Wadhurst Astronomical Society Newsletter
July 2013

MEETINGS

COMMITTEE MEETING

Members of the Committee are respectfully reminded that there is a meeting of the Committee at 1930 on Monday the 1st of July at Phil Berry's house.

As always, any member of the Society is welcome to come along, but please let Phil Know before hand.

JUNE MEETING

The June meeting was introduced by our Secretary, Phil Berry who welcomed visitors and members to our Telescope Open evening which is held each June around the Summer Solstice.

He noted that the Parish Council are replacing the village sign at the southern entrance to the village and Phil said they were asking for suggestions for its design and he has suggested that perhaps it would be an idea to include stars on it from the constellation of Cassiopeia which form the letter "W", appropriate to the name of the village. Not mentioning the fact that we ourselves use it as our logo for the Wadhurst Astronomical Society.

The Committee have been working on a new Constitution and Phil said there were draft copies for members to take away with them and suggest any changes or additions they think may be appropriate.

He then introduced a series of short talks for the evening, beginning with Brian Mills, our Director of Observation.

Astronomical Observing for the Amateur

For some time now Brian Mills has been giving a number of introductory talks for the beginner amongst all his other talks at our meetings. So for the Telescope Evening he looks at ideas for observing for the amateur either purely for enjoyment or possibly suggesting a project.

The Sun

He began by looking at our own star, although he stressed the need for great care when observing the Sun and never to look directly at it or through any optical device without taking precautions.

In the early days of navigation, observing the position of the Sun was necessary. One interesting but precautionary thought came from our idea of an old sea captain with a patch over one eye. Brian said they had to take sightings of the Sun and this often damaged the retina in that eye if they weren't careful.

A big telescope is not necessary when observing the Sun and sunspots, but a filter is needed over the front of the telescope, such as a Baader Solar Filter.

Another method of looking at detail on the Sun includes using the telescope to project an image onto a sheet of paper, with the sheet preferably inside a shaded box. Binoculars could also be used for projection, covering one of the eyepieces to prevent a double image.

Since the eyepiece or finder cannot be used to find the Sun, Brian reckoned the best method was to look at the shadow of the instrument and minimise it. This should leave the telescope or binoculars looking at the Sun. The finder scope should have its cover in place.

A more professional method is to use a Herschel Wedge which reflects and projects at right angle nearly all the light from the Sun, leaving a very small amount to be seen safely through an eyepiece.

A Herschel Wedge

All these methods view the Sun in broad spectrum white light. One final method is to use a Solar Telescope such as the PST (Personal Solar Telescope) which picks out a very narrow wavelength in hydrogen-alpha, allowing details to be seen such as the granular surface, flares and prominences around the rim.

The Moon

Brian is particularly interested in occultations where very accurate timings of a star being occulted by the Moon are taken and these timings, together with those from other observers are sent to a clearing house which collates the data to produce fine information about the size and shape of the Moon.

A grazing occultation occurs when the edge of the "shadow" of the moon passes a point on the Earth. Then the light from the star being occulted can wink in and out as it passes behind mountains on the lunar surface as seen by an observer at that exact point, again giving useful information to the clearing house. A string of observers may be needed for one of them to witness it.

Other changes take place on the Moon, known as Transient Lunar Phenomena and these can be unusual glows or flashes and Patrick Moore was particularly interested in these. They are still observed and recorded now.

Photographing the Moon can be very rewarding and Brian showed some images as examples.

Mercury

Mercury is very small and close to the Sun making it only visible through a telescope a few times a year but enabling the phases to be seen.

Venus

Venus is a little larger and further from the Sun. The phases are much easier to see and with a reasonably sized telescope, some cloud detail can be seen.

Mars

Mars is particularly observable when at opposition, being almost in line with the Earth and away from the Sun. Quite a bit of surface detail can be made out through a telescope.

Jupiter

Jupiter is much bigger and the four Galilean moons are ever changing position and can occasionally be seen to occult each other. The moons and their shadow can be seen when they pass over the planet's surface as seen from Earth.

Brian showed a slide showing the four moons and some cloud detail on the planet.

An example of what might be seen of Jupiter and the Galilean moons using a medium sized telescope

Saturn

The ring system can easily been seen although as Brian said it can be a little disappointing if one expects to see it as shown in modern images.

Uranus and Neptune

Both planets are very faint and need a telescope to observe them and a pretty large telescope is necessary to make out any surface detail.

Asteroids

These again are very faint but groups of amateur astronomers view occultations of stars by asteroids and then by combining these results their size and shape have been calculated.

Variable Stars

Brian described how known standard brightness stars are used to compare the brightness of variable stars and over a period of time it is possible to draw the graph of a light curve.

Meteors

A meteor shower was appropriately described like driving a car through a snow storm with the flakes appearing to come from one point or "radiant". It is the same with the Earth passing through a part of space with large numbers of particles where the shower is named after the constellation straight ahead of the Earth in its orbit at the time.

Clusters, Nebulae and Galaxies

Finally Brian talked about objects further afield such as star clusters, nebulae and galaxies, saying that there was little the amateur could add, but they make excellent objects to observe and photograph.

A Short Introduction to Choosing a Telescope for Astronomy

Geoff Rathbone the Newsletter editor

There are two basic types of telescope; the Refractor and the Reflector.

A small refractor is an ideal telescope to start astronomy with a minimum object lens diameter of something like 75 mm (3-inches). The larger the object lens, the more light gathering there is and determines the faintest detectable stars. This is probably more important that magnification. Magnification depends on the eyepiece and to begin with, low power is going to be more useful. Magnification can be found by dividing the focal length of the object lens by the focal length of the eyepiece. Probably a 25 mm eyepiece is a good start. A Barlow lens fits between the eyepiece and the draw tube and can double or even treble the magnification.

It must be pointed out that to keep as much light as possible passing through the telescope, the image is inverted in astronomical instruments.

The focal length of a lens is the point at which an object at infinity reaches the point of focus behind the object lens.

Without wishing to become too complicated, a lens has what is called an f-number and is the ratio of the focal length to the diameter of the object lens, the same as in a camera. A low f-number results in a wider field of view and can be useful when looking at planets or the moon.

The other type of telescope is the reflecting telescope where a curved mirror focuses the light in the same way as a lens, except that this point is in front of the mirror and a small flat mirror reflects this light off to the side where the eyepiece focuses the image.

To bring the image to one point of focus from the whole diameter, the mirror has to have a parabolic shape which makes manufacture just that little bit more complicated.

For an astronomical telescope, the mirror diameter should be not less that about 100 mm (4-inches). Again the diameter dictates the light gathering power.

This reflecting telescope arrangement is known as a Newtonian telescope.

There are other reflecting telescope arrangements. In a Cassegrain telescope, the image from the main mirror is reflected back from a small central mirror through a hole in the centre of the main mirror where the eyepiece is placed. This has the advantage of having a much shorter tube.

Now, with modern manufacturing methods, a telescope called the Catadioptric combines the refracting and reflecting telescope. There are two types. In the Schmidt-Cassegrain, light enters the telescope through a large thin correcting lens and passes to a much simpler spherical mirror. This image is reflected back to a small concave mirror mounted in the centre of the correcting lens and then back through a hole in the centre of the primary mirror and to the eyepiece.

The other is the Maksutov whose meniscus correcting lens is so shaped that at the back and in the centre of the lens, the surface is coated with the small reflecting mirror resulting in a truly portable telescope with a relatively large main mirror.

The advantages of the refractor over the reflecting mirror is that it has good definition and image contrast; there is no central small mirror in the light path and the alignment holds well.

The disadvantages of the refractor are that it is bulkier and difficult to mount rigidly. All but the costlier lenses suffer from colour fringing and the eyepiece can sometimes be in an awkward position.

On the other hand, the advantages of the reflecting telescope include being cheaper for the same size and the eyepiece is in a more convenient position. They are fairly compact and don't require a tall mount.

Their disadvantages include being sensitive to optical alignment although easy to put right, the surface of the mirrors often require recoating periodically. Because of the central flat lens obstruction, they suffer from less contrast.

Aperture for aperture, the refractor is better for planetary detail and close double stars. If aperture is the main consideration, then the reflector is the best.

A simple mount for the telescope is the alt-azimuth which rotates horizontally and the telescope is tilted up vertically.

For astronomical purposes, a much better mount is aligned with the tilt of the Earth and is called the Equatorial mount. Now the telescope follows objects in the night sky just by turning the telescope in line with the celestial equator and tilting the telescope for higher or lower objects. These mounts are often driven by a small motor.

Another mount being used by some amateur astronomers is the Dobsonian mount. This is using an alt-azimuth mount that can be easily made out of available materials. They can be a cheap mount for a quite large mirror and usually using fairly small magnification. They are mostly used for visual observing and sometimes unfairly referred to as a "light bucket".

An example of a Dobsonian. Members may remember Murray Barber as a previous Chairman of the Society, now living in dark skies just off Exmoor

Now that we are in the age of the computer, the telescope can be computer controlled which line themselves up and just by entering the title of the object, the telescope will find and then follow it.

Typically, a 3-inch refracting Newtonian telescope on a simple tripod can start at around £50. A basic 3-inch reflecting telescope on an equatorial mount may begin at about £80. A 5-inch motor driven equatorial mounted telescope can start at around £150.

A computerized 3-inch reflecting telescope can cost from £250.

Looking at bigger telescopes, a 5-inch computerised Maksutov telescope will cost something like £400 or more.

Using a telescope, there are two ways of observing the Sun. The first is to use a filter such as a Baader Solar Filter which fits in front of the object lens. At no time should a solar filter be fitted inside the telescope because energy from the sun would heat the internal part of the telescope, doing damage or even cracking the filter itself which might leave light from the Sun passing directly through the eyepiece and that would be extremely dangerous if one is looking through it at the time.

Another method of observing the Sun is using a Personal Solar Telescope (PST). Although they start at around £650, they allow the sun to be seen in hydrogen-alpha light which is the wavelength that reveals details of the surface of the Sun and also the prominences around the rim.

Ian King Describes the Telescopes at the Meeting

Our next talk was given by Ian King of Ian King Imaging, making him the ideal person to describe each of tonight's telescopes.

He briefly introduced us to each of the various telescopes and equipment present at the meeting beginning with the Society's own Konus 4-inch refracting telescope (available to any member to borrow) and described basically how it worked. He also mentioned chromatic aberration and to reduce the effect in early telescopes, they had a very long focal ratio; long tubes and small object lenses. As an example, Jan Drodz had brought a model of Galileo's first telescope.

Ian described how with modern telescopes, the main lens is made up of several pieces of glass each with a different refractive index and in this way it has been possible to almost eliminate chromatic aberration and also making it possible to have a much shorter tube.

Next he looked John Wayte's Mead LX-6, a 6-inch Catadioptric telescope consisting of lenses and mirrors and mounted on a computer controlled mount making it easy to set up. It comes with a huge database of stars and objects. Ian said this was an excellent telescope for both a beginner and the more experienced amateur making it easier and quicker to find the target and explore the night sky.

Brian Mills' had brought along another Catadioptric telescope with a 12-inch primary mirror. Basically it is intended as a visual instrument but also with the ability of taking a camera at the back.

A Personal Solar Telescope, belonging to Phil Berry was described as an excellent way of looking at the Sun in monochromatic hydrogen-alpha light. Ian described this as the only way of observing flares and prominences.

There were several pairs of binoculars present and Ian said that even a small pair of binoculars could be very useful when looking at the night sky and with a wider field than a telescope make them ideal for just looking at the night sky. Stabilising binoculars made it easier to view with higher magnification.

Finally Ian showed us a really interesting Cassegrain Astrograph with a 12-inch primary mirror and relatively large secondary mirror that he himself had brought. Basically it is meant for serious astrophotography using a large format CCD sensor. He said it contained an intricate set of correcting lenses which could not be seen but which provide a very wide flat field, highly corrected to provide a sharp image over the whole of the sensor's surface.

The Astrograph brought to the meeting by Ian King

As Ian said, it is a serious and very expensive telescope intended for professional style imaging but it gave an idea of the ultimate telescope for the amateur.

He said he was taking orders, although on this occasion members were a little reluctant but were left wide-eyed with jealousy.

Aligning an Equatorial Mount for Observing
Phil Berry, the Society's Secretary

To counter the effect of the rotation of the Earth, a German Equatorial Mount (GEM) must be aligned with the axis of the Earth and move the telescope in the opposite direction. The North Celestial Pole (NCP) is the point in the sky to which the Earth's axis points in the northern hemisphere.

When aligned, a telescope rotates in the opposite direction to the rotation of the Earth and will enable accurate tracking of a celestial object by cancelling out the effect of the Earth's rotation. To set up a German Equatorial Mount we use the pole star which is just ¾ of a degree away from the NCP. As we all probably know, Polaris the pole star is found at the end of the handle of Ursa Minor and is also indicated by the pointer stars in Ursa Major. If an equatorial mount is aligned correctly it will minimise the drift of an object away from the field of view whilst tracking with manual or motorised mounts.

Finderscope. The Finderscope must be accurately adjusted to the view in the main telescope. It is best to check/adjust the Finderscope in daylight. Orient the Finderscope to the side of the scope for easy access. Make sure it is aligned to the telescope by adjusting on a very distant object to avoid parallax errors, finally refining the adjustment on a star at night.

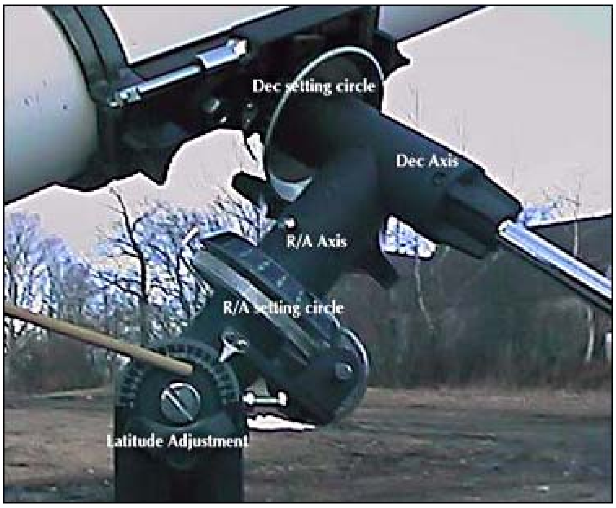
Setting up the Mount

Adjust the legs to the length required. This may seem obvious but the height of any tripod needs to be decided before we start. A Newtonian telescope has the eyepiece set high on the scope whereas a refractor has the eyepiece at the lower end. In addition, the height of the observer needs to be taken into consideration as well as the height above the horizon the telescope will be pointing during use. The working height of the tripod therefore needs to be known before we begin. The first few uses should be enough to give you a good idea for a working height.

Place the mount in position. Once you have the mount height sorted it is time to place it on the selected observing site taking the view and any obstructions into consideration. The most straightforward way to set down a mount is to have it positioned so that one leg is pointing south with the line of the RA axis (the one without the weights) pointing north. The Society scope has north clearly labelled and this would be a good thing to do with any mounts that members have. Setting the mount down in this way greatly assists with levelling.

Settle the Mount. Before levelling on grass or other soft surface it is best to settle the scope into the surface by applying pressure to each of the tripod legs. This increases the firmness of the mount and minimises settlement as weight is added.

Levelling. The accessory tray on most scopes is pretty much parallel with the mount head. By placing a simple 2-way level on the tray with one of the phials aligned with the south leg it is very easy to see which leg needs adjusting to attain a level mount.



Showing some details of an equatorial mount

Setting Latitude. An essential step in alignment is to set your latitude. This only needs to be done once unless you take the scope to a place significantly distant from the original setup latitude. For Wadhurst it is 51° N. To adjust, use the locking levers, you need to unscrew one and screw in the other to adjust. The RA axis is now roughly towards the NCP. Providing you have the mount pointing reasonably accurately north, I have found this is often all that is needed to allow for several minutes of tracking using just the RA control and an occasional tweak of the Dec. control.

Balancing. Once the mount is aligned; remove the "toe-saver" screw from the counter weight shaft ready to slide on the weight. Move the weight close to the mount to prevent topple before the telescope is added. Put the weight on the shaft with the locking screw towards the top of the weight. For safety replace the toe-saver screw after the weight is on the shaft.

The telescope cradle should have the hinges at the bottom with the control handle towards the eyepiece end of the telescope. Carefully unlock the RA lock and slide the counterweight to balance the scope. Tighten the RA lock and then slide the scope in the cradle so that it also balances. Then with both Dec and RA locks off the scope should be able to be moved in any direction without falling to one or the other side, Check also the speed of movement to remove any fine balance bias.

You should now be polar-aligned to an accuracy suitable for observing. If it has been done adequately you will be able to track any star or planet for several minutes with just the RA control. If the object does slowly drift out of the field of view, this can be corrected by slight use of the DEC control.

Observing Your Target Object. Once you reach this point you can select your target. For example if it is the Moon just unlock the RA and Dec locks and slew the telescope to the Moon. Then lock up the RA and Dec locks and home in with the use of the RA and Dec controls and the Finderscope or a low power eyepiece.

Additional Alignment. If you want to align the mount more accurately and do not have a polar alignment scope there is a useful tip you can use to improve your alignment. Notice that when the telescope is looking north in the same direction of the RA axis, the telescope body is clearly parallel to the RA axis.

If you now line up the telescope vertically and north in the Dec axis it should also be near to the pole star. If you look through the Finderscope or use a low power eyepiece you can lock up the RA and Dec controls in this position and home in on the pole star using the mount's horizontal and vertical fine adjustment.

This will enable you to view and track stars with the minimum amount of Dec adjustment and ease the task of tracking stars to the sole adjustment of the RA control on manual and motorised mounts. The image will stay in view much longer before any Dec intervention is required so that the observer can concentrate on observing.

Even Better Alignment! For further accuracy in alignment there are other methods you can use including the Polar Alignment, Drift method and computer aided alignment but these methods are outside the scope of this guide and are usually only required for alignment-critical pursuits for example long exposure astro-photography.

Happy Observing……

JULY MEETING

Wednesday 17th July 2013 – John Vale-Taylor, the Society's Chairman, gives a very useful talk; "Astrophotography on a Shoestring", something members often ask about and with John's usual inventiveness, this should be an interesting subject.

Meetings begin at 1930 although members are invited to arrive anytime after 1900 as this is a good time to exchange ideas and discuss problems and also relax before the meeting.

The venue as always is held in the Upper Room of the Methodist Church at the east end of Wadhurst Lower High Street, opposite the entrance to Uplands College. (For those with SatNav – the post code is TN5 6AT)

Anyone is welcome but non-members are asked if they wouldn't mind contributing £2 towards costs.

FUTURE MEETINGS

There is no meeting in August but an Astro-barbecue is organised for **Saturday 24th August 2013**. It will be in Wadhurst at Phil Berry's house and will begin at 1900. Details of how to get there will be given in the August Newsletter. Members and visitors are invited to bring telescopes etc.

You will need to bring your own food to cook on the barbecue and your own drink.

This has been a very enjoyable event in previous years involving some astronomy and is well worth putting in your diary. It is the Saturday of the August Bank Holiday weekend.

Wednesday 18th September 2013 – Steve Tonkin will be talking about "Binocular Astronomy"

Wednesday 16th October 2013 – James Fradgely FRAS calls his talk "The Birth of the Solar System"

Wednesday 20th November 2013 – Tony Roberts FRAS tells us about "The History of the Telescope up to 1960"

Wednesday 11th December 2013 – (the second Wednesday of this month only) Our Director of Observations, Brian Mills FRAS takes as his theme "The Star of Bethlehem".

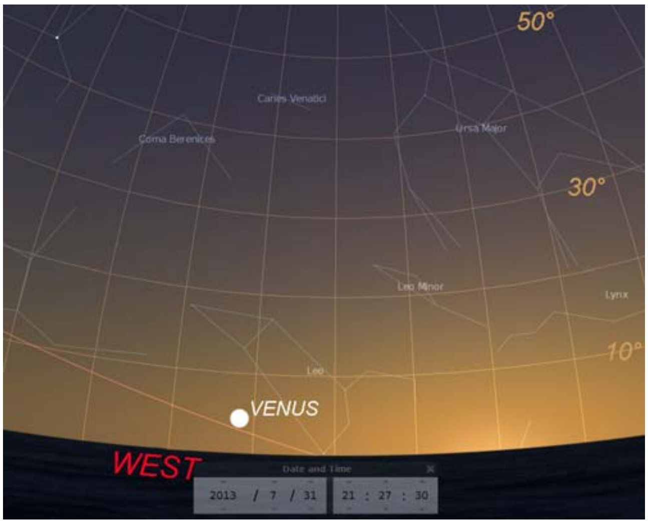
OTHER NOTES AND INFORMATION

SKY NOTES FOR JULY

Planets

Mercury reaches inferior conjunction on the July 5th. Because of this it will be unobservable until the end of the month when it becomes a morning object (at magnitude +0.8) and may just be glimpsed 6° above the north eastern horizon when the Sun is 6° below it at the end of nautical twilight (04.45 BST).

Venus suffered a superior conjunction at the end of March and is now beginning to draw away from the Sun although it will always be low in the sky as seen from the UK. At the start of the month it is only 5° above the west-north-western horizon at the start of nautical twilight (22.00 BST). By the end of the month nautical twilight begins at 21.27 BST, but despite the passage of time the altitude of Venus has not improved at all. The diagram shows its position on the last day of July after it has moved from Cancer into Leo. Its magnitude at this time is -3.8.



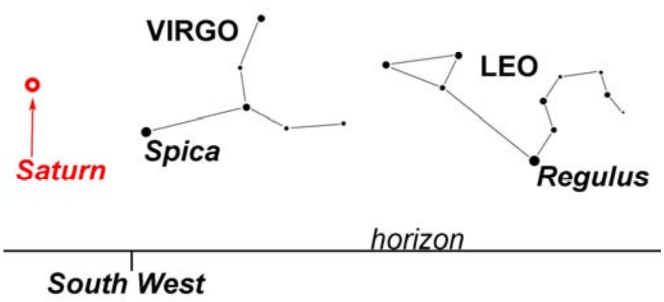
Earth reaches aphelion (its furthest from the Sun) on July 5th when we will be 94.5 million miles from our parent star.

Mars is a morning object, beginning the month in Taurus but moving into neighbouring Gemini as July progresses. On the 1st the planet rises at 03.30 BST and is just 4° high when nautical twilight ends. However, by the end of the month things have improved and the planet is more that 13° in altitude above the east north-eastern horizon with the Sun 6° below it. The planet's magnitude throughout the period is constant at +1.6. It passes close to Jupiter on the 22nd.

Jupiter is a morning object in Gemini at a magnitude of -1.9. As the month begins it rises just thirty minutes ahead of the Sun, but by the end this has increased to more that two and a half hours. On the last day of the month it is 22° above the eastern horizon at sunrise. The planet currently has an apparent diameter of 32 arc seconds although this is increasing steadily as Jupiter heads towards an opposition in the first week of 2014.

Saturn is an evening object currently in the constellation Virgo, where it remains all month, at magnitude +0.6. At the beginning of July it is still 25° above the south-south- western horizon at the start of nautical twilight and sets more than four hours after the Sun. This has dwindled to three hours by the end of the month as Saturn slips closer towards the twilight and a November solar conjunction. The north pole of the planet is currently tilted towards us at an angle of just over 17° giving excellent views of the ring system which is also tilted by the same amount. As the year progresses this angle increases to afford us even better views of the most majestic planet in the solar system. The other outer planets, Jupiter, Uranus and Neptune, also have rings, but they are of a far more tenuous nature. Saturn is moving retrograde at the start of July but reaches its second stationary point on the 11th after which it begins direct motion (west to east) once more.

Position of Saturn - 1st July 2013 22.30 BST



Lunar Occultations

In the table below I've listed events for stars down to around magnitude 7.0 that occur before midnight although there are many others that are either of fainter stars or occur at more unsociable hours. DD = **d**isappearance at the **d**ark limb. The column headed "mm" (millimetres) shows the minimum aperture telescope required for each event. **Times are in BST.** Please remember that the Society has telescopes that members can borrow, all of which are suitable for the following event.

July	Time	Star	Mag	Ph	Alt °	% illu	mm
17th	23.39	ZC2147	6.9	DD	9	70	110

Phases of the Moon for July

New	First ¼	Full	Last ¼
8th	16th	22nd	29th

ISS

There are no evening passes of the ISS as seen from Wadhurst this month. The only ones that are visible are in the early hours of the morning.

Iridium Flares

The flares that I've listed are magnitude -3 or brighter although there are a lot more that are fainter or occur after midnight. If you wish to see a complete list, or obtain timings for somewhere other than Wadhurst, go to:
www.heavens-above.com

Remember that when one of these events is due it is sometimes possible to see the satellite before and after the "flare", although of course it will be much fainter at those times. **Times are in BST.**

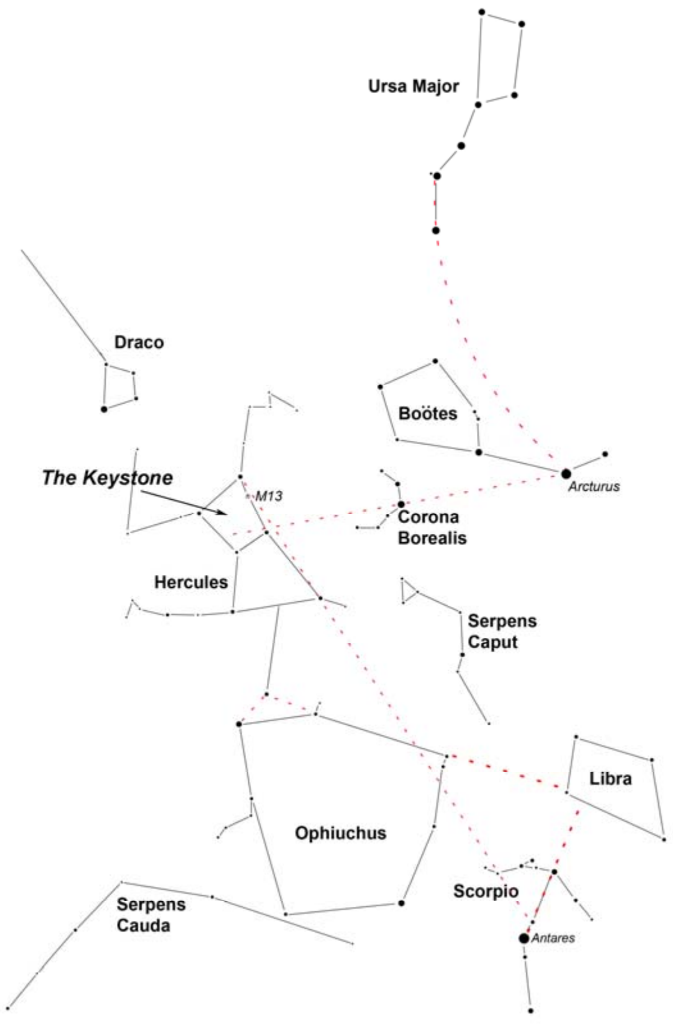
July	Time	Mag	Alt°	Az°
5th	22.54	-6.2	29	272 (W)
6th	23.39	-5.1	9	12 (NNE)
7th	22.51	-5.7	26	276 (W)
9th	22.48	-4.2	22	281 (W)
10th	23.59	-4.8	44	237 (WSW)
11th	22.45	-6.1	20	285 (WNW)
11th	23.20	-6.3	20	25 (NNE)
12th	22.16	-4.9	11	346 (NNW)
12th	22.48	-4.2	17	289 (WNW)
13th	22.44	-5.2	16	290 (WNW)
14th	22.55	-3.8	13	295 (WNW)
14th	23.43	-5.2	40	245 (WSW)
15th	22.58	-3.8	10	299 (WNW)
15th	23.06	-6.4	28	32 (NNE)
16th	21.32	-5.9	21	343 (NNW)
18th	23.28	-7.5	36	252 (WSW)
20th	22.45	-4.4	35	39 (NE)
21st	23.19	-7.2	33	258 (WSW)
24th	23.10	-6.9	29	263 (W)
26th	22.18	-3.0	43	48 (NE)
26th	23.08	-4.0	25	268 (W)
28th	23.05	-6.2	23	271 (W)
30th	23.02	-6.3	20	276 (W)
31st	21.57	-8.0	51	55 (NE)
31st	23.05	-4.0	18	278 (W)

The Night Sky in July (Written for 2200 hrs BST mid month)

In the north Ursa Major lies to the west of the celestial pole and is beginning its descent towards the horizon. Its smaller namesake stands on its tail pointing towards the zenith, whilst winding its way between the two is Draco, now well placed to allow its twists and turns to be more easily identified. Cassiopeia, on the opposite side of the celestial pole to Draco has passed its lowest point and is starting to climb away from the horizon.

To the east the Summer Triangle is fully risen whilst Pegasus is just making an appearance. M57, the Ring Nebula, is now at an altitude of 60° and with a magnitude of 9.7 will require an aperture of around 80 mm, although the central star will need a much larger instrument to resolve it. At this time of the year Hercules rides high in the sky lying close to the head of Draco. The globular clusters in the area are worthy of a look although M13 is the best by far of those visible from the UK. In the area of sky approximately bounded by Pegasus, Aquila and Cygnus lie the four small constellations of Equuleus, Delphinus, Sagitta and Vulpecula which are often overshadowed by their larger and brighter neighbours.

Looking low down in the south you will see the bright star Antares - the "Rival of Mars" in Scorpio, a constellation that is sadly too far south for UK observers to fully enjoy. Antares is a red supergiant thought to be approximately 900 times the size of the Sun and is a slow irregular variable. Above Scorpio in the sky are the rather faint constellations of Ophiuchus and Serpens, the latter of which is divided into two distinct parts. Just east of Scorpio is Sagittarius more often depicted as the "Teapot" asterism rather than as a celestial archer. It contains the galactic centre and is thus crowded with both globular and open clusters as well as many nebulae.



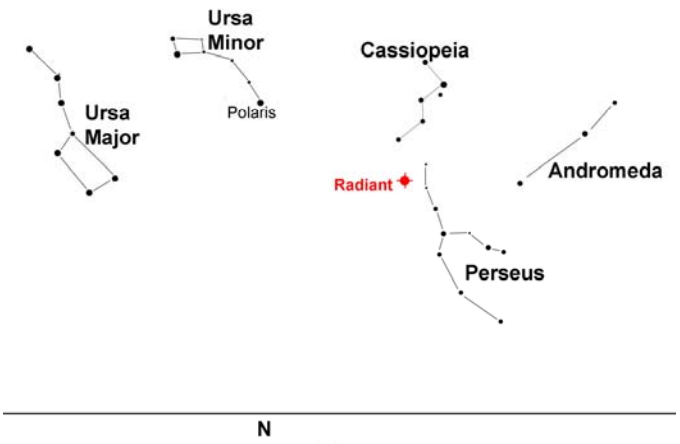
Hercules lies higher than all of them but is again rather indistinct with no bright stars to speak of. The best way of locating it is to first use the "handle" of the Plough to find Arcturus and then draw a line from it through the brightest star in Corona Borealis, continuing it on eastwards until it brings you to the "Keystone" a quadrilateral of stars that makes up part of the strong man's body. He is traditionally drawn standing on his head except in a version by H A Rey where he appears as a running man wielding a club. The stars on the west side of Hercules can then be used to locate Antares.

In the west Leo and Virgo are close to setting. Virgo is the second largest constellation by area in the sky, but despite this it has few bright stars although by way of compensation it is home to the Virgo Cluster of galaxies - sometimes referred to as the Virgo-Coma Cluster because this massive collection of galaxies crosses the border into Coma Berenices. The majority are of the 9th and 10th magnitudes although one or two are slightly brighter, notably M104, known as the "Sombrero Hat" weights in at 8.3.

A little higher in the sky we find the two small constellations of Coma Berenices (which contains the north galactic pole) and Canes Venatici, the former added by Tycho Brahe, and the latter by John Flamsteed.

Meteors

The Perseid meteor shower begins on July 23rd and builds slowly until the maximum in August, after which activity drops away more quickly until it ends around August 20th.



By the end of July the radiant is approximately 25° above the north-north-eastern horizon at 22.00 BST. The meteors from this shower are regularly long, fast and bright and very often leave ionised trails in their wake. You can tell if a meteor belongs to the shower by noting its position and continuing a line back in the direction it came from to see if it originates from the radiant point shown on the map. However, the sky close to the radiant is not the best place to look, as meteors can be seen over a wide area. The area around Pegasus is often a favourite if you want to limit your observations to a smaller patch of sky. However, if you lay back on a sun lounger that is facing roughly north with the head end slightly raised, you will be able to be aware of a large area of the sky without focussing on one particular part.

Meteor showers can usually be associated with an asteroid or comet, and in the case of the Perseids the parent body is the comet Swift-Tuttle which has an orbital period of 130 years. Each time the comet passes through our part of the solar system it leaves behind it a trail of minute particles that encounter the Earth's atmosphere and burn up causing the brief streak of light that we see.

You will be aware that there are a number of meteors that are obviously not associated with the shower, and we call these sporadic. They are caused not by debris from Swift-Tuttle but are random grains of material that just happen to strike the Earth.

Advanced Warning for August.

A daylight lunar occultation of the magnitude 3.5 star epsilon Tauri occurs on August 1st.

There is a disappearance at the bright limb at 10.15 BST which needs an aperture of 14 mm. There is then a reappearance at the dark limb at 11.28 BST which can be observed with just a 70 mm instrument.

Later in the year (September) there is a daylight occultation of the first magnitude star Spica.

The Perseid meteor shower reaches maximum on August 12th when the ZHR will be around 80.

NASA SPACE PLACE

High-energy Spy

By Dr. Martin C. Weisskopf

The idea for the Chandra X-Ray Observatory was born only one year after Riccardo Giacconi discovered the first celestial X-ray source other than the Sun. In 1962, he used a sounding rocket to place the experiment above the atmosphere for a few minutes. The sounding rocket was necessary because the atmosphere blocks X-rays. If you want to look at X-ray emissions from objects like stars, galaxies, and clusters of galaxies, your instrument must get above the atmosphere.

Giacconi's idea was to launch a large diameter (about 1 meter) telescope to bring X-rays to a focus. He wanted to investigate the hazy glow of X-rays that could be seen from all directions throughout the sounding rocket flight. He wanted to find out whether this glow was, in fact, made up of many point-like objects. That is, was the glow actually from millions of X-ray sources in the Universe. Except for the brightest sources from nearby neighbours, the rocket instrument could not distinguish objects within the glow.

Giacconi's vision and the promise and importance of X-ray astronomy was borne out by many sounding rocket flights and, later satellite experiments, all of which provided years-, as opposed to minutes-, worth of data.

By 1980, we knew that X-ray sources exist within all classes of astronomical objects. In many cases, this discovery was completely unexpected. For example, that first source turned out to be a very small star in a binary system with a more normal star. The vast amount of energy needed to produce the X-rays was provided by gravity, which, because of the small star's mass (about equal to the Sun's) and compactness (about 10 km in diameter) would accelerate particles transferred from the normal star to X-ray emitting energies. In 1962, who knew such compact stars (in this case a neutron star) even existed, much less this energy transfer mechanism?

X-ray astronomy grew in importance to the fields of astronomy and astrophysics. The National Academy of Sciences, as part of its "Decadal Survey" released in 1981, recommended as its number one priority for large missions an X-ray observatory along the lines that Giacconi outlined in 1963. This observatory was eventually realized as the Chandra X-Ray Observatory, which launched in 1999.

The Chandra Project is built around a high-resolution X-ray telescope capable of sharply focusing X-rays onto two different X-ray-sensitive cameras. The focusing ability is of the caliber such that one could resolve an X-ray emitting dime at a distance of about 5 kilometres!

The building of this major scientific observatory has many stories.

Learn more about Chandra at:
www.science.nasa.gov/missions/chandra

Take kids on a "Trip to the Land of the Magic Windows" and see the universe in X-rays and other invisible wavelengths of light at:
spaceplace.nasa.gov/magic-windows

Dr. Weisskopf is project scientist for NASA's Chandra X-ray Observatory. This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Caption:
Composite image of DEM L50, a so-called superbubble found in the Large Magellanic Cloud. X-ray data from Chandra is pink, while optical data is red, green, and blue. Superbubbles are created by winds from massive stars and the shock waves produced when the stars explode as supernovas.

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CONTACTS

General email address to contact the Committee
wadhurstastro@gmail.com

Chairman John Vale-Taylor

Secretary & Events Phil Berry
01892 783544

Treasurer Mike Wyles

Editor Geoff Rathbone
01959 524727

Director of Observations Brian Mills
01732 832691

Paul Treadaway

Wadhurst Astronomical Society website:
www.wadhurstastro.co.uk

SAGAS web-site www.sagasonline.org.uk

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