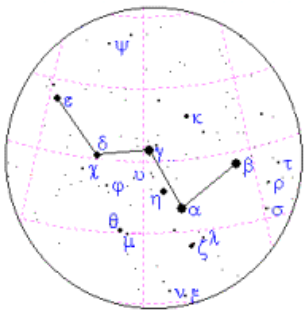


Wadhurst Astronomical Society Newsletter MARCH 2016

COMING TO TUNBRIDGE WELLS THEATRE

Members may be interested to hear of a talk to be given by Professor Brian Cox.

Later this year, he is at the Tunbridge Wells Theatre in what is called ”Professor Brian Cox Live”.

It takes place on Saturday the 29th of October at 1930 and the cost of a ticket is either £40 or £30 plus a booking fee. The link for the Theatre is at:

https://www.assemblyhalltheatre.co.uk/whats-on/spoken-word/professor-brian-cox-live

MEETINGS

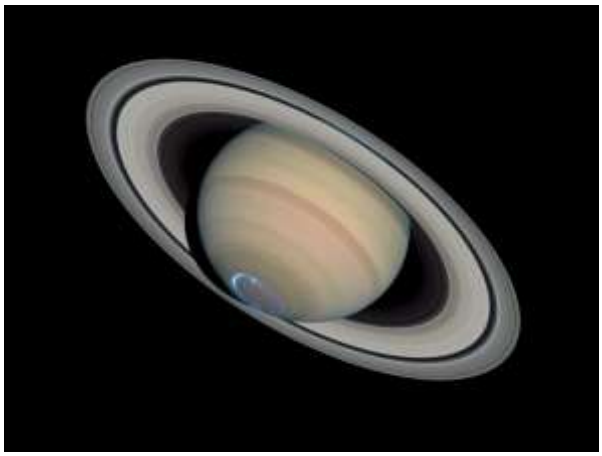
THE FEBRUARY MEETING

The February meeting was introduced by Phil Berry who welcomed both members and visitors. He also sent our best wishes to Brian Mills, our Director of Observations who was unwell and unable to attend.

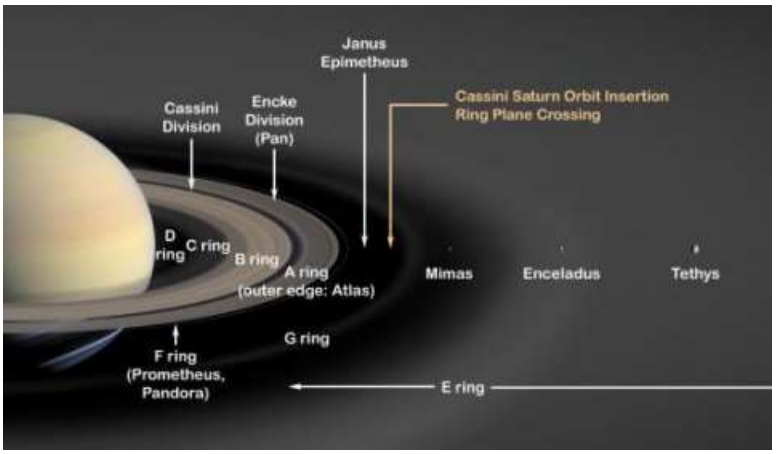
He then introduced our speaker, Melanie Davies, who is the creator of Creative Science, a community interest company in Hastings.

Cassini-Huygens – A Journey to Saturn
Melanie Davies

To prepare the setting for her talk, Melanie described the structure of Saturn with its rocky core surrounded by heavy ices. Surrounding this is a layer of Metallic Hydrogen and then a layer she called ‘Helium Rain’. The outer layers were a mixture of gasses mainly helium and finally the cloud layer which is what we see from Earth. We were told that both the North and South poles exhibit some amazing aurorae, but the most notable feature of the planet is its spectacular ring system.



Saturn and its polar aura – NASA image



Saturn’s ring system - NASA

The structure of the rings was describes in some detail and also the many gaps and their discoveries were referred to. The ring system itself is only 10 metres deep and the Cassini Division can be seen from Earth using a telescope but the mission has revealed

that it is really of low-density material. The rings are about 93% water ice although recently an inner ring 'D' has been discovered which is dark and thought to be mainly carbon and silicate dust.

A number of other rings have been detected during the mission, one is a huge low density ring called the 'E Ring' hardly seen from Earth and reaching out from the orbit of Enceladus to as far as Titan.

There is an even more remote ring called the Phoebe Ring which Melanie said has a retrograde motion when compared with the rest of the rings.

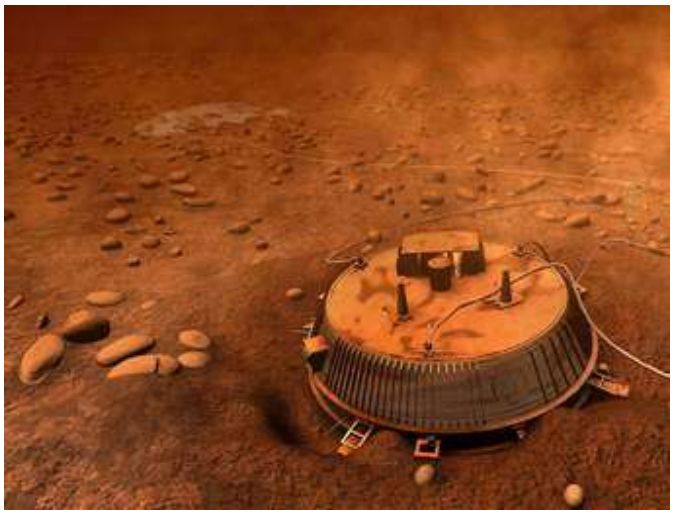
Saturn's axis is tilted at 3½° which gives the planet 30 year seasons.

Melanie then went through the history of a number of discoveries. In 1610 Galileo looked at Saturn through a telescope for the first time, seeing what he thought looked like an oval. In 1659 Huygens found the rings and then in 1675, Cassini discovered the gap now called the Cassini Gap in-between rings A and B.

The Cassini-Huygens mission was launched in 1997 in a joint venture between NASA, esa and ASI (The Italians). It took seven years to reach Saturn and insert into the planet's orbit.

It has been found that the ring system consists mainly of ice ranging from the size hailstones to the size of small icebergs.

In 2005 the Huygens probe was released to land on the surface of Titan, the largest of Saturn's moons.



Artist's impression of Huygens on the surface of Titan - NASA

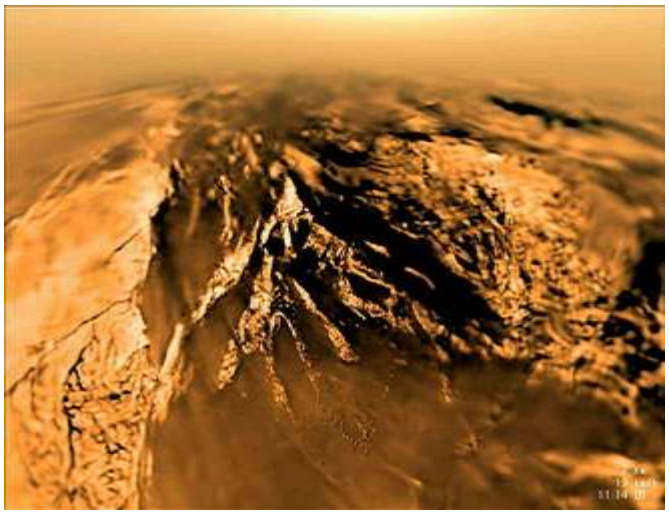


Image of the surface of Titan - NASA

Melanie said that the whole mission was designed to last for four years but it was noticed that another of Saturn's moons, Enceladus was very strange and was emitting plumes of water vapour, so in 2008 there was a two year extension to the mission named the 'Equinox Mission' to investigate further.

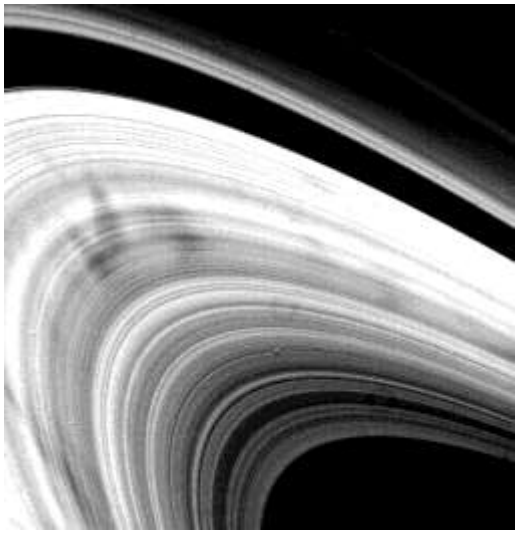
In 2010 there was a further extension called the 'Solstice Mission' to gain information about the Polar Regions. This extension is intended to last for seven years at the end of which it is proposed to plunge into the cloud tops of the planet and this will be next year.

There have been a number of discoveries made and Melanie mentioned a few such as the behaviour of Enceladus and the discovery of more moons now totalling 60. One other experiment showed that when the Sun was between Earth and Saturn, radio waves were taking longer to reach Earth due to the Sun's gravity, vindicating Einstein's theory of Space-Time.

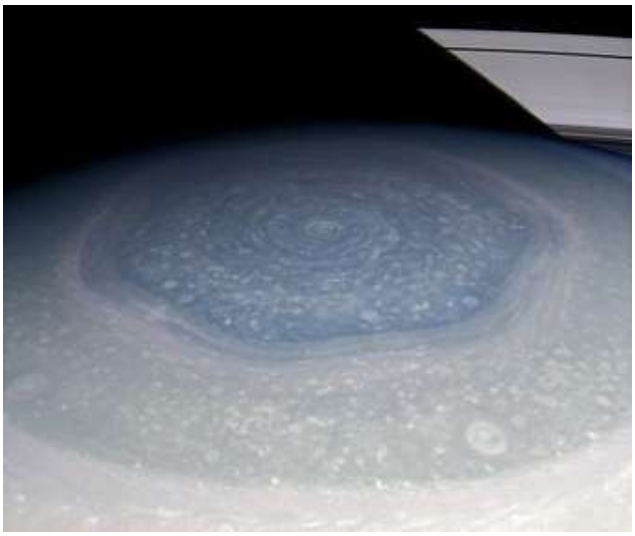
We were told of a theory by a lady called Robin Canup who thinks that when an object reaches what is called the Roche Limit when the gravity-gradient from the planet is so strong that the object would be pulled apart, resulting in the heavier material being pulled into the core, leaving the lighter material to form the rings.

Another interesting theory considers the rings of Saturn to be too white suggesting that they are not all that old and may in fact be only a few hundred million years old.

We were shown a short video clip of tiny moons within the ring system, creating a swirling trail and leaving a path. These are called Shepherd Moons. Another clip showed shadowy spokes moving round the ring system at different speeds. These had first been seen from Voyager as it journeyed past Saturn in the early 1980s and it is hoped that perhaps an explanation can be found before Cassini finally ends its mission.



Saturn's mysterious shadowy spokes - NASA



Hexagon clouds over Saturn's north pole - NASA

Next, we were shown an amazing picture of the 'Polar Hexagon' surrounding the north pole of Saturn. This is a huge slowly rotating cloud formation, which somehow maintains its shape. A close-up of the centre taken in Infra Red shows several layers of cloud in turmoil.

We were told about some of the more interesting moons such as Iapetus that when viewed from Earth only appears when on one side of its orbit. It has now been found that it has two faces, one black and one white with the leading face possibly collecting carbon rich material, leaving the other face white.

Hyperion is possibly the weirdest moon, quite different from the others. It consists of soft material and has a very fast axial spin and is thought to be a captured comet.

Next Melanie looked at Mimas with its huge crater, Herschel, on one side, which is surrounded by a much cooler surface than the rest of the moon.

Titan was referred to as an Earth like world and is Saturn's largest moon. When Cassini first took radar pictures of the surface through the thick cloud, NASA scientists were astonished to find it looking remarkably like Earth. Titan has a methane cycle that works in just the same way as the water cycle on Earth, including eroding the surface as it rains hydrocarbons. As the Lander fell through the clouds it was able to take images of what looked like river channels. The surface has a temperature of -180° C.

Finally Melanie said that so much had been discovered during the Cassini Mission that in the future other missions would take place, amongst them to further investigate Titan and to look at Enceladus, which may even support some form of life.

Melanie's talk contained so much more information than can be mentioned here and she also has a number of other talks, so we look forward to welcoming her back sometime in the future.

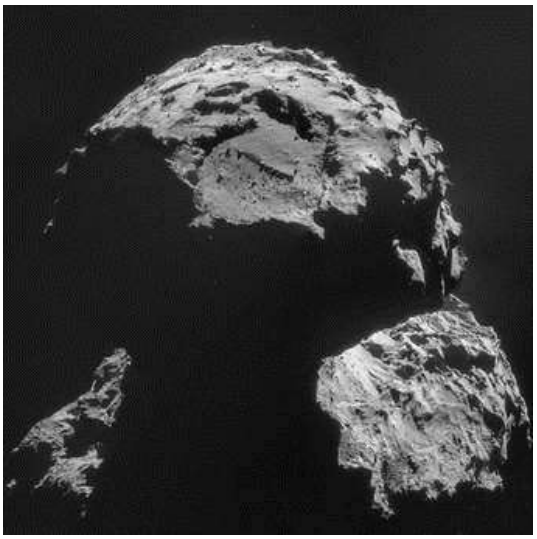
Snippets from the World of Science
John Wayte

ESA has announced that Philae is now officially dead. The scientists say that the chances of getting any more signals from the lander are virtually zero. The last signal was received on the 9th of July last year and even that signal was very weak.

Just to remind you of the history of this incredible mission:

- Rosetta launched from French Guiana March 2004
- Flew around the Earth 3 times in a slingshot manoeuvre to gather speed.
- Took 12 years to reach comet 67P/Churyumov-Gerasimenko and travelled over 6.4 billion Km.
- June 8th 2011 – hibernation for over 3 years.
- Jan 20th 2014 – woke up.
- Reached the comet August 2014.
- Philae deployed Nov 2014.
- Over 80% of the planned scientific activities were completed.
- 14/15th November, Philae went into hibernation because of the inability to charge its batteries following a very bouncy landing and finally resting – we don't know where.
- 13th June, Philae woke up again and sent a further 7 intermittent contacts until July 7th 2015.
- Now that the comet's activity has reduced sufficiently the Rosetta Orbiter will continue to fly around the comet at an orbiting height of 10 to 12 kilometres or even closer in the final stages of its mission. It will take high-resolution photographs of Philae's suspected landing area to try and establish where it finally went to sleep.
- This mission is considered an historic 'high' in space missions.

One of the remarkable images taken by Rosetta - ESA



Philae lies somewhere in the shadows of the large crater - ESA

Gravity Waves

So Einstein has been proved right again. This time it is with gravitational waves. By a strange coincidence at last December's meeting I talked about LISA (Laser Interferometer Space Antenna), which was launched 100 years after Einstein predicted gravitational waves. LISA reached its operational location at Lagrange Point L1, some 1.5 million miles from Earth on the 3rd of December last year. And on the 22nd of January this year released its very precious gold cubes to test the gravity to an astonishing degree of accuracy.

But in the meantime, down on Earth at the LIGO (Laser Interferometer Gravity-wave Observatory) in Livingstone USA, they announced on the 11th of February that they had actually found these very weak signals that proved Einstein was right in stating that large astronomical events do cause ripples in the gravity and that we can measure it. It is just the same as dropping a large stone in a very calm lake and watching the ripples travel to the other side. So we can see these huge events that have travelled across the universe since the beginning of time.

The phenomenon detected was the collision of two black holes. Using the World's most sophisticated detector, the scientists listened for 20 thousandths of a second as the two giant black holes, one 35 times the mass of the Sun, the other slightly smaller, circled around each other.

At the beginning of the signal, their calculations told them how stars perish: the two objects had begun by circling each other 30 times a second. By the end of the 20-millisecond snatch of data, the two had accelerated to 250 times a second before the final collision and a dark, violent merger.

I am sure that there will be lots more about this incredible discovery in the near future. I am pretty sure that there is a Nobel Prize floating around here.

Magnetar

What happens when a star finally runs out of fuel?

If a star about the same size as our Sun starts to run out of hydrogen fuel, it then expands to a Red Giant, burns the remainder of its fuel and gradually collapses under gravity to become a White Dwarf, cooling and dimming still further to eventually become a Black Dwarf.

But if it is a bigger star, say about 10 times or more bigger than the Sun, then things become much more exciting. When the hydrogen has fused into helium, the star then becomes a Red Supergiant forming the heavier elements. After a relatively short time period, the star collapses in less than a second and what does it leave behind? - A Neutron Star.

As you are completely familiar with a Neutron Star I only need remind you that it is very dense – a matchbox full of Neutron star stuff would have a mass of 1,000 Km^3 of Earth rock. The original star collapses to a radius of about 7 miles. Some also rotate very fast up to 43,000 RPM!

But have you heard of a Magnetar?

A Magnetar forms in a very similar way to the Neutron Star but they have a very different characteristic. They are dramatically magnetic. At 1,000 Km away, the magnetic effect would render life on Earth impossible by rearranging the atoms and molecules in our bodies. If it were placed halfway to the Moon, all the magnetic strips on our credit cards would be instantly rearranged.

So how do we know they are out there? On the 5th of March 1979, having successfully dropped off satellites into the Venusian atmosphere, the Russian spacecraft Venera 1 and 2 were continuing through the solar system when at precisely 1051 EST they were

hit by a blast of gamma radiation that increased the counts from the normal 100 per second to over 200,000 counts per second in less that a millisecond.

This radiation burst then continued past the Sun-satellite, Helios 2, which it saturated and then on to Venus where Pioneer Venus Obiter's detectors were overcome and on Earth it knocked out three military satellites. This was the strongest wave of extra-solar gamma waves ever detected – over 100 times stronger in fact. The source of the gamma radiation could be calculated to an accuracy of about 2 arc seconds (two-sixtieths of a degree) and so we know precisely which star it was – SGR 0525-66 located in the Large Magellanic Cloud that went Supernova around 3000 BC.

This blast of gamma rays may have been caused by the Magnetar suffering a Starquake where the crust suddenly rearranges itself and produces a gamma-ray flare that happened to fire in our direction.

And just to get you worried, the Large Magellanic Cloud is only 158,200 light years away and this star can still affect us this much.

Finally, how many of these things have we detected? While we have detected over 2,000 Neutron stars in the Milky Way, we have so far only found 21 Magentars.

MARCH MEETING

Wednesday 16th March 2016 – The entertaining Dr. David Mannion updates us on "The Search for Dark Matter and Dark Energy"

This meeting will take place in the Drama Studio at Uplands Community College. The address is: The Drama Studio, Uplands Community College, Lower High Street, Wadhurst TN5 6AZ and is through the gates and on the left. It is just possible that the meeting could be held in one of the classrooms by the tennis courts instead. Signs would redirect you if that is the case.

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.

2016 SUBSCRIPTIONS

Subscriptions to the Wadhurst Astronomical Society become due from the 1st of January 2016. They remain at £16 per adult member and £23 for two members at the same address.

Subscriptions can be paid either by cheque made payable to Wadhurst Astronomical Society or as cash at the meetings or by post to:
John Wayte
Members Secretary
Wadhurst Astronomical Society
27 Pellings Farm Close
Crowborough
East Sussex
TN6 2BF

The Subscriptions can also be paid via electronic banking to:
Wadhurst Astronomical Society
Account Number **35104139**
Sort Code **60-22-15**
Putting your name as the **Reference** so we know who is paying.

FUTURE MEETINGS

20th April – Rob Cray gives another of his talks on America's Space Programmes, this time he calls it "Skylab – America's First Space Station"

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

15th June – To Be Announced

SKY NOTES FOR MARCH 2015

Planets

Mercury is a morning object at the start of March, but rising just fifteen minutes ahead of the Sun, means that observation is all but impossible. The planet will reach superior conjunction on 23rd March after which it moves east of the Sun to become an evening object in April. This will be the best evening apparition of the year, and although its elongation will be only 20°, it will lie well above the celestial equator.

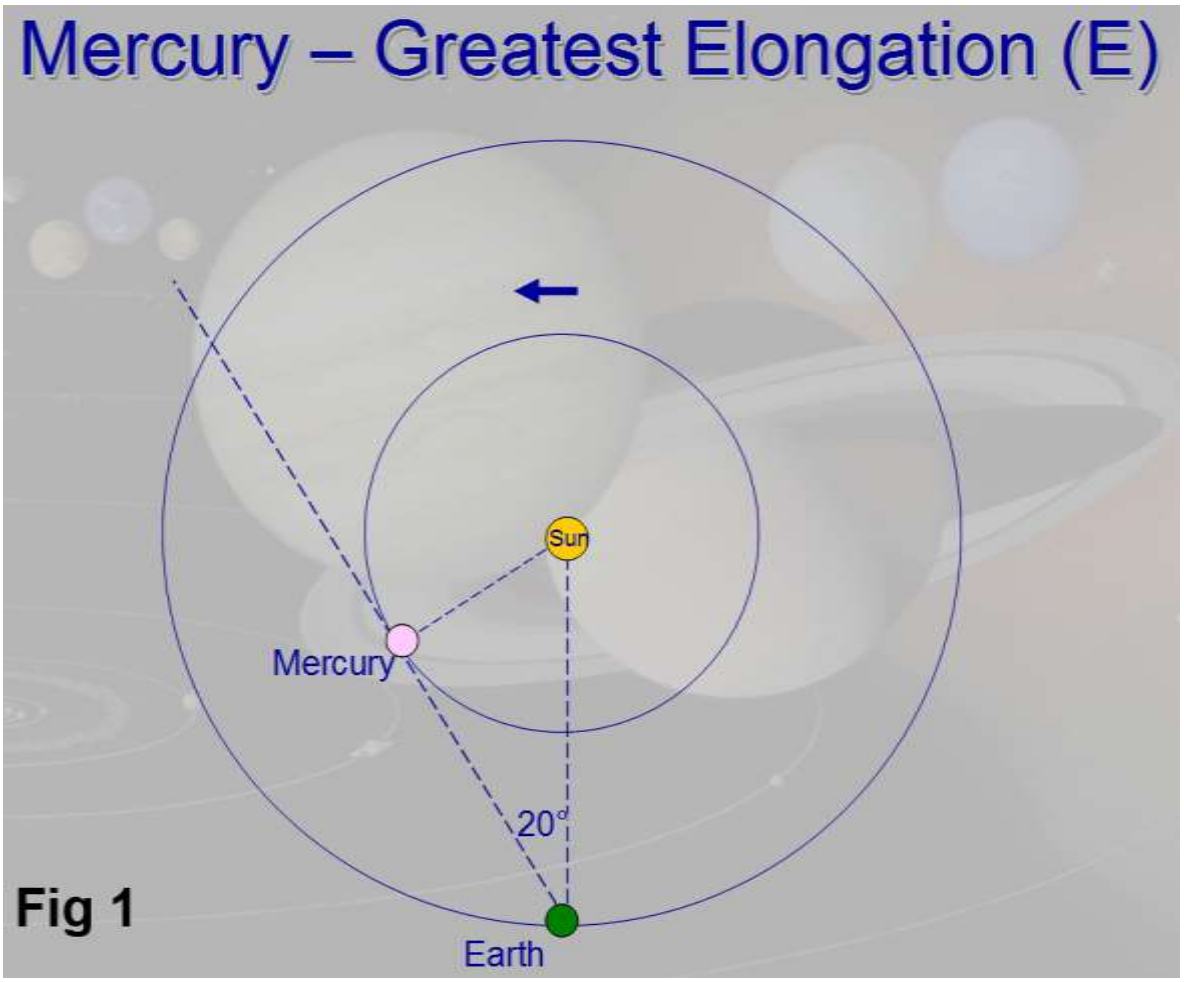
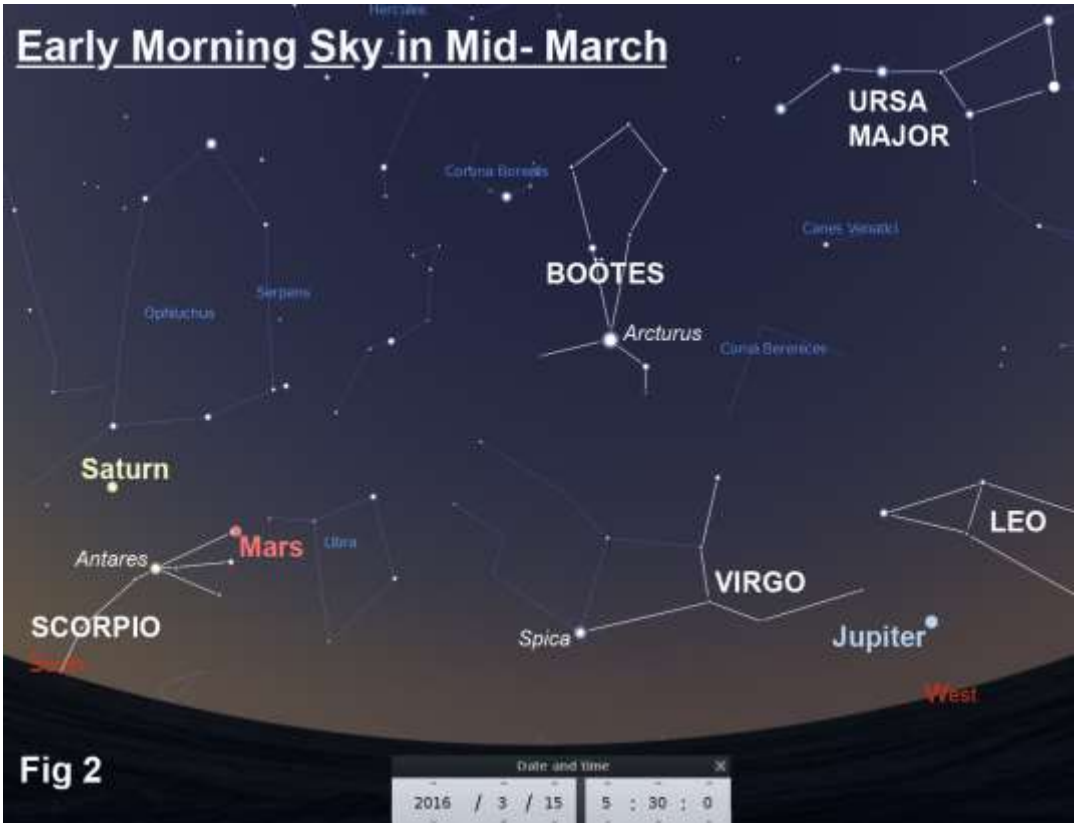


Fig 1

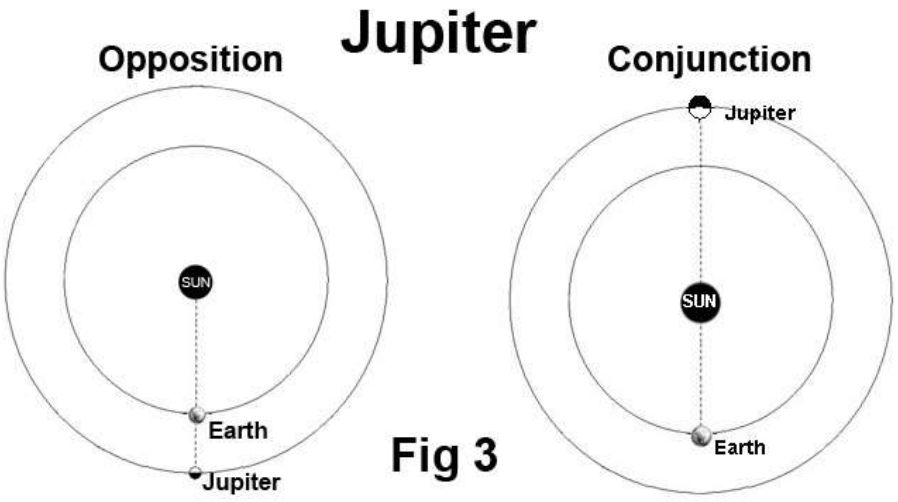
The diagram at fig 1 shows what we mean by the term "greatest elongation" and also what the relevance of the angle is.
With Mercury in the position shown, it is clear it has reached the point where it *appears* to be furthest from the Sun. A line drawn from the Earth to Mercury strikes the planet's orbit at a tangent, whilst another line drawn from Earth to the Sun provides us with the second reference from which to measure the angle of elongation – in this case 20°.
Mercury has an extremely elliptical orbit, in fact the most elliptical of any of the planets, which causes this angle to vary between 18° and 28°. Obviously as the angle increases, so the planet's apparent distance from the Sun increases and observation becomes easier.

Venus continues to slip back into the Sun's clutches in the morning skies, rising only forty minutes ahead of our star. Despite being extremely bright at magnitude -3.9, it will need keen eyes to spot it in twilight only 4° above the south eastern horizon. After the first week of March Venus will be lost to us in the UK until it reappears in the evening skies in late August.

Mars continues to brighten as it approaches opposition on 22nd May and is currently magnitude +0.0. The red planet rises closer and closer to midnight until the change to BST comes into play, which temporarily halts its advance towards becoming an evening object. Despite this, Mars is essentially best seen in the morning as shown in fig 2. As you can see, Mars, Saturn and the bright star Antares in Scorpio make a pleasant grouping. The planet's angular size grows from 8.7 to 11.8 arc seconds during March which means that it has more than doubled in apparent size since the start of the year.



Jupiter reaches opposition on 8th March meaning it will be at its best for observation for a period either side of that date. At the time of opposition Jupiter, or indeed any of the planets whose orbits lie beyond that of the Earth, is described as being opposite the Sun in the sky. This means that as the Sun sets in the evening, Jupiter (in this case) is just rising. Then as the Sun rises the next morning Jupiter will be setting having been visible throughout the hours of darkness. See fig 3 for a diagram of both opposition and conjunction.

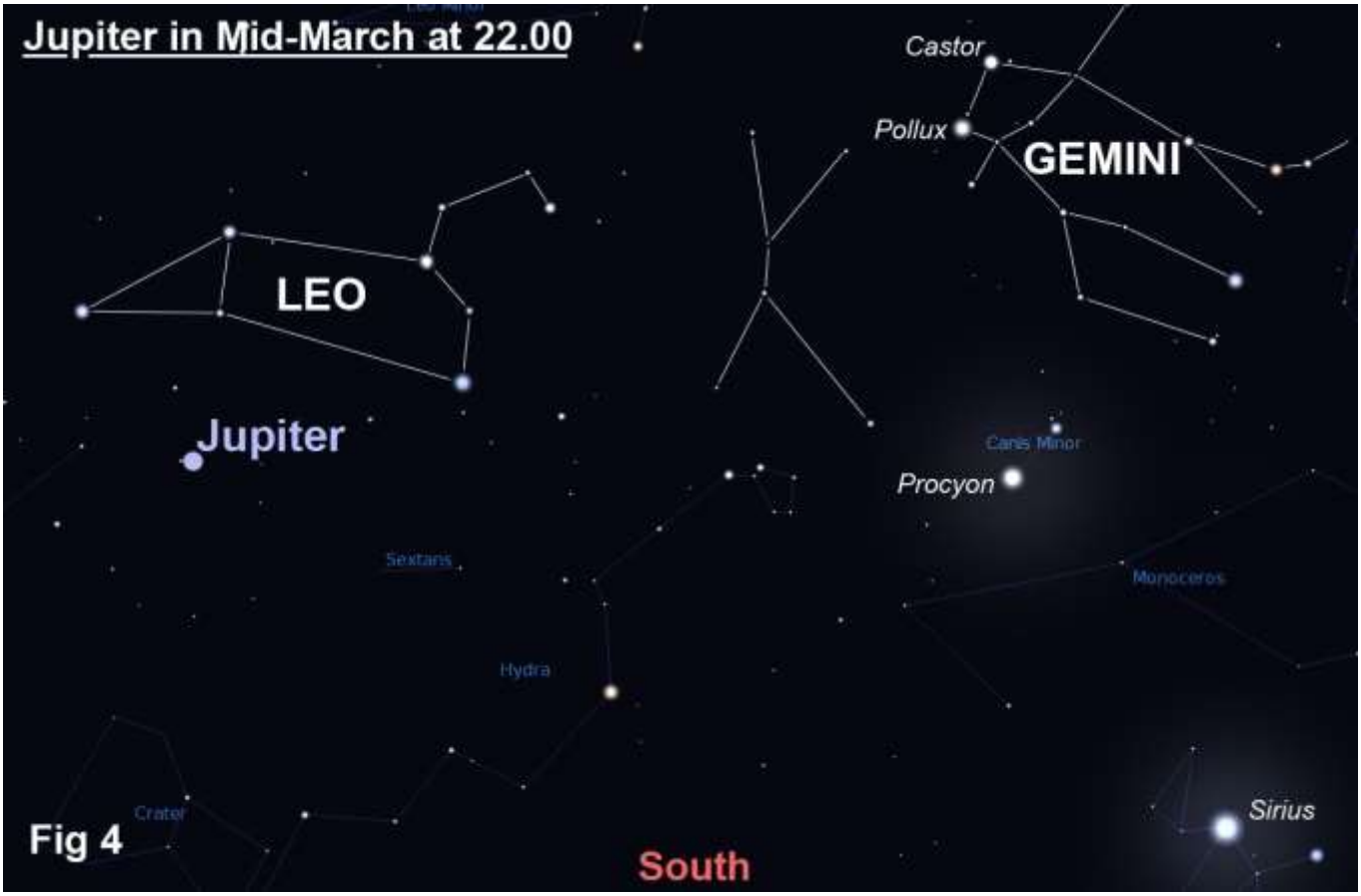


On 8th March Jupiter crosses the meridian (culminates) as seen from this area at 00.13 at an altitude of 45°. This seems a reasonable altitude on the face of it although reference to last years opposition on 6th February shows it culminated at a height of 55° and a glance ahead to next year shows this will have shrunk to 33°.

The reason for these changes is due to the planet's passage along the ecliptic as the years pass. This year, for example, Jupiter lies some 6° above the celestial equator at the moment of opposition whereas next year it will lie 6° below it and in 2018 it will have will have dropped to 16° below. Don't forget that the celestial equator is simply the projection of the Earth's equator out into space, so an observer simply has to change position to achieve a better view. Those who live closer to the equator don't suffer the same problems as those of us in northern temperate latitudes as the increased altitude of the celestial equator means that variations in planetary positions are not nearly so critical. The answer would seem to be to live on the equator where all of the sky will be visible to you at some time in the year!

Now is an excellent time, with the planet being so close, to observe the Galilean moons of Jupiter and the cloud belts. Binoculars, which can be held steady, will easily show the four largest moons whilst a small telescope will begin to show the cloud bands that encircle the planet. A larger telescope will show more detail in the clouds, but beware of using too much magnification, as you are also magnifying any unsteadiness that there is in the atmosphere.

Fig 4 shows the position of Jupiter around 22.00 in the middle of the month.



Saturn is a morning object in the constellation of Ophiuchus, rising at 02.00 at the start of the month. It begins by moving direct (west to east) but reaches its first stationary point on 25th March after which it moves retrograde until mid August. The ringed planet is slowly increasing in both brightness and angular size as it moves towards opposition in early June. The rings are still well presented to the Earth because the planet's north pole is tilted towards us by just over 26°.

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 GMT.**

Mar.	Time	Star	Mag	Ph	Alt °	% illum.	mm
15th	20.09	ZC 878	5.5	DD	49	51	40
16th	19.08	ZC 1029	5.2	DD	56	62	40

Phases of the Moon for March

Last ¼	New	First ¼	Full
1st	9th	15th	23rd
31st			

ISS

There are no evening passes of the International Space Station (ISS) this month. However, there are a number that occur in the period after midnight and through to sunrise. If you would like to find out when these occur please go to www.heavens-above.com.

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 . 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 GMT unless otherwise stated.**

Mar.	Time	Mag.	Alt°	Az.°		Mar.	Time	Mag.	Alt°	Az.°
5th	19.24	-6.2	37	8 (N)		18th	20.40	-3.0	10	1 (N)
8th	19.06	-2.8	43	9 (N)		20th	20.17	-6.4	19	1 (N)
14th	18.38	-7.8	52	5 (N)		21st	20.10	-2.6	22	2 (N)
16th	18.26	-3.6	56	1 (N)		31st	21.17 BST	-3.3	39	356 (N)

The Night Sky in March (Written for 22.00hrs GMT mid month)
In the south the "Sickle" of Leo is approaching the meridian whilst the faint shape of Cancer has just passed it. Below Cancer lies the head of Hydra, the water snake, whose body contains numerous twists and turns before it reaches the horizon. On the back of the water snake sit two small constellations; Crater the cup and Corvus the crow or raven. Both of these are original groups from the list of 48 that were proposed by the 2nd century astronomer Ptolemy, and have lasted to become part of the canon of 88 modern constellations.

Turning to the west, Orion and his entire retinue are still visible although they are well past their best. Of the winter groups, Auriga and Gemini are still both well positioned with the "twins" of the latter still at an altitude of 60°.

To the north the plough lies very close to the zenith whilst its smaller relation points away to the east. Closer to the horizon Cepheus lies on the meridian with Cassiopeia to its west and the head of Draco to its east. If you look even closer to the horizon you should be able to see two members of the summer triangle; Deneb in Cygnus and Vega in Lyra. Deneb is actually circumpolar from these latitudes but Vega disappears below the horizon for a short while.

In the east a few of the summer groups are becoming visible. Hercules, Boötes and Corona Borealis (the northern crown) have all cleared the horizon. The arrival of these groups will be a welcome indication that some of the skies brighter globular clusters are now on view once more. M13 is probably the best known of that class, although M3, M5 and M92 are all well worth a look, though admittedly M5 is still quite low down. Fig 5 shows their positions. Use the tail of Ursa Major in the first instance to locate Arcturus in Boötes, and then find Hercules using the brightest star in Corona Borealis as shown by the dotted lines. Hercules is a comparatively faint constellation whose body is made up of two quadrilaterals.

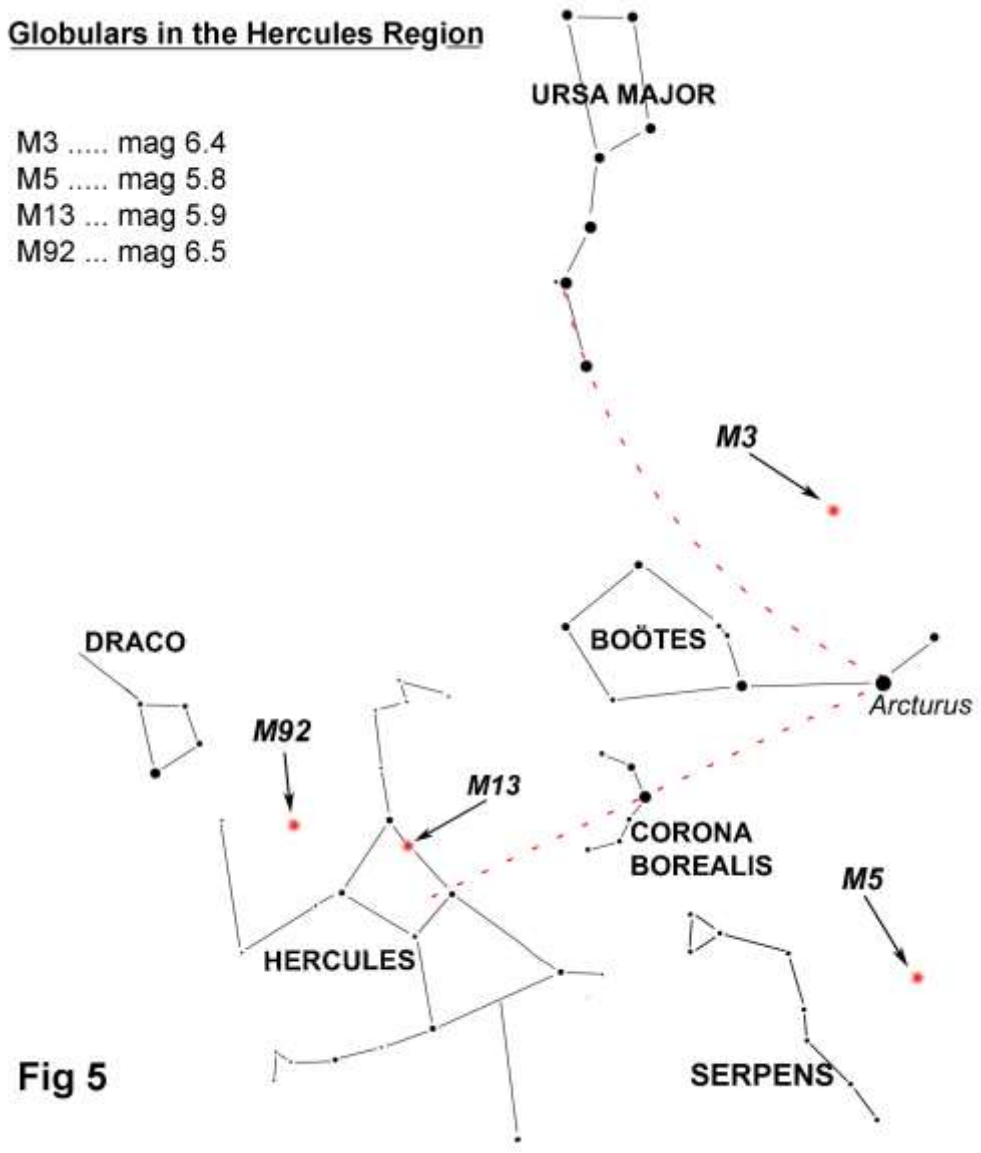


Fig 5

Total Solar Eclipse
On 9th March there will be a total solar eclipse visible from Indonesia. There are usually video feeds available on the internet that will allow you to watch the event live.

British Summer Time
Don't forget that British Summer Time (BST) officially begins at 01.00 on Sunday March 27th when clocks go forward one hour.
BST ends officially at 02.00 on Sunday October 30th.

Advanced Warning for April
April 4th – Mercury at greatest eastern elongation.
April 6th – Daylight occultation of Venus by the Moon.

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!

The Closest New Stars To Earth
By Ethan Siegel

When you think about the new stars forming in the Milky Way, you probably think of the giant star-forming regions like the Orion Nebula, containing thousands of new stars with light so bright it's visible to the naked eye. At over 400 parsecs (1,300 light years) distant, it's one of the most spectacular sights in the night sky, and the vast majority of the light from galaxies originates from nebulae like this one. But its great luminosity and relative proximity makes it easy to overlook the fact that there are a slew of much closer star-forming regions than the Orion Nebula; they're just much, much fainter.

If you get a collapsing molecular cloud many hundreds of thousands (or more) times the mass of our sun, you'll get a nebula like Orion. But if your cloud is only a few thousand times the sun's mass, it's going to be much fainter. In most instances, the clumps of matter within will grow slowly, the neutral matter will block more light than it reflects or emits, and only a tiny fraction of the stars that form—the most massive, brightest ones—will be visible at all. Between just 400 and 500 light years away are the closest such regions to Earth: the molecular clouds in the constellations of Chamaeleon and Corona Australis. Along with the Lupus molecular clouds (about 600 light years distant), these dark, light-blocking patches are virtually unknown to most sky watchers in the northern hemisphere, as they're all southern hemisphere objects.

In visible light, these clouds appear predominantly as dark patches, obscuring and reddening the light of background stars. In the infrared, though, the gas glows brilliantly as it forms new stars inside. Combined near-infrared and visible light observations, such as those taken by the Hubble Space Telescope, can reveal the structure of the clouds as well as the young stars inside. In the Chameleon cloud, for example, there are between 200 and 300 new stars, including over 100 X-ray sources (between the Chamaeleon I and II clouds), approximately 50 T-Tauri stars and just a couple of massive, B-class stars. There's a third dark, molecular cloud (Chamaeleon III) that has not yet formed any stars at all.

While the majority of new stars form in large molecular clouds, the closest new stars form in much smaller, more abundant ones. As we reach out to the most distant quasars and galaxies in the universe, remember that there are still star-forming mysteries to be solved right here in our own backyard.

Image credit: NASA and ESA Hubble Space Telescope. Acknowledgements: Kevin Luhman (Pennsylvania State University), and Judy Schmidt, of the Chamaeleon cloud and a newly-forming star within it—HH 909A—emitting narrow streams of gas from its poles.

The Society were pleased to receive the above certificate from NASA JPL

CONTACTS

General email address to contact the Committee
wadhurstastro@gmail.com

Chairman	Brian Mills
Secretary & Events	Phil Berry 01892 783544
Treasurer	John Lutkin
Membership Secretary	John Wayte
Newsletter Editor	Geoff Rathbone 01959 524727
Director of Observations	Brian Mills 01732 832691 email: brianm@wkrcc.co.uk
Committee Members	Jim Cooper Eric Gibson

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

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

Any material for inclusion in the April 2016 Newsletter should be with the Editor by March 28th 2016