Wadhurst Astronomical Society Newsletter August 2013

Many members now read the Newsletter on their computer screens without printing it which must be good for the planet. But up until now the Newsletter has been written using two columns making it cumbersome to follow on-screen so starting this month we are taking away the columns making it easier to read this way. I would welcome any comments from members. *Ed.*

MEETINGS

THE JULY MEETING

The July meeting was introduced by Brian Mills who mentioned that there were still questionnaires on the table asking for members' views on how the Society is run,. He added that once sufficient responses had been received, the Committee will look at them and feed the results back to members to see if there are any changes we could consider for the future.

During the meeting, our Chairman, John Vale-Taylor said that copies of the Society's proposed new Constitution had now been with members for some time and asked for a show of hands for its approval. It was carried unanimously and so this becomes our Constitution from now on.

Brian then introduced our main talk for the evening to be given by John Vale-Taylor.

Astrophotography on a Shoestring
John Vale-Taylor

During Brian's introduction, he said that we are often presented with incredibly good astro-images and this often puts amateurs off trying to obtain them for themselves. Tonight John went a long way to encourage anyone to have a go and gave us many different ideas on how to go about it together with a number of useful tips, based on his own experiences.

He began by explaining his curiosity for anything technical, saying that during his childhood his father never threw anything away but encouraged John to take things apart, find out how they worked and then try and put them back together again such as clocks etc. From this he developed a need to always have a project on the go.

He showed a picture of the first telescope he had made using anything he found lying around. The tube was a piece of large diameter pipe, the finder was from a rifle telescopic sight, the tripod had been a potter's tripod but the mirror he had used had been in need of re-silvering.

He also showed a much later telescope he had developed that worked horizontally with a very ingenious flat mirror system that enabled the telescope to be used from a sitting position and was intended to be used by someone who was disabled.

A little while ago, John had bought a faulty Canon Digital Single Lens Reflex (DSLR) camera on eBay for very little and then managed to fix it just by cleaning its contacts. But with this camera he was able to try astro-imaging, and stressed the need for some kind of remote control to help reduce camera shake. A good pan-and-tilt tripod is also a great asset.

Imaging the Sun was the first project John dealt with. Using an A4 sheet of Baader Solar Filter that reduces the transmission of light by about 99.999% and costing about £20 a sheet, he cut out a circle and mounted it between two camera lens filters. This provided a safe means of turning the lens towards the Sun. He stressed very strongly that at no times should anyone ever look directly at the Sun with the naked eye without taking proper precautions.

The first problem is making sure the camera is looking at the Sun and John used the shadow of the camera as his guide; reducing the shadow to a minimum.

It is best to use the highest image quality the camera can provide. RAW images provide the maximum data available but they create huge files and the final image has to be processed on a computer.

Focus can be a problem unless the camera has Live View. To begin with John set the lens for infinity, but by experimenting found that this was in fact not true infinity. So having set the lens-focus without the filter on something at least a mile away, he used a piece of Gaffer Tape to fix the focus ring and this he found much better for his astronomical imaging.

The camera can set its own exposure automatically and the results he showed us certainly revealed sun-spots.

We briefly looked at John's 5-inch Cassegrain with its own solar filter this time minimising the shadow thrown by the telescope on to a dustbin to help find the Sun.

Next, we moved on to imaging the Moon with the solar-filter now removed. The exposure has to be increased and we were shown a result which also had a plane passing close to the Moon in the same frame.

Using an adaptor, John has been able to use his camera looking through the telescopes eyepiece. The Moon now showed quite a bit of detail.

For deep-sky imaging he said that to help keep the exposure as short as possible, it was suggested that the camera ISO be set to 1600, although this does increase noise somewhat. This noise can be reduced by taking a dark field with the lens cap on for the same exposure time and using this in processing, taking away some of the noise.

Something that John has found useful is an "app" on his mobile phone called "Astro Panel" on Android that predicts the viewing conditions from the observer's site and was described in the talk given by Phil Berry at the February meeting. It displays important data such as cloud cover, seeing conditions, and the phases of the Moon.

He also said that a DSLR camera vibrates slightly when the mirror flips out of the way when the shot is taken. This normally doesn't matter but with astro-photography it is necessary to "lock up" the mirror before the image is taken, and he described how to do this from the camera's menu. We also saw a slide that illustrated convincingly how effective mirror-lock up could be.

It was explained that much of the light, particularly from deep-sky features contains a lot in the infra-red (IR) part of the spectrum, but although the CCD chip is sensitive to IR, the human eye isn't, so for terrestrial photography the camera has a filter in front of the chip to remove it. The next part of John's talk was directed towards removing this filter for astro-imaging purposes.

This was mentioned in a talk to the Society given by John Durant some time ago and with instructions downloaded from the Internet, John Vale-Taylor set about removing the IR filter from the Canon camera he had bought from eBay and with the able help of Brian Mills. The website was at:
www.12dstring.me.uk/350dmod.htm

He had included in his presentation a detailed set of slides of the process and though it sounded like an alarming project to undertake and did take them 2 hours to take apart and a little longer to reassemble, whilst taking lots of precautions to prevent static from damaging some of the components, thy achieved success.

During the next part of his talk John described the 5-inch Celestron C5 he uses. It has a good stable wedge and he uses it with one camera attached at prime focus and another camera "piggy-backed" on the mount. It tracks extremely well and he said this was due to the roller-bearing arrangement inside the mount.

One problem John found was to achieve focus using the telescope's focus knob and to this end he had found a small 12 volt motor with a suitable gear ratio on its end in his spares box and also using a printed circuit board bi-directional drive and an arrangement of small gears he cleverly constructed the means of remotely adjusting the focus knob on the telescope.

We were shown a number of examples of what can be achieved such as images of Jupiter, the Moon and the Orion nebula.

Finally, to complete this introduction to astro-photography on a shoestring, John described how, using a Philips Webcam SPC 880 a series of images can be collected and stacked together using free software such as Registax to produce quite acceptable results.

All this showed how much or little one needed to actually have a try at producing one's own astro-images starting very little outlay. From this small beginning can grow a life-time's interest at almost any level.

As John said; all this, achieved on a shoestring…!

It was suggested at the meeting that if sufficient members were interested perhaps some workshops could be arranged in the future.

John Waytes Snippets from the World of Science

Pluto's Moons

In July I did something on Pluto saying that the minor planet has 5 moons but only 3 are named. P4 is now called *Kerberos*, a three-legged hellhound, and P5 has been named *Styx*, an underworld river. Mr Spock's (Leonard Nimoy's) bid for *Vulcan* never made it through the International Astronomical Union's naming committee…

Pack of Cards

We are used to massive sequences of numbers, generated by the complexities of space and indeed science. The speed of light is 5,874,601,661,280 miles in a year – or more simply 5.87×10^{12}.

However, even this vast sum pales into insignificance by everyday things that can sometimes generate staggering numbers. I am holding a pack of cards and I can be pretty certain you could never have seen the particular sequence of cards I have, before.

With 52 cards, the possible different sequences come out at:
80,568,175,170,943,878,571,660,636,856,403,766,975,289,505,440,863,277,824,000,000,000,000
or 8.0×10^{67}.

If every star in our galaxy, with a trillion planets and each planet has a trillion people shuffling cards at 1,000 shuffles per second since the time of the Big Bang, only now would there be an evens chance of repeating the sequence!

The Moon

AND - just when you thought it was safe to go back into the water…

It is theorised that early in the Solar System's history, a massive object called Galio smashed into the Earth, cleaving it into two unequal parts. The smaller of these condensed into the Moon. The best simulations of this process suggest that about 80 percent of the Moon ought to have come from the impactor and 20 percent from the Earth.

That's hard to reconcile with the measured make-up of Moon rock, which is almost identical to Earth-rock in terms of isotopic content. Some planetary geologists say this could be explained if, soon after the impact, the debris mixed well before forming into solid bodies. But others counter that this might explain the similarity in the isotopic ratios of lighter elements such as oxygen but can't easily account for the identical ratio of heavier elements such as chromium, neodymium and tungsten.

But there's another theory called the fission hypothesis that could account for the similar isotopic content. This idea is that the Earth and Moon both formed from a rapidly spinning blob of molten rock. This blob was spinning so rapidly that the force of gravity only just overcame the centrifugal forces at work. In this system, any slight kick would have ejected a small blob of molten rock into orbit. This blob eventually formed the Moon.

The fission hypothesis has been studied for 150 years but ultimately rejected because nobody has been able to work out where the energy could have come from to kick a lunar-sized blob into orbit.

Now Rob de Meijer at University of the Western Cape and Wim van Westrenen at VU University in Amsterdam say they know where that kick might have come from.

Their idea is that centrifugal forces would have concentrated heavier elements such as uranium and thorium near the Earth's surface at the equatorial plane. High concentrations of these radioactive elements can lead to nuclear chain reactions, which can become supercritical if the concentrations are high enough.

The question is how concentrated could these elements have become. De Meijer and van Westrenen calculate that it is quite possible for the concentration to be high enough for a runaway nuclear reaction.

Their theory is that the explosion of a natural nuclear georeactor after it became supercritical, ejected the material that eventually formed the Moon.

They also say that there ought to be telltale evidence that such an explosion took place, particularly in the lunar abundance of helium-3 and xenon-136, which would both have been produced in great quantities in a natural georeactor.

Future measurements from the Moon's surface could provide the evidence needed to confirm their theory but the analysis will not be easy. It is well known that the solar wind deposits vast amounts of these substances onto the lunar surface so that will have to be taken into account.

Of course, georeactors are by no means hypothetical. The most famous is in Oklo in Gabon, not so far from the equator, where a natural nuclear reactor was clearly in operation until about 1.5 billion years ago, leaving telltale signs in the uranium deposits now being mined there.

One interesting corollary of this discussion centres on the origin of this theory which is credited to George Darwin, son of the more famous member of this family. Not content with settling the debate over the origin of the species, could it be that the Darwin family might eventually account for the origin of the Moon as well?

Brian Mills' talks for Beginners No. 7
Asteroids

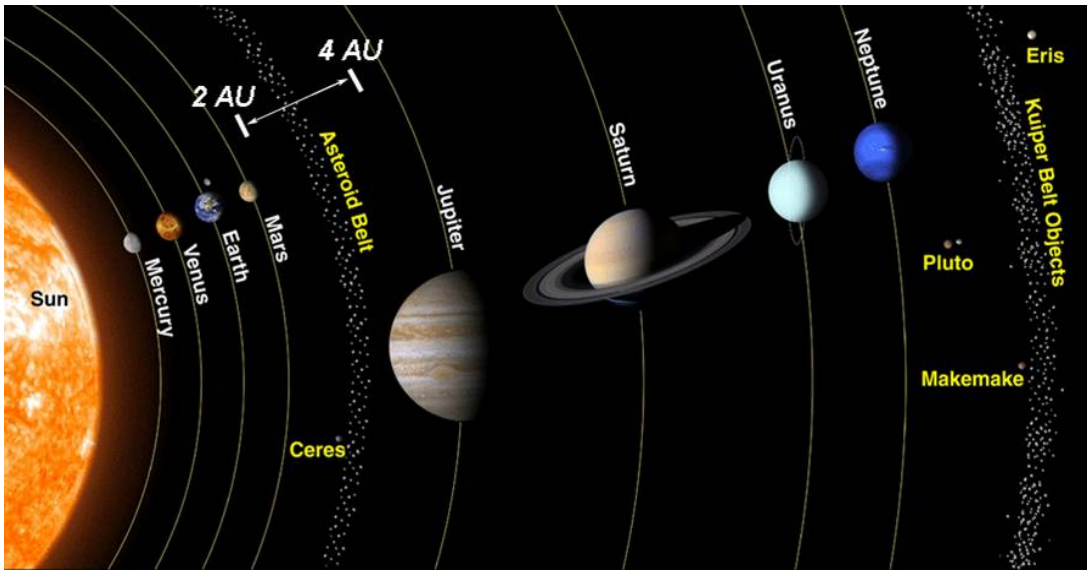
This month, Brian introduced us to Asteroids starting by considering what an asteroid is compared with the planets and other objects in the Solar System.

They all orbit the Sun but a planet must also have coalesced from other material to generally form a sphere, reaching what is known as hydrostatic equilibrium. A planet must also have cleared material in its neighbourhood.

A Dwarf Planet is defined by the International Astronomical Union as a planet that has not cleared material in its orbit.

Every other body is said to be a Small Solar System Body, SSSB.

Brian showed a diagram of the solar system and pointed out a belt of SSSBs between 2 and 4 Astronomical Units away from the Sun between the orbits of Mars and Jupiter and said this was known as the Asteroid Belt. (An AU being the distance from the Earth to the Sun)



There are also SSSBs known as Jupiter Trojans oscillating around certain points called Lagrange Points in Jupiter's orbit. These are stable points at certain locations relative to Jupiter in its journey around the Sun. There are many more SSSBs in the Kuiper Belt beyond the orbit of Neptune and is where many recurring comets spend much of their time.

We were also told that there are now acknowledged to be 9,991 SSSBs known as Near Earth Asteroids, within 1.3 AU of the Earth and varying in size from about 1 metre to 41 Km in size. One called 2010 TK7 is the Earth's Trojan and again oscillates around one of the Earth's Lagrange points.

Brian explained that in 1781, two astronomers, Titius and Bode devised a formula which they believed predicted how far each planet is from the Sun. The formula worked fairly accurately but mysteriously predicted a planet at about 2.8 AU from the Sun between the orbits of Mars and Jupiter but nothing was there until Ceres was discovered in 1801 just where it had been expected and shortly after this, more, though smaller objects were found in a belt at about this distance, forming the asteroid belt. Ceres is classified as a Dwarf Planet with a diameter of just under a kilometre.

Uranus fitted in well with the formula but when Neptune was discovered in 1846 it far from fitted in. Then Pluto was found in 1930 and this discredited the formula even more.

Next, we looked at what formed the Solar System in the first place, with a suggestion that there may have been a molecular cloud containing something called a pre-solar nebula which eventually formed a proto-planetary disk and slowly over many millions of years material began to lump together and eventually formed the planets as we know them today.

It is quite possible that Jupiter's mass may have prevented the smaller sized material that remained from forming more planets, leaving it as the asteroid belt.

Finally Brian looked at what the asteroids are, saying they range in size from Ceres down to something the size of a pebble or even smaller and without any atmosphere.

There are three types; carbonaceous which are very dark, Silicaceous which is much brighter and metallic with a brightness midway between the other two.

It is thought that there are something between 1.5 and 2 million asteroids although as time goes on more and more smaller ones are being discovered.

One last slide showed Asteroid 243 Ida with its own moon. The main asteroid being 54 km long and the moon called Dactyl only 1.5 km in size.

Brian then gave the Sky notes which follow later in this Newsletter.

FUTURE MEETINGS

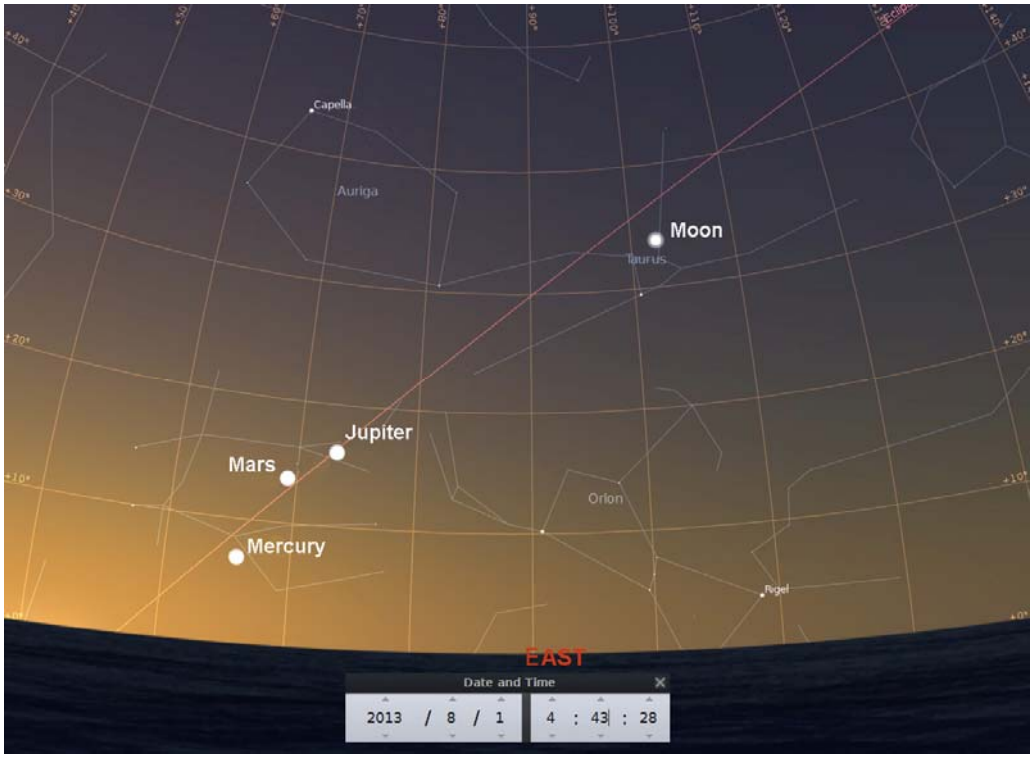
Wednesday 18th September 2013 – Steve Tonkin will be talking about "Binocular Astronomy"
Wednesday 16th October 2013 – James Fradgely FRAS calls his talk "The Birth of the Solar System"
Wednesday 20th November 2013 – Tony Roberts FRAS tells us about "The History of the Telescope up to 1960"
Wednesday 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 AUGUST

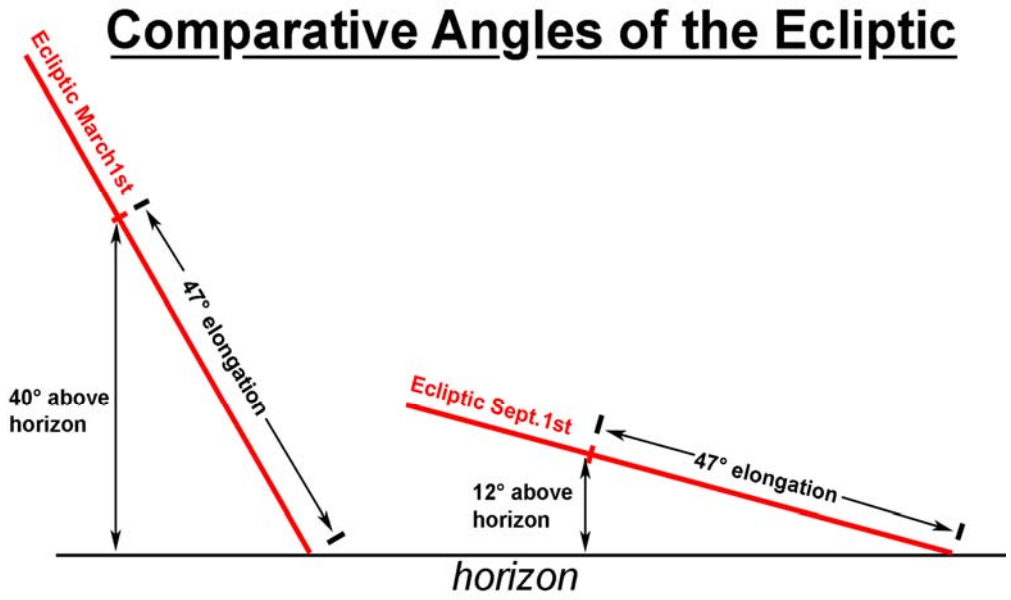
Planets

Mercury is currently a morning object in Gemini, moving into neighbouring Cancer as the month progresses. It reached greatest western elongation on the last day of July, so it is now growing gradually closer to the Sun. The map shows its position on August 1st with the Sun 6° below the horizon. This is when nautical twilight is ending and civil twilight is beginning. At that time the inner-most planet is only 7° above the horizon. If you want to see Mercury in the morning sky, then you need to be prepared for an early start because it rises at 03.45 hrs BST.



As you can see from the map, Mars and Jupiter are close by, with the latter being by far the brightest. Mercury suffers a superior conjunction (on the far side of the Sun) on August 24th after which it moves east of the Sun to become an evening object. Unfortunately for UK observers it will be a very poor apparition with the planet not being observable from these latitudes.

Venus is an evening object in Leo as the month begins but moves eastwards into Virgo by the 11th. The phase of the planet is decreasing whilst its apparent diameter is increasing, the outcome of which is that it is gradually becoming brighter. On the first of the month it is just 5° above the western horizon as civil twilight ends. This sad state of affairs fails to improve as the month continues and on the last day of August Venus still sets just over an hour after the Sun despite its elongation (angular distance from the Sun) increasing. The problem lies with the very shallow angle that the ecliptic makes with the horizon on summer evenings.



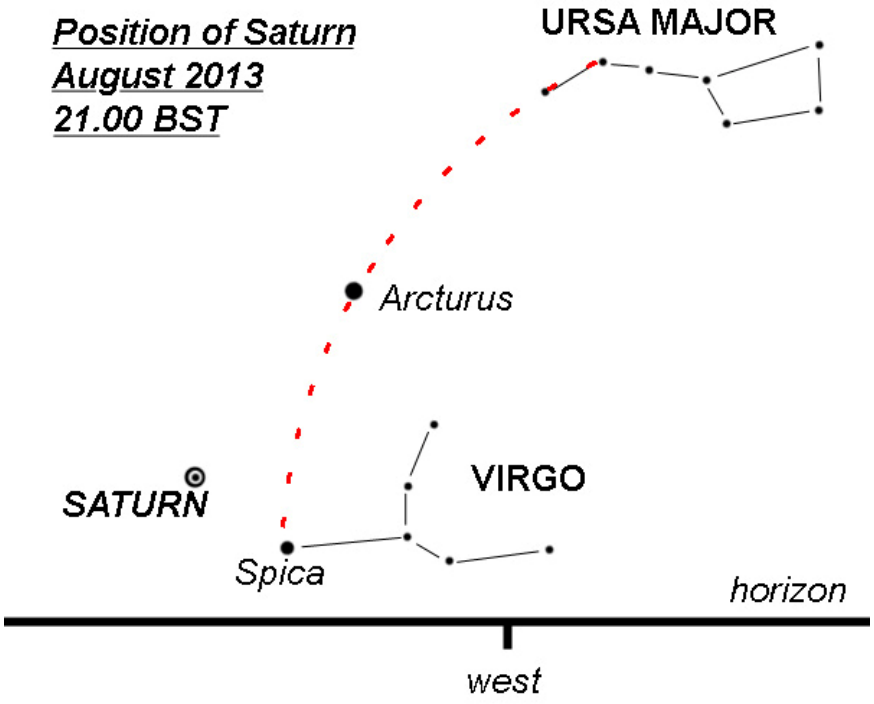
The diagram shows how this angle changes over the months. To demonstrate the effect that the ecliptic's position has on how observable a planet will be, lets consider Venus when its at greatest elongation, which in November will be 47°. If this were to occur on March 1st, then with Venus at this angular distance from the Sun it would be almost 40° above the horizon at sunset and would set 4½ hours later. However, if we suppose it reached this elongation on September 1st instead then it would only be just under 12° above the horizon at sunset and would set itself only 2 hours later. Note: the examples in the diagram are for 21.00hrs.

Mars is a morning object in Gemini at the start of August when it rises 2½ hours ahead of the Sun. By the end of the month this time has increased to 3½ hours whilst the planet has moved eastwards across the border into Cancer. The apparent diameter of Mars is slowly increasing whilst the magnitude stays more or less constant at +1.6. Its position is shown in the "Mercury" section above.

Jupiter is also a morning object, rising just ahead of near neighbour Mars as the month begins. It soon draws quickly away from Mars, until by the end of August it rises at 01.20 BST, 5 hours before the Sun. Jupiter spends all this month in Gemini at magnitude -2.0 although it brightens very gradually throughout the rest of the year whilst its apparent diameter increases as it heads towards an opposition on January 5th 2014.

The screenshot from "Stellarium" shows the situation on the 31st of this month with the Sun 6° below the horizon as civil twilight begins.

Saturn is still visible in the south-west after sunset but is gradually being engulfed by the twilight as its brightness and apparent diameter both decrease.



The rings though continue to improve in their presentation to us with the tilt of the north pole towards us reaching 18°. The tilt continues to increase and will make the planet an excellent sight when it reaches opposition on May 10th next year although it will be slightly lower in the sky (23°) than it was this year.
It can be found by using the stars in the end of the tail of Ursa Major and drawing a gently curving line onwards through the bright star Arcturus, in Bootes, until it reaches the moderately bright star Spica in Virgo. Saturn can be found a little above and to the east of Spica.

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.

Aug.	Time	Star	Mag.	Ph	Alt °	% illum.	mm
15th	21.41	ZC2394	6.3	DD	15	66	60
17th	22.12	ZC2724	6.3	DD	19	86	70

Daylight Lunar Occultations

There are a pair occultations of a bright star that take place during the morning of August 1st, and although the disappearance at the bright limb needs a large aperture, the reappearance at the dark limb requires a telescope of only 70mm.

Aug.	Time	Star	Mag.	Ph	Alt °	% illum.	mm
1st	10.15	Epsilon Tauri	3.5	DB	54	26	140
1st	11.28	Epsilon Tauri	3.5	RD	45	25	70

The graphic shows how the Moon and star will appear as the star emerges from behind the dark limb.

Phases of the Moon for August

New	First ¼	Full	Last ¼
6th	14th	21st	28th

ISS

Below are details of passes of the International Space Station (ISS) that occur before midnight and are magnitude -2.5 or brighter. The details of all passes including those visible from other areas 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 a few minutes beforehand. **Times are in BST.**

Aug.	Mag	Time	Alt°	Az.		Aug.	Mag	Time	Alt°	Az.
6th	-3.4	23.04	76	SSE		12th	-3.2	21.25	84	N
7th	-3.3	22.16	59	SSE		12th	-3.4	23.02	86	SSW
7th	-3.0	23.52	67	WNW		13th	-3.3	22.13	83	N
8th	-2.9	21.27	43	SSE		14th	-3.2	21.25	79	N
8th	-3.3	23.04	83	N		14th	-2.9	23.01	52	SW
9th	-3.3	22.15	88	S		15th	-3.3	22.12	74	SSW
9th	-2.6	23.51	50	WNW		16th	-3.3	21.24	88	SSW
10th	-3.3	21.26	73	SSE		17th	-2.7	22.11	44	SSW
10th	-3.2	23.03	79	N		18th	-3.1	21.22	60	SSW
11th	-3.2	22.14	79	N						

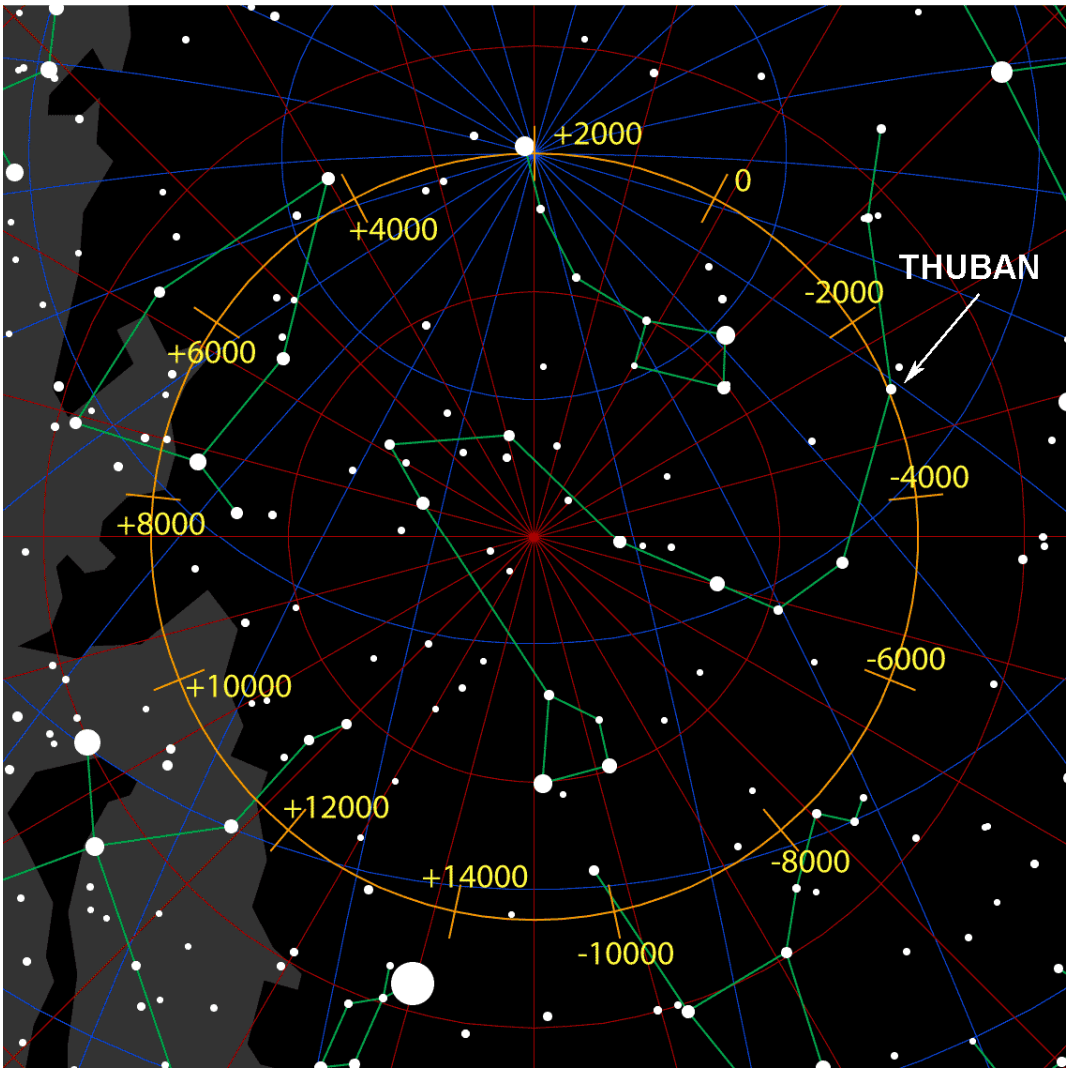
Iridium Flares

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. Some of those visible this month are extremely bright, with -8.1 being almost as brilliant as they can get. Don't forget that Venus at its brightest only achieves -4.9. **Times are in BST.**

Aug.	Time	Mag.	Alt°	Az°		Aug.	Time	Mag.	Alt°	Az.
1st	21.52	-8.1	52	56 ENE		15th	20.46	-3.7	69	87 E
1st	23.16	-5.7	16	25 ENE		17th	20.39	-5.8	72	95 E
3rd	23.15	-4.4	11	288 WNW		19th	22.06	-7.6	43	59 ENE
4th	23.08	-6.4	21	32 ENE		20th	22.00	-4.0	44	61 ENE
5th	23.02	-3.9	23	34 NE		21st	20.18	-6.3	73	112 ESE
6th	21.38	-5.9	19	348 NNW		22nd	23.02	-5.1	9	21 NNE
7th	21.25	-8.1	60	67 ENE		25th	21.39	-8.1	50	70 ENE
8th	21.19	-4.3	61	69 ENE		25th	22.54	-4.1	15	31 NNE
9th	22.47	-4.9	29	41 NE		28th	22.46	-3.1	20	39 NE
13th	22.32	-6.7	35	48 NE		30th	21.18	-5.8	55	80 E
14th	20.52	-5.9	68	84 E		31st	21.12	-7.1	57	83 E
14th	22.27	-5.8	36	50 NE						

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

In the north Ursa Major continues its descent towards the horizon meaning that on the opposite side of the pole, Cassiopeia is climbing and Cepheus is approaching culmination not far from the zenith. There are a number of open clusters that fall within the borders of Cepheus, the brightest being NGC 7160 which lies inside the quadrilateral that makes up the main body of the constellation. At magnitude 6.1 it requires only a small telescope or binoculars. Now is a good time to identify the convoluted shape of Draco which begins with its tail between the two Bears and ends with its head close to Hercules. The third star in the tail of the dragon is Thuban otherwise known as Alpha Draconis although it is not the brightest star in the constellation. Nearly 5,000 years ago it had the distinction of being the pole star, but due to the Earth's precession it has lost that role, one that it will not return to until approximately 20350 AD.

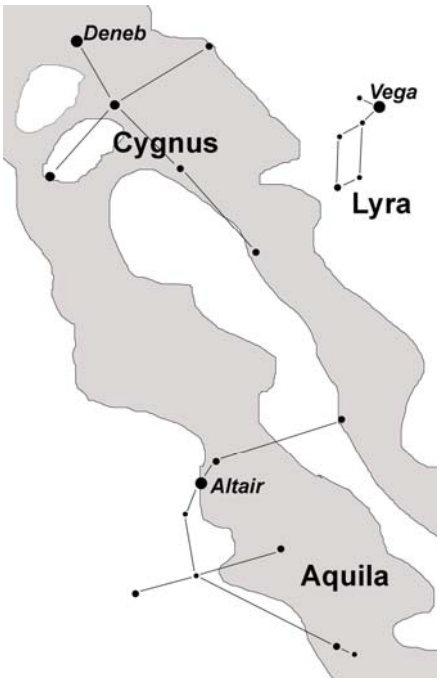


The diagram shows the circular path that the Earth's north pole draws out amongst the stars.
The brilliant Capella is now visible some 10° above the northern horizon.

Looking east we see that the autumn favourites of Pegasus, Andromeda and Perseus are making their presence felt. The asterism that we know as the "Square of Pegasus" is of course something of a misnomer because the top left star is Alpheratz or Alpha Andromedae.

Towards the south the bright star Deneb is approaching the meridian at an altitude of 70° meaning that the Pelican and North American nebulae are well positioned. Below and slightly to the west of Deneb we find one of the other members of the Summer Triangle - Altair in Aquila, which is always easy to identify because of the two stars (β and γ) that attend it on either side. Lower is Capricornus which contains the globular M30, visible in larger binoculars although a moderate sized telescope is needed to begin resolving individual stars. The final member of the Summer triangle, the brilliant Vega in Lyra, is at a commanding altitude of 75° and lies right on the meridian. Beta (β) is a much observed naked eye variable with a period of thirteen days and a magnitude range from 3.3 to 4.3. Also in Lyra is the lovely planetary nebula M57 at magnitude 8.8 lying roughly on a line between beta(β) and gamma (γ) Lyrae and slightly closer to the former. An aperture of 120mm will show it well but the central star at magnitude 14.8 will require something with considerably more light gathering power. Below Lyra are the two indistinct constellations of Serpens and Ophiuchus, both of which were members of Ptolemy's original 48. The former has been divided into two (Serpens Caput and Serpens Cauda) by the large and faint Serpent-Bearer. M5 is a magnitude 5.7 globular cluster in Serpens Caput which should be just visible to the naked eye given a dark site and good air quality.

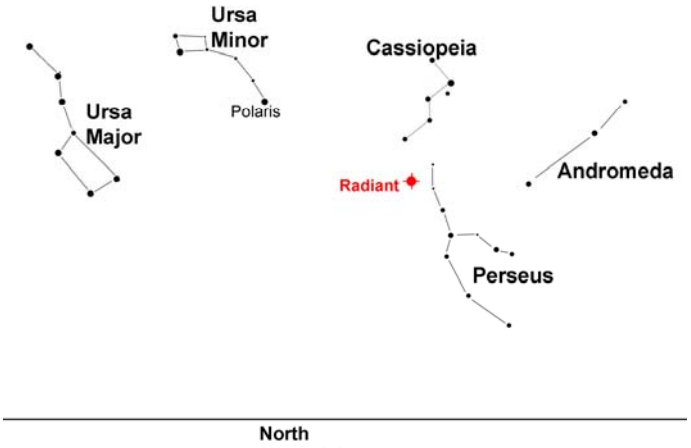
In the west the brilliant Arcturus is still at an altitude of 30° whilst above it and slightly west is Corona Borealis, The Northern Crown. Higher still we find the rather faint constellation of Hercules that is home to M13, arguably the most impressive globular cluster visible from the northern hemisphere. Discovered in 1714 by Edmund Halley (of comet fame) it is thought to contain something in the order of 300,000 stars. Its visual magnitude is +5.8 which places it at the edge of naked eye visibility. It is well shown with binoculars or small telescopes partly because its angular diameter is 20' (twenty arc minutes) which is two thirds that of the full Moon which is 30' (thirty arc minutes or half of one degree). For a location map see the July Newsletter.



At this time of the year the Milky Way is a beautiful sight as it makes its way through Perseus, Cassiopeia, and Cygnus before it meanders to the horizon via Aquila and Sagittarius. From somewhere that is moderately dark it is possible to see an area in Cygnus where there seems to be hardly any stars at all - this is known as the "great rift". It isn't a star free region but it is in fact simply an area where a cloud of molecular dust prevents us from seeing any stars that lie beyond it. Even at the time of Perseid maximum, meteor watchers at dark sites will be able to admire the majesty of the Milky Way particularly at times of good transparency. A pair of binoculars should always be to hand to sweep it looking for those jewels that a simple pair of 7X50's can so often reveal.

Meteors

The Perseid meteor shower which began on July 23rd reaches its maximum on August 12th at 17.00 hrs BST.



At this time the zenithal hourly rate (ZHR) is expected to be around 80, so with luck we could see perhaps one meteor every minute once the sky is properly dark. Watches on the nights of 11th/12th, 12th/13th (max) and 13th/14th should hopefully prove worthwhile particularly as the crescent Moon sets at 21.45, 22.15 and 22.45 respectively. By mid August the radiant is approximately 30° above the north-north-eastern horizon at 22.00 BST.

The most comfortable way to observe is to lie on a sun lounger, pointing roughly north or north east, with the head end raised slightly. It isn't necessary to be looking at the radiant, meteors can appear over a large area of the sky. Perseids can be fast and bright, often leaving ionised trains behind them for a second or so.

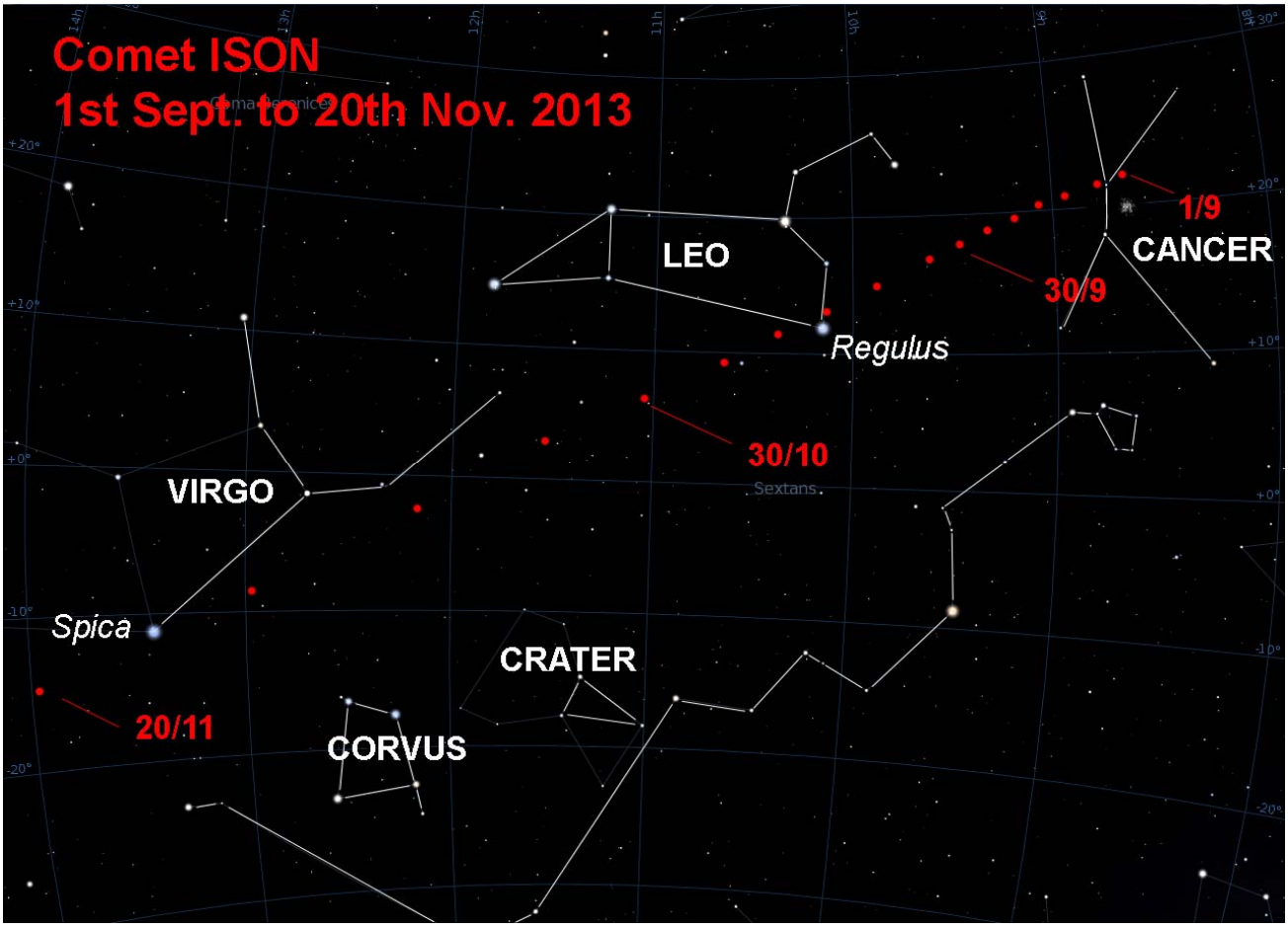
Advanced Warning for September

8th - daylight occultation of magnitude one star, Spica.

Update on Comet ISON

You may remember that a few months ago I told you about a comet we are expecting towards the end of this year, that was predicted by some to be "the comet of the century". Comet C/2012 S1 (ISON) is still on track to be a bright object although astronomers are playing down just how spectacular it could be. It is currently at magnitude 13, and in between the orbits of Mars and Jupiter on its way in towards the Sun. It reaches perihelion (closest to the Sun) on November 28th when it will pass less than two million kilometres from the solar centre making it a "Sun-grazer". One possibility is that the nucleus, which is thought to be in the region of 5km across, may break up due to the gravitational forces exerted on it by the Sun.

I've plotted the comet's position from orbital details supplied by the British Astronomical Association, and these confirm that it should be visible as a morning object from the beginning of September onwards, although it will then be magnitude 11.7 in the area between Cancer and Leo and within reach of larger amateur instruments. The Sun will seriously hinder observations at this time as it will itself be in southern Leo. As the autumn progresses the Sun moves further east of the comet, which will then be brightening.



However, it soon speeds up as can be seen from the spacing of red dots in the diagram which indicate the comets position every five days. Unfortunately, this means it "catches up" with the Sun and becomes lost in the solar glare for several weeks whilst it passes through perihelion. Hopefully it will be visible again to us around December 4th. After this ISON moves quickly north between Boötes and Hercules and becomes an evening object. It then passes within 4° of Polaris and moves south through Camelopardus and Perseus. Naturally, the one thing that we would all like to know for sure is how bright it will be.

Date	Mag.		Date	Mag.		Date	Mag.
1/9/2013	11.7		1/10/2013	9.8		1/112013	6.3
15/9/2013	11.5		15/10/2013	8.5		15/11/2013	3.5

The table gives *predicted* magnitudes up until the time of closest approach to the Sun. Current modelling suggests that when it becomes visible again after perihelion its brightness may be around -6 to -8. Predicting the magnitude of incoming comets is a far from exact science and one which past experience has shown should always include a wide margin for error. There have been reports in the press that it will be as bright as a full Moon and visible in broad daylight. Whilst that is a possibility it would be wise to err on the side of caution. Those of us with long enough memories will remember Comet Kohoutek in 1973 that was heralded as being another "comet of the century". Sadly, as a trip to the Brecon Beacons to observe it from dark skies was to prove, it was a grave disappointment and failed to live up to even the most conservative of predictions. Hope for the best but be prepared for the worst!

Brian Mills

NASA SPACE PLACE

Inventing Astrophotography: Capturing Light Over Time
By Dr. Ethan Siegel

We know that it's a vast Universe out there, with our Milky Way representing just one drop in a cosmic ocean filled with hundreds of billions of galaxies. Yet if you've ever looked through a telescope with your own eyes, unless that telescope was many feet in diameter, you've probably never seen a galaxy's spiral structure for yourself. In fact, the very closest large galaxy to us—Andromeda, M31—wasn't discovered to be a spiral until 1888, despite being clearly visible to the naked eye! This crucial discovery wasn't made at one of the world's great observatories, with a world-class telescope, or even by a professional astronomer; it was made by a humble amateur to whom we all owe a great scientific debt.

Beginning in 1845, with the unveiling of Lord Rosse's 6-foot (1.8 m) aperture telescope, several of the nebulae catalogued

by Messier, Herschel and others were discovered to contain an internal spiral structure. The extreme light-gathering power afforded by this new telescope allowed us, for the first time, to see these hitherto undiscovered cosmic constructions. But there was another possible path to such a discovery: rather than collecting vast amounts of light through a giant aperture, you could collect it *over time*, through the newly developed technology of photography. During the latter half of the 19th Century, the application of photography to astronomy allowed us to better understand the Sun's corona, the spectra of stars, and to discover stellar and nebulous features too faint to be seen with the human eye.

Working initially with a 7-inch refractor that was later upgraded to a 20-inch reflector, amateur astronomer Isaac Roberts pioneered a number of astrophotography techniques in the early 1880s, including "piggybacking," where his camera/lens system was attached to a larger, equatorially-mounted guide scope, allowing for longer exposure times than ever before. By mounting photographic plates directly at the reflector's prime focus, he was able to completely avoid the light-loss inherent with secondary mirrors. His first photographs were displayed in 1886, showing vast extensions to the known reaches of nebulosity in the Pleiades star cluster and the Orion Nebula.

But his greatest achievement was this 1888 photograph of the Great Nebula in Andromeda, which we now know to be the first-ever photograph of another galaxy, and the first spiral ever discovered that was oriented closer to edge-on (as opposed to face-on) with respect to us. Over a century later, Andromeda looks practically identical, a testament to the tremendous scales involved when considering galaxies. If you can photograph it, you'll see for yourself!

Astrophotography has come a long way, as apparent in the Space Place collection of NASA stars and galaxies posters at: http://spaceplace.nasa.gov/posters /#stars

Great Nebula in Andromeda, the first-ever photograph of another galaxy. Image credit: Isaac Roberts, taken December 29, 1888, published in *A Selection of Photographs of Stars, Star-clusters and Nebulae*, Volume II, The Universal Press, London, 1899.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

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Any material for inclusion in the September 2013 Newsletter should be with the Editor by August 28th 2013