

NEWBURY ASTRONOMICAL SOCIETY

MONTHLY MAGAZINE – MAY 2019

PICTURE THIS – Astro-imaging



An image of Jupiter and one of its Moons taken by Steve Harris in 2010

In our modern age of technology there is a great interest in science in general but particularly in astronomy. There are now many facets to the hobby of astronomy involving many branches of modern technology. This technology is more readily available to the interested amateur now than any time in our history.

Fifty years ago scientific instruments such as a good telescope would have cost what an average man earned in a year. Today they cost the average earnings for one week. The quality of these instruments has also improved enormously. They also have the advantage of modern electronics including computerised goto guidance systems.

Most amateur astronomers have some interest in computers. Very good quality cameras are available at very reasonable prices for those of us that have an interest in photography. Combining all this modern technology has produced a great boom in the branch of astronomy we now know as astro-imaging.

There is now a vast range of equipment on the market for all three elements required for astro-imaging. There is a similar range of prices to satisfy all levels of interest. Most people these days already have access to a Personal Computer (PC) so that is the first requirement. Almost everybody has a camera even if it is incorporated into their mobile phone. A good first (beginners) telescope (costing £100 to £150) would be a bonus as would a DSLR camera.

Fairly good images of star patterns (constellations) have been obtained using a mobile phone camera or a fairly cheap compact digital camera but a DSLR (Digital Single Lens Reflex) camera is really the best. A compact camera mounted on a tripod can be used to take some very nice pictures of the Moon. A DSLR with a telephoto lens can be used to take very good photos of the Moon, planets and some of the brighter Deep Sky Objects in the Messier Catalogue (see the April issue of this magazine).

Cameras can also be mounted to telescopes to improve the imaging process. These methods can include: simply attaching a camera to a telescope (piggy backing) to support the camera when imaging. Most telescopes have a standard camera mounting screw thread incorporated on the mounting for attaching a camera.

Most cameras can also be used to take pictures through the eyepiece of a telescope using a special mounting.

NEWBURY ASTRONOMICAL SOCIETY MEETING

3rd May

When Galaxies Collide

Website:

www.newburyastro.org.uk

NEXT NEWBURY BEGINNERS MEETING

15th May

Daytime Astronomy

Website:

www.naasbeginners.co.uk

USING A CAMERA TO IMAGE THE NIGHT SKY

There are three main ways to use a camera to take pictures of the night sky, these are:

- 1 Direct imaging and with the camera on a tripod.
- 2 With the camera fixed to a telescope mounting.
- 3 Taking pictures through a telescope.

There are three main problems with direct imaging: The objects to be imaged are not very bright, they are small (even the Moon is surprisingly small) and it is difficult to hold the camera steady for longer exposures.

We must use long exposures to capture sufficient light so it is best to mount the camera. Even if we select the 'night shot' function on the camera this will increase the exposure time so any movement of the camera will cause the image to be blurred. The simplest solution is to mount the camera on a tripod. A simple cheap tripod can be bought for as little as £15.

If a mobile phone is being used, some method of fixing it steady must be devised or purchased. This can be as simply as securing the phone to a steadying fixture using elastic bands. Various mounting devices can be purchased for mobile phones so it is worth checking astronomy and photographic websites and of course mobile phone centres.

Nearly all cameras have a standard mounting thread incorporated into the camera body so it can be easily fixed to a tripod. This is done by screwing the camera on to the thread and securing the camera to the thread using a lock nut. This is generally fitted to the thread. Some tripods have a fixing plate that is first secured to the camera then clamped to the head of the tripod.



A compact digital camera mounted on a tripod



A DSLR mounted on a tripod

The pictures above show how the two main types of camera (digital compact and DSLR) can be mounted to a simple tripod using a Mounting Pad.

These articles are not intended to be a lesson about how to operate a camera to take images of the night sky but we do need to consider the attributes and limitations of the camera to be used.

The modern mobile phone is often equipped with a very versatile and useful camera but it is not really designed for night sky imaging. They are supplied with many special functions such as a dark shot facility that can be used to take twilight images. However they are of limited use for astronomical imaging but they can be used on a tripod or attached to a telescope with a special mounting adaptor.



A multi-purpose mobile phone mounting adaptor

A Compact Digital Camera has similar attributes to the mobile phone but has a bigger and better lens and the camera generally has more built in functions. One distinct advantage it does have over the mobile phone is that it can be easily mounted on a tripod. This provides greater stability when taking a picture using a long exposure.

A DSLR (Digital Single Lens Reflex) camera is really the best camera for taking astronomical images for a number of very important reasons:

- 1 It is designed for mounting on a tripod.
- 2 Its lens assembly can be changed to suit the image.
- 3 It has a multitude of special functions.
4. It can be operated remotely to avoid movement.



A DSLR with additional lens and remote button

All the cameras mentioned above produce digital images that can be downloaded to a computer. This has the advantage that the downloaded images can be processed on the computer to enhance and improve the image.

ATTACHING A CAMERA TO A TELESCOPE

There are three alternative ways to attach and use a camera with a telescope and its mounting. The first is to simply use the telescope to support and direct the camera to the object to be imaged. The image below shows a DSLR mounted 'piggy back' on a small refracting telescope. It does not matter that the camera is on its side the image can be rotated on a computer.



A DSLR 'piggy backed' on a telescope mount

The image above shows the DSLR secured to a screw thread on the telescope mount. This allows the camera to be pointed to the object in the sky using the main telescope and finder scope. The telescope mount can also provide tracking for longer exposure images.

A mobile phone or a compact digital camera can also be mounted to take pictures of an object as seen through the telescope eyepiece. This can be achieved (mainly when taking a picture of the Moon) by just holding the camera lens in front of the eyepiece and using the image on the camera screen to centralise it. Obviously this can be made a lot easier by mounting the camera (or mobile phone) over the eyepiece as shown below.



A compact camera mounted over a telescope eyepiece

Many good images have been taken particularly of the Moon using this method. However this process is rather limited but it can also be used with a mobile phone and a suitable mounting device. The fixture shown above has a mounting platform with a screw to fit the camera. It has a screw adjuster to move the platform left and right, with a knob positioned to the right hand side of the platform. The extension arm below has an up and down adjustment and there is a locking knob to the front.

The more versatile DSLR camera has the advantage that it can be mounted on a telescope to use the telescope as its primary optical device (lens [or mirror]). This can be done by removing the camera lens and fitting an adaptor that will fit directly into the telescope focuser.



A DSLR with a focuser adapter fitted

The picture above shows a DSLR with the camera lens removed and a telescope focuser adaptor fitted. This is a very easy task, the camera has a lens release button that when pressed allows the lens to be twisted and released from the camera body. The adaptor is simply clicked in and twisted until it is engaged and clamped in position. The adaptor above is shown with an inferred / ultraviolet filter fitted to prevent these unwanted rays reaching the imaging chip to spoil the image.

The camera above also has a 'video out' outlet that allows the image that the camera is waiting to expose, to be displayed on a larger screen such as a TV monitor. This feature is a great improvement over trying to focus the image on the camera's small 'built in' screen.

All we need to do now is fit the camera to the telescope focuser and we are ready to start imaging.



A DSLR mounted for imaging with remote button

The image above shows the DSLR fitted to the focuser of a 120mm Skywatcher refracting telescope. It also shows the remote shutter operating button that is a really good accessory to reduce vibration when shooting images. It is worth pointing out the camera strap is looped around the finder scope mounting. This is in case the pinch screws holding the camera should slip and drop the camera. Focusing the image is done using the telescope focuser.

USING A WEBCAM WITH A TELESCOPE



The image above shows a webcam fitted to a 120mm Skywatcher refracting telescope

Using a webcam to produce images of the night sky is a brilliant method of imaging developed by amateur astronomers. Not only does this method produce stunning images of the Moon and planets it is great for those of us who have an interest in telescopes, photography and computers. This method requires imaging outside, on any clear nights. Then the cloudy nights can be spent processing the images.

Originally a shop bought webcam had to be modified by removing the lens (simply unscrewing it) and replacing it with an adaptor to fit into the focuser of a telescope. The very earliest models were fitted with 'home made' adaptors. Modified webcams can be bought over the counter now and cost as little as £70. These are a vast improvement mainly thanks to the use of larger and more sensitive photosensitive chips.



An Orion StarShoot IV webcam

The camera is supplied with all that is needed, Cable and software to operate the camera using a laptop.

It is of course necessary to first point the telescope so the target can be seen in the eyepiece. Then the eyepiece is removed and the camera fitted in its place. When the webcam software is opened it appears as a screen to show what the camera is going to capture. It will be necessary to focus the image using the telescope focuser and centralise the target on the screen.

A webcam is a video camera and is used capture a minute or two of video, normally in the .avi format. Between 1000 and 3000 individual frames (pictures) are usually collected. The video is downloaded and saved directly to the hard drive on the laptop.

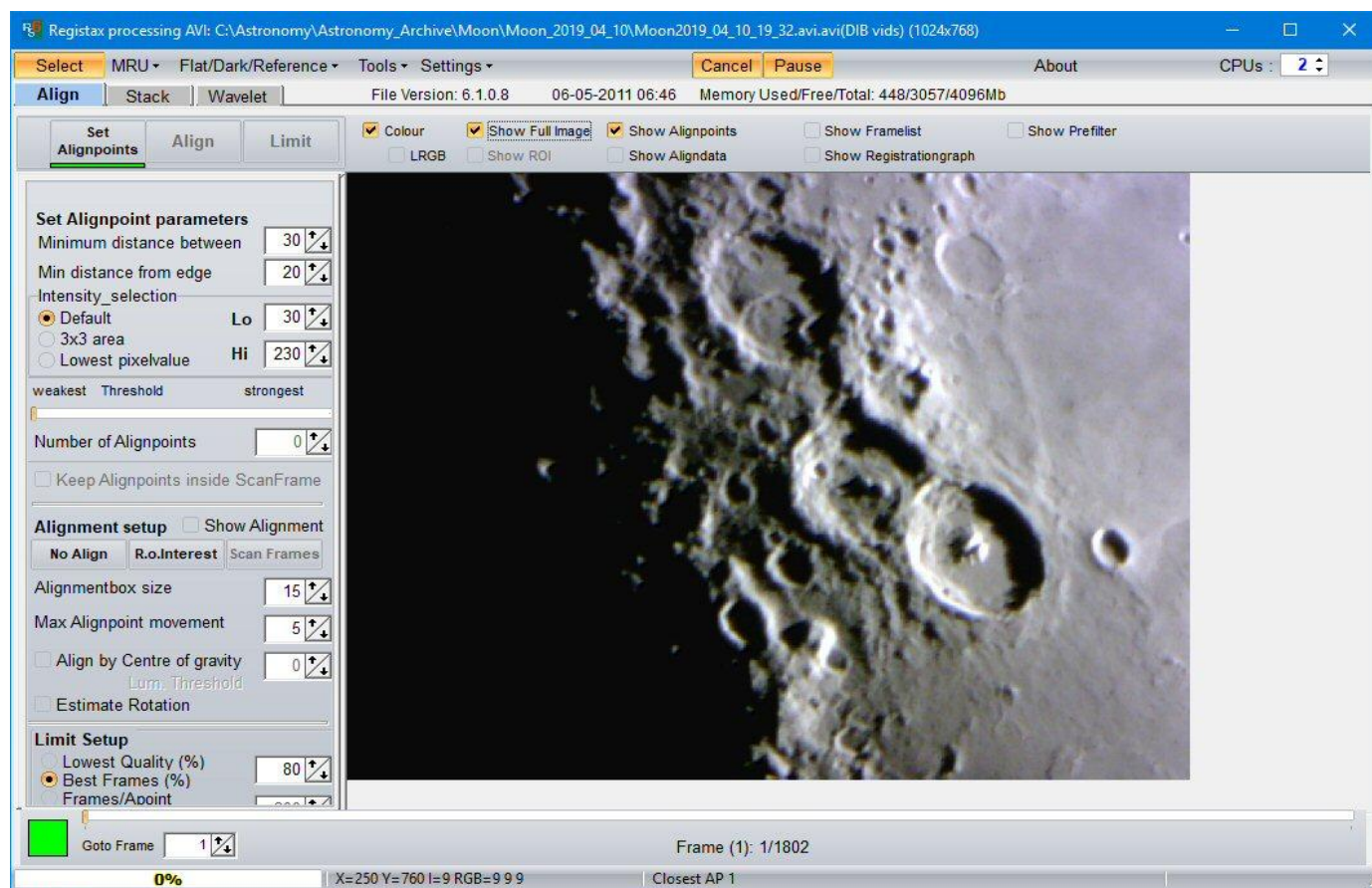
If each individual frame is examined it will appear to be of a fairly poor quality due to the movement of the air in our atmosphere. This is caused by heat rising, natural air movement and areas of turbulence. The effect can be seen in the twinkling of a star that is located low over the horizon where air movement is at its most prominent.

By collecting a video of short exposure frames the amount of movement is minimised. It is however in the smaller details on the image that the 'blurring' effect is most noticeable. Each feature on the image recorded will appear slightly different on each frame. Our task is to average out this movement by combining all the separate frames into one image.

To process the captured video a free app called 'Registax' needs to be down-loaded from the internet. Registax has a window to display each frame of the video in sequence. The default is for Registax to carry out the processing almost automatically but it can be adjusted to provide as much individual control and input as is required.

Registax performs three operations: It will identify features on one frame and will align those features on every other frame. Then it will limit to only the best frames and will finally stack all the aligned frames into one image.

PROCESSING AN IMAGE ON A COMPUTER



The image above shows a 'screen shot' of the opening window of the image processing application 'Registax'. The first frame of the selected video is shown in the main window. This video was captured using the Orion StarShoot camera shown on the previous page but imaged using a 300mm aperture f10 Meade telescope. There are 1802 separate frames in this video clip.

At the top left of the screen is the sequence of operations that Registax will carry out on the video. These are Select, Align, Stack and Wavelet. There are further subroutines within these main operations and Registax invites the user to continue to each sequential stage.

The 'Align' task aligns and sorts the frames into a sequence of best first and worst last. The yellow pointer on the slider at the bottom of the screen will be positioned at the point where Registax has determined the quality to be good enough. Frames to the right of the pointer will be ignored in the next process but the pointer can be moved manually to adjust this limit of frames.

By clicking on the 'Stack' button Registax will stack all the aligned frames (up to the limit) into one image. This process takes a few minutes and the progress will be indicated at the bottom of the screen. The finished image will be displayed in the main window. At this point the image is raw and looks good but not perfect. We should now save the raw image to disk. We can now click on the 'Wavelet' button to carry out processing to improve the image before saving to a new file.

A set of Wavelet sliders will appear in the panel to the left of the main display screen. Moving the sliders to the right can clarify different sized features of the image.

Moving the sliders to different positions enhances the quality of the image. However too much movement can cause the image to look unreal so the sliders can be adjusted back to the left to tone down the effect. When processing is deemed to be correct a button marked 'Do All' can be clicked to incorporate the improvements. If the processing is not up to expectations the raw image can be reloaded and the processing can be done again and saved as a different file.



The finished processed image

These articles have not been too detailed and are intended to give an indication of what can be done in the field of Astro-imaging using fairly basic equipment. It can be interesting and exciting to process our own images.

SOME IMAGES OF THE MOON BY THE AUTHOR



The image above was taken on 11th April 2019 using a DSLR camera mounted to the focuser in place of the eyepiece. The telescope used was the 120mm aperture 1000mm focal length refracting telescope shown on page 3. The exposure was 1/3000 second. The only processing was to change to grayscale with the contrast and brightness slightly enhanced using Paintshop.



The image above was taken on 13th April 2019 using the same DSLR camera and telescope and slightly enhanced using Paintshop as above.



The image of the Full Moon above was taken on 19th April 2019 using the same DSLR camera and telescope and slightly enhanced using Paintshop as above.



The image above was taken on 13th April 2019 using the same DSLR camera mounted to the focuser in place of the eyepiece. The telescope used was a 300mm aperture 3000mm focal length Meade telescope. The exposure was 1/3000 second.

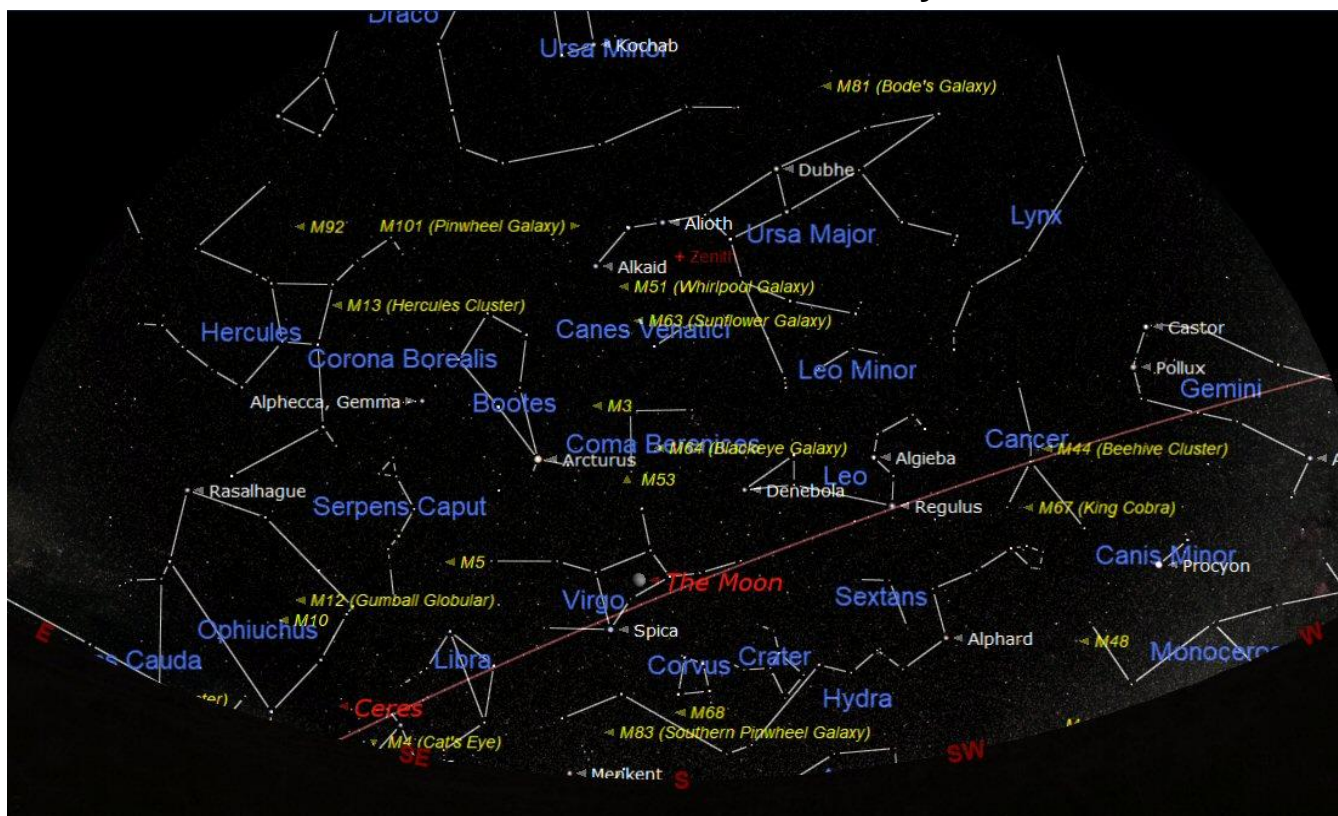


The image above was taken on 13th April 2019 using a DSLR camera mounted to the focuser in place of the eyepiece using the same telescope as above.



The image above was created by combining the two images above to produce this image of the complete Moon as it appeared in the sky. The processing was done using Paintshop but with no enhancement.

A TOUR OF THE NIGHT SKY - May 2019



The chart above shows the night sky looking south at about 22:00 BST on 15th May. 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, marked in red at the top and 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 Gemini (the Twins), Cancer (the Crab), Leo (the Lion), Virgo (the Virgin) and Libra (the Scales) rising over the eastern horizon. The constellation of Sagittarius will rise in the east later in the evening.

Mars is still just about visible in the bright sky, just above the western horizon, at sunset but is looking small now. Earth overtook Mars a few months ago as it moved faster along its smaller orbit inside the orbit of Mars. Mars is now being left behind Earth and appears smaller as it moves further away. Although it is looking smaller it is still quite bright.

Jupiter will be rising over the eastern horizon at about 23:00 in the constellation of Sagittarius. It will be midnight before Jupiter is high enough to observe. The view will not be good because Jupiter will be in the dirty and turbulent air close to the horizon.

In the west and sitting astride of the Ecliptic is the constellation of Gemini (the Twins). The twin stars Castor and Pollux are easy to identify. For those that have a telescope, Castor can be seen as a double star. By increasing the magnification, Castor itself will be seen as a pair of stars. It will push a small telescope to its limits to see but this lovely triple star system it is worth the effort.

To the east (left) of Gemini is the constellation of Cancer with its lovely Open Cluster Messier 44 (M44) also known as Praesepe or the Beehive Cluster. This is a lovely Cluster that is best seen using binoculars or a small telescope using a low power eyepiece. The cluster is about twice the diameter of the Full Moon and contains about 200 stars. It is located about 577 light years away and its stars are estimated to be around 400 million years old.

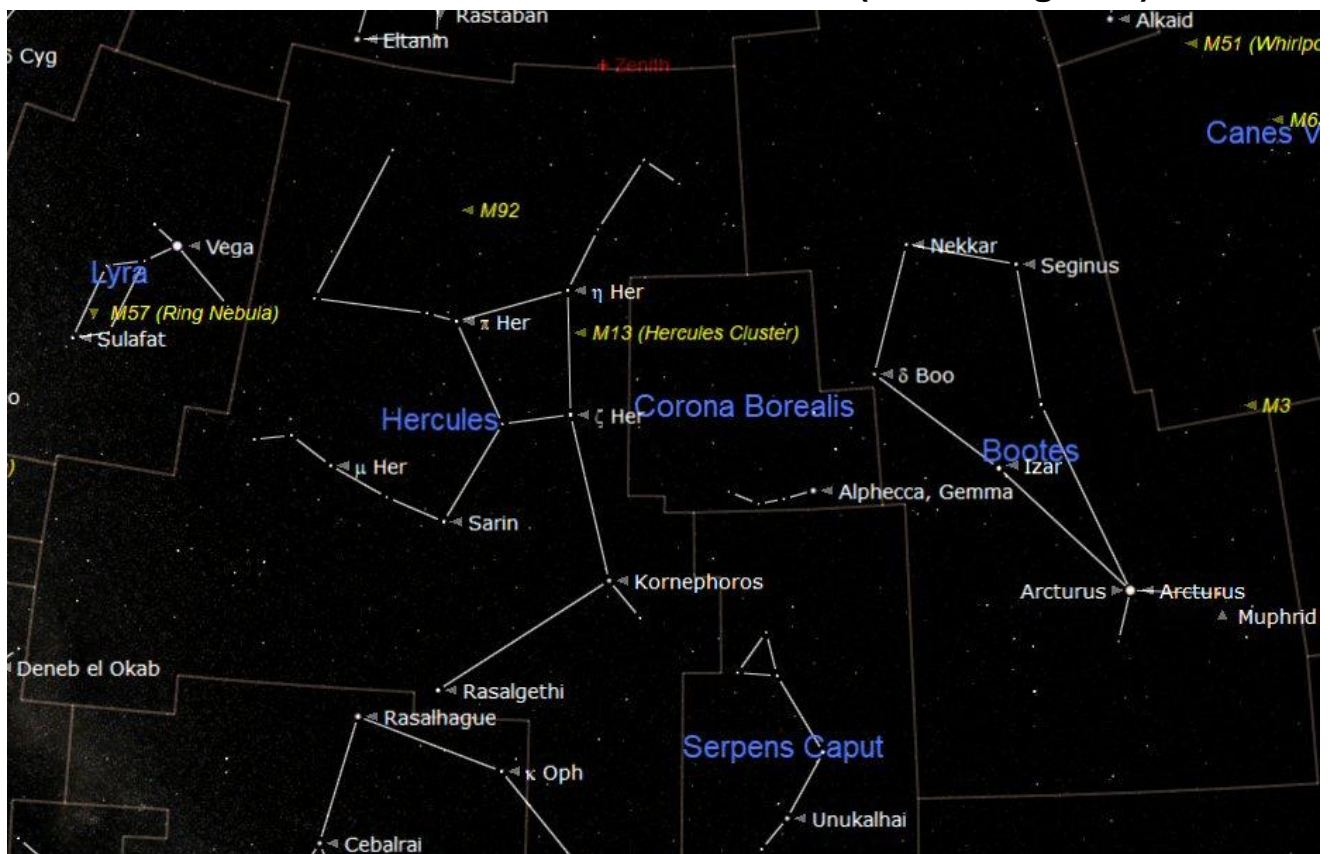
Further to the east (left) of Gemini is the constellation of Leo (the Lion). Leo is quite distinctive with the 'Sickle' shaped pattern of stars looking much like the head of the lion that Leo represents. In fact the traditional 'stick figure' shape of Leo as shown on the chart above does look rather like the lion's body or the Sphinx in Egypt. The 'Sickle' shape is also described as looking like a backwards question mark (?).

Following Leo is the less obvious constellation of Virgo but it does have one fairly bright star called Spica. Virgo gives its name to a large cluster of Galaxies that is also spread over into the neighbouring constellations of Coma Berenices (Berenices' Hair) and into Leo.

To the north of Virgo is the bright orange coloured star called Arcturus in the constellation of Boötes (see the next page). Arcturus is a Red Giant star that is nearing the end of its 'life' as a normal star. It has used almost all of its Hydrogen fuel and has expanded to a diameter of around 25 times the diameter of our Sun. At the moment it shines 115 times brighter than our Sun but it is destined to collapse to become a White Dwarf.

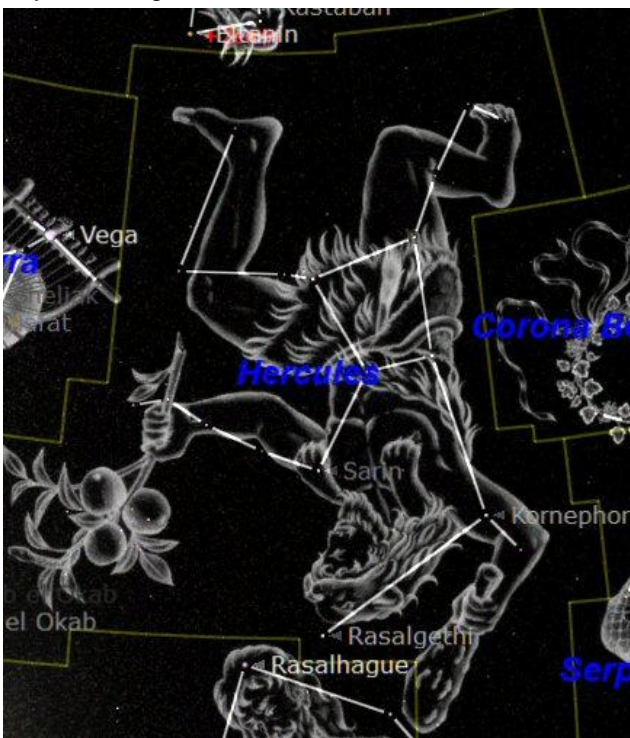
Higher in the south east is the constellation of Hercules (the Strong Man). Hercules has a rather distinctive distorted square shape, at its centre, called the 'Keystone' due to its resemblance to the centre stone of an arch or bridge. See the next page.

THE CONSTELLATION OF HERCULES (the Strong Man)



The constellation of Hercules with Lyra and Boötes

The chart above shows the constellation of Hercules and its location to the west (right) of the Summer Triangle. Hercules is the great strongman from Greek mythology. He is illustrated in the picture below (upside-down), as he appears in the sky, with a club held above his head. The 'Keystone' asterism (shape) can be a little difficult to identify in a light polluted sky but easy to find again.



An illustration of the constellation of Hercules

The jewel of Hercules is without doubt is the Great Globular Cluster, Messier 13 (M13). M13 can be found in the western (right) vertical imaginary line of the 'Keystone'. It is just visible using a good pair of 9 x 50 binoculars. The cluster, of about a million stars, can be seen using a 90mm f10 telescope but will look even more impressive when using a larger telescope.



The Great Globular Cluster in Hercules

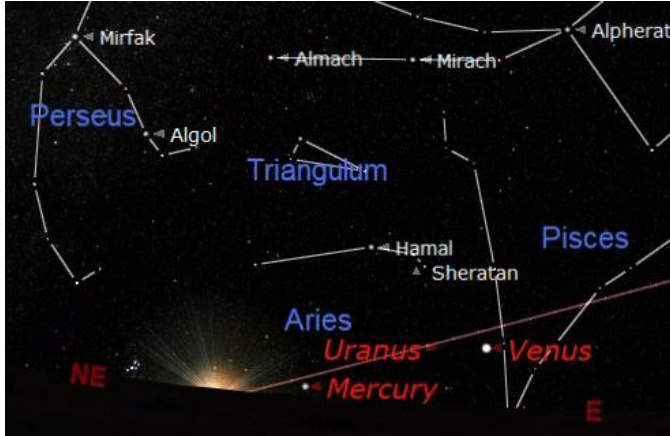
Globular clusters are thought to be the cores of small galaxies that have ventured too close to Giant Spiral Galaxies like our Milky Way. The outer stars of these smaller galaxies have been stripped away, by the gravity of the giant spiral. This process has left the dense core clusters of between 100,000 and a million stars. There are about 100 Globular Clusters in a halo around the Milky Way.

There is another Globular Cluster in Hercules M92 but it is further away and needs a telescope to see.

THE SOLAR SYSTEM THIS MONTH

MERCURY will be very low over the eastern horizon before sunrise at the beginning of the month and will be very difficult to see. It will move into Superior Conjunction (pass behind the Sun) on 21st May.

VENUS rises over the eastern horizon at about 04:30 and will be very difficult to see as it draws closer to the Sun. Although Venus is very bright at magnitude -3.8 its light will be drowned out by the Sun rising just half an hour later. Venus will be moving into Superior Conjunction (pass behind the Sun) on 14th August. See the chart below.



Mercury, Venus and Uranus in the early morning sky

MARS is still observable in the early evening but is much lower now and getting close to the southern western horizon in turbulent and smoggy air. The Red Planet is looking smaller at 4.0 arc-seconds in diameter but still quite bright at magnitude +1.7.

JUPITER is now a late evening object rising over the eastern horizon around 23:50 at the beginning of the month and 22:00 at the end of the month. So it will have risen high enough for observing at midnight at the end of the month. See the chart below.



Saturn and Jupiter at 02:00

SATURN will rise at midnight at the end of the month so will be observable at about 01:30 but will be low over the horizon. It will of course be worth staying up for if it is a clear night.

URANUS will not be observable this month as it will be too close to the Sun. See the Venus chart above.

NEPTUNE will not be observable this month as it will be very low and too close to the Sun.

THE SUN

The Sun rises at 05:20 at the beginning of the month and at 04:45 by the end of the month. It will be setting at 20:35 at the beginning and 21:10 at the end of the month. There was a lovely sunspot from 8th April until 20th April the best seen so far this year.



The sunspot imaged by Steve Harris 10th April 2019

The image above was taken using a DSLR camera mounted on the 120mm aperture 1000mm focal length refracting telescope shown on page 3.

Sunspots are caused by the magnetic force lines on the Sun. These lines of magnetic force emanate from the poles and loop around the Sun from pole to pole. Being composed of gas, the mass of the Sun is fluid and the equatorial region rotates faster than the poles. This stretches and distorts the lines of magnetic force around the equator.

After about four years the lines of magnetic force become so stretched they begin to break up and loop in and out of the surface of the Sun. As the surface is broken the indentations allow a slightly cooler lower layer to become visible as a darker Sunspot.

THE MOON PHASES IN MAY

2019	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Apr-29							
May-05							
May-06							
May-12							
May-13							
May-19							
May-20							
May-26							
May-27							
Jun-02							
2019	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

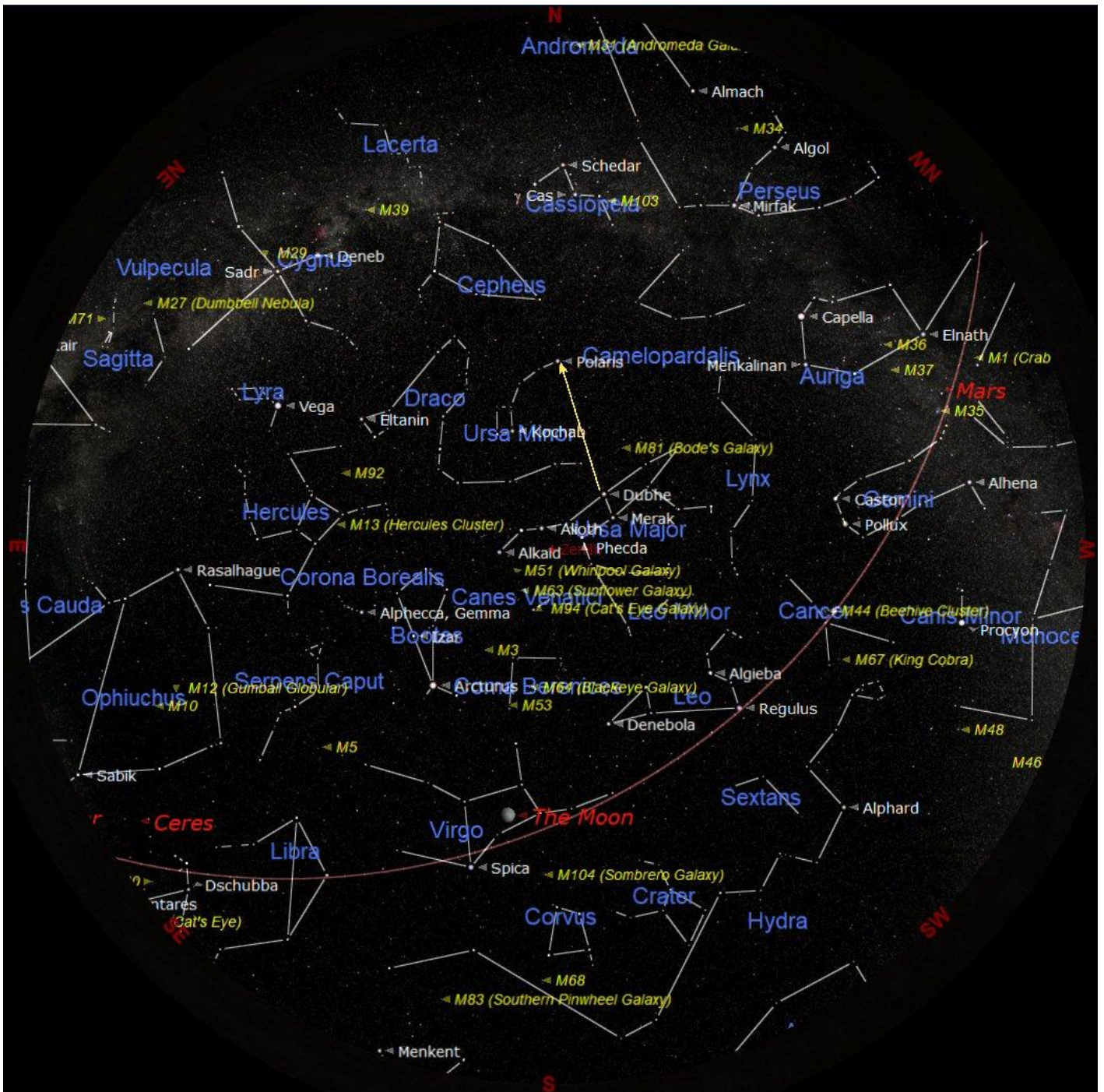
New Moon will be on the 4th May

First Quarter will be on 12th May

Full Moon will be on 18th May

Last Quarter will be on 26th May

THE NIGHT SKY THIS MONTH



The chart above shows the night sky as it appears on 15th May at 22:00 (10 o'clock) in the evening British Summer Time (BST). 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 23:00 (11 o'clock BST) at the beginning of the month and at 21:00 (9 o'clock BST) at the end of the month. The stars also appear to move 15° (360° 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 easy to find. This month it is almost overhead. 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 50° 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: Mars and Jupiter. Venus and Saturn are just observable in the early morning.