Wadhurst Astronomical Society Newsletter June 2013

MEETINGS

MAY MEETING

The May meeting took place on Wednesday the 15th of May and was introduced by Phil Berry who welcomed new members and visitors.

He then went on to say that at a meeting of the Parish Council held on the 22nd of April, an official announcement was made by the Chairman saying that the council were going to use the detailed Dark Sky data and recommendations made in a document compiled by Phil over many months. They would be using this as a basis for reference in future discussion on street lighting development in Wadhurst. Phil then went of to say if anyone needed advice on approaching their own local authority with regard to public street lighting, he would be more than pleased to help and provide information. He also asked anyone with their own security lighting systems to make sure they light up their property but prevent spillage into their neighbours' grounds.

Next month's meeting is our Telescope Evening when we are invited to bring along telescopes, binoculars or other astronomical instruments or devices to demonstrate to others how they are used. On the other hand if any one would like advice on setting up equipment and using it Phil feels sure someone would be able to help. There will also be short talks on astronomical subjects.

Now Phil introduced tonight's speaker. Louise Harrar is currently professor of Solar Physics at the UCL (University College London) Mullard Space Science Laboratory, where her main areas of research are solar flares, coronal mass ejections and solar wind formation. She is the UK project leader for the Extreme Ultraviolet Imaging Spectrometer on the joint UK and Japanese Hinode space mission and is also involved in much more solar research.

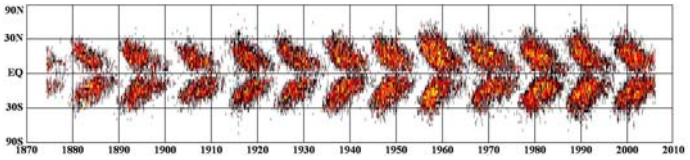
The solar cycle keeps its secrets
Louise Harra

To begin her talk, Louise reminded us of some basic data about the Sun such as its mean distance from the Earth at 150 million Km meaning that light from the Sun takes about 8 minutes and 20 seconds to get here. A plane travelling at 500 Km an hour would take something like 34 years to get there.

It has a diameter of about 1.4 million Km and something like 1,300,000 Earths would fit inside it.

The Sun was described as a magnetic star and we were shown an image of an eclipse where the effects of the dipole magnetic field could be seen surrounding it and looking like the familiar demonstration seen in experiments using iron filings surrounding a bar magnet.

Louise described the internal magnetic field within the Sun as twisting due to the rotation of the Sun's fluid plasma which moves faster in the equatorial regions relative to the poles and we were shown a graphic video demonstration. As the field becomes twisted it eventually gets to the stage when the field bulges through the surface resulting in sunspots usually in pairs, starting at the higher latitudes and working towards the equator. Over a period of time a graph of the sunspot latitude and activity against time results in the now familiar "Butterfly Diagram".



From the quiet period to the time when the field is most twisted is about 11 eleven years.

Also soon after the end of each cycle the polarity of the Sun's magnetic field flips.

To help with this description, Louise illustrated the changes on the Sun's surface seen in x-ray images which she herself had helped to make and which made her explanation much clearer to understand.

During the last solar minimum, we were told that solar activity, which is usually quiet at this time, was in fact quite active with the solar winds becoming a mess and the reason for this is not really fully understood still, although there were very few sunspots seen in visible light for a much longer time than is usual at minimum.

One particularly interesting image of activity on the Sun was demonstrated when one image was subtracted from another over time using false colours. What had looked like a quiet sun now looked more like the surface of a boiling cauldron. We could see where plasma from the Sun was being thrown out and then falling back, although Louise did say some of the material was leaving the Sun, occasionally in our direction.

Various solar observing satellites were described, each using different instruments to provide data from various points around the Sun, resulting in a continuous picture of activity.

All of these results help countries around the world to be aware of possible threats to such things as power lines and sensitive electronic devices. Recently, methods of protecting the electronic equipment including those aboard space satellites are being developed which include working in "safe mode" or complete shut down if predictions are made for very strong solar activity.

The week before the May meeting, astronauts aboard the International Space Station went outside the vehicle to repair a serious ammonia leak. If this had been planned for the week of the meeting, Louise said the radiation would have been too strong and any EVA would have had to be postponed for the time being until levels became safe again.

We were told that sometimes scheduled air-flights have to be diverted taking longer to reach their destination because of strong solar winds causing dangerous levels of radiation on their original path. Not popular with airline companies because it then meant higher fuel costs and expenses.

Louise talked about many other effects of radiation such as disturbances with communication, navigation (particularly in northern latitudes such as Russia) and problems with long gas pipelines, all attributed now to solar radiation reaching the Earth.

Even animal navigation can be affected with racing pigeons losing their way, so that now pigeon fanciers take into account solar radiation predictions.

More whales become stranded at time of high activity and this has been established by looking back at records over many

years to see when this occurred most frequently and finding that most happened during solar activity. But at these times it can also result in the most spectacular aurora displays.

The next mission to the Sun will be the Solar Orbiter Mission, due to be launched around 2017. It is due to orbit the Sun within the orbit of Mercury and Louise said this needs very careful consideration when the need to protect the instruments on board from the intense heat and radiation will be essential. Eventually, it is planned that the orbit will be kicked into a path that takes the mission over the poles, giving a new chance of observing the magnetic fields from above the Sun's axes and so help to understand more about what the Sun is doing and how it does it.

During Louise's talk she used a lot of carefully prepared and unique images and videos which helped to explain what is a very complex subject at the level she is involved.

John Wayte's snippets from the world of science

Following on from John's talk last month called "What If…?" he added these thoughts:

Just to very slightly continue from my "What if" thoughts last month, here is another superb example of not being able to predict the future because you don't know what will be invented or discovered in the future.

In the mid 15th century there lived one of the most inventive people that have ever lived on this planet.

He invented flying machines, tanks, bridges, the parachute, a rudimentary mechanical calculator and many other war machines. All of his inventions used technology of the time and were all mechanically based. Also, he wasn't a bad painter and his sketches of the human body took centuries to better.

But he didn't know about electricity – that was a discovery in *his* future. What other inventions would he have made if he had an inkling about this vast field?

His name of course was Leonardo da Vinci.

I will leave you all to ponder on what may lie in our future with things that we don't even know about today.

In the meantime, back to the present.

The largest spiral galaxy detected from Earth has been found. It is 212 million light years from us and has been named NGC 6872.

The distance between the tips of its outstretched arms is 522,000 light years which is more than 4 times the size of our own Milky Way.

Apparently there has been some interaction with a dwarf galaxy at its northern arm that has caused it to grow so big.

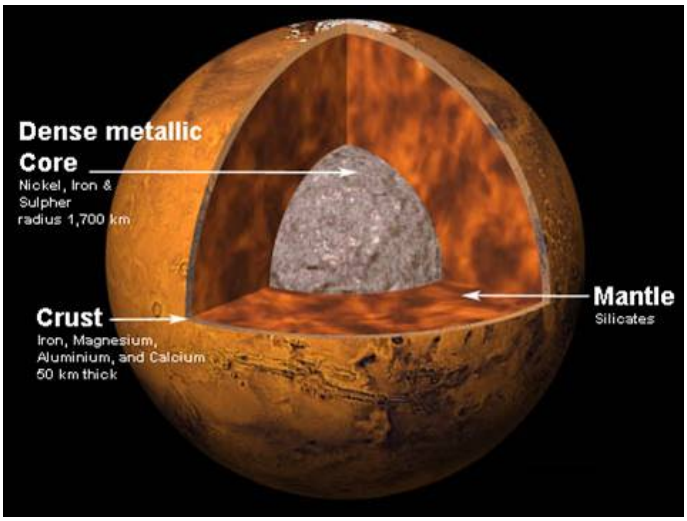
The galaxy was discovered using the Galaxy Evolution Explorer, capturing its image in ultraviolet light, which also indicates the formation of hot stars.

Continuing Brian Mills' talks for beginners
The planet Mars – The red planet

Having previously talked about Mercury and Venus, Brian continued his beginner's series about the planets by talking this month about the planet Mars, the fourth planet from the Sun.

It is 0.5 of an Astronomical Unit (AU) about 230 million Km from our Sun and is our next closest neighbour, Venus.

It has a diameter of something like 6,500 Km with a dense metallic core about 1,700 Km in diameter made up of nickel, iron and sulphur. The crust is about 50 Km thick and is made up mainly of iron, magnesium, aluminium and calcium. Brian said that Mars' red colour is due to the iron oxide in the fine dust on the surface.



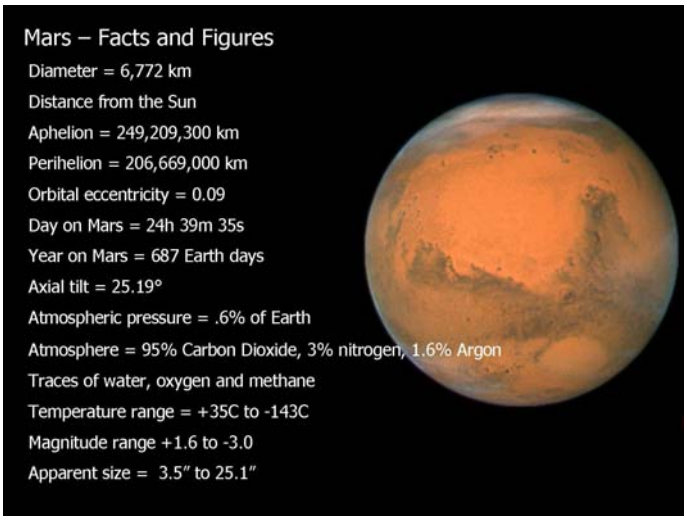
In between the core and the crust is the mantle which is made up mainly of silicates.

Mars is roughly half the diameter of the Earth but has an orbital eccentricity of 0.09 which compared with other planets is quite big.

A day on Mars is just a little longer than a day on Earth but a year is 687 Earth days and as Brian said, is something like twice as long as an Earth year although the axial tilt is very similar to our own, so there will be seasons but a lot longer than ours resulting large extremes of surface temperature.

The atmospheric pressure is 0.6 % that of Earth's meaning water could not exist as a liquid. The atmosphere is mainly made up of carbon dioxide with 3 % nitrogen and 1.6 % argon and just traces of water, oxygen and methane. It seems that what atmosphere there is, is slowly being stripped away by the solar wind.

The maximum temperature at the surface reaches a bearable 35° Celsius but at the other extreme, it can drop to as low as -143° Celsius. In some parts of the planet it is dark for almost the whole of the year!



Looking at Mars from the Earth, the apparent magnitude is at most -3 and can drop to as low as +1.6 and the visible apparent size can range from about 3.5 arc seconds to about 25.1 arc seconds. Brian said that at conjunction, size can vary considerably due to eccentricity of both the Earth's and Mars' orbits. Also at opposition, again the apparent size can vary which means that those imaging Mars want it to be as large as possible and just for the record, Mars will be at its apparent largest at opposition in 2018.

Mars has two relatively small satellites, Phobos and Deimos respectively 22 Km and 12 Km in diameter. Their origin is uncertain at present. One theory is that they could have been captured asteroids but Brian said one would have expected their orbits to be quite eccentric yet in fact they are almost circular.

Finally We looked at some surface features of Mars. There are volcanoes such as Olympus Mons which is a shield volcano where the lava flows have formed in different layers. There are also huge lava flows elsewhere and evidence of water-ice, certainly at the poles and below the surface.

Brian went on to say that Olympus Mons is something like 22,300 meters high and covers an area that is as big as France!

The Valles Marineris is a surface feature that is about 3,000 Km long and 8 Km deep. Because there is no material either side of the feature, it is suggested that it has been caused by plate tectonics.

Looking back to the early days of Mars observations, an Italian saw what he thought were lines on the surface and called them Canali, - the Italian for gouges, but as Brian said, Percival Lowell at Lowell observatory in Arizona believed they were canals and possibly being used by Martians to transfer water from the polar regions, although this has now been completely dismissed.

Life on Mars? Yes! Brian had discovered an old American soap advertisement declaring that people on Mars wanted to use their product…

Brian then gave the Sky Notes. Those for June follow later in this Newsletter.

JUNE MEETING

Wednesday 19th June 2013 – Open Telescope Evening. An evening to look at and talk about telescopes.

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

Wednesday 17th July 2013 – John Vale-Taylor gives a useful talk; "Astrophotography on a Shoestring".

There is no meeting in August but an Astro-barbecue is organised for **Saturday 24th August 2013**. It will be in Wadhurst and will begin at 1900. More details will be announced nearer the time, but 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"

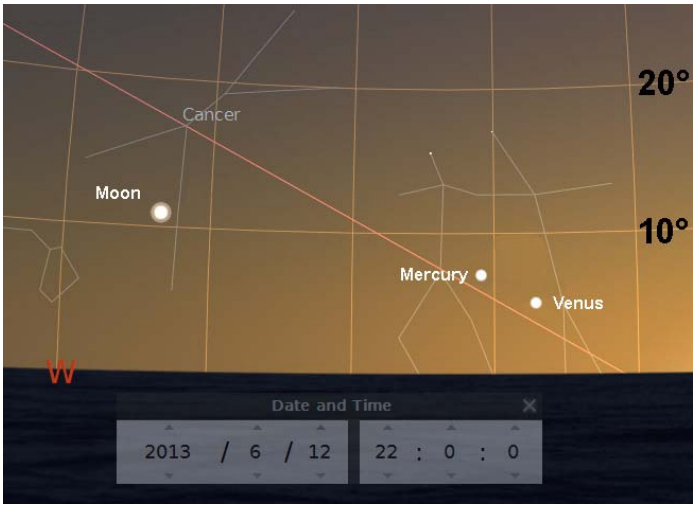
Wednesday 11th December 2013 – (the second Wednesday of this month only) Our Director of Observations, Brian Mills FRAS takes as his theme "The Star of Bethlehem".

OTHER NOTES AND INFORMATION

SKY NOTES FOR JUNE

Planets

Mercury reaches greatest eastern elongation on June 12th when it will be 24° away from the Sun. Despite this comparatively large angular separation it will be difficult to find in the twilight because of the angle the ecliptic makes with the horizon during summer evenings. The diagram shows the position of Mercury on the 12th when the Sun is 6° below the horizon, and you can see the planet is only 7° high. The close attendance of Venus should help with identification but remember that you must **NEVER** sweep the horizon with binoculars or a telescope until after the Sun has set.



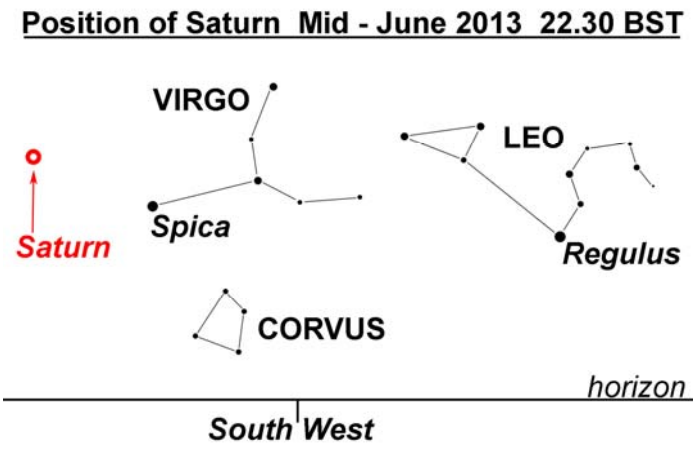
Venus suffers from the same problem as Mercury in that it is destined to be low in the sky for the reason mentioned above. Things hardly improve during the month, and on the 30th Venus is still only 5° above the west-north-western horizon at the time that the Sun is 6° below it (the end of civil twilight). Venus begins the month in Taurus but moves swiftly across Gemini and into Cancer at a magnitude of -3.8.

Mars is a morning object in Taurus and rises less than an hour before the Sun. It is therefore not observable from the UK this month. This situation improves slowly although it will be

February 2014 before it becomes an evening object ahead of its opposition on April 8th.

Jupiter is in conjunction with the Sun on June 19th and so is not observable this month. Following this it moves swiftly west of the Sun to become a brilliant morning object and should be visible to early risers in July.

Saturn lies in Virgo for the duration of this month at an average magnitude of +0.5. It continues to move retrograde until July 11th when it reaches its second stationary point. After this it resumes direct motion once again (west to east). The north pole of Saturn is tilted towards us at an angle of 17° giving excellent views of the ring system.



Summer Solstice

This occurs on June 21st at 05.04 GMT and is the time when the Sun is at its northernmost point in declination. The outcome, in non-technical terms, is that this is the day of the year with the most hours of daylight.

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 events.

Jun.	Time	Star	Mag	Ph	Alt °	% illu	mm
15th	22.42	55 Leonis	5.9	DD	15	42	40
19th	22.33	ZC 2063	6.7	DD	21	82	80

Phases of the Moon for June

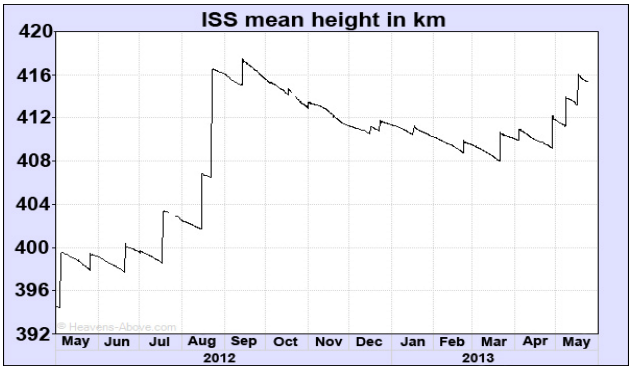
New	First ¼	Full	Last ¼
8th	16th	23rd	30th

ISS

Below are details of passes of the International Space Station (ISS) that occur before midnight and are brighter than magnitude -2.0. The details of all passes can be found at: www.heavens-above.com

Please remember that the times and directions shown below are for when the ISS is at it's ***maximum*** elevation, so you should go out and look five minutes beforehand . **Times are in BST.**

Jun.	Mag	Time	Alt°	Az.
3rd	-2.1	22.49	23	SE
4th	-3.3	23.36	59	SSE
5th	-3.0	22.47	42	SSE
6th	-2.5	21.58	30	SSE
6th	-3.4	23.35	87	S
7th	-3.4	22.45	72	SSE
8th	-3.2	21.56	54	SSE
8th	-3.2	23.33	79	N
9th	-3.3	22.44	84	N
10th	-3.3	21.54	84	SSE
10th	-3.3	23.31	83	N
11th	-3.2	22.42	78	N
12th	-3.4	23.29	75	SSW
13th	-3.3	22.40	90	NW
14th	-2.9	23.27	46	SSW
15th	-3.2	22.38	62	SSW
16th	-2.0	23.24	25	SSW
17th	-2.5	22.35	36	SSW



The height of the ISS gradually decreases due to atmospheric drag which itself is variable because of the way that solar activity affects the density of the atmosphere. The graph shows how its height decays and also the boosts that it receives to increase its altitude.

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.**

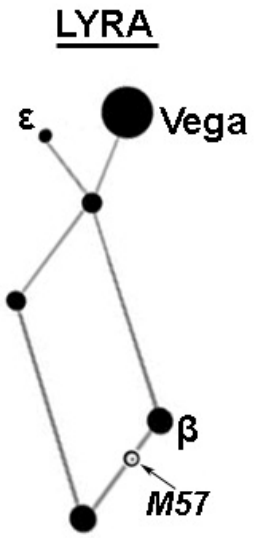
Jun.	Time	Mag	Alt°	Az°
1st	21.40	-3.9	18	244 NNW
1st	22.41	-5.5	14	295 WNW
2nd	21.34	-5.7	19	343 NNW
4th	23.21	-7.5	39	252 WSW
8th	23.06	-7.1	35	262 W
11th	22.57	-3.7	32	268 W
14th	22.48	-4.4	28	274 W
17th	22.39	-5.2	25	280 W
19th	22.36	-6.2	22	285 WNW
20th	23.47	-3.9	44	242 WSW
21st	22.10	-5.1	12	345 NNW
21st	23.41	-5.5	44	244 WSW
22nd	22.37	-5.7	17	293 WNW
23rd	21.48	-3.7	17	343 NNW
23rd	22.40	-5.6	15	296 WNW
25th	23.26	-3.3	41	252 WSW
26th	21.20	-5.9	23	341 NNW
28th	23.12	-7.3	38	258 WSW

The Night Sky in June (Written for 22.00hrs BST mid month)

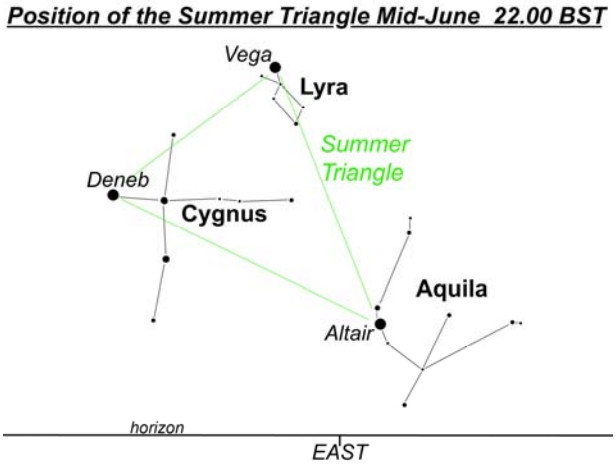
In the east, the arrival of Altair means that all of the Summer Triangle is now visible, with the brightest member, Vega in Lyra, at an altitude of almost 50°. Lyra is home to the

famous Ring Nebula that Charles Messier catalogued as M57. It's magnitude is 9.7 so should be visible with an aperture of 75 to 80 mm although something larger will be needed to see the central star.

The constellation is also home to the well known "double double" or, more correctly, epsilon (ε) Lyrae. This consists of a double that people with good vision can split with the naked eye, plus each component is itself a double that can be split with an aperture of around 70 mm.



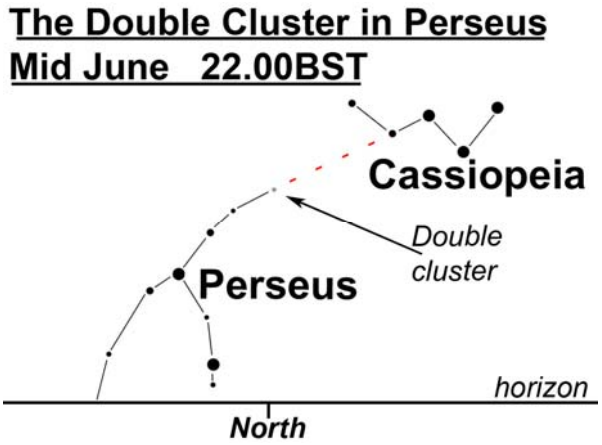
The star beta (β) Lyrae gives its name to a type of eclipsing binary whose orbit (in this case) just happens to lie in our line of sight, so we see one component pass in front of the other and witness the apparent change in brightness. There is thought to be some exchange of material between the two stars which has caused the smaller of the two, over time, to become considerably larger.



The map above shows how to locate Vega and the two other bright stars in the Summer Triangle - Altair and Deneb.
Looking south Arcturus, the brightest star in Boötes, is just past the meridian at an altitude of nearly 60° and ideally placed to assist in finding both Corona Borealis and Hercules. Use the map in either the April or May Newsletters for this. Below Boötes and either side of the meridian are Libra and Virgo. A little to the east (left) of Libra and closer to the horizon lies the bright star Antares in Scorpio. It is a red supergiant with a radius nearly 900 times that of the Sun and whose luminosity is 10,000 times greater. Antares will be better placed for observation during July when it's altitude will have increased slightly.

Towards the west Gemini, Cancer and Leo are making their way towards the horizon.

In the north the Great Bear is pointing down towards the horizon whilst its smaller namesake is standing on its tail and pointing towards the zenith. The constellation of Draco is now well displayed as it winds its way between the two bears. Despite the fact that Cassiopeia has reached its lowest point, the double cluster in Perseus, is still visible at a respectable altitude of around 20°, and is an excellent binocular object. As its name suggests it is two clusters of the open type designated NGC 869 and NGC 884 with each containing more than 100 members.



The Double Cluster in Perseus.

Incidentally NGC is an abbreviation for the "**N**ew **G**eneral **C**atalogue of Nebulae and Clusters of Stars" that was compiled in 1888 by the Danish astronomer John Dreyer. Dreyer essentially revised the catalogue that had been compiled by Sir John Herschel (son of Sir William Herschel) and then added two Index Catalogues (abbreviated IC). The original catalogue contained information on 5,079 objects whilst the NGC expanded this to 7,840 as well as adding an extra 5,386 in the two IC's.

Dreyer was educated in Copenhagen but at the age of 22 he moved to Ireland to work for Lord Rosse who had at his disposal the massive 72 inch reflecting telescope at Birr Castle. This telescope was the largest of its type in the world until the 100 inch was built in 1917 at Mount Wilson, near Pasadena in the USA.

Observing the Sun

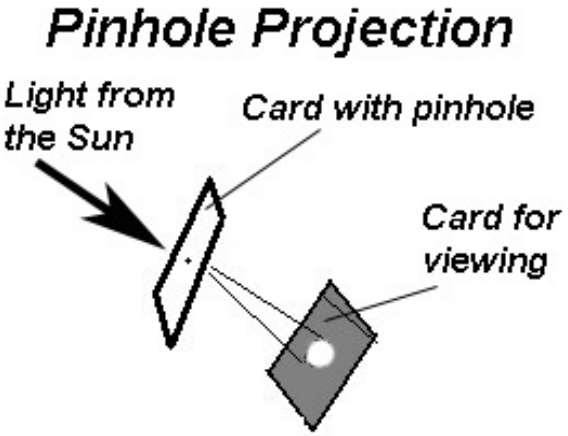
With the light nights with us now, perhaps we ought to turn our attention to our nearest star - the Sun. I will briefly describe the various methods of observing it. Firstly though the safety advice. **You must never look at the Sun using any optical aid - if you do you risk blindness.**
Having said that, there are ways to do it safely which we will look at in a moment.

Method 1 - Naked Eye (with “Eclipse Viewers”)

This is the simplest way of looking at the Sun and requires the use of “eclipse sunglasses” that were common at the time of the total eclipse visible from Cornwall in August 1999. These will allow you to see only the largest sunspots. Do not be tempted to make your own from old pieces of exposed film negative - they will not stop all the harmful radiation.

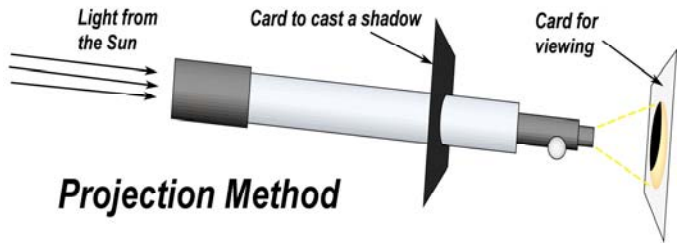
Method 2 - Pinhole Projection.

This method requires just two pieces of card, one with a very small hole in it. The rays of sunlight are allowed to pass through the hole in the front card whilst the other card (preferably white) is held up behind it as shown in the diagram. The image will be small, but the further away the second card is held then the larger the image will be. The image, incidentally, will be inverted rather like a pinhole camera.



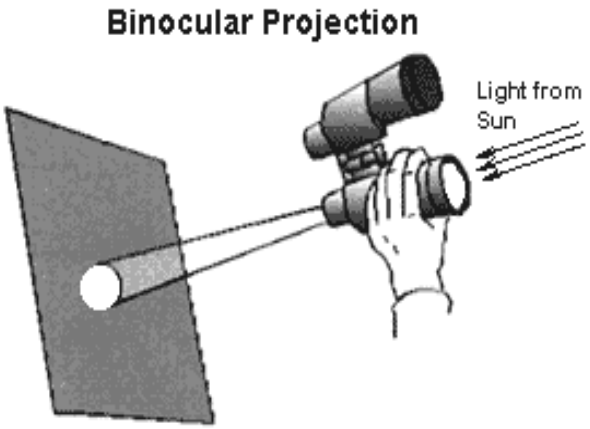
Method 3 - Telescope Projection.

With this method a telescope is pointed at the Sun (without looking through it or the finder) and an image allowed to fall onto a white card held behind the eyepiece. This will allow much smaller sunspots to be seen and some of the bright faculae that appear near the limb. If the telescope is mounted on a tripod, this will make observation much easier and allow the spots to be drawn on the card or paper that the image is projected onto.



Method 4 - Binocular Projection

The same thing can be done with binoculars, but in this case it is best to cover up one of the objective lens’ so that there is only one image. Again, if the binoculars are tripod mounted, the recording of the spots position on the disk becomes much easier. Also it can be quite difficult to hold a small telescope or binoculars steady for even a short period.



Method 5 - Using a Filter

This is one of the methods that will, with care, allow you to look directly at the Sun by placing a filter over the front of the telescope or binoculars. The filters come in several styles and can be made of optically flat glass that has a thin metallic film deposited on them or a thin sheet of flexible material that resembles aluminium foil. In both cases the filter is placed in a holder that fits *securely* over the front end of the telescope. Different types of material give different casts to the image - some are blue whilst others are slightly orange. The image below shows a reflecting telescope with a filter in place - the wrinkles in the film make no difference at all to the image quality.

Method 6 - Herschel Wedge

This is a precision glass wedge that fits onto the eyepiece end of the telescope and sends most of the light and heat out through an opening in the body whilst a tiny portion of it is transmitted to the observer.

Method 7 - Solar Telescope

These are specially made for solar observation and transmit only certain wavelengths of light through to the eyepiece. There are currently two types - one that permits observation in Hydrogen alpha light (656.28 nanometres) and the other in Calcium K (393.4 nanometres). With them it is possible to watch not only active areas on the solar disk but also prominences at the limb of the Sun.

It should be remembered that whatever method of observing you use, care must always be taken when your telescope has a finder (small telescope to help in object location) fitted to it. These must always be kept covered to prevent accidental use. The question is then, with the finder out of use, how do you point your telescope precisely at the Sun. The simplest way of doing this is to look at the shadow that the telescope casts on the ground and adjust it so the shadow is as small and symmetrical as possible. It will not be circular from the latitudes of the UK, but this method is safe and quick and once some of the image is on the rear card, only slight adjustment will be required.

Brian Mills

NASA SPACE PLACE

Triple Treat

By Dr. Ethan Siegel

(This article was received late in May and refers to some events that have already taken place but has interesting information– ed.)

The solar system is a busy place, with five wandering planets visible to the naked eye alone. When any two pass close by each other from our point of view, we see an astronomical conjunction, but on very rare occasions, three planets will find themselves grouped together: a triple conjunction. Towards the end of May, Mercury, Venus and Jupiter will treat us to the best triple conjunction in years.

On May 25th, Mercury will pass within 1.4° of Venus, then two days later Mercury comes within 2.4° of Jupiter, and finally on the 28th, Jupiter and Venus approach within 1° of one another. If it weren't for the slight orbital tilt of our solar system's planetary orbits, these conjunctions would all be occultations instead. During the nights of May 26th-27th, all three planets are visible immediately after sunset within the same 3° field of view, with the triple conjunction peaking in a triangular shape on the 26th. (For scale, the full Moon subtends about 1/2°.) The three planets appear close together for a few days more, making a line in the sky on the 30th/31st.

How does this happen? Mercury and Venus race around the Sun far faster than Earth, with Mercury completing more than four revolutions around the Sun for each one that Earth makes. At the same time, Jupiter is far slower, taking 12 years to orbit just once around the Sun. Jupiter's been high in the sky during the early parts of the night, but steadily lowers throughout May as Earth continues to move away from it, approaching its maximum distance from Earth. Mercury and Venus, meanwhile, begin to move out from behind the Sun during May: Venus at the beginning of the month and Mercury in the middle.

Thus, during this triple conjunction, all three planets will be on the far side of the Sun, something that happens just 25% of the time in triple conjunctions involving Mercury and Venus! If you telescopically resolve these planets into disks, you'll see our inner worlds in a nearly-full gibbous phase. Jupiter will appear largest in terms of angular diameter, followed by Venus and lastly by Mercury. Just a year ago, during its now-famous transit, Venus took up more than a full arc-minute in the sky; during this conjunction, it will just one-sixth that angular size and less than a third the apparent diameter of Jupiter. Nevertheless, Venus will still be more than six times as bright as Jupiter during this time, outshining all night-sky objects other than the Moon. Closer conjunctions of two naked-eye planets are frequent, but getting three or more like this happens just once or twice per decade, so don't miss your chance to see it.

And speaking of occultations, The Space Place has a great kid-friendly explanation of the Venus transit and solar eclipses of 2012 at:
spaceplace.nasa.gov/venus-transit

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The image shows the configuration of Mercury, Venus, and Jupiter in the western sky just after sunset on May 26, 2013. Insets show the relative size appearance of the planets on that date.

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