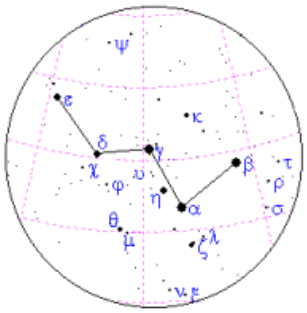


Wadhurst Astronomical Society Newsletter April 2017

SAD NEWS

Alan Branch

Fortunately, it is rare that we have to make such an announcement, but it is with great sadness that I have to report the death of Alan Branch after a long and brave battle against cancer. Alan had been missing from the meetings for some time whilst he had treatment, but when he returned we were all hopeful that he would be with us for a long time to come. Sadly, despite being a man who seemed to be always positive, this was not to be the case.

Alan was a quiet and thoughtful man who was never one to push himself to the front, but his was a gentle and entirely pleasing demeanour which we were all fortunate enough to share. This was particularly true for those of us who came from the Sevenoaks and Tonbridge areas, when Alan would be one of the group who met up to travel en-masse to the meetings. We will miss his contributions on any number of topics and his subtle humour that helped the journeys pass more quickly. Alan Branch was a nice guy.

It goes without saying that our thoughts are with his wife, his three sons and their extended families at this difficult time.

Brian Mills FRAS
Chairman

Alan's family have said that any of his friends from WAS will be most welcome at his funeral.
It will take place at Corpus Christie Church, 41 Lyons Crescent, Tonbridge, TN9 1EY at 12.00 on Monday April 10th.
There is a reception afterwards at Nizels Golf Club, Nizels Lane, Hildenborough, TN11 8NU to which we are also warmly invited.

MEETINGS

COMMITTEE MEETING

Members of the Committee are respectfully reminded that there is a meeting of the Committee at Jim Coopers house starting at 1930 on Tuesday the 11th of April.

MARCH MEETING

Our March meeting was led by Phil Berry who outlined the evenings programme and then told members that Brian Mills, our Chairman, was looking at arranging a visit to the Royal Astronomical Society Library in London, which contains a number of very important and interesting books and documents. It would take place during the summer holidays this year and would be a weekday. Following a show of hands from those members interested Phil said this indicated that enough interest was shown to continue making arrangements.

Eric Gibson struggles in with our own library each month and it is well worth having a look because there are a number of useful books both historical and recently added up-to-date volumes.

Phil then introduced tonight's speaker, Professor Louise Harra who has taken time out of a very busy schedule, working on the Solar Orbiter Programme at the Mullard Space Science Laboratory near Dorking where she does research into Solar Mass Ejections. Louise is also the Principle Investigator for a number of projects.

Solar Activity
Professor Louise Harra

During the Society announcements, a series of dramatic clips of solar activity had been playing on the screen and Louise began by saying that as we could see, the Sun is very dynamic.

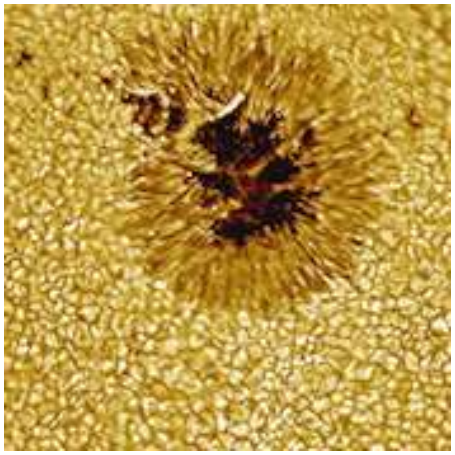
We were told about University College London and the many areas used in teaching students about the Sun, including PhD students studying at the Mullard centre near Dorking where Louise mainly works.

She reminded us about some of the Sun's statistics. The Sun is 1.4 million km across; over a million Earth's would fit inside it and it is 150 million km away so that light takes about 8 minutes to reach us.

The Solar Cycle is the cycle of waxing and waning sun-spots over a period of time and is something we don't fully understand.

The Sun is a magnetic star and we were shown a number of photographs showing solar eclipses, where the magnetic lines could be clearly seen rather like a bar magnet with field lines emanating from the poles.

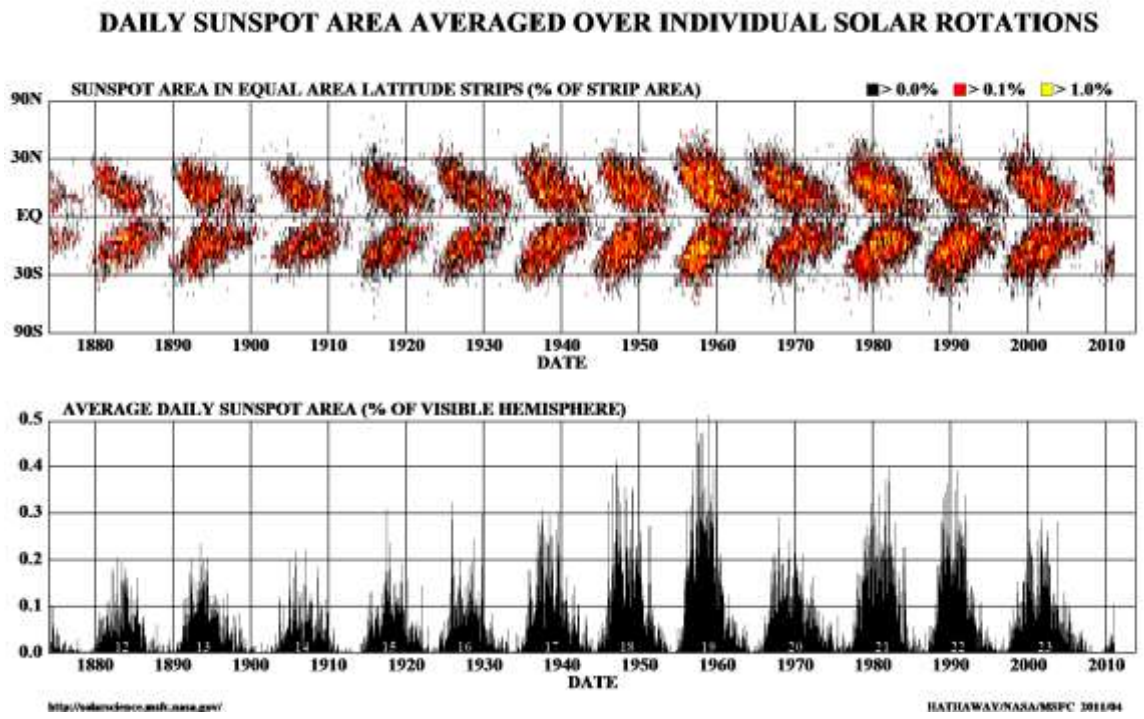
Solar eclipse - NASA



Sunspot and surrounding convection currents - NASA

Convection currents takes place on the surface of the Sun due to different temperatures and we were shown the area around a sunspot where temperatures and the magnetic field are very turbulent and it was possible to see the convection currents which are always present on the surface. Then Louise went on to describe how the Sun consists of gas and rotates differentially, so that the equator is moving much faster than the poles. This messes up the magnetic field over an eleven-year cycle.

Starting at the beginning of a solar cycle minimum, sunspots begin to form near the poles but as the cycle progresses, there are an increasing number of spots and they appear more towards the equator. We were shown a diagram of sunspot activity covering several cycles showing increasing activity over time with sunspots decreasing in latitude towards the equator. This diagram is known as the 'Butterfly Diagram". We were also told that at peak activity, the Sun's magnetic field flips about every eleven years and the cycle begins again.



"The Butterfly Diagram"

We are approaching a minimum and this is when the Solar Orbiter mission will be launched, predicted to be in a relatively quiet period.

There is an indication that the solar maximums have been getting slightly less active over the last few cycles although it is not known why. During this time, the solar wind has been weaker which has been having less effect on the Earth's upper atmosphere.

Showing a Mass Ejection of Material from the Sun - NASA

When magnetic lines come close together in a sunspot, a lot of energy is released causing flares and loops of material that can be seen from Earth. If this energy is sufficient, there is a Coronal Mass Ejection when material from the Sun is thrown out into the solar system. If this is in the direction of the Earth, it can cause aurora at both poles and if strong enough can cause interference with electrical equipment and we were told that this can even confuse animals such as pigeons that use the Earth's magnetic field for navigation. Solar mass ejection events cause a ripple on the surface of the Sun and this takes about an hour to cross the whole surface.

Louise told us that the first connection between flares on the Sun and effects on the Earth were first suggested by Carrington in 1859. He made many drawings of dark sunspots but one day he saw a white spot and a day or so later there was interference with the early telegraph networks all round the world and he proposed that there might be a link.

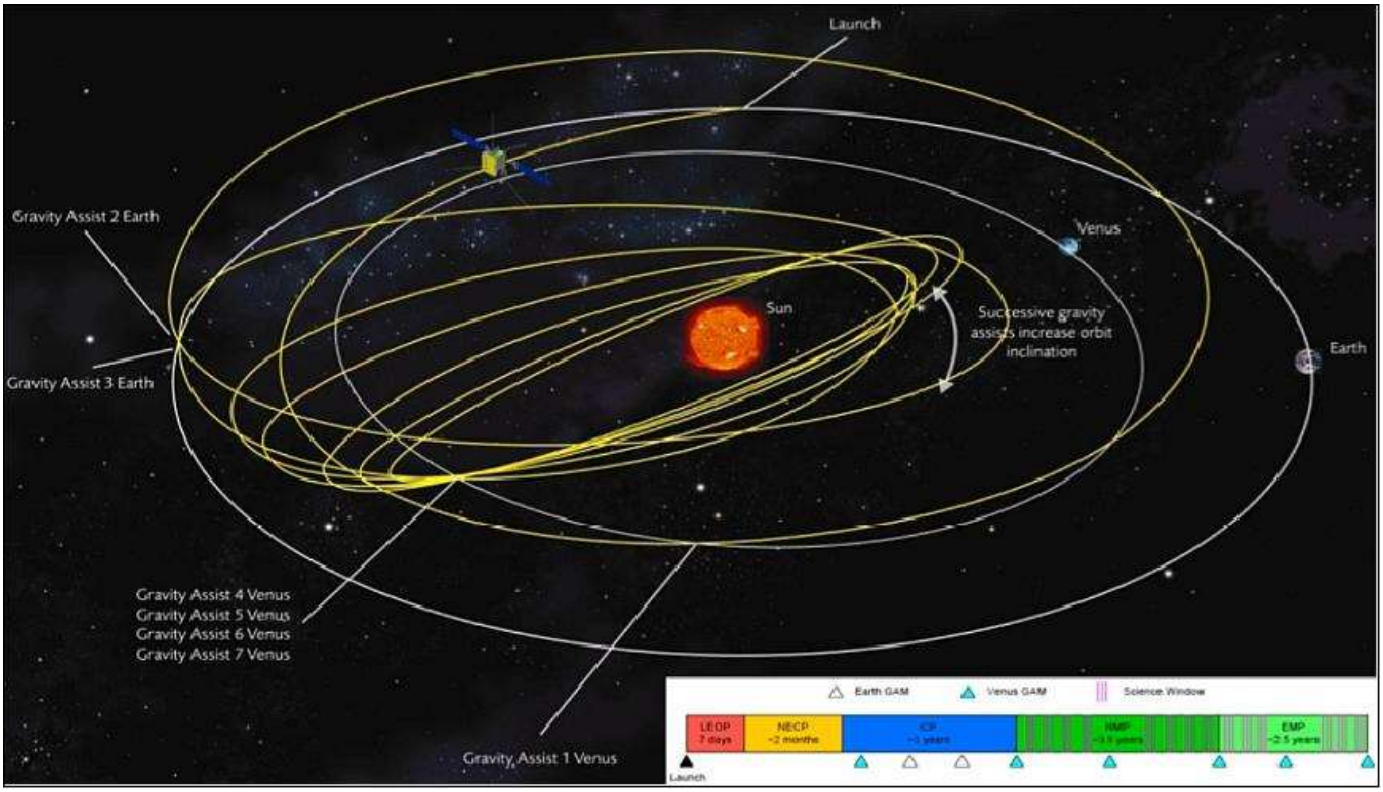
In 2003, there was a huge increase in mass ejections received at the Earth and because of the time of year it became known as the Halloween Storm. At this time, many orbiting space craft were put into 'safe mode' to protect them as much as possible. Public electricity supplies were interrupted and GPS systems affected. Interestingly, distant Voyager 2 detected a disturbance after 180 days.

An artist's impression of the Solar Orbiter

Now Louise turned to the space mission she is working on, called the European Space Agency Solar Orbiter. We were shown a picture of the space craft and the most dominant part was the huge heat shield, required because this is going to be the nearest anyone one has so far sent a telescope so close to the Sun, although small apertures in it will be able to opened briefly to allow

imaging. Also, it was noted that the solar panels could be tilted at quite an angle to the Sun to prevent damage from the enormous heat.

The spacecraft is being built at Airbus Stevenage and in many ways is a UK mission with four of our instruments on board. It will orbit the Sun just inside the orbit of Mercury and at closest will be only 0.28 astronomical units away where temperatures could reach 500^{o} Centigrade at the front.



Proposed path of the Orbiter Mission, showing gravity assistance

The spacecraft will be launched in February 2019 and will use several fly-bys of the Earth and Venus, taking about three years to get into orbit around the Sun. By using gravity assist, it will also be taken out of the ecliptic by about 34^{o} to enable observations looking down onto the polar regions during an orbit that will take about 150 days.

One huge challenge has been the need to develop a clever method of compressing data that hasn't been used before.

The project Louise is working on is the Extreme Ultraviolet Imager which will help provide more information about the outer corona of the Sun in more detail than we have ever had previously. There are three EUV telescopes each with its own opening window.

Finally, Louise described the space module and showed the electronic boards that manage the craft's operation and process the data. The electronics have the ability to correct themselves if problems arise with the added importance that there will be times when the craft is the other side of the Sun and out of direct communication with Earth.

During the past two weeks, the craft has been undergoing tests in a thermal chamber where temperatures can be very cold and very hot. This coming week electromagnetic testing is being carried out, which will be followed by calibration and then vibration testing.

After her absorbing talk, Louise said that she was returning to Dorking tonight and will carry on with some of her work!

Snippets from the World of Science
John Wayte

The Giant Magellan Telescope

This is one of the largest telescopes currently being built. When it comes on-line in 2020 it will have about 10 times the resolving power of the Hubble Space Telescope.

It is a ground based telescope being built in Chile at the Las Campanas Observatory site.

Las Campanas Observatory in Chile

This site in Chile is one of the best in the World because of its outstanding astronomical seeing with clear weather for most of the year. And as most of you who live in Wadhurst will be completely familiar with, almost perfect dark skies…

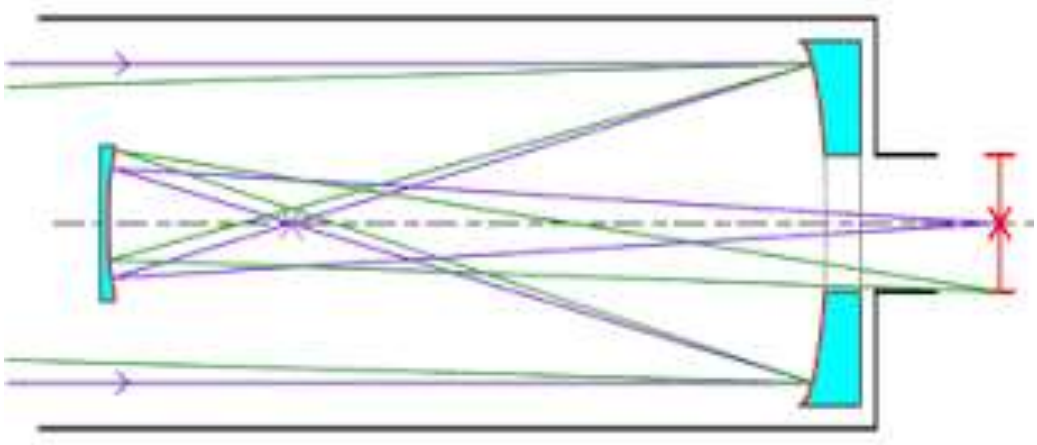
The telescope will use 7 of the world's largest mirrors as primary mirror elements and each will have a diameter of 8.41 metres (over 26 feet). The casting of the first mirror took place in Arizona on November 3rd 2005 and needed to cool for 6 months. 20 tons of borosilicate glass is needed for each of the 7 mirrors.

Mirror arrangement of the Giant Magellan Telescope

They are building one further of these off-axis mirrors so that they can rotate the re-coating which will be needed every 1 to 2 years.

The secondary mirror is pretty small and is only 3.2 metres in diameter.

This is the mirror alignment in a Gregorian telescope.



And here is the light path of the Gregorian scope.

Objectives of the telescope:

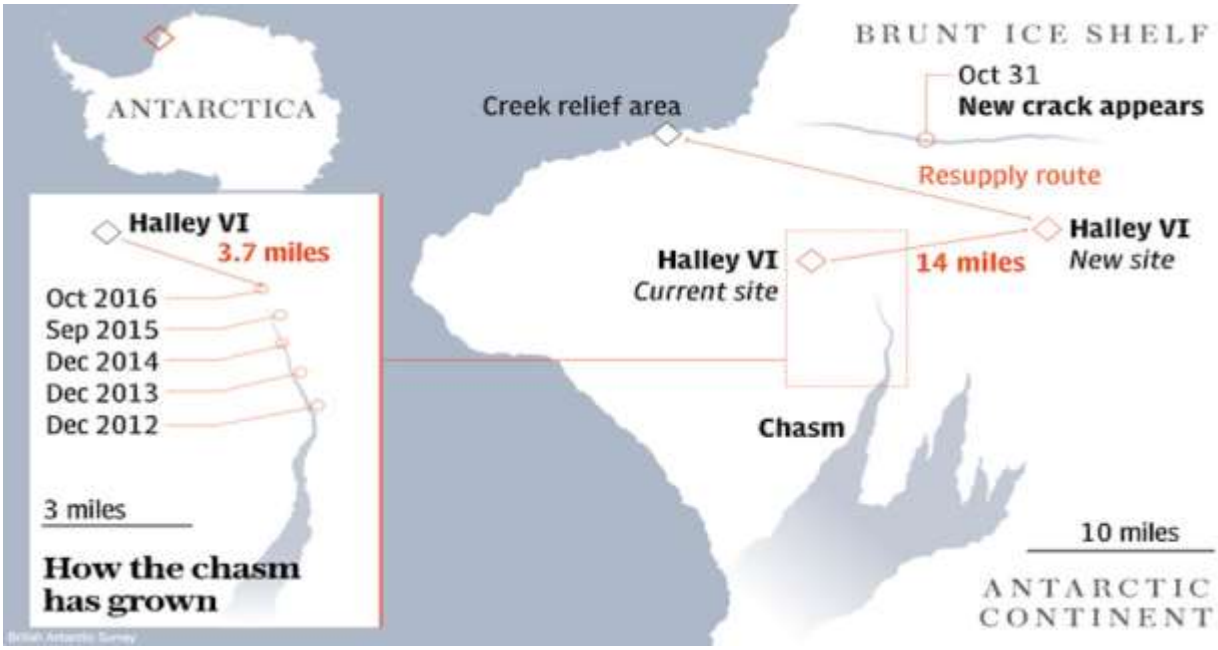
- Answer questions on exoplanets
- Are we alone in the universe?
- Answer some of the questions about the beginning and formation of the Universe.
- And produce some more jolly good pictures

The Brunt Ice Shelf in Antarctica

The British Antarctic Survey is the research station that discovered the ozone hole at the south pole.

The modules of the British Arctic Survey

More recently it is in the news because the 150-metre-thick ice shelf it is positioned on has begun to develop an alarming crack.



Map showing details of the Brunt Ice Shelf

The research station is mounted on modules that are supported on hydraulic legs with ski feet and can be moved using huge tractors. It was planned to move the base to a new position, but because of the speed of the crack's development it has been decided the area could be becoming unstable and to rescue the 88 people employed on the survey before the arctic winter arrives, whilst it is still possible to permit access by sea and air.

Following the break, Brian Mills, our Chairman and Director of Observations gave the Sky Notes which following later in the newsletter

APRIL MEETING

19th April – William Joyce tells us about "Interacting and Active Galaxies"

Meetings will take place in classrooms IL5 and 6 which are in the blue walled classroom block at the far end of the drive from the main gate of Uplands College and up by the tennis courts. Signs will direct you. There is car parking near the block. 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

17th May – **This meeting will take place in the Drama Studio** – The Science and Astronomy writer Colin Stuart sets out "13 Journeys Through Space and Time: Christmas Lectures From the Royal Institution"

21st June – TBC

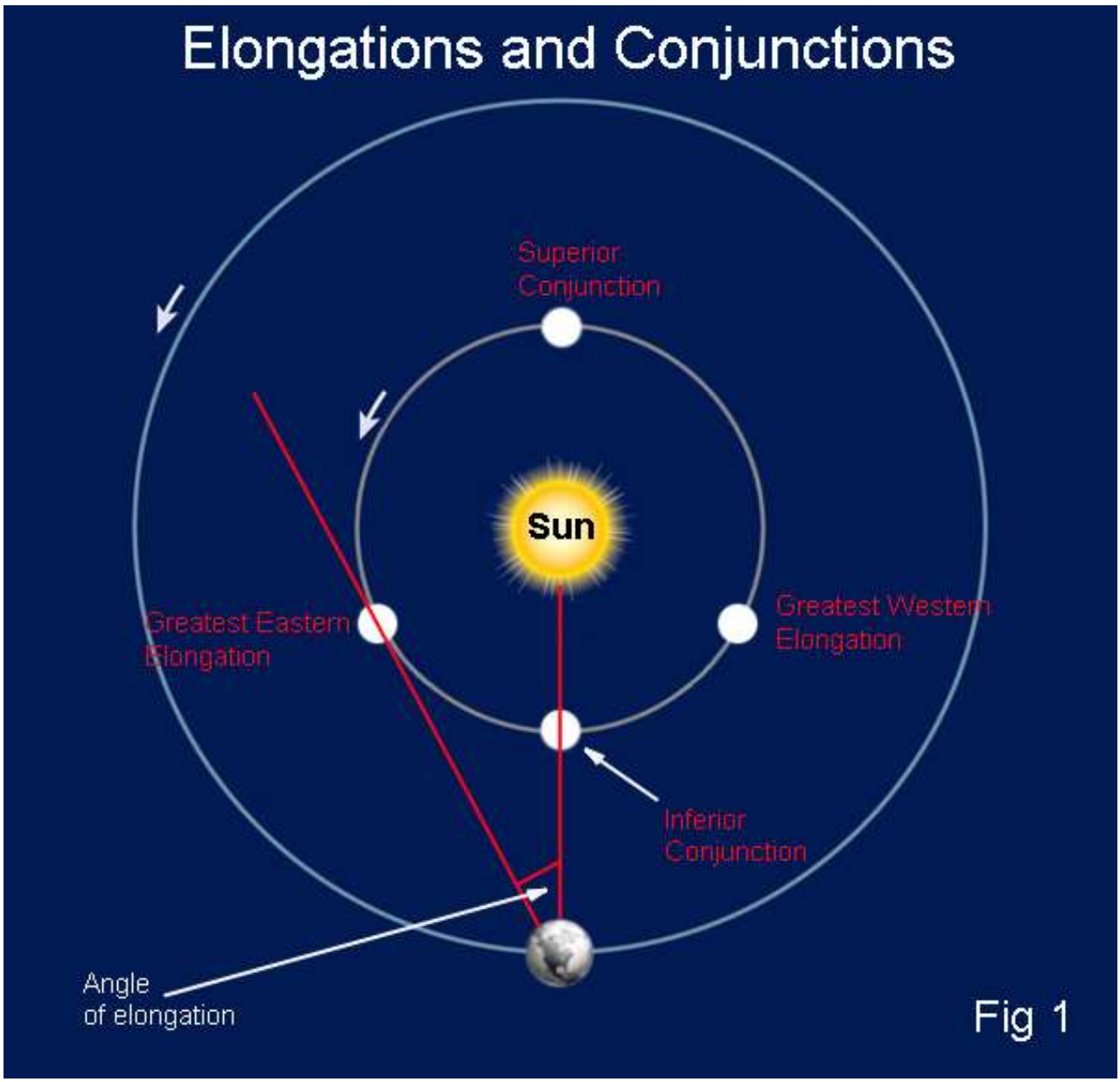
19th July 2017 – Popular speaker, Melanie Davies returns again, this time to tell us about "Mission to Mars; Fiction vs Reality"

There is no meeting in August.

SKY NOTES FOR APRIL 2017

Planets

Mercury reaches greatest elongation east on April 1st when in angular terms it will be 19° from the Sun, or to put it another way, its elongation on that date will be 19°. This will be the best opportunity of 2017 to see the solar systems smallest planet in the evening sky. Fig 1 shows the mechanics of elongations and conjunctions which apply equally to both Mercury and Venus because these are the only two planets that lie within the orbit of the Earth. None of the other members of the Sun's family are capable of reaching elongation, nor can they suffer inferior conjunction as they can never pass between the Earth and Sun. They do however pass through a solar conjunction when they are behind the Sun.



Mercury will be visible at the end of March, low down in the west as soon as the Sun has set. It will be brighter then, than it will be at elongation, although it will be lower in the sky and considerably more difficult to locate due to its proximity to the Sun. The reason for the greater brilliance is that the planet presents a larger phase towards the Earth immediately after superior conjunction, whereas when it is closer to inferior conjunction its phase becomes less and less until it is a slim crescent prior to conjunction. You may think that its increased closeness to us would make up for the reduced phase but this is not so in the case of Mercury because the differences in distance are not sufficient. However, for Venus the exact opposite is true with its brightness increasing with its size, as the phase diminishes thanks to it being so much closer to Earth as it approaches inferior conjunction.

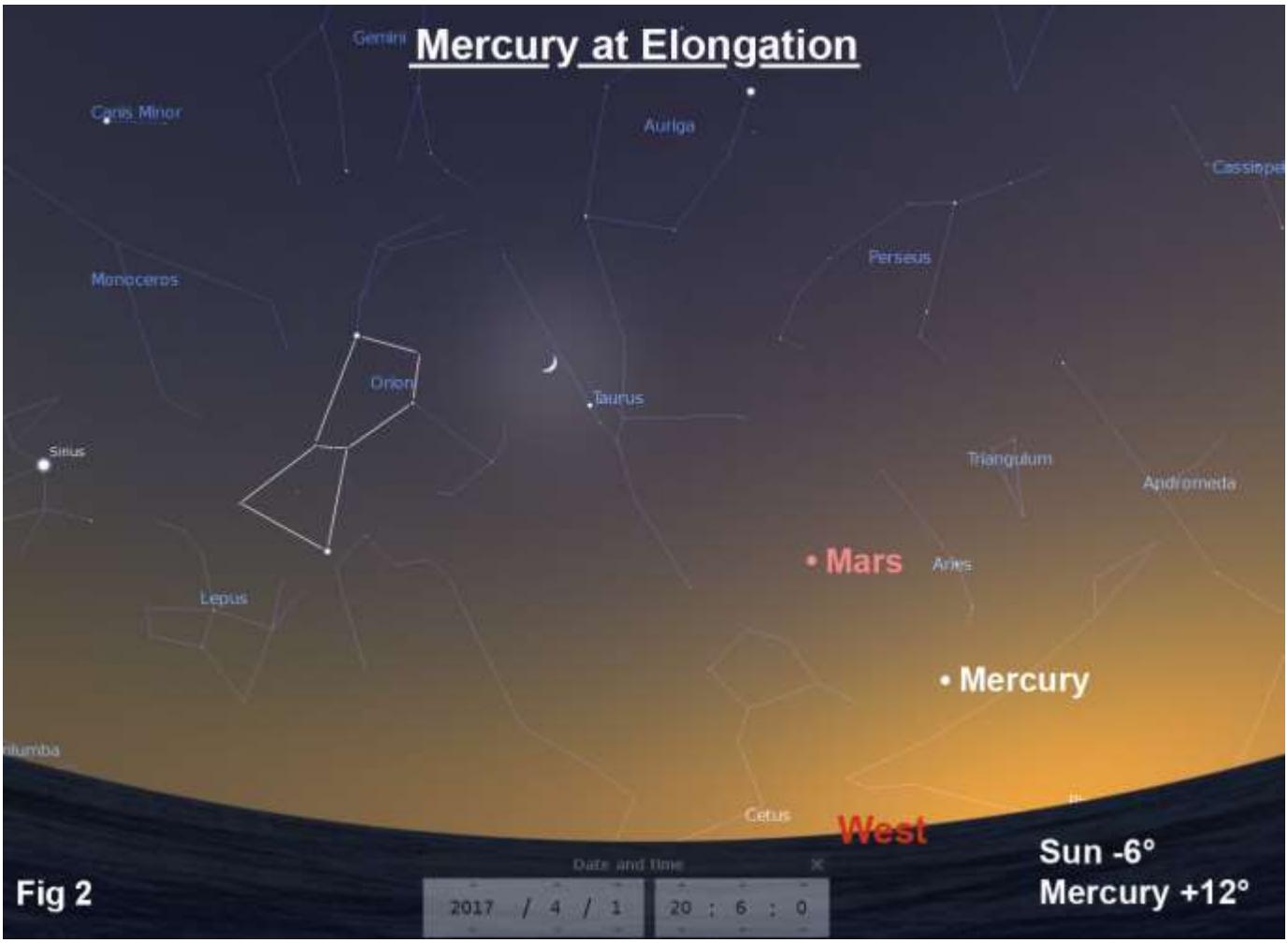
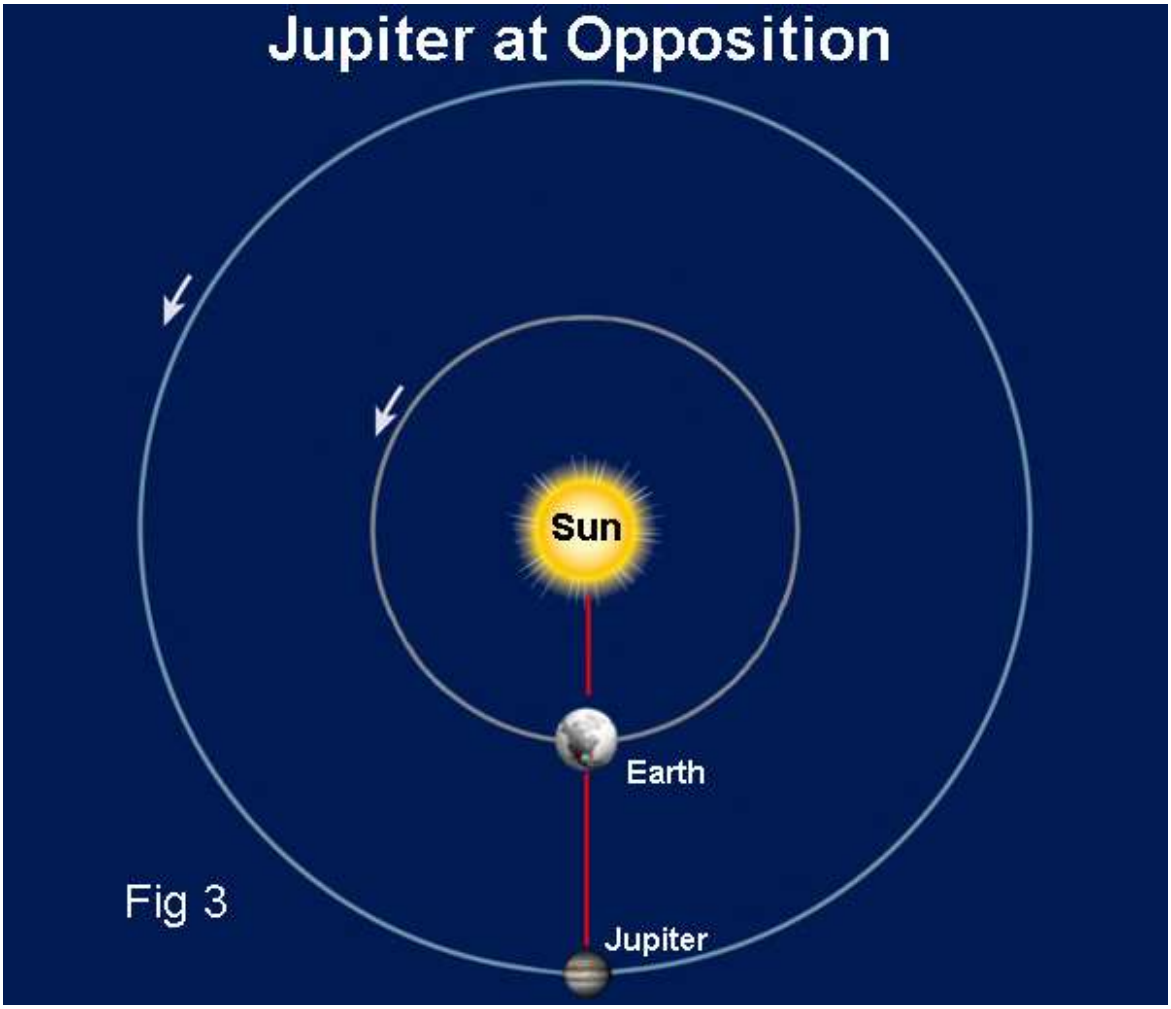


Fig 2 shows the position of Mercury on the day of elongation, just after 20.00 hours when the Sun will be 6° below the western horizon. This is at the time at which civil twilight ends and nautical twilight begins.

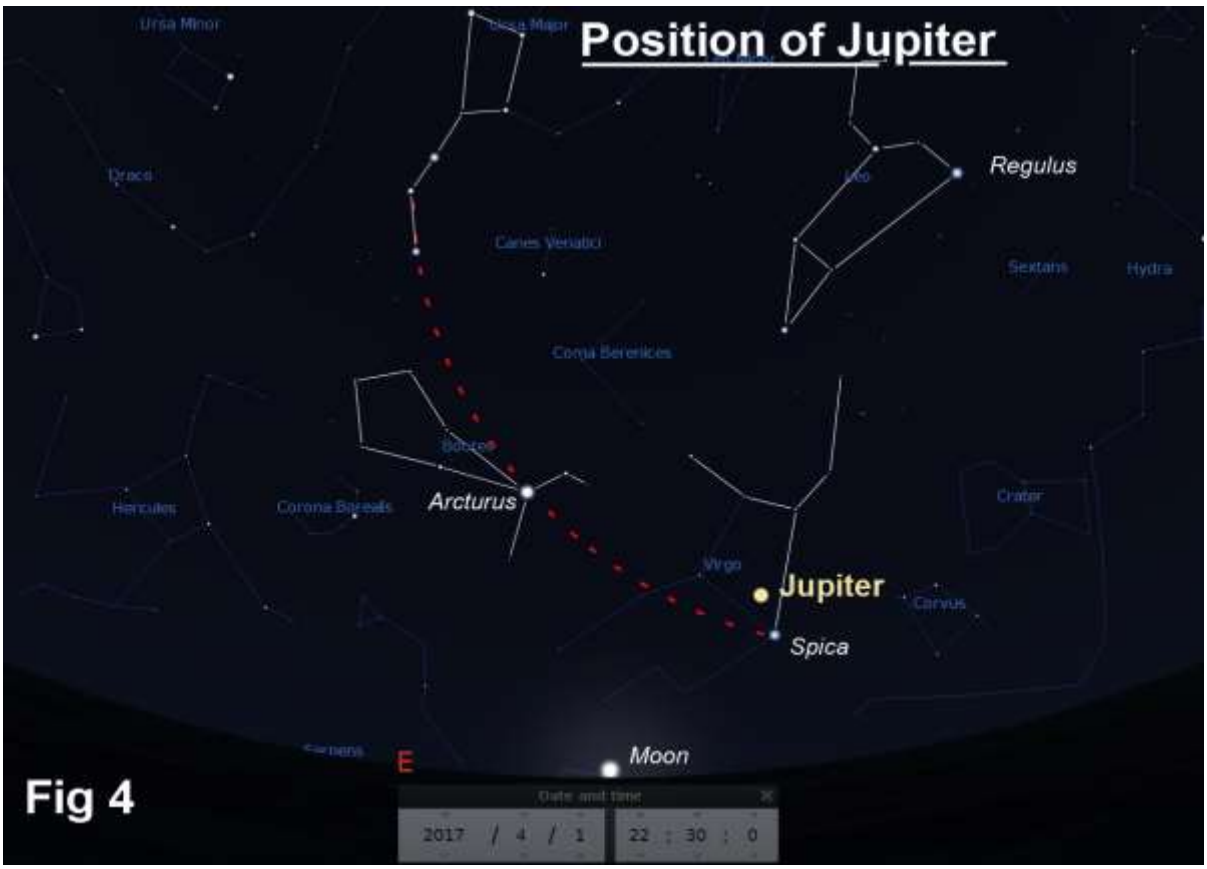
Venus was at inferior conjunction on March 25th and so will not be visible during the early part of the month. However, by mid to late April, you may glimpse the planet low in the sky, due east just before sunrise. It will be extremely bright at magnitude -4.5, and if you viewed it with a telescope you would see that its phase is a crescent, not too far from being half illuminated. Venus continues to draw away from the Sun and move further north of the celestial equator in the coming months to make observation easier.

Mars is very gradually being overtaken by the twilight as the distance between it and the Sun slowly decreases. At the beginning of the month the red planet sets three hours after the Sun, but by the end this has dropped to just over two hours. Mars is extremely small now, at 4 arc seconds, because it is almost as distant from the Earth as it is possible to get. Its position at the start of the month is shown in fig 1.

Jupiter is becoming a prominent evening object rising at 20.00 on the first of the month and reaching opposition on the seventh when it will be on view throughout the hours of darkness. Jupiter has a synodic period of 399 days which means that it reaches opposition around a month later each year. A synodic period is defined as the time taken for a body to return to the same place relative to two other bodies. In this case of course we are referring to Jupiter returning to the same spot with respect to the Sun and Earth as shown in fig 3. This does not mean, however that the body in question returns to the same location in space.
Opposition is the best possible time for observation as Jupiter will be at its closest and will therefore appear to be at its largest and brightest. Another plus is that any planet at opposition is “opposite” the Sun in the sky and by definition rises at sunset and then sets next morning at sunrise.

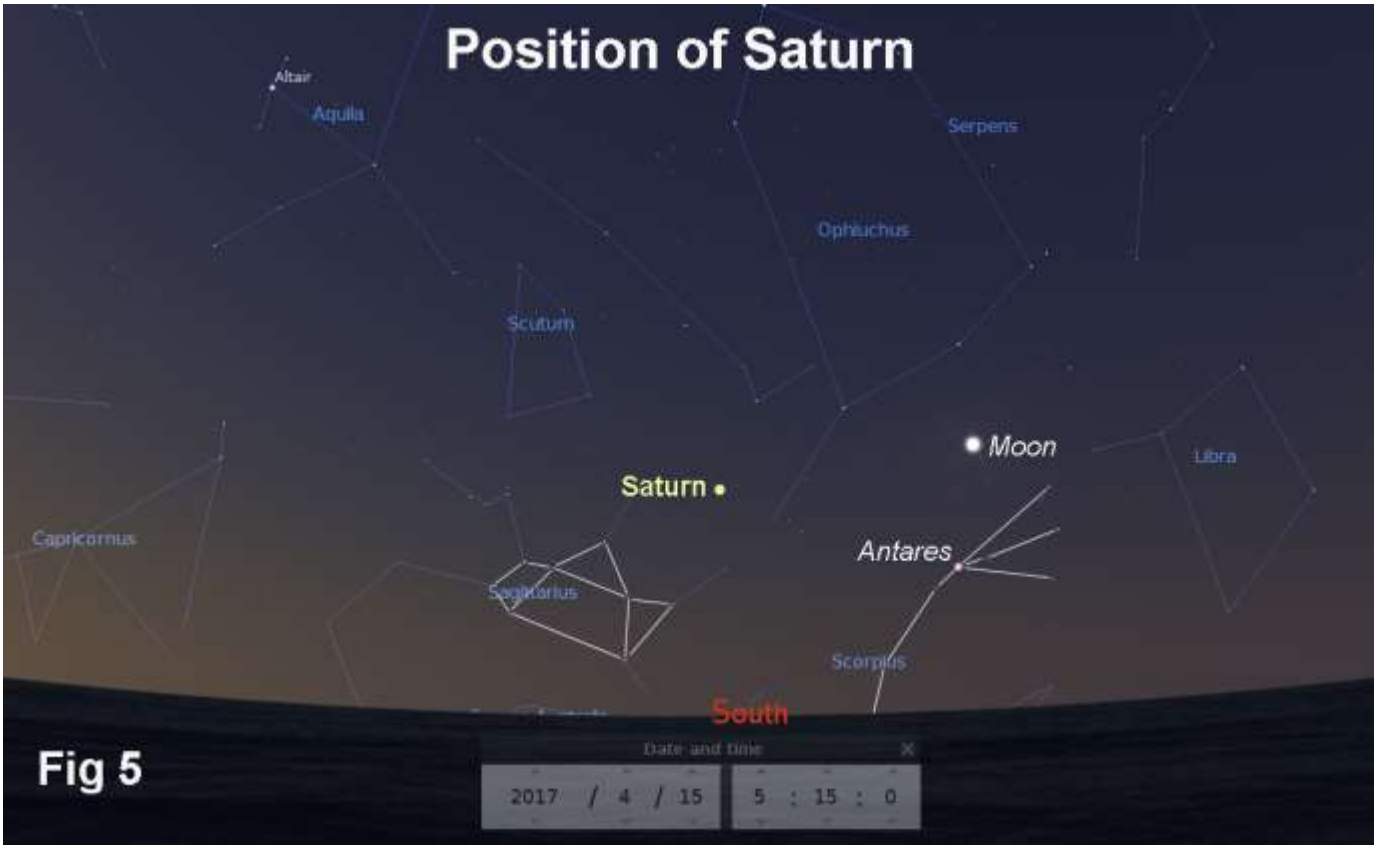


Jupiter is not known as a “gas giant” for nothing. At the time of closest approach it will have an apparent diameter of 44.3 arc seconds, more than ten times that of Mars at the current time, and a magnitude of -2.4. Binoculars will show the four Galilean moons, provided that you can mount them on a tripod or support them in some other way so as to keep them perfectly still.



The position of Jupiter at the beginning of the month is shown in fig 4. It is still moving retrograde in Virgo and will not stray too far from its current position for the rest of the month although its motion does carry it a little further from Spica. The dotted red line in the diagram suggests one method of locating Jupiter if you are unsure, which is to draw a curved line through the two stars in the end of the handle of the Plough. Continue this line through Arcturus and on to Spica where Jupiter will be found a little to the north of it. The Moon is just 1.5° north of Jupiter on the evening of April 10th.

Saturn rises around 02.00 at the start of the month and will not become an evening object until late May. It currently resides in Sagittarius, close to the "Teapot" asterism and not far from the border with Ophiuchus. Fig 5 shows its position just before sunrise in the middle of the month when it lies on the meridian, due south.



The planet is slowly growing in brightness as it approaches a June opposition and by mid April is magnitude +0.3. Its angular size is also increasing as the Earth draws closer, though it will only ever appear half the apparent size of Jupiter. The planets north pole is still tilted towards us by over 26° giving superb views of the upper surface of the rings.

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 = **d**isappearance at the **d**ark limb. 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.**

April	Time	Star	Mag	Ph	Alt °	% illum.	mm
April 6	21.06	ZC 1448	6.9	DD	50	81	80
April 14	01.54	ZC 2223	3.9	RD	22	93	40
April 28	19.12	Aldebaran	0.9	DD	31	7	40
April 28	20.07	Aldebaran	0.9	RB	22	8	50
April 30	22.31	ZC 1040	6.4	DD	20	26	40

Phases of the Moon for April

First ¼	Full	Last ¼	New
3rd	11th	19th	26th

ISS

Below are details for passes of the International Space Station (ISS). 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 it's ***maximum*** elevation, so you should go out and look at least five minutes beforehand. **Times are in BST.**

Apr.	Time	Mag.	Alt°	Az.		Apr.	Time	Mag.	Alt°	Az.
1st	21:19:37	-3.9	90°	SE		6th	20:10:21	-3.7	78°	N
2nd	20:27:12	-3.9	73°	SSE		6th	21:46:50	-3.8	64°	SSW
2nd	22:03:04	-3.1	53°	WNW		7th	20:54:22	-3.9	83°	SSW
3rd	21:11:15	-3.8	79°	N		8th	21:38:13	-3.1	40°	SSW
4th	20:18:48	-3.8	86°	N		9th	20:45:47	-3.5	58°	SSW
4th	21:55:05	-3.8	75°	W		10th	21:29:27	-2.1	24°	SW
5th	21:02:51	-3.8	81°	N		11th	20:37:05	-2.7	35°	SSW

Iridium Flares

The flares that I've listed are magnitude -2.0 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. Please note that those occurring on the 2nd, 4th, 15th and 26th are particularly bright. **Times are in BST.**

Apr.	Time	Mag	Alt°	Az.°		Apr.	Time	Mag.	Alt°	Az.°
1st	22:21:00	-3.7	30°	58° (ENE)		17th	22:46:12	-3.9	21°	39° (NE)
2nd	20:49:04	-8.4	61°	101° (E)		19th	22:43:35	-2.0	25°	42° (NE)
4th	22:12:15	-7.5	34°	61° (ENE)		20th	21:12:16	-3.3	60°	77° (ENE)
7th	20:27:55	-2.5	68°	114° (ESE)		20th	22:37:33	-2.6	25°	43° (NE)
7th	22:03:19	-5.2	39°	64° (ENE)		22nd	22:34:54	-4.1	30°	46° (NE)
10th	21:54:25	-2.3	44°	67° (ENE)		23rd	22:28:58	-3.2	31°	47° (NE)
11th	21:48:26	-5.2	46°	68° (ENE)		25th	20:51:12	-2.4	68°	83° (E)
13th	22:51:05	-3.2	14°	30° (NNE)		25th	22:26:14	-3.1	35°	49° (NE)
15th	21:33:22	-2.6	53°	72° (ENE)		26th	22:20:09	-7.5	36°	51° (NE)
15th	22:48:35	-6.3	17°	34° (NE)		29th	22:11:16	-4.9	41°	53° (NE)

Meteors The Lyrids are active from April 18th to 25th with the maximum expected on April 22nd. Rates are expected to be around 10 and the Moon will be approaching new so will cause few problems for observers.

The Eta Aquarids are visible from April 24th until May 20th and reach maximum on May 5th/6th. This is essentially a southern shower, as the radiant doesn't rise as seen from southern England until 02.00BST.

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

If you look towards the south you will see Leo high up on the meridian and to the east of it, the faint constellation of Cancer which contains the open cluster M44 also known as the "Beehive". Below Cancer is the head of Hydra, the water snake, whose body twists and turns across 75° of sky to end just below Spica in Virgo. The two small constellations of Crater, the cup and Corvus, the crow, are, according to mythology, riding on the back of the snake.

In the west Orion is about to set, though some of his winter entourage are still at moderate altitudes. The celestial twins, Castor and Pollux, are 50° above the horizon, whilst the brilliant Capella, in Auriga the charioteer, is 40° high. There are numerous open clusters in this area including a number at the "feet" of Castor and a whole host of them that lie within the confines of Auriga.

Looking north, Ursa Major commands the zenith at this time whilst the little bear below it points to the east. Cepheus lies beneath the pole on the meridian and contains IC1396 otherwise known as the "Elephant's Trunk Nebula". Two of the stars of the Summer Triangle, Deneb and Vega, are now visible as a sign that better weather is on the way.

To the east Arcturus in Boötes is almost 40° above the horizon whilst below it are Corona Borealis and Hercules. The latter contains two bright globular clusters, M13 which is the best example of its type in the northern hemisphere and M92 which is often overlooked in favour of its brighter neighbour.

Brian Mills

SPACEPLACE - 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.
Visit **spaceplace.nasa.gov** to explore space and Earth science!

What It's Like on a TRAPPIST-1 Planet
By Marcus Woo

With seven Earth-sized planets that could harbor liquid water on their rocky, solid surfaces, the TRAPPIST-1 planetary system might feel familiar. Yet the system, recently studied by NASA's Spitzer Space Telescope, is unmistakably alien: compact enough to fit inside Mercury's orbit, and surrounds an ultra-cool dwarf star—not much bigger than Jupiter and much cooler than the sun.

If you stood on one of these worlds, the sky overhead would look quite different from our own. Depending on which planet you're on, the star would appear several times bigger than the sun. You would feel its warmth, but because it shines stronger in the infrared, it would appear disproportionately dim.

"It would be a sort of an orangish-salmon color—basically close to the color of a low-wattage light bulb," says Robert Hurt, a visualization scientist for Caltech/IPAC, a NASA partner. Due to the lack of blue light from the star, the sky would be bathed in a pastel, orange hue.

But that's only if you're on the light side of the planet. Because the worlds are so close to their star, they're tidally locked so that the same side faces the star at all times, like how the Man on the Moon always watches Earth. If you're on the planet's dark side, you'd be enveloped in perpetual darkness—maybe a good thing if you're an avid stargazer.

If you're on some of the farther planets, though, the dark side might be too cold to survive. But on some of the inner planets, the dark side may be the only comfortable place, as the light side might be inhospitably hot.

On any of the middle planets, the light side would offer a dramatic view of the inner planets as crescents, appearing even bigger than the moon on closest approach. The planets only take a few days to orbit TRAPPIST-1, so from most planets, you can enjoy eclipses multiple times a week (they'd be more like transits, though, since they wouldn't cover the whole star).

Looking away from the star on the dark side, you would see the outer-most planets in their full illuminated glory. They would be so close—only a few times the Earth-moon distance—that you could see continents, clouds, and other surface features.

The constellations in the background would appear as if someone had bumped into them, jostling the stars—a perspective skewed by the 40-light-years between TRAPPIST-1 and Earth. Orion's belt is no longer aligned. One of his shoulders is lowered.

And, with the help of binoculars, you might even spot the sun as an inconspicuous yellow star: far, faint, but familiar.

Want to teach kids about exoplanets? Go to the NASA Space Place and see our video called, “Searching for other planets like ours”: https://spaceplace.nasa.gov/exoplanet-snap/

This artist's concept allows us to imagine what it would be like to stand on the surface of the exoplanet TRAPPIST-1f, located in the TRAPPIST-1 system in the constellation Aquarius. Credit: NASA/JPL-Caltech/T. Pyle (IPAC)

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www.wadhurstastro.co.uk

SAGAS web-site:
www.sagasonline.org.uk

Any material for inclusion in the May 2017 Newsletter should be with the Editor by April 28th 2017