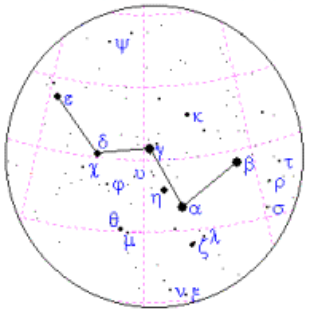


Wadhurst Astronomical Society Newsletter November 2017

MEETINGS

OCTOBER MEETING

Our October meeting was introduced by Phil Berry who announced that Uplands College have recently installed security gates.

These gates will automatically close at 22.30 each night. This will not be a problem for those with cars still in the grounds because there is a buried sensor loop which will open the gates as you drive up to them. But the problem arises for those who leave their cars in the grounds whilst they visit the pub. They would not be able to get back in to retrieve their cars. There is a car park just inside the front gates and these are outside the security fencing and any cars in there would not have a problem getting out.

Phil outlined the evening's programme and then introduced our main speaker. David Pulley is from the astronomical society called "The Local Group" who meet in Bexhill.

So, how do we know they are Planets?
David Pulley

David began by saying that his subject was Exoplanets. The first exoplanet that was discovered and confirmed was in 1992, around PSR 1257 +12, a Pulsar. The number represents its position in the sky. The first part of the number is the Right Ascension at 12h 57m and +12 is the Declination. This pulsar was found to have an anomaly in its position and from this, it was found to have a planet.

We were told that the first confirmed planet around a Main Sequence star was 51 Pegasi b, discovered in 1993. David said that in those days, the rate of discovery was somewhat slow but today the NASA Exoplanet Archive database has over 3,500 exoplanets to date although some still have to be formerly confirmed.

The idea that there might be planets around stars came at the time of Copernicus, following his heliocentric theory back in the mid sixteenth century putting the Sun at the centre of our system. If the stars were like our sun then it was considered reasonable to think that they also had planets around them.

David looked at the definition of a planet and said that until 2006 there was no formal definition. Then, the International Astronomical Union agreed that a planet was a body orbiting the Sun, it was large enough to form a spherical shape and sufficiently massive to clear material from its path. It was the last of these that failed Pluto from being defined as a planet. He added that at present, there is no formal definition of an exoplanet.

Since exoplanets are so far away, these definitions can't be applied, so astro-physicists base their classification around mass.

Briefly David described how stars form out of clouds of material and then go through various states as they become denser and through nuclear reactions form the heavier elements. He said that the smallest mass needed to form a star is at least 1/12 times the mass of our Sun. Jupiter is about 1/1,000 that mass.

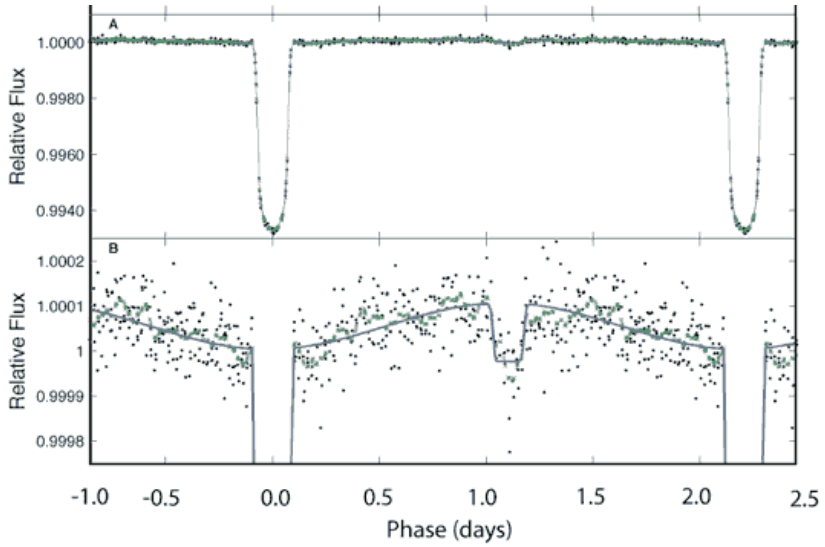
Planets are thought to form from the debris left over from the creation of the star.

There are a number of data bases for exoplanets. David tended to use a few of these data bases, all with slightly different criteria. The three he uses mostly are; the NASA Exoplanet Archive which uses 30 Jupiter Masses, Exoplanet Database Explorer uses 24 Jupiter masses and a European one based in Paris uses 60 Jupiter masses.

How are exoplanets discovered? David said that NASA has ten methods but he is going to look at just a few. The one thing they have in common is the wobble of the central sun caused by the orbiting planets. A sun and planet orbit around a common centre of gravity called the barycentre. In our case this is very close to the Sun and the wobble would be something like its radius.

The first method we were told about is to measure of the wobble of a star with a known mass. Only one exoplanet has been discovered in this way. The period of the wobble was measured and from Kepler's third law the distance of the planet from its sun was be determined.

Next, we looked at the transit method. As an example, David used the recent transit of Mercury across the face of the Sun and said that the dip in luminance would be very difficult to detect a planet the size of Mercury. But providing the transit was by a larger planet, it would be measurable as a dip in the luminance and then when the planet went behind the star, there would be a very small dip and this would make it possible to measure the period. Knowing the period and using the width of the dip, it is possible to estimate the radius of the planet. This method is most useful for planets whose orbits are close to the star.



The next technique we looked at was the Radial Velocity method. David used the discovery of HAT-P-7b in Cygnus as an example. The star HAT-P-7 was found to have a wobble that made it possible to measure the Doppler effect. As the star comes towards the viewer, a spectrometer measures the blue shift of the hydrogen-alpha line. As it moves away, the red shift is measured and from the difference, the planetary period can be determined together with the separation. The mass of the star is already known and from this it is possible to work out the barycentre. From all this it is now possible to calculate the mass of the exoplanet.

David mentioned a number of observatories used in finding exoplanets. Pulsars emit very accurately timed pulses. By measuring very precisely any changes in these pulse timings arriving at the Earth as radio waves at observatories such as Arecibo, it becomes possible to estimate the existence of an exoplanet.

Arecibo radio dish in Porto Rico, although significantly damages from hurricane Maria

We were told that candidates for possible exoplanets came from various observatories. One of the earlier ones was WASP, **W**ide **A**ngle **S**earch for **P**lanets and was the combined effort of six British Universities and the Isaac Newton Group in the Canaries and another in South Africa.

Each telescope is made up of eight wide angle cameras each looking at a slightly different but continuous parts of the sky. Between them they are slowly covering the whole sky and the results are then analysed in search for exoplanet candidates.

COROT was a French space observatory. **CO**nvection **RO**tation et **T**ransit **P**lanètaires. It had a wide field of view of 9^{o} and was in operation from 2006 to 2012 making about 30 discoveries.

TRAPPIST is the name of two telescopes operated by the Belgians in the search for exoplanets. David told us that the word was the name of a Belgium beer and they fitted an acronym to it, **TRA**nsiting **P**lanet and **P**lanetesimals **S**mall **T**elescopes. They operate one telescope in the northern hemisphere and the other in the southern hemisphere.

The Kepler Space Telescope was launched in 2009 and David said this was game changer in the search for exoplanets. Its orbit is the same as the Earth's but trails so that it is not affected by the Sun or Moon. It is studying just one area of sky in Cygnus. Because of its position in space it is able to look back further into space than any ground-based telescope and can reach 3,000 light years. The results are relayed back to Earth for analysis. Suddenly, the discovery of exoplanets jumped due to the Kepler Space Telescope's contribution.

In the future, discoveries are expected to increase mainly because of improvements in the sensitivity of detecting methods.

Finally, David looked at the recent discovery of a planet around our nearest star, Alpha Proxima Centauri about 4.24 light years from Earth. It is called Proxima-b, is about the same size as the Earth and is in the habitable zone. It is believed to have a strong magnetic field but with no atmosphere. Proxima-b orbits Alpha Proxima Centauri, a red dwarf, in about 11 days.

Subsequently David has sent the Society two attachments that more than explain the maths surrounding the data from Proxima b and are now being sent in addition along with this newsletter.

Snippets from the World of Science
John Wayte

Sputnik 1

60 years ago, Sputnik 1 was launched on October the 4^{th}. It completed 1,440 orbits of the Earth, travelling at 18,000 miles per hour with each orbit lasting 96.2 minutes, finally burning up on the 4^{th} of January 1958 during re-entry.

The satellite weighted 83.6 kg and was less than 2 feet in diameter. It contained very basic equipment but it gave us the characteristic blip that we now associate with space travel.

Sputnik 2 was launched on the 3^{rd} of November 1957, just 32 days after its predecessor, this time with a passenger, a dog called Laika that sadly did not survive the heat.

Laika being prepared as the first animal in space

Comet 67P – Churyumov Gerasmenko

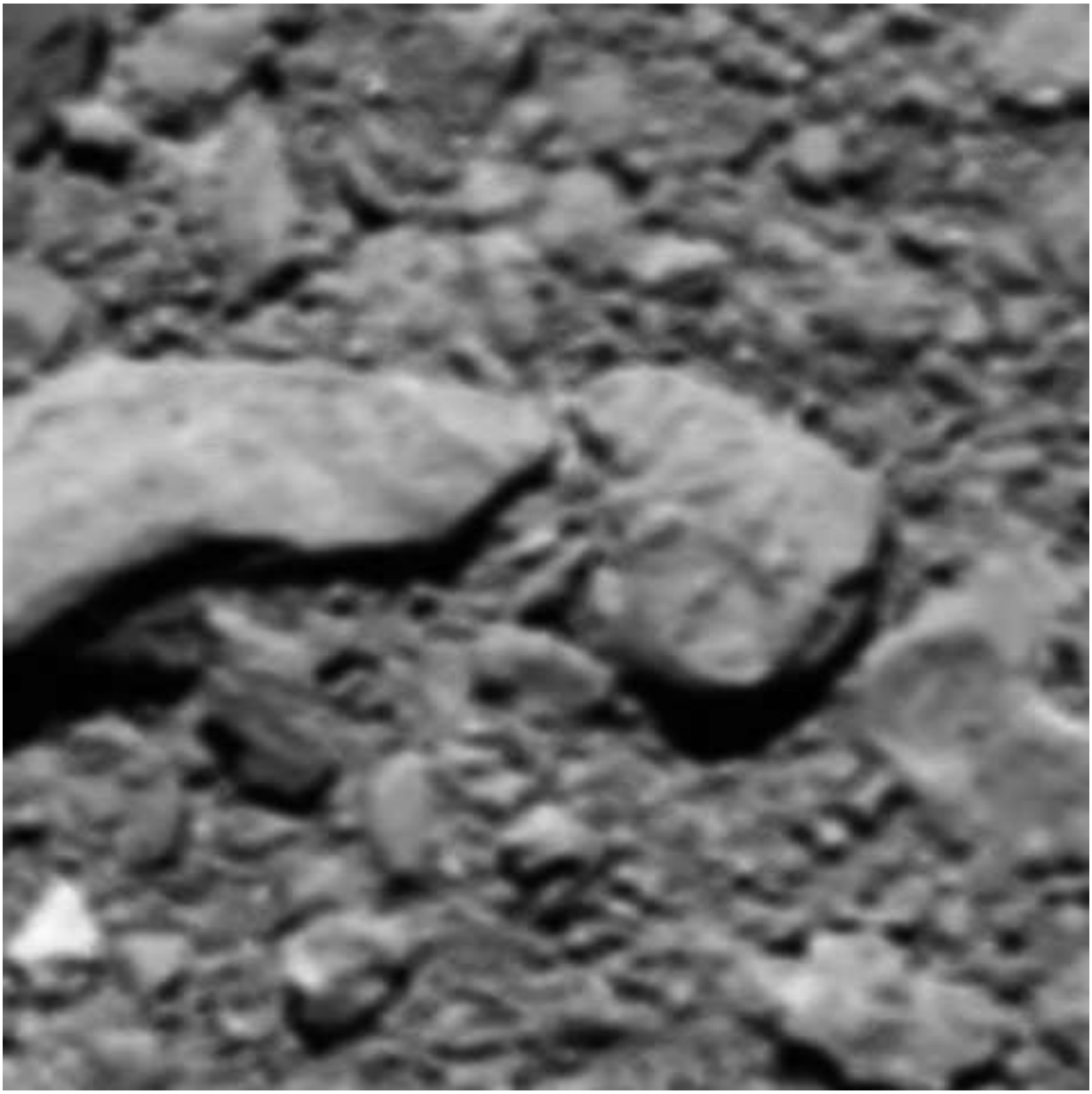
"The last complete image transmitted by Rosetta was the final one that we saw back on Earth and was taken moments before touchdown" Holger Sierks, principal investigator for the OSIRIS camera at the Max Planck Institute for Solar System Research in Göttingham, Germany, said in a statement.

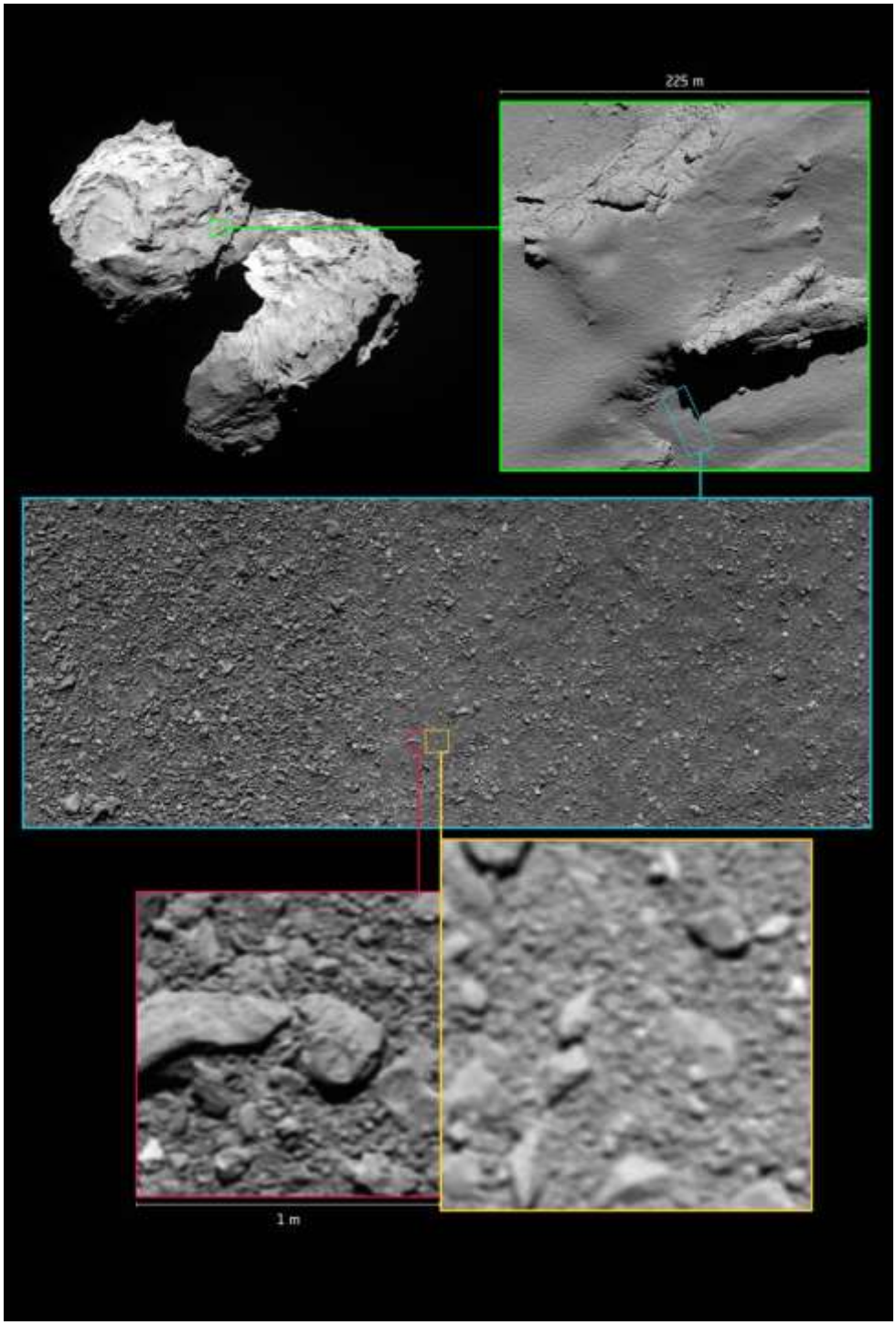
Sierks added "Later, we found a few telemetry packets on our server and thought, 'Wow, that could be another image'". ESA released the new image on Thursday 28th September this year.

Nearly a year after the Rosetta Spacecraft intentionally crashed into a comet, the mission's scientists have discovered a new surprise: the very last image Rosetta took before its cosmic demise.

With only half of the data for the image, ESA's automatic processing software was unable to generate an image. But Rosetta scientists found a way to outsmart this software and reconstruct the image from that fragmented data.

The reconstructed photo was taken right before Rosetta collided with the comet's surface and the view spans about 3 feet (I metre). Though the image is a bit blurry, it offers a detailed look at the comet's rocky surface.





. Surprise! Scientists Recover Rosetta Spacecraft's last photo of Comet 67P.
This shows details of the final resting place for Rosetta

NOVEMBER MEETING

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

Meetings will take place at Uplands College, Lower High Street, Wadhurst and are held in classrooms IL5 and IL6 which are in the blue walled classroom block at the far end of the drive from the main gate 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.

WADHURST ASTRONOMICAL SOCIETY OUTREACH EVENT

On Saturday October 28th a group from WAS were involved in an event at King John's Nursery in Etchingham. They provided telescopes, and assistance with viewing, in the early evening to look at Saturn and the Moon before a series of talks got under way. Apart from our own "Introduction to Astronomy" there were talks about birds of prey from a group that had brought along some hawks and owls, a moth trapper and finally a storyteller spoke about mythology, with the audience gathered outside around the fire pit. Following this, the group consisting of Phil Berry, Margaret and Ian McCartney, Jim Cooper and Brian Mills once again guided visitors as they viewed M31 and the Pleiades as well as performing a number of laser guided tours of the constellations. The organisers were obviously pleased with the outcome because we have been asked to make a return visit at a later date.

FUTURE MEETINGS

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

17 January 2018 – A brief AGM will be followed by a talk by Ian King, entitled "Remote Astronomy in Spain" This meeting will be held in the Drama Studio

21 February 2018 – Dr Graham Appleby tells us about "Monitoring Sea Levels from Space – The Role of Geodesy"

21 March 2018 – TBC

18 April 2018 – Barry Soden returns to enlighten us on "Daylight Skies"

SKY NOTES FOR NOVEMBER 2017

Planets

Mercury is now an evening object having reached superior conjunction in early October. It will be at greatest eastern elongation on November 24th when, in angular terms, it will be 22° from the Sun. Unfortunately on that date the planet's position, some 26° below the celestial equator, will make it extremely difficult to locate. Fig 1 shows the situation at sunset on the 24th and you can see that Mercury is very close to the horizon: in fact it is just 5° in altitude. Following this it moves back towards the Sun and subsequently into the morning sky where it is better positioned for observation at western elongation on January 1st 2018.

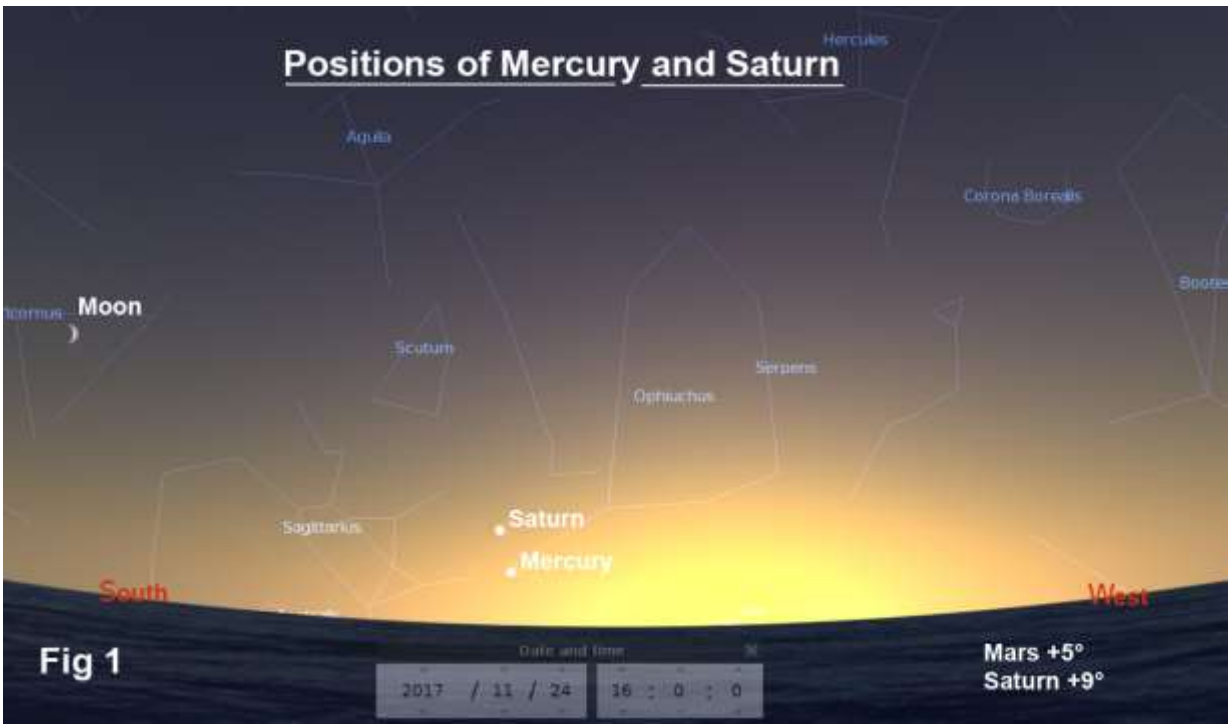


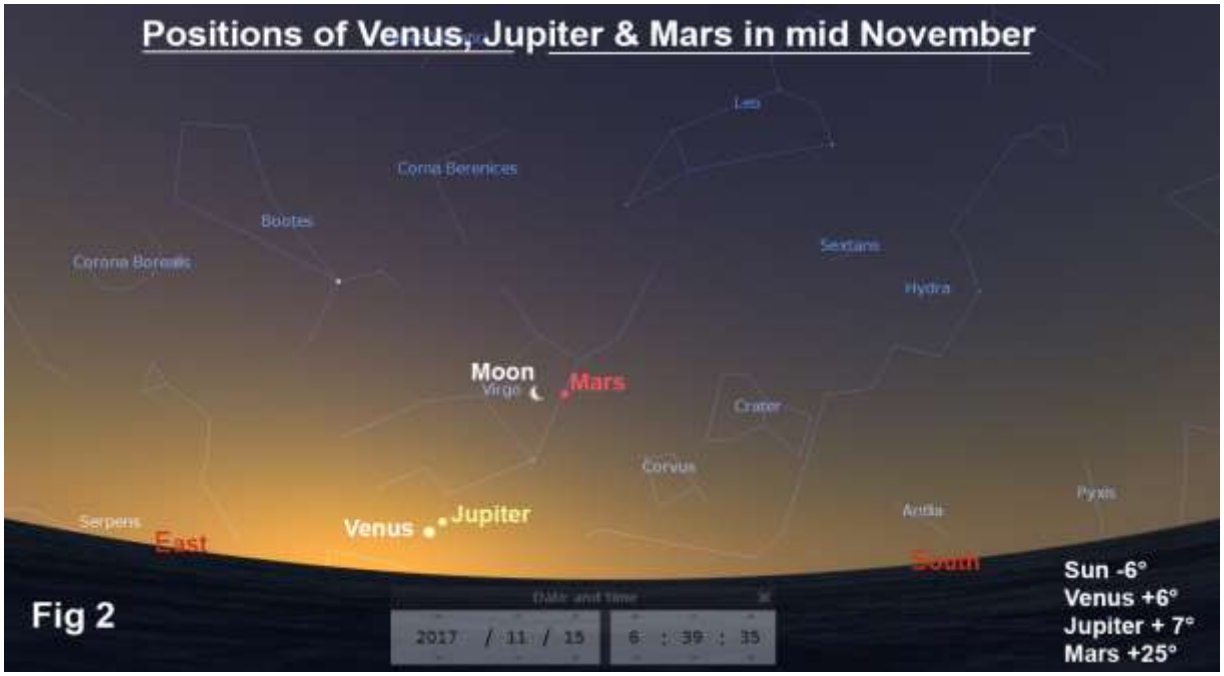
Fig 1

Venus is still a brilliant morning object though it is moving gradually back into the clutches of the Sun. At sunrise on the first of the month the planet is almost 15° high in the east-south-east and then on the morning of the 13th, Venus (magnitude -3.9) passes within a third of a degree of the fainter Jupiter (magnitude -1.7). The two objects will be just 10° in altitude at sunrise so a clear horizon will be required to see them. Please remember that if you sweep the area with optical aid, **you should not do so** after the Sun has risen because of the risk of eye damage should you inadvertently bring the Sun into the field of view. See fig 2 for its position in the middle of the month.

Mars is also currently in the morning skies and pulling slowly away from the Sun. At the beginning of the month the red planet rises at 03.45 which is three hours ahead of the Sun, but this will have stretched to just over four hours by the end. Mars spends the month

moving direct (eastwards) in Virgo and has a slender crescent waning Moon for company on the morning of the 15th. On the 29th and 30th it lies just 3° north east of Spica, the brightest star in Virgo. Fig 2 shows its position on the 15th with the Sun 6° below the horizon.

Jupiter reached solar conjunction in late October and so is just emerging into the morning skies. Its position in the middle of the month is shown in fig 2 and on that date it rises 1½ hours ahead of the Sun. However, the planet's motion is swift so that by the end of the month it becomes visible 2½ before sunrise and can be observed in a moderately dark sky. Jupiter's apparent diameter and magnitude are both beginning to increase and will continue to do so until it reaches opposition in early April 2018.



Saturn, as can be seen in fig 1 is still just an evening object although it is very low in the south west immediately after sunset. At the beginning of November it is still 10° high with the Sun 6° below the horizon (the end of civil twilight). By the end of the month, with the Sun in the same position, Saturn is only 4° high and has been effectively lost to the solar glare.

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. As you can see the Moon once again passes through the Hyades on the night of the 5th/6th culminating in an occultation of first magnitude Aldebaran in the early hours of the 6th. **Times are in GMT.**

Nov.	Time	Star	Mag	Phase	Altitude °	% illumination	mm
Nov 1	22.20	ZC 83	6.6	DD	38	93	80
Nov 2	19.08	ZC 210	6.6	DD	26	97	100
Nov 4	21.56	ZC 491	6.0	RD	41	99	70
Nov 5	19.46	ZC 635	3.7	RD	16	96	40
Nov 5	22.14	ZC 659	6.6	RD	38	95	90
Nov 5	23.48	ZC 667	5.0	RD	50	95	40
Nov 5	23.53	ZC 672	6.7	RD	50	95	90
Nov 6	02.40	Aldebaran	0.9	DB	53	95	40
Nov 6	03.24	Aldebaran	0.9	RD	49	95	40
Nov 6	23.00	ZC 823	6.7	RD	38	89	80
Nov 6	23.51	ZC 829	6.8	RD	45	89	90
Nov 24	16.37	ZC 3041	6.2	DD	21	31	40
Nov 25	20.13	ZC 3181	6.0	DD	15	41	40
Nov 28	19.10	ZC 20	6.7	DD	35	71	70
Nov 28	21.31	SAO 128661	6.6	DD	31	71	70
Nov 29	19.46	ZC 150	6.1	DD	39	80	60
Nov 29	22.32	ZC 165	6.4	DD	35	81	70

Phases of the Moon for November

Full	Last ¼	New	First ¼
4th	10th	18th	26th

ISS

Below are details for the only evening passes of the International Space Station (ISS) this month. The details of other 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 GMT.**

Nov.	Time	Mag.	Alt°	Az.		Nov.	Time	Mag.	Alt°	Az.
28th	18.39	-1.2	15	SSW		30th	16.56	-1.4	13	SE
29th	17.49	-2.0	20	SE		30th	18.31	-2.1	29	SW

Iridium Flares

The flares that I've listed are magnitude -4.0 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 GMT.**

Nov.	Time	Mag	Alt°	Az.°		Nov.	Time	Mag	Alt°	Az.°
3rd	18.19	-8.1	46°	23° (NNE)		17th	18.17	-7.8	39°	154° (SSE)
6th	16.27	-5.4	76°	58° (ENE)		19th	17.00	-6.0	66°	47° (NE)
6th	18.27	-7.9	42°	23° (NNE)		26th	17.41	-7.4	34°	174° (S)
7th	16.21	-6.2	76°	65° (ENE)		28th	16.25	-8.4	71°	71° (ENE)
12th	18.38	-7.8	39°	142° (SE)		29th	16.20	-4.9	72°	76° (ENE)
14th	17.43	-7.8	54°	32° (NNE)		30th	17.26	-5.8	31°	183° (S)
15th	17.37	-5.7	56°	34° (NE)						

Meteors

The Taurids began on October 20th and last until November 30th although there are two separate showers with two independent radiants. The first shower reaches its maximum on November 5th whilst the second has a peak on November 12th. The ZHR's for both showers are predicted to be around 10. The Moon will seriously interfere with the first maximum but will not rise until 01.30 GMT for the second. Fig 3 shows the radiant position.

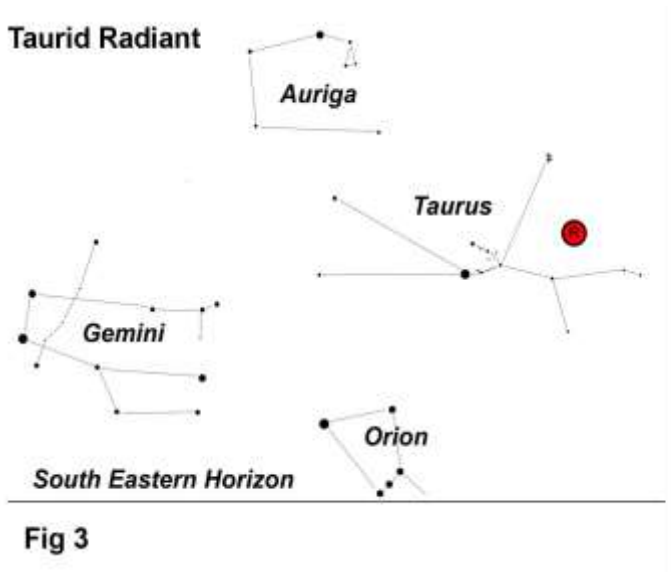


Fig 3

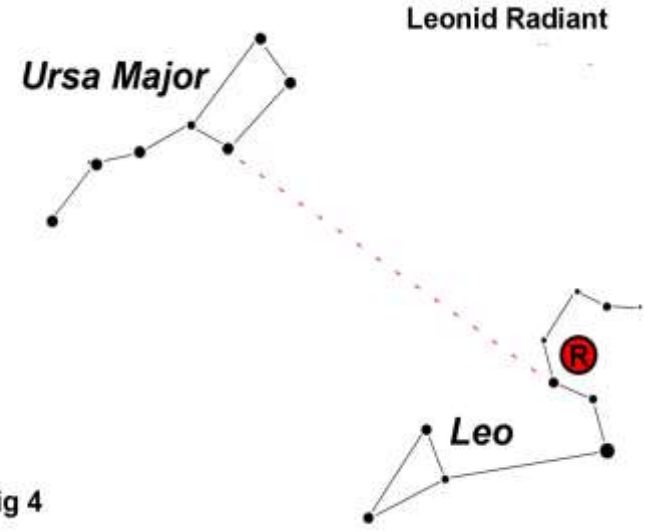


Fig 4

The Leonids are active from November 15th to the 20th with a sharp maximum occurring on the 17th at 19.00 GMT. Numbers are expected to be low although these are extremely fast meteors which often leave an ionised train behind them. Unfortunately, there is the disadvantage that the radiant doesn't rise in the UK until 22.00, but this is balanced by the Moon being new at the time of maximum so that, on this occasion, it won't spoil the party. Fig 4 shows the position of the radiant within the "Sickle" of Leo.

The Night Sky in November (Written for 22.00hrs GMT mid month)

Looking towards the north, the tail of Ursa Major straddles the meridian as the bear begins its climb away from the horizon once more with that photogenic pair M81 and M82 now more than 35° in altitude. The constellation of Cassiopeia lies close to the zenith with Cepheus to the west and Perseus and Camelopardalis immediately to the east. The latter is the 18th largest by area but it contains mostly faint stars with beta, at magnitude 4.03, being the brightest. There are a number of galaxies of magnitude 9 to 11, plus an open cluster, NGC 1502 at magnitude 5.7. This is a notable object because "Kemble's Cascade", an asterism of at least 20 stars that form an almost straight line, have been described as "tumbling" towards the cluster. The stars in the cascade are not in any way connected and only appear as they do, due to a line of sight effect.
In the east the winter groups are coming into view with Gemini, Auriga, Taurus (with the Pleiades already nearly 55° in altitude) and Orion all now clear of the horizon. Apart from the well known Pleiades and Hyades, Taurus contains a number of other open clusters mostly of magnitude 6 to 7. It is also home to the very first object in Messier's catalogue, M1, the Crab Nebula although it had been observed some 27 years earlier in 1731 by the Englishman John Bevis. It is the remnant of a supernova event that occurred in 1054 and contains a rapidly rotating neutron star. At magnitude 8.4, good binoculars will show the nebula although with apertures of more than six inches it appears as an oval patch of diffuse light whilst a twelve inch instrument will show some filamentary details. To the north of Taurus lies Perseus with the famous double cluster 80° above the horizon and almost due east.
The south contains very little by way of sparkle when compared to what the east has to offer. Close to the meridian are Andromeda and Pegasus which both contain objects of interest although the Milky Way passes just north of them both. Andromeda, as well as being home to the M31, M32 and M101 complex, also boasts a number of open clusters with NGC 7686 and NGC 752 being the brightest at magnitudes 5.6 and 5.7 respectively. Also in the area is a magnitude 9.2 planetary nebula, NGC 7662, otherwise known as the "Blue Snowball". It needs instruments with a diameter of twelve inches and above to reveal anything more than a tiny bluish disk. Below the "Square" is Pisces where Uranus has been resident since 2009 excepting a brief dalliance with the borders of Cetus in March 2013. Closer still to the horizon are the groups of Cetus and Aquarius, the latter of which contains the other ice giant, Neptune.

Towards the west the three members of the Summer Triangle are still visible though Altair will be the first to be lost. Above Altair in a line from west to east are the four small constellations of Vulpecula, Sagitta, Delphinus and Equuleus of which Sagitta, the arrow and Delphinus, the dolphin are the most obvious. With a little imagination it is possible to see similarities in both to their mythological namesakes.

Advance warning for December
Dec. 14th – Geminid meteor shower maximum.
Dec. 23rd – Ursid meteor shower maximum.

Brian Mills

SPACEPLACE - NASA

This article is provided by NASA Space Place.
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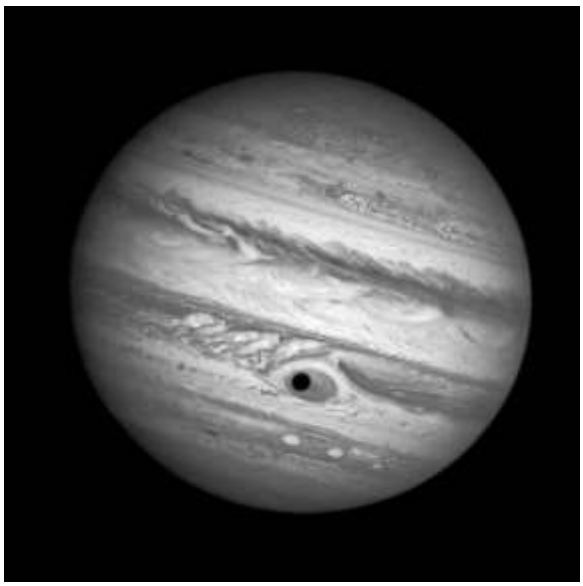
Spooky in Space: NASA Images for Halloween
By Linda Hermans-Killiam

Have you ever seen a cloud that looks sort of like a rabbit? Or maybe a rock formation that looks a bit like an elephant? Although you know that a cloud isn't *really* a giant rabbit in the sky, it's still fun to look for patterns in images from nature. Can you spot some familiar spooky sites in the space images below?

Credit: NASA/GSFC/SDO

This might look like the grinning face of a jack-o'-lantern, but it's actually a picture of our Sun! In this image, taken by NASA's Solar Dynamics Observatory, the glowing eyes, nose and mouth are some of the Sun's active regions. These regions give off lots of light and energy. This causes them to appear brighter against the rest of the Sun. Active regions are constantly changing locations on the Sun. On the day this image was captured, they just happened to look like a face!



Credit: NASA/ESA/A. Simon (Goddard Space Flight Center)

This is a Hubble Space Telescope image of Jupiter. Do you notice something that looks like a big eye peeking back at you? That's actually the shadow of Jupiter's moon Ganymede as it passed in front of the planet's Great Red Spot. Jupiter's Great Red Spot is a gigantic, oval shaped storm that is larger than Earth and is shrinking. It has been on Jupiter for several hundred years, and its winds can swirl up to 400 miles per hour!

Credit: NASA/JPL-Caltech

Can you see the profile of a witch in this image? This image, from NASA's Wide-Field Infrared Survey Explorer, shows the Witch Head nebula. The nebula is made up of clouds of dust heated by starlight. These dust clouds are where new stars are born. Here, the dust clouds happen to be in the shape of an open mouth, long nose and pointy chin.

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Any material for inclusion in the December 2017 Newsletter should be with the Editor by November 28th 2017