NEWBURY ASTRONOMICAL SOCIETY
MONTHLY MAGAZINE – MARCH 2021

CHARLES MESSIER AND HIS DEEP SKY CATALOGUE

Charles Messier 1730 - 1817

Astronomers talk a lot about 'M' number this and 'M' number that so what are these 'M' numbers?

The 'M' is short for Messier and refers to in an object from the Messier Catalogue of 'fuzzy' objects. Charles Messier was a French comet hunter who spent much of his life searching for and studying comets. While scanning the night sky, Messier kept finding 'fuzzy' objects that were not stars, looked like comets but did not appear to move like comets.

To avoid confusion Messier made a list of these 'fuzzy' objects so he could avoid them when he was searching for new comets. We now know what these 'fuzzy' objects are. In fact these are the very interesting things that amateur astronomers search out when they start exploring the night sky.

Telescopes in the time of Messier were not as good as the telescopes of today and even telescopes used by many amateurs today are far better than the best telescopes available in the late 1700's. We now know these objects are galaxies, star clusters, nebulae, planetary nebulae and super nova remnants. To Messier these objects were just 'a nuisance' but they are 'the things to search out and see' for us.

We now know that these objects, that we so annoying to Charles Messier, are Deep Space Objects (also called Deep Sky Objects). They are objects that reside beyond the furthest reaches of our Solar System and out to the most distant parts of the Universe.

In the February issue of this magazine we considered our Solar System and the objects that comprise the family of our Sun but now we will consider the Deep Sky and its interesting objects beyond the Solar System.

Deep Sky objects may have been a nuisance to Charles Messier but to the modern amateur astronomer they are the things to look for. We now use Charles Messier's Catalogue to search out the brightest of the interesting objects to look at through our telescopes.

Messier's first catalogue [of these mysterious fuzzy objects] was published in 1774 and listed 45 objects. There are now many other catalogues of deep sky objects such as the New General Catalogue (NGC Numbers) with thousands of objects listed. However the 110 Messier objects are still the things most amateur astronomers start off looking for.

The good thing about these Messier objects is that new astronomers can search them out with their telescopes and see them with their own eyes from their own garden.

NEWBURY ASTRONOMICAL SOCIETY MEETING

5th March	The Solar Cycle
Website:	www.newburyastro.org.uk

NEXT NEWBURY BEGINNERS MEETING

17th March	The Messier Catalogue
Website:	www.naasbeginners.co.uk

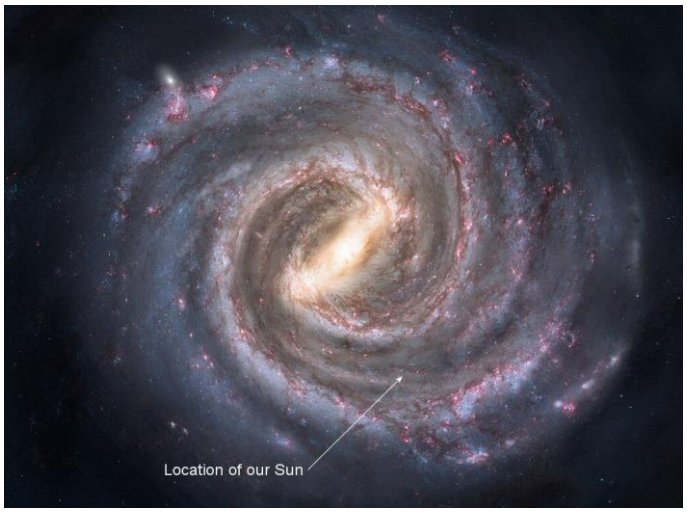
TABLE OF THE MESSIER OBJECTS

The objects shown in orange are possibly misidentified

NUM	CONSTELLATION	Object and Remarks	NUM	CONSTELLATION	Object and Remarks
M.01	Taurus	Supernova remnant	M.56	Lyra	Globular cluster
M.02	Aquarius	Globular cluster	M.57	Lyra	Planetary Ring Nebula
M.03	Canes Venatici	Globular cluster	M.58	Virgo	Galaxy type Sb
M.04	Scorpio	Globular cluster	M.59	Virgo	Galaxy type E3
M.05	Serpens	Globular	M.60	Virgo	Galaxy type E1
M.06	Scorpio	Open cluster naked-eye	M.61	Virgo	Galaxy type Sc
M.07	Scorpio	Open cluster	M.62	Ophiuchus	Globular cluster
M.08	Sagittarius	Lagoon Nebula	M.63	Canes Venatici	Spiral galaxy
M.09	Ophiuchus	Globular cluster	M.64	Coma Berenices	Galaxy Black-Eye
M.10	Ophiuchus	Globular cluster	M.65	Leo	Galaxy type Sa
M.11	Scutum	Open cluster Wild Duck	M.66	Leo	Galaxy type Sb
M.12	Ophiuchus	Globular cluster	M.67	Cancer	Open cluster
M.13	Hercules	Naked-eye Globular	M.68	Hydra	Globular cluster
M.14	Ophiuchus	Globular cluster	M.69	Sagittarius	Globular cluster
M.15	Pegasus	Globular cluster	M.70	Sagittarius	Globular cluster
M.16	Serpens	Nebula + cluster	M.71	Sagitta	Open cluster
M.17	Sagittarius	Nebula Omega	M.72	Aquarius	Globular cluster
M.18	Sagittarius	Open cluster	M 73	Aquarius	Asterism of stars
M.19	Ophiuchus	Globular cluster	M.74	Pisces	Galaxy
M.20	Sagittarius	Nebula Triffid Nebula	M.75	Sagittarius	Globular cluster
M.21	Sagittarius	Open cluster	M.76	Perseus	Planetary
M.22	Sagittarius	Globular cluster	M.77	Cetus	Galaxy
M.23	Sagittarius	Open cluster	M.78	Orion	Nebula
M.24	Sagittarius	Open cluster	M.79	Lepus	Globular cluster
M.25	Sagittarius	Open cluster	M.80	Scorpio	Globular cluster
M.26	Scutum	Open cluster	M.81	Ursa major	Galaxy type Sb
M.27	Vulpecula	Planetary Dumb-Bell	M.82	Ursa major	Galaxy irregular
M.28	Sagittarius	Globular cluster	M.83	Hydra	Galaxy type Sc
M.29	Cygnus	Open cluster	M.84	Virgo	Galaxy type E1
M.30	Capricornus	Globular cluster	M.85	Coma Berenices	Galaxy type Ep
M.31	Andromeda	Great Spiral Galaxy	M.86	Virgo	Galaxy type E3
M.32	Andromeda	Galaxy M31 companion	M.87	Virgo	Galaxy type Eo
M.33	Triangulum	Galaxy type Sc..	M.88	Coma Berenices	Galaxy type Sb
M.34	Perseus	Open cluster	M.89	Virgo	Galaxy type So
M.35	Gemini	Open cluster naked eye	M.90	Virgo	Galaxy type Sc
M.36	Auriga	Open cluster	M.91	Coma Berenices	Galaxy
M.37	Auriga	Open cluster	M.92	Hercules	Globular cluster
M.38	Auriga	Open cluster cruciform	M.93	Puppis	Open cluster
M.39	Cygnus	Open cluster	M.94	Canes Venatici	Spiral Galaxy
M.40	Ursa Major	Double star	M.95	Leo	Galaxy type SBb
M.41	Canis Major	Open cluster naked eye	M.96	Leo	Galaxy type Sa
M.42	Orion	Nebula the Great nebula	M.97	Ursa major	Planetary Owl Nebula
M.43	Orion	Nebula (part of M42)	M.98	Coma Berenices	Galaxy type Sb
M.44	Cancer	Open cluster Praesepe.	M.99	Coma Berenices	Galaxy type Sc
M.45	Taurus	Open cluster Pleiades	M.100	Coma Berenices	Galaxy
M.46	Puppis	Open cluster	M.101	Ursa Major	Spiral galaxy
M.47	Puppis	Open cluster naked-eye	M.102	Not confirmed might	be NGC 5866
M.48	Hydra	Open cluster	M.103	Cassiopeia	Star cluster
M.49	Virgo	Galaxy type E4	M.104	Virgo	Galaxy
M.50	Monoceros	Open cluster none	M.105	Leo	Galaxy
M.51	Canes Venatici	Spiral galaxy Whirlpool	M.106	Canes Venatici	Galaxy
M.52	Cassiopeia	Open cluster	M.107	Ophiuchus	Star cluster
M.53	Coma Berenices	Globular cluster	M.108	Ursa Major	Galaxy
M.54	Sagittarius	Globular cluster	M.109	Ursa Major	Galaxy
M.55	Sagittarius	Globular cluster	M.110	Andromeda	Galaxy

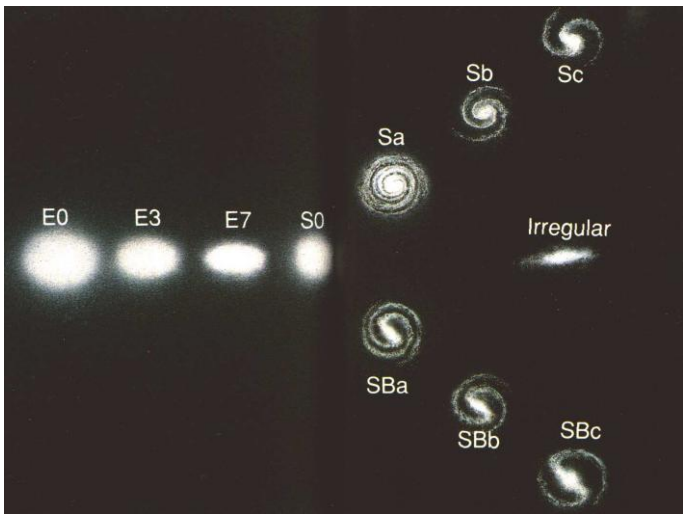
MESSIER DEEP SKY OBJECTS – GALAXIES

Galaxies are huge conglomerations containing billions of stars. All stars that we know about are located or were formed within galaxies. Some stars could be found outside galaxies but they are likely to have been ejected from a galaxy. All the stars we see in our night sky are in our own galaxy that we call 'The Milky Way'.



An artist's impression of our Galaxy

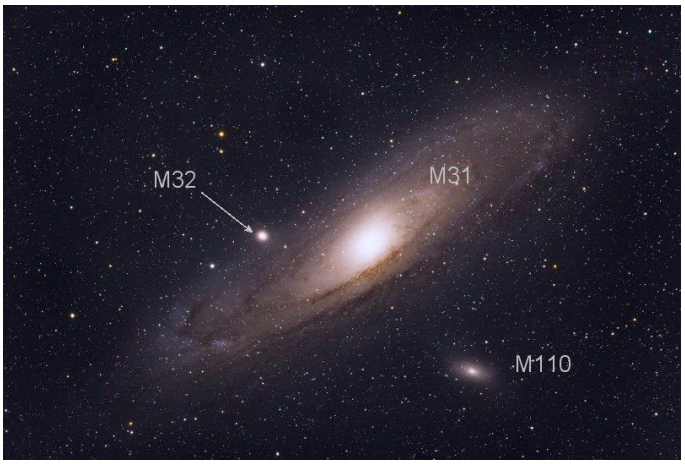
There are many different types of galaxy but they are divided into four main classes based on their apparent shape. The shapes are grouped as Elliptical, Spiral, Barred Spiral and Irregular. Spiral and Barred Spiral galaxies are further divided into three subdivisions a, b and c depending on how tightly the arms are wound. They are therefore referred to as Sa, Sb and Sc or SBa, SBb and SBc. Elliptical galaxies have seven subdivisions ranging from E0 for those that appear spherical to E7 for those that are rather cigar shaped.



The classes of galaxies

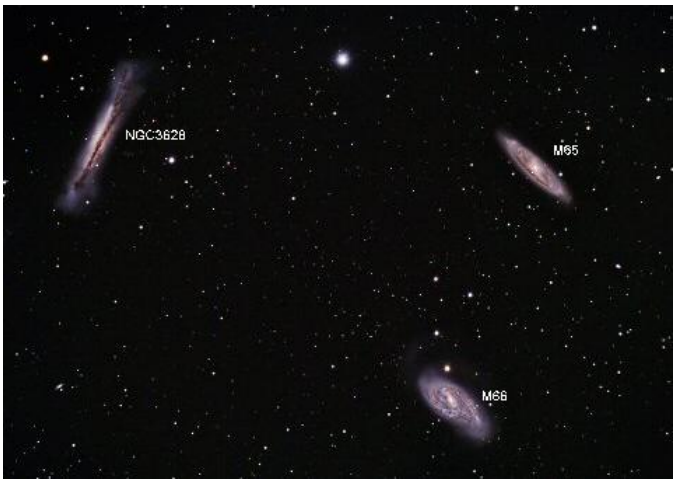
Spiral galaxies are usually large and have a bright central ball of stars with curved arms spreading out from the ball to form a flat disc. Some of the brighter Messier galaxies are M31 in Andromeda and M65, M66, M95 and M96 in Leo. M110 is a small spiral and M32 is a rare Dwarf Elliptical, both are gravitationally associated with M31. See the image of M31 below.

Some Elliptical galaxies are the largest of all galaxies and the Irregular galaxies tend to be the smallest with the very smallest being called Dwarf Galaxies.



M31 Imaged by George Sallit

M31 is the closest and brightest spiral galaxy and can just about be seen as a small smudge of light with the naked eye in a clear dark sky. It can be seen as a small cigar shaped patch of fuzzy light using a good pair of binoculars. However a telescope is needed to see it well and the bigger the telescope the better it will appear.



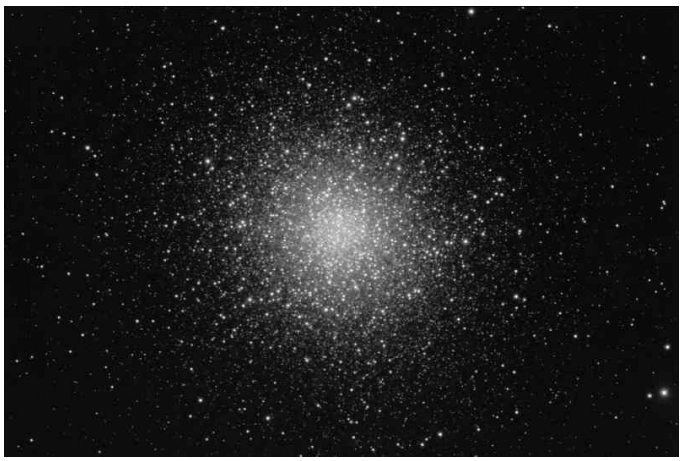
M65, M66 and NGC3628 in Leo

All the other galaxies do require a telescope and a dark sky to see. There are four Messier galaxies in Leo these are: M65, M66, M95 and M96. These can be seen using a 100mm refractor or a 130mm reflecting telescope but will need a clear dark sky. One of the loveliest galaxies to see is M51 in Canes Venatici and located just off the end of the 'handle' of Ursa Major (the Plough). This is two galaxies that have had a close encounter.

Colliding galaxies M51 imaged by John Napper

MESSIER DEEP SKY OBJECTS – GLOBULAR STAR CLUSTERS

Globular Clusters are spherical clusters of stars that appear as a tight spherical ball of between about ten thousand and a million stars. These clusters are found in spiral galaxies but are not situated in the main disc of the spiral arms. They form a halo above and below the main disc of the galaxy orbiting around the central nucleus and even pass through the spiral arms. M13 in Hercules is the brightest example in our sky.



The Great Globular Cluster M13 in Hercules

Globular clusters are comprised of very old stars with some appearing to be even older than the galaxy they are found in. Globular Clusters are thought to be the dense cores of small galaxies that have ventured too close to Giant Spiral Galaxies like our own Milky Way. Our Galaxy has about 100 Globular Clusters and our closest Giant Spiral Galaxy M31 has about 200. The image of part of M31 below has 64 Globular Clusters that have been identified and labelled.

M31 with 64 Globular Clusters labelled

All Giant Spiral Galaxies have smaller satellite galaxies associated with them and are gravitationally controlled by the much larger spiral. Satellite galaxies M32 and M110 are shown on the picture of M31 on the previous page. These smaller galaxies have orbits that may take them closer to the giant spiral where the strong gravity can pull off the outer stars that are more weakly controlled by the smaller galaxy. Eventually only the dense cores of these small galaxies are all that is left.

Our Galaxy also has some satellite galaxies and two are bright and are prominent in the southern hemisphere sky. They are called the Small and Large Magellanic Clouds and can be seen in the image below. These small galaxies appear to have had a close encounter in the past because a trail of stars can be seen between them. In the distant future these Satellites may become Globular Clusters orbiting our Milky Way.

The Small and Large Magellanic Clouds

A good pair of binoculars will allow the brighter Globular Clusters to be seen. A small telescope will show the dense brighter central core of the closer globular clusters but a larger telescope will be able to reveal the outer stars as individual stars.

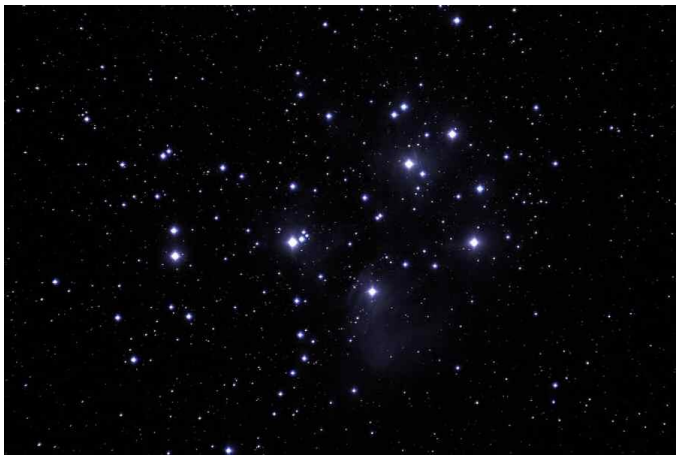
M5 in the constellation of Serpens

The next best Globular Clusters to look out for are M3 in Canes Venatici, M5 in Serpens (shown above) and M15 in Pegesus (shown below). M3 in the constellation of Canes Venatici is another good one.

M15 in the Constellation of Pegasus

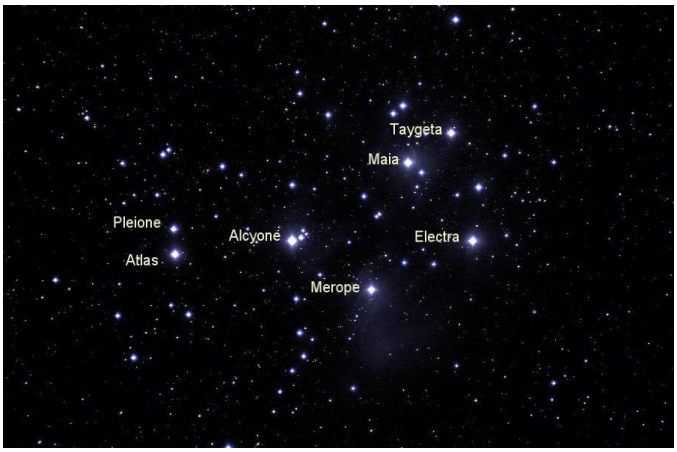
MESSIER DEEP SKY OBJECTS – OPEN STAR CLUSTERS

Open Star Clusters are groups of between a few tens to a few thousand stars that have formed together from a collapsing cloud of gas and dust called a Nebula. See M16 on page 6. When stars form in a nebula they start their life as very active stars with a powerful wind of radiation blasting out into the surrounding space. This 'Solar Wind' eventually pushes the remaining gas and dust away to reveal a cluster of new stars. As millions of years pass the stars gradually move further apart until the cluster is dispersed. M45 'The Pleiades' (Seven Sisters) in Taurus is one of our closest and most beautiful open clusters.



M45 The Pleiades Open Cluster in Taurus

M45 is the brightest and most impressive of the many Open Clusters that are included Charles Messier's Catalogue. Anyone with reasonably good eyesight will be able to count the six or seven brightest stars in the cluster on a clear night. Initially the cluster may look like a small fuzzy cloud but with a deeper study the individual stars can be seen. We can see the brightest stars (with good eyesight including Pleione the most difficult) that are called the Seven Sisters. Binoculars will show the cluster at its best with more than thirty stars visible. There are about 300 stars in total that can be seen using a telescope but only a small number of stars can be seen in the smaller field of view of a telescope so the pattern of the cluster will be lost.



M45 The Pleiades (Seven Sisters named) in Taurus

It is almost certain that our own star, the Sun, was formed in a nebula. It would also have been a member of an open cluster but over the past 4.3 billion years the stars have drifted so far apart we cannot tell which stars were our Sun's siblings.

Another naked eye open cluster is M44 in Cancer is beautiful to see. It can be seen in a dark sky on a clear night but the stars are not as bright as those in M45 and more spread out. Binoculars will show the cluster at its best with more than forty stars visible.

M44 the Beehive cluster in Cancer

M44 is called The Beehive Cluster because 4 or five of the brightest stars can appear to look like an old straw bee hive. The rest of the cluster is said to look like bees flying around the beehive.

There are many other open clusters to search out but they really need binoculars to pick them out. There is a rather nice line of three open clusters in the constellation of Auriga these are M36, M37 and M38. A telescope is required to see them as individual stars. There is a forth open cluster M35 in Gemini that almost appears to be in the same line as the three in Auriga.

M35 in Gemini and NGC2168 (to the right)

M35 is the best of the four and has what appears to be a string of stars running through it, see the image above. All the stars in the cluster are related but the string of stars is just a 'line of sight' effect. There is another open cluster to the upper right of M35 but it appears much smaller and fainter. This is called NGC2168 and was too faint to be seen by Charles Messier in the 1700's. It is much further away than M35 and therefore appears smaller. It is listed in the New General Catalogue of Deep Sky objects. There are many more Open Clusters listed in the New General Catalogue (NGC).

MESSIER DEEP SKY OBJECTS - NEBULAE

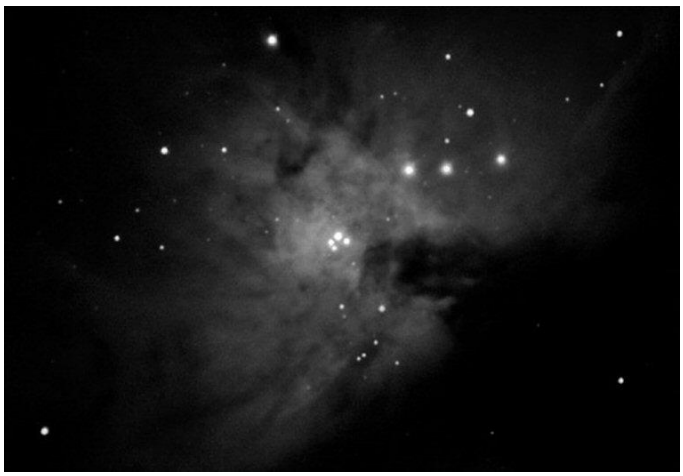
Stars form in vast clouds of gas and dust, called Nebulae (singular Nebula) that are located in the arms of Spiral Galaxies. Galaxies are huge rotating discs of stars, gas and dust where hundreds of billions of stars form. The spiral arms of these galaxies are created by shock waves of star formation moving through the nebulae. These shock waves stir up the gas and dust causing the atoms to swirl around and be drawn together by gravity.

Denser clumps of gas develop that pull in more gas and dust as they grow and their gravity increases. These dense clouds begin to spin and form into a flat disc of rotating gas and dust.

M16 the Eagle Nebula imaged by Hubble

Nebulae (plural, the singular is Nebula) are huge clouds of gas and dust mainly found in the arms of spiral galaxies. Most of the gas in these clouds is Hydrogen but there are often traces of other elements. There are two main types of nebula these are called Reflection Nebulae and Emission Nebulae. As the names suggest they either reflect light from neighbouring stars or emit light from the gas within them. The image above shows M16 the Eagle Nebula with the 'Pillars of Life' star forming 'pillar shaped' clouds in the Nebula.

The gas in a Nebula is dark and largely invisible so the only parts we can see are the areas lit up by stars within the Nebula. In the picture of M42 below, light from the stars is being reflected off the nebulosity around the stars.



M42 showing the four stars of the Trapezium

M42 is just a part of a vast cloud of gas and dust that pervades the whole area around the constellation of Orion. The constellation of Orion is located in the direction that we are looking away from the centre of our Galaxy 'the Milky Way'. M42 is just a small part of the Nebula that is illuminated by stars forming within M42.

Light is also emitted by the gas in the cloud when it has been hit by the radiation from the four large powerful and very active stars called the Trapezium. The image opposite shows the Trapezium superimposed on M42. Photons of mainly ultraviolet radiation from the stars of the Trapezium are absorbed by the atoms of the nebula.

Messier 42 (M42) the Great Orion Nebula

To absorb this additional energy an electron jumps from its normal orbit around the nucleus to a higher orbit. The atom will become unstable so the electron will quickly jump back to its original orbit. To enable this to happen, the atom must release the excess energy it has absorbed. It does this by radiating a flash of light photons. Light is always emitted at the same wavelength (colour) from an atom of a particular element. For example Hydrogen always emits a red light photon as can be seen above in the images on this page.

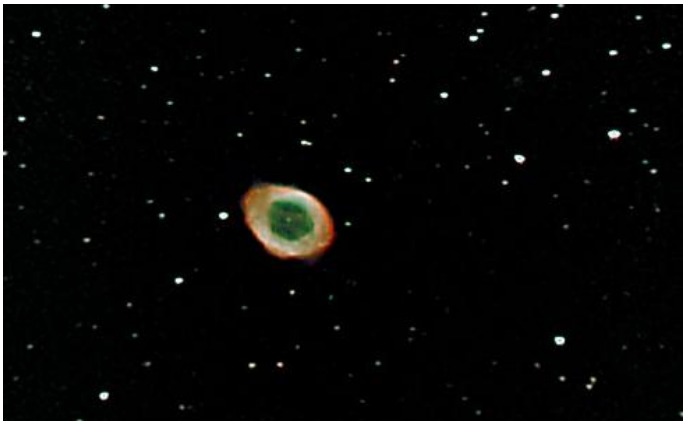
Most Nebulae (with the exception of M42) are difficult to see and need a telescope. There are a few that can be seen but they generally need a good dark sky and a very clear night. With the use of modern astronomical cameras very detailed images of nebulae can be produced. The Horse Head Nebula close to Messier 42 is one of the most imaged features as it is silhouetted against part of M42 in the Orion Nebula.

The Horse Head 'dark' Nebula in M42

MESSIER DEEP SKY OBJECTS - PLANETARY NEBULAE

A Planetary Nebula is the remains of a star of about the same size as our Sun and nothing to do with planets at all. After about ten billion years the Hydrogen that has powered the star would have run out. The outer parts of the star then became inflated like a giant balloon. Eventually the outer parts of the star drifted off into space and formed a huge bubble. As we look through the bubble we see more material through the edge so it appears more like a ring.

The Ring Nebula M57 in Lyra is the most famous. The White Dwarf star that is the remains of the original star can be seen in the centre of M57 below and in the image of NGC6543 in the next column. The interesting thing about Planetary Nebulae is we can see what will happen to our star the Sun as it reaches the end of it 'life'.



Messier 57 (M57) the Ring Nebula in Lyra

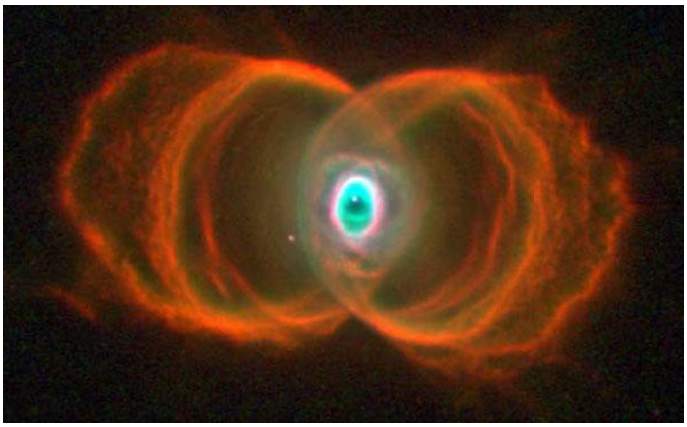
Most Planetary Nebulae are small and faint and require a telescope to see them. M57 is one of the closest to us and consequently is also the brightest. It can be seen using a small telescope and looks like a small 'smoke ring'. A telescope will not show any of the beautiful colours only photographic images can show colours.

Perhaps the largest Planetary Nebula to see is M27 in the constellation of Vulpecula in the Summer Triangle. It may be large for a Planetary Nebula but it is quite faint and requires a dark and clear sky to see.

M27 the Dumbbell Nebula

M27 can be seen using large binoculars or a small to medium telescope using a low power eyepiece. It will appear as a misty patch of light with two brighter lobes. Its common name is the Dumbbell Nebula but it looks more like a butterfly. Colour with only be seen in photographs.

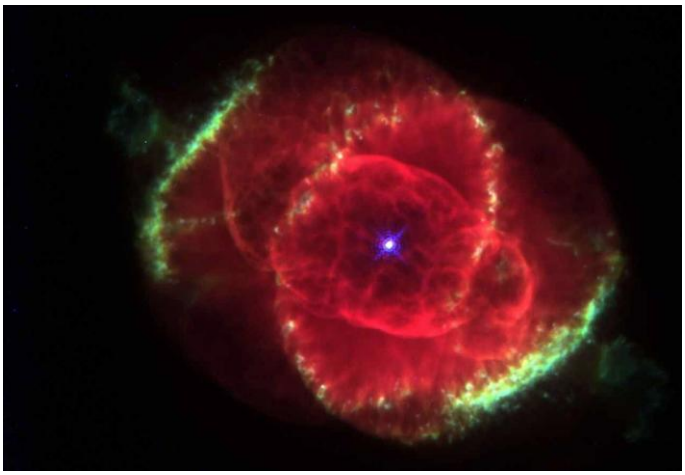
Many planetary nebulae look like a smoke ring but others may have very beautiful and intricate shapes. It is common for some planetary nebulae to have two lobes and look like an hourglass or a butterfly.



The Hourglass Nebula imaged by Hubble

The Hourglass Nebula is a faint nebula approximately 8,000 light-years away from Earth in the Musca constellation. It was discovered in the early 20th century by Annie Jump Cannon and Margaret W. Mayall and listed this nebula for the first time in the Henry Draper Catalogue as MyCn18.

Many images from Hubble and other large and expensive telescopes are very beautiful but beyond the range of our 'first' telescope but we can see then in all their glory online or in books and magazines. The Eskimo Nebula NGC 2392 is one of the most famous.



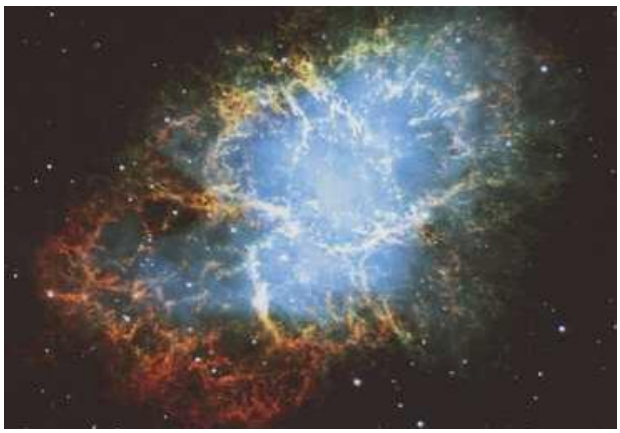
The Cat's Eye Nebula imaged by Hubble NGC6543

Many of these Planetary Nebulae have intricate and very beautiful structure that can be seen in astro-images produced by amateur astronomers using fairly modest equipment. There are only three Planetary Nebulae listed in Charles Messier's Catalogue (M27, M57 and M76) but there are a good number of Planetary Nebulae listed in the New General Catalogue (NGC). The Cat's Eye Nebula NGC6543 is a good example.

Most Planetary Nebulae are faint and difficult to see using a small telescope or even a larger amateur astronomer's larger telescopes. However M27 and M57 are possible to see in most telescopes. Even though they may look small and faint it is still well worth searching them out to see them with your own eye using your own telescope from your own garden.

MESSIER DEEP SKY OBJECTS – SUPERNOVA REMNANTS

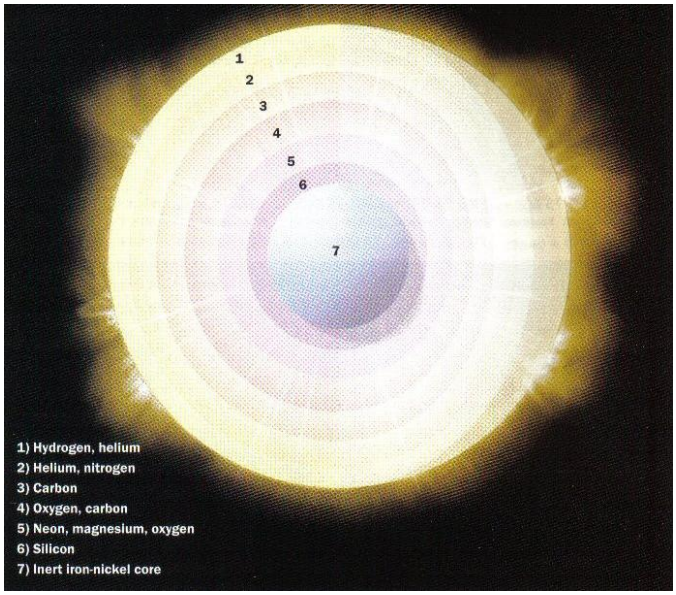
One particular type of dying star called a Super Nova produces a different fuzzy patch. This is created when a giant star about five or more times the mass of our Sun reaches the end of its existence. The star becomes very unstable until it eventually explodes and completely destroys itself. The super nova remnant known as the Crab Nebula, in Taurus, is the first entry in Messier's Catalogue and is therefore designated as Messier 1 (M1).



Messier 1 (M01) the Crab Nebula

The Crab Nebula Supernova exploded about 7000 years ago but its light took about 6000 years to reach Earth. A new star (Nova) was seen in the sky in the year 1054 and was recorded by Chinese astronomers. It was bright enough to be seen in the bright daytime sky. It is still possible to see M1 using a larger pair of binoculars or a smaller telescope but it does require a clear dark sky away from light pollution.

Stars with mass greater than 4 or 5 Suns will have much more gravity to compress and heat the atoms in their core. The core will have so much heat and pressure that the Helium created by fusion of Hydrogen atoms also begins to fuse into heavier and heavier elements. Each stage of fusing will create additional energy that will push the outer layers out against the force of gravity. The star will develop into a Super Hot Giant.



The sequence in which elements build up in the core

The main elements created in the core are in sequence: Helium, Nitrogen, Carbon, Neon, Magnesium, Oxygen, Silicon, Nickel and finally Iron.

These Giant stars are so violent in nature that they become unstable so they pulsate and vary in brightness. With Nuclear Fusion creating heavier elements, each elementary phase produces its own energy from the process. As each heavier element is produced the overall energy output of the star increases. This increases the outward thrust from the radiation which overpowers the inward force of gravity. The outer layers of the star are pushed outwards and the star expands to become a Red Supergiant.

As the Iron in the core builds up the star becomes more unstable because the production of the Iron does not produce any additional energy. At some point the Nuclear Fusion Process will breakdown and stop. Without the radiation energy pushing outwards the force of gravity causes the core to collapse inwards.

As the outer layers hurtle in and on to the collapsed core the pressure and temperature increase very rapidly. The huge increase in pressure and temperature causes a massive runaway Nuclear Fusion explosion to tear through the collapsing star. The massive star is torn apart in a gigantic Supernova explosion.

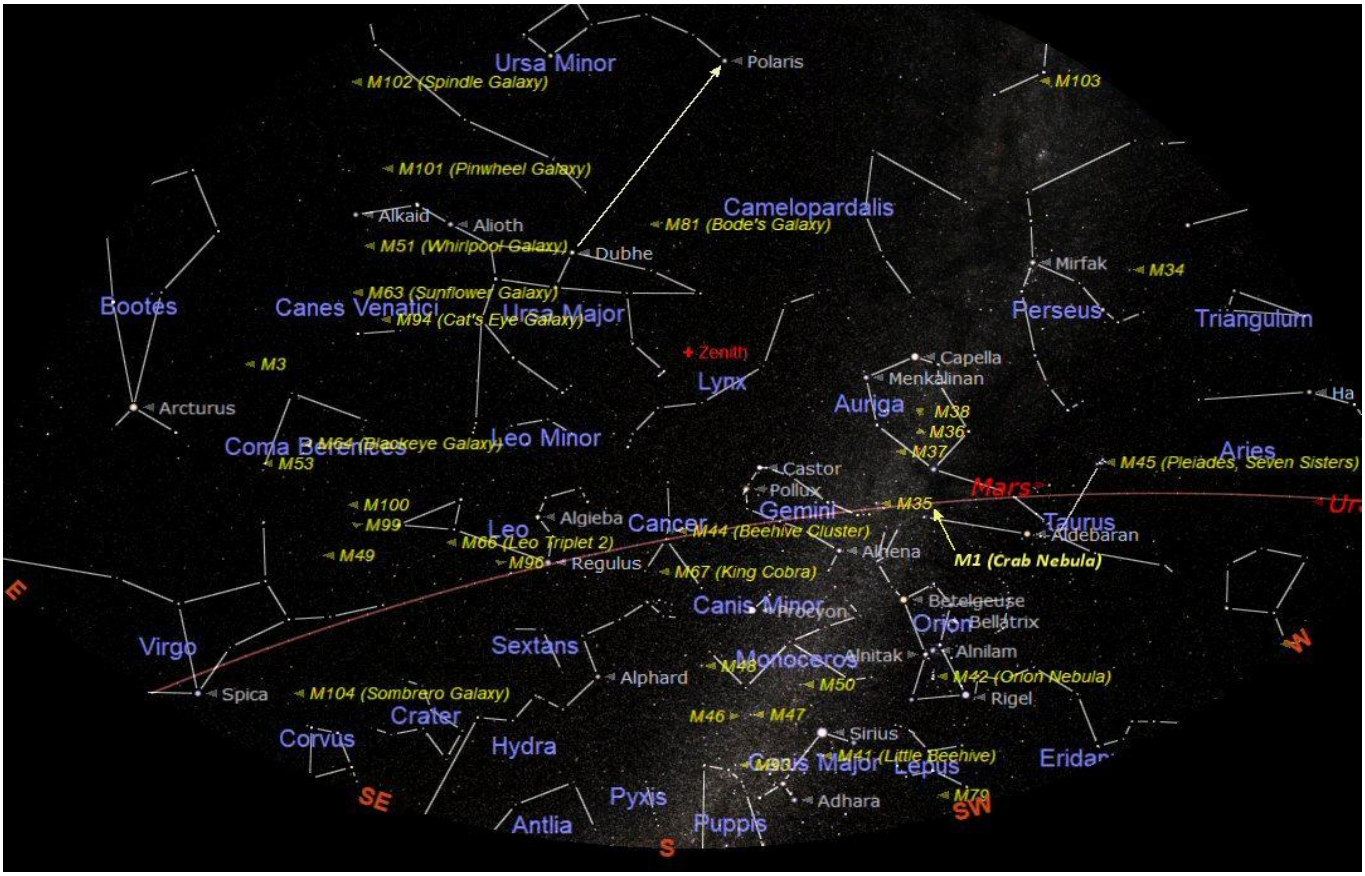
In the Supernova explosion the outer parts of the star are blown away into space. The core is compressed by the explosion and is driven inwards until it is crushed to the size of a White Dwarf. The maximum size and mass of a White Dwarf is dictated by its Electron Degeneracy Pressure. This is the force acting between its atoms that stops it collapsing further.

However if the collapsing core has a mass greater than 1.4 times the mass of our Sun the Electron Degenerate Pressure will be overcome. The core will continue to collapse down to a diameter of about 25 kilometres. The collapse will be halted at this size if its Mass does not exceed four to five times the mass of our Sun and a Neutron Star will be formed.

The Veil Nebula – Supernova Remnant

With the passage of time over the course of many thousands of years the expansion of the gas and dust blasted into space by the explosion dissipates. The filaments that can be seen in M1 will become long faint wisps spread across vast distances of space. The Veil Nebula in the constellation of Cygnus is one such ancient super nova remnant. It is very faint so it needs a large telescope to see its filaments and is best seen in images that bring out the detail.

A TOUR OF THE NIGHT SKY - MARCH 2021



The chart above shows the night sky looking south at about 20:00 GMT on 15th March. West is to the right and east to the left. The point in the sky directly overhead is known as the Zenith and is shown (in red) at the upper centre of the chart. The curved brown line across the sky at the bottom is the Ecliptic or Zodiac. This is the imaginary line along which the Sun, Moon and planets appear to move across the sky. The brightest stars often appear to form a group or recognisable pattern; we call these 'Constellations'.

Constellations through which the ecliptic passes this month are Aquarius (the Water Carrier), Pisces (the Fishes), Aries (the Ram), Taurus (the Bull), Gemini (the Twins), Cancer (the Crab), Leo (the Lion) and Virgo (the Virgin).

Moving over the south western horizon is the constellation of Aries (the Ram). Aries is rather faint and indistinct but it is worth finding this month because the planet Uranus is located within its boundaries. Uranus can just be seen using binoculars but it looks like a slightly blue 'fuzzy' star using a telescope.

High in the south west is the constellation of Taurus (the Bull). The most obvious star in Taurus is the lovely Red Giant Star called Aldebaran. It appears slightly orange to the 'naked eye' but it is very obviously orange when seen using binoculars or a telescope. Aldebaran is located at the centre of the 'flattened' X shape formed by the brightest stars in Taurus. It appears to be in a cluster of stars known as the Hyades but it is not a true member and is much closer to us.

The bright orange planet Mars is in Taurus but is now looking smaller as it moves further away from us. At the end of the top right (upper west) arm of the 'X' of Taurus is the beautiful 'naked eye' Open Star Cluster Messier 45 (M45) known as the Pleiades (or the Seven Sisters). It really does look magnificent using binoculars. Just above the star at the end of the lower left arm of the 'X' is the faint Supernova Remnant Messier 1 (M1) the Crab Nebula. This exploding star was seen as a bright new star in 1054 and can still be seen as a faint patch of light using a medium telescope in a dark and clear sky.

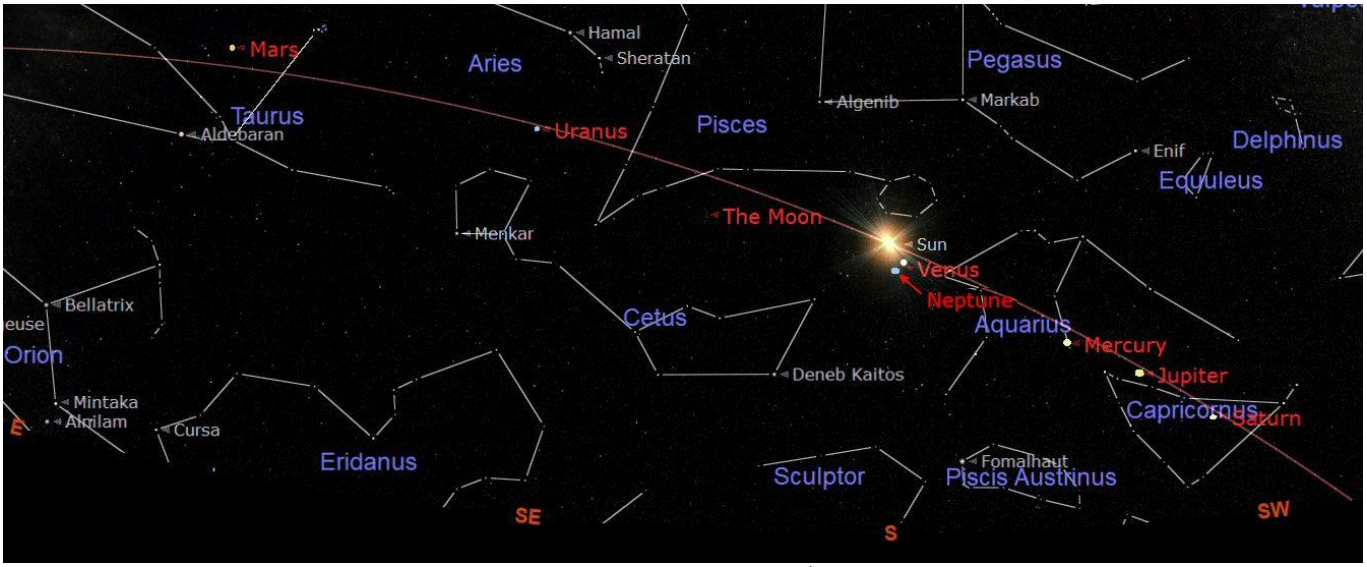
Following Taurus is the constellation of Gemini (the Twins). The two brightest stars in Gemini are Castor and Pollux that are named after mythological twins. To the north of Taurus is the odd pentagon shape of Auriga (the Charioteer). Dominating Auriga is the brilliant white star Capella which is almost directly overhead. For those with a telescope there is a line of lovely open clusters to search out in Taurus and Auriga. These are M35 in Taurus and M36, M37 and M38 in Auriga.

To the east (left) of Gemini is the rather indistinct constellation of Cancer (the Crab). The stars of Cancer are quite faint and can be difficult to discern especially in a light polluted sky. It is really worth searching out Cancer using binoculars or a telescope to see the Open Cluster M44 (the Beehive Cluster). M44 is older and further away than M45 (the Seven Sisters) so is fainter than M45 but still looks lovely. It has a group of stars that resemble an old straw Beehive with bees around it.

To the south of Taurus and Gemini is the spectacular constellation of Orion (the Hunter). Orion is one of the best known constellations and hosts some of the most interesting objects for us amateur astronomers to seek out. Orion was the constellation of the month last month.

The constellation of Leo (the Lion) follows Cancer along the Ecliptic and will be the constellation of the month next month. It does actually look a little like a lion or the Sphinx in Egypt.

THE SOLAR SYSTEM - MARCH 2021



The planets at midday on 15th March

MERCURY will be rising just before the Sun low in the east this month and will be very difficult to see. The smallest planet will be close to Jupiter and Saturn as they rise in the bright dawn sky.

VENUS is now too close to the Sun and will not be visible. It is moving towards the Sun and into Superior Conjunction (behind the Sun) on 25th March 2021. It will emerge into the early evening sky in the west.

MARS is still well positioned in the evening sky for observing and will be in the south as the sky darkens. However it is getting smaller at about 5.8 arc-seconds as Earth pulls further away from it. Mars will be around until May but will be moving closer to the south western horizon and appearing smaller. After it has moved over the horizon we will not see it again for two years.

JUPITER will not be visible this month as it moving out from its conjunction with the Sun on 29th January so is hidden in the glare of the sky just before the Sun rises. From March onwards it will be worth getting up in the early hours to see it rising in the South East from about 05:30. Jupiter and Saturn will move further away from the Sun during the year and will be at their best for observing in August. Jupiter will be at opposition on 20th August.

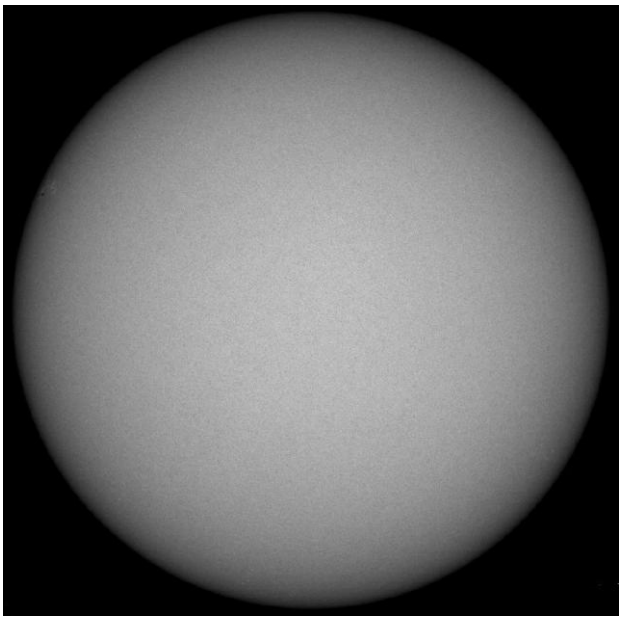
SATURN will be even more difficult to see than Jupiter in the bright early morning sky. The ringed planet rises just before Jupiter in the South West at about 05:00. It is moving into the early morning sky before sunrise after its conjunction with the Sun on 24th January. Saturn will be at its best this year on 2nd August when it will be at opposition and will be due south at midnight.

URANUS will be more difficult to find and will really need a telescope. This month it will be in the south west and sets at about 22:00.

NEPTUNE will not be visible this month as it will be moving into conjunction with the Sun on 11th March. It will reappear in the morning sky after conjunction.

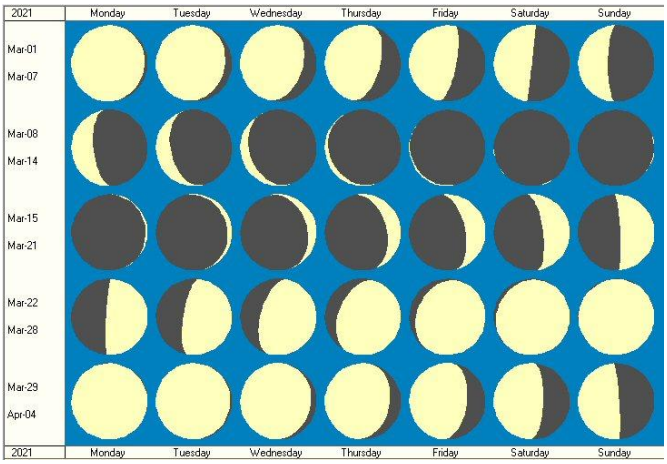
THE SUN

The Sun rises at about 06:35 at the beginning of the month and 05:50 at the end. It sets at 17:45 at the beginning of the month and 18:20 at the end. There have been very few Sunspots recently.



The Sun imaged by SOHO on 19th February

THE MOON PHASES DURING MARCH



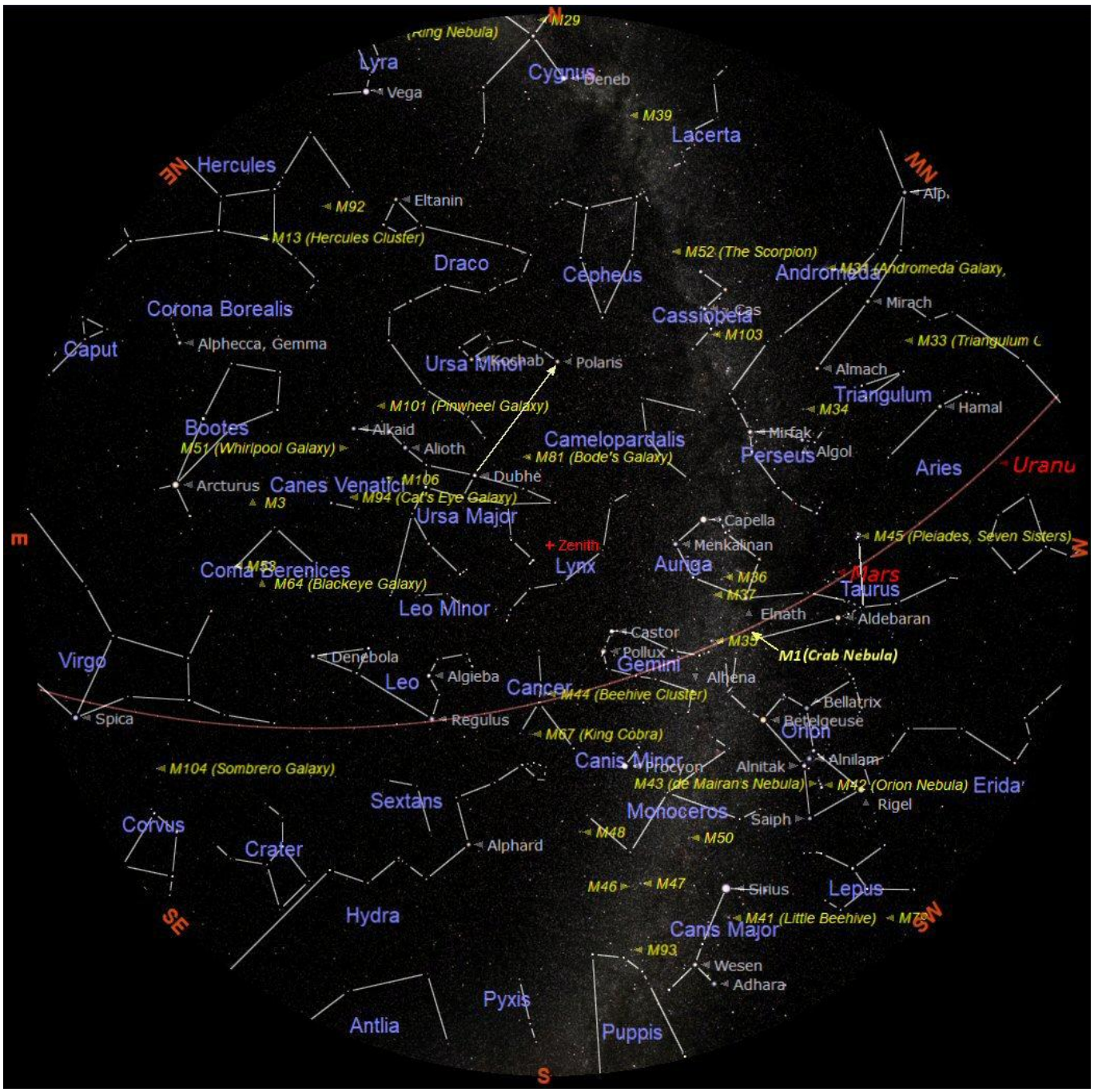
Last Quarter will be on 6th March

New Moon will be on 13th March

First Quarter will be on 21st March

Full Moon will be on 28th March

THE NIGHT SKY – MARCH 2021



The chart above shows the whole night sky as it appears on 15th March at 21:00 (9 o'clock) Greenwich Mean Time (GMT). As the Earth orbits the Sun and we look out into space each night the stars will appear to have moved across the sky by a small amount. Every month Earth moves one twelfth of its circuit around the Sun, this amounts to 30 degrees each month. There are about 30 days in each month so each night the stars appear to move about 1 degree. The sky will therefore appear the same as shown on the chart above at 8 o'clock GMT at the beginning of the month and at 10 o'clock GMT at the end of the month. The stars also appear to move 15º (360º divided by 24) each hour from east to west, due to the Earth rotating once every 24 hours.

The centre of the chart will be the position in the sky directly overhead, called the Zenith. First we need to find some familiar objects so we can get our bearings. The Pole Star **Polaris** can be easily found by first finding the familiar shape of the Great Bear 'Ursa Major' that is also sometimes called the Plough or even the Big Dipper by the Americans. Ursa Major is visible throughout the year from Britain and is always quite easy to find. This month it is high in the North East. Look for the distinctive saucepan shape, four stars forming the bowl and three stars forming the handle. Follow an imaginary line, up from the two stars in the bowl furthest from the handle. These will point the way to Polaris which will be to the north of overhead at about 50º above the northern horizon. Polaris is the only moderately bright star in a fairly empty patch of sky. When you have found Polaris turn completely around and you will be facing south. To use this chart, position yourself looking south and hold the chart above your eyes.

Planets observable in the evening sky: Mars and Uranus.

REMINDER: British Summer Time (BST) begins on 28th March