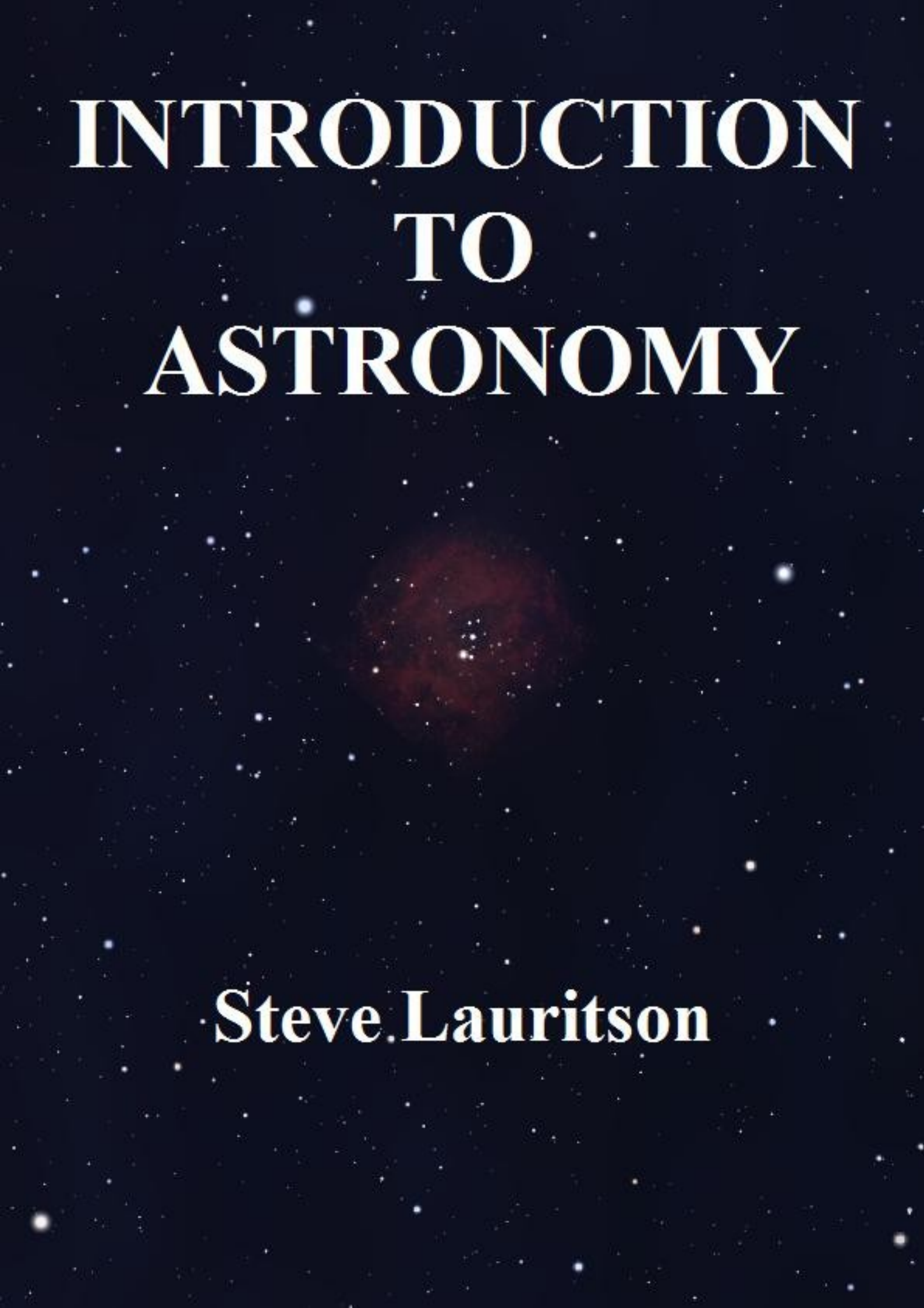
INTRODUCTION TO ASTRONOMY



Steve Lauritson

Contents

Foreword

The aim of this book is to introduce people to the fascinating world of astronomy. It assumes that the reader has no, or very little understanding of astronomy. As such everything the newcomer needs to begin their study of astronomy is contained within this book. The introduction will give a brief history and background of astronomy as well as some basic information that is necessary to fully understand the information presented in the following pages. This will be kept as brief as possible before plunging straight into observing.
To start with you do not need any equipment to begin your observations. You will be surprised by how much satisfaction you will gain by looking up into the night sky and identifying the constellations and their stars. As your interest grows you might want to get yourself a pair of binoculars or a small telescope. What appears to the unaided eye as an area with just one or two stars can be revealed as a rich star field through binoculars. This book will show you the stars that can be seen with the naked eye as well as objects that can be seen with binoculars.
Rather than starting off with a complete and detailed list of all constellations, this book will start you the most prominent ones. Once you have learned these then you will be able to learn the less prominent ones. These will be covered in the follow up book which will also include details of the planets in our Solar System.
I hope that you find this book interesting at that its study will lead you to a lasting interest in astronomy.

Steve Lauritson

January 2009.

To download the latest version of this book please visit:-

http://www.astronomybristol.co.uk

For any comments about this book, requests for better explanations, more information on observing or the inclusion of anything else to do with astronomy then please email me at:

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This book was originally part 1 of an Introduction to Astronomy. Part 2 was to include the rest of the constellations and a section on the planets. The book is now evolving. There will not be a part 2. Instead this book will become a complete Star Atlas. This process is not yet complete. I still need to add the remainder of the constellations. I also intend to add appendices with additional information. I intend to update this book on a periodic basis as time permits. This book was last updated on 22/02/2010.

Acknowledgements

PP3 A celestial chart generation program.
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My Father 'Laurie' Lauritson and Grandfather George Corbett FRAS without whose help I would have never have had the access to the equipment and knowledge that launched me into the world of Astronomy.
NASA for the images used in the section 'The Solar System'.

Introduction

Ever since humans first looked to the night skies they have been fascinated by the stars. Ancient humans saw shapes in groups of stars (constellations) and associated them with hero's from their legends. We of the western world have followed the constellations first described by the ancient Greeks. Through their study of the skies the ancient Greeks noticed that some stars did not stay in the same place but moved through the constellations. They called these stars wanderers which in their language was planetai and it is from this that we derive the name planet. The path that the planets and our sun trace through the sky is known as the ecliptic and the constellations that the ecliptic passes through are known as the zodiac. Fortune telling by the positions of the planets within the zodiac is known as astrology and is not discussed by this book.

Johannes Bayer published the first complete star catalogue in 1603. As each star was by then known by many different names, he standardised them in his catalogue by naming each star in a constellation after a letter in the Greek alphabet. Generally the brightest star was designated α Alpha, the first letter in the Greek alphabet , β Beta for the next brightest and so on. Sometimes Bayer designated letters based on position as well as brightness, which means sometimes you will find that order seems incorrect. The complete Greek alphabet is given on the next page.
The brightness of stars is measured in magnitude. Vega in the constellation of Lyra was originally picked to be to be the reference magnitude of 0.0. Brighter stars such as Sirius have a negative magnitude, Sirius is -1.47. Stars fainter than Vega are positive numbers. The unaided eye can see stars down to a magnitude of 6 in good conditions. With binoculars you can see stars down to magnitude 8. Larger binoculars and small telescopes can see down to magnitude 11. The larger amateur telescopes can see down to magnitude 14 whereas the Hubble Space Telescope can see stars down to magnitude 28.

Because of the vast distances involved between stars, distance is measured in light years. This is the distance a particle of light will travel in one year. Light travels at approximately 186 000 miles per second. In one minute it travels just over 11 million miles. The Earth is 93 million miles from the Sun so light emitted from the surface of the Sun takes just over 8 minutes to reach us here on Earth. In an hour light has travelled almost 700 million miles and in a day it has travelled about 16 billion miles. In a year light has travelled 5 869 713 600 000 miles. The nearest star to the Sun is a star called Proxima Centauri which is just over 4.2 light years away. As you can see it is easier to write 4.2 light years rather than 24 770 191 392 000 miles.

The night sky is like a time machine looking into the past. As you can see from above the light from the sun is 8 minutes old when it reaches us (NEVER look straight at the sun and NEVER try and look at it through binoculars or telescopes). When we look towards the nearest star to the sun we are seeing it as it was just over 4 years ago. 4 light years in the universe is nothing. Some of the easily visible stars are over 2000 light years away so we are seeing them as they were over 2000 years ago. The light from the Andromeda Nebulae which is visible to the unaided eye, left there 2.5 million light years ago. Even this is quite insignificant compared to the furthest objects ever observed with the worlds most powerful telescopes which are over 13 billion years old, almost as old as the universe itself.

So, enough of the technical stuff, lets see what is out there.

A Brief Note on Celestial Objects

Double stars and Binaries.
Many stars that look like a single star to the unaided eye are seen to be two or more stars when viewed with binoculars or telescopes.
If the stars are the same distance away and part of a system where their orbits share a common centre of gravity then they are known as Binary stars. If they appear to be together but lie at different distances, only seeming to be together because of line of sight, they are known as optical double stars.

Star Clusters.
There are two types of star cluster, an open cluster and a globular cluster.
An open cluster can consist of a few hundred to a few thousand stars. They are relatively young stars that have formed from the same gas cloud. In some cases the remains of the gas cloud can be seen in nebulosity surrounding the stars. The Pleiades in Taurus have to be the best known example of an open cluster.
A globular cluster is a spherical cluster of many thousands of stars with a dense core of stars. All the stars in a globular cluster are very old and are thought to consist of some of the first stars that formed in a galaxy.

Nebulae
A nebula is a cloud of interstellar gas or dust. Nebulae can be regions where new stars are forming. Before galaxies were actually discovered, the ones that had already been observed were called nebulae and the name sticks today. So a nebula is a gas cloud within our own galaxy or other galaxies outside ours.

The Greek alphabet.
α Alpha, β Beta, γ Gamma, δ Delta, ε Epsilon, ζ Zeta, η Eta, θ Theta, ι Iota, κ Kappa, λ Lambda, μ Mu, ν Nu, ξ Xi, ο Omicron, π Pi, ρ Rho, σ Sigma, τ Tau, υ Upsilon, φ Phi, χ Chi, ψ Psi, ω Omega.

Notes on the information about the constellations.
Where possible I've tried to put a name to the star along with its Bayer identifier. The distances of the stars have been taken from the Hipparcos Catalogue that was created by the Hipparcos Space Astrometry Mission that measured over one hundred thousand stars with high precision. Even so there is still a calculated margin of error that varies from star to star. As to the brightness of the stars compared to our sun, I have found wildly varying estimates from star to star and in each case have entered the best result from the data that I have. As this is an introduction to astronomy and there will be a lot of unaided eye observations I have rounded up the magnitudes of stars to two significant digits.

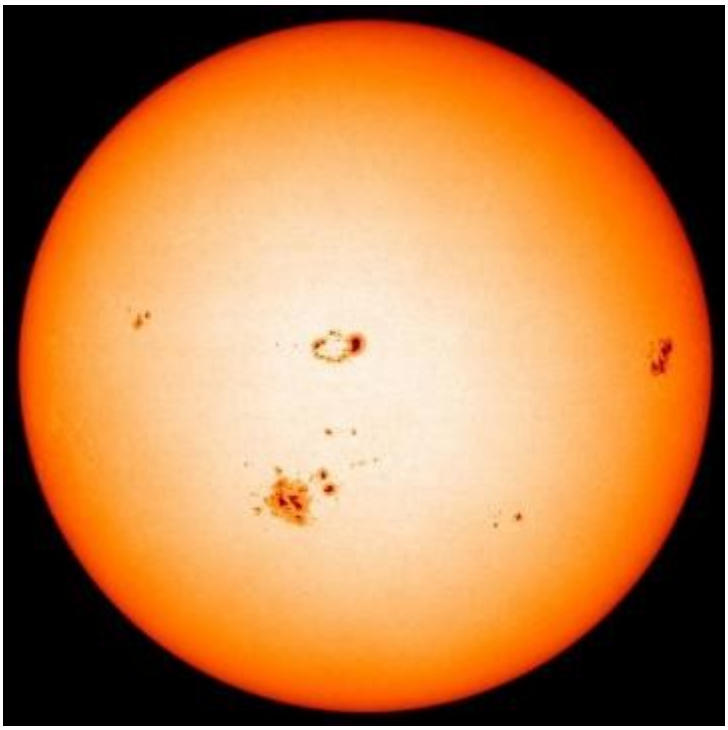
Notes on observing.
Learn the constellations one at a time. Study the diagrams on the constellation page and then check with the monthly chart to make sure that the constellation you want to observe will be visible on that night. If necessary refer to the star charts at the back of the book to see how the constellation you are studying fits in with the others on the sky. Once you are happy that you can recognise the constellation without having to refer to the chart then you can move on to the next one. There is nothing to stop you looking around the whole sky, in fact I would encourage it. You will observe something, want to know what it is, and then study the charts to find out what it was. That sort of knowledge always sticks. Learning the constellations is essential to finding your way around the sky. So if you mix the two, learn a constellation and then have a general look around, you will be surprised how quickly you learn.
When you want to observe faint objects you will have to make sure that the moon is not in the sky at the same time. A full moon can blot out even relatively bright objects when it is close to them.
Binoculars that are good for day viewing such as 8x21 are not recommended as they do not collect enough light for astronomical use although they can still be used to good effect. Ideally you need binoculars with objective lenses of at least 50mm eg 10x50. 10 times magnification is about the highest magnification you can use hand held. Anything higher and you will need a tripod to keep the image steady.

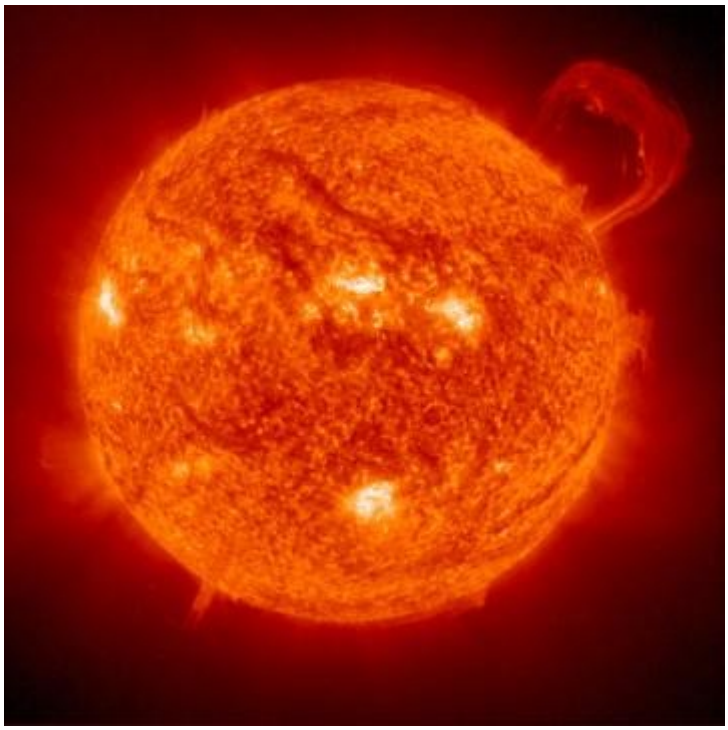
THE SOLAR SYSTEM

OR

OF THE SUN
PLANETS
MOONS
ASTEROIDS
AND
PLUTO

THE SUN





The Sun is a star at the centre of the Solar System around which all the planets orbit. The Sun itself orbits around the centre of the galaxy once every 220 million years. The Sun is huge compared to the planets with diameter of 865 278 miles along the equator and containing 99.8% of the total mass of the Solar System. The Sun takes 25 days 9 hours and 9 minutes to rotate once on its axis. The Sun is exceedingly hot. The temperature at the surface is 5 500ºC/10 000ºF and at the centre the temperature is over 15 000 000ºC/ 27 000 000ºF.

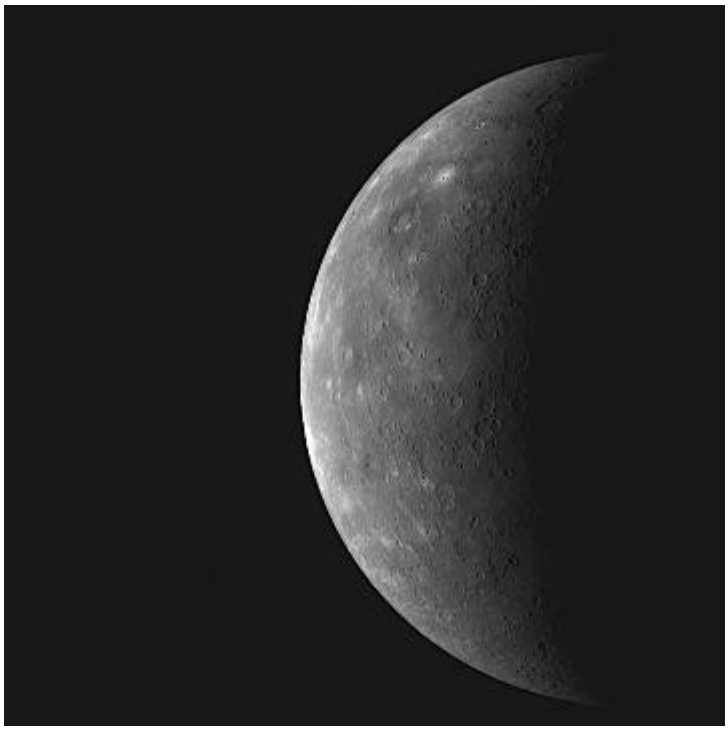
The Sun consists of about 70% hydrogen, 28% helium with other elements making up the remaining 2%. Through nuclear fusion, every second the Sun converts about 700 000 000 tons of hydrogen into 695 000 000 tons of helium and 5 000 000 tons of energy in the form of Gamma rays. This energy is continually reabsorbed and re-emitted as it makes its way from the centre of the Sun to its surface, each time losing a tiny bit of temperature. By the time this energy reaches the surface it is emitted as radiation across most of the electromagnetic spectrum. This includes X-rays, ultraviolet rays, visible light, infra-red (heat), microwaves and radio waves. The Sun has enough hydrogen left to continue shining for about another 5 billion years.

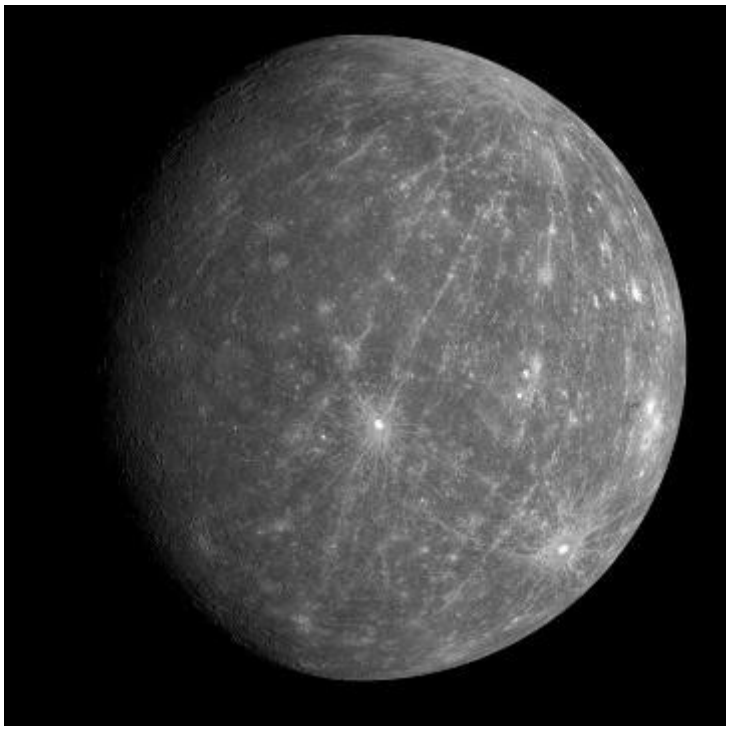
For some reason a lot of people regard the Sun as an ordinary star. Although there are very many stars similar to the Sun there very many more that are smaller so the Sun is larger than at least 80% of the stars in the galaxy. Saying this however there are also many stars that are very much more massive than the Sun and many that are much hotter.

The picture above on the left shows Sunspots on the surface of the Sun. These are areas where there is intense magnetic activity. The reason that they appear as dark spots is that the surface temperature of a Sunspot is about 4 500ºC/8 100ºF. If you could view a sunspot by itself it would appear to shine almost as bright as the Sun itself.

The picture above on the right shows a large Solar Prominence. A Prominence is a huge cloud of plasma suspended in the Sun's hot and thin corona. All the details of the prominence trace the magnetic field structure of the Sun.

MERCURY

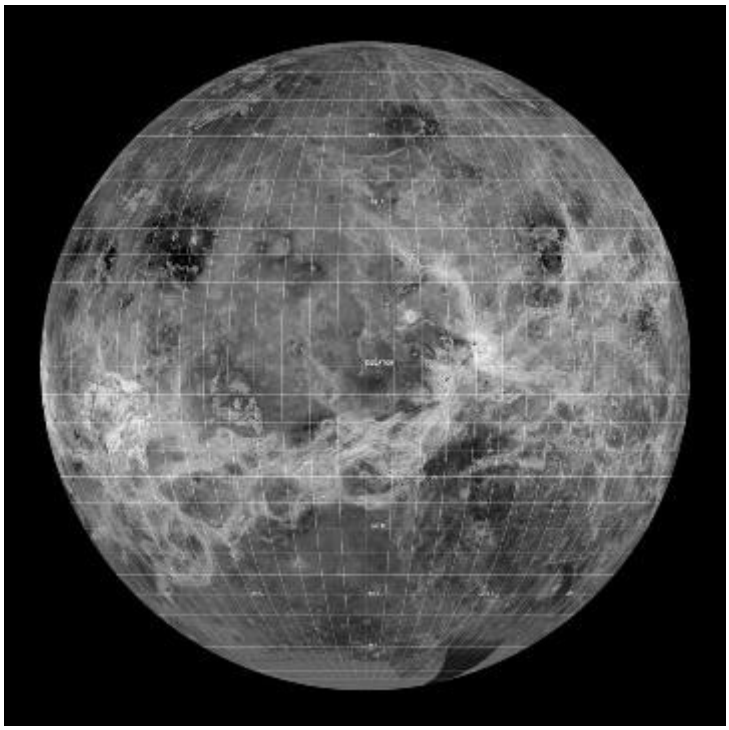




Mercury is the closest planet to the Sun, its average distance from the Sun being 36 million miles. It is much smaller than our Earth with a diameter of 3 031 miles along the equator. Mercury takes just 88 days to complete one orbit (its year) around the Sun. The time it takes Mercury to complete one rotation (its day) is just over fifty eight and a half earth days. Any atmosphere that Mercury had after its formation was quickly lost. This was due to the very low gravity of Mercury and the Solar Wind emitted from the Sun. What remains of the atmosphere is considered negligible but is detectable with probes that have been sent to Mercury. Because the atmosphere is negligible, Mercury suffers extremes of temperature. The side facing the Sun is heated to around 450ºC/840ºF whereas on the night side the temperature plunges to -180ºC/-292ºF.

Observing Mercury is difficult. As it is so close to the Sun it is only visible just before sunrise or just after sunset, depending on where it is in its orbit in relation to the position of the Earth. When viewed through a telescope Mercury, because it is inside the orbit of the Earth, will display similar phases as we see of our own Moon. The pictures of Mercury above show detail that is not visible from Earth. Both the pictures above were taken by NASA's Messenger probe. You can see from the pictures above that Mercury has been subject to many impacts from meteors and has a very similar appearance to that of Earth's Moon.

VENUS



Venus is the second planet out from the Sun, its average distance from the Sun being 67 million miles. Venus is marginally smaller than the Earth with a diameter of 7 521 miles on the equator, just 400 miles less than that of the Earth. Venus takes 243 days to rotate once on its axis and about 224 days and 17 hours to orbit once around the Sun. This means that Venuses day is actually longer than its year.
Venus is considered as Earth's sister planet due its similar size, although conditions on both planets could not be more different. Venus is completely covered in cloud and its surface temperature is on average is 465ºC / 870ºF.

Observing Venus is easy as when Venus is visible, it is the brightest object in the sky. Like Mercury, the orbit of Venus is inside that of the orbit of the Earth and so it displays similar phases as that of the Moon. These phases are visible through binoculars, but whether you use binoculars or a telescope, you will see not see any surface detail due to the solid cloud cover. The only way we can see any surface detail of Venus is by radar images. The picture above on the left shows Venus as seen through a telescope, while the one on the right shows an image created through radar images. The picture on the left was taken by NASA's Messenger mission in 2007 while the radar image was taken by NASA's Magellan mission in 1996. Venus can either be seen as a bright star in the morning before sunrise, or a bright star after sunset.

THE EARTH

The Earth is the third planet out from the Sun, its average distance from the Sun being 93 million miles. The Earth is the fifth largest planet in the solar system with a diameter of 7 926 miles on the equator. The Earth takes 24 hours to revolve on its axis so that the Sun is in the same position in the sky. This is called a solar day which we commonly refer to as a day. During the solar day the Earth moves in its orbit around the Sun. As the Earth's position has changed, this means that the stars appear in the same place in the sky every 23 hours 56 minutes and 4.09 seconds. This period of time is called a sidereal day. As a sidereal day is shorter than a solar day, the stars rise in the sky about 4 minutes earlier every day. The earth takes 365 days 5 hours 49 minutes and 12 seconds to complete an orbit around the Sun, so that the Sun is in the same position in the sky. We refer to this as a year but the official term is a solar year. It is because of this almost 6 hour difference that we add an extra day every 4 years, a leap year, to keep the Earth synchronised with the seasons. The difference left over does add up over time but it is compensated for by making the century years (years ending in 00 such as 1900 and 2000) only a leap year if the year is divisible by 400. That is why 1900 was not a leap year but 2000 was.

The Earth's axis is tilted by 23.5º from the perpendicular of it's orbital plane. I will add a diagram soon to explain this. During the vernal equinox (spring, normally on the 21st of March) and the autumnal equinox (autumn, normally on the 21st of September) both the northern and southern hemispheres receive the same amount of light and heat. Because of the tilt in the Earth's axis, in our summer the northern hemisphere is tilted towards the Sun, so the sunlight is concentrated over a small area and it is generally hot. In our winter the northern hemisphere is tilted away from the Sun so the sunlight is spread over a greater area and hence it is colder.

A diagram explaining Axial Tilt will be added on the next update.

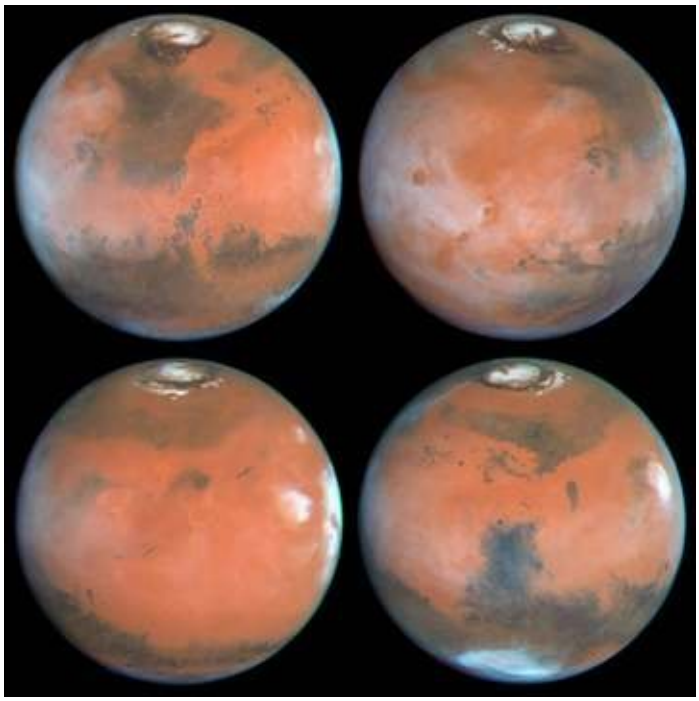
THE MOON

The Moon orbits the Earth at an average distance of 238 811 miles. It has a diameter of 2 159 miles making it about two thirds the size of Mercury, of half the size of Mars. The Moon takes 27 days 7 hours and 44 minutes to complete an orbit around the Earth. However the Earth is orbiting the Sun, so by the time the Moon has completed an orbit around the Earth, the Earth itself has moved further in its orbit around the Sun and the angle between Moon, Earth and Sun has changed slightly. Because of this it takes the Moon a little longer to return to the same phase. The average time between New Moons (or any phase) is 29 days 12 hours and 44 minutes. It takes the Moon exactly the same time to rotate once on its axis as it does to complete one orbit around the Earth. Because of this the same side of the Moon always faces the Earth. The far side of the Moon was only seen for the first time in 1959 when the Soviet probe Luna 3 transmitted images of the far side back to the Earth. The Moon is moving away from the Earth at the rate of about 1.5 inches per year.

The gravitational influence of the Moon causes the Earth's oceans and seas to bulge out slightly towards the Moon. It is this bulge that causes the Earth's tides. When the Moon is New or at its Full, it is in line with the Earth and the Sun. Because of this the Sun's gravity also has an additional effect on the tides making the difference between high tide and low tide greater. These are known as spring tides but have nothing to do with the spring season. When the Moon is at it first or third quarter it is at 90º to the Earth and Sun. Because of this the Sun's gravitational effect on the tides cancels some of the Moon's influence and the difference between high and low tide is at its least. These as known as neap tides. The Sun's gravitational influence on the tides is 44% that of the Moon's.

The two pictures above show the Moon in different phases and were taken by myself.

MARS



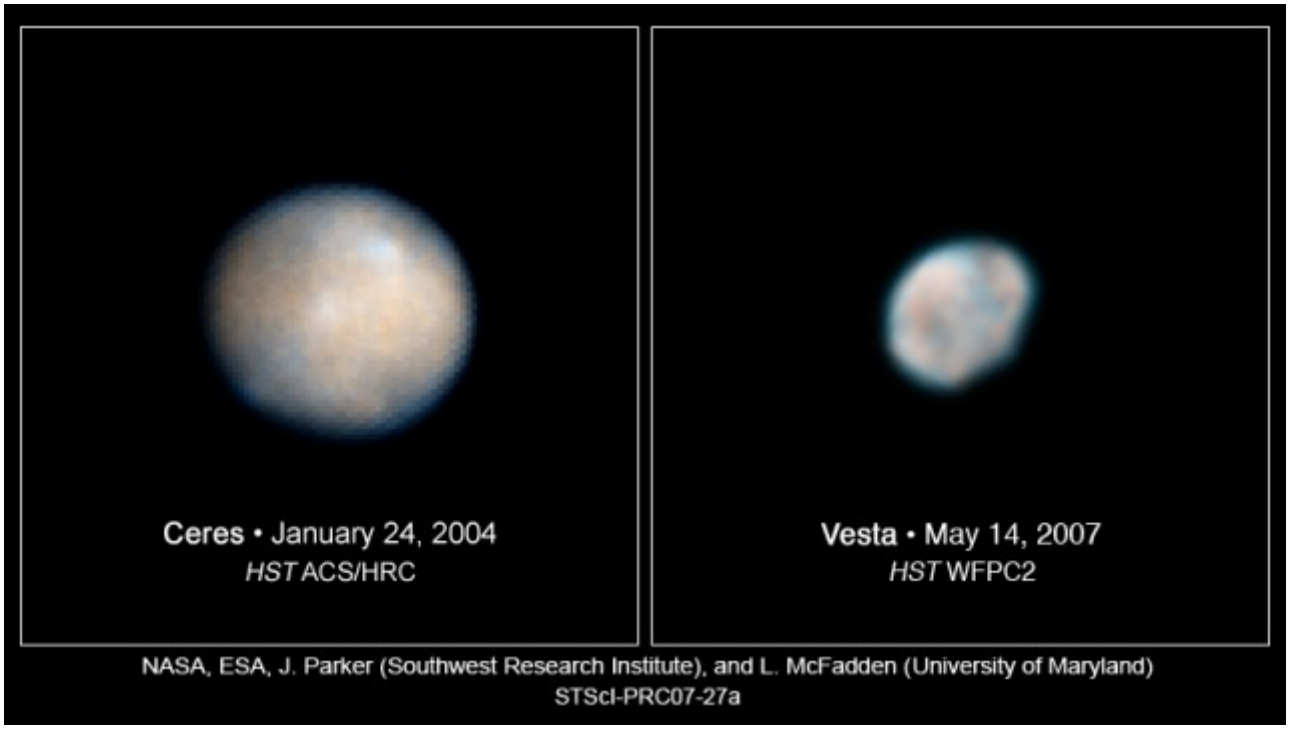
Mars is the fourth planet out from the sun, its average distance from the sun being 141.5 million miles. Mars is about half the size of the earth with a diameter of 4 222 miles along the equator. Mars takes about 687 days to complete one orbit around the sun so its year is almost twice as long as that of the earth. However it takes Mars 26.6 hours to complete one rotation about its axis so its day is almost the same as that of our Earth. Mars' atmosphere is a lot thinner than that of the earth and has an entirely different composition. It is 95% carbon dioxide, 3% nitrogen, 1.6% argon and trace elements of oxygen, water and methane. However its atmosphere extends to almost 7 miles above its surface compared to just over 4 miles of that of the earth. The temperature on Mars ranges from a high of between -30 to -40ºC/-20 to -40ºF to a low of -130ºC/-200ºF.

In 1877 Giovanni Schiaparelli, an Italian astronomer observed lines on Mars that he called Canali which meant channels. This was misinterpreted into Canals in English. From this sprang the notion that the canals were built to transport water from Mars' icecaps to an otherwise dry planet. Percival Lowell was a strong proponent of the possibility of life on Mars and he spent a great deal of time trying to prove it. This caught the public imagination and sparked all sorts of stories concerning life on Mars, probably the most famous being The War of the Worlds by HG Wells. As telescopic instruments and observations improved, it was found that the canals were in fact an optical illusion caused by poor optics and a good deal of imagination. Probes sent to Mars have proved beyond any doubt that there are no canals on Mars.

As the orbit of Mars lies outside that of the Earth, the surface of Mars facing us will always be fully illuminated by the Sun, so we shall always observe Mars as a disc. Through binoculars and small telescopes you will see Mars as a small red disc without any features. Mars has 2 moons, Phobos and Deimos. As both at their brightest are of magnitudes 11.3 & 12.4 respectively, these are not visible to binoculars or small telescopes.

Both pictures above were taken by the Hubble Space Telescope. The picture on the right shows four different views of Mars as it rotates.

THE ASTEROIDS



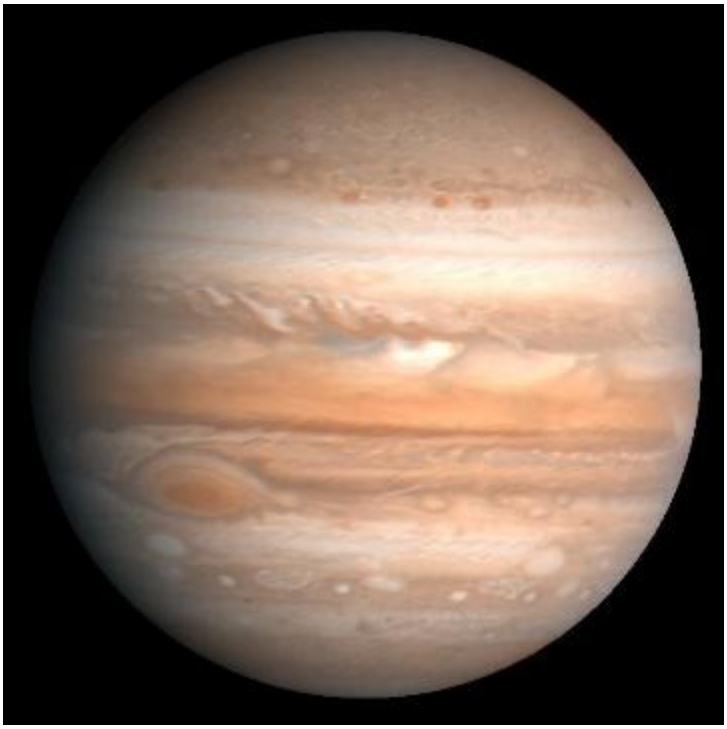
The Asteroid Belt is the name given to the area between the orbits of Mars and Jupiter where the majority of asteroids orbit. Asteroids are rocky metallic objects known as Minor Planets. It is believed that asteroids were formed from the same materials as the other planets but were prevented from forming into a planet because of the strong gravitational force of Jupiter.

The first asteroid was discovered in 1801 and was given the name Ceres. It also happens that Ceres is the largest of the asteroids with a diameter of about 580 miles and it contains about a third of the total mass of the Asteroid Belt. There are over 750 000 asteroids that have a diameter greater than 5/8 of a mile and millions with smaller diameters, one of the smallest having a diameter of just 20 feet.

The picture above taken by the Hubble Space Telescope shows Ceres and Vesta. It is possible at times to see these two asteroids with binoculars or a small telescope as their magnitudes at their brightest are 6.8 and 6.1 respectively.

On August the 24th 2006, the International Astronomical Union redefined the definition of a planet as a celestial body that (a) is in orbit around the Sun, (b) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape and (c) has cleared the neighbourhood around its orbit. Obviously this did not affect the status of the asteroids but unfortunately our 9th planet Pluto has not cleared its neighbourhood. The International Astronomical Union created another class of object, a Dwarf Planet. A dwarf planet is defined as a celestial body that (a) is in orbit around the Sun, (b) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape, (c) has not cleared the neighbourhood around its orbit, and (d) is not a satellite/moon of a planet. Pluto now falls into the definition of a dwarf planet but this definition has had the result of promoting Ceres from an asteroid to a dwarf planet. Because of the outcry over the relegation of Pluto the IAU has named dwarf planets outside the orbit of Neptune as Plutoids.

JUPITER



Jupiter is the fifth planet out from the Sun, its average distance from the Sun being 483.5 million miles. Jupiter is the largest planet in our Solar System with a diameter of 88 732 miles. Jupiter takes 11.86 years to complete one orbit around the Sun and yet despite it size, rotates once about its axis every 9 hours and 51 minutes. Jupiter is known as a Gas Giant. Most of its mass is composed of Hydrogen and Helium. Jupiter does not have a surface that we are familiar with here on Earth. In fact most of what we know of the inside of Jupiter is based on scientific theory alone. The top 30 miles of its atmosphere consists of clouds of Hydrogen and Helium. The next 1300 miles thick layer of atmosphere is where gravity causes the Hydrogen and Helium to change from a gaseous form to a liquid form. Below this is a 25 000 mile thick layer of liquid metallic hydrogen which is believed to be the source of Jupiter's extremely strong magnetic field. Below this is Jupiter's core which is estimated to have a diameter of 12 000 miles. It is estimated that the heat of the core is about 30 000ºC/ 55 000ºF. There is no evidence one way or another as to whether Jupiter's core is solid. It is believed that if Jupiter was 80 times more massive it would have become a star instead of a planet. The temperature at the top of the clouds is -145ºC/-230ºF.

The picture on the left was taken by the probe Voyager 2 in 1979 while the picture on the right was taken by Voyager 1 also in 1979.

The picture on the left has had the colour enhanced and clearly brings out Jupiter's Great Red Spot. The Great Red Spot was first discovered in 1664 by Robert Hooke, the inventor of the reflecting telescope. In fact it was Hooke's work on planetary motion that led Sir Isaac Newton to formulate his theory of Gravity. The Great Red Spot is a storm that has been raging on Jupiter for at least 346 years.

The picture on the right shows Jupiter with its innermost moon Io.

Jupiter is easy to observe through binoculars or a small telescope. It is visible as a disc even with 8 times magnification binoculars. Even a small telescope will reveal the dark equatorial belts of Jupiter and given ideal conditions a 3 inch (80mm) telescope will reveal the Great Red Spot.

Jupiter has 63 moons, 4 of which are visible as bright dots with almost any optical instrument. These four moons are known as the Galilean moons named after Galileo Galilei who discovered 3 of them on the 7th of January 1610 and the fourth on the 13th of January 1610.

THE GALILEAN SATELLITES

IO

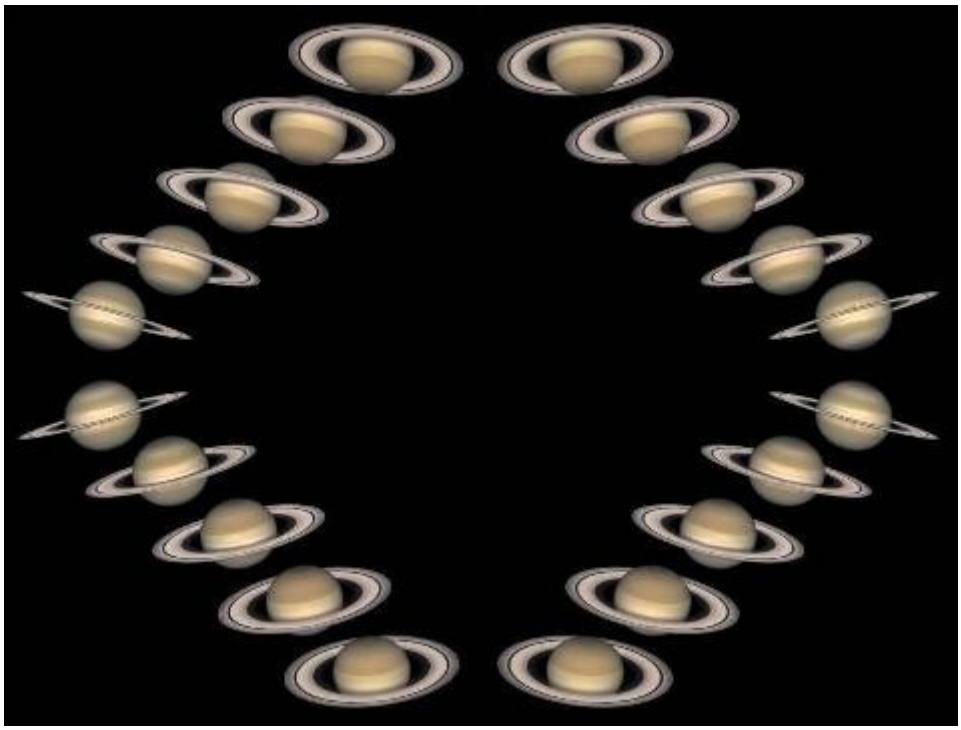
EUROPA

GANYMEDE

CALLISTO

Io is the closest moon to Jupiter. It has a diameter of 2 274 miles and orbits Jupiter once every 1 day, 18 hours and 27 minutes.
Europa is the second moon out from Jupiter. It has a diameter of 1 950 miles and orbits Jupiter once every 3 days, 13 hours and 15 minutes.
Ganymede is the third moon out from Jupiter (the fourth discovered by Galileo). It has a diameter of 3 270 miles making it larger than Mercury and orbits Jupiter once every 7 days, 3 hours and 43 minutes.
Callisto is the fourth moon out from Jupiter. It has a diameter of 2 983 miles and orbits Jupiter once every 16 days, 16 hours and 32 minutes.

SATURN

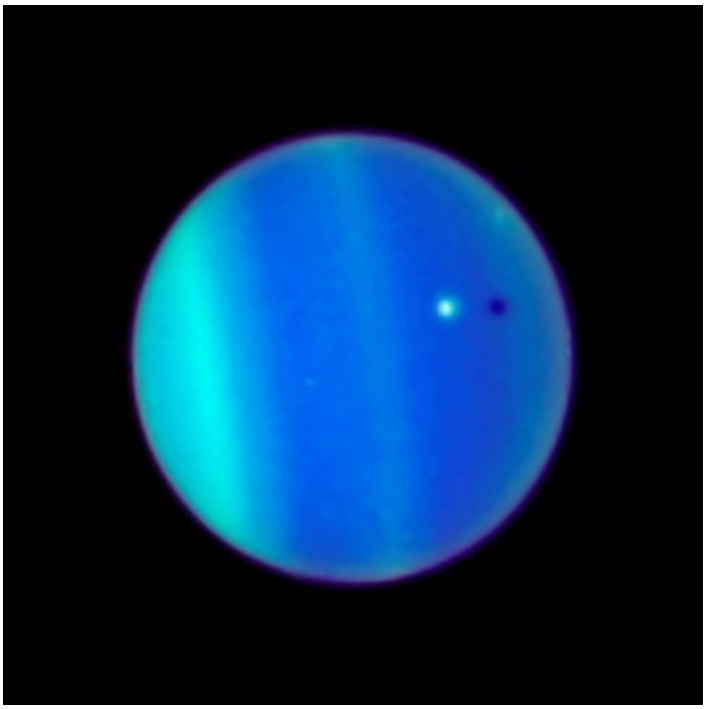


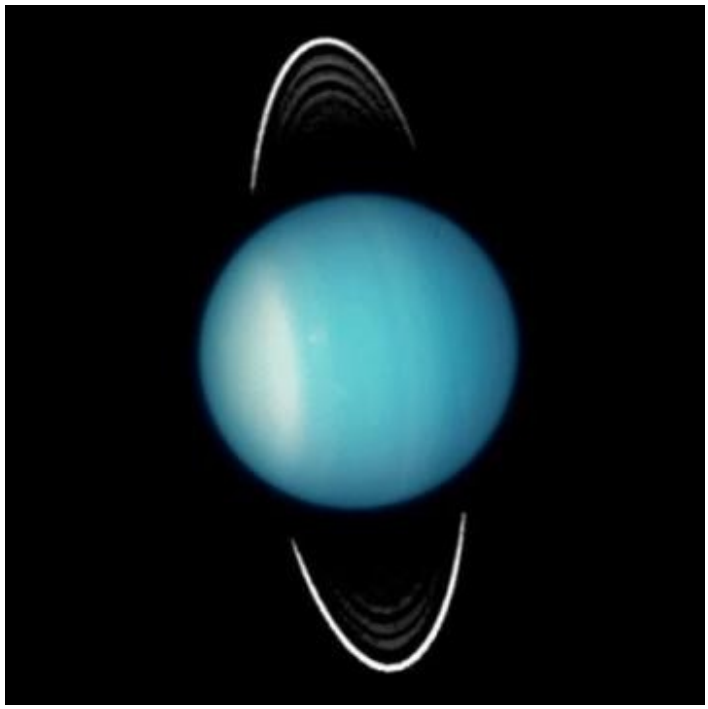
Saturn is the sixth planet out from the Sun, its average distance from the Sun being 888 million miles. Saturn is the second largest planet of the solar system with a diameter of 74 565 miles on the equator. Saturn takes 29.45 years to orbit once around the Sun and like Jupiter rotates very quickly about its axis taking just 10 hours and 14 minutes to do so. Saturn has a very similar composition to Jupiter but is less dense. Because of this Saturn bulges out at the equator presenting more of an oval appearance compared to any other the planets of the Solar System. Also like Jupiter our knowledge of the interior of Saturn is based on scientific theory. The temperature at the top of Saturn's clouds is -175ºC/-285ºF.

Saturn is unique in the Solar System for its planetary rings. Whereas Jupiter, Uranus and Neptune also have ring systems, only Saturn's rings are easily visible from our Earth with binoculars and small telescopes. Because of the inclination of Saturn's axis, the appearance of Saturn's rings changes over a 29 year period. The picture above on the right shows how the rings appearance changes over this period.

The picture on the left was taken by Voyager 2 and shows Saturn with 3 of its moons, Tethys, Dione and Rhea. Saturn has a total of 62 moons.

URANUS





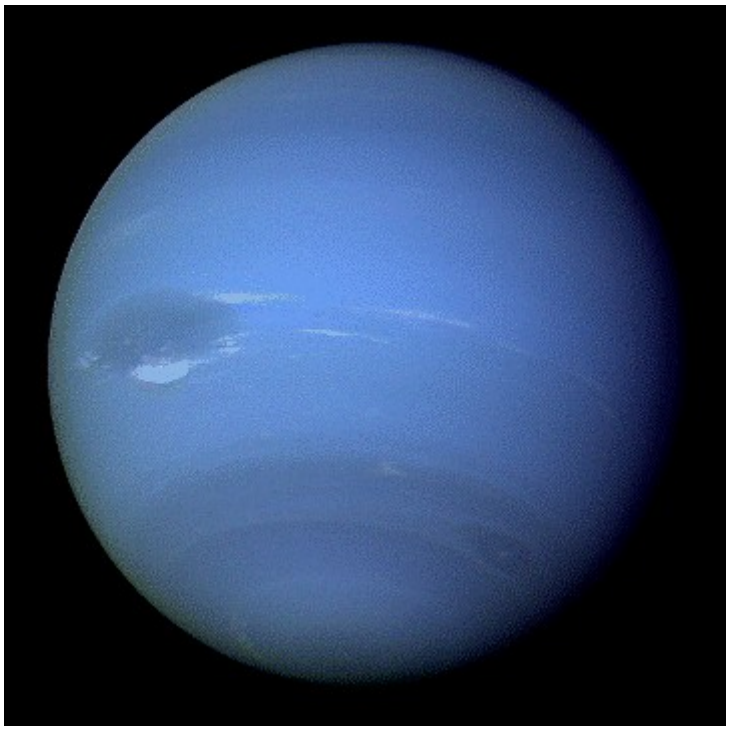
Uranus is the seventh planet out from the Sun, its average distance from the Sun being on average 1 786 million miles. Uranus is the third largest planet with a diameter on the equator of 32 311 miles. Uranus takes 84 years to complete one orbit around the Sun. Again like the other gas giants it rotates quickly on its axis, taking between 16 hours and 28 hours to complete one rotation. While Uranus like Jupiter and Saturn consists mainly of hydrogen and helium, it has more ices such as water, ammonia and methane. Because of this Uranus is sometimes referred to as an Ice Giant. The temperature of the atmosphere is believed to be the coldest in the Solar System of -224ºC/-371ºF.

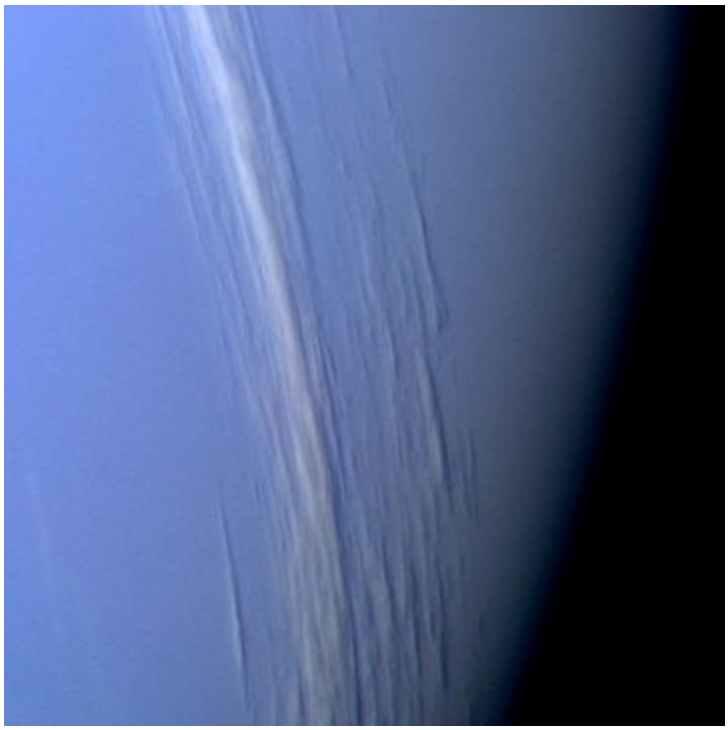
Uranus was the first planet to be discovered by a telescope. It had been observed as far back as 1690 but was not identified as a planet. Sir William Herschel first observed Uranus on the 13th of March 1781. He initially reported at as a comet but following further observations he eventually reported it as a planet.

The two pictures above were taken by the Hubble Space Telescope. The one on the left shows Uranus with one of its moons Ariel. Uranus has a total of 27 moons. The picture on the right has been enhanced to show its ring system.

Unlike any other planet in the Solar System, Uranus's axis lies on the plane of its orbit around the Sun whereas the other planets have their axis inclined up to 90º compared with the plane of their orbits.

NEPTUNE





Neptune is the eigth planet out from the Sun, its average distance from the Sun being on average 2 799 million miles. Neptune is the smallest of the Gas Giants with a diameter on the equator of 30 074 miles. Neptune takes 165 years to complete one orbit around the Sun. Again like the other gas giants it rotates quickly on its axis, taking between 18 hours and 20 hours to complete one rotation. Neptune has a similar composition as Uranus and is also sometimes referred to as an Ice Giant. The temperature of the atmosphere is believed to be the -218ºC/-360ºF.

Neptune has a very active atmosphere and the picture on the left shows Neptune's Great Dark Spot, similar to the Great Red Spot on Jupiter. The picture on the right shows clouds in Neptune's upper atmosphere.

Neptune has 13 moons, the largest of which is Triton.

Neptune is the first planet whose existence was worked out by mathematics before being observed. Unexpected changes in Uranus' orbit led Alex Bouvard to believe that there was another planet causing these changes. Urbain Le Verrier worked out the position where the suspected planet should be and Johann Galle was the first person to observe Neptune, which was within one degree of the position stated by Urbain Le Verrier.

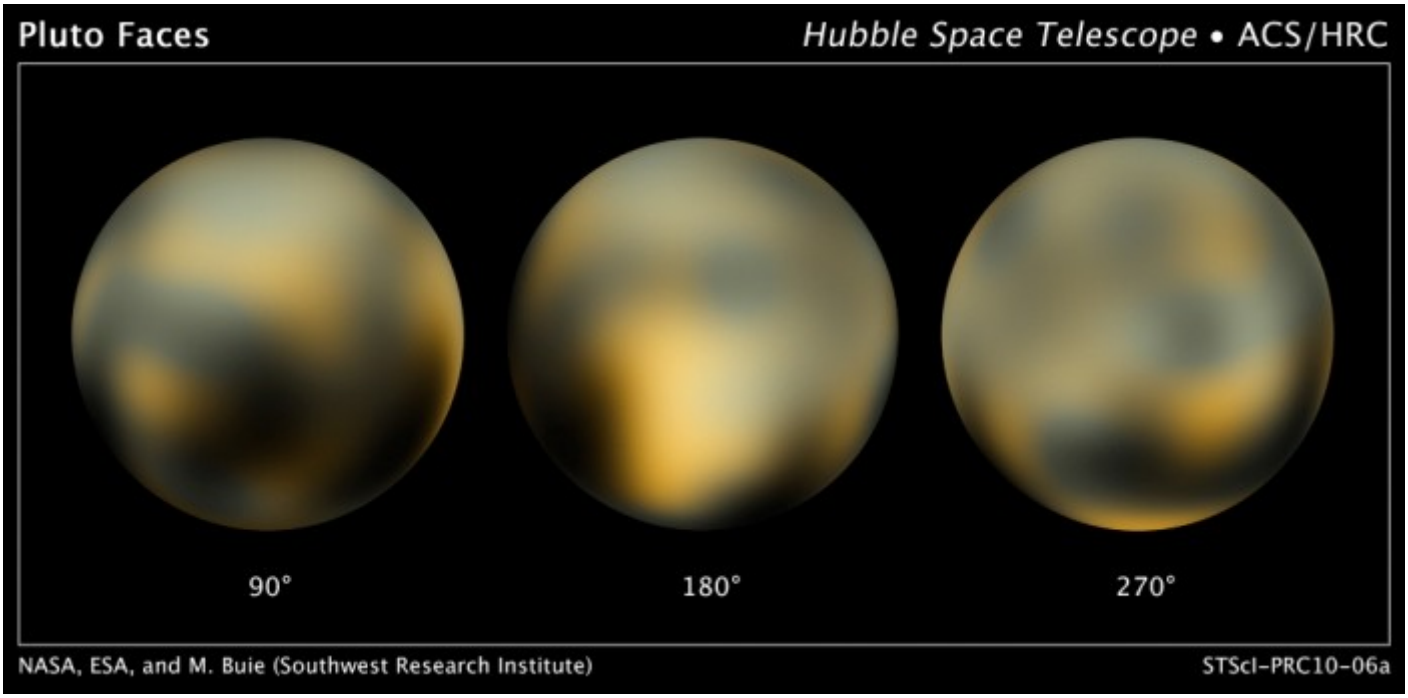
PLUTO

Pluto until recently was regarded as the ninth planet in the Solar System. It is on average 39 times the distance away from the Sun compared with the earth at 3 678 million miles. The time it takes to complete one orbit around the Sun is thought to be about 248 years. While it was still regarded as a planet it was the smallest planet in the Solar System with a diameter of 1 519 miles. It takes Pluto 6 days and 21.6 hours to rotate once on its axis.

Pluto has three moons, the largest of which is Charon. The picture above, taken by Hubble in 1994 shows Pluto in the bottom left and Charon in the top right.

Pluto was discovered on the 18th of February by Clyde Tombaugh. The reason that Pluto is no longer considered a planet is discussed on page 12 about Asteroids.

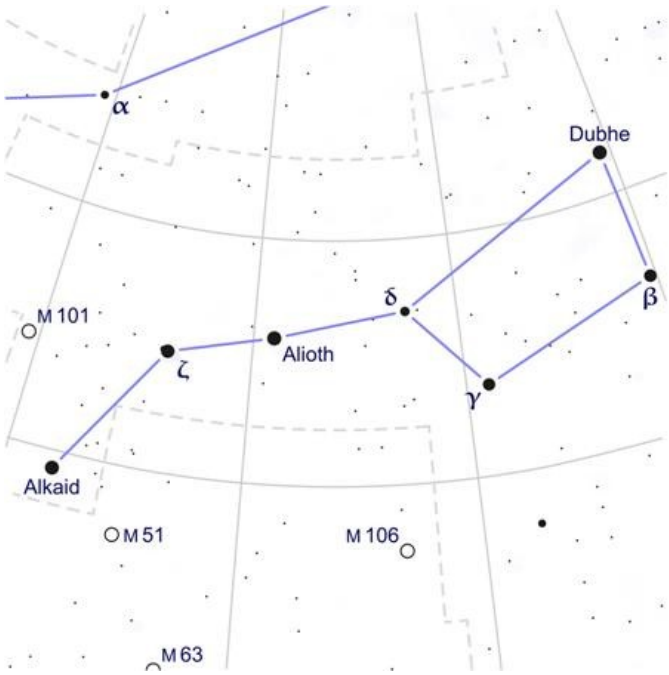
Below is the latest view of Pluto taken by Hubble released by NASA on 04/02/2010.



THE CONSTELLATIONS

URSA MAJOR

The Great Bear, also known as the Plough – Star Atlas Chart 1



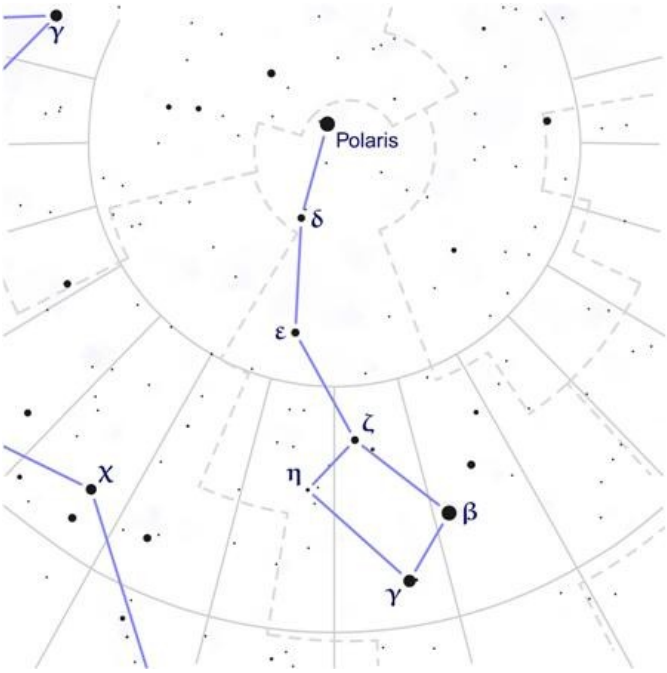
Ursa Major is one of the best recognised constellations in the sky. From the UK it is visible all year round. If you face towards the north then in the autumn it is low in the sky while in the springtime it is high in the sky almost over head. It is a large constellation but is most recognisable from its seven major stars shown here.
α UMa Dubhe is a yellowish star of magnitude 1.8. It is 232 times brighter than the sun and is 124 light years away.
β UMa Merak is a blue-white star of magnitude 2.3. It is 60 times brighter than the sun and is 79 light years away.
γ UMa Phad is a blue-white star of magnitude 2.4. It is 60 times brighter than the sun and is 84 light years away.
δ UMa Megrez is a blue-white star of magnitude 3.3. It is 25 times brighter than the sun and is 81 light years away.
ε UMa Aloith is a blue-white star of magnitude 1.8. It is 104 times the brightness of the sun and is 81 light years away.
ζ UMa Mizar is probably the most famous double star in the sky. It has a companion Alcor that is just visible to the unaided eye. When viewed through binoculars another star is visible between Mizar and Alcor. Through a small telescope Mizar itself is seen to be a double star. Not visible through a small telescope is that both stars that make up Mizar are both themselves double stars but you need a very large telescope to resolve them.
η Alkaid is a blue star of magnitude 1.8. It is 148 times brighter than the sun and is 100 light years away.

Dubhe and Merak are known as the pointer stars. If you draw a line from Merak and extend it through Dubhe, it points towards the pole star – Polaris.

Myth.
The Great Bear represents Callisto, daughter of King Lacaon. Callisto hunted with Artemis Goddess of the hunt and became her favourite. Once when visiting the Earth Zeus the Head of the Gods saw Callisto asleep in the forest. Zeus had his way with her and she became pregnant. Callisto gave birth to a son Arcas. Hera the wife of Zeus was furious and changed Callisto into a bear. Arcas grew up to be a hunter himself. One day on a hunt he saw Callisto but did not recognise her in her shape as a bear and he went in for the kill. Zeus stopped him slaying his mother by sending down a whirlwind which took both Callisto and Arcas into the sky where they were placed as stars, Callisto as the Great Bear and Arcas as the Little Bear.

URSA MINOR

The Little Bear – Star Atlas Chart 1



Ursa Minor is a faint constellation with only 3 of its stars being relatively bright. Its brightest star is Polaris which is known as the Pole star or North star, so called because it is always above the North Pole. Apart from this there are no real interesting objects in the constellation.

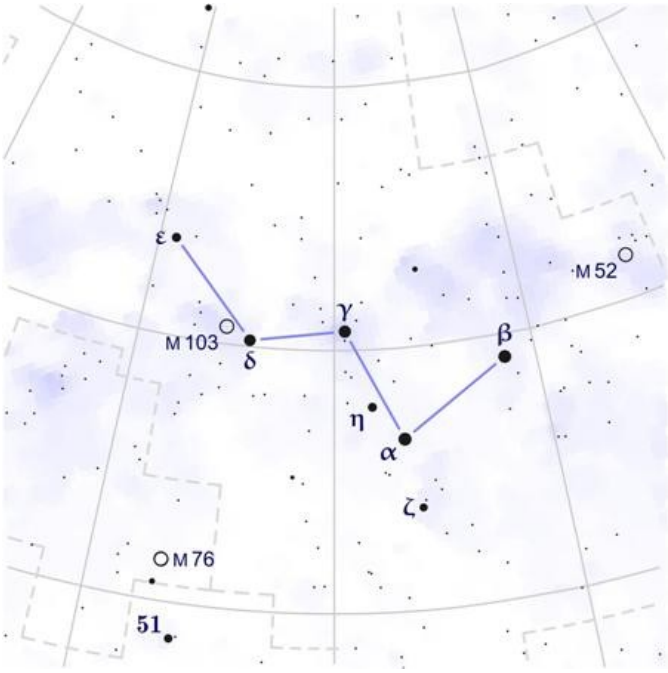
α UMi Polaris is a white star of magnitude 1.97. It is 2400 times brighter than the sun and is 431 light years away.
β UMi Kocab is an orange star of magnitude 2.0. It is 190 times brighter than the sun and is 126 light years away.
γ UMi Pherkad Major is a blue-white star of magnitude 3.0. It is 1200 times brighter than the sun and is 480 light years away.
δ UMi Yildun is a blue-white star of magnitude 4.3. It is 50 times brighter than the sun and is 183 light years away.
ε UMi is a yellowish star of magnitude 4.2. It is 200 times brighter than the sun and is 347 light years away.
ζ UMi Alifa is a blue-white star of magnitude 4.3. It is 220 times brighter than the sun and is 375 light years away.
η UMi Alasco is a white star of magnitude 4.9. It is 8 times brighter than the sun and is 97 light years away.

Myth.

The Little Bear is Arcas, son of Callisto.

CASSIOPEIA

The Queen – Star Atlas Chart 1



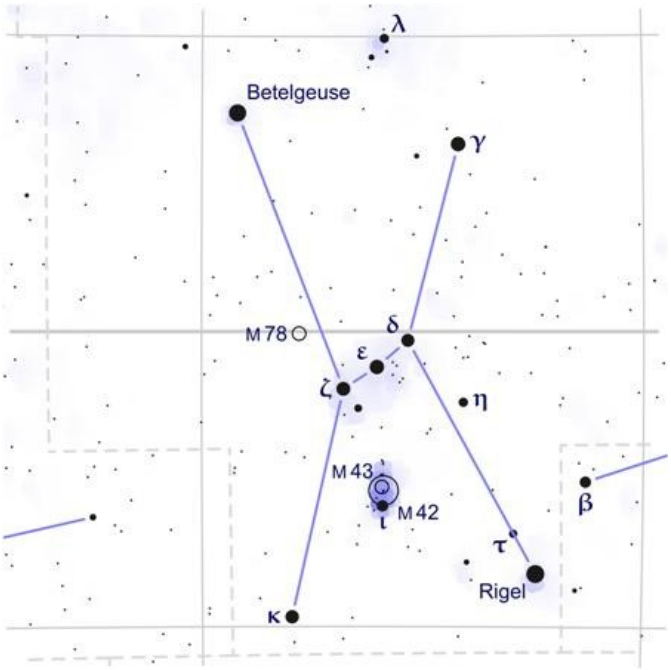
Cassiopeia is one of the most easily recognisable of the constellations in the northern sky. Standing out as a giant W Cassiopeia lies within the Milky Way and has many wonderful objects.
α Cas Schedir is an orange star of magnitude 2.2. It is 534 times brighter than the sun and is 229 light years away.
β Cas Caph is a yellowish star of magnitude 2.3. It is 29 times brighter than the sun and is 55 light years away.
γ Cas Tsih is a blue star of magnitude 2.2. It is 4180 times brighter than the sun and is 613 light years away.
δ Cas Ruchbah is a blue-white star of magnitude 2.7. It is 69 times brighter than the sun and is 99 light years away.
ε Cas Segin is a blue star of magnitude 3.4. It is 720 times brighter than the sun and is 442 light years away.
η Cas Achrid is a star of magnitude 3.4 and is 20 light years away.

Myth.

Cassiopeia was the vain Queen of King Cephus. She boasted that she was more beautiful than the Nereids, the daughters of the God Nereus, the old man of the sea. One of the Nereids was the wife of Poseidon, God of the sea. She begged him to punish Cassiopeia because of her boasts. Poseidon sent Cetus the sea monster to attack the lands of Cephus and Cassiopeia. Cephus had to offer his daughter Andromeda as a sacrifice to appease the monster. Andromeda was chained to a rock but was rescued by Perseus who killed Cetus. Cassiopeia was set in the sky. She is depicted as sat on a chair and suffers the indignity of spending half her time upside down as she circles the celestial pole.

ORION

The Hunter – Star Atlas Chart 3



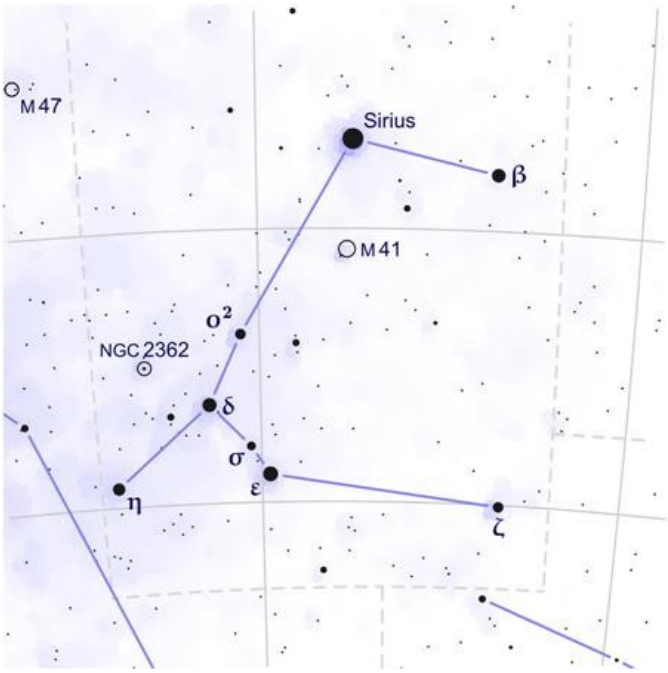
For me Orion has to be the most spectacular constellation in the night sky. It is easily the most recognisable of all the constellations and is full of interesting objects.
α Ori Betelgeuse is a variable red giant star of magnitudes between 1.3 and 0.4 . It is 10,000 times brighter than the sun and is 427 light years away. It has a diameter of 650 times that of our sun and if it was put in place of our sun it would encompass the orbits of Mercury, Venus, our Earth, Mars and out as far as the asteroid belt. It is easily seen as a red star.
β Ori Rigel is a blue supergiant star of magnitude 0.2. It is 40,000 times brighter than the sun and is 770 light years away. It is the brightest star in Orion and the 6th brightest star in the sky. It is a double star with its companion a 7th magnitude star. However because of the brightness of Rigel it is only visible through telescopes with objective lenses or mirrors greater than 6 inches.
γ Ori Bellatrix is a blue giant star of magnitude 1.6. It is 1000 times brighter than the sun and is 243 light years away. It is the 3rd brightest star in Orion.
δ Ori Mintaka, ε Ori Alnilam and ζ Ori Alnitak make up the famous 'Belt' of Orion. All 3 stars are binary stars. Mintaka is a blue giant of magnitude 2.3. It is 3000 times brighter than the sun and is 920 light years away. Alnilam is a blue supergiant star of magnitude 1.7. It is 250,000 times brighter than the sun and is 1340 light years away. Alnitak is a blue supergiant star of magnitude 1.7. It is 11,000 times brighter than the sun and is 820 light years away.
Hanging down from the belt is the 'Sword' of Orion. It is made up of what looks like 3 stars to the unaided eye but is in fact stars and nebulae. ι Ori Nair al Saif is a blue star of magnitude 2.8. It is 11,200 times brighter than the sun and is 1326 light years away. Above it is θ Ori which part of 4 stars known as the Trapezium which illuminates the famous Orion nebula. This is a fantastic region to look at through binoculars and telescopes and is one of the most studied parts of the sky.
κ Ori Saiph is a blue supergiant star of magnitude 2.1. It is 6000 times brighter than the sun and is 720 light years away.

Myth.

Orion was a famous hunter who was killed when he stood on a scorpion. As a result the gods put him in the sky with his two hunting dogs Canis Major and Canis Minor. The scorpion was put in the opposite part of the sky so the two will never meet again.

CANIS MAJOR

The Great Dog – Star Atlas Chart 3



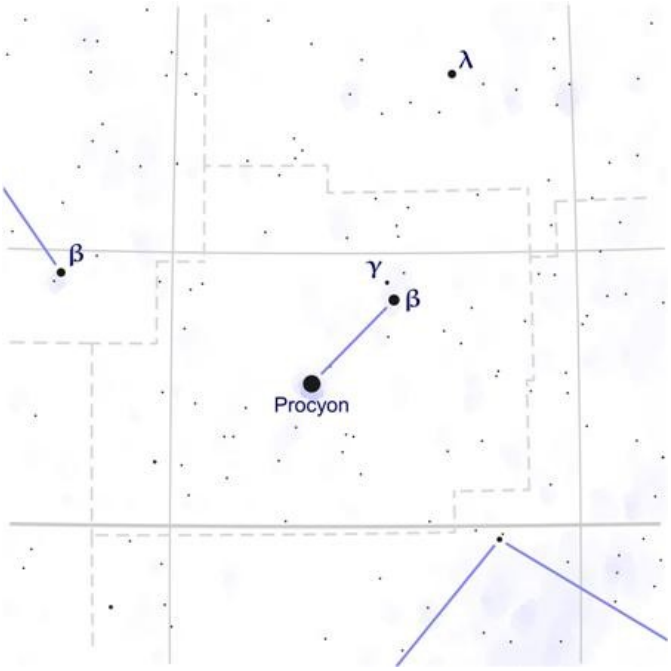
Canis Major is a small constellation with a few bright stars. It is most famous for its brightest star, Sirius the dog star.
α CMa Sirius is a white star of magnitude -1.5. It is 22 times brighter than the sun and is 8.6 light years away. It is the brightest star in the night sky. It is a double star with its companion known as the pup.
β CMa Mirzam is a blue star of magnitude 2. It is 3250 times brighter than the sun and is 499 light years away.
γ CMa Muliphein is a blue star of magnitude 4.1. It is 295 times brighter than the sun and is 295 light years away.
δ CMa Wezen is a yellowish supergiant star of magnitude 1.8. It is 47,900 times brighter than the sun and is 1790 light years away.
ε CMa Adara is a blue star of magnitude 1.5. It is 3750 times brighter than the sun and is 431 light years away.
ζ CMa Furud is a blue star of magnitude 3. It is 560 times brighter than the sun and is 336 light years away.
η CMa Aludra is a blue supergiant star of magnitude 2.5. It is 100,000 times brighter than the sun and is 3200 light years away.
NGC 2362 is a cluster of 40 - 60 stars surrounding τ CMa and is easily seen with binoculars. τ CMa is of magnitude 4.4 and is thought to be a part of the cluster. It is estimated to be 5000 light years away a brightness of 50,000 times that of the sun.
M 41 is a large cluster which is easily seen with binoculars. If the viewing conditions are excellent then it is possible to discern the cluster with the unaided eye.

Myth.

Canis Major is one of Orion's hunting dogs.

CANIS MINOR

The Little Dog – Star Atlas Chart 3

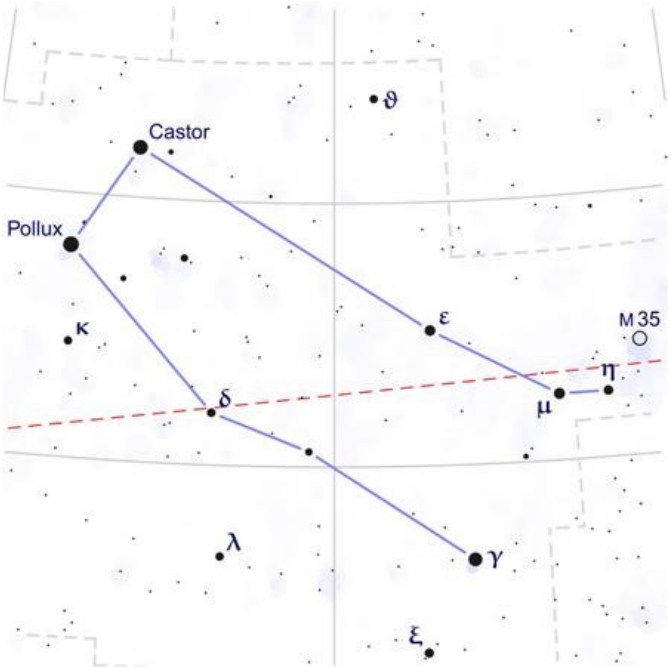


Canis Minor is a small constellation that contains only two bright stars.
α CMi is a yellowish star of magnitude 0.4. It is 7 times brighter than the sun and is 11.4 light years away. It is a binary star with its compainion being of 10th magnitude.
β CMi Gomeisa is a blue-white star of magnitude 2.9. It is 163 times brighter than the sun and is 170 light years away.
γ CMi is an orange star of magnitude 4.3. It is 236 times brighter than the sun and is 398 light years away.

There are no other notable objects in Canis Minor.

GEMINI

The Twins – Star Atlas Chart 3



Gemini is the third constellation of the Zodiac and is best known for its two brightest stars Castor and Pollux.

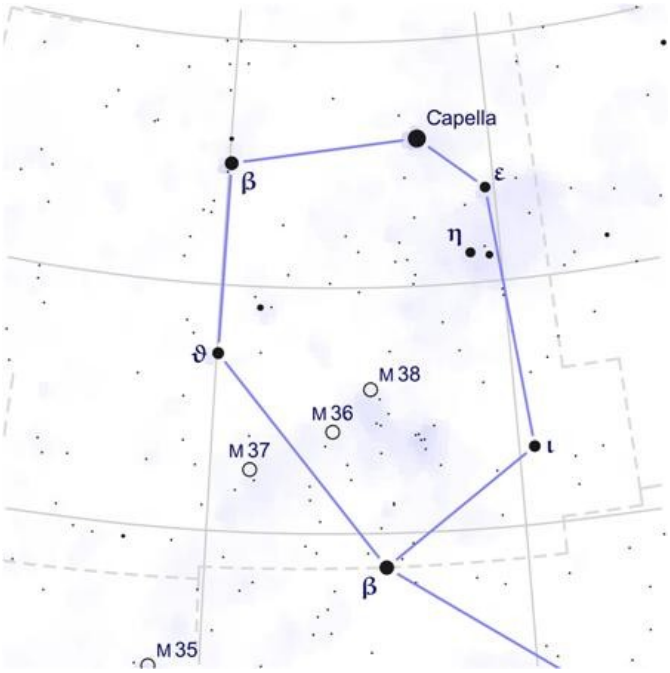
α Gem Castor is a white star of magnitude 1.6. It is 50 times brighter than the sun and is 52 light years away. It is a triple system. Unfortunately a good telescope is required to see the 3 stars.
β Gem Pollux is a red giant star of magnitude 1.2. It is 30 times brighter than the sun and is 34 light years away.
γ Gem Alhena is a white star of magnitude 1.9. It is 150 times brighter than the sun and is 105 light years away.
δ Gem Wasat is a white star of magnitude 3.5. It is 11 times brighter than the sun and is 59 light years away.
ε Gem Mebsuta is a blue-white star of magnitude 3. It is 3900 times brighter than the sun and is 903 light years away.
M 35 is a cluster of about 200 stars. When viewed through binoculars or small telescopes the cluster is visible as a hazy patch.

Myth.

Castor and Pollux were identical twins. Their mother Queen Leda was seduced by Zeus. Castor was born mortal while Pollux was immortal. Both were hunters and skilled in the art of war. They accompanied Jason and the argonauts on the search for the golden fleece. Castor was killed in a fight with another pair of twins Idas and Lynceus. Lynceus killed Castor, Pollux killed Lynceus. As Idas was about to attack Pollux, Zeus intervened and killed Idas. Pollux was inconsolable at the death of his brother and begged Zeus that he could share his immortality with his brother. Zeus placed them together in the stars as Gemini.

AURIGA

The Charioteer – Star Atlas Chart 3



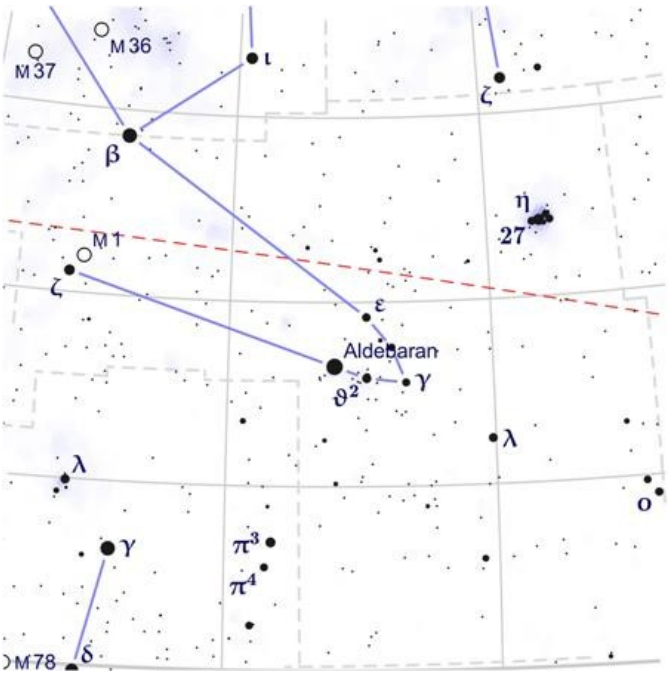
Auriga is a fairly large constellation with many interesting objects.
α Aur Capella is a yellowish giant star of magnitude 0.1. It is 80 times brighter than the sun and is 42 light years away.
β Aur Menkalinan is a white star of magnitude 1.9. It is 95 times brighter than the sun and is 82 light years away.
δ Aur Prijipati is a orange star of magnitude 3.7. It is 51 times brighter than the sun and is 140 light years away.
ε Aur Maaz is a white star of magnitude 3. It is 20,600 times brighter than the sun and is 2040 light years away.
η Aur is a blue star of magnitude 3.2. It is 206 times brighter than the sun and is 219 light years away.
θ Aur is a blue-white star of magnitude 2.6. It is 210 times brighter than the sun and is 173 light years away.
ι Aur Kabdhilinan is an orange star of magnitude 2.7. It is 1770 times brighter than the sun and is 512 light years away.
There is no γ Aur as it is shared with Taurus and is listed as β Tau.
There are 3 good open clusters that are visible with binoculars in Auriga.
M 36 consists of 60 stars. It is 41,000 light years away. M 37 is the brightest of the clusters and estimates of its distance range from 4,100 – 4,700 light years. M38 is 4,200 light years away.

Myth.

There are many legends about the charioteer but we will recount the Greek one. King Erichthonius was the son of Hephaestus the God of fire. Like his father Erichthonius was lame. He was raised by Athene patron Goddess of Athens. She taught him how to tame horses. It was Erichthonius who first harnessed 4 horses to a chariot to imitate the Sun Chariot of Apollo the God of the Sun. He was honoured by Zeus by being placed in the stars as Auriga.

TAURUS

The Bull – Star Atlas Chart 3



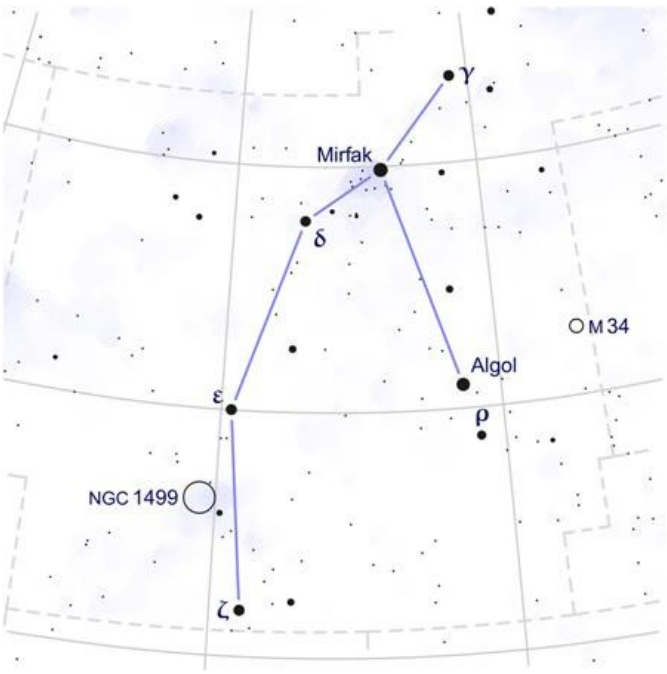
Taurus is the second sign of the Zodiac.
α Tau Aldebaran is a red giant star of magnitude 0.9. It is 200 times brighter than the sun and is 65 light years away. Aldebaran represents the glowing eye of the bull.
β Tau Alnath is a blue star of magnitude 1.7. It is 302 times brighter than the sun and is 131 light years away.
γ Tau is a yellowish star of magnitude 3.6. It is 67 times brighter than the sun and is 154 light years away.
δ Tau is a wide double consisting of δ1 a yellow-white star of magnitude 3.8 and δ2 a blue-white star of magnitude 4.8. δ1 is 59 times brighter than the sun and is 153 light years away while δ2 is 20 times the brightness of the sun and is 146 light years away.
ε Tau Ain is an orange star of magnitude 3.5. It is 75 times brighter than the sun and is 155 light years away.
ζ Tau is a blue star of magnitude 3. It is 900 times brighter than the sun and is 417 light years away.
θ Tau is a yellow star of magnitude 3.8. It is 58 times brighter than the sun and is 158 light years away. It is a binary star that is easily seen in binoculars and also with the unaided eye when viewing conditions are very good. Its companion is a blue-white star of magnitude 3.4. It is 87 times the brightness of the sun and is 158 light years away.
The Pleiades are the most famous object in Taurus. Also known as the Seven Sisters they are an open cluster of which 6 stars can easily been with the unaided eye. Through binoculars or a telescope the view is spectacular with the faint nebulosity clearly seen as well as many more stars.
The Hyades is the nearest open cluster to us. On a clear night they are a rich star field around Aldebaran. While Aldebaran seems to be part of the Hyades it is not associated with them, it just happens to be in the line of sight. Through binoculars the view is just as spectacular with many more stars revealled.

Myth.

Taurus represents Zeus as the Bull was one of the disguises he used to appear to mortals.

PERSEUS

The Hero – Star Atlas Chart 2



Perseus is a fairly large constellation between Auriga and Andromeda.
α Per Mirphak is a white star of magnitude 1.8. It is 5400 times brighter than the sun and is 592 light years away.
β Per Algol is a blue star of magnitude 2.1. It is 100 times brighter than the sun and is 93 light years away. It is a famous variable star that varies by a magnitude of 1.3. The variation is caused by Algol being an eclipsing binary. The companion star passes in front of Algol every 2 days and 21 hours causing it to dim to magnitude 3.4
γ Per is a yellow star of magnitude 2.9 and is 221 light years away.
δ Per is a blue star of magnitude 3. It is 1400 times brighter than the sun and is 527 light years away.
ε Per Miram is a blue star of magnitude 2.9. It is 1600 times brighter than the sun and is 538 light years away. It lies in a rich star field which makes an interesting object with binoculars and telescopes.
ζ Per Menkib is a blue star of magnitude 4. It is 6480 times brighter than the sun and is 1770 light years away.

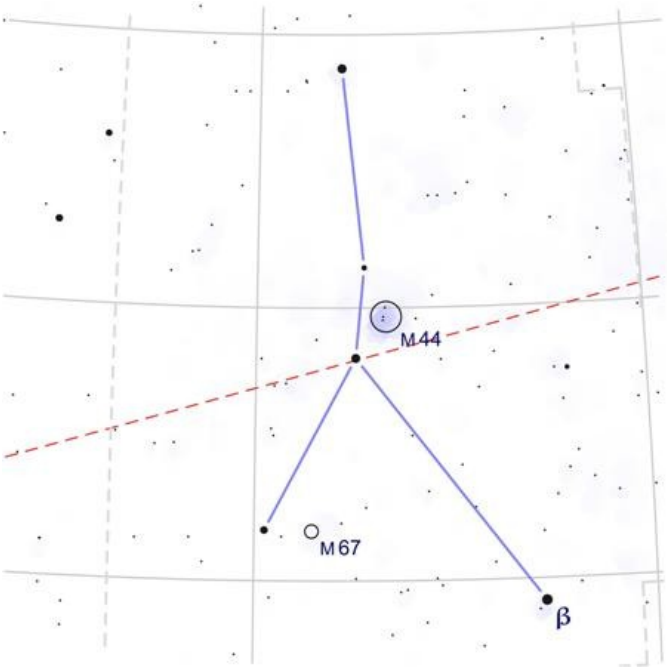
M 34 is an open cluster. It can be seen as a nebulous patch by the unaided eye and can be resolved as single stars with binoculars.

Myth.

Perseus was the son of Zeus and Danae, daughter of King Arcisius. He was raised by Dictys brother of King Polydectes. The King desired Perseus's mother but Perseus prevented this. Polydectes decided to get rid of Perseus. He announced his marriage to Hippodameia and demanded that Perseus bring him the head of Medusa as a wedding gift. The King thought that Medusa would kill Perseus. Perseus had friends amongst the gods. Hades, God of the underworld gave him a helmet to make him invisible. Hermes the messenger gave him winged sandals to fly through the air. Hephaestus, God of fire and the forge gave him a sword of diamond. Athena gave him a polished bronze shield that he could use as a mirror so that he did not have to look at Medusa directly and so avoid being turned to stone. Perseus fought Medusa and cut off her head. Out of her body came Pegasus the winged horse. Perseus rode Pegasus back to King Polydectes but on the way saw Andromeda chained to a rock with Cetus about to kill her. Perseus killed Cetus and freed Andromeda. He claimed Andromeda for his wife. After they were married Perseus returned to King Polydectes who was angry with Perseus for succeeding. Perseus showed him Medusa's head thereby turning the king to stone.

CANCER

The Crab – Star Atlas Chart 4



Cancer is the 4th sign of the Zodiac. It is quite a faint constellation but does contain a couple of interesting objects.
α Cnc Acubens is a blue-white star of magnitude 4.3. It is 48 times brighter than the sun and is 174 light years away.
β Cnc Altarf is an orange star of magnitude 3.5. It is 263 times brighter than the sun and is 290 light years away.
γ Cnc is a blue-white star of magnitude 4.7. It is 28 times brighter than the sun and is 158 light years away.
δ Cnc is an orange star of magnitude 4. It is 40 times brighter than the sun and is 136 light years away.
ι Cnc is a yellowish star of magnitude 4. It is 70 times brighter than the sun and is 188 light years away. It is a double star with a companion of 7th magnitude and should be visible through binoculars.

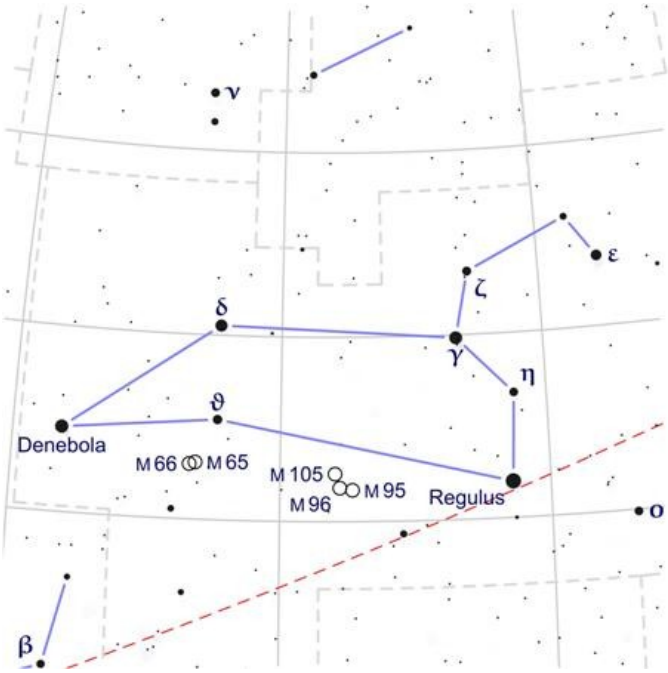
M 34 Praesepe, also known as the Beehive cluster is visible to the unaided eye as a faint nebulous patch. It is quite a large cluster and is best viewed through binoculars.

Myth.

Hera wife of Zeus was angry with Hercules. One of his labours was to defeat the Hydra of Lerna. While he was doing battle with the Hydra, Hera sent a crab to distract him. However Hercules stepped backwards and crushed the crab. Hera put the crab in the stars as Cancer as a reward for its efforts.

LEO

The Lion – Star Atlas Chart 4



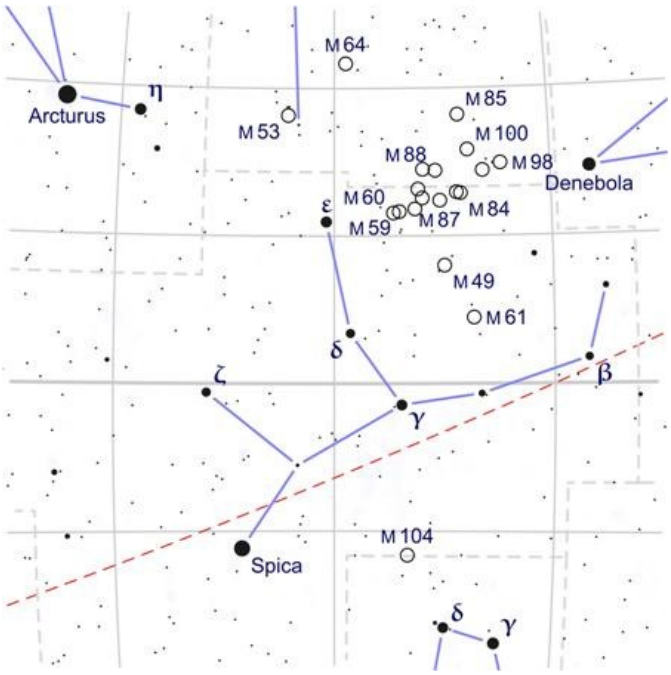
Leo is the 5th sign of the Zodiac and is best recognised by the stars that from a shape of a sickle.
α Leo Regulus is a blue star of magnitude 1.4. It is 140 times brighter than the sun and is 78 light years away. It is a double star with an 8th magnitude companion that can be seen with binoculars.
β Leo Denebola is a blue-white star of magnitude 2.1. It is 15 times brighter than the sun and is 36 light years away.
γ Leo Algeiba is an orange star of magnitude 2. It is 199 times brighter than the sun and is 126 light years away. It is a binary star with a companion of magnitude 3.8 that is visible with binoculars.
δ Leo Duhr is a blue-white star of magnitude 2.6. It is 25 times brighter than the sun and is 58 light years away. The Greek name for this star is Zosma but it was translated from the wrong word so the Arabic Duhr is used which means The Lion's Back.
ε Leo Ras Elased australis is a yellow star of magnitude 3. It is 328 times brighter than the sun and is 251 light years away.
ζ Leo Adhafera is a white star of magnitude 3.4. It is 34 times brighter than the sun and is 99 light years away. It is a triple star but is visible as a double through binoculars.
η Leo is a blue-white star of magnitude 3.5. It is 14,800 times brighter than the sun and is 2130 light years away.
θ Leo Chertan is a blue-white star of magnitude 3.3. It is 118 times brighter than the sun and is 178 light years away.
μ Leo Rasalas is an orange star of magnitude 3.9. It is 40 times brighter than the sun and is 133 light years away.
There are many nebulae in the constellation of Leo but unfortunately they are not visible with binoculars.

Myth.

Legend says that there was a lion that terrorised a town of Nemea south west of Corinth. He had a hide that could not be pierced by any weapon. Hercules was given the task of killing this lion as the first of his twelve labours. Hercules fought with the lion for a whole month before he was able to strangle it. Once it was dead he used its own claws to cut off its hide. He then used the hide as armour and its head as a helmet. This is the lion that was put into the stars as Leo.

VIRGO

The Virgin – Star Atlas Chart 5



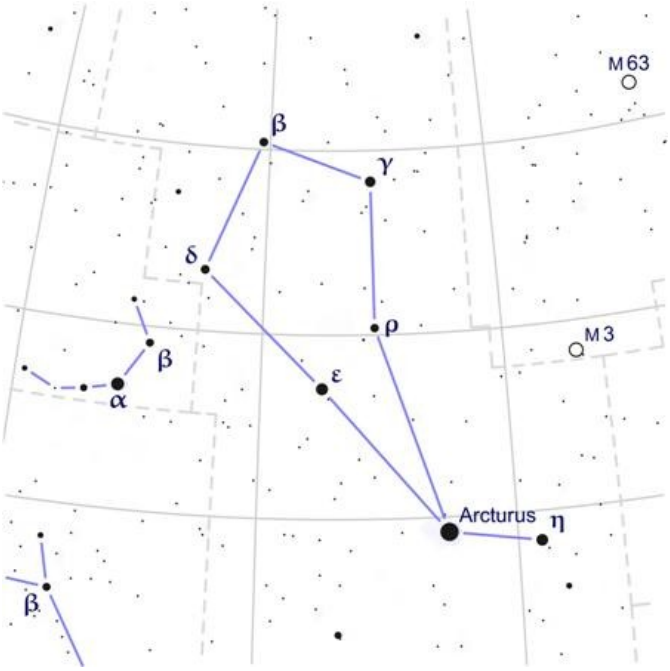
Virgo is the 6th sign of the zodiac. It is famous for the Virgo galaxy cluster but unfortunately most of these can only be seen with a reasonably powerful telescope.
α Vir Spica is a blue giant star of magnitude 0.98. It is 2200 times brighter than the sun and is 262 light years away. Because Spica is the 16th brightest star in the night sky and it is in a fairly barren region of the sky, it stands out very prominently.
β Vir Zavijava is a white star of magnitude 3.6. It is 4 times brighter than the sun and is 36 light years away.
γ Vir Porrima is a white star of magnitude 2.9. It is 39 light years away.
δ Vir Minelauva is a red star of magnitude 3.4. It is 146 times brighter than the sun and is 202 light years away.
ε Vir Vindemiatrix is a yellow star of magnitude 2.9. It is 60 times brighter than the sun and is 102 light years away.
ζ Vir Heze is a blue-white star of magnitude 3.4. It is 19 times brighter than the sun and is 73 light years away.
θ Vir is a blue-white star of magnitude 4.4. It is 245 times brighter than the sun and is 415 light years away.
ν Vir is a red star of magnitude 4. It is 191 times brighter than the sun and is 313 light years away.

Myth.

There are various stories concerning Virgo.
One is that she is Dike, the Goddess of Justice, hence she is next to Libra, the scales of justice.
Another is that she is Demeter Goddess of the Harvest. The brightest star in the constellation Spica, is Latin for 'The Ear of Wheat'.
Yet another is that she is Persephone, daughter of Demeter.
There are others but Demeter seems the most likely.

BOOTES

The Herdsman – Star Atlas Chart 5



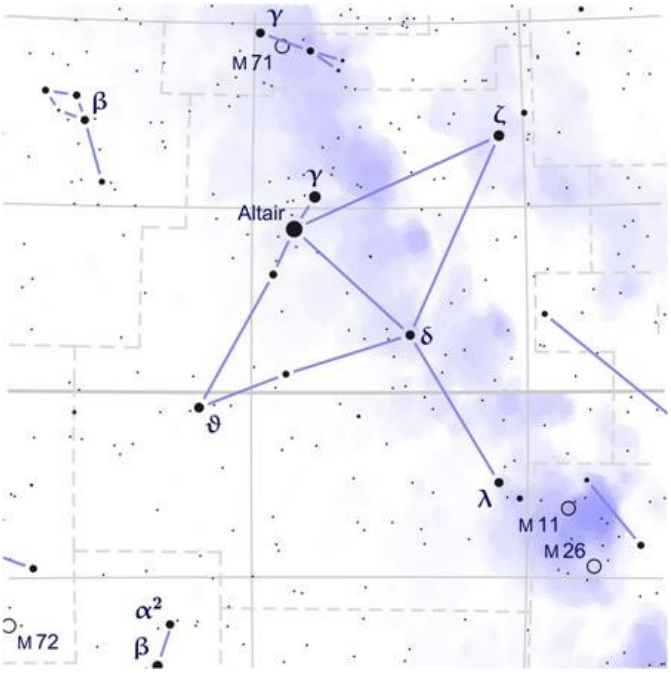
Bootes is a constellation mainly recognised due to its only bright star Arcturus. It is only because of Arcturus that I have included Bootes in this introduction. As there are no other bright stars in Bootes it is not the easiest constellation to learn at the beginning.
α Boo Arcturus is a red star of magnitude 0.05. It is 110 times brighter than the sun and is 37 light years away. Arcturus is the 4th brightest star in the sky
β Boo Nekkar is a yellow star of magnitude 3.5. It is 155 times brighter than the sun and is 219 light years away.
γ Boo Seginus is a blue-white star of magnitude 3. It is 35 times brighter than the sun and is 85 light years away.
δ Boo is a yellow star of magnitude 3.5. It is 46 times brighter than the sun and is 116 light years away.
ε Boo Izar is an orange star of magnitude 2.4. It is 407 times brighter than the sun and is 210 light years away.
η Boo Muphrid is a yellow star of magnitude 2.7. It is 9 times brighter than the sun and is 37 light years away.
ρ Boo is an orange star of magnitude 3.6. It is 67 times brighter than the sun and is 148 light years away.

Myth.

The translation of the name Arcturus is 'Bear Driver'. Unfortunately the myths that surround Bootes contradict myths of the other constellation. Callisto's son was Arcas the Bear Driver. As Callisto had been changed into a bear, Zeus took both and made them neighbouring constellations so as to prevent Arcas from killing her.
As you can see this differs from the story of Ursa Major where Arcas became the little bear.

AQUILA

The Eagle – Star Atlas Chart 6



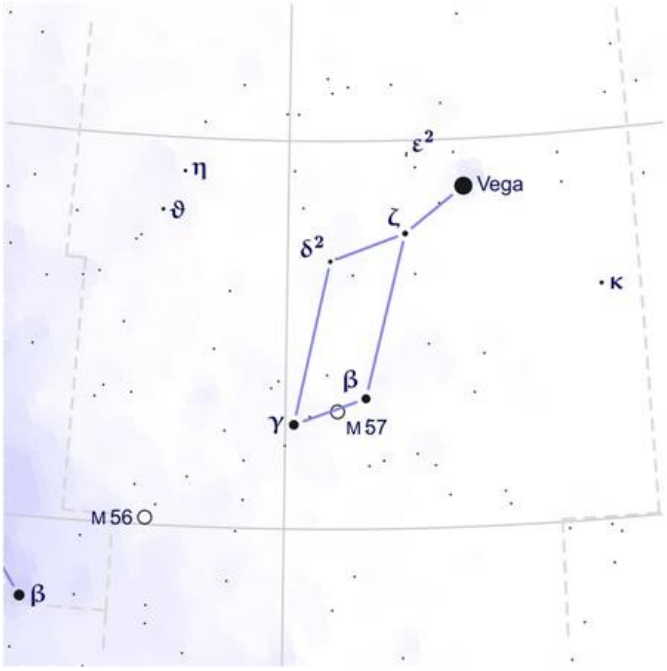
Aquila is a constellation best known for its brightest star Altair.
α Aql Altair is a white star of magnitude 0.76. It is 11 times brighter than the sun and is 16.8 light years away. Altair is one of the fastest rotating stars known. It takes 6.5 hours to rotate once compared with our sun that takes 25.4 hours.
β Aql Alshain is a yellow star of magnitude 3.7. It is 5 times brighter than the sun and is 45 light years away.
γ Aql Tarazed is an orange star of magnitude 2.7. It is 1400 times brighter than the sun and is461 light years away.
δ Aql is a white star of magnitude 3.4. It is 9 times brighter than the sun and is 50 light years away.
η Aql is a white star of magnitude 3.9. It is 3130 times brighter than the sun and is 1173 light years away.
θ Aql is a blue-white star of magnitude 3.2 and is 287 light years away.
λ Aql is a blue star of magnitude 3.4. It is 3.4 times brighter than the sun and is 125 light years away.

Myth.

Aquila represents the eagle that was the bird of Zeus. It was famed for carrying the thunderbolts of Zeus. It is also thought to be the eagle that tormented Prometheus. Prometheus revealed the secret of fire to mankind whereas up until then it had only been known to the Gods. Zeus was furious and had Prometheus chained to a rock. Each day the eagle would fly down and peck out his liver. Being an immortal Prometheus couldn't die and each night his liver would grow back. The following day the eagle would once again fly down and peck out his liver.

LYRA

The Lyre also known as the Harp – Star Atlas Chart 6



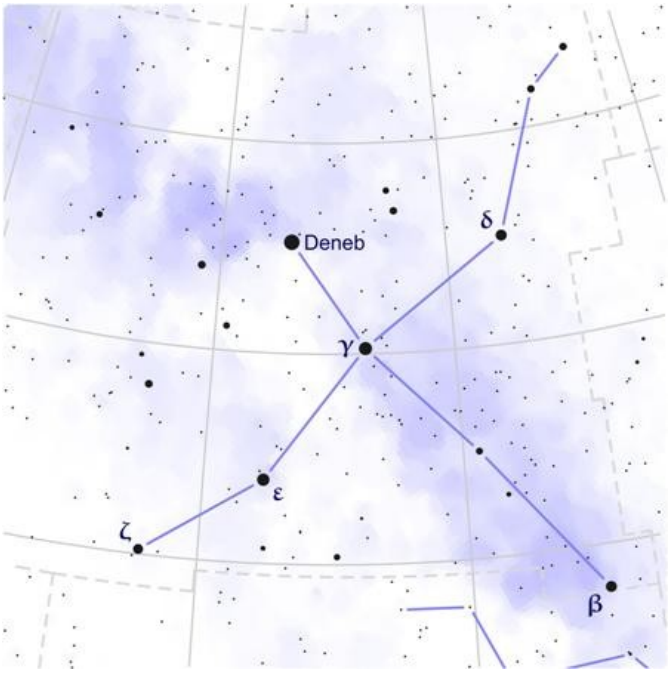
Lyra is easily recognised by its brightest star Vega and its accompanying quadrangle of stars.
α Lyr Vega is a blue-white star of magnitude 0.03. It is 50 times brighter than the sun and is 25 light years away.
β Lyr Sheliak is a blue-white star of magnitude 3.5. It is 2440 times brighter than the sun and is 882 light years away.
γ Lyr Sulafat is a blue star of magnitude 3.3. It is 1620 times brighter than the sun and is 635 light years away.
δ Lyr is a blue star of magnitude 5.8. It is 549 times brighter than the sun and is 1080 light years away. It is a double star with a red companion that varies between the 4th and 5th magnitude.
ε Lyr is a white star of magnitude 4.7. It is 29 times brighter than the sun and is 162 light years away. It is one of the most famous quadruple stars. On a very clear night ε Lyr can be seen as a double with the unaided eye, otherwise it can easily be seen as a double with binoculars. It requires a small telescope with a high magnification to reveal each stars companions.
ζ Lyr is a blue-white star of magnitude 4.3. It is 35 times brighter than the sun and is 153 light years away. It is a double star with a companion of 6th magnitude that can be seen with binoculars.
M 56 is a globular cluster that on a clear night can be just be seen with binoculars.
M 57 is the famous 'Ring Nebula'. It is difficult to see with binoculars, just a faint patch similar to a star. Small telescopes will reveal a elliptical patch whereas larger telescopes will actually reveal it as a ring.

Myth.

The Lyre was invented by Hermes the messenger God. He made it out of an empty tortoise shell with strings strung across it that produced a beautiful sound when played. Hermes gave the lyre to Apollo who in turn gave it to Orpheus. Orpheus accompanied Jason and the Argonauts as their harpist. Orpheus became famous for his music. There are various accounts of how Orpheus died. All agree that he was torn limb from limb, however they differ on who did it. They also differ on who carried the Lyre up into the stars, Some say that it was Zeus who sent down a bird to take it up while others say it was the Muses.

CYGNUS

The Swan, sometimes called the Northern Cross – Star Atlas Charts 6 & 7



Cygnus is easily recognised by its cross formation. It lies directly in the milky way and has many good binocular objects.
α Cyg Deneb is a blue-white supergiant star of magnitude 1.3. It is 265,000 times brighter than the sun and is 3260 light years away.
β Cyg Albired is a red gaint star of magnitude 3.1. It is 722 times brighter than the sun and is 386 light years away. It is a binary star with a blue-white companion of magnitude 5.1. It makes a spectacular view through binoculars being one of the best coloured binaries in the sky.
γ Cyg Sadr is a yellow-white star of magnitude 2.2. It is 24,000 times brighter than the sun and is 1520 light years away.
δ Cyg is a blue star of magnitude 2.9. It is 169 times brighter than the sun and is 171 light years away.
ε Cyg is an orange star of magnitude 2.5. It is 42 times brighter than the sun and is 72 light years away.
ζ Cyg is a yellow-white star of magnitude 3.2. It is 95 times brighter than the sun and is 151 light years away.
η Cyg is an orange star of magnitude 3.9. It is 43 times brighter than the sun and is 139 light years away.
ι Cyg is a blue-white star of magnitude 3.8. It is 38 times brighter than the sun and is 122 light years away.

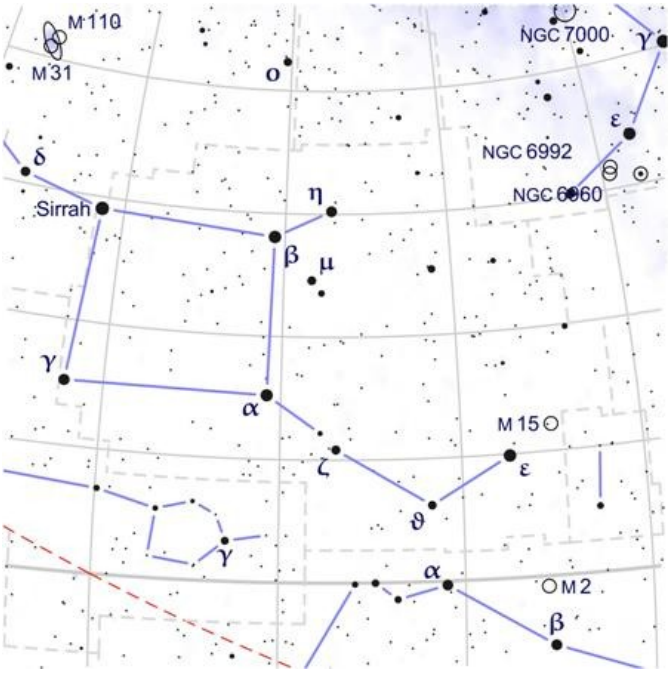
M 29 is an open cluster that is visible with binoculars.
M 39 is a fairly large open cluster. With good viewing conditions it is just visible to the unaided eye. With small binoculars it is seen as a nebulous patch but with larger binoculars 10 x 50 it is possible to see the brighter stars in the cluster.
NGC 7000 is the North America Nebula. It is a difficult object to see with binoculars due to the faintness of the nebula and requires almost perfect viewing conditions. Due to various circumstances it is the only object in this book that I have never managed to see with binoculars.
IC 5070 the Pelican Nebula needs the same viewing conditions as NGC 7000 to be seen in binoculars.
NGC 6960, 6992 and 6995 are collectively known as the Veil Nebula. It spans quite a large area but some parts are visible through binoculars.

Myth.

The swan represents Zeus in one of the forms that he used to disguise himself while amongst humans.

PEGASUS

The Flying Horse – Star Atlas Chart 7



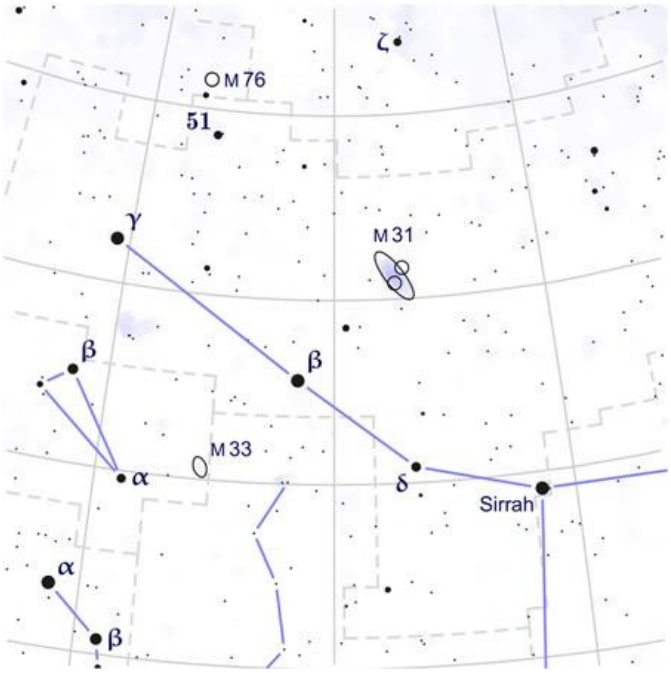
Pegasus is easily recognised by the 4 bright stars that make up what is known as the square of Pegasus which take up quite a large area of the sky. The top left star actually now belongs to the constellation of Andromeda and this is why there is not a δ Pegasi.
α Peg Markab is a blue star of magnitude 2.5. It is 158 times brighter than the sun and is 140 light years away.
β Peg Scheat is a red star of magnitude 2.4. It is 338 times brighter than the sun and is 199 light years away.
γ Peg Algenib is a star of magnitude 2.8. It is 660 times brighter than the sun and is 333 light years away.
ε Peg Enif is an orange supergiant star of magnitude 2.4. It is 4060 times brighter than the sun and is 673 light years away. It is a double star with a companion of 9th magnitude which is just visible with binoculars.
ζ Peg Homan is a blue star of magnitude 3.4. It is 152 times brighter than the sun and is 209 light years away.
η Peg Matar is a yellow-white star of magnitude 2.9. It is 250 times brighter than the sun and is 215 light years away.
θ Peg Biham is a blue-white star of magnitude 3.5. It is 29 times brighter than the sun and is 97 light years away.
μ Peg Sadalbari is a red star of magnitude 3.5. It is 43 times brighter than the sun and is 117 light years away.
ξ Peg is a white star of magnitude 4.2. It is 4.7 times brighter than the sun and is 53 light years away.

M 15 is a dense globular cluster. It is visible as a misty patch through binoculars and small telescopes. It takes large telescopes to resolve any stars of the cluster and even then its core is so dense that it is impossible to resolve individual stars in the core.

Myth.
Pegasus was said to have sprung from the body of Medusa when Perseus cut off her head. Others say that it was the blood of Medusa mixing with the sea that formed Pegasus. After leaving Perseus, Pegasus flew to mount Helicon where the Muses lived. As he landed his hoof struck the ground creating a spring that gushed forth. The spring was known as the Hippocrene, the Horses Fountain and it was said that anybody who drank from it would be gifted with the art of poetry.
The hero Bellerophon claimed Pegasus as his own and had many adventures with the horse. Bellerophon grew so bold that he decided to fly up to the Gods on Mount Olympus. This angered Zeus who sent an insect to sting Pegasus. Pegasus reared up and threw off Bellerophon who fell to earth and was blinded. Pegasus carried on to Mount Olympus where Zeus finally placed him in the stars.

ANDROMEDA

Andromeda – Star Atlas Chart 2



Andromeda is a large constellation famous for the Andromeda Nebula.
α And Sirrah (Alpheratz) is a blue-white star of magnitude 2.1. It is 100 times brighter than the sun and is 97 light years away.
β And Mirach is a red star of magnitude 2.1. It is 476 times brighter than the sun and is 199 light years away.
γ And Almak is an orange star of magnitude 2.1. It is 1500 times brighter than the sun and is 355 light years away.
δ And is an orange star of magnitude 3.3. It is 40 times brighter than the sun and is 101 light years away.
μ And is a blue-white star of magnitude 3.9. It is 43 times brighter than the sun and is 136 light years away.

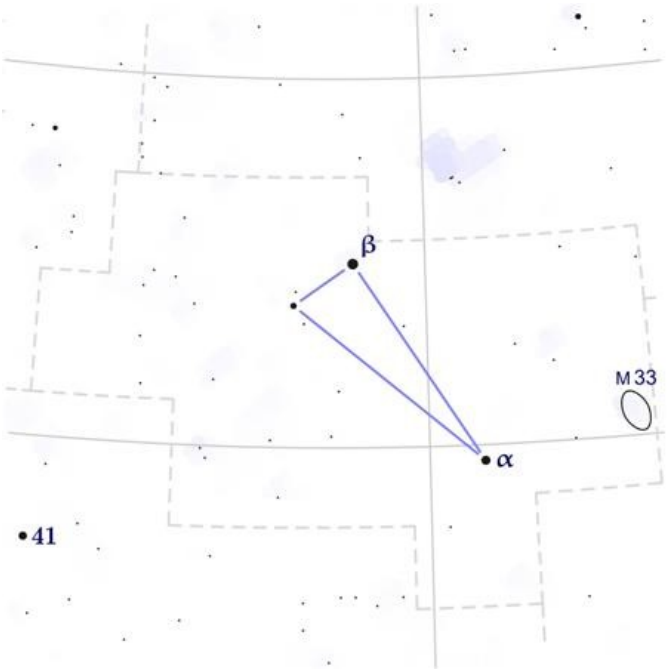
M 31 is the famous Andromeda Nebula. It is the closest galaxy to our own and is 2.5 million light years away. It is visible to the unaided eye on a reasonable night as a large elliptical misty glow. Because of its size it is a good object through binoculars, but if you are using a telescope then it is best to use a low power with a wide field of view.

Myth.

Andromeda was the daughter of King Cepheus and Queen Cassiopeia. Because of Cassiopeia's boasts Andromeda was chained to a rock to be sacrificed to the sea monster Cetus. Perseus killed Cetus and rescued Andromeda. Perseus and Andromeda got married and unusually for the myths had a happy life before being placed together in the stars.

TRIANGULUM

The Triangle – Star Atlas Chart 2



Triangulum is a small constellation that has been included in this introduction because of the M 33 nebula.
α Tri Elmuthalleth is a white star of magnitude 3.4. It is 14 times brighter than the sun and is 64 light years away.
β Tri is a white star of magnitude 3 and is 124 light years away.
γ Tri is a blue-white star of magnitude 4. It is 27 times brighter than the sun and is 117 light years away.

M 33 is a spiral galaxy almost face on to us. It is faint but with exceptionally good conditions can be seen with the unaided eye. This makes it the furthest and oldest object that can be seen with the unaided eye at about 3 million light years away, the light having left there 3 million years ago. It is also best to view it through binoculars on a dark night.

MONTHLY STAR CHARTS 2010

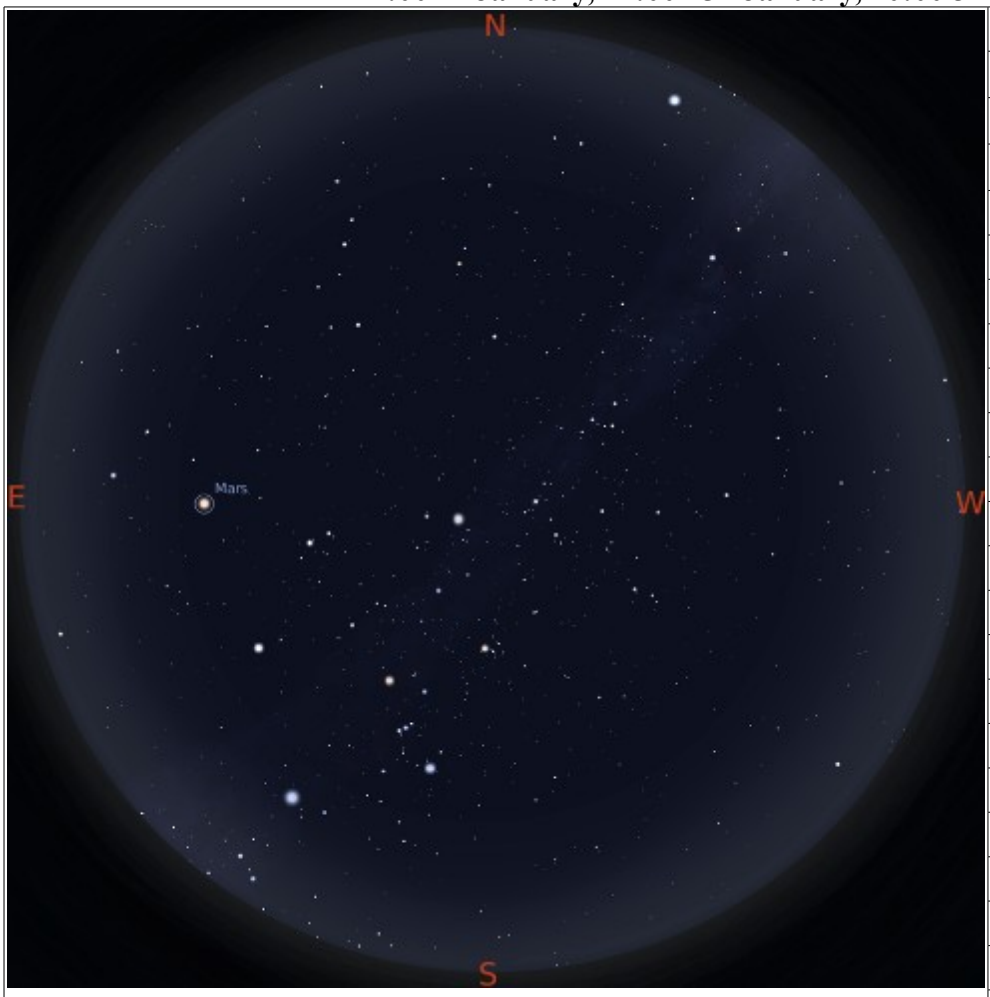
The monthly star charts over the following pages contain two views of the night sky for each month. The chart on the first page shows details of the constellations and the chart on the next page shows how you would see the sky itself. To use the charts it is best to print them out. The edge of the charts show the horizon. With the page the normal way up it is showing the stars as you would see them if you are facing South. If you want to see the stars when looking North then rotate the page until it is upside down compared with normal. The word 'North' will now be the right way up and you will see the stars as they are looking north. The same applies if you want to see the stars as they are to the east or west. Just rotate the page until the word for the direction you want to observe is the right way up.
The charts are designed to show the positions of the stars at 21:00 Greenwich Mean Time on the 15th of each month (except for the summer months). As the Earth rotates on its axis the stars seem to move across the sky. Because of this the same chart can be used to show the stars roughly as they are at 22:00 GMT on the 1st of the month and at 20:00 GMT at the end of the month. Most Astronomical Almanacs only show the time in Universal Time UT (the same as GMT) so you have to add an hour on yourselves to the times when we are in BST. As this is an introduction to astronomy I have adjusted the times on the charts for when we are in British Summer Time so you do not have to make any adjustments. The same goes for all other times shown such as sunrise and sunset times.
All times are calculated for the north east of Bristol (rounded up to Latitude 51:30:00 North, Longitude 2:30:00 West) but are good for all of Bristol and the surrounding area.

Most of the constellations mentioned in the monthly star charts are constellations that are only visible for a few months each year. They are best placed for observation when they are in the south as this is when they will be at their highest point above the horizon. Constellations that are visible all the year round are called circumpolar constellations. As these can be observed on any night with a clear sky they are not mentioned in these monthly charts.

Some constellations named in the monthly star charts are preceded by an asterisk *. This shows that the constellation can only be observed from this latitude when it is directly south and as such is close to the horizon. To observe the constellation you will need an unobstructed view looking south, no light pollution and the higher up you are, the better.

NIGHT SKY JANUARY

22:00 1st January, 21:00 15th January, 20:00 31st January



Sun		Rise	Set
1st		08:16	16:12
15th		08:09	16:30
31st		07:50	16:57
Moon		Rise	Set
1st		17:14	08:51
15th		08:15	16:51
31st		19:10	08:08
New Moon			15th
First Quarter			23rd
Full Moon			30th
Last Quarter		07th	
Planet		Rise	Set
Mercury	1st	08:38	16:52
Mercury	15th	06:46	15:03
Venus	1st	08:16	15:50
Venus	15th	08:25	16:23
Mars	1st	19:13	10:37
Mars	15th	17:54	09:38
Jupiter	1st	10:33	20:10
Jupiter	15th	09:43	19:32
Saturn	1st	23:43	11:48
Saturn	15th	22:48	10:53

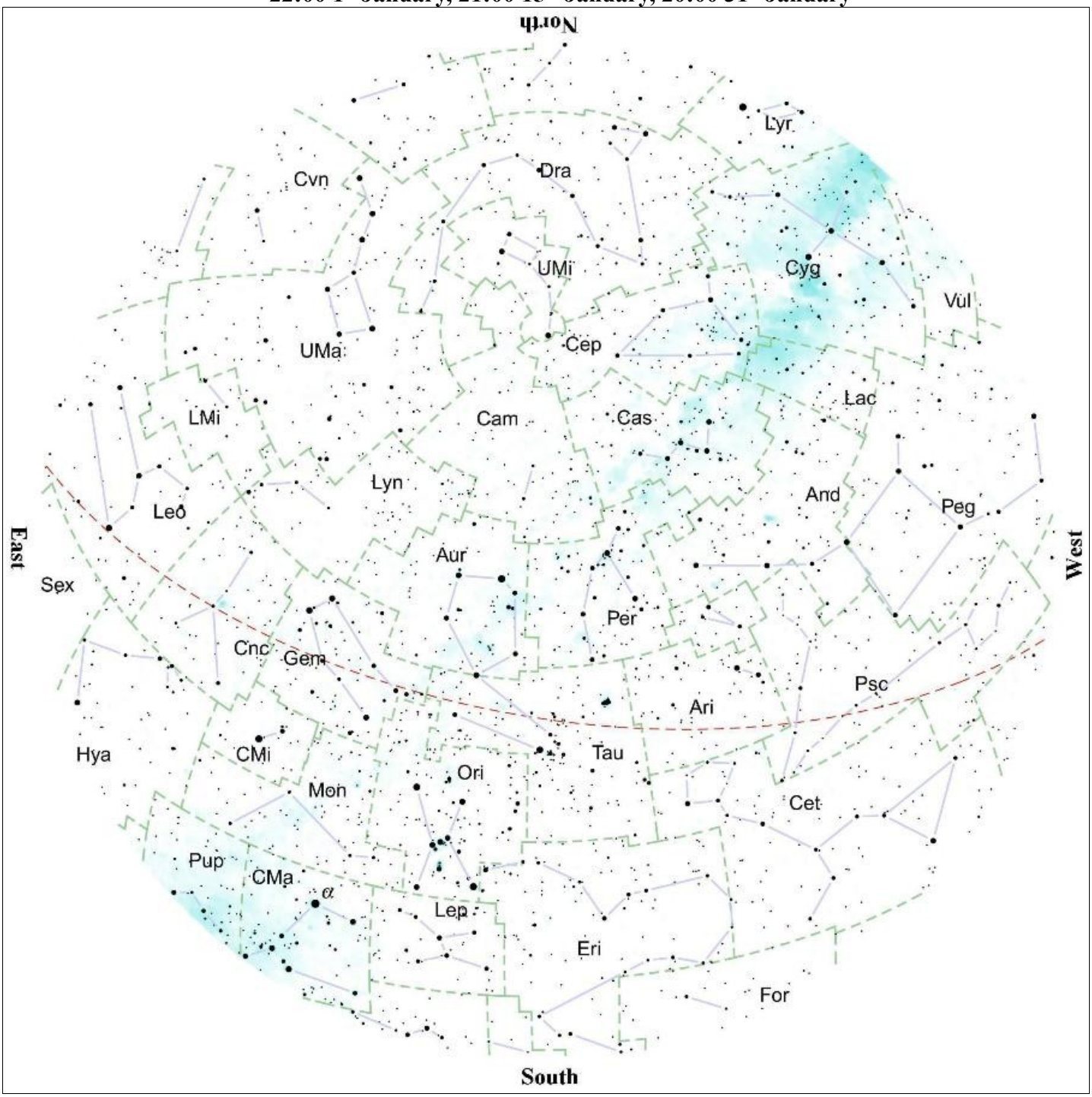
Mercury is just visible before sunrise in the last week of the month, but only if you have an unobstructed view of the south western horizon.
Venus is not visible this month.
Mars is visible in the east after sunset by the end of the month.
Jupiter is visible as a bright object in the south west after sunset at the beginning of the month, becoming lower in the sky by the end of the month.
Saturn rises in the east just before midnight at the beginning of the month and by 22:00 by the end of the month.

M45 the Pleiades are well placed for observing this month. Also known as the seven sisters 6 of the stars can be seen with the unaided eye.
Another open cluster that is worth observing is the Hyades. This cluster can be seen just below Aldeberan in Taurus. Although visible to the naked eye it is well worth a look through binoculars.
Collinder 70 is a large open cluster that surrounds the belt of Orion. Viewed through binoculars it reveals a rich star field.
M42 is the famous Orion Nebula and is visible to the naked eye. It lies in the sword of Orion and makes rewarding viewing through binoculars and telescopes.
Constellations best placed for observing are Eridanus, *Fornax, Perseus and Taurus.

The Quadrantids meteor shower which normally requires good conditions to be seen in the northern hemisphere will be obscured this year by the waning gibbous moon.

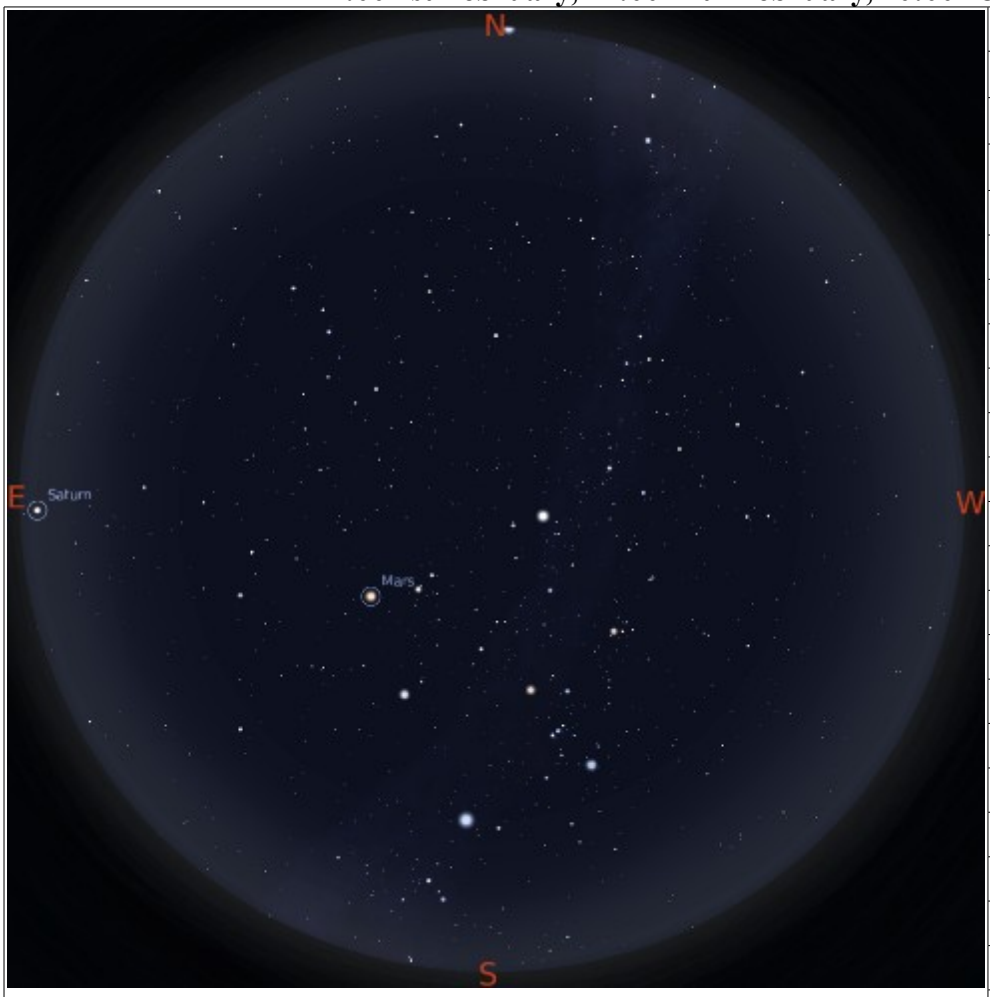
NIGHT SKY JANUARY

22:00 1st January, 21:00 15th January, 20:00 31st January



NIGHT SKY FEBRUARY

22:00 1st February, 21:00 14th February, 20:00 28th February



Sun	Rise	Set
1st	07:49	16:59
14th	07:26	17:23
28th	06:58	17:48
Moon	Rise	Set
1st	20:38	08:27
14th	07:16	18:08
28th	18:01	06:29

New Moon		14th
First Quarter		22nd
Full Moon		28th
Last Quarter	5th	

Planet		Rise	Set
Mercury	1st	06:44	14:41
Mercury	14th	06:57	15:18
Venus	1st	08:15	17:16
Venus	14th	07:57	17:59
Mars	1st	16:07	08:19
Mars	14th	14:19	07:16
Jupiter	1st	08:44	18:48
Jupiter	14th	07:58	18:14
Saturn	1st	21:39	09:46
Saturn	14th	20:45	08:55

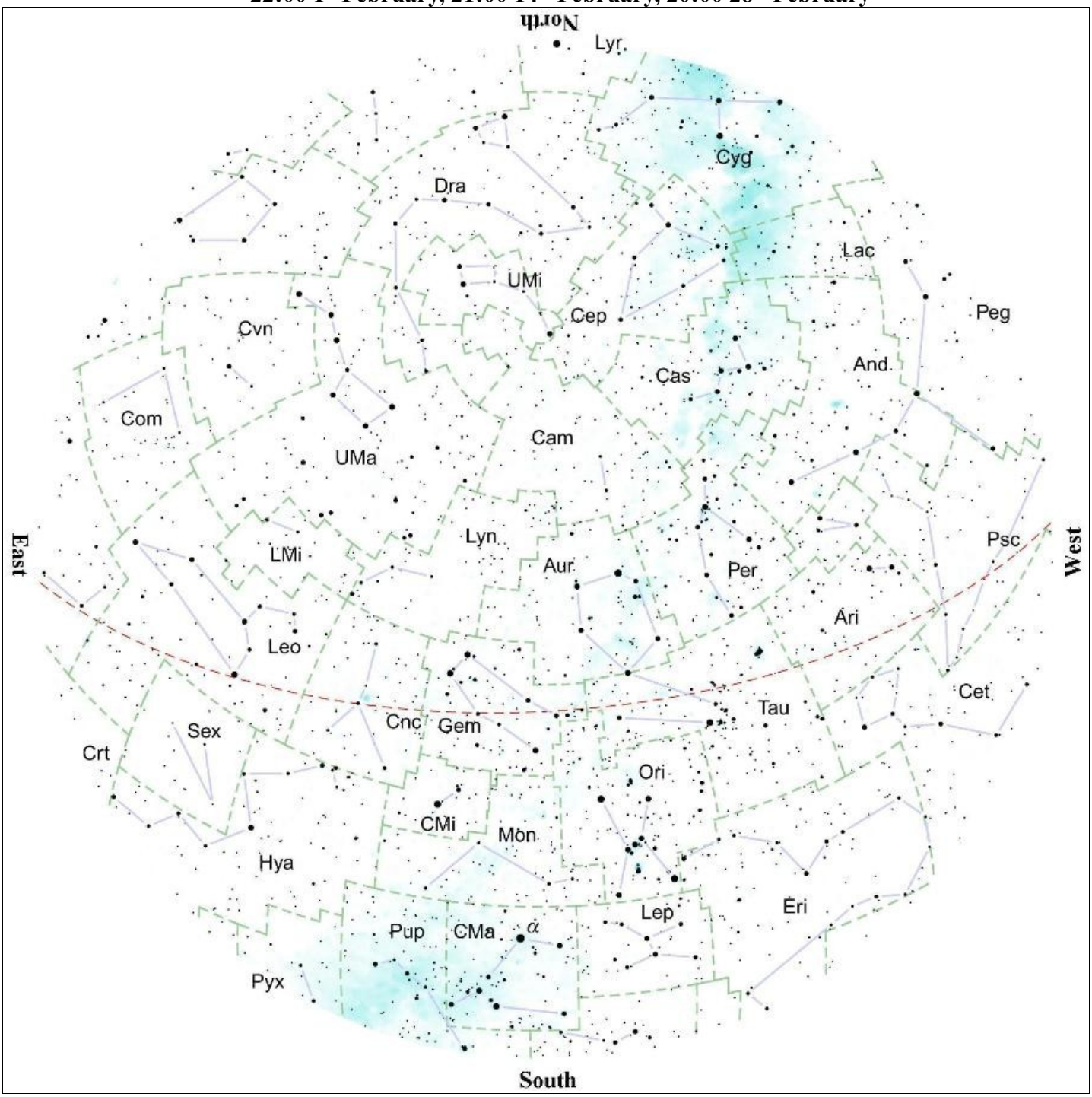
Mercury is not visible this month.
Venus is not visible this month.
Mars is visible in the east after sunset at the beginning of the month and is high in the sky directly south by midnight. Apart from Sirius it is the brightest object in the sky. By the 14th Mars is high in the east after sunset.
Jupiter is visible just after sunset but is low in the sky and is no longer visible by the second week of Feb.
Saturn rises in the east just after 22:00 at the beginning of the month and by 20:00 at the end of the month.

Orion still continues to dominate the southern sky during the evening. M 42 in Orion's sword is visible to the unaided eye as a star with slight nebulosity surrounding it. Through binoculars the nebula is easily visible and combined with the other stars in Orion's sword, makes a spectacular view.
Follow the line of Orion's belt down to Sirius the brightest star in the sky in the constellation of Canis Major. The whole of the Canis Major is above the horizon and this is the best month to view it. M 41 in Canis Major is an open cluster that is just visible to the unaided eye. It is just below Sirius. Follow a curve up from Sirius and we find Procyon in Canis Minor. Almost half way between Sirius and Procyon is M50 in Monoceros. This is an open cluster that is visible through binoculars. Continue the curve upwards from Procyon and we come to Pollux and Castor in the constellation of Gemini. M 35 in Gemini is an open cluster easily visible in binoculars. Continue the curve and we arrive at Capella in the constellation of Auriga. Auriga contains three open clusters M 36, M 37 and M 38, all of which are visible through binoculars.
Also best placed for observation this month are the constellations Lepus and *Columba.

There are no meteor showers this month.

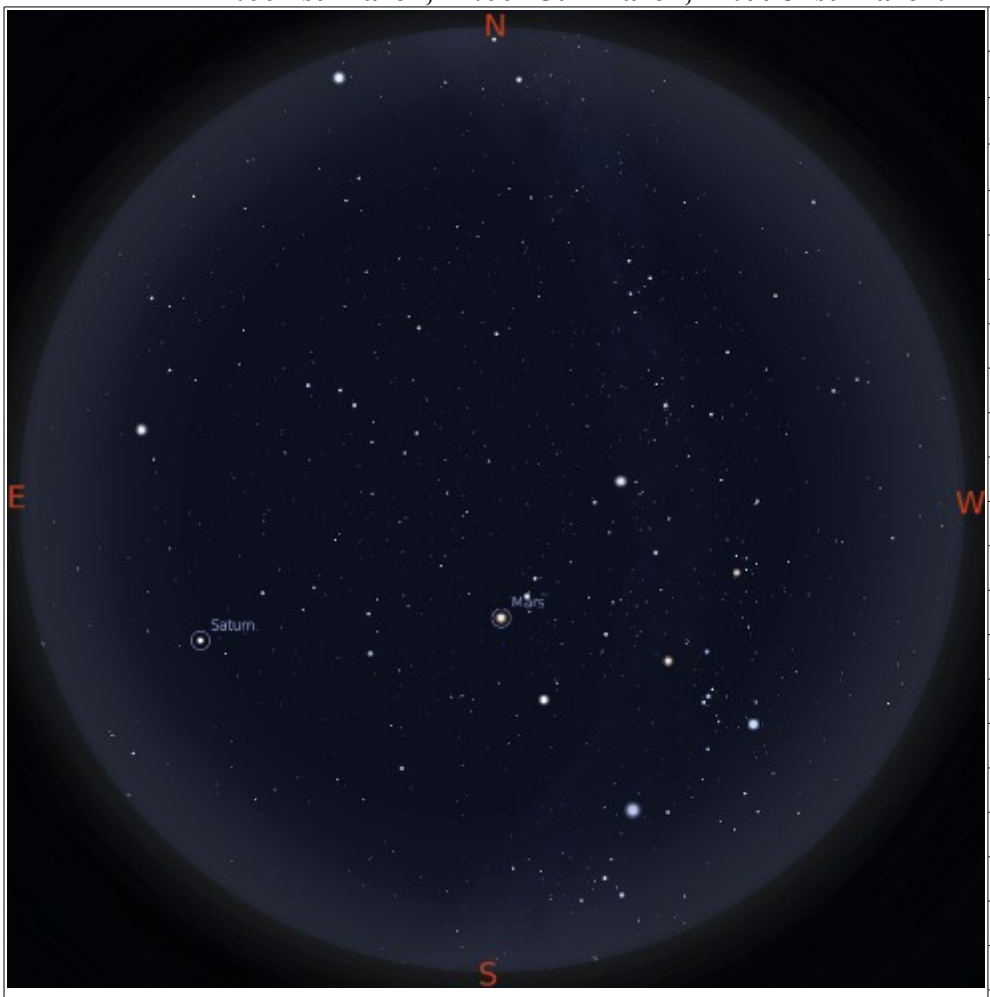
NIGHT SKY FEBRUARY

22:00 1st February, 21:00 14th February, 20:00 28th February



NIGHT SKY MARCH

22:00 1st March, 21:00 15th March, 21:00 31st March. Time adjusted for BST.



Sun	Rise	Set
1st	06:56	17:50
15th	06:25	18:14
31st	06:48	19:41
Moon	Rise	Set
1st	19:30	06:47
15th	05:52	18:15
31st	22:13	06:47

New Moon	15th
First Quarter	23rd
Full Moon	30th
Last Quarter	07th

Planet		Rise	Set
Mercury	1st	06:55	16:35
Mercury	15th	06:40	18:11
Venus	1st	07:30	18:47
Venus	15th	07:02	19:32
Mars	1st	13:34	06:05
Mars	15th	12:40	05:05
Jupiter	1st	07:06	17:36
Jupiter	15th	06:17	17:00
Saturn	1st	19:40	17:36
Saturn	15th	18:39	06:58

Mercury is not visible until the last week of the month.
Venus becomes visible just after sunset by the middle of the month and is visible in the sky together with Mercury by the last week of the month.
Mars is now high in the south eastern sky after sunset.
Saturn rises just after 20:00 at the beginning of the month and by the end of the month, is visible in the eastern sky after sunset.
Jupiter is not visible this month.

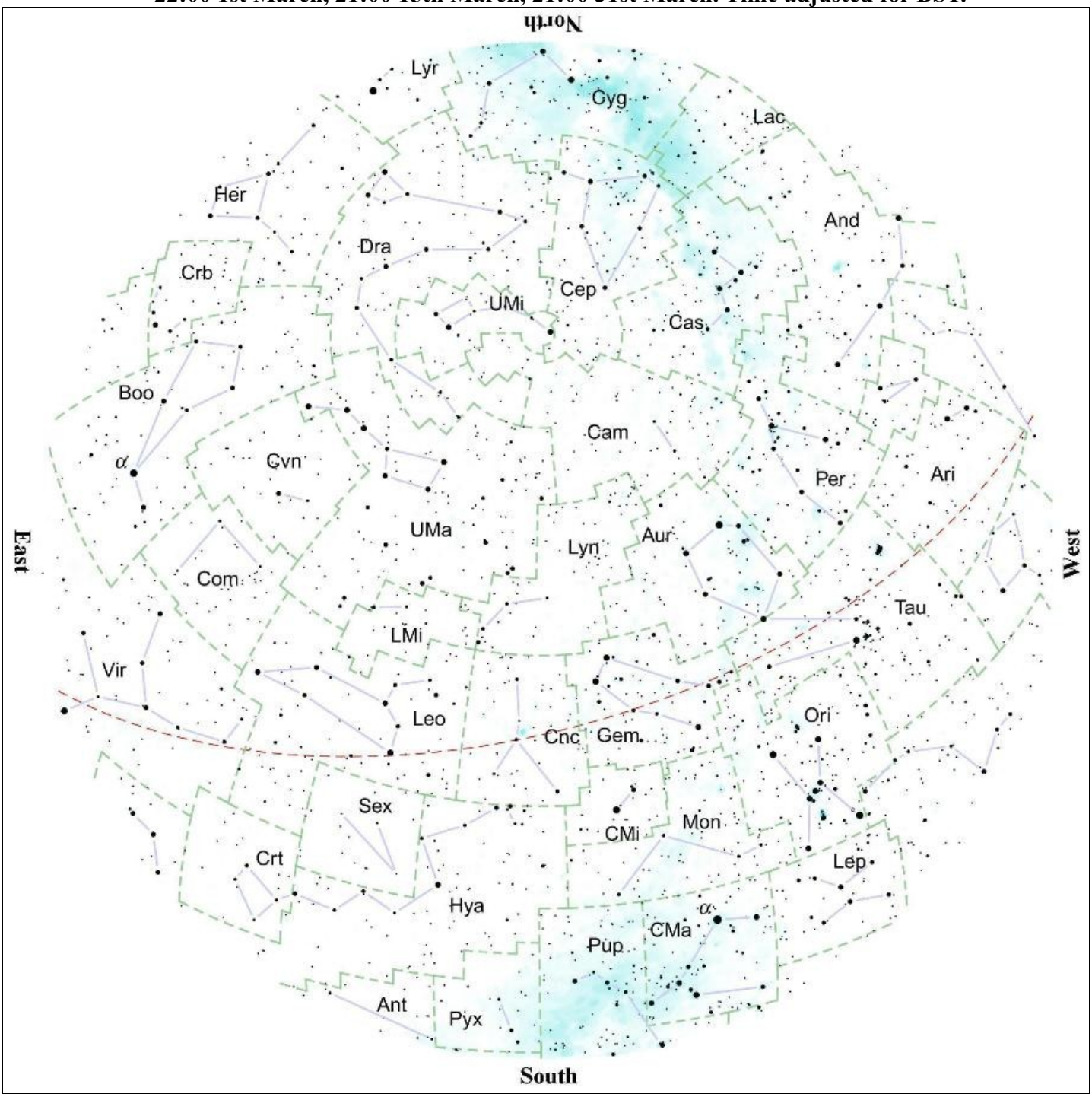
The Vernal Equinox is on the 20th of March at 17:32. This is the time when the sun is directly over the equator, moving from the southern hemisphere to the northern hemisphere.

Between the bright stars Castor and Pollux and the easily recognised sickle of Leo is the faint constellation of Cancer. Although faint it is easy enough to pick out as the stars surrounding it are fainter still. Between and to the right of γ and δ Cnc is M 44 Praesepe, the Beehive cluster. To the unaided eye a nebulous patch, this open cluster is easily visible and best viewed through binoculars. To the right of α Cnc is M 67. This open cluster is not visible to the unaided eye but is easily visible through binoculars. Following a line down from β Cnc we find M 48 an open cluster in Hydra which is easily visible in binoculars. Another open cluster which is a fine object to observe is M 47 in Puppis. To locate M47 follow a line left from Sirius and a line down from Procyon. Where these line intersect you will find M 47.
Constellations best placed for observing are Cancer, Canis Major, Canis Minor, Gemini, Lynx, Monoceros, *Puppis and *Pyxis.

There are no meteor showers this month.

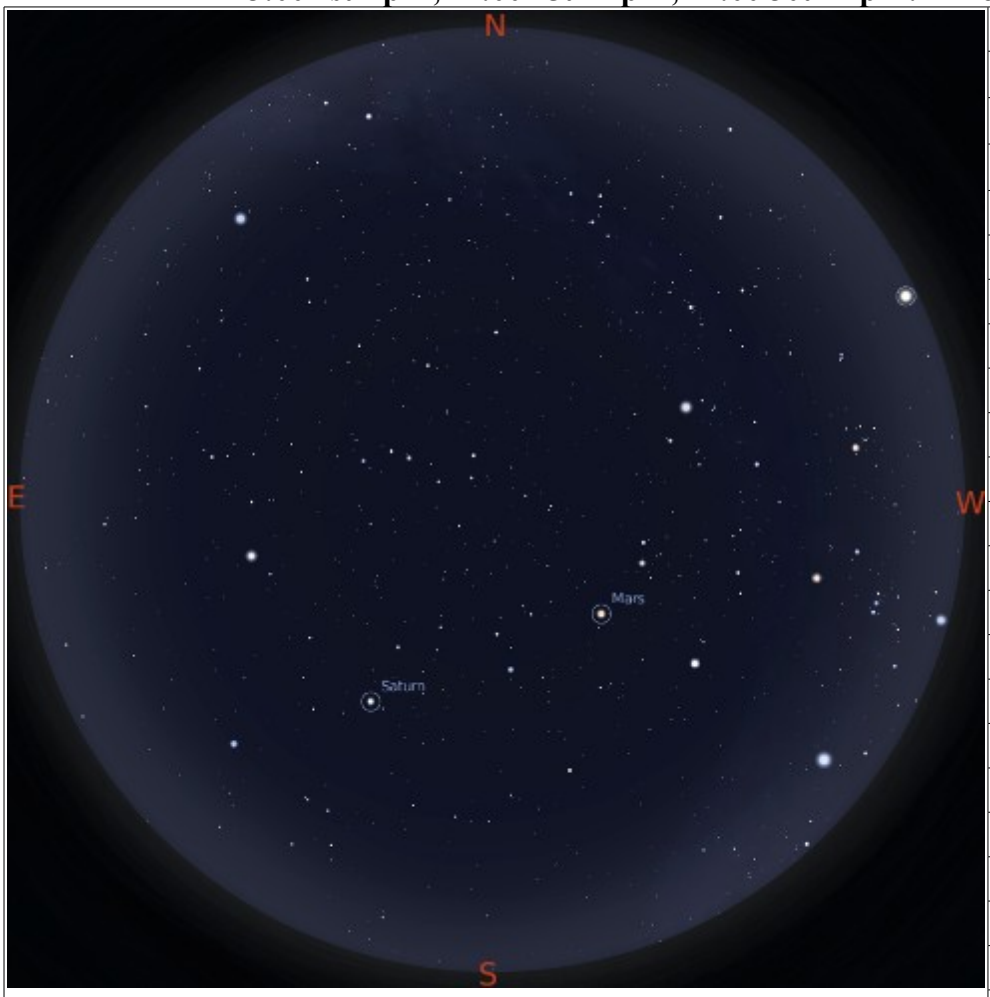
NIGHT SKY MARCH

22:00 1st March, 21:00 15th March, 21:00 31st March. Time adjusted for BST.



NIGHT SKY APRIL

23:00 1st April, 22:00 15th April, 21:00 30th April. Time adjusted for BST.



Sun	Rise	Set
1st	06:46	19:43
15th	06:15	20:06
30th	05:44	20:31
Moon	Rise	Set
1st	23:35	07:12
15th	06:04	21:52
30th	23:35	06:16

New Moon			14th
First Quarter			21st
Full Moon			28th
Last Quarter		06th	
Planet		Rise	Set
Mercury	1st	06:11	20:20
Mercury	15th	05:33	20:49
Venus	1st	06:29	20:27
Venus	15th	06:06	21:12
Mars	1st	11:51	04:00
Mars	15th	11:20	03:12
Jupiter	1st	05:17	16:16
Jupiter	15th	04:27	15:39
Saturn	1st	17:25	05:49
Saturn	15th	16:24	04:52

Mercury is best placed for viewing during the first week of April in the west after sunset. On the 4th Mercury is just 2 degrees apart from Venus. By the third week Mercury is too close to the sun to be seen.
Venus is visible in the west after sunset at the beginning of the month, moving towards the west-north-west as the month progresses.
Mars is high in the sky and directly south at the beginning of the month and sets before 03:00 by the end.
Jupiter is not visible this month.
Saturn is visible in the south west after sunset, rising higher and is directly south just before midnight.

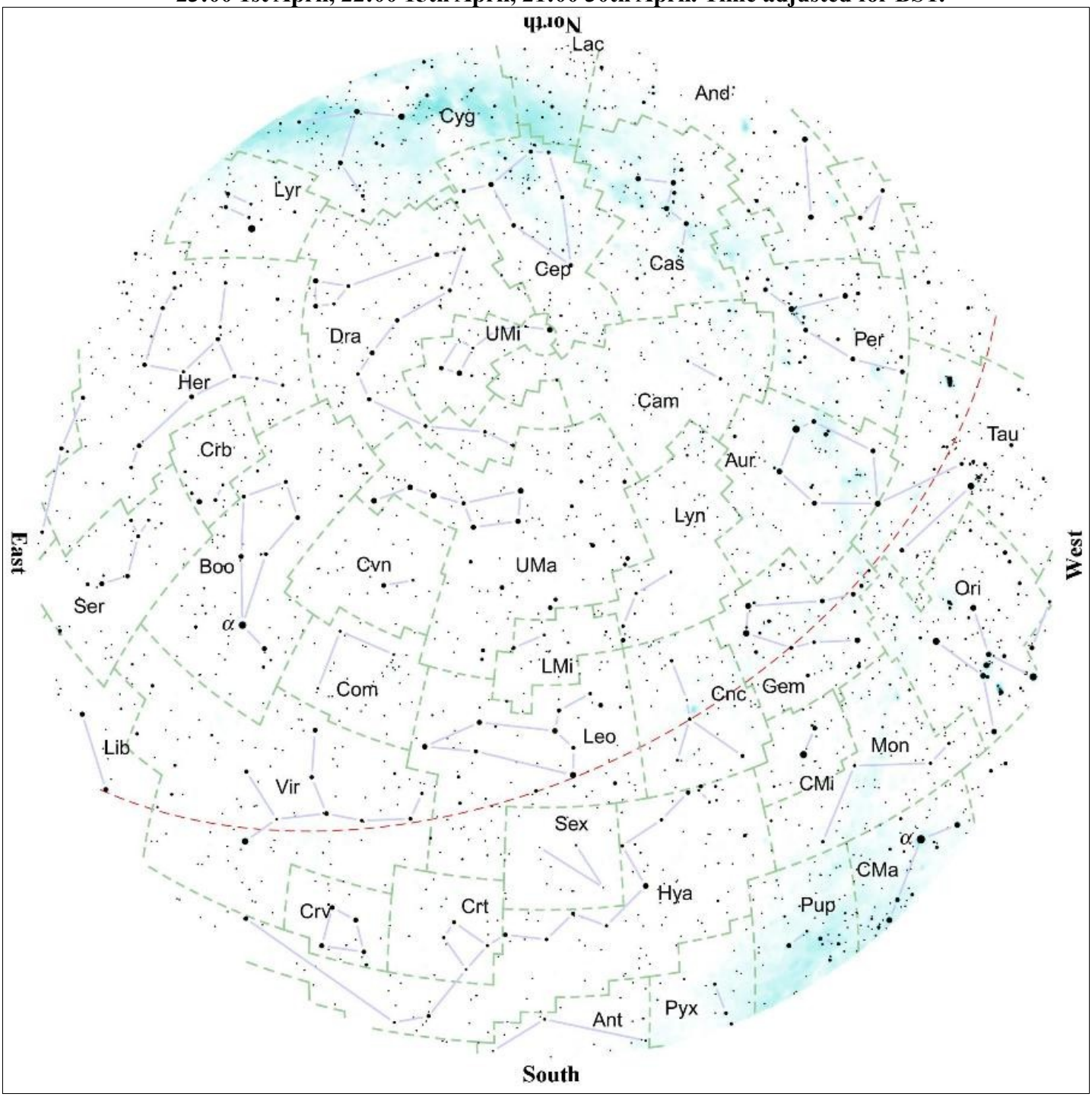
With the clocks going forward in March the sun is now setting over an hour later than it was in March. Any observing will now have to be done later on in the evening.

γ Leo is an optical double which is easily resolved with binoculars. M65 and M66 in Leo are both spiral galaxies that are almost edge on. They should just be visible through binoculars as small fuzzy spots. Constellations best placed for observing are *Antlia, Corvus, Crater, Hydra, Leo, Leo Minor and Sextans.

The Lyrid meteor marks the end of a rather bland period for meteors between January and April. The Lyrids radiate from an area between Lyra and Hercules and are active between April the 16th and the 25th . The maximum occurs on the April the 22nd at 17:00 which is unfortunately during daylight, where the hourly rate can be between 18 and 90 meteors. However it should still be possible to see meteors in the early hours of the 22nd. The moon which is just past the first quarter sets by 03:00 which leaves time to observe any meteors before dawn. This shower can be unpredictable sometimes resulting in many more meteors than normal so it is well worth watching.

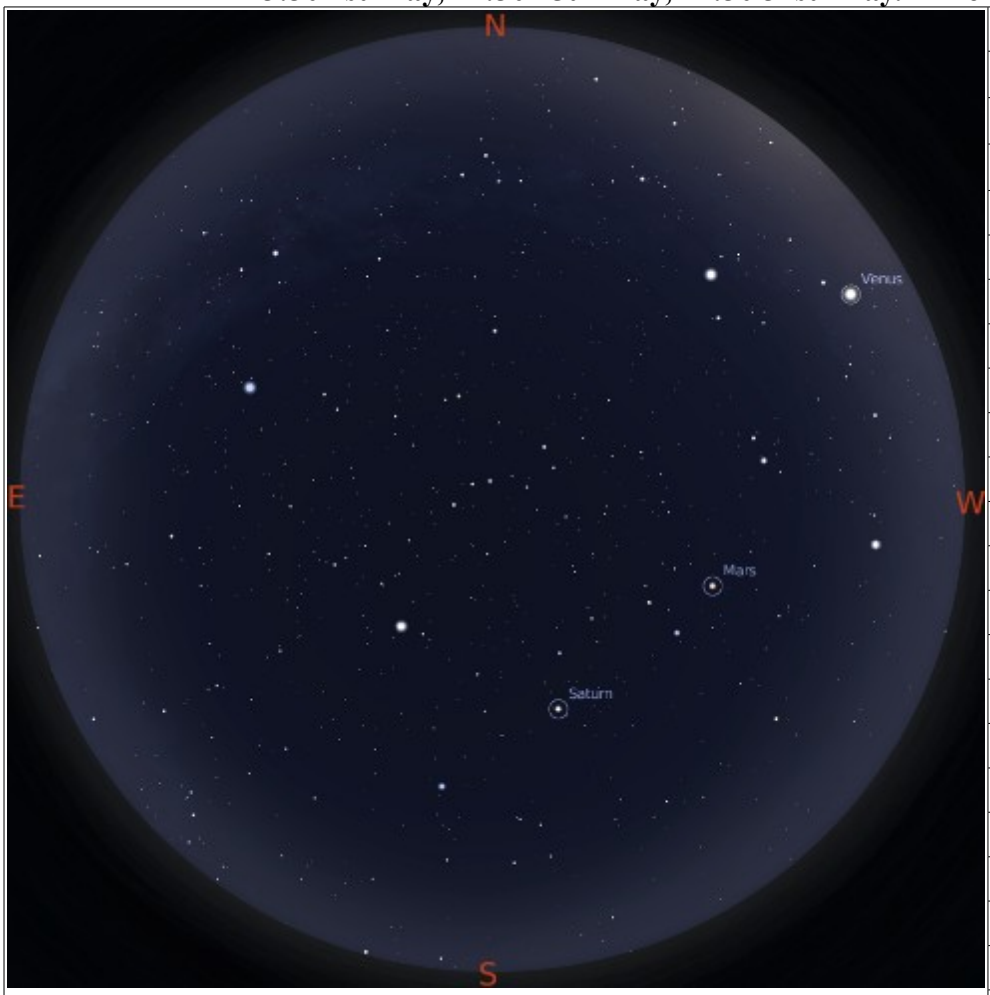
NIGHT SKY APRIL

23:00 1st April, 22:00 15th April, 21:00 30th April. Time adjusted for BST.



NIGHT SKY MAY

23:30 1st May, 22:30 15th May, 21:30 31st May. Time adjusted for BST.



Sun	Rise	Set
1st	05:42	20:33
15th	05:18	20:55
31st	05:00	21:16
Moon	Rise	Set
1st	00:31 - 2nd	07:03
15th	05:46	23:09
31st	00:14	07:57

New Moon			14th
First Quarter			21st
Full Moon			28th
Last Quarter		06th	
Planet		Rise	Set
Mercury	1st	04:38	18:59
Mercury	15th	03:57	17:35
Venus	1st	05:51	22:02
Venus	15th	05:52	22:36
Mars	1st	10:54	02:20
Mars	15th	10:35	01:36
Jupiter	1st	03:30	14:55
Jupiter	15th	02:40	14:14
Saturn	1st	15:16	03:47
Saturn	15th	14:18	02:51

Mercury is not visible this month.
Venus remains a brilliant object to be seen in the west after sunset throughout the month.
Mars is now visible in the south-west after sunset.
Jupiter is just visible before sunrise at the beginning of the month becoming more noticeable before sunrise by the end of the month.
Saturn is visible in the south after sunset.

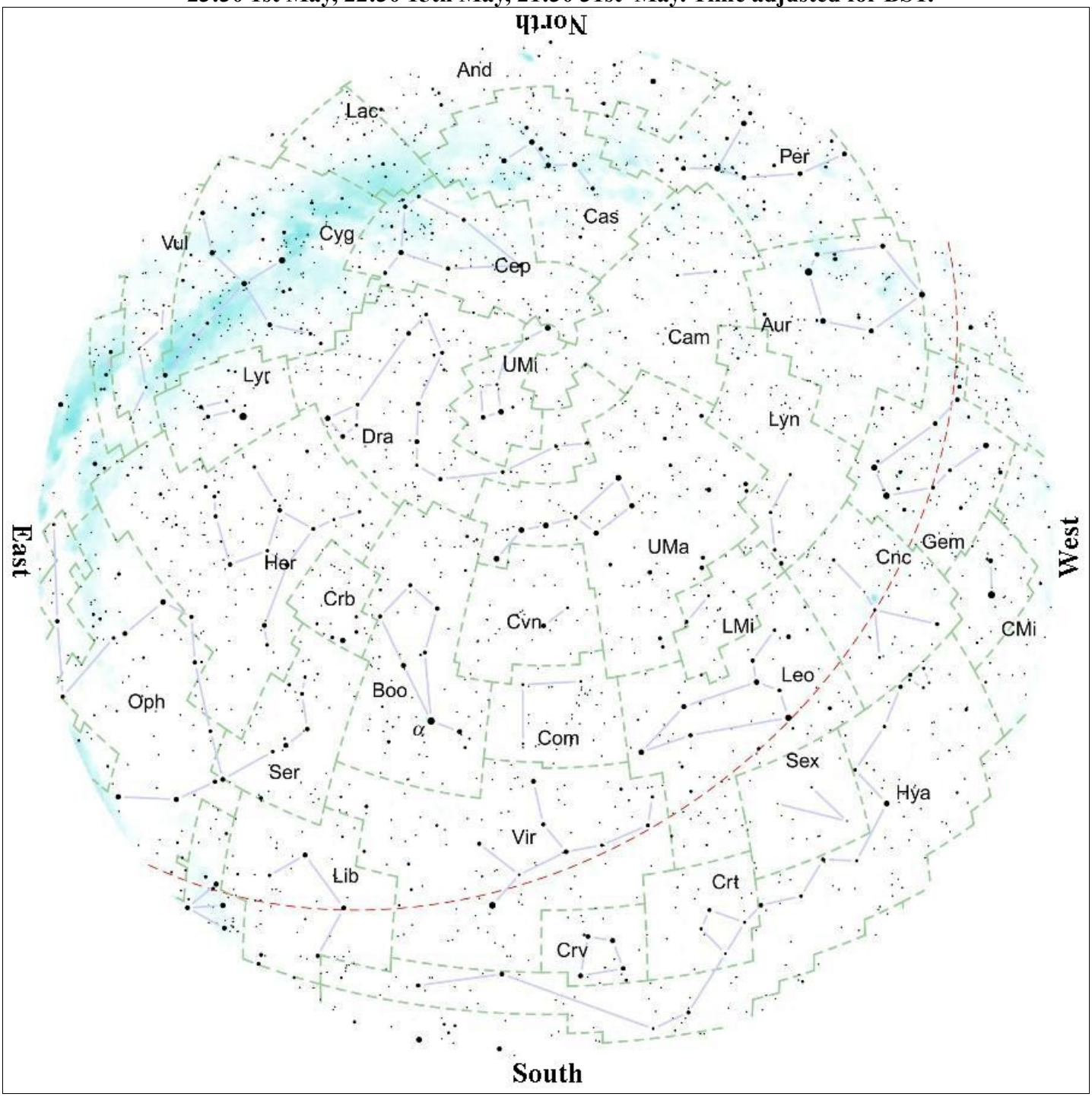
The sun is now setting late in the evening meaning that any serious observing cannot take place until after 22:30.

There is a constellation that lies between Leo and Bootes called Coma Berenices. You can find it on chart 5 in the atlas at the end of this book looking like an upside down L. γ Coma Berenices is the star at the right of the inverted L and immediately below is the Coma Berenices Star Cluster. This is visible to the unaided eye.
Other constellation that are well placed for viewing in May are Bootes, Canes Venatici and Virgo. Libra is also well placed for viewing but not until after midnight.

There are no meteor showers this month.

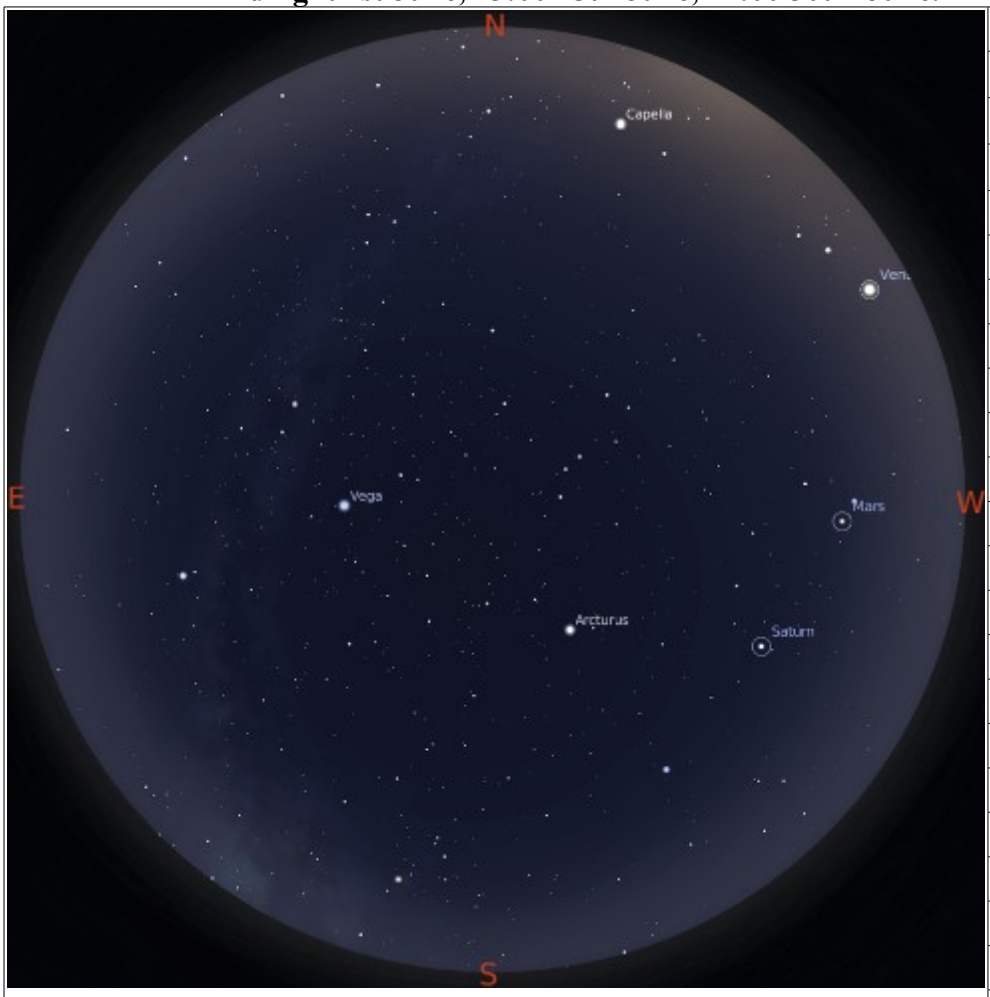
NIGHT SKY MAY

23:30 1st May, 22:30 15th May, 21:30 31st May. Time adjusted for BST.



NIGHT SKY JUNE

Midnight 1st June, 23:00 15th June, 22:00 30th June. Time adjusted for BST.



Sun	Rise	Set
1st	04:59	21:18
15th	04:52	21:29
30th	04:56	21:31
Moon	Rise	Set
1st	23:36	09:07
15th	08:17	23:43
30th	23:15	09:11

New Moon			12th
First Quarter			19th
Full Moon			26th
Last Quarter		04th	
Planet		Rise	Set
Mercury	1st	03:20	17:46
Mercury	15th	03:12	19:04
Venus	1st	06:16	22:56
Venus	15th	06:50	22:52
Mars	1st	10:18	00:43
Mars	15th	10:06	23:57
Jupiter	1st	01:38	13:23
Jupiter	15th	00:47	12:38
Saturn	1st	13:11	01:44
Saturn	15th	12:17	00:49

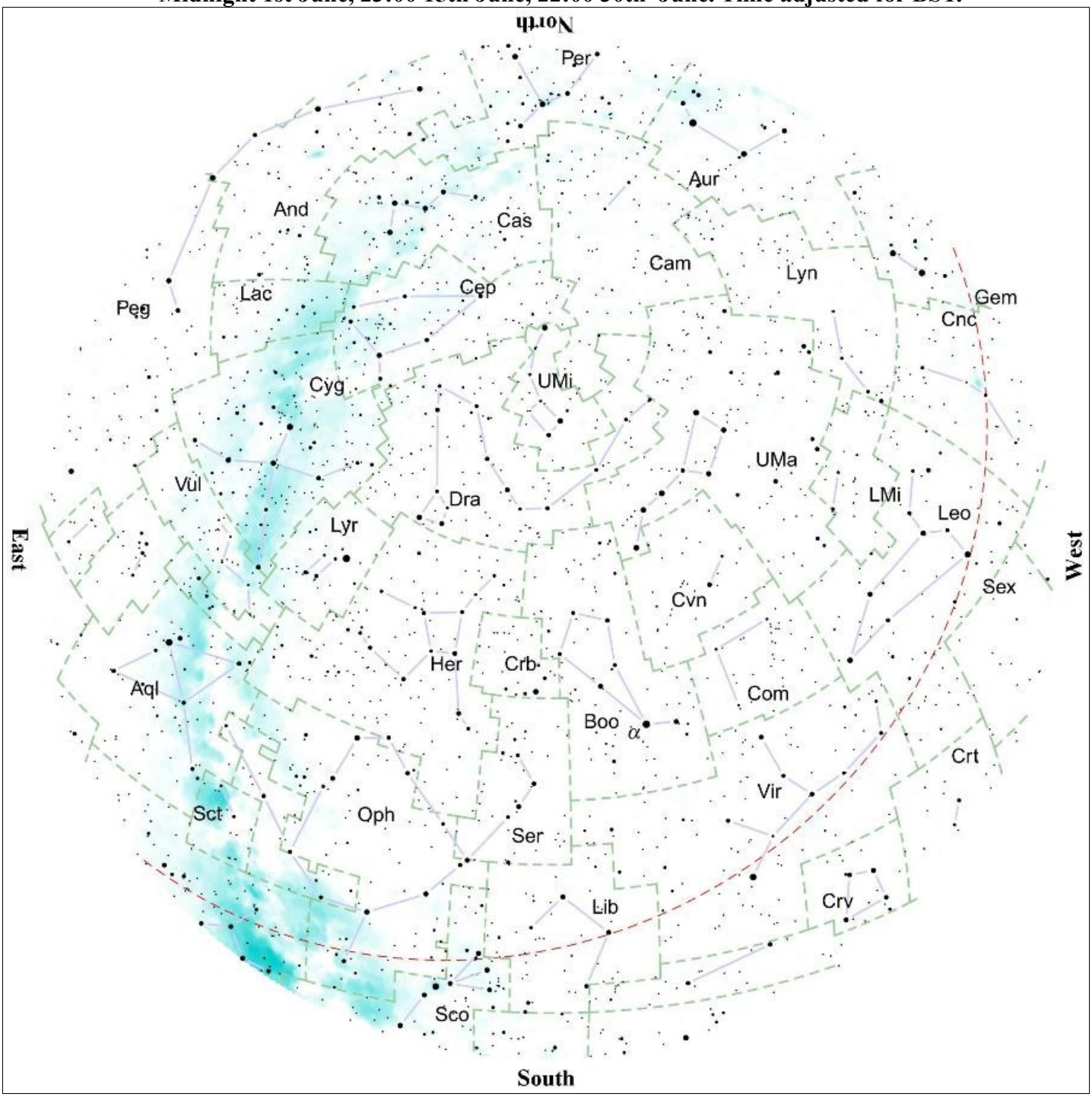
Mercury is not visible this month.
Venus remains as a brilliant object after sunset, moving more to the west during the course of the month.
Mars is visible after sunset in the western sky.
Jupiter rises well before dawn in the constellation of Aquarius.
Saturn is visible in the south west after sunset.

The Summer Solstice is on the 21st of June at 11:28. This is the time when the sun is at its farthest north. Any serious observing will take place after midnight.

The June Bootids is a totally unpredicatable meteor shower. It is all or nothing. If any activity is going to occur it will be between June the 22nd and July the 2nd. The maximum will occur on June the 27th and the maximum hourly rate will be anything between 0 and 100 meteors plus. If the shower does occur then they will radiate from almost directly overhead. Unfortunately the moon is almost full which will obscure any faint meteors but it is still worth watching just in case there is a good shower.

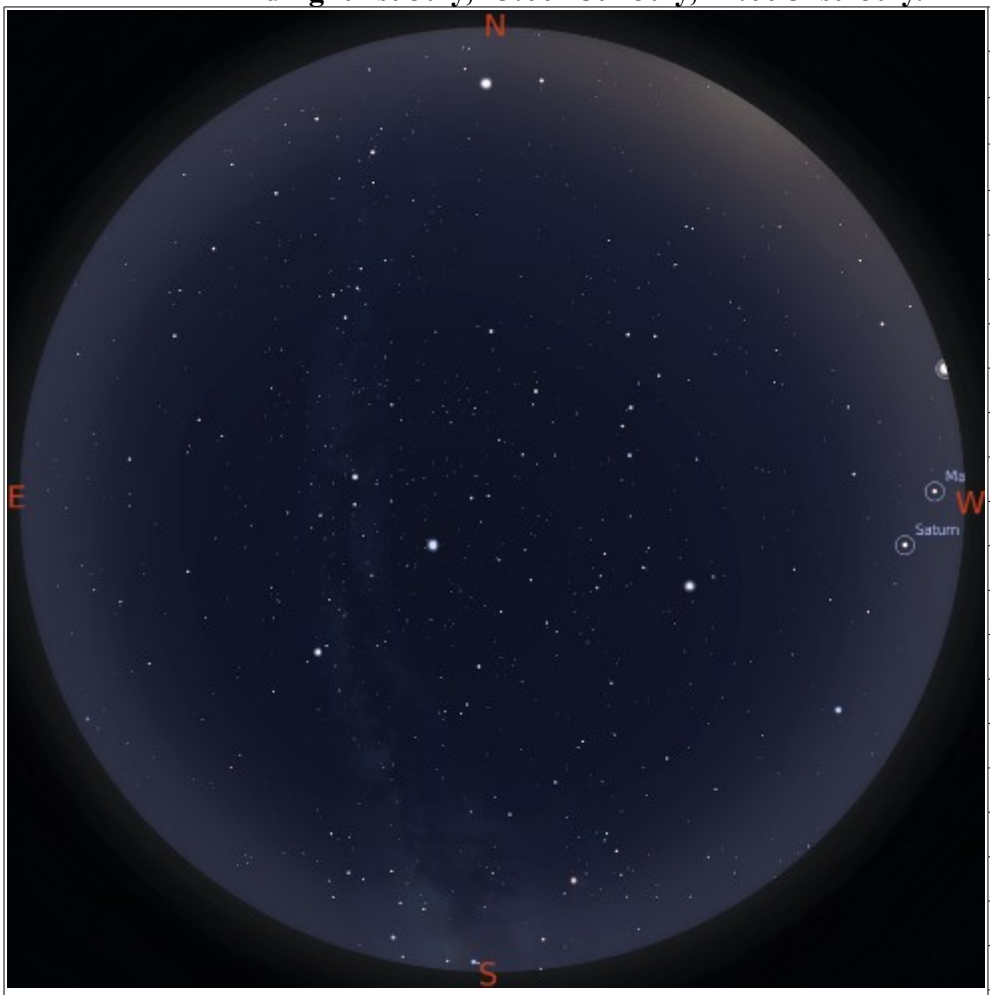
NIGHT SKY JUNE

Midnight 1st June, 23:00 15th June, 22:00 30th June. Time adjusted for BST.



NIGHT SKY JULY

Midnight 1st July, 23:00 15th July, 22:00 31st July. Time adjusted for BST.



Sun	Rise	Set
1st	04:57	21:30
15th	05:10	21:21
31st	05:32	21:00
Moon	Rise	Set
1st	23:30	10:19
15th	10:13	22:47
31st	22:21	11:29

New Moon			11th
First Quarter			18th
Full Moon			26th
Last Quarter		04th	
Planet		Rise	Set
Mercury	1st	04:10	20:50
Mercury	15th	05:47	21:15
Venus	1st	07:35	22:31
Venus	15th	08:14	22:02
Mars	1st	09:54	23:08
Mars	15th	09:46	22:25
Jupiter	1st	23:43	11:43
Jupiter	15th	22:49	10:52
Saturn	1st	11:18	23:43
Saturn	15th	10:28	22:49

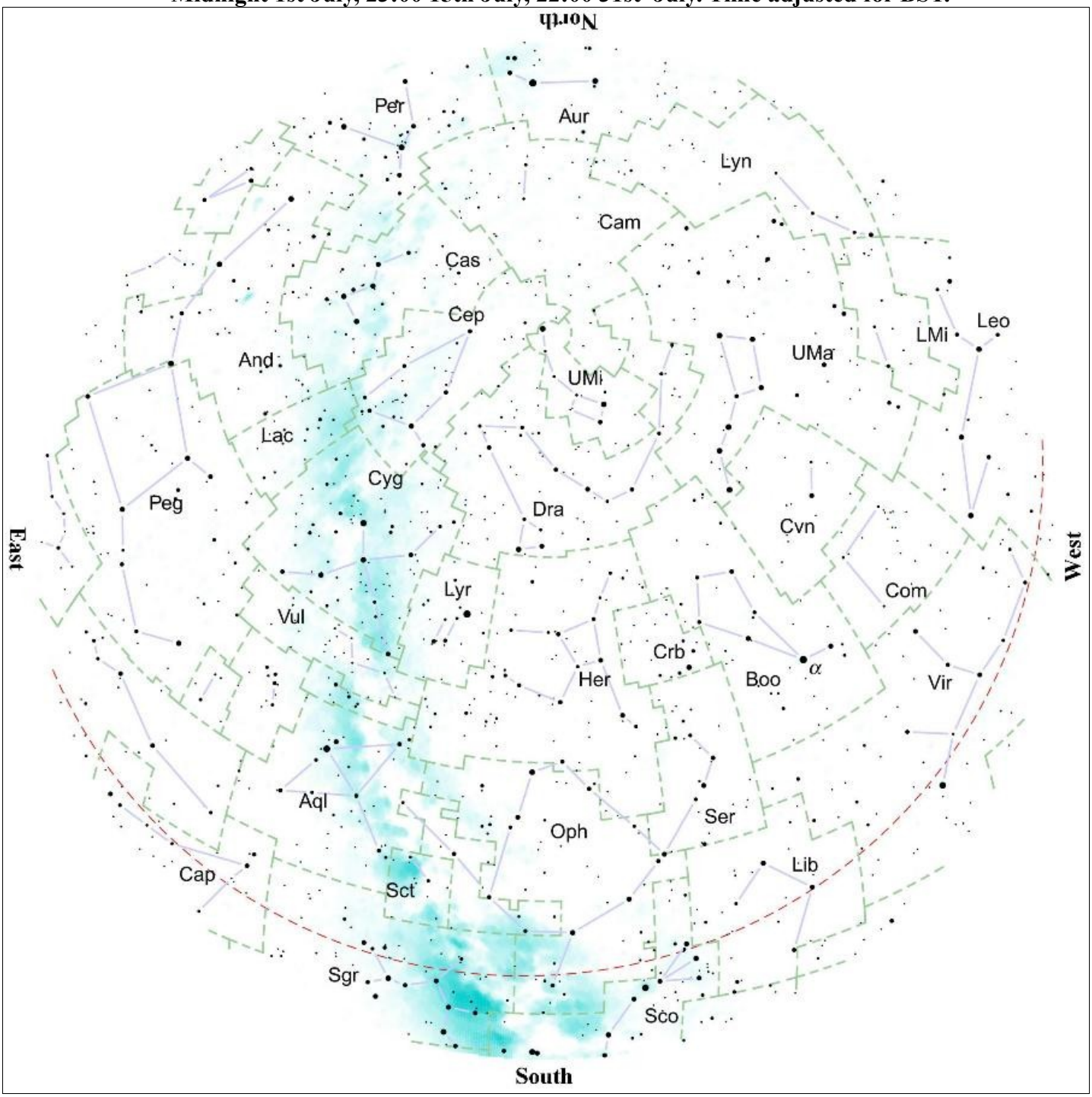
Mercury is not visible this month.
Venus, Mars and Saturn, are visible after sunset on the 1st, forming a line in the west toward the constellation of Leo as seen in the diagram to the right. As the month goes on all 3 planets move closer together and closer to the horizon after sunset.
Jupiter rises in the east before midnight now and by the end of the month is directly south at sunrise.

M 13 is known as the Great Globular cluster in Hercules. It should just be visible to the unaided eye on a very dark night and is easily visible in binoculars. M 10 is a dense globular cluster and M 12 is a loosely packed globular cluster. Both are in Ophiuchus and both are visible through binoculars. M 5 in Serpens is a fairly bright globular cluster. With a dark sky it is possible to see it with the unaided eye and is easily seen through binoculars. M 4 in Scorpio is one of the easiest of globular clusters to find. It is visible to the unaided eye on a dark night and very easy to see through binoculars. M 6 and M 7 are both open clusters in Scorpio. Unfortunately they only just rise above the horizon at this latitude so to see them you will need an unobstructed view south with no light polution.
Constellations best placed for observing are Corona Borealis, Hercules, *Lupus, Ophiuchus, *Scorpio and Serpens.

There are no meteor showers this month.

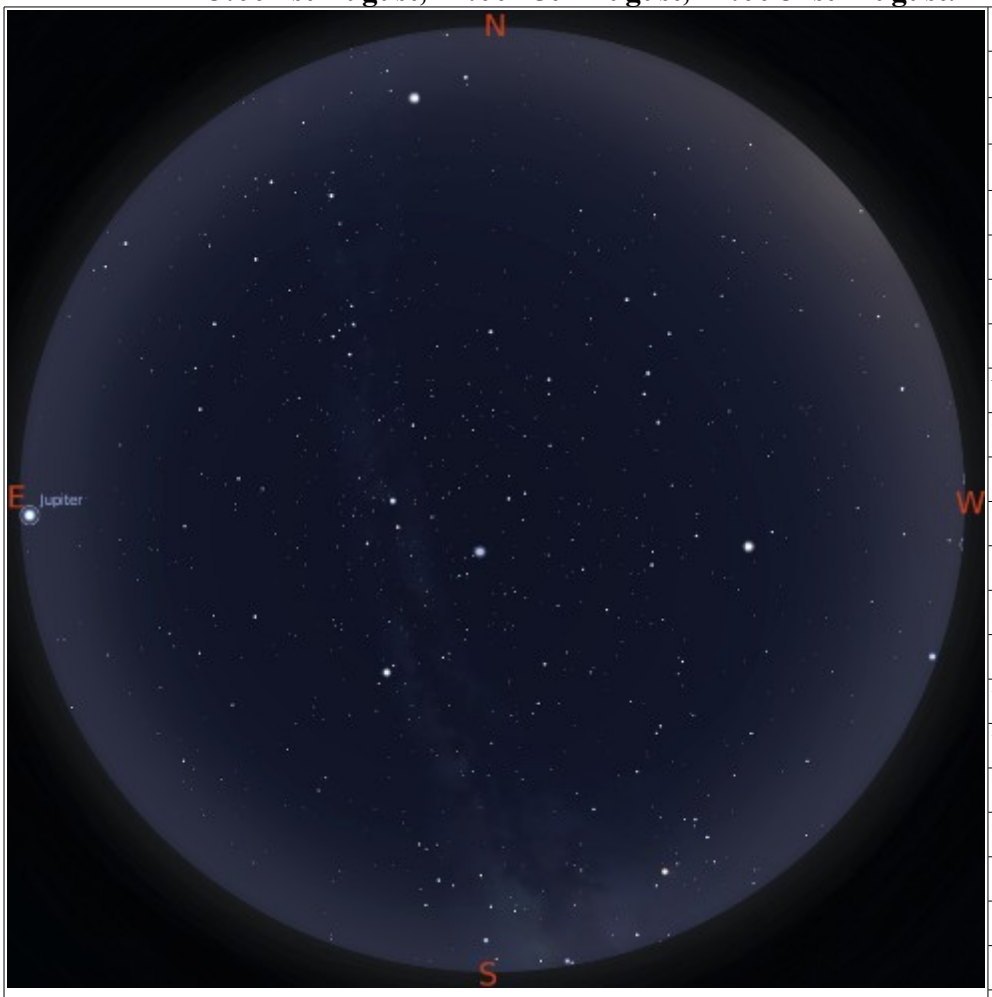
NIGHT SKY JULY

Midnight 1st July, 23:00 15th July, 22:00 31st July. Time adjusted for BST.



NIGHT SKY AUGUST

23:00 1st August, 22:00 15th August, 21:00 31st August. Time adjusted for BST.



Sun	Rise	Set
1st	05:33	20:58
15th	05:55	20:33
31st	06:21	19:59
Moon	Rise	Set
1st	22:38	12:38
15th	13:26	22:18
31st	22:02	13:58

New Moon			10th
First Quarter			16th
Full Moon			24th
Last Quarter		03rd	
Planet		Rise	Set
Mercury	1st	07:14	20:44
Mercury	15th	07:36	19:53
Venus	1st	08:56	21:20
Venus	15th	09:26	20:40
Mars	1st	09:37	21:34
Mars	15th	09:32	20:53
Jupiter	1st	21:43	09:45
Jupiter	15th	20:47	08:45
Saturn	1st	09:29	21:44
Saturn	15th	08:42	20:51

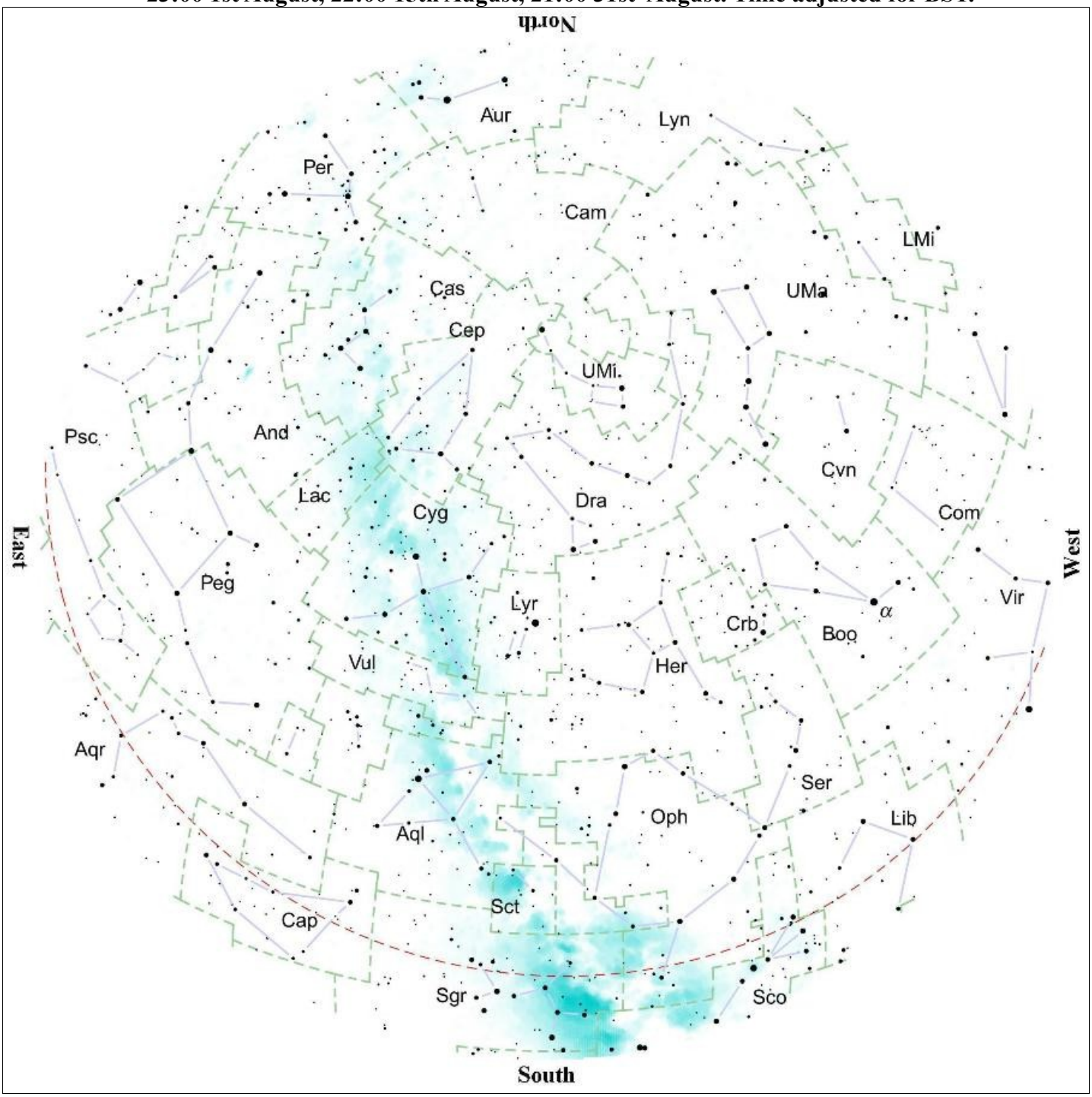
Mercury is not visible this month.
Venus, Mars and Saturn are close together and just above the horizon at sunset at the beginning of the month. By the end of the month only Venus is visible above the horizon after sunset.
Jupiter rises well before midnight now and by the end of the month is visible higher in the south east sky.

M 11 the Wild Duck Cluster in Scutum is a very rich and compact open cluster that is easy to see with binoculars.
Sagittarius has many easy to see nebulae and clusters, although a good view south is necessary. M 8 the Lagoon nebula is easy to see with binoculars. M 16 the Eagle nebula, is a nebula that also contains an open cluster. It is easy to see with binoculars. M 17 the Omega nebula is easy to see eith binoculars and may just be visible with the unaided eye. M 18 is an open cluster easy to see with binoculars. M 22 is the brightest of the globular clusters and was the first one discovered. It can be seen with the unaided eye. M 24 is known as the Sagittarius Star Cloud and is visible to the unaided eye.
Constellations best placed for observing are Lyra, Sagittarius and Scutum.

The Perseid meteor shower is the best known meteor shower. It radiates from the constellation of Perseus. It is active between July 17th and August 24th. At the beginning of August you can expect to see up to 5 meteors and hour. By the 10th this will have risen to about 15 an hour. The maximum is on August 12th where you can expect to see in excess of 100 meteors an hour. This will drop down to about 10 meteors an hour by the 15th then tailing off until the shower ends on the 24th. Unlike last year the moon sets just after sunset so viewing conditions will be excellent if the sky is clear.

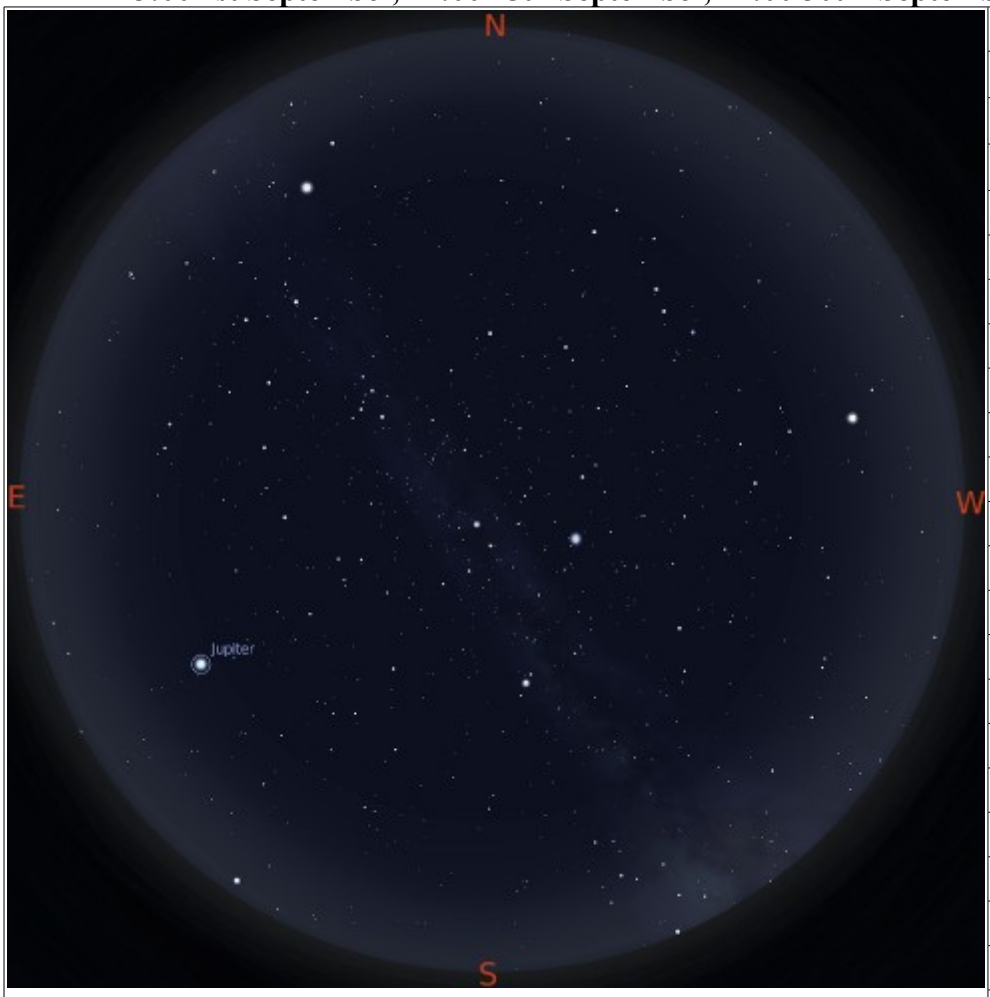
NIGHT SKY AUGUST

23:00 1st August, 22:00 15th August, 21:00 31st August. Time adjusted for BST.



NIGHT SKY SEPTEMBER

23:00 1st September, 22:00 15th September, 21:00 30th September. Time adjusted for BST.



Sun	Rise	Set
1st	06:22	19:57
15th	06:45	19:25
30th	07:09	18:50
Moon	Rise	Set
1st	22:46	15:05
15th	15:39	23:17
30th	22:39	14:39

New Moon		8th
First Quarter		15th
Full Moon		23rd
Last Quarter	1st	

Planet		Rise	Set
Mercury	1st	06:06	18:31
Mercury	15th	04:18	17:48
Venus	1st	09:56	19:48
Venus	15th	10:11	19:01
Mars	1st	09:28	20:03
Mars	15th	09:26	19:24
Jupiter	1st	19:38	07:29
Jupiter	15th	18:40	06:24
Saturn	1st	07:45	19:47
Saturn	15th	07:00	18:55

Mercury is just visible in the east, just before sunrise on the 15th. It should be visible for about half an hour before sunrise for the rest of the month.
Venus is just visible at the beginning of the month, on the horizon after sunset. By the 15th Venus is no longer visible.
Mars is not visible this month.
Jupiter is now visible after sunrise but is low in the sky.
Saturn is not visible this month.

The Autumnal Equinox is on the 23rd of September at 03:09. This is when the sun is directly over the equator, moving from the northern hemisphere to the southern hemisphere.

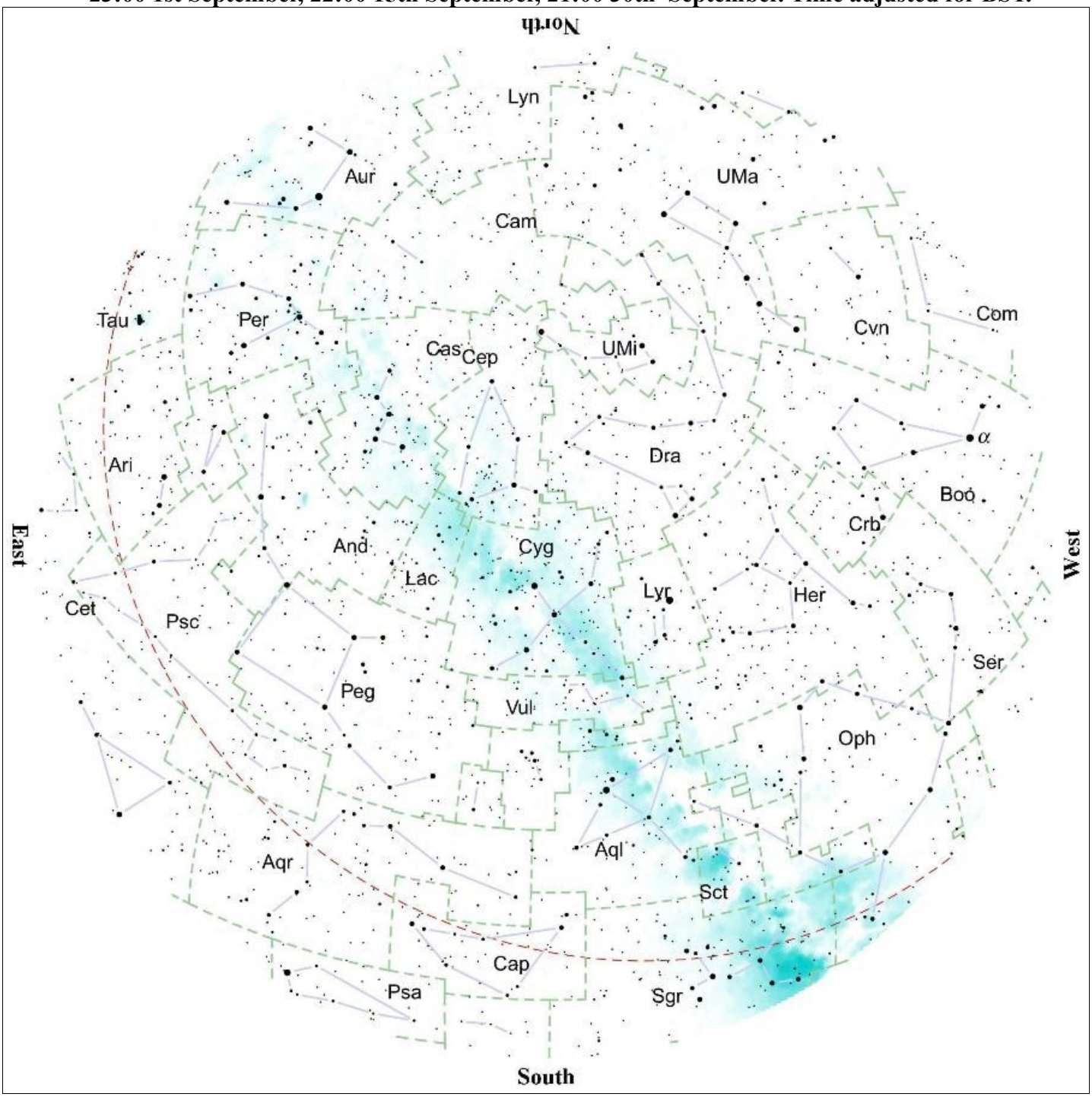
NGC 7000 the North American Nebula in Cygnus is ideally placed for observation this month. Although it is a large nebula it very faint and so is only visible with binoculars and a dark sky. M 29 in Cygnus is an open cluster visible with binoculars.
M 27 the Dumbbell nebula in Vulpecula is a fine object to observe through binoculars.

Constellations best placed for observing are Aquila, Cygnus, Sagitta and Vulpecula.

There are no major meteor showers this month.

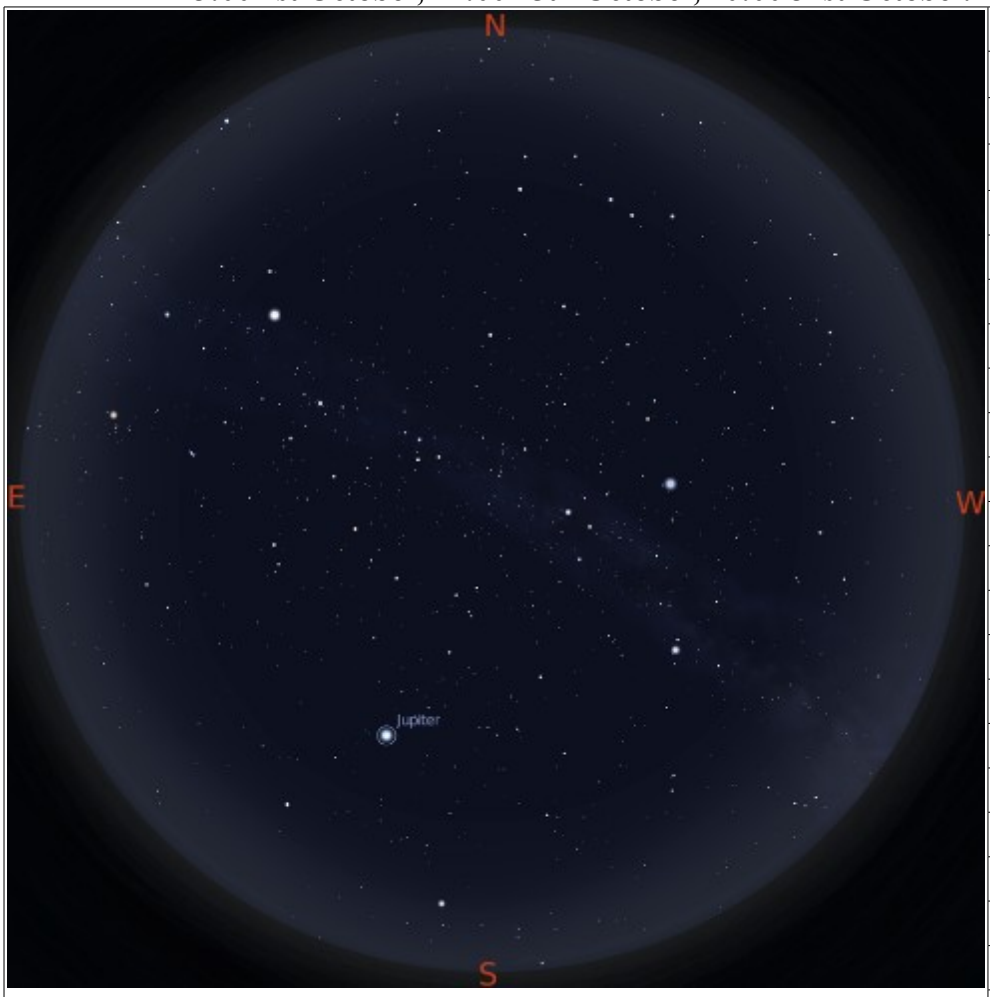
NIGHT SKY SEPTEMBER

23:00 1st September, 22:00 15th September, 21:00 30th September. Time adjusted for BST.



NIGHT SKY OCTOBER

23:00 1st October, 22:00 15th October, 20:00 31st October. Time adjusted for BST.



Sun	Rise	Set
1st	07:10	18:48
15th	07:34	18:17
31st	07:01	16:45
Moon	Rise	Set
1st	23:53	15:31
15th	15:19	00:28
31st	23:21 -30th	13:56

New Moon		7th
First Quarter		14th
Full Moon		23rd
Last Quarter	1st	30th

Planet		Rise	Set
Mercury	1st	05:01	17:35
Mercury	15th	06:28	17:16
Venus	1st	10:02	17:58
Venus	15th	09:10	16:58
Mars	1st	09:26	18:42
Mars	15th	09:27	18:08
Jupiter	1st	17:34	05:09
Jupiter	15th	16:36	04:05
Saturn	1st	06:08	17:55
Saturn	15th	05:23	17:03

Mercury will be just visible for the first few days of the month and then is not visible for the rest of October.
Venus is not visible this month.
Mars is not visible this month.
Jupiter is well placed for observation in the evening sky after the 15th.
Saturn is now a morning object, visible just before sunrise on the 15th and rising an hour before sunrise by the end of October.

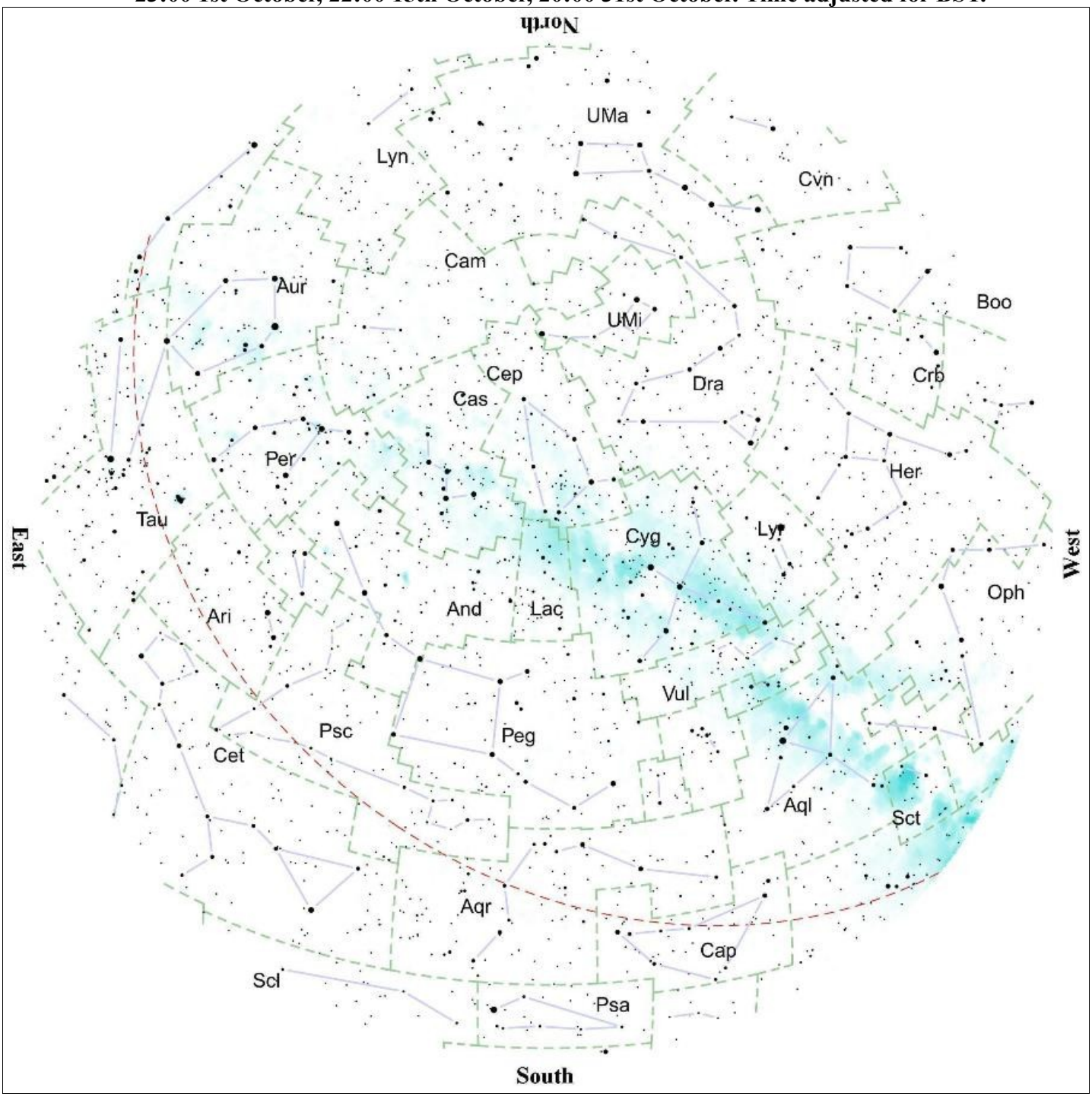
The clocks go back at the end of this month bringing making observing possible from 18:00

M 15 is a globular cluster in Pegasus. Under perfect viewing conditions it is just visible to the naked eye. With binoculars it is easily seen. M2 is a globular cluster in Aquarius. It is easily seen with binoculars.
Constellations best placed for observing are Aquarius, Capricornus, Delphinus, Equuleus and *Microscopium.

The Orionids meteor shower is active from October 2nd to November 5th with the maximum occurring on October the 21st. Unfortunately the moon is almost full and will obscure all but the brightest of meteors. The maximum should produce in excess of 30 meteors an hour, but whether any will be visible is unknown.
The Draconids meteor shower is active from October 6th to October 10th with the maximum occurring on October the 8th at 22:45. Unfortunately a shower is not predicted this year, the next one is in 2011. However as the maximum can occasionally produce hourly rates of 20 – 500 meteors it maybe worth watching just in case there is some activity.

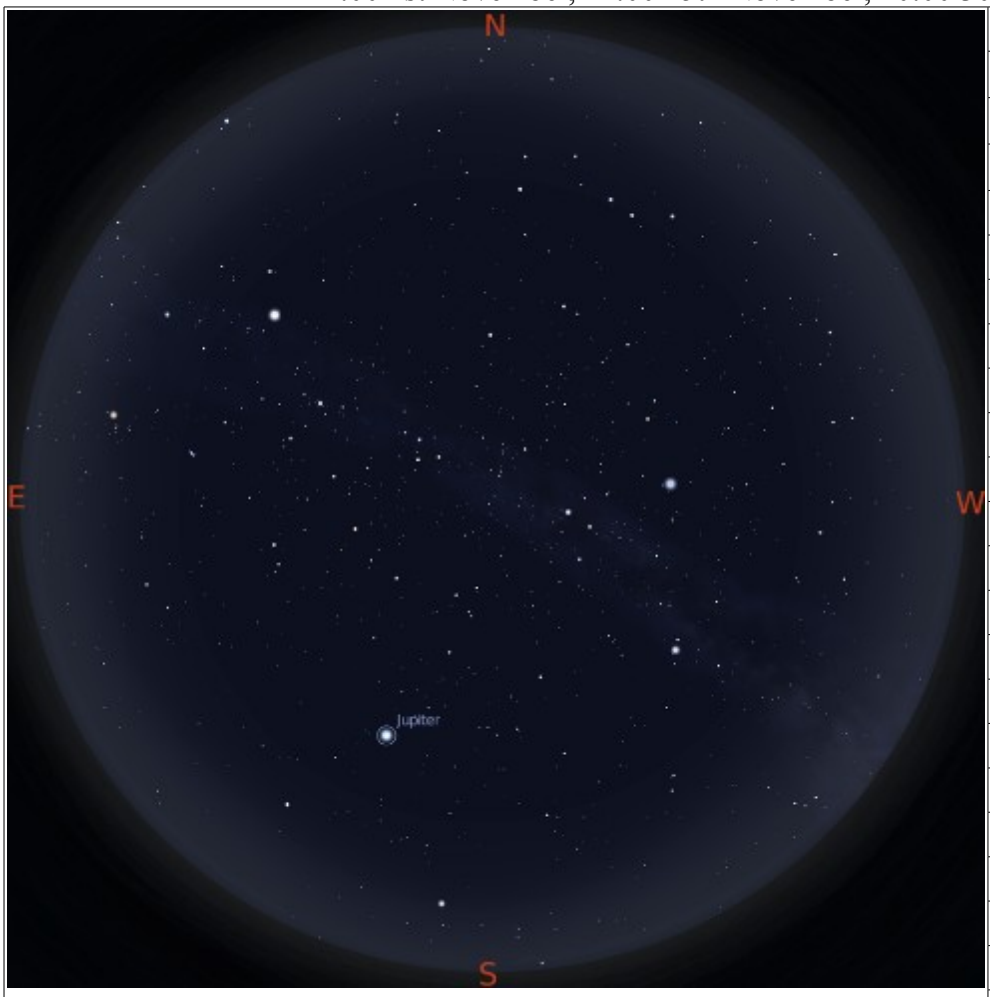
NIGHT SKY OCTOBER

23:00 1st October, 22:00 15th October, 20:00 31st October. Time adjusted for BST.



NIGHT SKY NOVEMBER

22:00 1st November, 21:00 15th November, 20:00 30th November.



Sun	Rise	Set
1st	07:03	16:43
15th	07:28	16:21
30th	07:52	16:05
Moon	Rise	Set
1st	00:44	14:17
15th	13:34	00:38
30th	01:14	13:00

New Moon		6th	
First Quarter		13th	
Full Moon		21st	
Last Quarter		28th	
Planet		Rise	Set
Mercury	1st	08:07	16:53
Mercury	15th	09:18	16:47
Venus	1st	07:00	15:50
Venus	15th	05:19	15:08
Mars	1st	09:28	17:33
Mars	15th	09:29	17:09
Jupiter	1st	15:26	02:50
Jupiter	15th	14:30	01:53
Saturn	1st	04:27	16:00
Saturn	15th	03:40	15:08

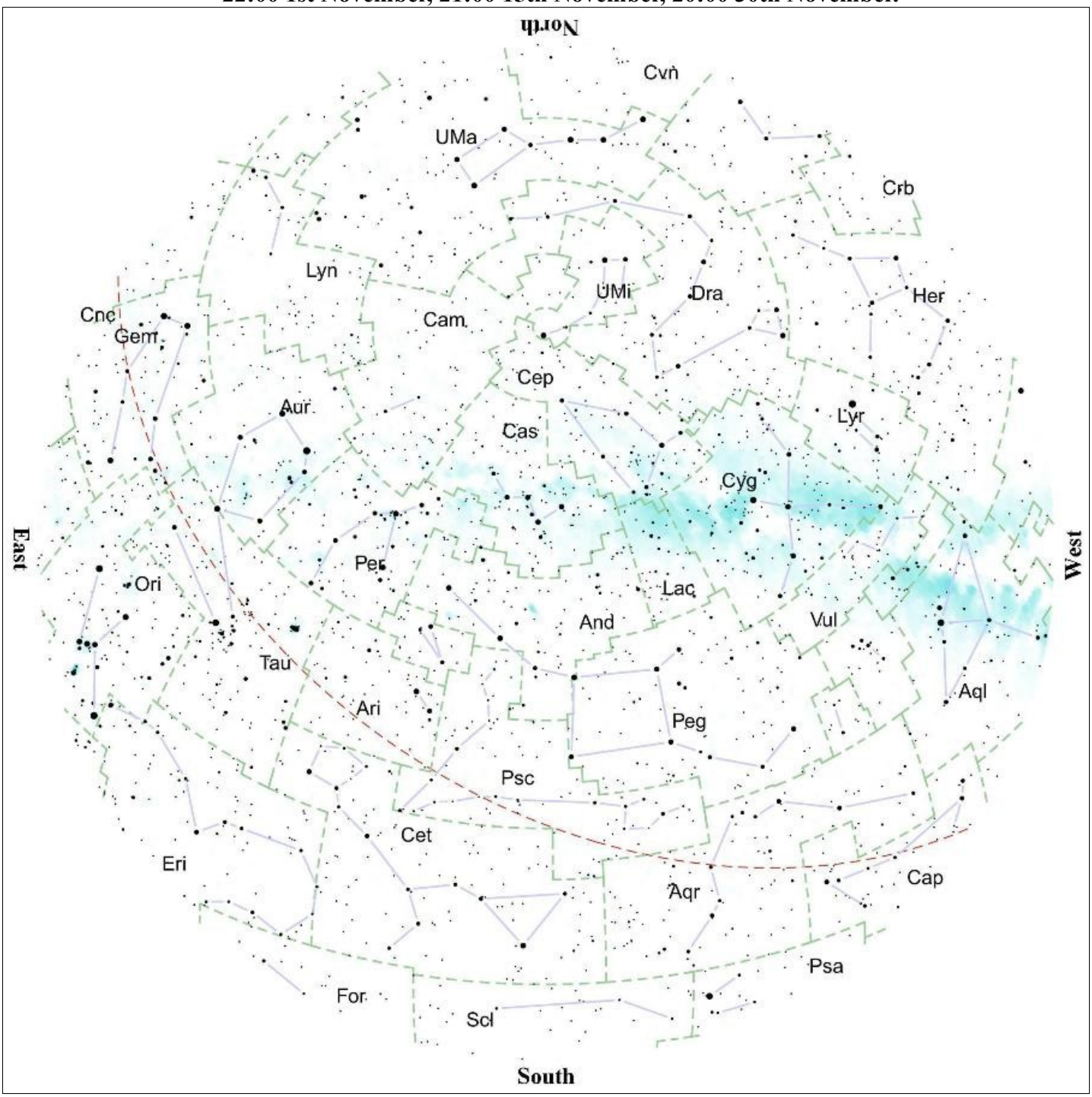
Mercury is not visible this month.
Venus is visible as a bright object in the south east before sunrise,
Mars is not visible this month.
Jupiter is visible after sunset in the south east. On the 15th Jupiter is directly south at 20:00.
Saturn continues to rise earlier in the east before sunrise. In the last week of November it can be seen in the sky with Venus.

M31 the Andromeda Nebula is best placed for observing this month. With the cold evenings and M31 being high in the night sky it is the best chance to see it with the unaided eye. If this proves impossible due to light pollution at your location then it should still be visible through binoculars.
Constellations best placed for observing are Pegasus, Pisces, Piscis Austrinus and *Sculptor.

The Leonids can be the strongest meteor shower of the year and has produced some of the most spectacular meteor showers in history. The shower is active from the 10th to the 23rd of November with the maximum occurring on the 17th. The moon is waxing gibbous but does set before 03:00 which will leave some good observing time before dawn. For me personally this is my favourite shower. I have seen a few fireballs in my time but at about 04:00 on the 19th of November 2002 I observed a brilliant emerald green fireball that has so far surpassed any fireballs I have ever seen.

NIGHT SKY NOVEMBER

22:00 1st November, 21:00 15th November, 20:00 30th November.



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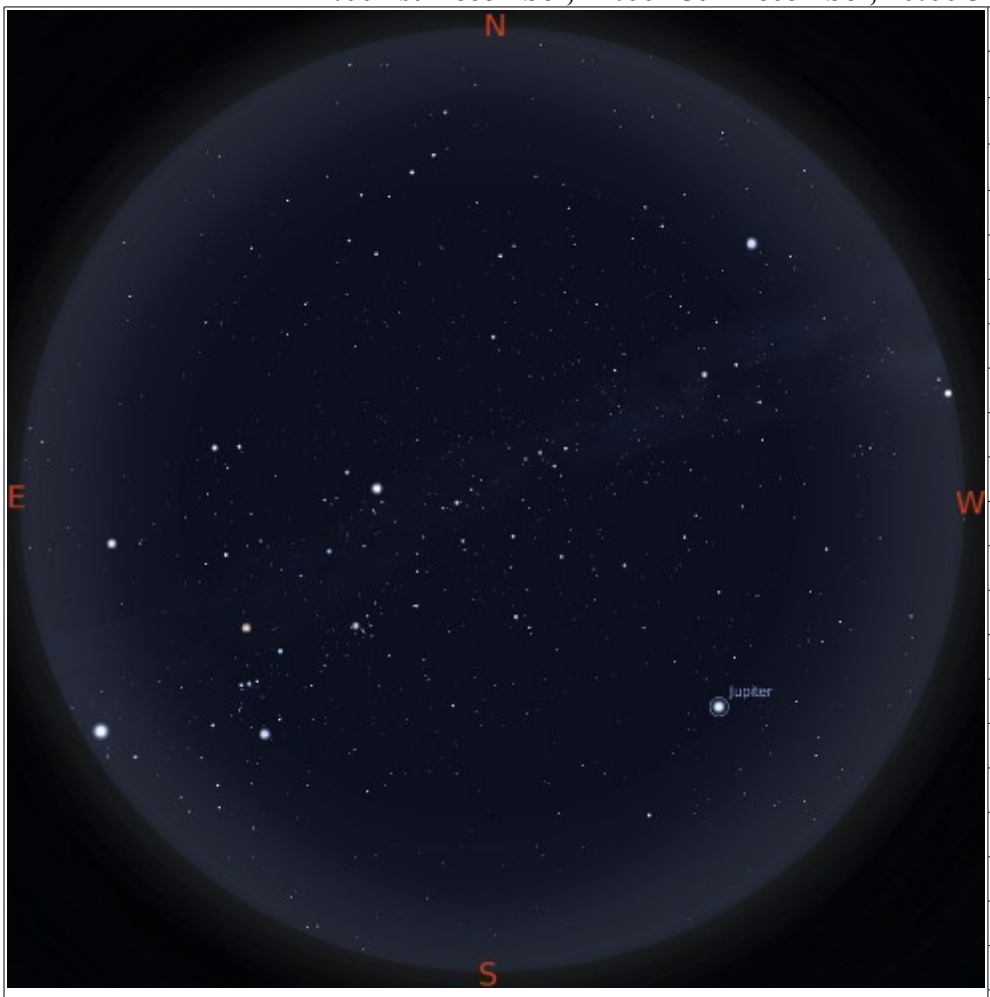
22:00 1st December, 21:00 15th December, 20:00 31st December.



Sun	Rise	Set
1st	07:53	16:05
15th	08:09	16:01
31st	08:16	16:10
Moon	Rise	Set
1st	02:36	13:20
15th	12:26	01:44
31st	04:26	12:47

New Moon		5th	
First Quarter		13th	
Full Moon		21st	
Last Quarter		28th	
Planet		Rise	Set
Mercury	1st	10:01	17:02
Mercury	15th	08:59	16:41
Venus	1st	04:19	14:31
Venus	15th	04:06	14:03
Mars	1st	09:25	16:50
Mars	15th	09:17	16:41
Jupiter	1st	13:27	00:51
Jupiter	15th	12:33	00:02
Saturn	1st	02:46	14:08
Saturn	15th	01:57	13:15

Mercury is not visible this month.
Venus continues to be a bright object in the morning, visible for 2 hours before sunrise throughout the month.
Mars is not visible this month.
Jupiter is high in the south east after sunset, setting just after 23:00 by the end of the month.
Saturn continues to rise earlier each day eventually rising at about 01:00 by the end of December.

The Winter Solstice is on the 21st of December at 23:38. This is the time when the sun is at its farthest south.

M 33 is a spiral galaxy in Triangulum. Under perfect viewing conditions it is just visible to the unaided eye.
NGC 869 and NGC 884 are known as the Double Cluster in Perseus. They are visible to the unaided eye.
Melotte 20 is also known as the Alpha Persei Star Cluster. It makes a fine object to observe through binoculars.
M 34 is an open cluster in Perseus. It is just visible to the unaided eye and easily seen through binoculars.

Constellations best placed for observing are Andromeda, Aries, Cassiopeia, Cetus and Triangulum.

The Geminids are considered to be the most reliable of all the meteor showers. It radiates from the constellation of Gemini and is active between the 7th and 17th of December. Its maximum is on the 14th where the hourly rate can be between 60 and 120 meteors, sometimes even more. The moon which is past its first quarter sets just after midnight leaving the early hours of the morning for observation.
The Ursids radiate just below β Ursa Minor and are active between the 17th and the 26th of December with the maximum occurring on the 22nd. The maximum rate is normally 10 meteors an hour but very occasionally have been known to have bursts of up to 100 an hour. Unfortunately most will be obscured by the full moon.

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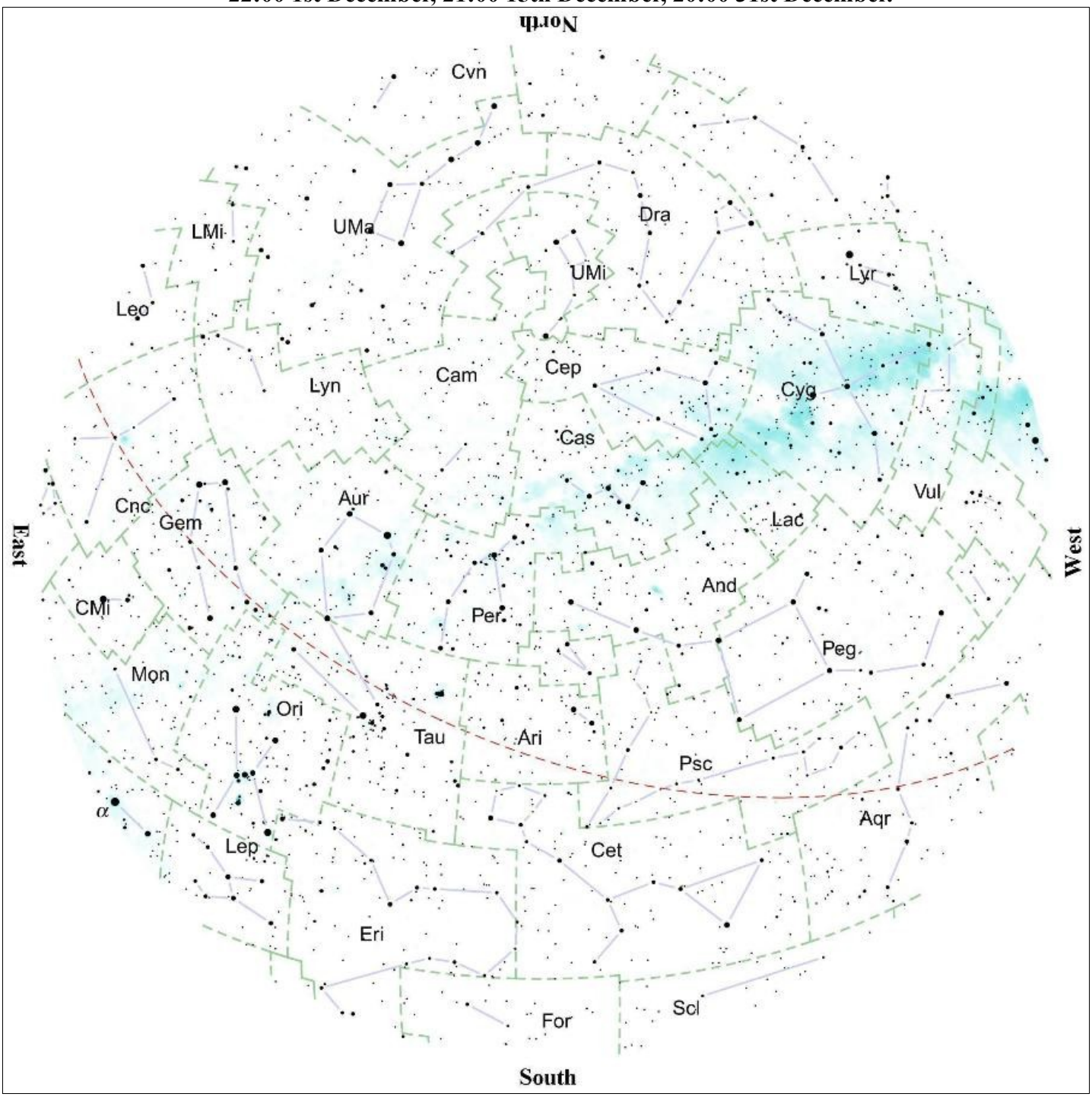

STAR ATLAS

Chart 1. Dec +50 to +90

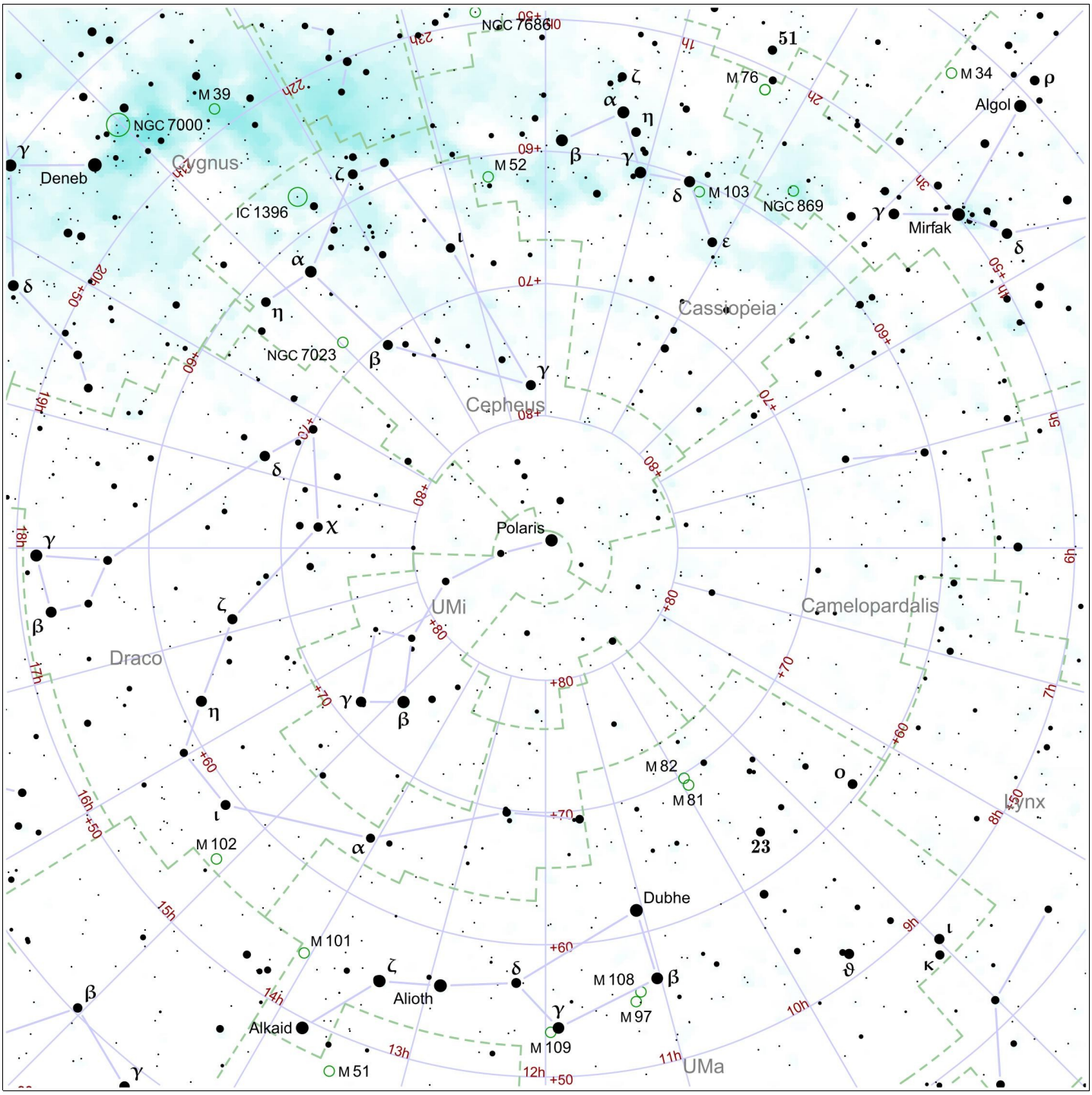

Chart 2. RA 0h to 4h. Dec -50 to +50

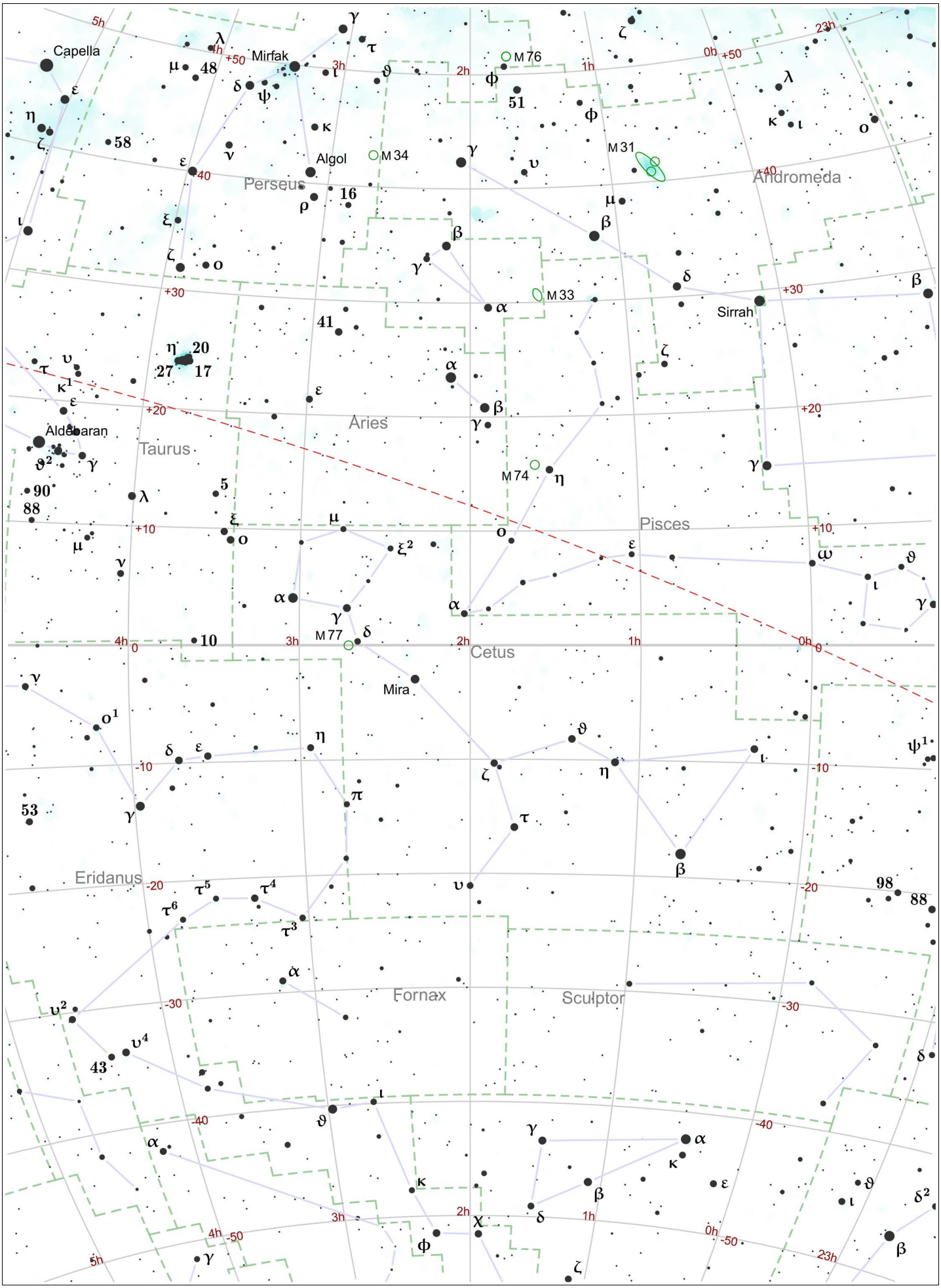

Chart 3. RA 4h to 8h. Dec -50 to +50

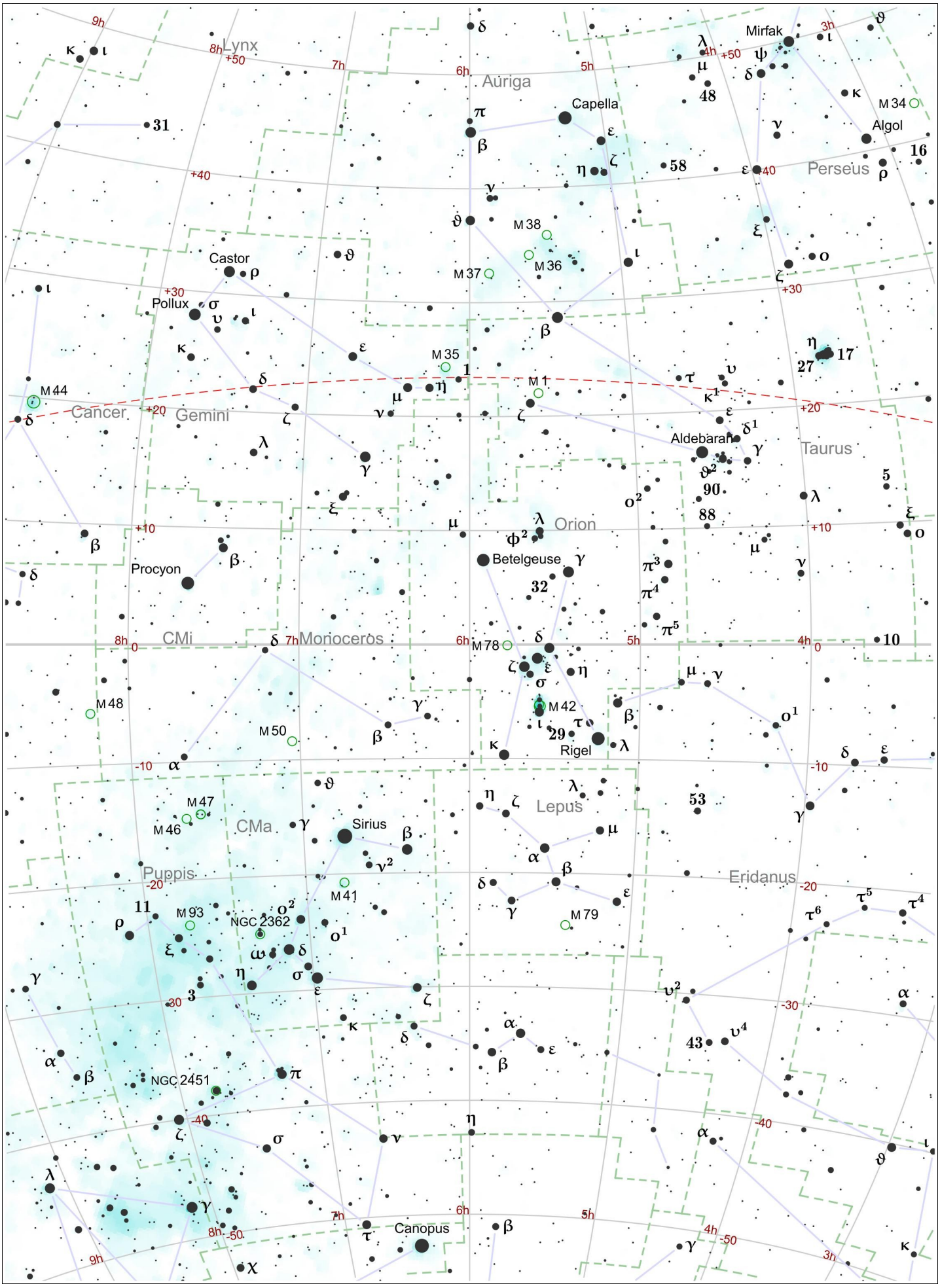

Chart 4. RA 8h to 12h. Dec -50 to +50

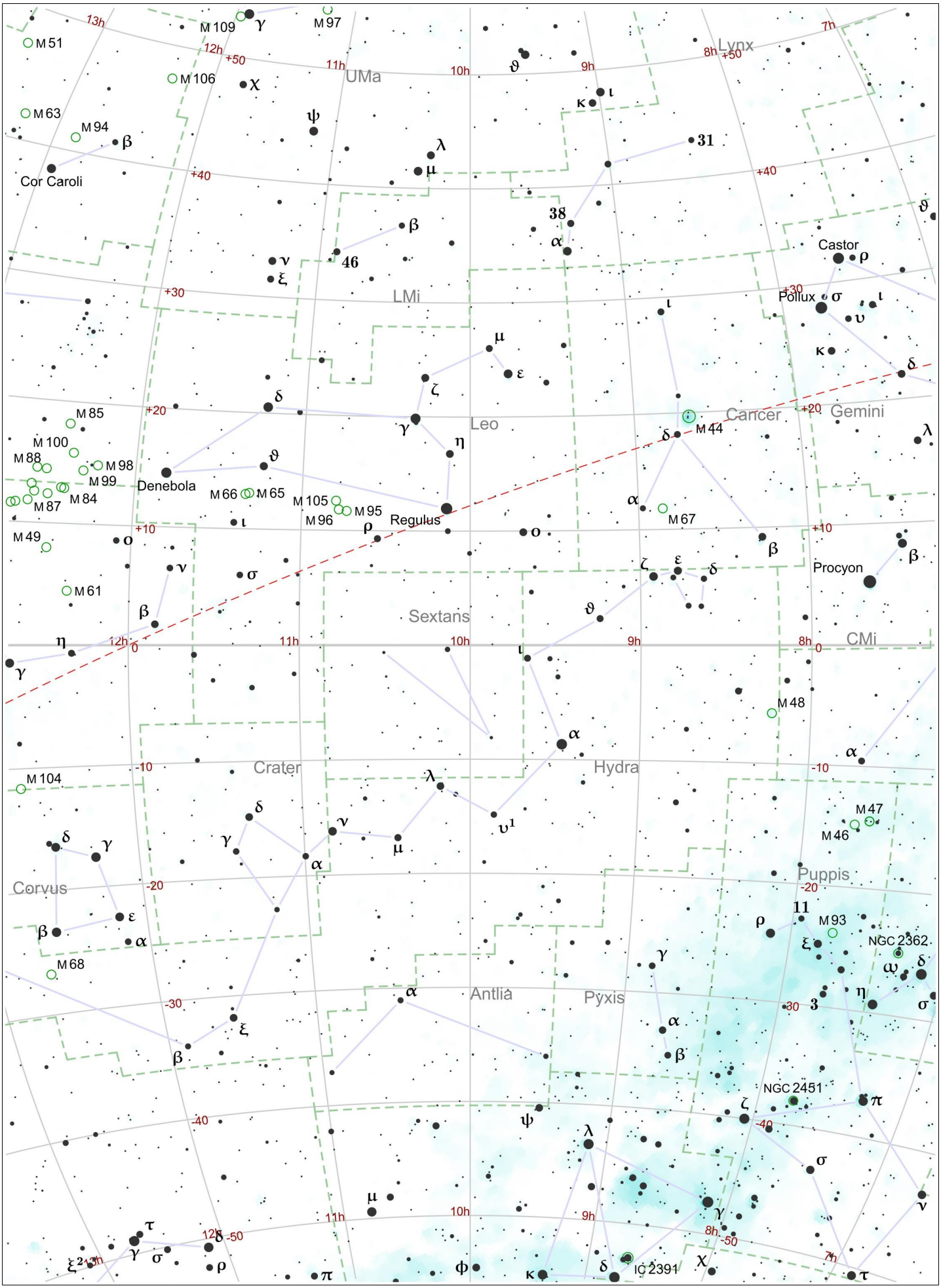

Chart 5. RA 12h to 16h. Dec -50 to +50

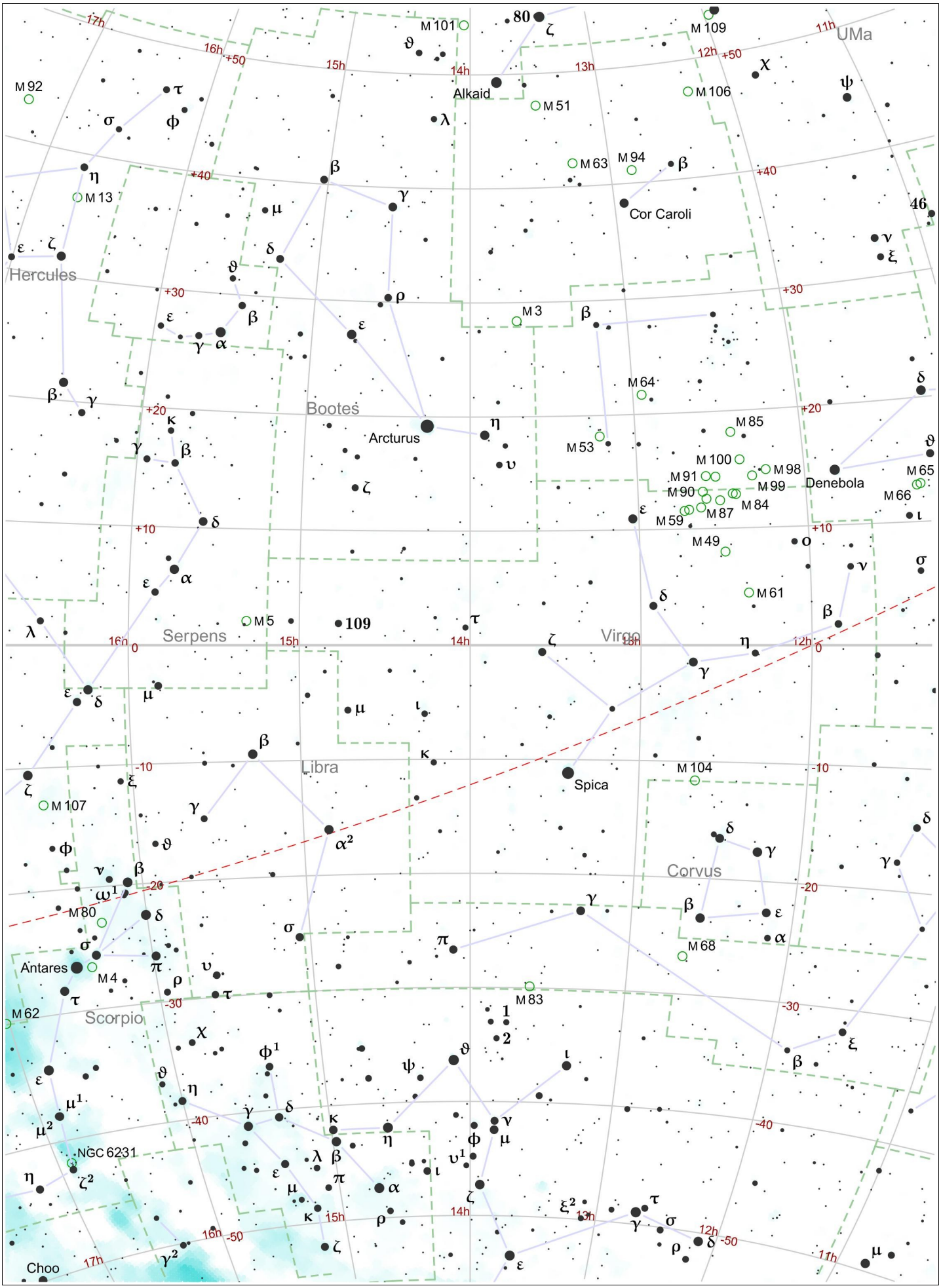

Chart 6. RA 16h to 20h. Dec -50 to +50

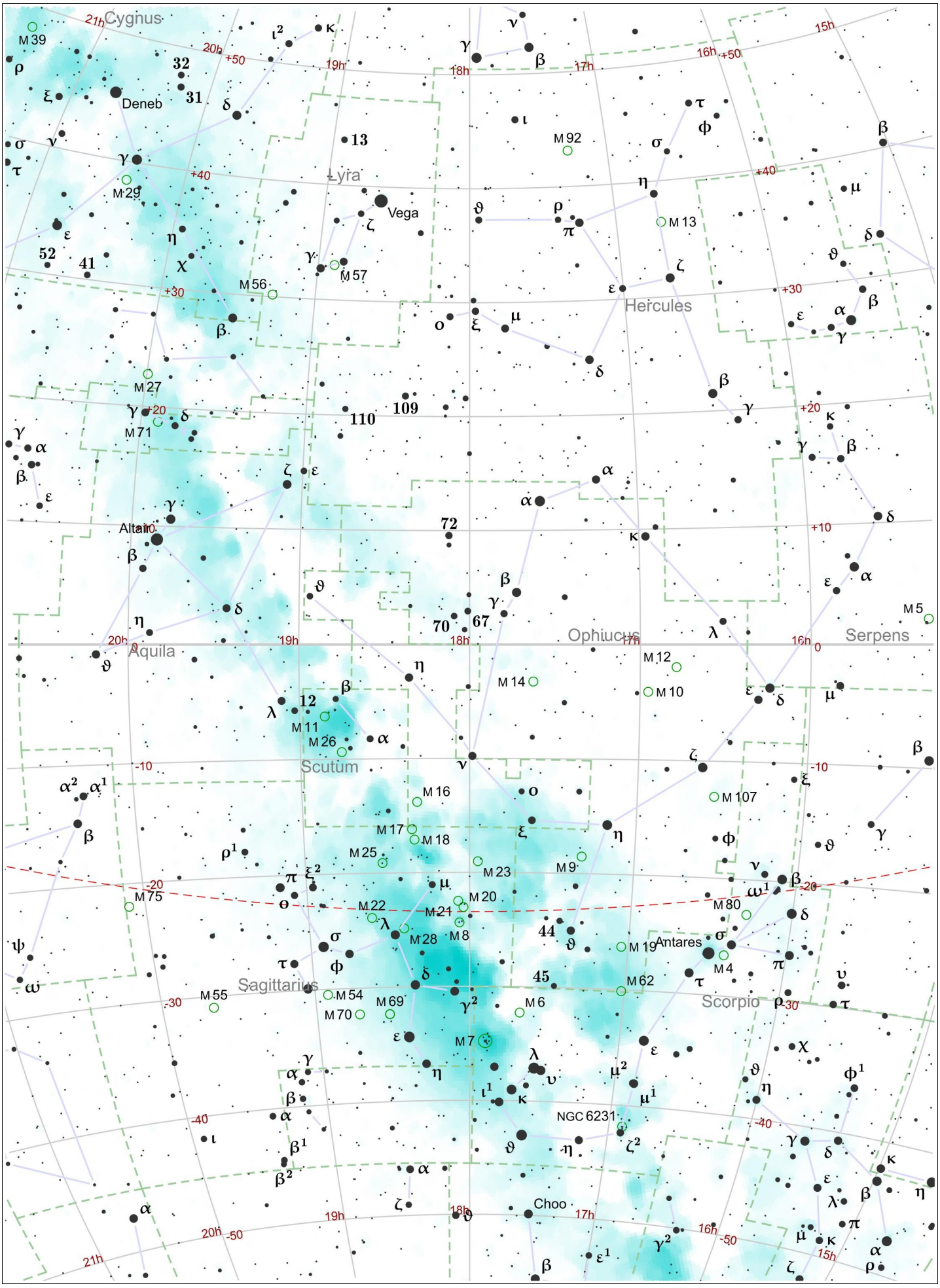

Chart 7. RA 20h to 0h. Dec -50 to +50

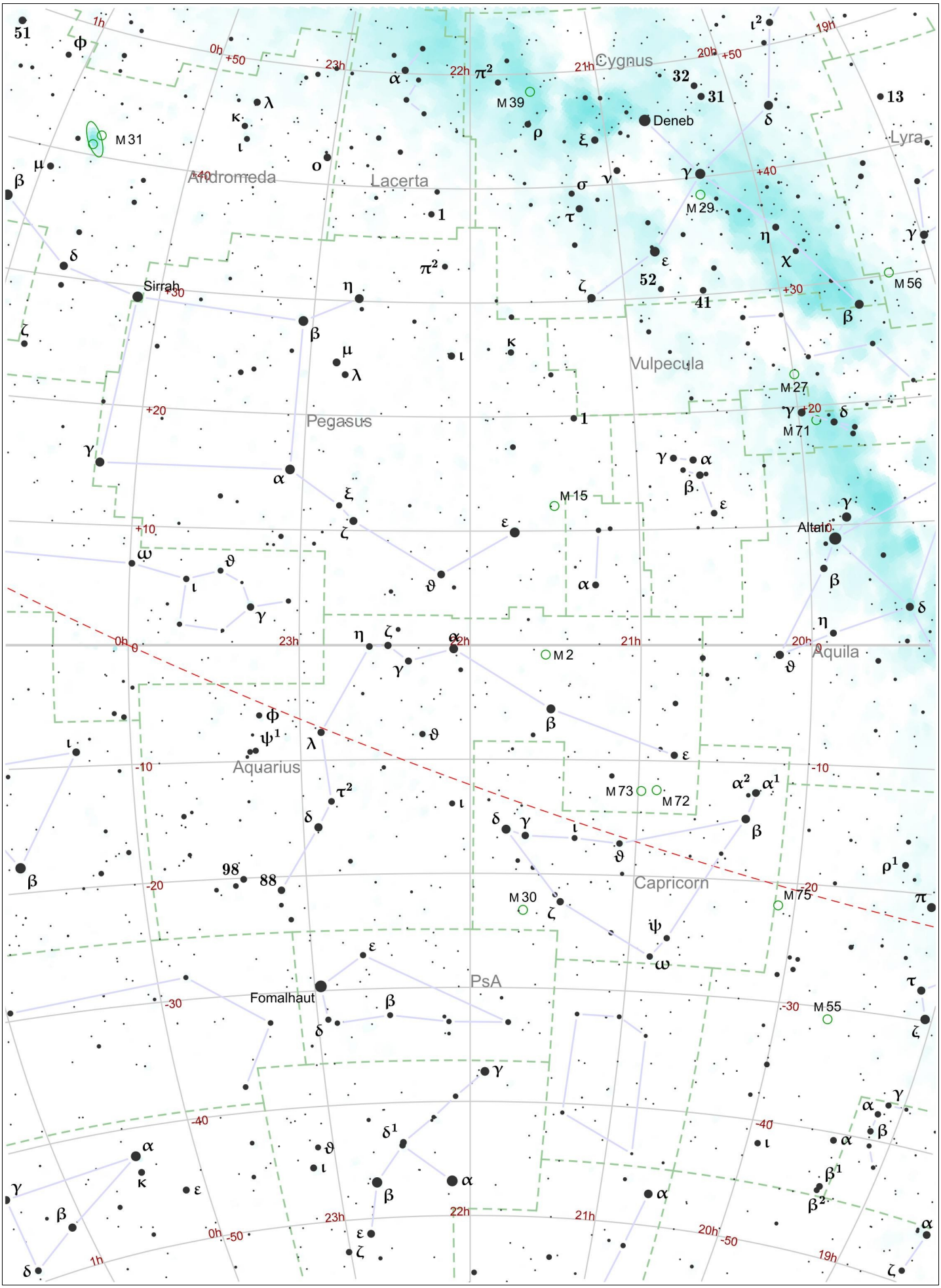

Chart 8. Dec -50 to -90