



Wadhurst Astronomical Society Newsletter August 2017

VISIT TO THE SPACE GEODESY FACILITY AT HERSTMONCEUX

Space Geodesy Facility Visit – Tuesday 8th August at 20.00.

These are the final instructions for those who put their names down to attend the tour around the SGF at Herstmonceux Castle. The site phone number is given below or use Brian's mobile number which is 07531 678022. This information will also be sent to the e-mail address you provided when booking. If you are now unable to attend, or find later that you cannot go, then please e-mail wadhurstastro@gmail.com so that we know not to expect you.

The start time has been arranged for 20.00. You should ensure that you are there by that time (at the latest) so the tour is not delayed. The directions to the correct entrance for the site (Wartling Road) and then those for the facility itself are quite specific. Do not use the postcode for the Castle; instead if you need directions from a sat-nav, enter the co-ordinates given. The directions that the facility provides are reproduced below. There are a few parking spaces right beside the facility, or if that is full park on the road that runs parallel with it.

SAT-NAV users: Do NOT use the address postcode, but instead enter into your machine the following latitude and longitude coordinates: 50.86856N and 0.34859E. These will lead you into the grounds of the Bader International Study Centre, Herstmonceux Castle, via the East gate. See further 'inside the grounds' directions below in order to reach SGF.

- Via A27 (Brighton road) to Pevensy, then local road to Wartling and Herstmonceux Castle.
- Via A22 (Eastbourne road) to Horsebridge, then A271 to Windmill Hill and then on local road to Herstmonceux Castle en-route to Wartling.
- Via A21 (Hastings road) to Battle, then A271 to Boreham Street and then on local road to Herstmonceux Castle en-route to Wartling.

Inside the grounds:

Please identify yourself via the intercom at the barrier (if down) or at the pay hut further inside (when the grounds are open to the public between Easter and the end of October – 10:00 to 18:00). Beware of a total of 5 speed humps before you get to SGF Proceed across the front of the castle, straight up the hill the other side and turn left at the top, with signpost to 'Bader Hall'; SGF (red brick building + 2 white domes) is 100m on left Telephone: (01323) 833888 if required.

MEETINGS

JULY MEETING

The July meeting was opened by Phil Berry who, after outlining the evening's programme announced that those on the list to visit the Geodetic Space Facility at Herstmonceux on the 8th of August would each receive an email containing details of the trip. Details will also appear in the August newsletter.

He then introduced our first speaker for this evening, our Chairman Brian Mills.

It Should Have Been Me – The Story of NASA's Unseen Female Astronauts

Brian Mills FRAS

Brian explained that his talk is going to be about a number of women who, early in the space race mistakenly thought they were being tested as possible future astronauts.

On the 4th of October 1957, the Russians put Sputnik 1 into orbit around the Earth. Brian said this alarmed the Americans because it showed then that a ballistic missile could be launched against the USA.

A month later, Sputnik 2 was launched, carrying Laika the dog, although this was always intended to be a one-way journey for the animal and finally it died from heat, but it showed what was possible.

Early in 1959 NASA began the search for suitable astronauts. They would need a degree in engineering science, have experience in flying jets, be less than 40 years old, be less than 5' 11" and less than 180 lbs. in weight. Also, they would require the right physical and psychological qualities for spaceflight.

Women would have suited many of these demands, but it was announced in April 1959 that a number of men had been selected, who became known as the "Mercury 7".

Of these seven, Shepard was the first American in Space and Glenn was the first American to orbit the Earth.

Women had begun flying in 1908 and Brian turned to an American woman, Jackie Cochran. She was a successful business woman and after the Wall Street crash, it was suggested that she should learn to fly to cover much of the USA for business purposes. She obtained her pilots licence in just three weeks and was so successful at flying that she entered a number of races and broke the women's national speed record.



Jackie Cochran – learnt to fly and achieved many flying awards

Jackie Cochran sat on a committee for an aviation award and Brian said she managed to manoeuvre an aviation award to include Randolph Lovelace the Second, who opened the "Lovelace Medical Foundation in Albuquerque where medical aerospace technology was being promoted. In fact, he went on to test the Mercury 7 astronauts.

In the meantime, Jackie Cochran learnt about the Air Transport Auxiliary service in Britain where women were delivering military aircraft and had full military status. In 1941, she flew a Lockheed Hudson to England and also to find out more. Whilst she was out of the country, her job was taken by Nancy Love, an experienced pilot who set up America's Women's Auxiliary Ferrying Squadron.

Jackie made quite a fuss and was awarded the command of another female group called WASPS (Women's Airforce Service Pilots).

After the war, women were no longer needed but Brian told us that another young female pilot, Jerrie Cobb who first flew when she was just 12! She gained her private pilot's licence when 17 and her Commercial Pilots licence at 18. At 21, we were told Jerrie was delivering four engine bombers around the world.



Nancy Love



Jerrie Cobb

Whilst working for Aero Design and Engineering Company in 1959, Jerry met Randolph Lovelace and Donald Flickinger, both important in Aerospace Medicine. She explained to them that women were both physically and medically better than men at withstanding pain, coldness and monotony although no one had tested women. They asked if she was willing to volunteer for astronaut training even though Flickinger, a military man, was not allowed funding,

Lovelace privately carried out the testing of women in secret with numerous test such as blood tests, pedalling an exercise bike until their pulse rate reached 180 and also tests for balance and vertigo.

Next Jerrie was tested on MASTIF which Brian explained stood for Multi Axis Spin Test Inertia Facility where she had to control roll, pitch and yaw and did exceptionally well.



National Aeronautics and Space Administration
Lewis Research Center

During psychological tests, she had to float weightless in a bath of water at body temperature and there was no sound, smell or light. She only asked to come out from boredom after more than 9 hours.

She was tested in a pressure chamber at 40,000 feet and lasted three times as long as the men before becoming drowsy.

Brian said that Lovelace told Jackie Cochran about the tests because he wanted to test more women to see if Jerrie was just a fluke, but that didn't go down well because Jackie had thought she would be the first female in space.

Several names were put forward to be tested and 12 passed the initial tests, and in January 1961 the New York Times announced that they would go forward to take astronaut tests. They went to the Lovelace Clinic to do the same tests as Jerrie.

Jackie Cochran was furious when Jerrie Cobb was taken on as a NASA consultant although the female astronaut programme was not officially run by NASA.

On April the 12th 1961, Yuri Gagarin orbited the Earth and shortly afterwards Alan Shepard took a short flight to 116 miles.

In May that year, President Kennedy announced that America would put a man on the Moon and return him to safely to Earth by the end of the decade.

Brian told us that this brought about the sudden cancellation of any female astronaut tests by order of the Pentagon.

Despite Jerrie's best efforts she could not persuade any change of heart and lack of support from Jackie Cochran certainly didn't help. It was all over!

Brian ended by telling us that Jerrie Cobb was in the Amazon jungle when, on the 12th of July 1969 she heard that Man had landed on the Moon, she danced for joy on the wing of a plane but said "It should have been me!"

Following the break, John Lutkin introduced Phil Berry for the second talk of the evening.

Smartphone Telescope Control

Phil Berry

Phil showed us his first observatory, which he had built out of necessity whilst doing an online Cosmology Course, which required observing a particular nebula, and he was fed up with having to put his telescope and equipment away after each session.

Later he built a 7-foot diameter dome in his garden to house his array of telescopes on one mount. His big problem was space and this resulted in making the meridian flip almost impossible. He described the meridian flip as the point in tracking when cables and equipment become too tight and close so that the mount has to be reversed to allow tracking to continue.



Phil's arrangement of telescopes on one mount inside his 7-foot dome

Since then, Phil has moved house and Ian King introduced Phil to the Avalon M-Uno Mount which is a cross between an alt-azimuth and equatorial mount which is ideal for astro-photography and also eliminated the need for the meridian flip. It is exceptionally accurate mainly due to the tooth belt drive it uses. There is zero backlash, it is very portable and is easy to align.



The Avalon M-Uno mount



The mount with an IKHAROS 8-inch Ritchey Chretien telescope and a narrow band filter

Phil has used an Avalon SkyScan control and he explained how he has installed it on the mount, which now becomes a router so that connections can be made through it.

Phil is interested in astro-photography and with this in mind he has incorporated a Parfocal eyepiece that sits in the camera's field of view via a prism and allows for accurate focussing. For imaging this prism is removed.



Phil's Parafocal eyepiece



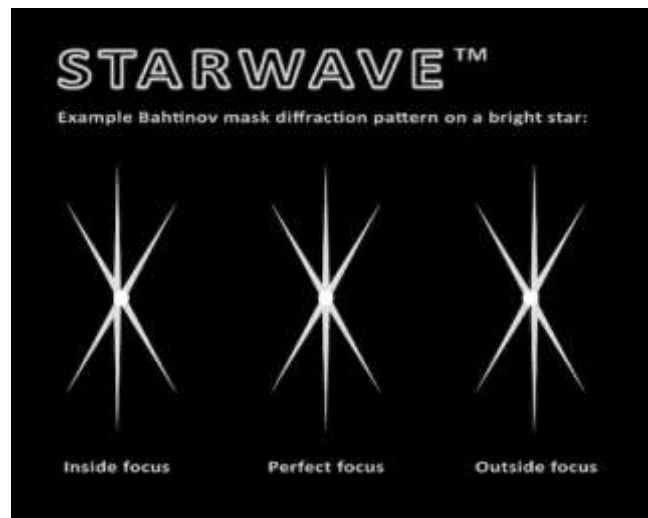
The Camera Phil is using for imaging

The camera Phil is using for astro-photography is the Canon 60Da hydrogen-alpha version of the DSLR.

To achieve very accurate focussing, a Bahtinov Mask is used which fits over the whole of the front of the telescope and it was illustrated how adjusting through focus produces the images below.



The Bahtinov Mask



The Bahtinov diffraction pattern on a star when passing through focus

Phil also uses a Laser Polar Aligner to speed setting up the telescope.



Showing the laser polar aligner

To control the telescope remotely, Phil downloaded SkySafari through Google Play, although he said there is also a version for IOS Apple available. He chose the Android version of SkySafari 5 Pro, which costs about £40 but is impressively comprehensive.

SkySafari 5 Pro has the largest database on any astronomy app with 25 million stars, hundreds of thousands of galaxies and solar system objects, and also includes ISS tracking. Phil said it contains more stuff than you can shake a stick at... But importantly it has flawless telescope control.

Phil then described the very simple process of aligning the app to the telescope.

We were shown how the app describes in astonishing detail, information about what the telescope is looking at and as an example we were shown data on one of the dwarf planets recently discovered in the Kuiper Belt.

Galaxy View was just another of the app's features, indicating where an object is in the galaxy by using the plan view of the Milky Way.

Yet another feature is "Tonight at a Glance" which gives information in detail of any object visible that night.

Also demonstrated was Celestron Audio with a sound description of an object.

Finally, Phil said that he has a long-range Wi-Fi aerial so that he can sit in his armchair and control the telescope up to a distance of a kilometre!

The evening closed with Brian giving the Sky Notes, which follow later in the newsletter.

THERE IS NO MEETING IN AUGUST

FUTURE MEETINGS

20th September - Barry Soden recalls "NASA Disasters (and Some Causes)".

18th October - David Pulley asks the question "So, How Do We Know They Are Planets?"

15th November – Jan Drozd regales us with stories about "Astronomical Blunders in Science Fiction"

13th December – (This is the second Wednesday in the month) Brian Mills FRAS tells the story of "The Great Telescope at Birr Castle"

RADIO ASTRONOMY FOR THE AMATEUR

Amateur Radio Astronomy

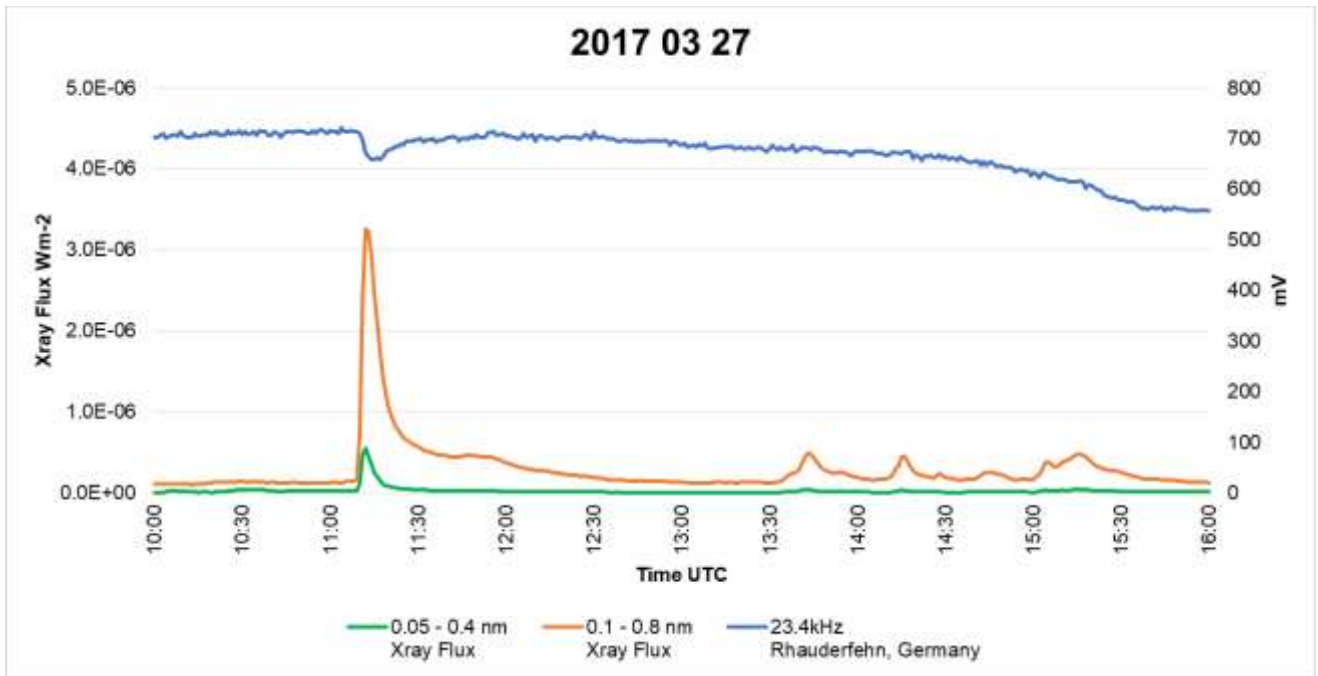
Andrew Thomas

Amateur astronomy is generally associated with visual or photographic observations, so it was a surprise to discover amateur radio astronomy is also possible. I am interested in radio astronomy and it is appealing to be able to make observations at any time of the day.

Observing is not dependent on clear skies, is not affected by light pollution or limited short summer nights. Are there any other members who share my interest?

A search of the internet identified two projects which make good starting points, meteor detection and observing Sudden Ionospheric Disturbances (SID) caused by solar flares. I chose SIDs because building the necessary equipment seemed straightforward and inexpensive.

Very low frequency (VLF) radio signals are reflected by the ionosphere and can be received over very long distances, the strength of the received signal depends on the condition of the lowest D layer at approx. 80km above the earth. This layer forms during daylight hours and is weakened by incoming X-rays from solar flares. By monitoring the signal from a distant transmitter (23.4kHz at Rhauderfehn, Germany) changes in the D layer in the ionosphere can be observed. The graph below is an observation I made on 2017 May 27 and shows the close correlation between a solar flare and the received signal level.



A SID has a characteristic “shark fin” shape as the D layer is quickly destroyed and then recovers to its normal level. This is seen after the C3.2 class flare at approximately 11:15. We are now approaching the end of the current sunspot cycle and this reduces the frequency and strength of SIDs.

Observations of VLF SIDs are collated by the BAA Radio Astronomy Group who publish a monthly summary. These observations have a close link to other areas of earth science and astronomy such as aurora and disturbances to the earth’s magnetic field which are another area for amateurs to contribute observations.

My receiver consists of a homemade 0.6m loop antenna and a commercially available VLF receiver and data logger designed for amateur radio astronomy. It is possible to build a receiver from scratch and use free software to achieve the same results.



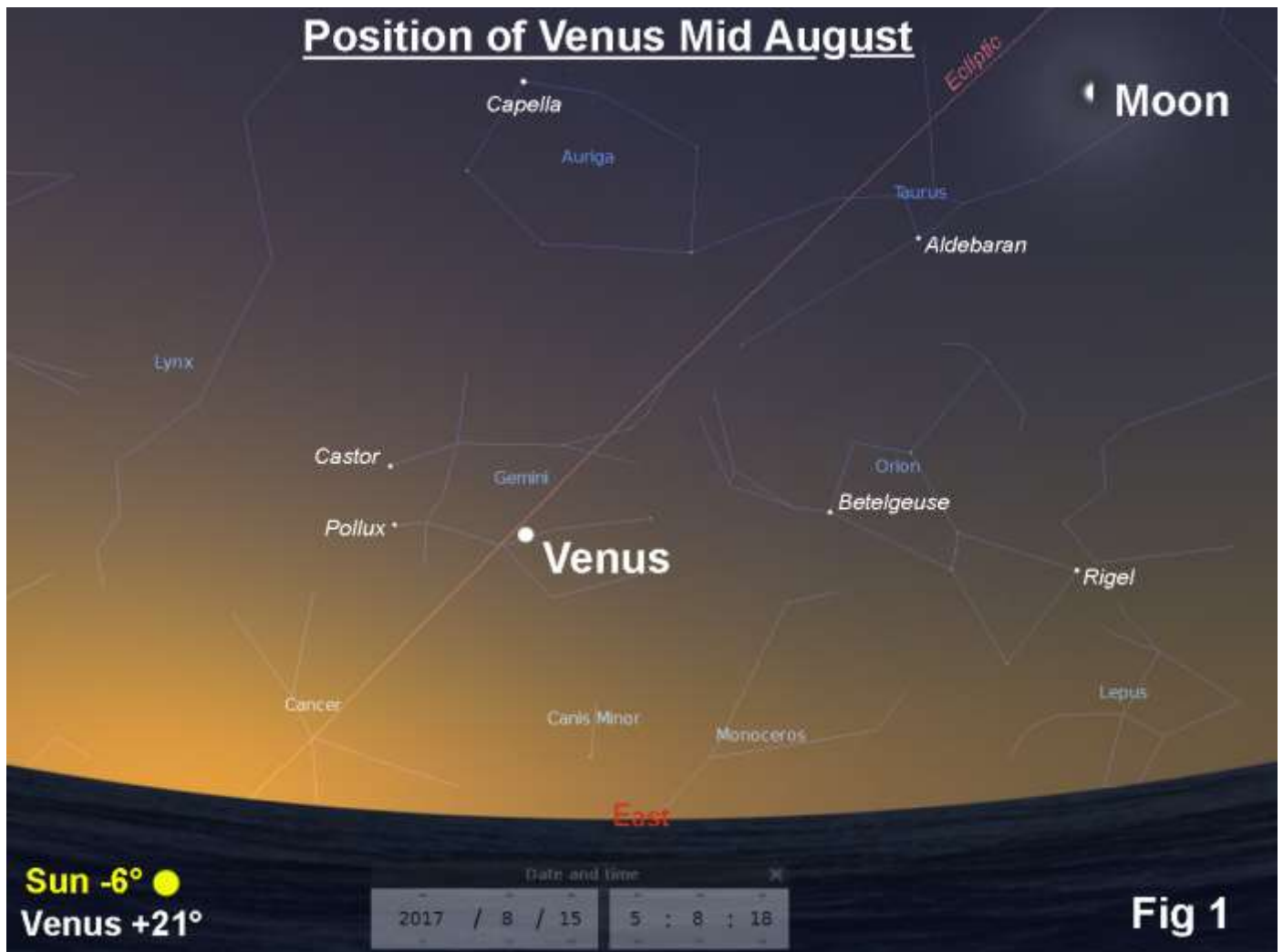
If you are interest in this article please contact the author Andrew Thomas by e-mail. andrew@silverbirch.me.uk

SKY NOTES FOR AUGUST 2017

Planets

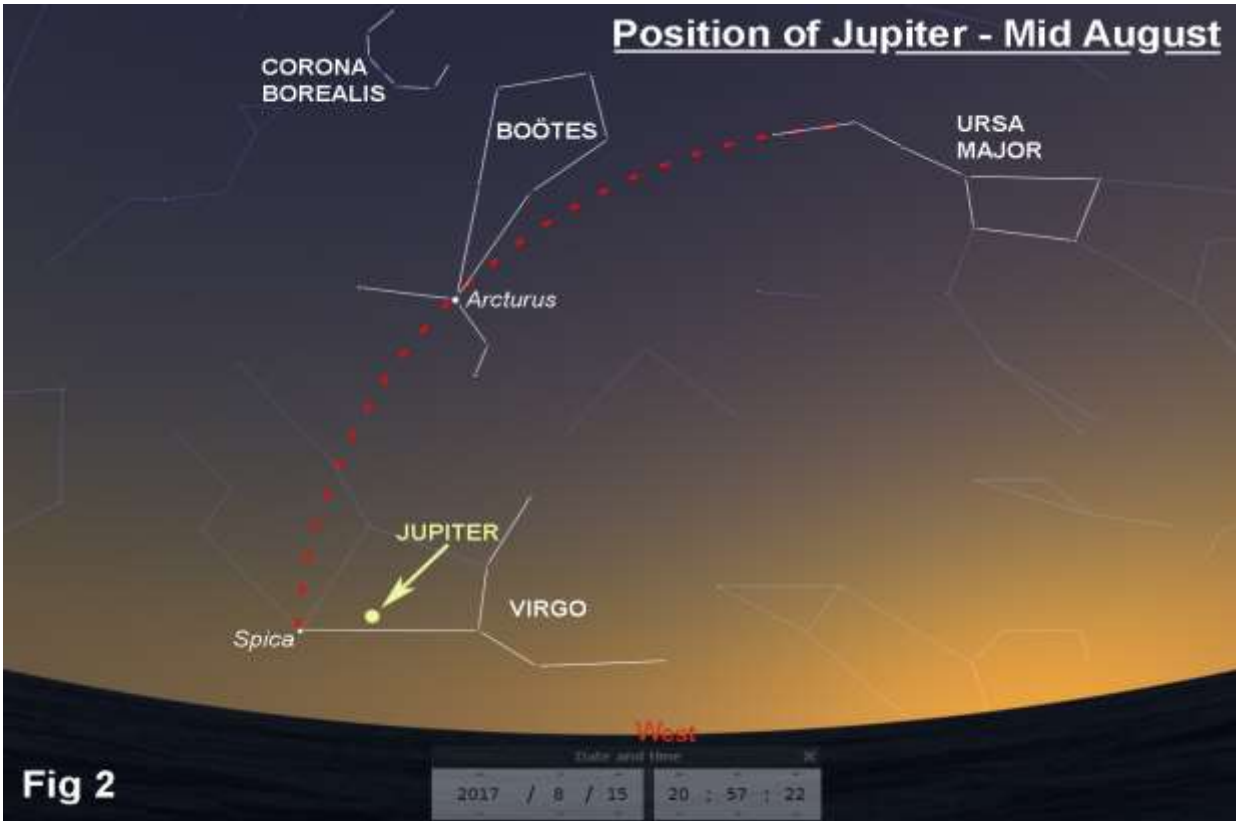
Mercury was at greatest eastern elongation on July 30th with an angular distance from the Sun of 27°. However, this was a very poor apparition of the planet which saw it just 1° above the horizon with the Sun 6° below it. This negative altitude denotes the end of civil twilight and the beginning of nautical twilight. The difficulty is that the ecliptic is very low to the horizon at this time of the day and year so Mercury sets very soon after the Sun. It reaches inferior conjunction on August 26th after which it moves west of the Sun to become a morning object during September.

Venus is still moderately well placed in the morning sky despite its gradual movement back towards the Sun following greatest western elongation in early June. By the middle of August it is 21° high in the east, amongst the stars of Gemini, with the Sun 6° below the horizon just after 05.00 (see fig 1). At that time its phase is approximately 80% and with a magnitude of -4.0 it is impossible to confuse it with any other object. Venus will not reach superior conjunction until early January 2018 after which it will gradually become visible in the evening sky.

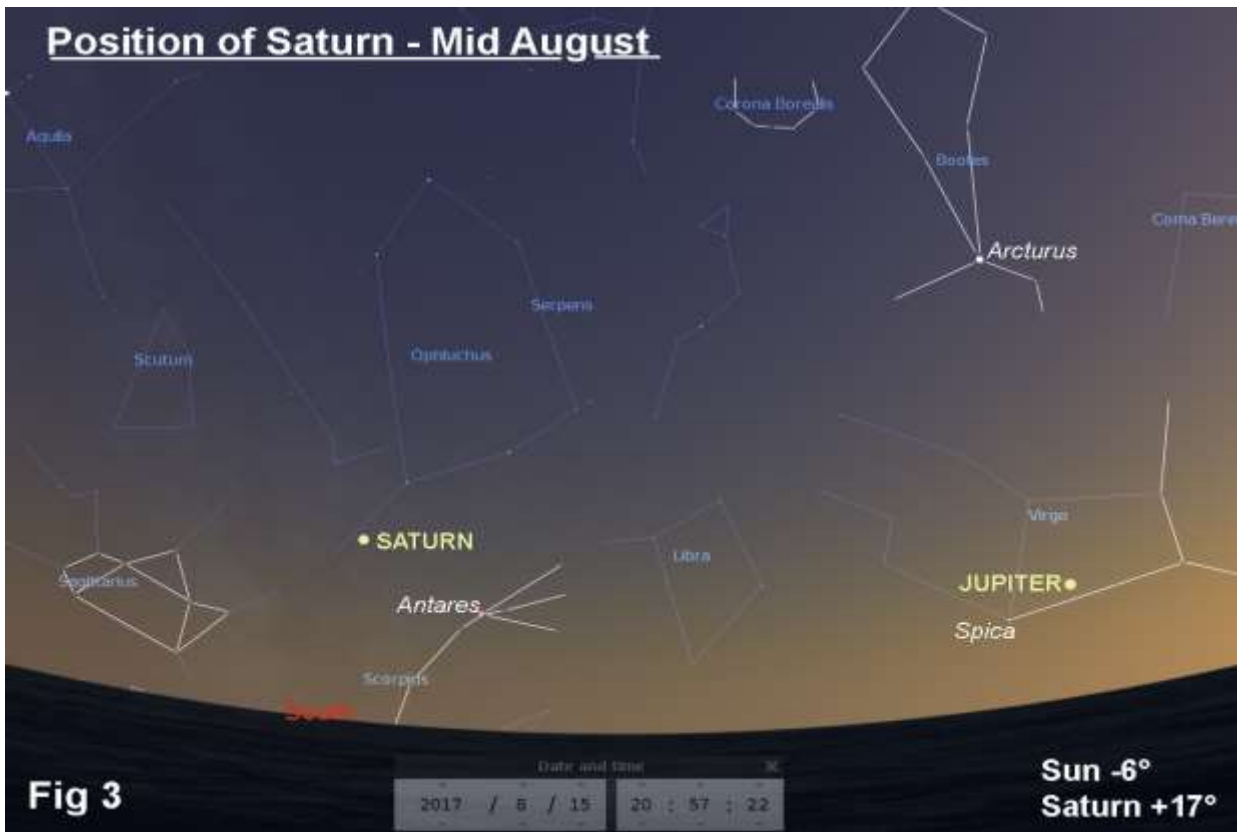


Mars was in conjunction with the Sun on July 27th and is consequently not visible this month. It should become visible as a morning object during mid to late September.

Jupiter moves more and more into the solar glare as August passes until, by the end of the month, it sets just an hour and a quarter after the Sun. Its position for the middle of the month is shown in fig 2 where the Sun is 6° below the horizon whilst Jupiter is at an altitude of 10°. To help you find the planet in the twilight, draw a curved line through the stars in the end of the tail of Ursa Major and continue it in the general direction of the western horizon. It will pass through the bright star Arcturus in Boötes and then, if you continue it further, through the less bright star Spica in Virgo. Jupiter is much brighter and a little to the right of it although it's possible that you may not be able to find Spica because the sky is too bright.



Saturn was at opposition in mid-June and so is past its best with respect to both brightness and apparent size.



By the middle of August it will be magnitude $+0.3$ and have an apparent angular diameter of 17.7 arc seconds. The ringed planet is still within the confines of Ophiuchus and sits amongst the star clouds of the Milky Way with a number of both globular and open clusters as well as nebulae close by. Its position, just before 21.00 in the middle of August, is shown in fig 3. At that time the Sun is 6° below the horizon whilst Saturn is almost due south at an altitude of 17° .

Saturn's largest moon Titan is magnitude 8.5 and so should be an easy target for a 60mm refractor. It is easiest to find when it is at elongation, or furthest from the planet as seen from Earth. During August it is at its most easterly on the 15^{th} and 31^{st} and is furthest west on the 7^{th} and 23^{rd} .

Saturn's rings are still superbly presented to the Earth thanks to the planet's north pole being tilted towards us by an angle of almost 27°.

Lunar Occultations

In the table below I've listed events for stars down to magnitude 7.0 that mostly occur before midnight although there are many others that are either of fainter stars or occur at more unsociable hours. DD = disappearance at the dark limb. RD = reappearance at the dark limb. The column headed "mm" (millimetres) shows the minimum aperture telescope required for each event. On the morning of August 16 the Moon once again cuts a swath through the stars of the Hyades cluster and concludes with a daylight occultation of Aldebaran which, from Scotland, will be a graze. The brighter events are included in the table. The Moon will next visit the Hyades on September 12th but on that occasion only one event will occur before sunrise. **Times are in BST.**

Aug	Time	Star	Mag	Ph	Alt °	% illum.	mm
2 nd	22.01	ZC 2448	6.3	DD	19	79	70
6 th	22.16	ZC 2981	5.1	DD	15	99	60
14 th	00.54	ZC 364	4.3	RD	16	62	40
16 th	03.34	ZC 661	4.5	RD	29	38	40
16 th	03.43	ZC 671	3.4	DB	30	38	90
16 th	03.45	ZC 669	3.8	DB	31	38	110
16 th	04.44	ZC 669	3.8	RD	39	37	40
16 th	04.46	ZC 671	3.4	RD	39	37	40
16 th	05.42	ZC 677	4.8	RD	47	37	40
16 th	07.42	Aldebaran (see below)	0.9	DB	55 (Sun +17°)	36	40
16 th	08.40	Aldebaran (see below)	0.9	RD	54 (Sun +26°)	36	40
29 th	19.54	ZC 2399	4.9	DD	20	54	50

Phases of the Moon for August

Full	Last ¼	New	First ¼
7 th	15 th	21 st	29 th

ISS

Below are details for passes of the International Space Station (ISS) when it is magnitude -2.0 or brighter. The details of all passes, including those visible between midnight and dawn, can be found at www.heavens-above.com. Please remember that the times and directions shown below are for when the ISS is at its *maximum* elevation, so you should go out and look at least five minutes beforehand. **Times are in BST.**

Aug	Time	Mag.	Alt°	Az.	Aug	Time	Mag.	Alt°	Az.
1 st	22:36:00	-3.9	87°	S	4 th	23:10:57	-2.4	25°	SW
2 nd	21:43:31	-3.8	82°	N	5 th	22:18:54	-3.1	38°	SSW
2 nd	23:19:48	-3.4	43°	SSW	6 th	21:26:29	-3.5	56°	SSW
3 rd	22:27:30	-3.8	62°	SSW	7 th	22:10:08	-2.2	23°	SW
4 th	21:35:03	-3.9	82°	SSW	8 th	21:17:46	-2.7	34°	SSW

Iridium Flares

The flares that I've listed are magnitude -3.0 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. 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 then. **Times are in BST.**

Aug	Time	Mag	Alt°	Az.°	Aug	Time	Mag.	Alt°	Az.°
1 st	23:21	-6.6	29°	257° (WSW)	18 th	23.45	-3.4	28°	242° (WSW)
2 nd	23.19	-7.1	28°	259° (W)	20 th	23.42	-7.0	24°	246° (WSW)
4 th	23.16	-4.1	24°	264° (W)	22 nd	23.39	-6.7	21°	250° (WSW)
6 th	23.13	-6.5	21°	267° (W)	23 rd	23.42	-3.2	18°	253° (WSW)
8 th	23.10	-3.7	19°	271° (W)	25 th	23.39	-5.6	16°	257° (WSW)
9 th	23.14	-6.2	16°	274° (W)	26 th	20.20	-3.4	39°	350° (N)
10 th	23.17	-5.9	14°	278° (W)	26 th	23.42	-6.1	13°	260° (W)
11 th	23.20	-5.8	12°	280° (W)	27 th	23.45	-4.9	11°	262° (W)
14 th	21.53	-4.9	14°	351° (N)	28 th	20.07	-3.2	42°	350° (N)
15 th	23.54	-7.1	31°	237° (WSW)					

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

The bright star Arcturus in Boötes lies almost due west, 30° above the horizon. Just east (left) of it is the compact form of Corona Borealis that does indeed have some semblance to a crown. Slightly east and a little north is the faint form of Hercules which contains M13, the most striking globular cluster visible from the northern hemisphere with a magnitude of +5.8. Also within the boundaries of the strong man is M92, another globular, though a little fainter at magnitude +6.5. Below Boötes both Virgo, which contains Jupiter, and Leo are leaving the evening skies for another year.

If we turn to the north the brilliant Capella, in Auriga the charioteer is circumpolar and just skimming the horizon. Ursa Major is west of the meridian and descending whilst Cassiopeia and Cepheus are east of it and climbing. The zenith lies in Draco with the head of the dragon close to the overhead point. At this time of year the Milky Way rises in Auriga and passes through Perseus and Cassiopeia before passing down the spine of Cygnus, the celestial swan. For this reason there are also concentrations here of nebulae and clusters.

In the east Andromeda is fully risen bringing with it Aquarius and Pisces, both of which contain an “Ice Giant”. Pisces has Uranus within its borders (though it is yet to rise) whilst Neptune resides in Aquarius. There are a few globular clusters in the area; M2 (magnitude 6.5) is in Aquarius whilst M15 (magnitude 6.4) lies within Pegasus, close to the border with Equuleus – the little horse.

Towards the south, the “Teapot” asterism of Sagittarius is on the meridian amongst the numerous nebulae and clusters that you would expect to see when you look towards the centre of our galaxy. Incidentally, Pluto (magnitude 14) lies within the borders of the archer close to the “Teaspoon” asterism. Above Sagittarius, the Summer Triangle commands the area with the brilliant Vega, in Lyra, due south at an altitude of nearly 80°. The two other members of the triangle, Deneb and Altair are just east of the meridian with each containing a portion of the Milky Way.

Meteors

The Perseids, which are one of the year’s stronger showers, began on July 23rd but won’t reach maximum until August 12th at 20.00. The build up to it is slow with meteors appearing to emanate from the area of Perseus that lies just south of Cassiopeia. At peak activity we might hope to see around 80 meteors per hour although the radiant will not reach maximum altitude during the hours of darkness. On the night of the 12th the Sun sets at 20.30 but a waning gibbous Moon will rise at 22.40 to spoil the party to a degree because not only will it drown out the fainter meteors but it will do so whilst the radiant is still comparatively low down (32°) meaning that a number of events will occur below the horizon. Fig 4 shows the position of the radiant at 22.00, although the meteors will appear over a wide area of sky and quite often they will be some distance from it. It is not necessary to watch close to the radiant, but it is useful to know where it is because if you see any meteors you can trace them back to see if they come from that area. If they do it is most likely that they are from the shower. Don’t forget that it is tough on your neck to stand for any length of time looking upwards. Far better to lie on a sun longer that is facing roughly north east with the head end raised. This will allow you to watch for much longer periods in comfort.

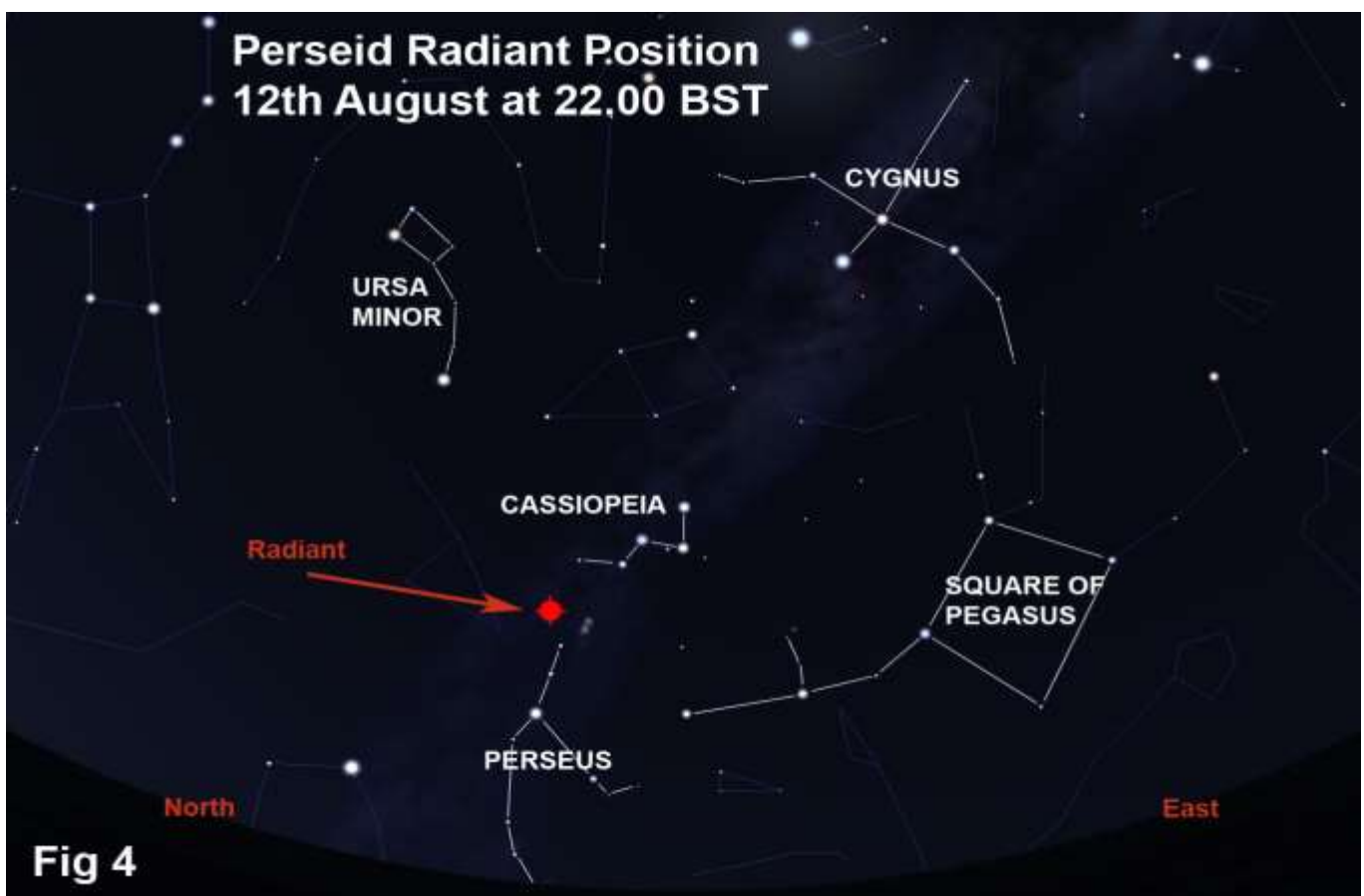


Fig 4

Aldebaran Occultation

On the morning of August 16th there will be a daylight occultation of Aldebaran by the Moon. At the time the Moon will be close to due south and at an altitude of 55°. The times are given in the occultations table above. The magnitude +0.9 star initially disappears at the bright limb, reappearing an hour later at the dark limb. The prediction software suggests that this event is visible with just a 40mm instrument. As the Moon is high in the sky and a long way away from the Sun it will be an interesting event should skies be clear plus the Moon will be easy to locate. Fig 5 shows the position of the star relative to the lunar disk.



Total Solar Eclipse

The “Great American Eclipse” occurs during the morning/afternoon of August 21st if you happen to be there watching it. It will of course depend on where you are as to what time zone is in operation at your location. For those of us watching on the TV or internet from home it is an afternoon/evening event. All times are in BST.

Partial phase begins 16.46
Totality begins..... 17.48
Greatest eclipse..... 19.26
Totality ends 21.01
Partial ends 22.04

There will be a massive choice of live streams to watch with NASA providing a number of options themselves which include YouTube and USTREAM. Look at <https://www.nasa.gov/eclipselive>
Another option is <https://www.exploratorium.edu/eclipse> A Google search will reveal many more.

However, the UK doesn't miss out entirely on the eclipse because we will witness a very small partial phase at the end of the event which from Wadhurst will see just over 4% of the Sun obscured. You will need a very low west-north-west horizon.

The partial phase begins at 19.40 when the Sun is just 3.2° in altitude.
Maximum eclipse occurs at 20.05 with the Sun 0.5° below the horizon.
The partial phase ends at 20.29 with the Sun 4.0° below the horizon.

Advance warning for September

September 15th – Cassini mission is due to end as the craft plunges into Saturn's atmosphere.

Brian Mills

SPACEPLACE - NASA

This article is provided by NASA Space Place.

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Twenty Years Ago on Mars...

By Linda Hermans-Killiam

On July 4, 1997, NASA's Mars Pathfinder landed on the surface of Mars. It landed in an ancient flood plain that is now dry and covered with rocks. Pathfinder's mission was to study the Martian climate, atmosphere and geology. At the same time, the mission was also testing lots of new technologies.

For example, the Pathfinder mission tried a brand-new way of landing on Mars. After speeding into the Martian atmosphere, Pathfinder used a parachute to slow down and drift toward the surface of the Red Planet. Before landing, Pathfinder inflated huge airbags around itself. The spacecraft released its parachute and dropped to the ground, bouncing on its airbags about 15 times. After Pathfinder came to a stop, the airbags deflated.

Before Pathfinder, spacecraft had to use lots of fuel to slow down for a safe landing on another planet. Pathfinder's airbags allowed engineers to use and store less fuel for the landing. This made the mission less expensive. After seeing the successful Pathfinder landing, future missions used this airbag technique, too!

Pathfinder had two parts: a lander that stayed in one place, and a wheeled rover that could move around. The Pathfinder lander had special instruments to study Martian weather. These instruments measured air temperature, pressure and winds. The measurements helped us better understand the climate of Mars.

The lander also had a camera for taking images of the Martian landscape. The lander sent back more than 16,000 pictures of Mars. Its last signal was sent to Earth on Sept. 27, 1997. The Pathfinder lander was renamed the Carl Sagan Memorial Station. Carl Sagan was a well-known astronomer and science educator.

Pathfinder also carried the very first rover to Mars. This remotely-controlled rover was about the size of a microwave oven and was called Sojourner. It was named to honor Sojourner Truth, who fought for African-American and women's rights. Two days after Pathfinder landed, Sojourner rolled onto the surface of Mars. Sojourner gathered data on Martian rocks and soil. The rover also carried cameras. In the three months that Sojourner operated on Mars, the rover took more than 550 photos!

Pathfinder helped us learn how to better design missions to Mars. It gave us valuable new information on the Martian climate and surface. Together, these things helped lay the groundwork for future missions to Mars.

Learn more about the Sojourner rover at the NASA Space Place: <https://spaceplace.nasa.gov/mars-sojourner>



Caption: The Mars Pathfinder lander took this photo of its small rover, called Sojourner. Here, Sojourner is investigating a rock on Mars. Image credit: NASA/JPL-Caltech

CONTACTS

General email address to contact the Committee

wadhurstastro@gmail.com

Chairman	Brian Mills
Secretary & Events	Phil Berry 01580 291312
Treasurer	John Lutkin
Membership Secretary	John Wayte
Newsletter Editor	Geoff Rathbone 01959 524727
Director of Observations	Brian Mills 01732 832691 email: bwmills65@gmail.com
Committee Members	Jim Cooper Eric Gibson

Wadhurst Astronomical Society website:

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SAGAS website:

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Any material for inclusion in the September 2017 Newsletter should be with the Editor by August 28th 2017