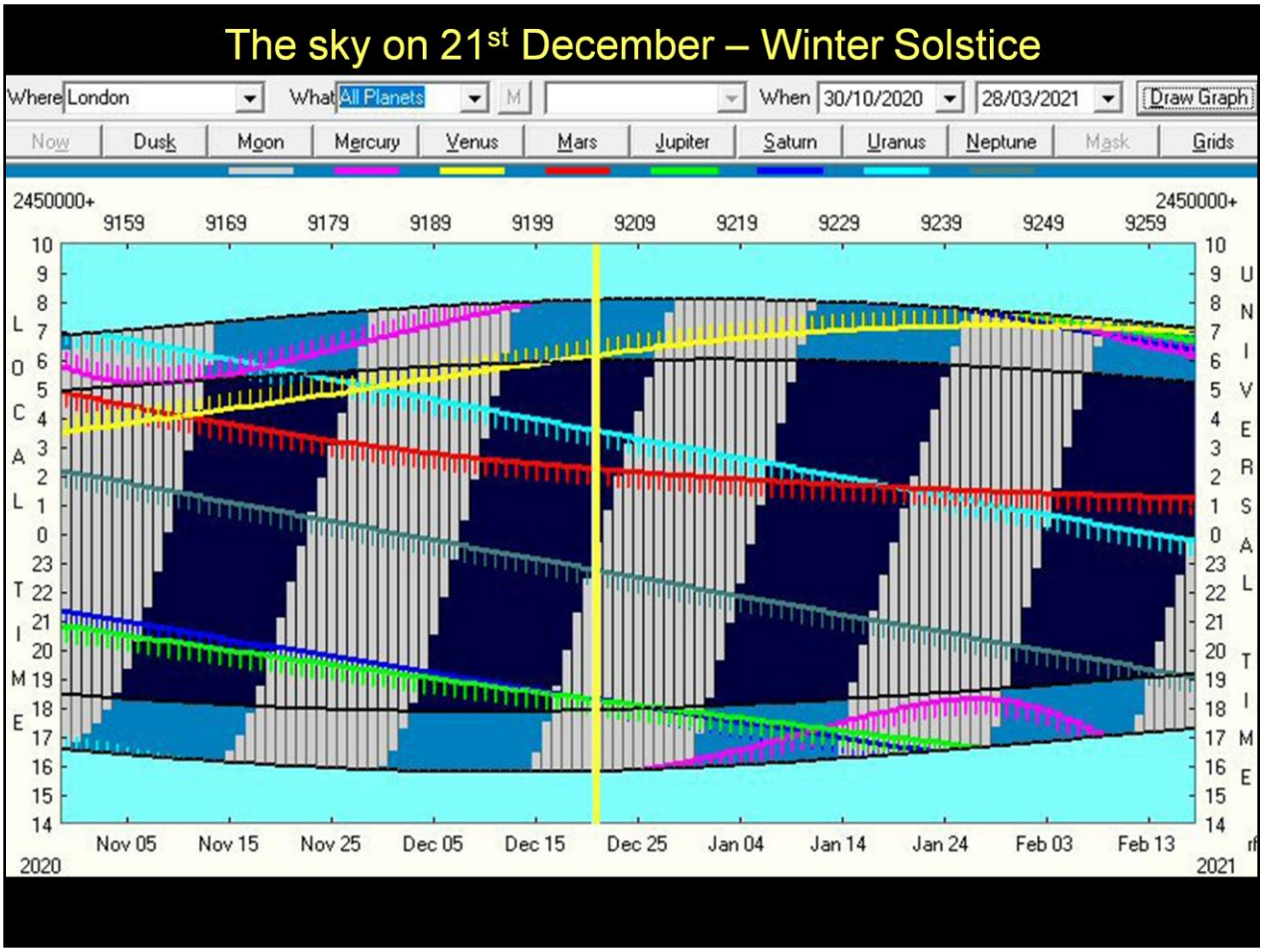
See the next slide to compare this Winter Solstice chart to the Summer Solstice Chart.



The chart above shows the night sky on midsummer day (summer solstice) 20th June 2020. It can be seen that the Ecliptic is very low and close to the southern horizon. Unfortunately this means the planets will be in the thick, turbulent and murky air close to the horizon as the appear to move along the ecliptic.

The Sun will be at its highest point in the sky at midday 12:00 GMT (13:00 BST).

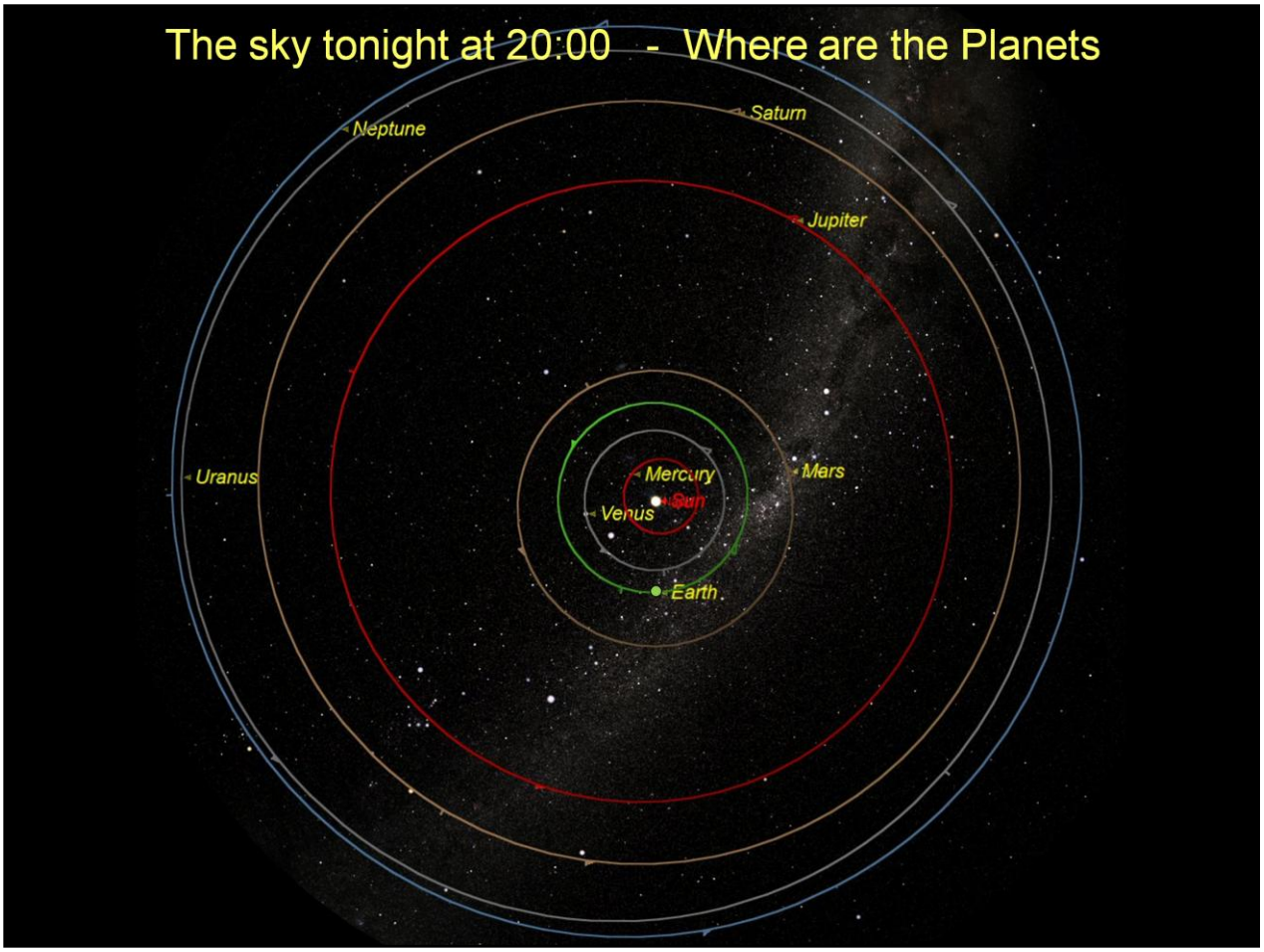
This day, being the Summer Solstice, will be the longest day of the year with 16 hours of daylight and only 8 hours of night. The summer constellations are now in full view.



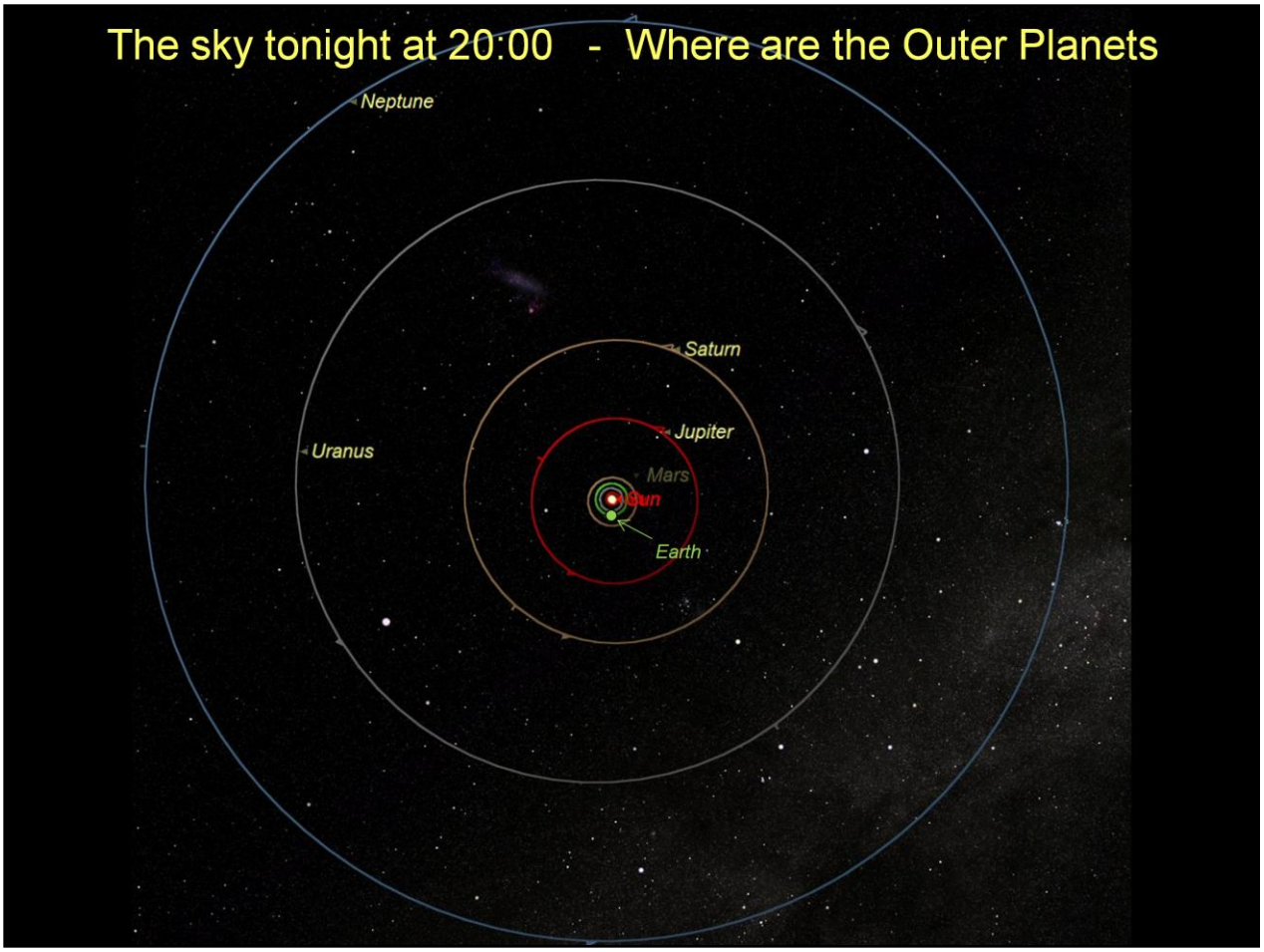
The Graphdark chart above shows the sky from the beginning of November 2020 through to the middle of February 2020 with the Winter Solstice, on 21st December shown as the vertical yellow column. The night will be 16 hours long, from about 16:00 through midnight to about 08:00 (time shown on the left of the chart). This means the night will be 18 hours long, the longest night of the year and the shortest day only 8 hours long.

It can be seen that 21st December will be in the white band, indicating the Moon will be in the sky until midnight when the Moon will set over the western horizon. After midnight it will be completely dark and good for observing the faint deep sky objects such as galaxies, nebulae and star clusters due to the better contrast with the dark sky.

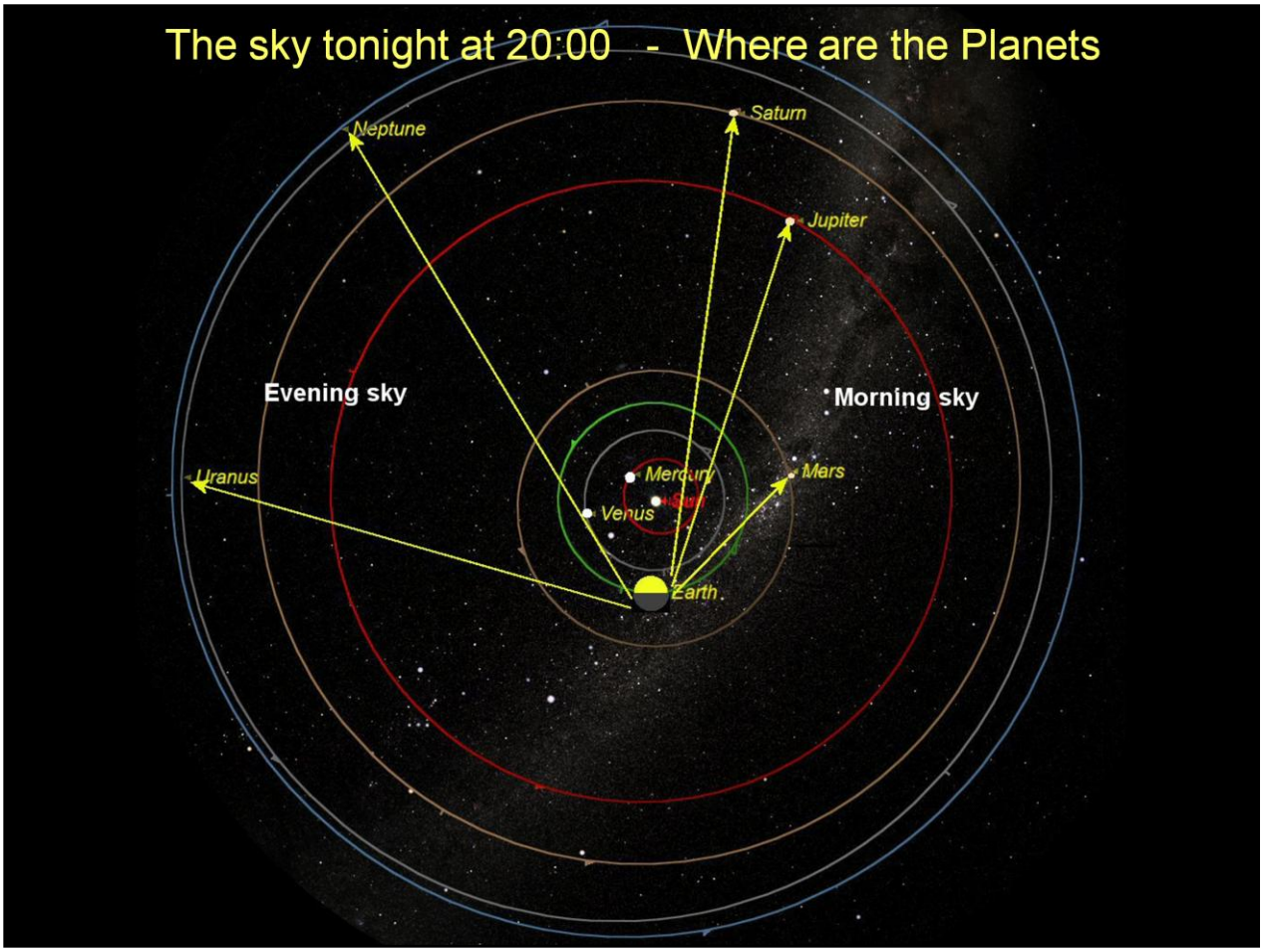
The planets visible are Mercury (not observable), Jupiter, Saturn, Neptune, Mars, Uranus all visible up to the time indicated by their coloured lines (bars below the line) and Venus from its line until sunrise in the dawn light (bars above the line).



The chart above shows the inner Solar System with the inner planets, Mercury, Venus, Earth and Mars in their relative positions compared to Earth on the evening of the January 2020 Beginners Meeting. The orbits of the outer planets have been compressed to allow all the planets to be included.

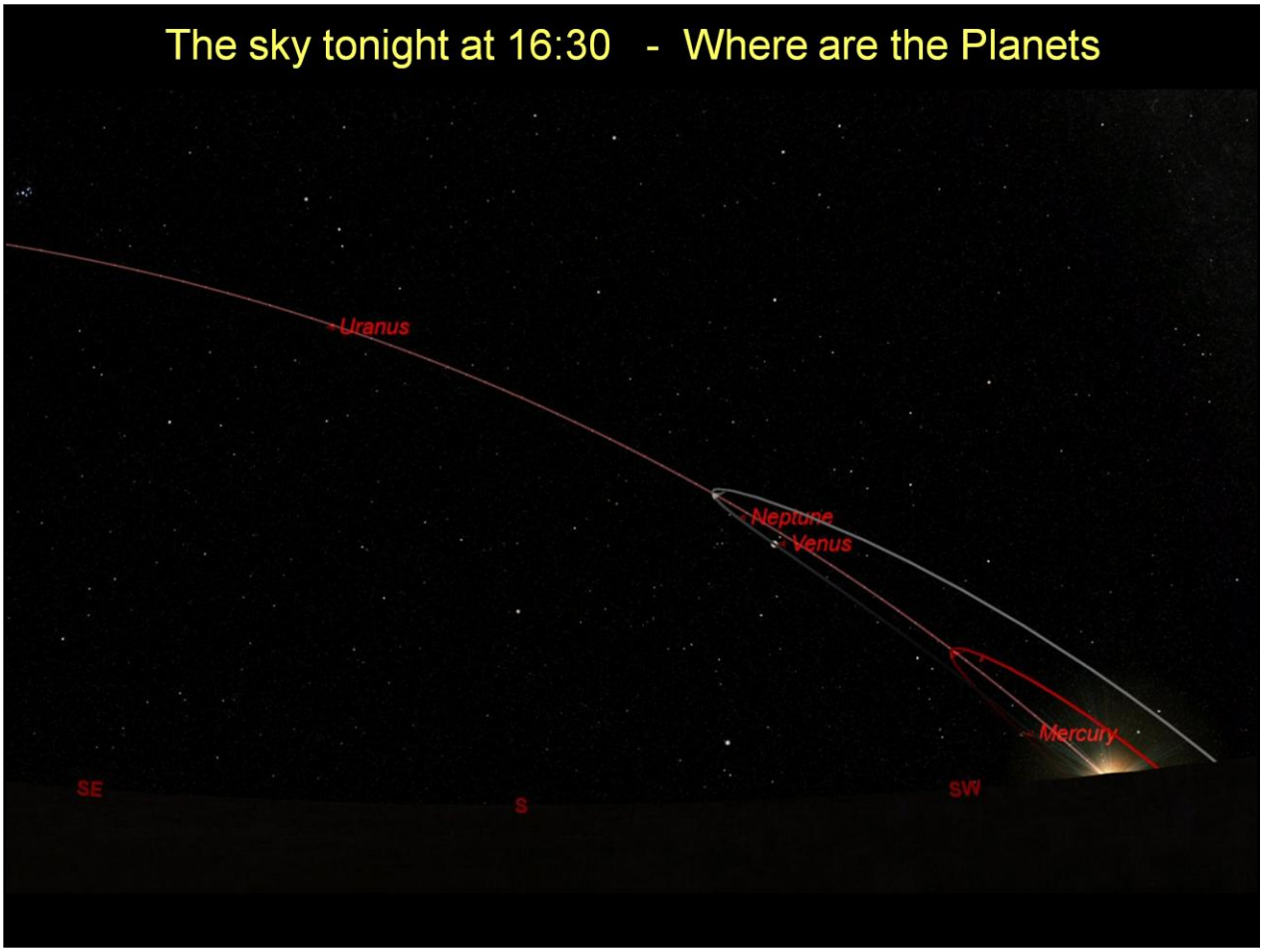


The chart above shows the whole Solar System with the orbits of the inner planets, Mercury, Venus, Earth and Mars compressed to allow all the orbits of the planets to be included. This chart shows the orbits of the outer planets Jupiter, Saturn, Uranus and Neptune in their relative positions to Earth.



The chart above shows the location of the planets around our Sun in their true positions as seen from Earth. The sky is shown as it was on 28th January 2020. This is because there was a conjunction (coming together) of the planets Venus and Neptune. Earth is rotating (once per day) in an anticlockwise direction as seen from our viewpoint looking at the chart. The yellow side is day and the black is night so the point on the left between day and night is sunset and on the right is sunrise.

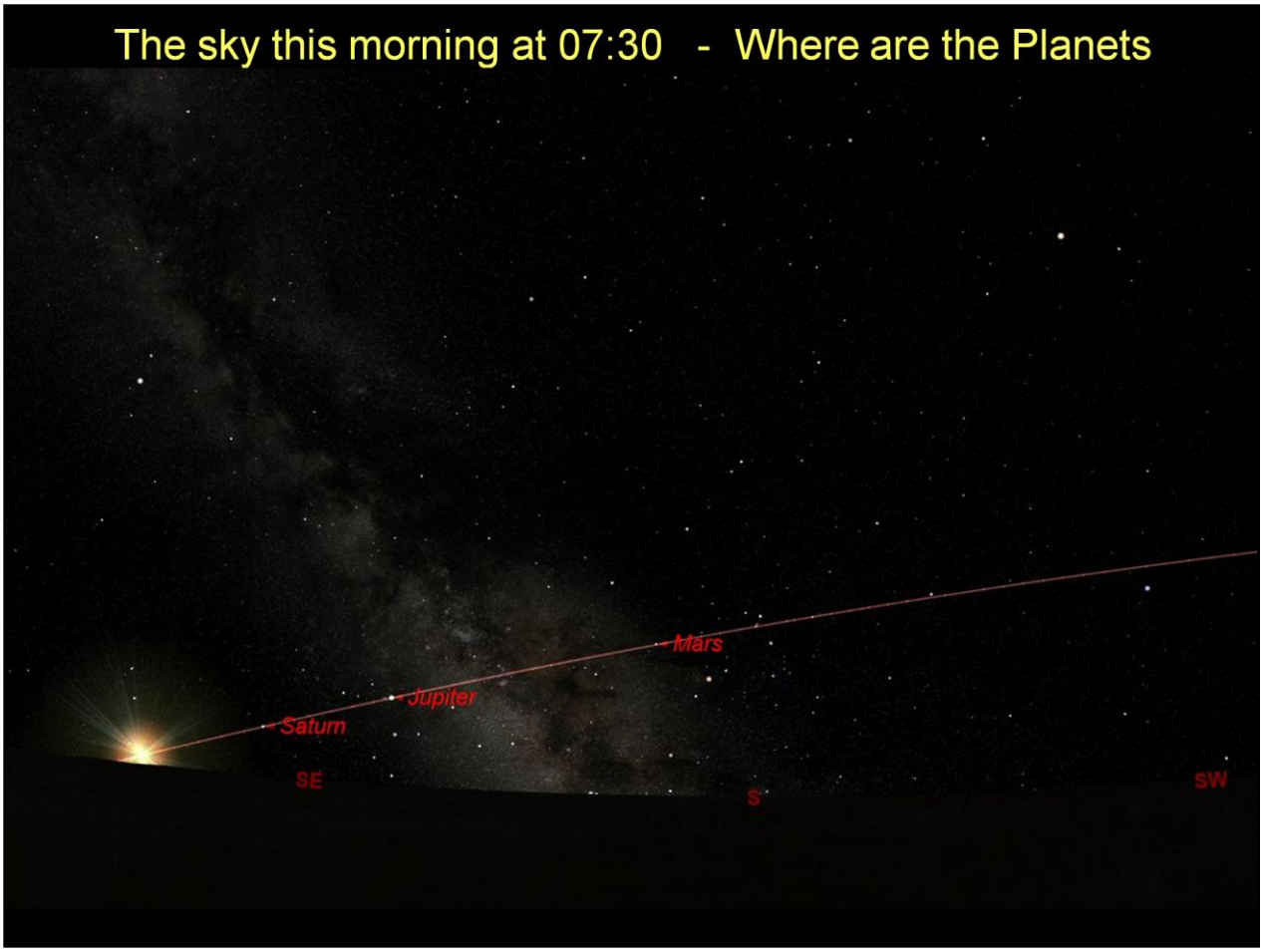
As an observer, at sunset (left), moves into the dark and looks to the west Venus is seen shining brightly over the western horizon. In the same line of sight but much further away is Neptune. It is much fainter than Venus but appears very close to it. Mercury can just be seen lower and in the glare of the setting Sun. The planet Uranus appears in the southern sky to our observer. As Earth rotates these planets will appear to move towards the west and set during the evening. Through the night the dark sky will appear to move from east (left) to west (right) as Earth rotates. As our observer approaches dawn, on the right side of Earth on the chart, Mars will be seen to rise over the eastern horizon followed by Jupiter and Saturn (hidden in the glare) of the Sun rising over the horizon.



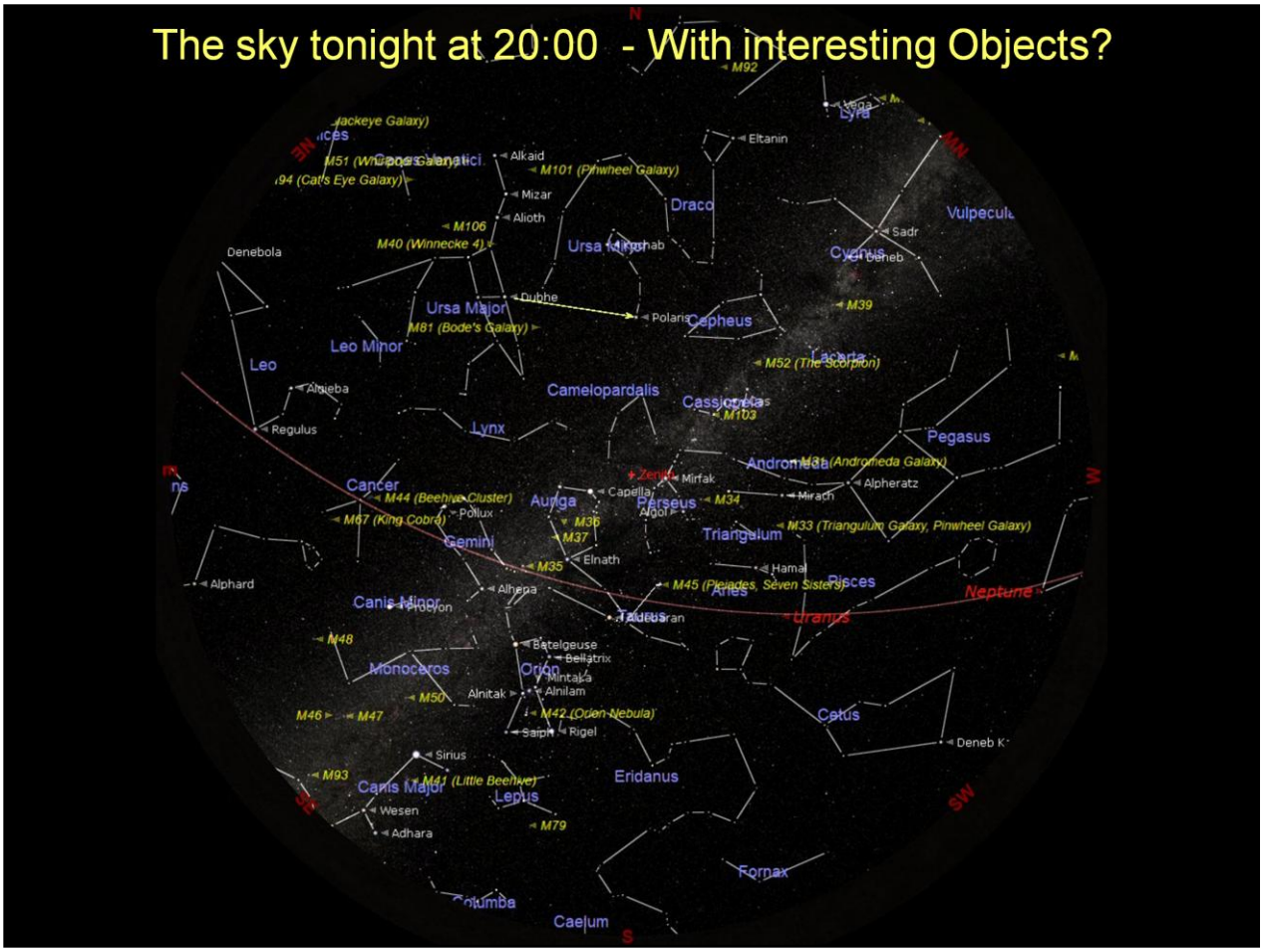
The chart above shows the early evening sky on 15th February 2020 as the Sun is setting in the west. Mercury is moving out from behind the Sun and is shown on the fainter part of its orbit shown as the red path. Over the next few weeks Mercury will reach the top of the arc on 10th February. This point is called the Greatest Eastern Elongation when Mercury will be 8º away from the Sun. It will continue along the brighter section of its orbital path and appear to move closer to the Sun and eventually pass directly between Earth and the Sun on 26th February in its Inferior Conjunction with the Sun.

Venus is also moving out from the Sun and will reach Greatest Eastern Elongation on 24th March when it will be at its greatest apparent distance from the Sun at 46º. It will then begin to move back towards the Sun and reach Inferior Conjunction on 3rd June. This is when it will pass between Earth and the Sun.

Neptune will set over the western horizon at 19:00 and Uranus will set at 23:30.



The chart above shows the early morning sky on 15th January 2020 as the Sun is rising in the east at about 07:30 on 15th January. Mars preceded the Sun rising at 04:25, followed by Jupiter rising at 05:35 and Saturn rising at 06:06, in the brightening.



The chart above is a computer generated view, using planetarium application (Starrynight), of the sky at 20:00 GMT (8 o'clock) on the 15th January 2020. This was the evening of the January Beginners meeting.

The chart shows the sky as we would see it looking towards the south. Of course the constellation figures and names are added and do not appear in the sky. Horizontally across the chart (shown in orange) is Ecliptic (the imaginary line along which the Sun, Moon and planets appear to move across the sky).

Interesting deep sky objects such as Galaxies, Nebulae and Star Clusters are marked in yellow print as a number preceded by a letter 'M' for Messier Object.

Beginner's Website:

naasbeginners.co.uk