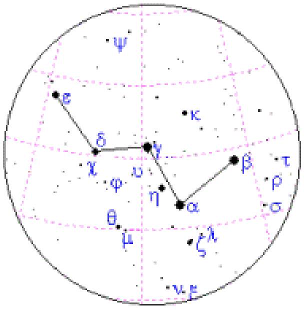


Wadhurst Astronomical Society Newsletter MAY 2016

MEETINGS

THE APRIL MEETING

The April meeting was introduced by our Chairman, Brian Mills who welcomed members and visitors to the evening.

He began by telling the meeting that from next month and until at least December our meetings will be held in classrooms IL5 and IL6 in the classroom block. Carry on down the entrance road and go through the double doors in the blue wall ahead of you. We will use the door into IL5 which will be on your left a little way down the corridor. There will be directions and there is also car-parking available nearby.

Again, this year there will be a SAGAS Summer Convention on Saturday the 16th of July and Brian said that this year it is being held in the Barn Theatre at Southwick between Lancing and Brighton, West Sussex, a little closer than Chichester where it has been held for the last few years. Talks will include a number of well known speakers such as William Joyce, Prof. Lucie Green and David Whitehouse. Doors open at 09.45 and the Convention finishes around 17.30. The cost will be £10 per member of SAGAS and that is any member of the Wadhurst Astronomical Society, or £12 for a non-member.

Further information is available on the SAGAS web-site at: www.sagasonline.org where it tells you how to book.

Brian then introduced Rob Cray, our speaker. Rob used to be Head of Physics here at Uplands Community College and is mainly responsible for the start of the Society nineteen years ago. He has returned to give a number of talks over the years, more recently on the Mercury and Apollo Missions and as Brian said it was a delight to welcome him back.

Skylab – The United States of America's First Space Station
Rob Cray

The Russians were the first to put a space station in orbit around the Earth, Salyut 1, a couple of years before the Americans but as Rob said it ended in tragedy, killing the crew on re-entry.

Von Braun had always had visions of getting into space and one of them was an idea of a space station something after the design featured in the film, "2001". Rob told us that following the Lunar missions ending with Apollo 17 in 1972, the Americans wanted a space station for research into amongst others things, the Sun, the stars and also into how the human body would survive during space travel further than the Moon.

Skylab was launched in 1973 and remained in orbit until 1979 and during that time there were three manned missions, although we were told that during the launch on the 14th of May 1973 Skylab suffered some damage. The micro-meteoroid protective shield deployed too early and was thought to have been torn off damaging the heat shield. Also there were indications that the solar array had not fully deployed. NASA calculated that the temperature inside the craft would heat up in time and food and instruments destroyed.

The crew of Kerwin, Conrad and Weitz was launched on the 26th of May 1973 taking with them the means of replacing the shields and fixing the solar panels which Rob said was going to be an extremely dangerous undertaking because the panels that had not deployed properly were spring loaded and at one time the astronauts were thrown to one side by one of the mechanisms as it was set free.

Taken by the last crew as they left

Spring loaded panels

Dangerous gasses had formed inside the craft and had to be vented three times with nitrogen before being filled with an oxygen atmosphere. The temperature inside the craft fell fairly rapidly to a rather hot but bearable level.

This mission lasted 28 days during which time the crew had to carry out more repairs to Skylab and also do a number of medical experiments and taking thousands of images of the Sun, some of which are still being used for research today.

The second crew with Garriott, Lousma and Bean was launched in July 1973 for a 59-day mission. And following this the last crew with Carr, Gibson and Progue was launched in November that same year for an 83-day stay.

One of the things Rob told us about was that life on Skylab needed improving and towards this the food had to be improved and books and music provided to make the environment more tolerable. A lot of work had been done to improve washing and toilet facilities. Sleeping was a problem since without gravity; the body floats about even though strapped into their sleeping quarters. All these improvements had to be installed by the astronauts. Also all the water they used had to be recycled and used many times over although later on wet-wipes were used helped a great deal.

A vast number of experiments had to be carried out even to the question from students who asked how did spiders build their webs in zero gravity.

Telescope control desk

Rob showed us a list of the experiments they had to perform and the different categories, many of them looking at how the human body deteriorates in the Skylab environment. One result showed the muscle loss during the missions. For instance, after 28 days there was 20% loss. During the 59-day mission, the astronauts exercised more but still lost a similar amount. A lot more specific exercise was done during the 84-day mission and we were told now the loss was down to between 10 and 12% but some specifically exercised muscles had actually grown in strength.

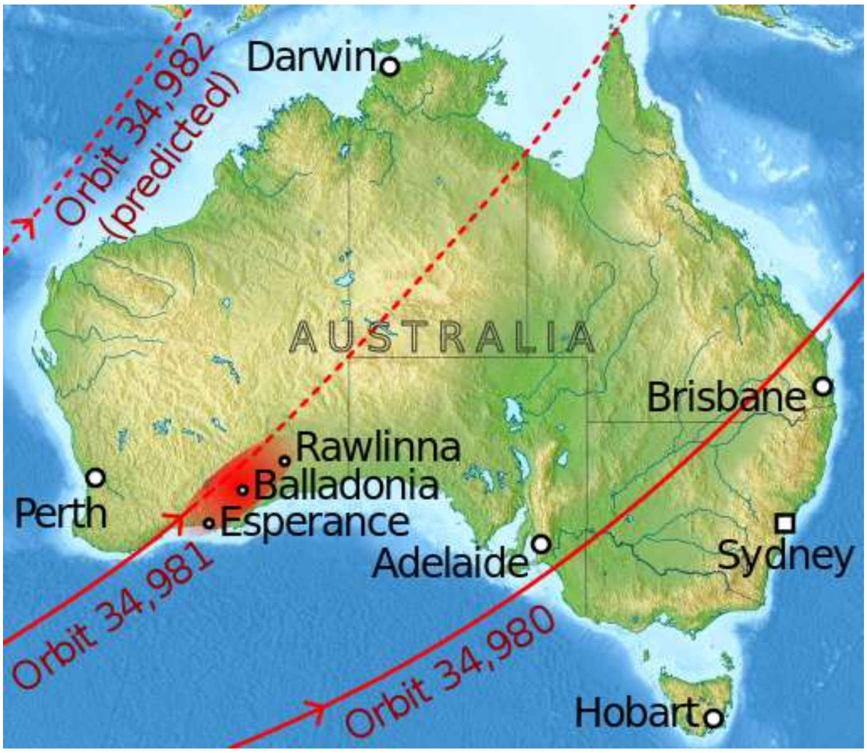
This had great significance for a two-year mission to Mars. Following the loss of muscle strength during the journey there, there would be a further loss due to the weaker gravity on the planet. But after returning to Earth, it was predicted that there could be a total loss of strength particularly in the knee by an incredible 48% and also a significant loss in bone strength.

On board Skylab there were eight major solar studies although as Rob said, in those days, images were recorded on film which had to be changed by the astronauts during space-walks outside the craft. Altogether the Sun was observed in wavelengths from visible light through to soft x-rays using an impressive array of solar telescopes. One event recorded was a spectacular solar prominence stretching a third of the way across the surface and is still one of the largest recorded.

Once the last crew had returned from Skylab it was decided to send no more missions there although as we were told, the craft was still capable of functioning. Studies were carried out into possible expansion of Skylab but as it was, the station's orbit was decaying despite the last crew boosting it into a higher orbit before they left.

A British mathematician, Desmond King-Hele predicted that Skylab's orbit would decay earlier than predicted by NASA due to increased solar activity and NORAD (North American Continental Defence Command) forecast re-entry in mid-1979.

It was originally intended for Skylab to hit the Earth nearly 1,000 miles southeast of Cape Town but finally it came down south of Australia and it didn't burn up quite as fast as predicted and part of the debris landed southeast of Perth. Some bits were retrieved and one boy who discovered a piece, was taken to America with it and received a prize of $10,000 for finding it.



One Shire of Australia jokingly fined NASA A$400 for dropping litter which was finally paid by an American radio show in 2009…

Rob finished by looking at space stations that came after Skylab. MIR was in service from 1986 to 2001 and at present the International Space Station began orbiting the Earth in 1998 and is due to remain in orbit until 2020.

Snippets from the World of Science
John Wayte

Our Past

Scientists are always digging around to find out more about our past. They have found two quite interesting clues about our astronomical history.

For more than half a century they have known about an isotope of iron; iron-60, that had been found in the Pacific Ocean buried deep within the Earth's crust. Now they know that Earth formed some 4.5 billion years ago and is very likely to have produced some of this isotope, they also know that its half-life is just 2.6 million years.

So this isotope should have long ago disappeared from that source. So where does this come from?

They have one further clue and that is the local Bubble.

Just imagine this classic doomsday scenario. A nearby star explodes in a brilliant supernova, pumping out more energy in a fraction of a second than the Sun will emit in a billion years.

The blast showers the Earth with radioactive elements that destroy the ozone layer and destroys life on Earth. Fortunately, this does not appear to have happened but it is difficult to find hard proof of this type of event within a catastrophic distance of Earth.

But a couple of stars only 300 light years away did explode 1.5 million and 2.3 million years ago and these are what appear to have deposited the Iron-60 on our seabed.

They also ran computer simulations of how the supernova bubble would have looked like and it very closely matched the maps of the local bubble.

So what, I hear you say!

Well, our ancestors were just climbing down from the trees when these flashes went off.

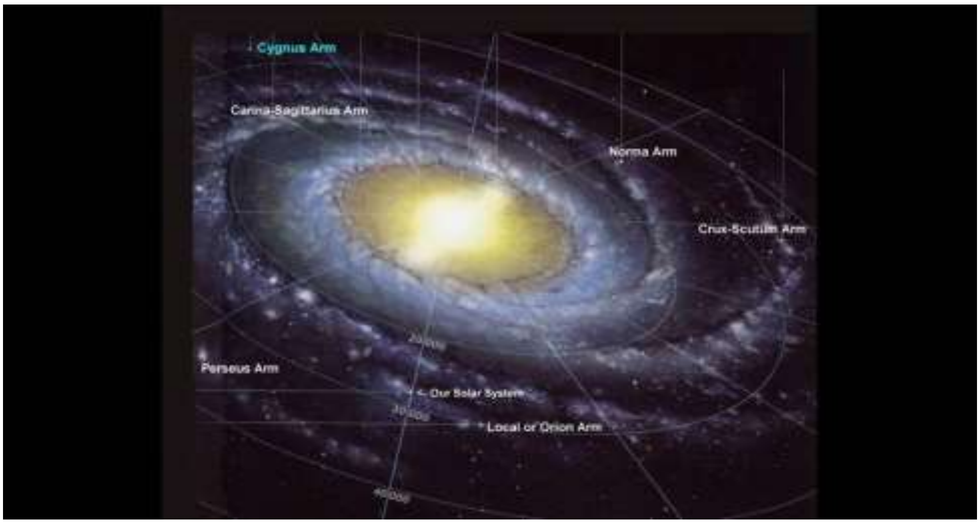
They recon that about 33 light years is just about as safe a distance from a supernova to prevent it doing major extinction on Earth.

Just continuing this story a little further – what if?

Have you ever wondered, what if our earth was not in a backwater of the Milky Way in a lonely place in the Orion Arm where our nearest star apart from the Sun is Alpha Centauri, some 4.3 light years away?

Well, probably not.

Here is a picture of where we are in the Milky Way. In a place far, far away from the hectic life in the middle down a leafy location of the Orion Arm.



But if we did live in a more crowded location of Sagittarius then we could expect to see over a million stars in the space as near as Alpha Centauri.

This is a view of that area taken by Hubble with its Wide Field Camera – A NASA image.

Just a thought…

Is it better to look for life in the outer reaches of a galaxy where we stand a better chance of not being blown to pieces?

Don't you feel lucky to be alive?

And finally…

This is the Spider Nebula IC 417 about 10,000 light years from us in the constellation of Auriga.

Taken by the Spitzer telescope, launched in 2003 with a 33-inch mirror. – A NASA image.

MAY MEETING

18th May – Our own Dr John Lutkin brings us up to date with "The Blackboys Triple Telescope Array"

Meetings will take place in classrooms IL5 and 6 which are in the building at the far end of the drive through the main gate of Uplands College and up by the tennis courts. Signs will direct you. There is car parking nearby. The postcode is TN5 6AZ.

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

Anyone is welcome but non-members are asked if they wouldn't mind contributing £3 towards costs.

FUTURE MEETINGS

15th June – There will be three mini-presentations on a variety of astronomical subjects.

20th July 2016 – William Joyce brings us up to date with "Astronomy of the Moon".

21st September 2016 – Professor Louise Harra tells us about the latest news of "Solar Activity".

19th October 2016 – Dr David Whitehouse returns to tell us about what we might encounter on a "Journey to the Centre of the Earth".

16th November 2016 – Jan Drozd tells about "A History of Man's Understanding of Our Universe".

14th December 2016 (NB the second Wednesday of this month) – Brian Mills FRAS tells us about "Local Astronomers".

SKY NOTES FOR MAY 2016

Planets

Mercury was at greatest eastern elongation in mid April giving us our best evening views of the planet for 2016. At the beginning of May it is moving westwards to reach inferior conjunction on the 9th. However, this is no ordinary conjunction because on this occasion we will be treated to a transit of Mercury as the tiny disk of the planet will be seen to pass across the face of the Sun. See below for more details of this event. The smallest planet then moves west of the Sun to become a morning object, although by the end of the month it rises just 35 minutes before the Sun. It reaches greatest western elongation in early June.

Venus is too close to the Sun for observation and will reach superior conjunction (on the far side of the Sun) in early June.

Mars is now an evening object rising at 22.45 BST at the start of the month, although by the end it will rise before sunset. The red planet will reach opposition on 22nd May when it will be visible throughout the hours of darkness. This is because opposition refers to the time when a planet is opposite the Sun meaning that as the Sun sets the planet in question is just rising. This is also the time, give or take a few days, when Mars will be at its closest to Earth and therefore when it will appear at its largest. Fig 1 shows its position at 23.00 BST on that night.
The planet is currently moving retrograde in Scorpio and will cross the border into neighbouring Libra on the 28th. Its brightness is rising, and on the 22nd it will shine at magnitude -2.1 and will culminate at a rather disappointing altitude of just 17°.

Fig 1

Oppositions of Mars occur on average every 780 days which means we experience one every two years. However, their position and how observable they are can vary enormously because the orbit of Mars is the second most eccentric of all the planets in the Solar System. The position of the planet in relation to the ecliptic and the celestial equator also has an effect on how well it is seen. The table in fig 2 gives the date for this and subsequent oppositions. From this you can compare the altitude of Mars, its brightness and apparent size along with its distance from us.

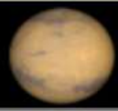
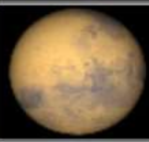
Opposition Date	Altitude	Declination	Apparent Magnitude	Apparent Diameter (arcsecs)	View from Earth (North up)	% of Max. Size	Distance From Earth (AU)
2016 May 22	17°	-21°.6	-2.0	18".4		71	0.5101
2018 July 27	13°	-25°.4	-2.8	24".2		94	0.3862
2020 October 13	44°	+5°.5	-2.6	22".4		87	0.4181
2022 December 8	64°	+24°.9	-1.8	17".0		66	0.5492
2025 January 16	64°	+25°.1	-1.4	14".5		56	0.6435
2027 February 19	54°	+15°.2	-1.2	13".8		54	0.6780

Fig 2

Rather disappointingly, when Mars is at its closest, brightest and largest it corresponds with the time of its greatest negative declination and therefore lowest altitude. Conversely, as we have come to expect, when the planet attains its greatest altitude it appears to be 40% smaller and 50% fainter.

Jupiter begins the month moving retrograde in Leo but reaches its second stationary point on 9th May after which it resumes direct motion (west to east).

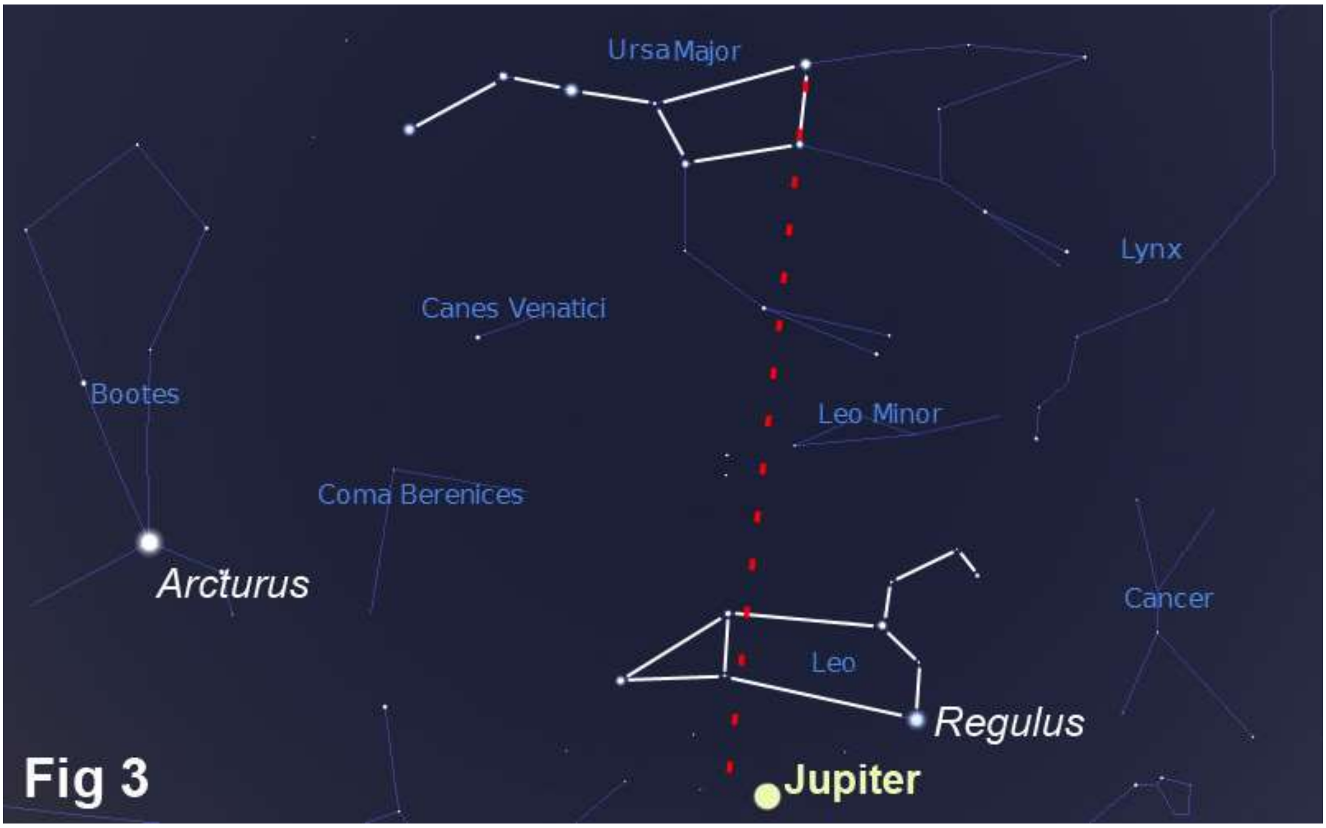


Fig 3

Despite the fact that opposition was two months ago Jupiter, at magnitude -2.2, still outshines anything in that part of the sky. The planet will culminate (transit due south) at 21.00 at the start of May, though this will become earlier as the month wears on. The plough, which is close to the zenith (overhead point), can be used to locate Jupiter as shown in fig 3. The alignment of the pointers in Ursa Major is not exact but is perfectly good enough and will remain valid for the whole of May.

The gas giant is very slowly decreasing in both apparent size and brightness, but excellent views are still available with modest telescopes. Don't forget that your view of any object will be enhanced if the telescope is placed outside well in advance of being used. This allows the air within the tube to equalise in temperature with the air outside it, preventing air currents that will spoil the sharpness of the image. Remember that large pieces of glass (mirrors and lenses) take a considerable time to cool down to outdoor evening temperatures if they have been kept indoors in a warm room.

Saturn is now an evening object, rising just after 23.00 at the beginning of May. By the end of the month (three days before opposition) it will rise around sunset. Fig 1 shows its position among the stars of Ophiuchus where it is currently moving retrograde. Its brightness increases marginally to +0.1 whilst its apparent size grows to 18.4" (arc seconds). On the last day of the month it transits due south at 01.15 BST at an altitude of 18°, not far from the red star Antares in Scorpio.

Lunar Occultations

In the table below I've listed events for stars down to 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 whilst RD = **r**eappearance at the **d**ark limb. The column headed "mm" (millimetres) shows the minimum aperture telescope required for each event. **Times are in BST.**

May	Time	Star	Mag	Ph	Alt °	% illum.	mm
13th	00.02	ZC 1344	6.5	DD	15	42	50
14th	21.59	ZC 1549	5.1	DD	39	62	40
17th	22.22	ZC 1850	6.4	DD	34	86	70

Phases of the Moon for May

New	First ¼	Full	Last ¼
6th	13th	21st	29th

ISS

Below are details for passes of the International Space Station (ISS) that occur before midnight and are magnitude **-**1.0 or brighter. The details of all passes, including those visible after midnight, 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 at least five minutes beforehand. **Times are in BST.**

May	Time	Mag.	Alt°	Az.		May	Time	Mag.	Alt°	Az.
24th	23.44	-1.0	13	E		28th	23.23	-3.5	72	SSE
26th	21.56	-1.4	12	SE		29th	22.30	-3.2	52	SSE
26th	23.32	-3.2	47	SSE		30th	23.14	-3.4	87	N
27th	22.40	-2.6	31	SSE		31st	22.21	-3.4	77	SSE
28th	21.47	-2.0	21	SE						

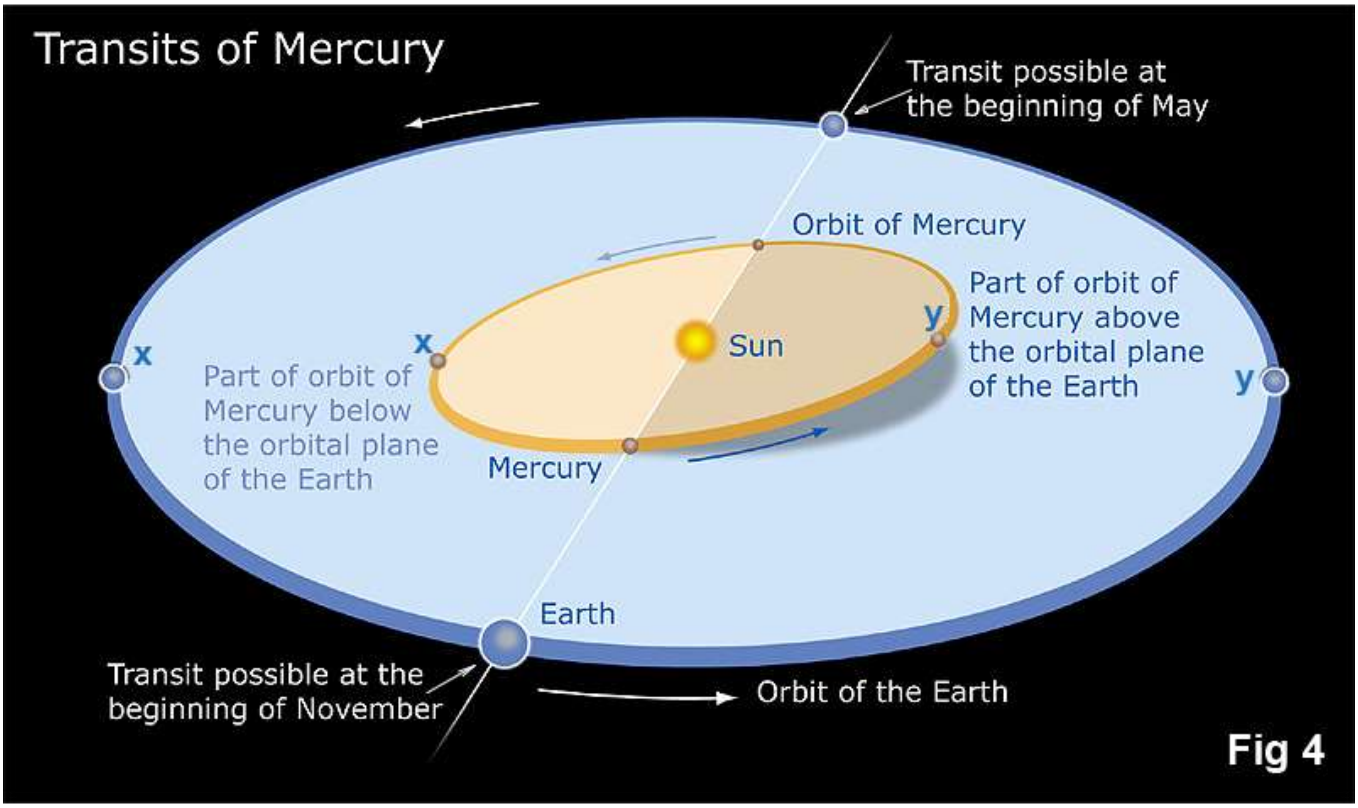
Iridium Flares

The flares that I've listed are magnitude **-**2.5 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.**

May	Time	Mag.	Alt°	Az.°		May	Time	Mag.	Alt°	Az.°
1st	23.04	-3.5	15	278 (W)		20th	22.05	-4.6	47	47 (NE)
2nd	23.57	-7.1	36	231 (SW)		21st	22.48	-6.6	25	273 (W)
3rd	23.00	-4.2	17	28 (NNE)		23rd	22.45	-4.8	22	277 (W)
5th	22.58	-5.2	22	32 (NNE)		23rd	23.20	-2.7	15	20 (NNE)
6th	23.42	-4.5	35	240 (WSW)		24th	22.39	-2.5	22	280 (W)
7th	23.36	-4.4	35	242 (WSW)		25th	21.44	-3.5	55	50 (NE)
8th	21.21	-2.7	21	346 (NNW)		25th	22.43	-3.8	20	283 (WNW)
8th	22.49	-3.9	27	37 (NE)		27th	22.40	-5.9	17	288 (WNW)
10th	23.27	-3.3	33	249 (WSW)		27th	23.06	-4.3	22	28 (NNE)
11th	23.21	-7.4	33	251 (WSW)		28th	22.43	-3.3	15	291 (WNW)
15th	22.26	-3.6	39	44 (NE)		29th	21.45	-4.8	16	344 (NNW)
15th	23.06	-3.6	31	259 (W)		30th	22.57	-2.5	27	31 (NNE)
16th	22.20	-3.7	39	45 (NE)		31st	21.17	-8.2	63	53 (NE)
18th	22.57	-6.9	27	266 (W)						

Transit of Mercury

On 9th May a comparatively rare event takes place when, if the weather plays ball, we will see the tiny disk of the planet Mercury transit across the face of the Sun. Transits have to take place at the time of inferior conjunction which is when the Earth, Sun and Mercury are all lined up with Mercury in the middle. However, because the orbital planes of Mercury and the Earth are not coincidental (they vary by about 7°) most of the time Mercury appears to pass either above or below the Sun at inferior conjunctions. It is only on rare occasions at the November and May inferior conjunctions that the two orbits intersect as shown in fig 4. These points are referred to as the nodes.



If an inferior conjunction occurs when Mercury and the Earth are at positions "x", then Mercury will appear to pass below the Sun as seen from Earth whereas if the planets are at positions "y", Mercury will seem to pass above the Sun.

Incidentally, the only planets that suffer inferior and superior conjunctions are the inner planets Mercury and Venus because they lie within the orbit of the Earth.

Below are details of the timings for the event which lasts for 7½ hours, some of which, surely, must be cloud free. It begins when the Sun is just 40 minutes away from culminating due south and ends with Mercury just over 6° high in the west-north-west. The diagram at fig 5 shows the progress of Mercury across the solar disk with hourly tick marks.

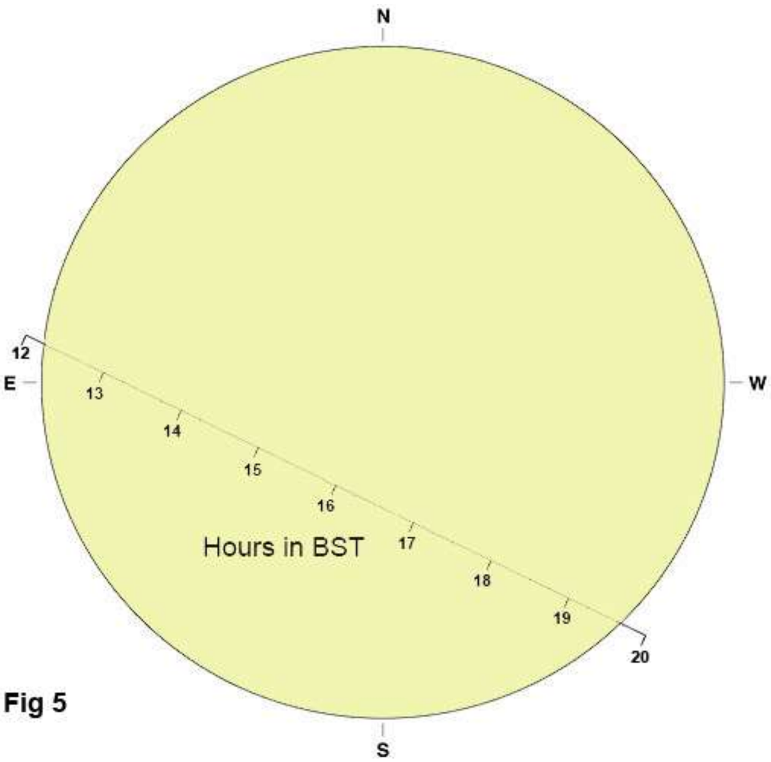


Fig 5

Transit Begins (BST)	**12.12**
Altitude	**55°**
Maximum Immersion (BST)	**15.57**
Transit Ends (BST)	**19.42**
Altitude	**6°**

How to Observe the Transit Safely

Before I go any further, I must repeat my previous warning that it is extremely dangerous to look at the Sun using any optical aid at all. You risk blindness if you look at the Sun, even briefly. Ensure any instrument, especially those without a filter, are safe at all times.

If you still have your “eclipse glasses” and they are undamaged then it is perfectly safe to look at the Sun with them. The problem is that Mercury is absolutely tiny in comparison with the Sun and will be difficult, if not impossible to see, with the naked eye. Therefore some form of magnification will be needed. The simplest way to do this is by using the projection method as shown in fig 6.

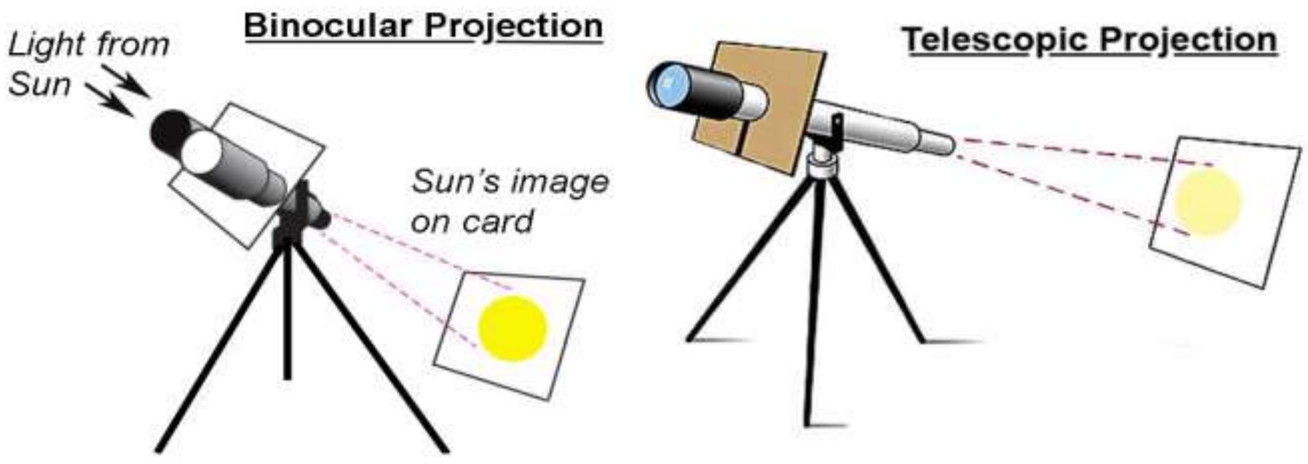


Fig 6

In both cases the light from the Sun is projected onto a white card held some distance behind the eyepiece. Another card is fitted to the body of the binoculars or telescope to cast a shadow which will allow the image of the Sun to be seen much more easily. If using binoculars it is best to cover one of the object glasses. By moving the white card and altering focus you can vary the size of the image and concentrate simply on the area around Mercury if you wish. If any sunspots are present, they will add to the aesthetic of the image. Do remember not to look through the instrument when aligning it initially on the Sun; instead move the telescope/binoculars so that the shadow they cast on the ground is as small as possible. Any finder that is fitted should be removed or have its object glass capped.

Another option is to fit a filter over the object glass (or open end of the telescope in the case of a Newtonian reflector) to allow you to view the Sun direct. Custom made filters are available from any astronomical supplier or you can very easily make your own. You will need to purchase a sheet of the special material which is made by several companies and looks rather like a sheet of cooking foil. Baader make one which I have used, whilst Thousand Oaks make another which I have not tried. The former is more easily available at around £20 for an A4 sheet. The links to two retailers are given below.

https://www.firstlightoptics.com/solar-filters/baader-astrosolar-safety-film-nd-50.html

http://www.rothervalleyoptics.co.uk/baader-astrosolar-a4-nd50-safety-film-sheet.html

It is quite simple to make a short tube out of cardboard and fix the solar film to it. Do not stretch the film tight in case you damage it; any wrinkles and creases will make no difference to the quality of the image. **Do ensure that it cannot fall off by accident.** The photographs below show two home made filters on a reflector and refractor respectively. Note on the image of the reflector that the finder has been removed as a precaution.

The final alternative that avoids any fuss or danger is to watch the whole thing live on the internet. There are a number of sites that have said they will be covering the event, three of which I have listed below.

https://main.slooh.com/event/transit-of-mercury/

http://www.cosmos.esa.int/web/bepicolombo/mercury-transit

http://serviastro.am.ub.edu/twiki/bin/view/ServiAstro/TransitMercuri090516

If you do try to observe this rare event, please take care particularly if young children are about.
Good luck with the weather!

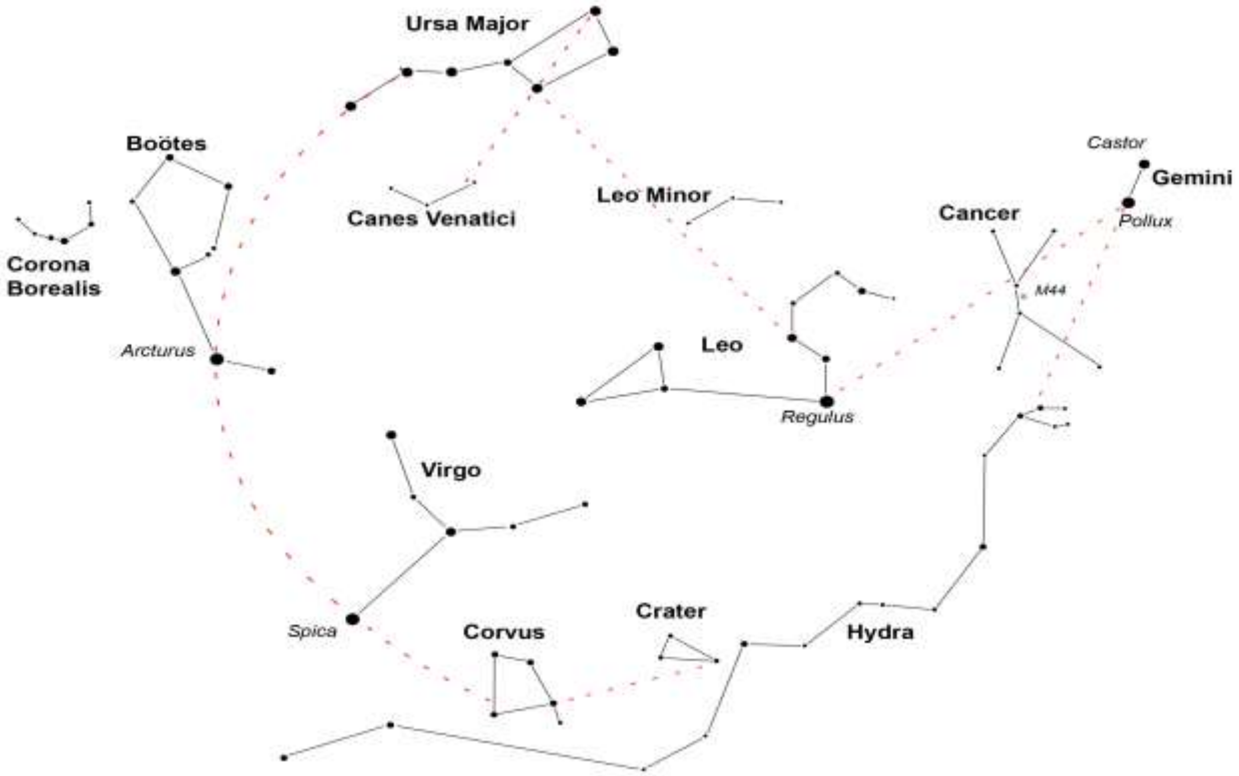
The Night Sky in May (Written for 22.00hrs BST mid month)

In the north the plough, or more correctly Ursa Major, is almost at the zenith (overhead point) whilst its smaller cousin seems to be balanced on its tail. Ursa Major can be used as a celestial signpost to find a number of other constellations as shown in the map below. Draco, the dragon, is well positioned if you want to follow its twists and turns as it passes between the two bears and on towards Hercules. Cassiopeia lies on the meridian roughly mid way between the pole and the horizon.

Turning to the east we see that two of the three bright stars that make up the Summer Triangle (Vega and Deneb) have now risen. The generally faint constellations that we associate with summer such as Ophiuchus, Serpens and Hercules are now appearing and with them are the selection of globular clusters that I mentioned last month. The brightest and most impressive of these is M31 which stands at an altitude of 45°. That familiar fan shape of stars that make up the scorpion are just rising above the south eastern horizon.

Looking to the south the small groups of Canes Venatici and Coma Berenices are high up on the meridian whilst below them lies Leo and Virgo. Hydra, the water snake, is now fully risen and has the small constellations of Corvus, the crow and Crater, the cup riding on its back.

To the west, the last of the winter constellations are still just visible. Having said that the celestial twins are more than 30° high and Capella has an altitude of 25°. In between Gemini and Leo is the faint group of stars that form Cancer, the crab with that pretty open cluster M44 known variously as the Beehive, the Praesepe (Latin for manger) and NGC 2632.



Brian Mills

SPACE PLACE - NASA

This article is provided by NASA Space Place.
With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology.
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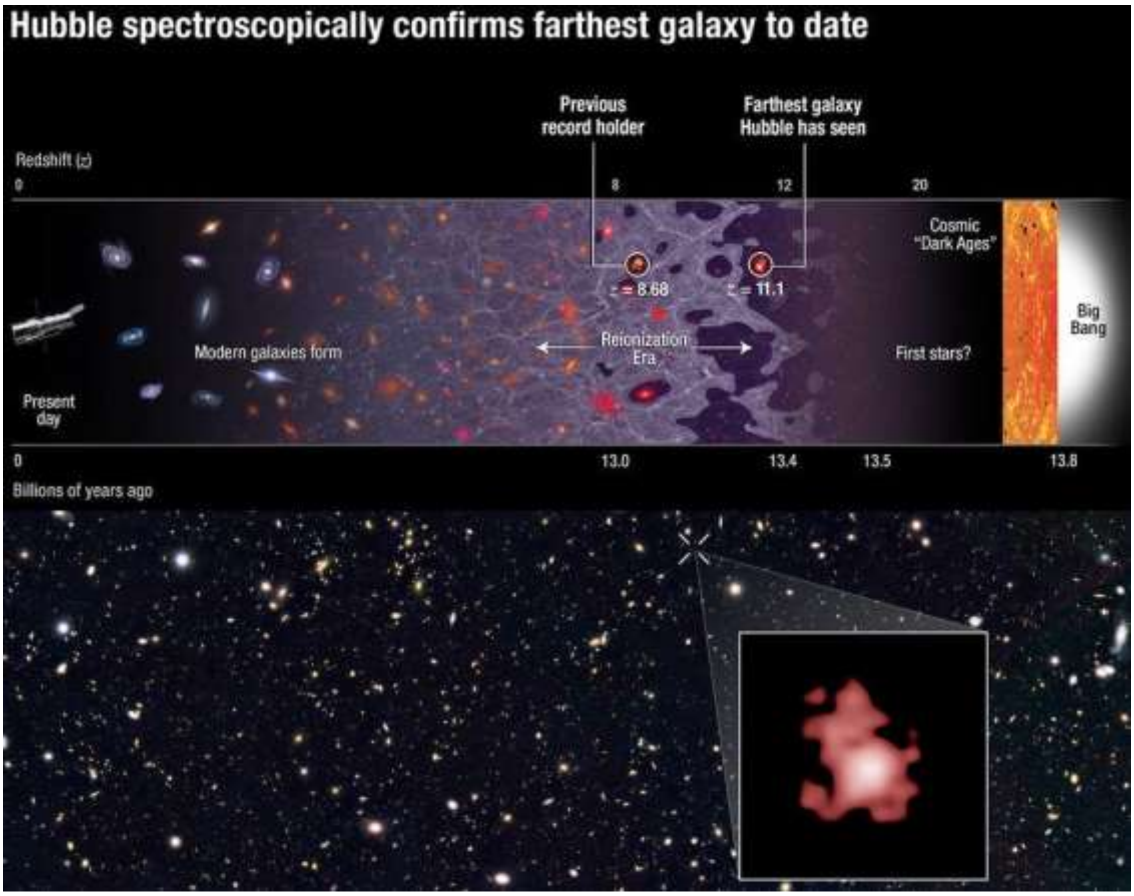
Hubble Shatters The Cosmic Record For Most Distant Galaxy

By Ethan Siegel

The farther away you look in the distant universe, the harder it is to see what's out there. This isn't simply because more distant objects appear fainter, although that's true. It isn't because the universe is expanding, and so the light has farther to go before it reaches you, although that's true, too. The reality is that if you built the largest optical telescope you could imagine -- even one that was the size of an entire planet -- you still wouldn't see the new cosmic record-holder that Hubble just discovered: galaxy GN-z11, whose light traveled for 13.4 billion years, or 97% the age of the universe, before finally reaching our eyes.

There were two special coincidences that had to line up for Hubble to find this: one was a remarkable technical achievement, while the other was pure luck. By extending Hubble's vision away from the ultraviolet and optical and into the infrared, past 800 nanometers all the way out to 1.6 microns, Hubble became sensitive to light that was severely stretched and red-shifted by the expansion of the universe. The most energetic light that hot, young, newly forming stars produce is the Lyman-α line, which is produced at an ultraviolet wavelength of just 121.567 nanometers. But at high redshifts, that line passed not just into the visible but all the way through to the infrared, and for the newly discovered galaxy, GN-z11, its whopping redshift of **11.1** pushed that line all the way out to 1471 nanometers, more than double the limit of visible light!

Hubble itself did the follow-up spectroscopic observations to confirm the existence of this galaxy, but it also got lucky: the only reason this light was visible is because the region of space between this galaxy and our eyes is mostly ionized, which *isn't true* of most locations in the universe at this early time! A redshift of 11.1 corresponds to just 400 million years after the Big Bang, and the hot radiation from young stars doesn't ionize the majority of the universe until 550 million years have passed. In most directions, this galaxy would be invisible, as the neutral gas would block this light, the same way the light from the center of our galaxy is blocked by the dust lanes in the galactic plane. To see farther back, to the universe's first true galaxies, it will take the James Webb Space Telescope. Webb's infrared eyes are much less sensitive to the light-extinction caused by neutral gas than instruments like Hubble. Webb may reach back to a redshift of 15 or even 20 or more, and discover the true answer to one of the universe's greatest mysteries: when the first galaxies came into existence!



Images credit: (top); NASA, ESA, P. Oesch (Yale University), G. Brammer (STScI), P. van Dokkum (Yale University), and G. Illingworth (University of California, Santa Cruz) (bottom), of the galaxy GN-z11, the most distant and highest-red-shifted galaxy ever discovered and spectroscopically confirmed thus far.

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