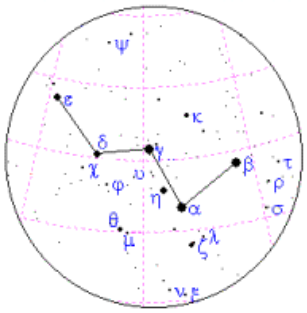


# Wadhurst Astronomical Society Newsletter October 2016

## MEETINGS

## MEETING OF THE COMMITTEE

Members of the Committee are respectfully reminded that there is a meeting of the Committee at Phil's house on Tuesday the 4th of October starting at 1930.

## SEPTEMBER MEETING

The September meeting was led by Phil Berry who, after welcoming members and visitors to a well-attended meeting introduced our speaker, Melanie Davies for another of her fascinating talks.

Melanie is a highly experienced Space Science communicator and is the founder of "Creative Space" based in Hastings which offers educational resources in astronomy to schools, colleges and societies and much more.

**The Pleiades**
*Melanie Davies FRAS*

Since we are just beginning to get into the longer dark evenings, Melanie said this was a good time to talk about one of the features that can easily be seen with the naked eye. The Pleiades is what is described as an open cluster which we were told is rather like an extremely small galaxy. It is often referred to as the Seven Sisters.


The main stars in the Pleiades

The first known record of the Pleiades was found in the Lascaux Caves in southern France in a painting made about 17,000 years ago. One interesting observation is that Orion's Belt is shown with four stars and not the three we see today. Melanie said the fourth star may well have exploded as we believe Betelgeuse will do sometime in the future, or something else may have happened to it.

Part of the cave paintings in the Lascaux Caves in Southern France
The four stars in Orion's Belt are to the left, Taurus is in the centre and the Pleiades are towards the upper right

Another fascinating fact is that the stars in the constellation of Taurus the Bull are also represented in the paintings as a bull which is thousands of years before the constellations were named.

We were shown a picture of the first star catalogue made by John Flamsteed in 1749, just before his death. This was the first chart showing the position of the stars from observations made through telescopes and showing the Pleiades.

Melanie described the line of the ecliptic, the path the Sun appears to take across the sky and is also the approximate path of the Moon and planets. The Pleiades lies close to the ecliptic and therefore the cluster's stars are often occulted by the Moon and even occasionally by some of the planets.

There are a number of mythological stories about the seven sisters such as one about Orion the Hunter chasing Atlas's daughters across the sky. Zeus, king of the gods felt sorry for Atlas and fixed Orion's position in the sky so that he could never catch the sisters. We were also told of the many beliefs among other cultures around the world.

Subaru is the Japanese name for the Pleiades and we were told that the logo on the Subaru car is an image of the Pleiades. Also Subaru is the name given to the 8.2 metre Japanese telescope.

NASA operate a huge computer called the Pleiades Super Computer which is used for simulations by NASA scientists and other scientists around the world. We were told that a scientist at UCL, the University College London, had used it to create an image of the 'cosmic web' as it would have been about 3 billion years after the Big Bang.

Melanie now looked at the age of the stars in both in the Orion Nebula and the Pleiades and said they were all about the same age of 125 million years old measured by their lithium depletion which is known to follow a precise decay rate, and means they are very young stars. They are all quite close together and as they age, although they have about the same proper motion, they will begin to drift apart.

The Orion Nebula and the Pleiades are all part of a giant molecular cloud, the birth place of stars. For a long time it was thought that the Pleiades were about 400 light years away but more recently, the Hubble Space Telescope used parallax to determine the distance as 440 light years and more recently still, using radio interferometry it has been possible to precisely put the distance at 444 light years.

With the naked eye it is usually possible to see 6 stars in the cluster, but in a really clear sky it may be possible to see as many as 12. Looking through a large telescope, astronomers can now count as many as 2,109 member stars and Melanie said that once GAIA is calibrated, an even more accurate count will be possible. More about GAIA later in the newsletter.

From Earth, the Pleiades measure about four moon-widths across at about $2^{o}$ and at the widest is about 43 light years across which is huge.

Melanie now talked about the main stars that make up the Pleiades. They are mainly hot blue giant stars which at birth would have been about 50,000 Kelvin cooling to about 20,000 Kelvin after a million years to become B class stars. Our Sun is about 5,600 Kelvin.

We were told that there are also white dwarfs in the cluster and this is unexpected because the stars are not old enough to have come to this state but a lady astronomer at Harvard University in the States believes some of the stars are spinning so rapidly that they have lost much of their material to become White Dwarfs in a shorter time.

Other objects in the cluster are called Cool Brown Dwarfs but not much is known about them. They are smaller than a radiating star but too large to be a planet. It is hoped that once the 30 metre Extremely Large Telescope being built in Chile has been completed it will be possible to learn more about these objects.

Showing the gas cloud in front of the Pleiades with some of the gas tendrils being drawn out by the giant stars

Images of the Pleiades taken from Earth show a nebulosity which for many years have been thought to be the remains of the gas from which the stars were formed but Melanie told us that using the Infra-red telescope aboard the Spitzer Spacecraft it has been found that there exists a cloud that is actually reflecting light and not absorbing it and is now thought to be quite separate from the cluster and passing in front of it, although not all that far because we were told that some of the stars in the Pleiades are having an effect on larger particles in the cloud, causing tendrils that have been seen in images taken by Hubble.

To finish, Melanie mentioned that further research is taking place particularly in the X-ray part of the spectrum and said that there is still a lot to find out about the Pleiades.

**Snippets from the World of Science**
*John Wayte*

**Rosetta**

When I told you at the July meeting that I had made my last talk on Rosetta for a while, I didn't expect that I would find it necessary to return to this feature quite so soon.

But I'm delighted that, with your permission I would like to just add a very important little addition.

So why am I telling you all about this 67/P/C-G mission?

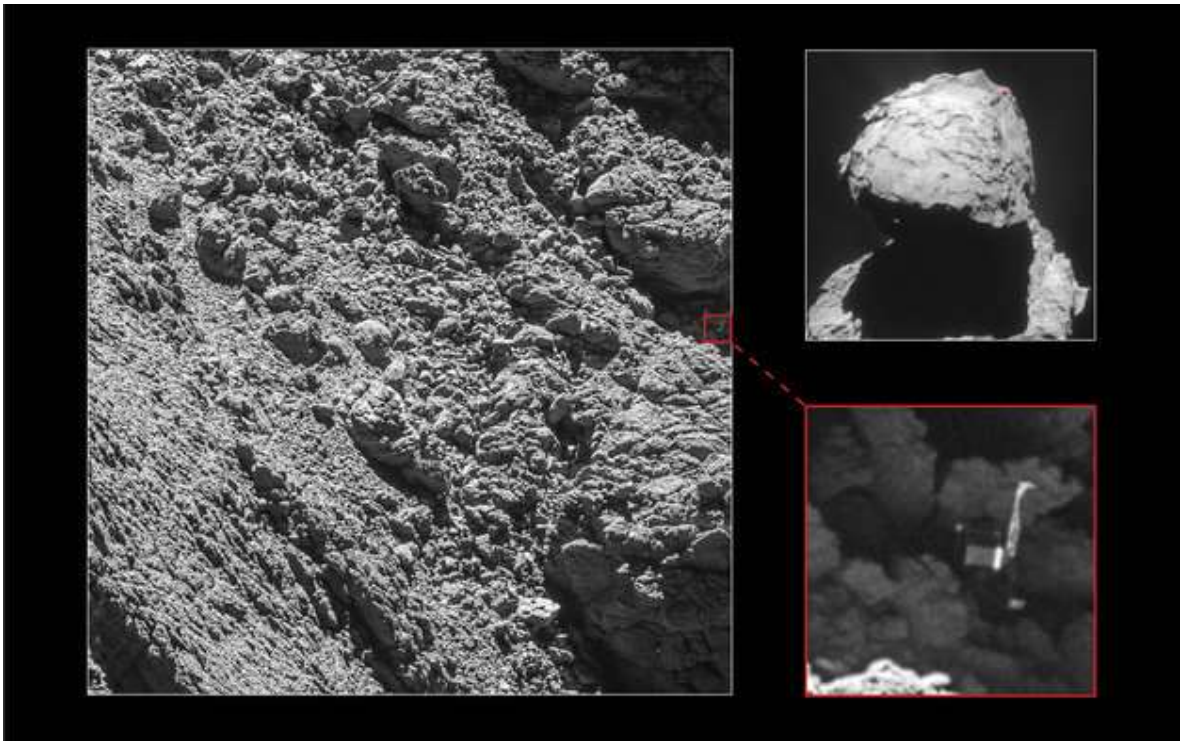
It has a sort of happy ending…

They have found the little fellow; Philae lying exhausted under a rock!

It is looking a little crumpled and lonely jammed under the rock-face with nowhere to charge its batteries.

During its final era of observations Rosetta had been put into an ever decreasing orbit and in the process brought it lower and lower so that it's ORISIS narrow-angle camera could take better shots of the surface. The scientists already had a suspicion as to the

rough location of Philae and deep analysis of radio communications provided a location of tens of metres square. Until they were able to bring Rosetta in closer the definition was not up to the standard required to achieve a positive identification. At a distance of 2.7 Km and with a definition of 5 cm/pixel – Bingo!



This image was taken on the 2nd of September. Image by ESA

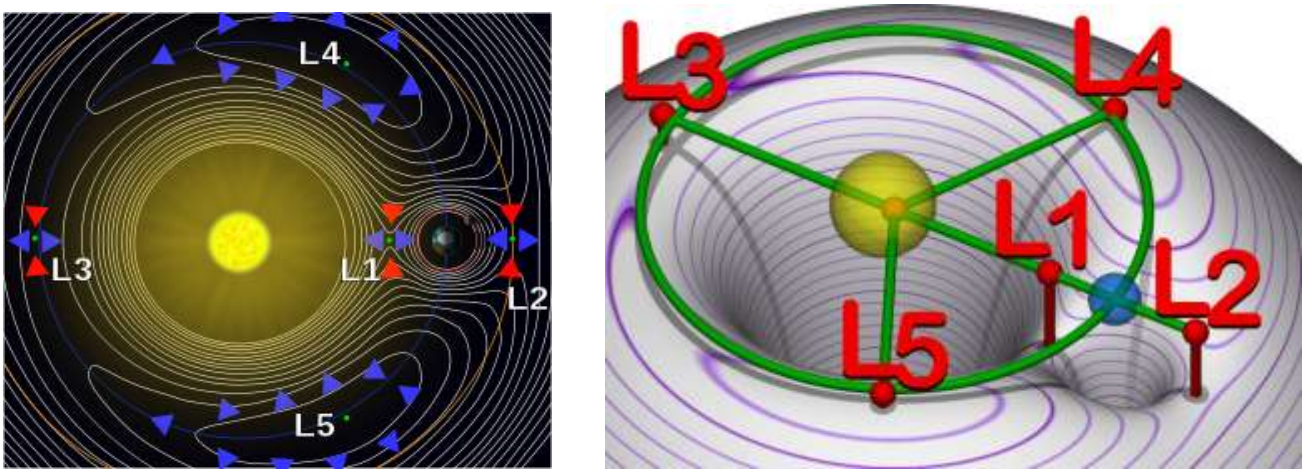
And all this from 608,764,010 Km away from Earth – as of 23rd. September 2016.

Rosetta was finally put down on the surface of the comet on 30th September and shut down. More images to come.

**GAIA**

Just as you thought that it was safe to get back into the water, I am going to bring up another old chestnut; ESA's GAIA spacecraft.

GAIA is currently 1.5 million Km from Earth at Lagrange point L2.




Plan view of the Sun-Earth positions with the stable Lagrange Points and a gravity map showing the points

As you will remember this satellite is measuring the position of one billion stars to an incredible degree of accuracy. The measurements are accurate to a micro-arc-second, which is equivalent to the edge of a Euro – sorry – pound coin, when viewed on the Moon.

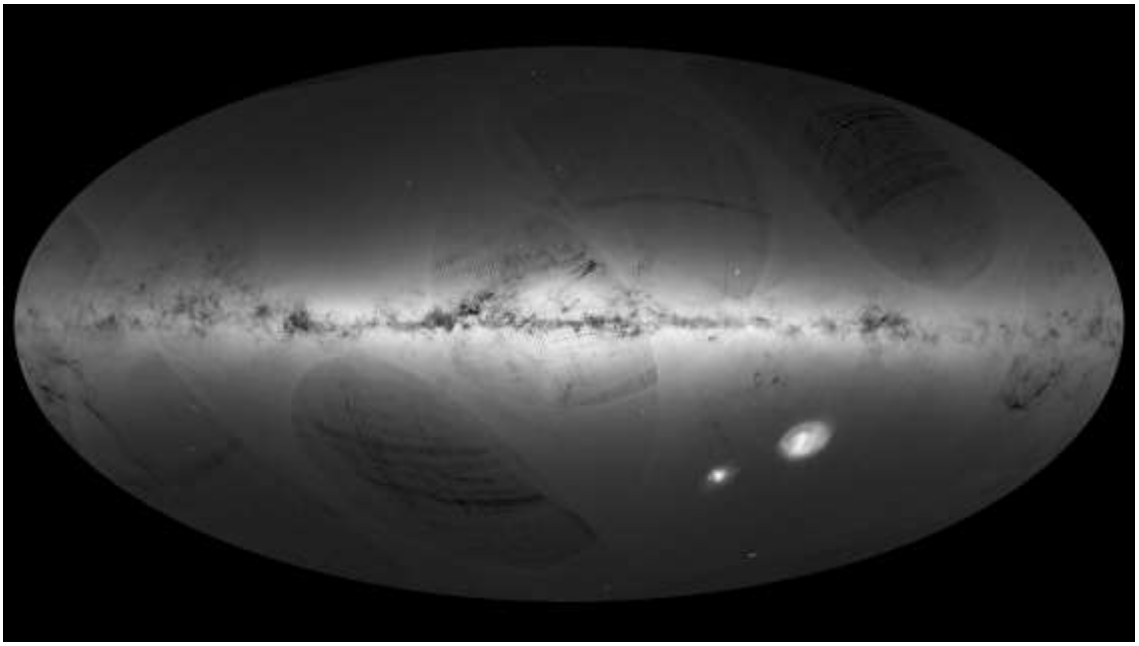
During this time there have been problems with water freezing on some parts of the optics but with several heating sequences this had been reduced (but not eliminated). GAIA can see stars to better than magnitude 20 which is about 400 million times fainter that our brightest star, Sirius.

Some stray light is getting into GAIA's focal plane and this is coming from sunlight being reflected by fibres in the surrounding insulating blanket that covers the 10 metre-diameter sunshield.

Micro-clanks are another problem. This is caused by structural changes within the spacecraft and is being eliminated by redesigned software.

Micrometeorites are another small problem but these are a well-known issue.

So the first catalogue of the stars that GAIA has monitored so far was published on September the 23rd. 1,142 million stars have been precisely pinned down for their position and brightness.



Part of GAIA's first catalogue. The two bright patches are the large and small Magellanic clouds, two dwarf galaxies orbiting the Milky Way. The Andromeda galaxy can be spotted bottom left at about 8 o'clock.

So far 110 billion photometric observations, 9.4 billion spectroscopic observations and 50 billion focal plane transits have been successfully processes to date.

And this is only the first year's publication.

## COURSE ON THE INTRODUCTION TO ASTRONOMY

Melanie Davies is running a course called "Introduction to Astronomy" at Uplands Community College here in Wadhurst. Although the course started on Monday 26th of September, it runs every Monday for ten weeks and Melanie say's it would not be too late to join the course if you are interested but you must book before turning up.

The classes run from 1900 to 2100 on Monday evenings and covers the history and physics of astronomy together with star recognition and includes practical observing sessions at the college. The course costs £116 and more can be found on http://www.acreslearning.org.uk/Course_info_sheet.asp?Key=5249

## OCTOBER MEETING

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

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

**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 OCTOBER 2016

### Planets

Mercury was at greatest western elongation on September 28th so it is still visible low down, in the east before sunrise. Fig 1 shows the position of the planet just before 06.30 on the first day of the month. Its magnitude then is -0.5 but it brightens considerably after elongation due to the phase increasing. In other words more of the planet's illuminated hemisphere is turned towards Earth, so it appears brighter. The down side of this is that as Mercury's brightness increases, it moves closer to the Sun until it reaches superior conjunction (lies behind the Sun) which on this occasion occurs on October 27th. Following this the smallest planet moves east of the Sun to become an evening object during November.

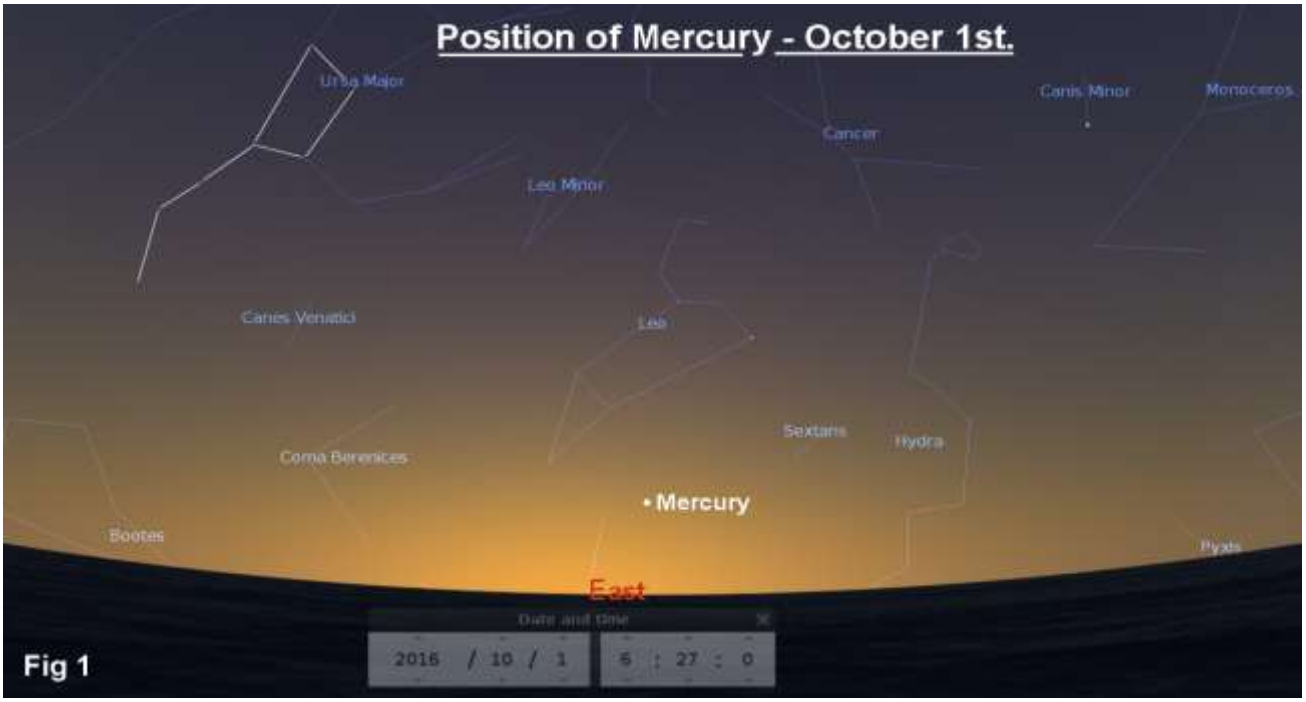


Fig 1

Venus at magnitude -3.9 is now visible in the south west immediately after sunset.

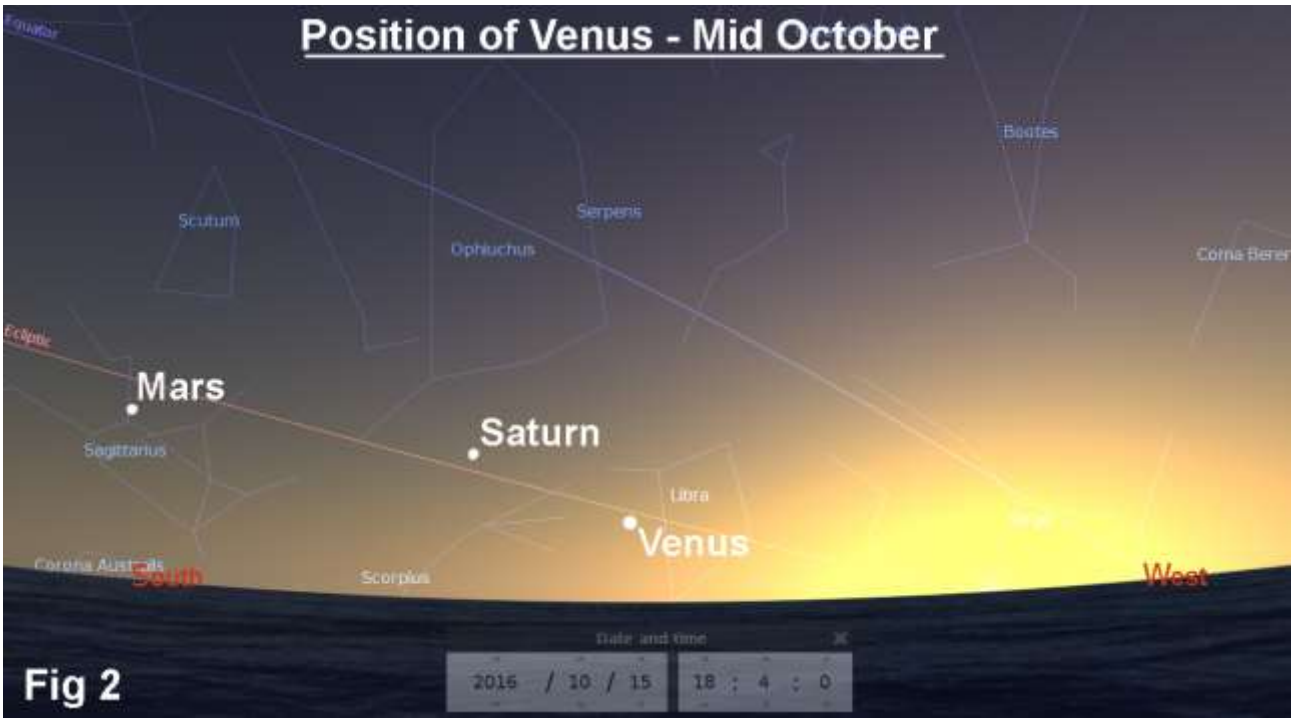


Fig 2

Fig 2 shows the situation in the middle of the month when the planet is 8° above the horizon as the Sun sets but will be just 4° high at the end of civil twilight. This rather unfortunate state of affairs will continue for some time due to Venus having a negative declination until the end of January. The planet is, of course, an easy day time object with an accurately aligned go-to telescope and with binoculars providing that you are careful not to sweep the sky when there is a danger of inadvertently viewing the Sun. In fig 2 I've included the positions of both the ecliptic and the celestial equator, the former being the line, give or take a few degrees, along which the planets are to be found. From this you can see that the evening planets at this time are all suffering for the same issue of lack of altitude because they are all below the celestial equator.

Mars is also an evening object (see fig 2 for position) though both its brightness (mag. +0.1) and apparent size (8.8 arc seconds) are diminishing as the Earth moves away from the red planet. During the month it tracks swiftly eastwards across Sagittarius, passing just north of the "Teapot" asterism.

Jupiter should become visible in the morning twilight around mid October. It moves swiftly westwards so that by the end of the month it rises 2½ hours ahead of the Sun. A 5% illuminated sliver of a crescent Moon lies 2° north of the planet on the morning of the 28th as shown in fig 3. The gas giant's brightness remains constant at -1.7 whilst its angular size is beginning to grow once more. Jupiter currently resides in Virgo, a constellation that it will occupy until mid November 2017.

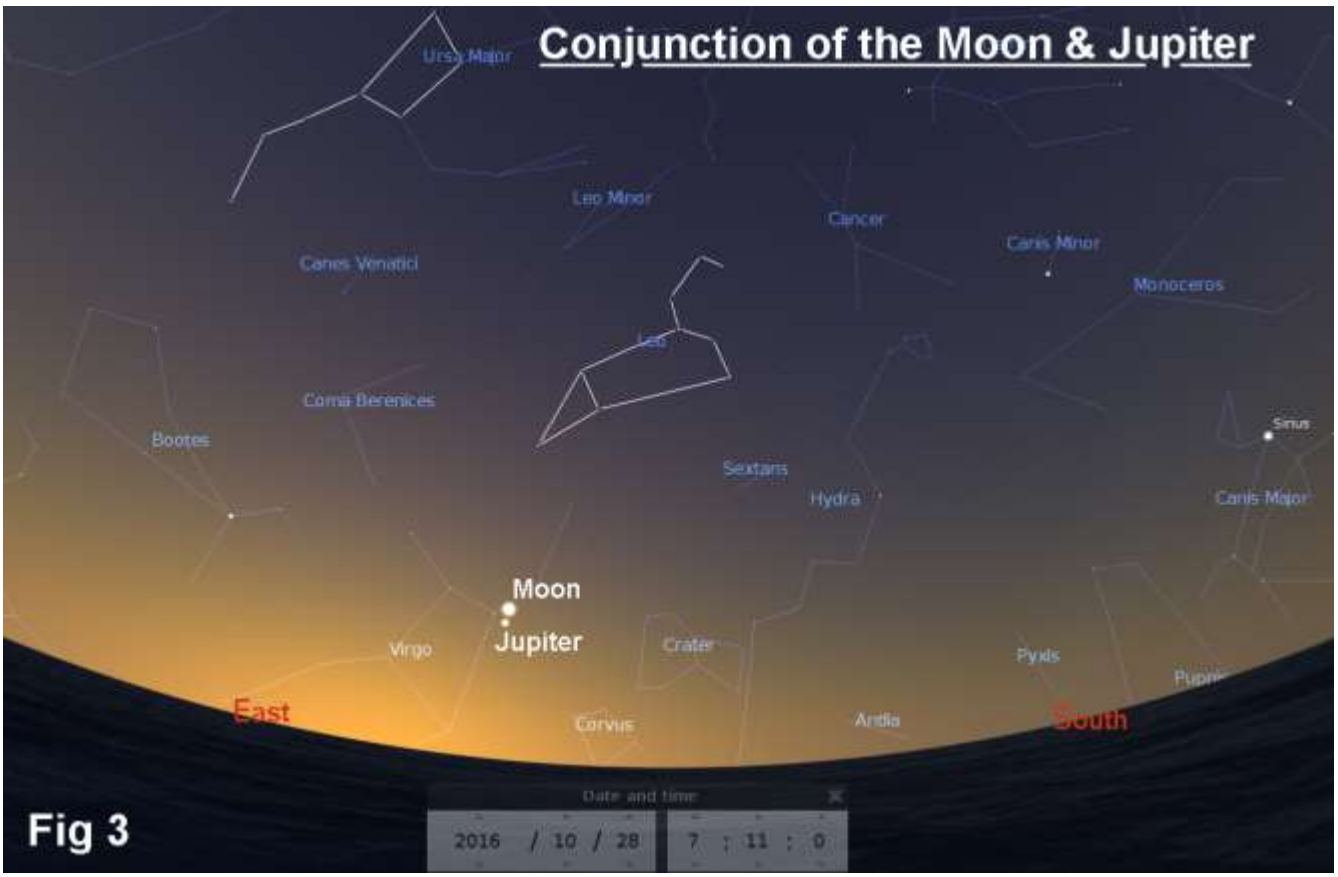
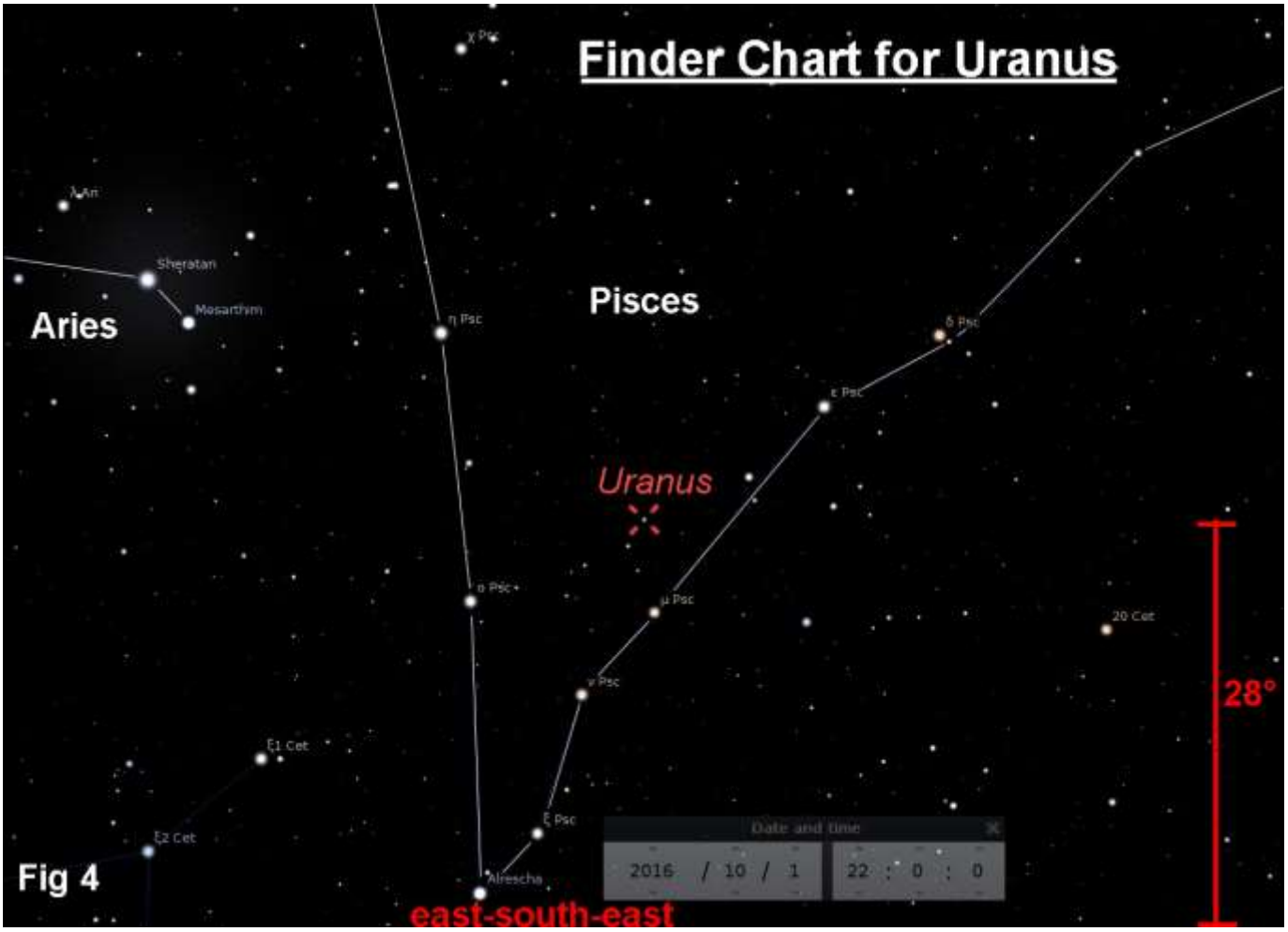


Fig 3

Saturn spends the month moving direct in Ophiuchus, although its period of visibility is drawing to a close. Fig 2 shows its position for the middle of the month, when it lies close to the horizon between Venus and Mars. On the nights of the 28th and 29th the much brighter Venus lies just 3° south of the ringed planet and will act as a suitable guide. At 18.12 BST Venus itself will be just 6° above the south western horizon with the Sun 6° below it. Within a few days of this Saturn will be lost in the twilight glare on its way to a solar conjunction in early December.

Uranus is not often mentioned here, but I'm making an exception this month because the ice giant reaches opposition on the 15th. At magnitude +5.7 it is technically visible to the naked eye although in reality you will need at least a pair of binoculars to see it. Fig 4 is a finder chart for the planet, showing that on the first of the month it lies 2½° to the north of mu (μ) piscium. The reason for drawing the map for this date and not for the time of opposition is because the Moon is close by then and would make identification much more difficult.




**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 whilst RD = **r**eappearance at the **d**ark limb. The column headed "mm" (millimetres) shows the minimum aperture telescope required for each event. On the night of October 18/19 the Moon once again passes through the Hyades cluster. Times for the brighter events are included through the early hours of the morning.

**Times are in BST.**

| Oct. | Time | Star | Mag | Ph | Alt ° | % illum. | mm |
|---|---|---|---|---|---|---|---|
| 8th | 20.44 | SAO 161842 | 6.9 | DD | 14 | 46 | 70 |
| 8th | 21.33 | ZC 2733 | 6.8 | DD | 10 | 46 | 70 |
| 9th | 18.41 | ZC 2865 | 5.7 | DD | 20 | 56 | 50 |
| 10th | 21.17 | ZC3005 | 6.2 | DD | 21 | 66 | 60 |
| 13th | 21.41 | ZC 3432 | 6.2 | DD | 31 | 92 | 70 |
| 17th | 21.26 | ZC 462 | 6.0 | RD | 19 | 95 | 70 |
| 18th | 23.17 | ZC 626 | 6.3 | RD | 30 | 89 | 70 |
| 19th | 01.12 | ZC 635 | 3.7 | RD | 45 | 88 | 40 |
| 19th | 05.41 | ZC 671 | 3.4 | RD | 47 | 87 | 40 |
| 19th | 05.45 | ZC 669 | 3.8 | RD | 46 | 87 | 40 |
| 19th | 05.59 | ZC 672 | 6.7 | RD | 45 | 87 | 80 |
| 19th | 06.45 | ZC 677 | 4.8 | RD | 39 | 87 | 40 |

**Phases of the Moon for October**

| New | First ¼ | Full | Last ¼ |
|---|---|---|---|
| 1st | 9th | 16th | 22nd |
| 30th | | | |

**ISS**

Below are details for passes of the International Space Station (ISS) that occur before midnight and are magnitude -2 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.**

| Oct. | Time | Mag. | Alt° | Az. | | Oct. | Time | Mag. | Alt° | Az. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1st | 20.09 | -2.5 | 32 | SSE | | 8th | 18.53 | -3.3 | 83 | SSE |
| 2nd | 20.52 | -2.1 | 37 | WSW | | 8th | 20.29 | -3.1 | 71 | WNW |
| 3rd | 20.01 | -3.1 | 52 | SSE | | 9th | 19.37 | -3.4 | 81 | N |
| 4th | 19.09 | -2.5 | 36 | SSE | | 10th | 18.44 | -3.3 | 82 | N |
| 4th | 20.44 | -2.7 | 55 | W | | 10th | 20.21 | -3.2 | 71 | SW |
| 5th | 19.53 | -3.4 | 77 | SSE | | 11th | 19.29 | -3.4 | 90 | SE |
| 6th | 19.01 | -3.1 | 58 | SSE | | 12th | 20.13 | -2.8 | 49 | SSW |
| 6th | 20.37 | -3.0 | 64 | WNW | | 13th | 19.21 | -3.2 | 68 | SSW |
| 7th | 19.45 | -3.4 | 85 | N | | 15th | 19.12 | -2.4 | 43 | 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. **Times are in BST unless otherwise stated.**

| Oct. | Time | Mag | Alt° | Az.° | | Oct. | Time | Mag. | Alt° | Az.° |
|---|---|---|---|---|---|---|---|---|---|---|
| 7th | 19.47 | -2.8 | 54 | 136 (SE) | | 25th | 17.43 | -5.4 | 18 | 273 (W) |
| 12th | 19.26 | -7.0 | 54 | 152 (SSE) | | 28th | 18.17 | -2.5 | 40 | 191 (S) |
| 16th | 19.06 | -3.2 | 52 | 166 (SSE) | | 28th | 19.57 | -2.4 | 33 | 16 (NNE) |
| 18th | 18.59 | -7.6 | 50 | 168 (SSE) | | 29th | 19.51 | -3.0 | 35 | 17 (NNE) |
| 24th | 17.59 | -5.3 | 16 | 275 (W) | | 31st | 18.38 GMT | -5.2 | 38 | 20 (NNE) |

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

In the north, Ursa Major is as close to the horizon as it can get as it straddles the meridian. Diametrically opposite it is the constellation of Cepheus which lies close to the zenith, although that honour presently goes to the group of stars that make up Lacerta (the lizard). This tiny constellation lies sandwiched between Cygnus and Andromeda and is sometimes referred to as "Little Cassiopeia" due to some of its components forming a "W" shape. It contains two open cluster, NGC 7209 (mag. 6.7) and NGC 7243 (mag. 6.4) but no globular clusters or bright galaxies.

Looking east, some of the winter groups are now appearing, with both Taurus and Auriga clear of the horizon. As if to signal the coming winter, the Pleiades are more than 25° in altitude. Above the bull, but below the outstretched lines of stars that make up Andromeda, we find the small constellations of Aries and Triangulum. The latter contains the moderately bright spiral galaxy M33 at magnitude +5.7 which is sometimes referred to as the Pinwheel Galaxy. Some 15° above it we find its better known relation, the Great Andromeda Galaxy whose brightness is +3.4, at a distance of 2.5 million light years. It was the discovery of its remoteness that brought to an end the debate about whether such objects lay within the boundaries of our own Milky Way or not.

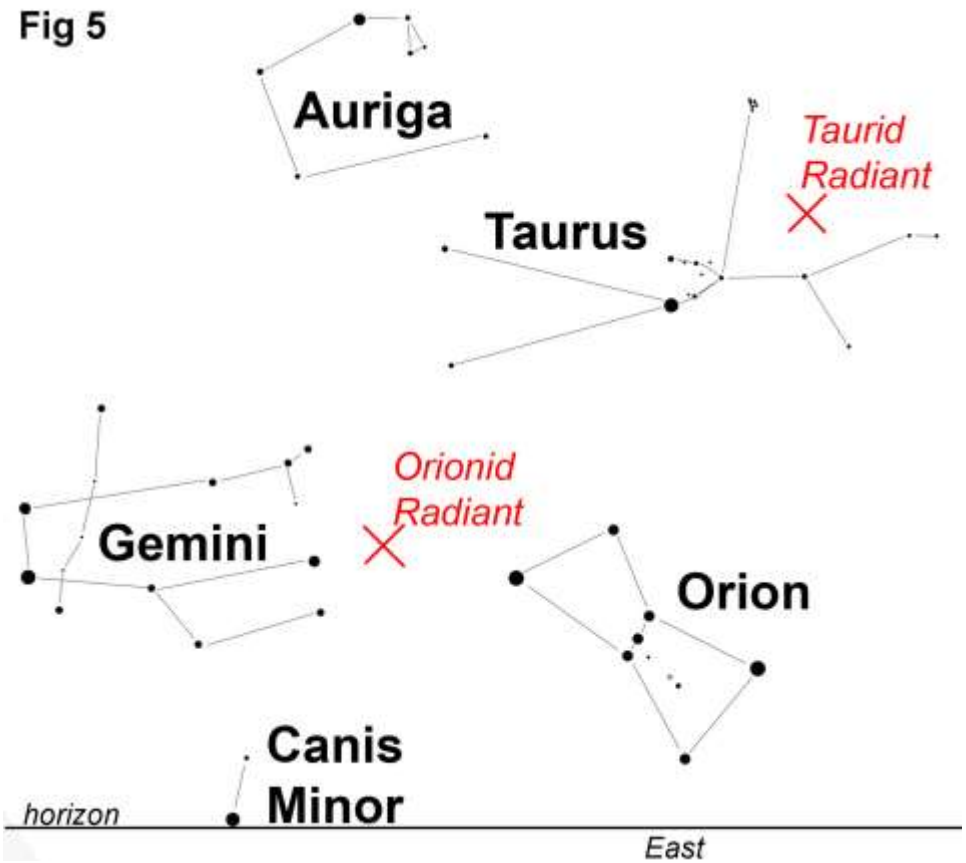
Towards the south the Square of Pegasus is approaching the meridian. Below the outstretched neck of the celestial winged horse lie Aquarius and Capricornus, both of which are mostly faint and indistinct although at the moment the former is home to the planet Neptune. If you draw an imaginary line through the two most westerly stars in the Square and continue it towards the horizon you will pass just east of the bright star Fomalhaut in Piscis Austrinus (the southern fish).

The west is still dominated by the Summer Triangle, with Deneb still 70° in altitude and the rest of the swan pointing headfirst towards the horizon. The other two members of the Triangle lie further south, although even Altair is still 35° high. Arcturus, one of the pointers to Hercules, has been lost although the other pointer, Alphecca, the brightest star in Corona Borealis, is still visible. Also disappearing is the large area of sky given over to Ophiuchus and the two separate parts of Serpens.

**Meteors**

The Orionids, which are associated with Halley's Comet, are active from October 16th to 30th with a long flat maximum occurring between October 21st and 24th. The Moon rises at the same time as Orion as maximum begins but by the end the 27% illuminated Moon rises at 02.00 BST. The Zenithal Hourly Rate (ZHR) for this shower is 25 with meteors described as fast, often with persistent trains. The map at fig 5 is drawn for midnight on the 23rd and shows the radiant position.

The Taurids are visible from October 20th through until November 30th and have two maxima, on November 5th and 12th due to perturbations on the particle streams by Jupiter. The shower is associated with Comet Encke which itself is though to be just a small part of a much larger comet. The particles are travelling at 28 km/s which is less than half the speed of the Orionids. The ZHR is predicted to be around 10. There will be no lunar intrusion for the earlier maximum but a nearly full Moon in Pisces will interfere with the later one. See fig 5 for the radiant position.




**BST Ends**
Don't forget that British Summer Time ends at 02.00 BST on Sunday October 30th.

*Brian Mills*

**SPACEPLACE - NASA**

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One Incredible Galaxy Cluster Yields Two Types of Gravitational Lenses
By Ethan Siegel

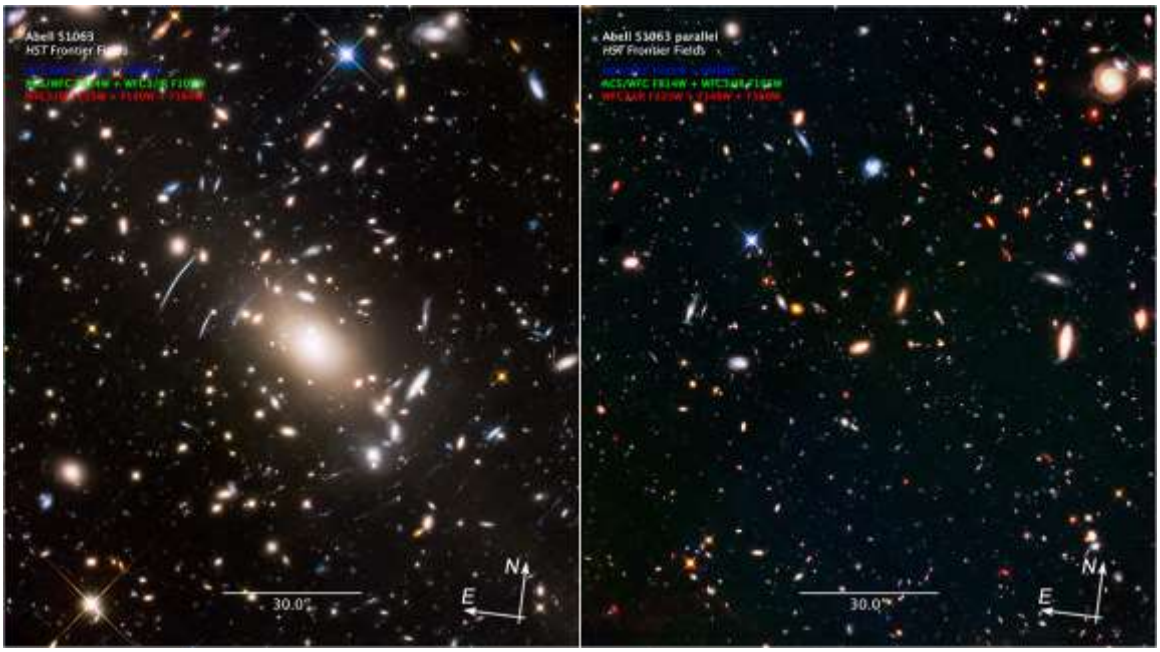
There is this great idea that if you look hard enough and long enough at any region of space, your line of sight will eventually run into a luminous object: a star, a galaxy or a cluster of galaxies. In reality, the universe is finite in age, so this isn't quite the case. There are objects that emit light from the past 13.7 billion years—99 percent of the age of the universe—but none before that. Even in theory, there are no stars or galaxies to see beyond that time, as light is limited by the amount of time it has to travel.
But with the advent of large, powerful space telescopes that can collect data for the equivalent of millions of seconds of observing time, in both visible light and infrared wavelengths, we can see nearly to the edge of all that's accessible to us.

The most massive compact, bound structures in the universe are galaxy clusters that are hundreds or even thousands of times the mass of the Milky Way. One of them, Abell S1063, was the target of a recent set of Hubble Space Telescope observations as part of the Frontier Fields program. While the Advanced Camera for Surveys instrument imaged the cluster, another instrument, the Wide Field Camera 3, used an optical trick to image a parallel field, offset by just a few arc minutes. Then the technique was reversed, giving us an unprecedentedly deep view of two closely aligned fields simultaneously, with wavelengths ranging from 435 to 1600 nanometres.

With a huge, towering galaxy cluster in one field and no comparably massive objects in the other, the effects of both weak and strong gravitational lensing are readily apparent. The galaxy cluster—over 100 trillion times the mass of our sun—warps the fabric of space. This causes background light to bend around it, converging on our eyes another four billion light years away. From behind the cluster, the light from distant galaxies is stretched, magnified, distorted, and bent into arcs and multiple images: a classic example of strong gravitational lensing. But in a subtler fashion, the less optimally aligned galaxies are distorted as well; they are stretched into elliptical shapes along concentric circles surrounding the cluster.

A visual inspection yields more of these tangential alignments than radial ones in the cluster field, while the parallel field exhibits no such shape distortion. This effect, known as weak gravitational lensing, is a very powerful technique for obtaining galaxy cluster masses independent of any other conditions. In this serendipitous image, both types of lensing can be discerned by the naked eye. When the James Webb Space Telescope launches in 2018, gravitational lensing may well empower us to see all the way back to the very first stars and galaxies.

If you're interested in teaching kids about how these large telescopes "see," be sure to see our article on this topic at the NASA Space Place: http://spaceplace.nasa.gov/telescope-mirrors/en/




Galaxy cluster Abell S1063 (left) as imaged with the Hubble Space Telescope as part of the Frontier Fields program. The distorted images of the background galaxies are a consequence of the warped space dues to Einstein's general relativity; the parallel field (right) shows no such effects. Image credit: NASA, ESA and Jennifer Lotz (STScI)

## CONTACTS

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**Wadhurst Astronomical Society** website:
www.wadhurstastro.co.uk

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

**Any material for inclusion in the November 2016 Newsletter should be with the Editor by October 28th 2016**