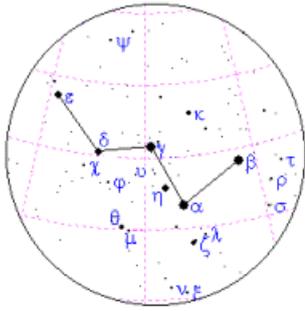


# Wadhurst Astronomical Society Newsletter July 2017



## MEETINGS

### JUNE MEETING

Our June meeting was opened by Phil Berry who sadly announced the loss of one of our long-standing members, Bob Seaney who died recently. There is an obituary to him later in the newsletter.

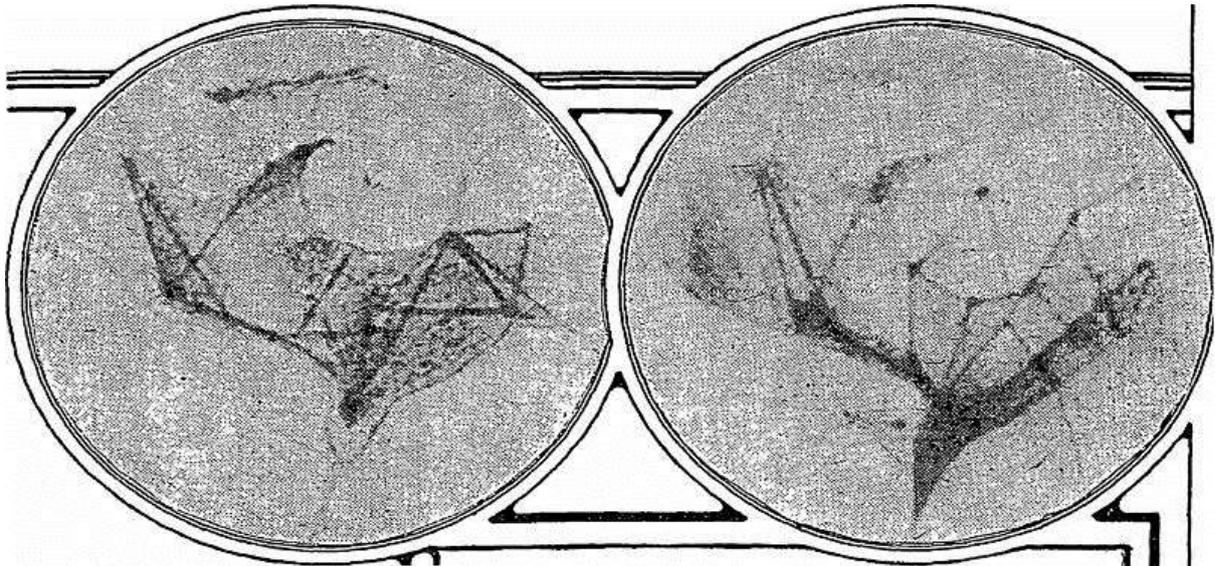
Phil also said that the visit to the Space Geodesy Facility at Herstmonceux will take place on Tuesday the 8<sup>th</sup> of August. Those who are going should have put their name, email address and mobile phone number on the list. We need to make our own way there for a start at 8pm. There are more details later in the newsletter.

After outlining the evening's programme, Phil welcomed back our speaker, Melanie Davies who runs Creative Space, which is a community Interest Company based in Hastings and gives many talks about different aspects of astronomy.

### **Mission to Mars – Fiction vs Reality**

*Melanie Davie FRAS*

Giovanni Schiaparelli was an Italian astronomer and Melanie began her talk by telling us that in 1877 he described seeing canals on the surface of Mars through his telescope. This led to a strong belief at the time that there was intelligent life on the planet. This was thought to be confirmed when other astronomers believed they also saw canals and made drawings them since there was no means of photographing them at the time.



These drawings of the canals made in the early 1900s were produced two years apart by Percival Lowell at his observatory in Flagstaff, Arizona. He claimed that the difference between the drawings showed how the Martians were building the canal systems very quickly. Melanie did say that the junctions of the lines do in fact coincide with major features on Mars but the lines were probably due to the way that the observations were being made and the strong belief that they were real.

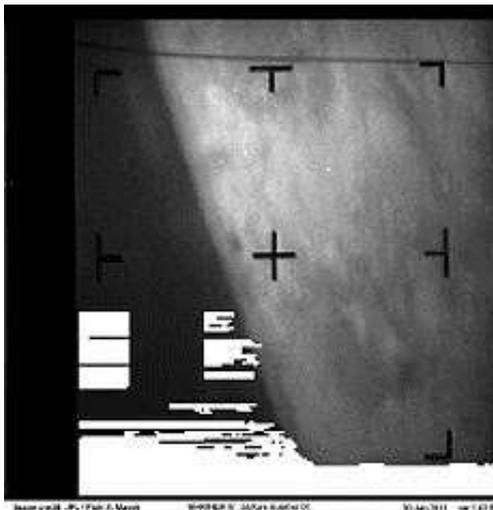
We were told that at about the same time, H G Wells wrote a serial in a magazine called "War of the Worlds" which was eventually made into the book. Belief in intelligence on Mars was so strong at the time that in 1938, America panicked during a radio broadcast of War of the Worlds made as a realistic drama and narrated by Orson Wells.

The first attempt to reach Mars with an unmanned spacecraft was made around 1960 by what became known as the Russian's Marsnik programme but sadly it was a failure.

In 1965 NASA successfully launched Mariner 4 which during its fly-by managed to send back the first close-up images of the surface of Mars. Finally laying at rest any ideas of canals.



The clearest image of the surface of Mars from Mariner 4 in 1965 - NASA



One image from Mariner 4 showed the first faint signs of an atmosphere on Mars - NASA

In 1971 the Russians sent Mars 2, which attempted to place a lander on the surface although sadly it crashed rather than landed, but Melanie said this showed it was possible to make a landing. Mars 3 followed 7 months later and did have a soft landing. The Russians managed to receive a partial image before the camera failed.

NASA's Viking programme was very successful and we were shown the very first clear image of the surface of Mars taken by Viking 1 Lander, giving scientists some idea of what it was like.

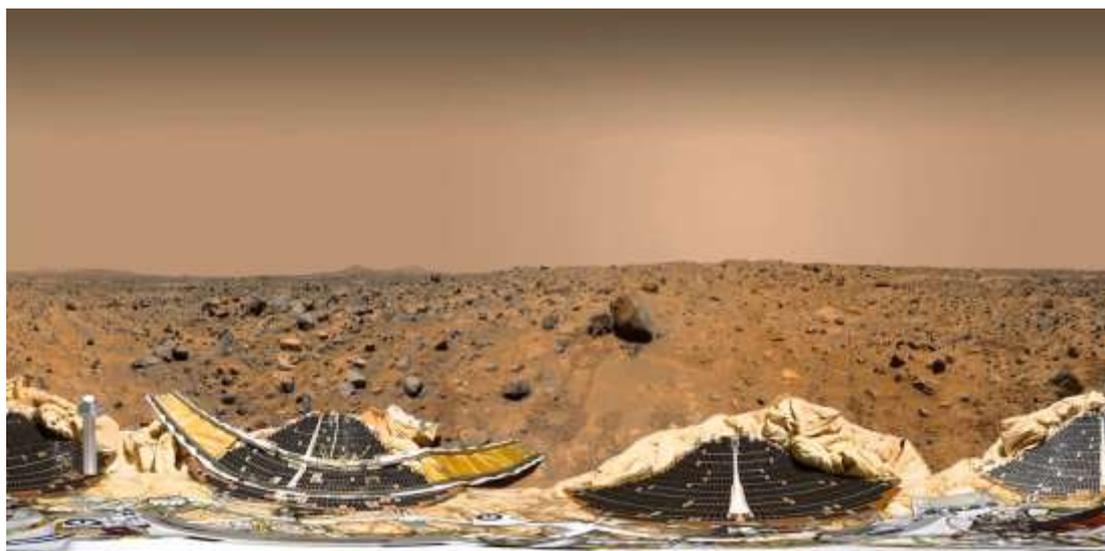


The first clear panoramic image of the surface of Mars in 1976 – Viking 1 - NASA

Viking Orbiter took images that suggested there were channels where water had once flowed billions of years ago.

In the 1980s the Russians sent Phobos 1 and Phobos 2. Phobos was lost and Phobos 2 managed to achieve detailed images from orbit but the lander was also lost.

Melanie went on to tell us about NASA's Pathfinder Mission which arrived at Mars in 1997. The lander was encased in a huge inflated air bags. Once having come to rest, the bags opened and the lander, Sojourner, descended a ramp safely to the surface.



Sojourner having just run down the right-hand ramp towards an adjacent rock. The remains of the air bags can be seen - NASA

Just 650 millimetres long with spiked wheels and travelling at only 1 centimetre a second, Sojourner was capable of carrying out various tasks such as x-ray spectroscopy and chemical analysis of rocks and soil, most of which is volcanic.

We looked next at ESA's Mars Express orbiter which was launched in 2003 and is still in orbit today. The images are very sharp and have revealed a great deal about the surface of the planet.



Also, using Radar Mapping a great deal of information of what is beneath the surface has been learnt.

Part of the NASA Mars Exploration Rover mission were Spirit and Opportunity. Both landed in 2004 and Melanie described how successful both had been. Spirit continued until 2009 when it got stuck and Martian dust prevented the solar panels from providing power. But Opportunity is still in operation today and sending back valuable data had been able to shake of any dust from its panels through moving.

One of the images from Spirit and Opportunity was of haematite in the shape of tiny balls, now called “blueberries” and we were told that these only form in the presence of water.



“Blueberries” formed in haematite only when water is present - NASA

NASA's Mars Reconnaissance Orbiter arrived in 2006 and has gained valuable data in order to prepare for further exploration of Mars. Melanie told us that the Orbiter will remain in orbit around the planet and operate as a relay satellite for future missions.

The Phoenix Lander was a joint mission headed by NASA and landed close to the north polar cap in 2008. One of the main purposes of Phoenix is to look for possible sources of oxygen, water and material that could be used to make rocket fuel for a return journey. Melanie said that any manned mission to the planet would be preceded by 3D printers whose purpose would be to build and create structures in preparation for a manned landing.

In 2012 NASA's Curiosity landed. Carrying a large number of instruments and its purpose is to be a Mars Science Laboratory with the intention of learning more about the chemical structure of rocks and what is beneath the surface.

Finally, Melanie spoke of the research being done with the aim of getting to Mars, living there and returning, sometime in the future.

On the International Space Station, much research is being done to see how possible it will be to grow plants in a Mars environment. Water recovery systems are now well understood and the development of spacesuits has also advanced considerably.

Power generation has also improved significantly over recent years with huge advances in solar panels and the development of radioactive thermonuclear electric generators.

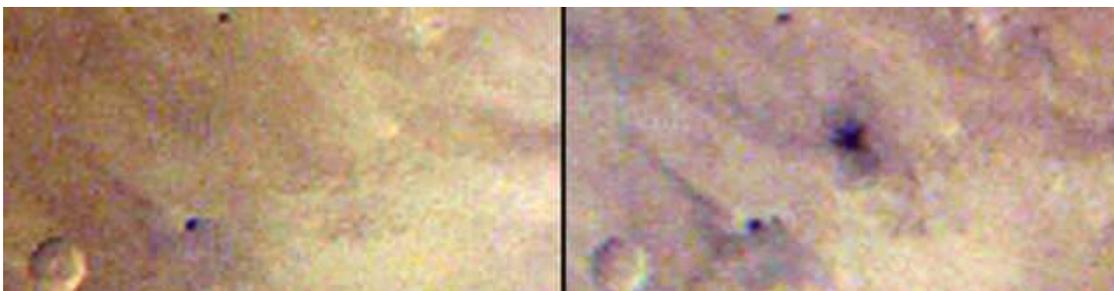
NASA have a downloadable file about a "Journey to Mars" and Melanie said it was possible to download the pdf file from the [www.NASA.gov](http://www.NASA.gov) web site and searching for "Journey to Mars".

### **Snippets from the World of Science**

*John Wayte*

A NASA spacecraft has spotted a fresh impact crater on Mars and they can pin the actual event down to one day.

On March 27 2012, the crater wasn't there but on a picture taken a day later, there it was.



NASA also reckons that the asteroid may have broken up at a high altitude because there are pockmarks near the strike zone. And there is some evidence that it may also have caused Mars-quakes. The size of the asteroid is reckoned to be similar to that which struck Chelyabinsk in Russia, which injured over 1,000 people.

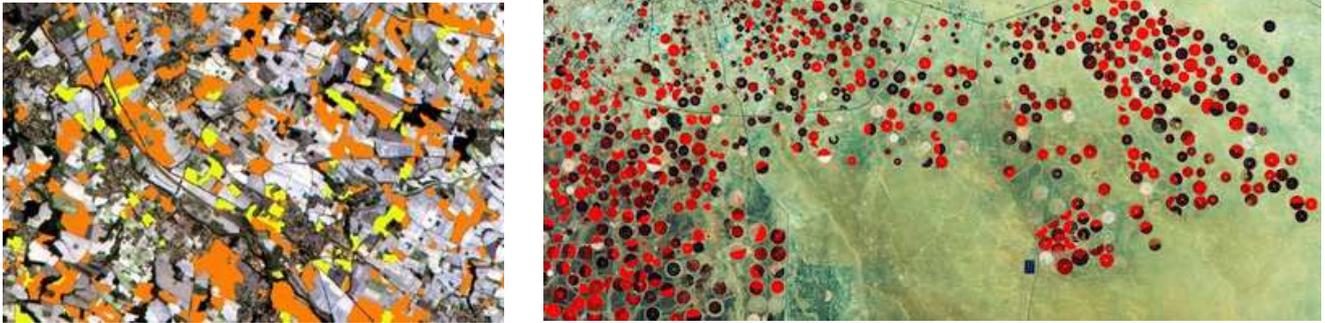
### **Sentinel – 2**



European Space Agency's ESA Sentinel satellites are an earth monitoring system that uses two satellites, 2a and 2b launched 23 June 2015 and 7<sup>th</sup> March 21017 respectively. They are designed for land and sea monitoring, natural disaster mapping and sea ice observations. They circle the Earth 14.3 times a day at a height of 488 miles.

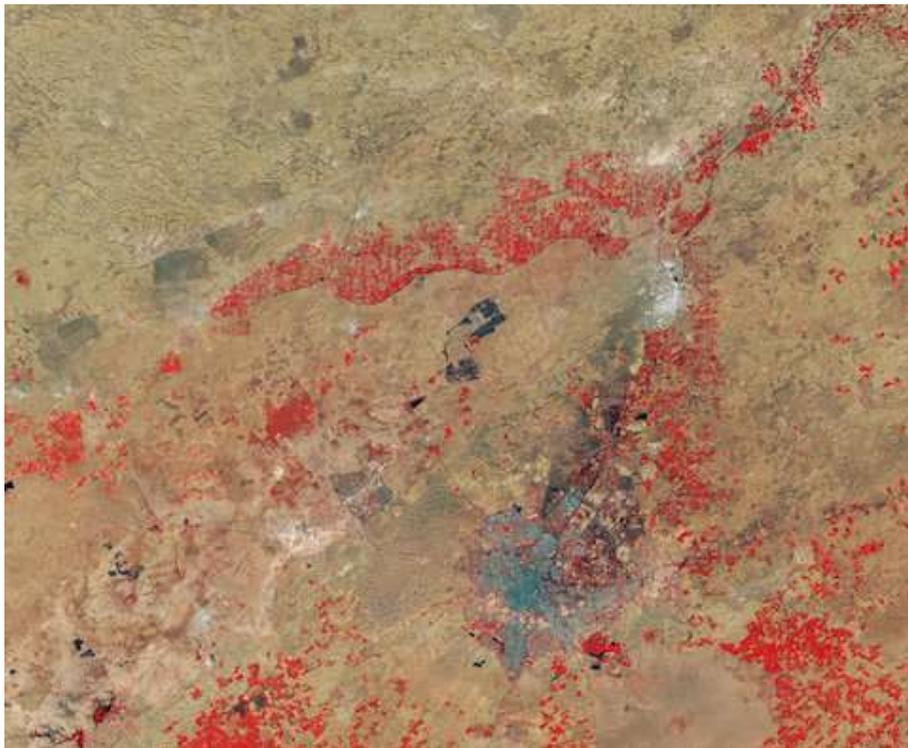
Sentinel 2 is the first optical Earth observation mission of its kind to include three bands in the "red edge" (near-infrared which shows rapid changes in reflected light that occurs in vegetation), providing key information on the state of vegetation. In the first image

below from 6 July 2015 of an area near Toulouse in France, the satellite's multispectral instrument was able to discriminate between two types of crops: sunflower (orange) and maize (yellow).



The second image is in false colour and shows the agricultural structures near Tubarjal, Saudi Arabia. Circles are central-pivot irrigation systems, where a long water pipe rotates radially around a well in the centre.

The false colour image below shows an area in north west India captured on 4 March 2017.



The Indian city of Bikaner is visible in the lower part of the image, surrounded by a varied landscape of agricultural structures and sand dunes.

The city lies in the Thar Desert, an arid region covering about 320,000 sq. km in India and Pakistan. Most of the desert is covered by large shifting dunes, some of which are visible in the upper part of the image. The high winds also carry dry soils to neighbouring fertile lands, degrading them. Archaeological evidence suggested that the region was once lush countryside, but the over-exploitation of land and water resources by humans over thousands of years drastically changed the landscape into what we see today.

In recent times, India has turned its attention to restoring the ecology and curbing the desertification of the region. For example, the Indira Gandhi Canal bringing water to the area pictured, was built to keep the desert from spreading to the fertile areas, and to reclaim the land with irrigated planting projects. In this false-colour image vegetation appears red.

In the picture below, algae bloom can be seen off Belgium's coast. Whilst ships have been monitoring them, this one was not noticed because it was in shallow water. While algae blooms are not always a bad thing, under some circumstances they can be detrimental due to their depletion of oxygen in the water.



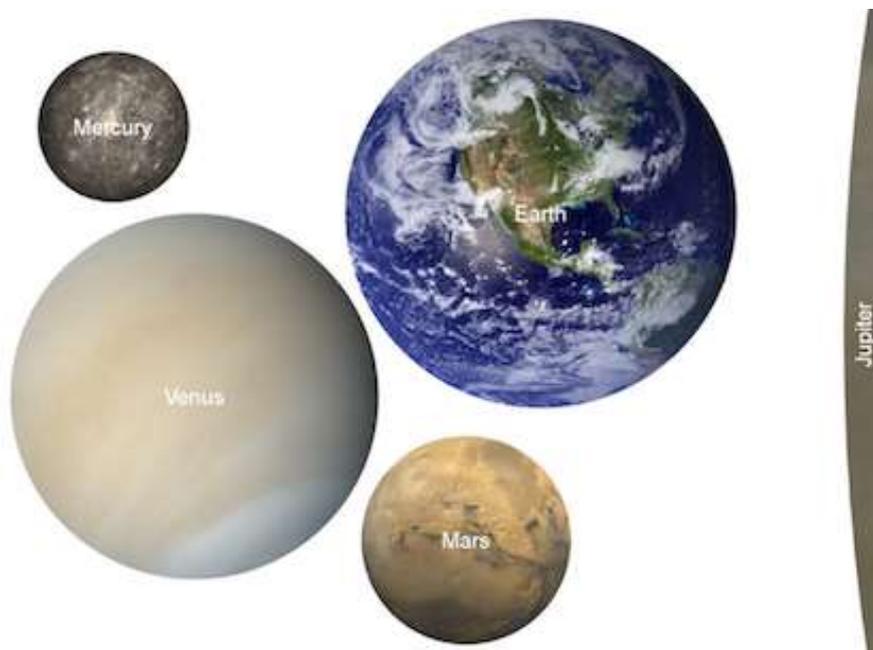
## Planet Earth

Brian Mills FRAS

Brian explained that from this September, schools will start teaching the new two-year GCSE Astronomy course and it is thought that it would be a good opportunity to work our way through the new curriculum. These talks will alternate each month with the Sky Notes that will now cover two months.

The first part is on the Earth's Structure with the shape described basically as a sphere. The diameter from pole to pole is 12,713 km and the equatorial diameter is 12,756 km. (For the purposes of the new GCSE, 13,000 km is good enough)

We were shown a comparison in size between neighbouring planets.

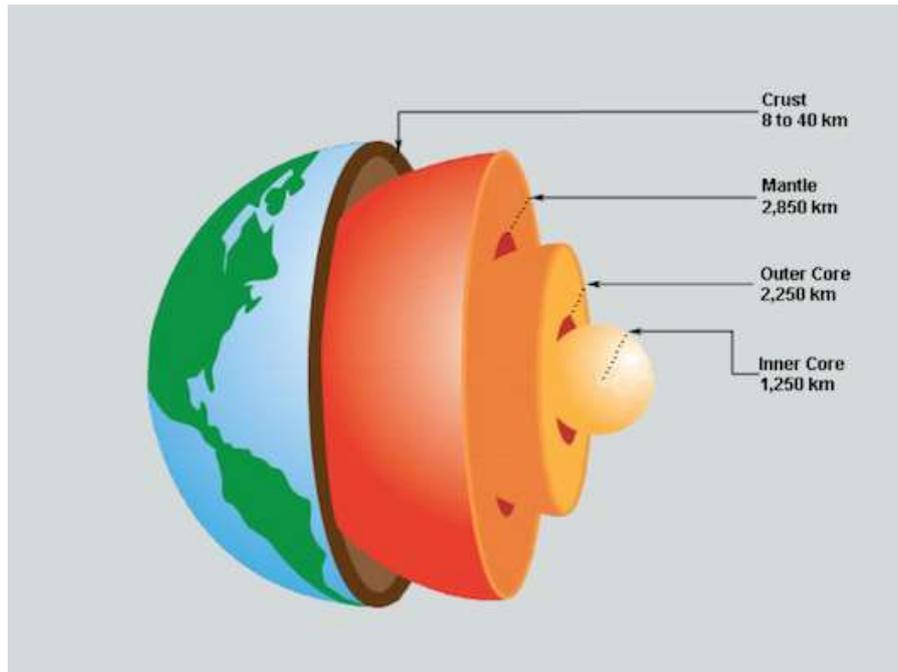


The Earth's Inner Core is about 1,250 km in diameter and is of iron and nickel at a temperature of about 5,500°C and is solid because of the enormous pressure.

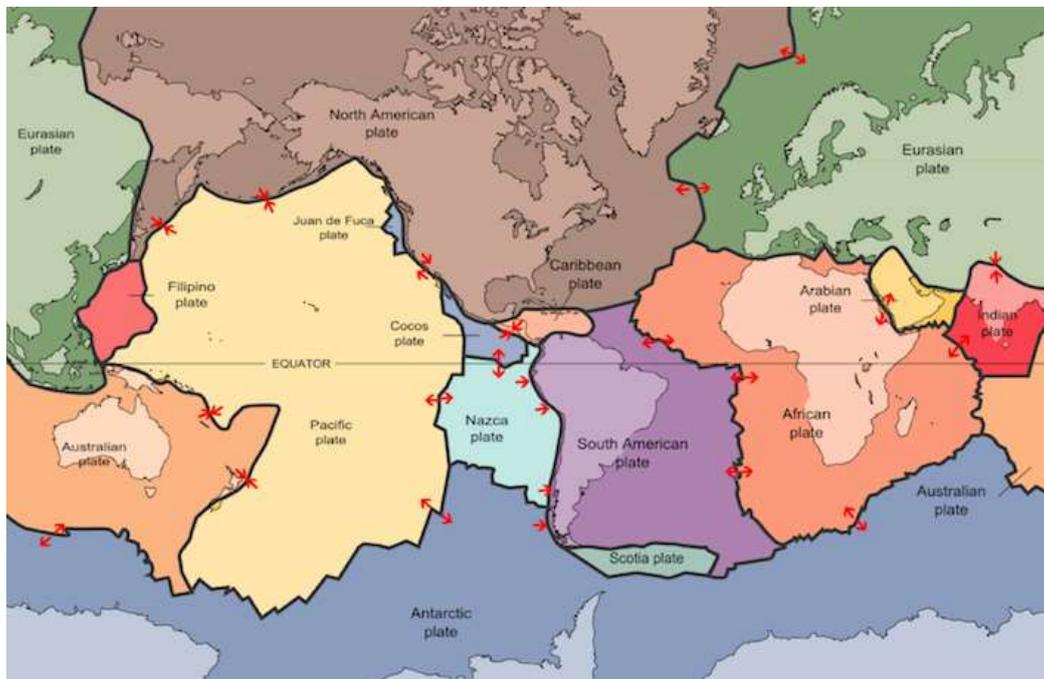
It is surrounded by a 2,250-km thick liquid Outer Core, again of iron and nickel but at a temperature of 5,000°C. Brian said that this generates the Earth's magnetic field through the dynamo effect. Heat from the Inner Core causes convection currents in the fluid metal, producing spirals due to the "Coriolis Effect" and this in turn creates circulating electric currents, resulting in the Earth's magnetic field.

The 2,850-km thick Mantle surrounds the cores and consists mainly of rock and although solid, over geological timescales it behaves as a viscous material.

The Crust is between 8 and 40 km thick but beneath the oceans it is 7 to 8 km thick, being volcanic rocks like basalt. The continental crust is much thicker but a lot less dense, mainly igneous, granite, sedimentary (dead animals and plants) and metamorphic (changed physically and chemically by heat and pressure) rock.



Brian then talked about the surface of the Earth and said it is divided into tectonic plates. There are 8 major plates and 10 minor plates being driven by heat rising from the Inner and the Outer Cores and through the Mantle.

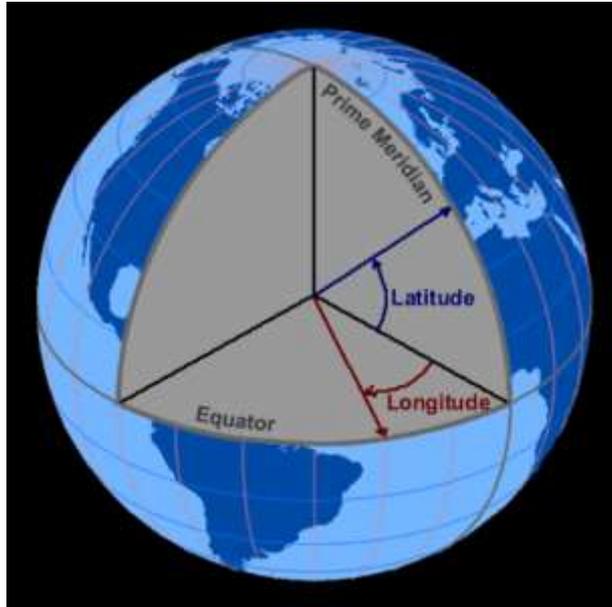


Brian concluded the first part of his presentation on GCSE astronomy by talking about defining any position on the surface of the Earth.

Two coordinates are needed. Latitude measures north and south in degrees along a meridian line from the equator to the poles with the equator being  $0^\circ$ . Longitude is a measure east or west. Brian said that before a Longitude reference was defined, locations were found by moving north or south along latitude lines, then moving west or east along the parallel line of longitude. A rather inefficient way to travel and we were told that this often caused many sailors to get lost and eventually die.

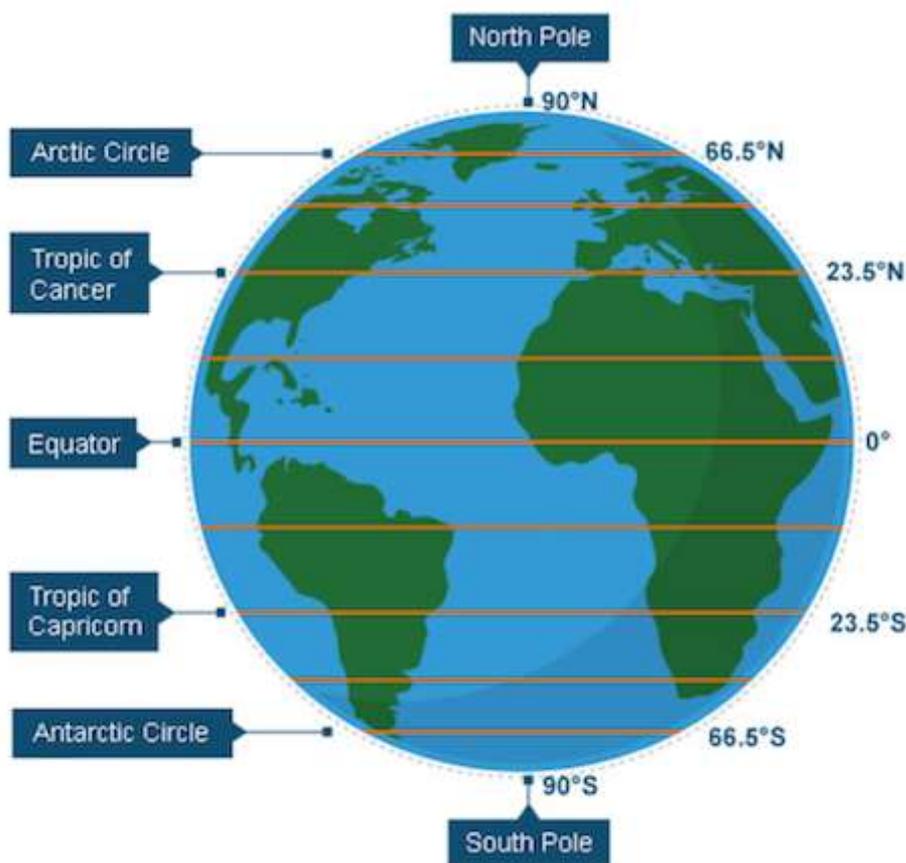
In 1884, it was internationally agreed that Greenwich should become the Prime Meridian, which navigation would refer to as  $0^\circ$  and measurements in degrees would be either east or west from here.

Brian stressed that it was very important to remember that these are projections from a point at the centre of the Earth.



Finally, Brian said that because the Earth is tilted at  $23.5^\circ$  relative to the plane of the Earth's orbit around the Sun, it means that the point at which the Sun is directly overhead in the tropics changes throughout the year. The furthest north this point reaches is known as the Tropic of Cancer at the Summer Solstice (north) and the furthest south it reaches is called the Tropic of Capricorn at the Summer Solstice (south).

The Arctic and Antarctic Circles are marked by the latitude below which the Sun is seen to rise and set every day. Above this in the Arctic Circle ( $66.5^\circ$  North) or the Antarctic Circle ( $66.5^\circ$  South) the Sun is seen all the time or is below the horizon all the time.



**BOB SEANEY**

We are very sad to announce the sudden death of Bob Seaney who had been a member of the Society for many years and given several thought-provoking talks covering a broad diversity of astronomical subjects such as astrophysics and astro-art as used to illustrate what it would be like on the planets long before modern space missions. He also gave a fascinating talk about a recent visit to Lick Observatory on Mount Hamilton in California.

More recently Bob had become interested in astro-archaeology and had given two talks on the subject which included work he had done on St. Mary in the Scilly Islands where, after some considerable research he found evidence of a standing stone circle quite close to the airport runway. He made sight lines and confirmed that the stones lined up with features on the horizon that predicted the summer solstice amongst other events.

He attended most meetings when he was not called away as a Government Scientist, and was always ready to talk about any subject on any level.

As a young man, Bob had studied physics at university and took his doctorate in that subject. On joining the Civil Service, he was asked to specialise in optics and went on to become an authority in the use of lasers at one of the government establishments.

We are all going to miss him and his gentle manner at our meetings.

### **BOOK OF THE MONTH FROM THE LIBRARY**

#### **In Search of Schrödinger's Cat**

You may well ask that if Einstein could not bring himself to accept it why on earth would I want to read this. However, the quantum world is so important that it provides the fundamental underpinning of all modern sciences. Without it, we'd have no computers, no science of molecular biology, no understanding of DNA, no genetic engineering.

In Search of Schrodinger's Cat tells the complete story of quantum mechanics, a truth stranger than any fiction. John Gribbin takes us step by step into an even more bizarre and fascinating place, requiring only that we approach it with an open mind. He introduces the scientists who developed quantum theory. He investigates the atom, radiation, time travel, the birth of the universe, superconductors and life itself. And in a world full of its own delights, mysteries and surprises, he searches for Schrodinger's Cat - a search for quantum reality - as he brings every reader to a clear understanding of the most important area of scientific study today - quantum physics.

As for myself, having seen this review from Amazon, this book is definitely on my list of future reads so, if you don't take it home this month, I certainly will!

*Phil Berry*

### **SAGAS SUMMER CONVENTION 2017**

This year's SAGAS Convention will be on Saturday the 17<sup>th</sup> of July. This year it is being hosted by Hampshire Astronomical Group at Clanfield Memorial Hall, South Lane, Clanfield, Hampshire PO8 0RB. There is car parking nearby.

Doors open at 0930 and registration begins at from 0945 and the Convention begins at 1030.

This year, talks cover subjects such as Black Holes, Higgs Boson, Meteor Research and more.

The cost is £10 for SAGAS member societies which includes Wadhurst AS and £12 for non-members. Seats are limited; booking will be confirmed on receipt of remittance.

The full programme and details can be found by visiting the SAGAS website at: [www.sagasonline.org](http://www.sagasonline.org)

Further information can be obtained from: [graham.g.bryant@btinternet.com](mailto:graham.g.bryant@btinternet.com)

### **JULY MEETING**

**19<sup>th</sup> July 2017** – Two talks this month. Phil Berry describes "My Smartphone Controlled Telescope", and Brian Mills continues his series about women in astronomy with "NASA's Unseen Female Astronauts".

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.

## FUTURE MEETINGS

There is no meeting in August.

**20<sup>th</sup> September** - Barry Soden recalls "NASA Disasters (and Some Causes)".

**18<sup>th</sup> October** - David Pulley asks the question "So, How Do We Know They Are Planets?"

**15<sup>th</sup> November** – Jan Drozd regales us with stories about "Astronomical Blunders in Science Fiction"

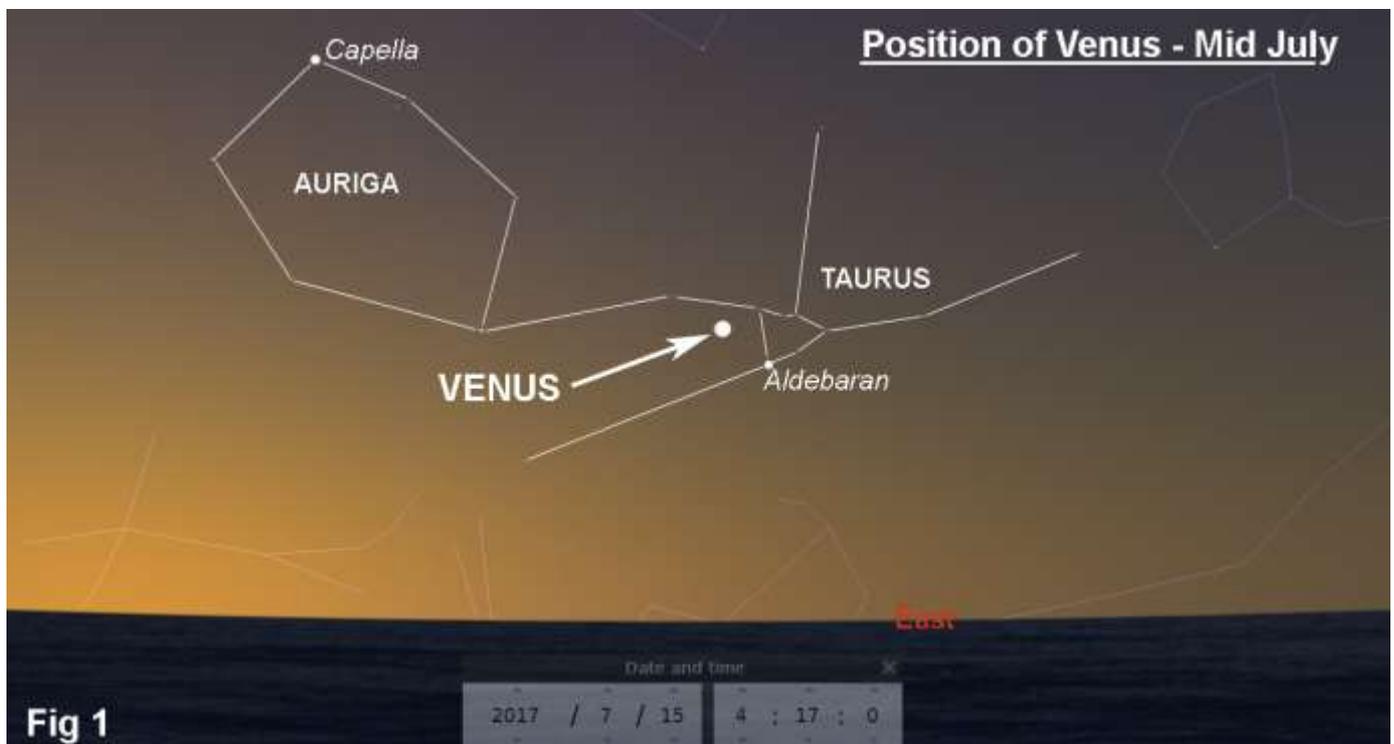
**13<sup>th</sup> December** – (This is the second Wednesday in the month) Brian Mills FRAS tells the story of "The Great Telescope at Birr Castle"

## SKY NOTES FOR JULY 2017

### Planets

Mercury is an evening object, reaching greatest eastern elongation (27°) on July 30<sup>th</sup>. Even at this time the planet will be a difficult object low in the west immediately after sunset. It sets just forty five minutes after the Sun, and with a magnitude of +0.5 it will hardly be obvious in the solar glare. If you do sweep for Mercury with optical aid, please remember to wait until the Sun has set or you risk permanent damage to your eyes.

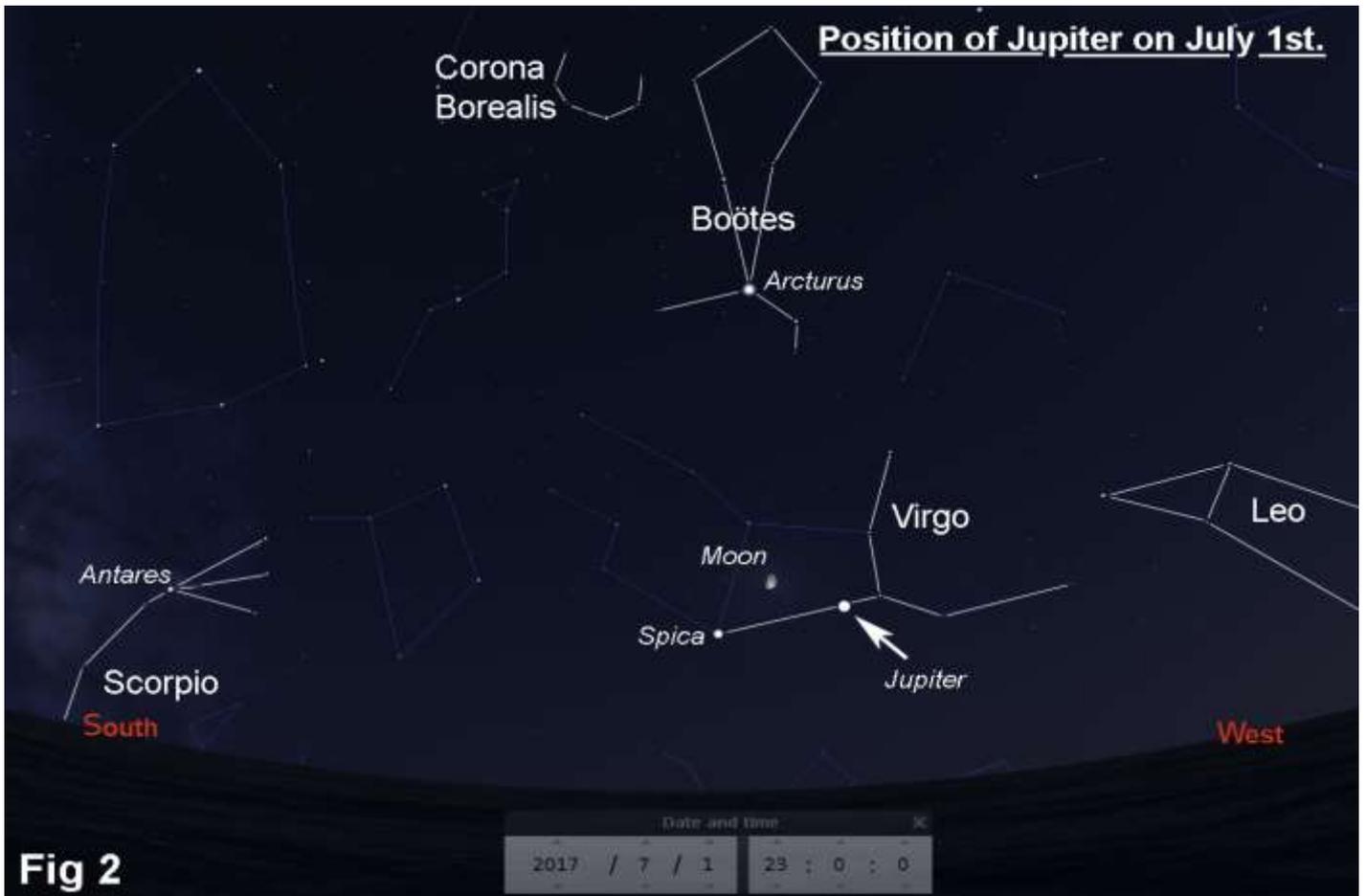
Venus is a morning object and was at greatest western elongation in early June. It rises at approximately 02.30 throughout the month but will be visible through into the autumn skies with its period of visibility shortening as the planet moves closer to the Sun. At the same time it gradually appears later in the morning twilight (due to later sunrise) making it more readily observed by those who rise at a more sociable hour. The position of the planet in mid July is shown in fig 1.



Earth is at aphelion (it's furthest from the Sun) on July 3<sup>rd</sup> at 21.11 BST when the distance between us will be 152,092,504 km.

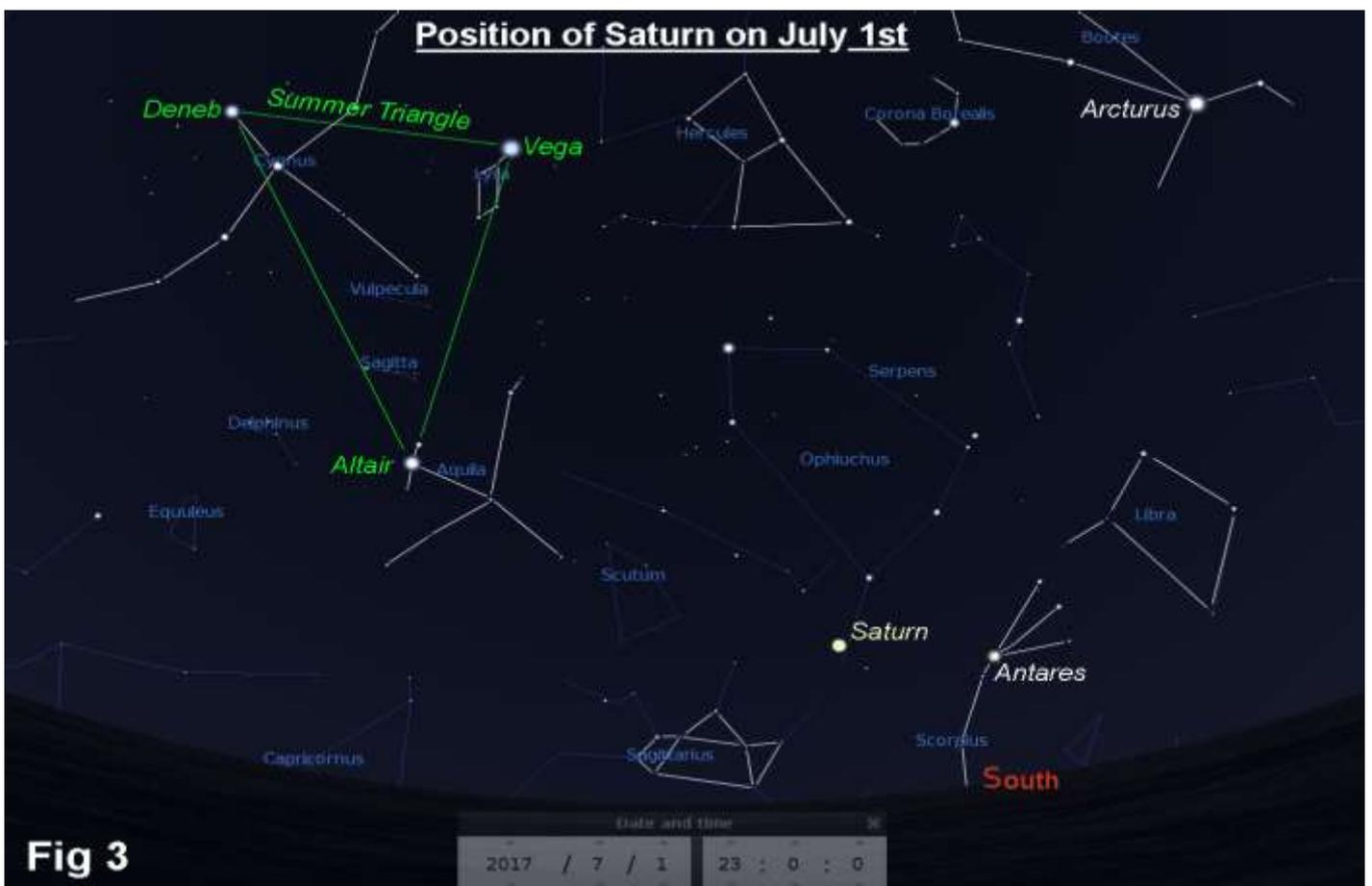
Mars lies just to the east of the Sun at the beginning of July and reaches solar conjunction on the 27<sup>th</sup> meaning that the red planet is not observable this month. Conjunction, in the case of planets that lie beyond the Earth's orbit, means that they are on the far side of the Sun from us.

Jupiter is still a brilliant evening object even though it reached opposition three months ago. As July begins, the gas giant remains above the horizon until 01.00, but its period of visibility is dwindling so that by the end of the month it will have set by 23.00. It is still within the confines of Virgo where it continues to move directly (west to east) although as it does so its declination becomes more negative. In other words it is moving further south of the celestial equator. Its brightness falls slightly from -2.0 to -1.9 while its apparent size slips from 37 to 34 arc seconds. The Moon, which is just past first quarter, forms a nice trio with the bright star Spica and Jupiter on the first of the month as shown in fig 2. Then on the 28<sup>th</sup> of July the Moon is once again close by and just 2° north west of the planet. As always the four Galilean moons are well worth following with a small telescope or binoculars though if you use the latter they will need to be held steady.



**Fig 2**

Saturn was at opposition in mid June and is now an evening object rising before the Sun has set.



**Fig 3**

Unfortunately the ringed planet will never be well placed for observation because its declination is minus more than  $21^\circ$  (it is more than  $21^\circ$  below the celestial equator). For this reason it will not be more than  $17^\circ$  above the horizon, even when it culminates due

south, throughout July. However, Saturn is well worth a look even if you only have a small telescope. Although other planets have ring systems, the sight of Saturn through an amateur telescope is unique. The planet's brightness falls very slightly and its angular diameter decreases as the Earth moves away from it.

### 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 = disappearance at the dark limb. RD = reappearance at the dark limb. The column headed "mm" (millimetres) shows the minimum aperture telescope required for each event. **Times are in BST.**

July	Time	Star	Mag	Ph	Alt °	% illum.	mm
July 2	23.33	ZC 2020	6.5	DD	17	68	80
July 29	20.59	ZC 1978	6.6	DD	22	42	90

### Phases of the Moon for July

First ¼	Full	Last ¼	New
1 <sup>st</sup>	9 <sup>th</sup>	16 <sup>th</sup>	23 <sup>rd</sup>
30 <sup>th</sup>			

### ISS

Below are details for passes of the International Space Station (ISS) when it is magnitude -2.5 or brighter. The details of all passes, including those visible between midnight and dawn, can be found at [www.heavens-above.com](http://www.heavens-above.com). Please remember that the times and directions shown below are for when the ISS is at its *maximum* elevation, so you should go out and look at least five minutes beforehand. **Times are in BST.**

July	Time	Mag.	Alt°	Az.		July	Time	Mag.	Alt°	Az.
22 <sup>nd</sup>	23:13:26	-3.3	36°	SSE		27 <sup>th</sup>	23:39:44	-3.8	78°	N
23 <sup>rd</sup>	22:21:02	-2.7	24°	SE		28 <sup>th</sup>	22:47:05	-3.8	81°	N
23 <sup>rd</sup>	23:57:11	-4.0	78°	SSE		29 <sup>th</sup>	21:54:25	-3.9	89°	SSE
24 <sup>th</sup>	23:04:38	-3.9	58°	SSE		29 <sup>th</sup>	23:30:57	-3.9	86°	N
25 <sup>th</sup>	22:12:07	-3.4	40°	SSE		30 <sup>th</sup>	22:38:16	-3.8	79°	N
25 <sup>th</sup>	23:48:28	-3.9	83°	N		31 <sup>st</sup>	21:45:35	-3.7	79°	N
26 <sup>th</sup>	22:55:52	-4.0	84°	SSE		31 <sup>st</sup>	23:22:04	-4.0	73°	SSW
27 <sup>th</sup>	22:03:16	-3.9	65°	SSE						

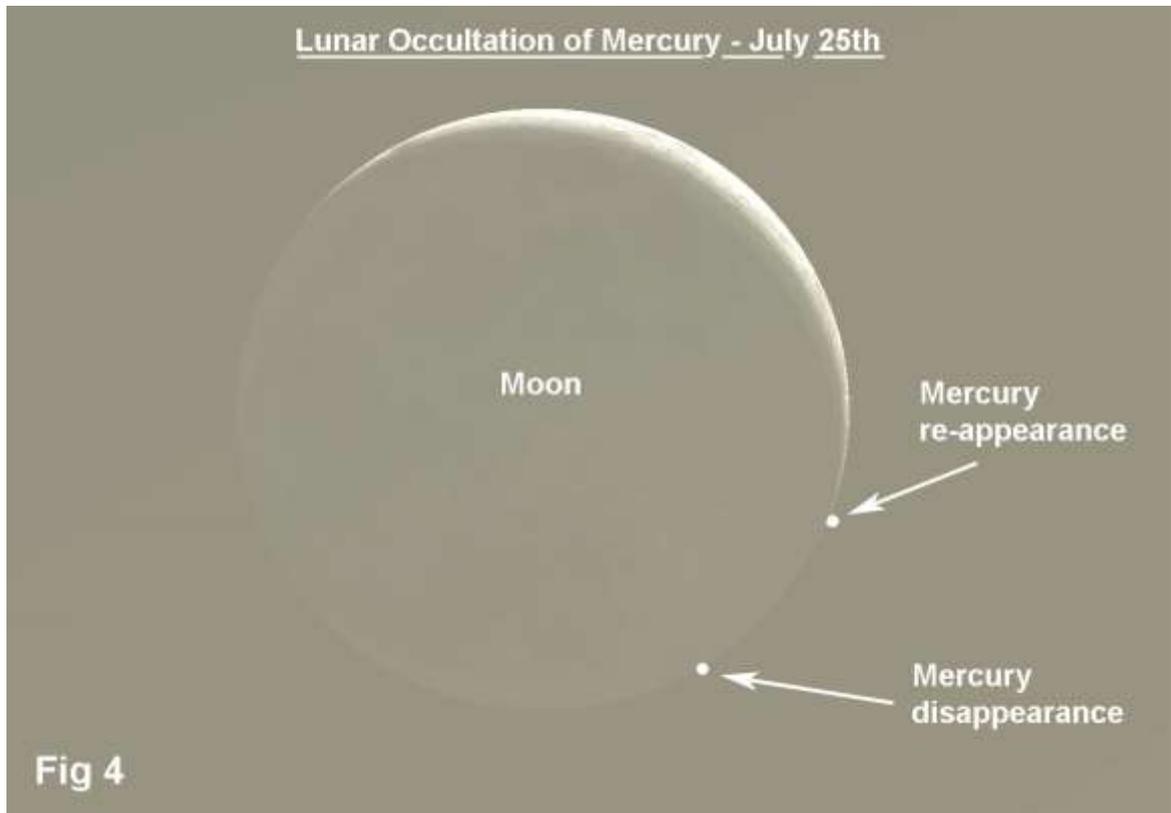
### Iridium Flares

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](http://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.**

July	Time	Mag	Alt°	Az.°		July	Time	Mag.	Alt°	Az.°
1 <sup>st</sup>	23.44	-7.8	44°	244° (WSW)		14 <sup>th</sup>	23.02	-3.2	28°	269° (W)
2 <sup>nd</sup>	21.57	-4.3	15°	344° (NNW)		17 <sup>th</sup>	22.53	-3.8	25°	275° (W)
2 <sup>nd</sup>	22.40	-4.0	16°	293° (WNW)		20 <sup>th</sup>	22.54	-6.0	19°	282° (WNW)
3 <sup>rd</sup>	22.43	-4.2	14°	296° (WNW)		22 <sup>nd</sup>	23.54	-4.8	40°	239° (WSW)
4 <sup>th</sup>	21.35	-3.1	20°	342° (NNW)		23 <sup>rd</sup>	22.03	-3.6	14°	347° (NNW)
4 <sup>th</sup>	22.56	-5.0	10°	302° (WNW)		24 <sup>th</sup>	23.07	-5.4	10°	295° (WNW)
5 <sup>th</sup>	23.29	-6.9	39°	252° (WSW)		24 <sup>th</sup>	23.46	-7.7	39°	243° (WSW)
9 <sup>th</sup>	23.14	-3.8	36°	259° (W)		30 <sup>th</sup>	21.00	-6.6	29°	344° (NNW)
12 <sup>th</sup>	23.05	-5.1	32°	265° (W)						

### Lunar Occultation of Mercury

On the morning of July 25<sup>th</sup> the Moon will occult Mercury at 08.33. The planet will disappear at the dark limb and re-appear at 08.53 on the bright limb. This will be an extremely difficult event because the Moon (5% illuminated) and Mercury are just 25° west of the Sun and only 6° above the eastern horizon. Fig 4 shows the position of Mercury relative to the Moon's disk.



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

Looking north the zenith lies on Draco's border with Hercules, indicating that the dragon is particularly well positioned for its twists and turns between the two bears to be identified. Ursa Minor points northwards while its larger relation has already begun its descent towards the horizon. That interesting pair of galaxies, M81 and M82, are still reasonably well placed at an altitude of more than 45°. Diametrically opposite the "Pointers" in the plough, on the opposite side of the meridian, is Cepheus that contains both the Iris and the Elephant's Trunk nebulae. Between the pole and the horizon lies the rather shapeless form of Camelopardalis (the giraffe) with some imagination being required to see the beast from just the four stars that are brighter than 5<sup>th</sup> magnitude. Capella is skimming the northern horizon and Perseus, just to its east, has almost fully risen.

If we turn towards the east we see that Pegasus has not yet cleared the horizon whilst above it Deneb, in Cygnus, is already at an altitude of 50°. The other two members of the Summer Triangle are moving towards the south east. Below one of them, Vega in Lyra, are a line of small constellations that reach down towards the head of the winged horse. From the north moving in the direction of the horizon they are Vulpecula the fox, Sagitta the arrow, Delphinus the dolphin and Equuleus the little horse. Of these, Sagitta and Delphinus are the most obvious with the former certainly having the shape of a mythological arrow.

In the south, Hercules with its smattering of globulars, is riding high close to the zenith. M13, at magnitude +5.8, is of course the best known of these although its neighbour M92, a very old example whose brightness is +6.3, should not be overlooked. Hercules, despite being one of the original 48 drawn by Ptolemy, is not the easiest of constellations to find. One method is to begin by locating Arcturus in Boötes by following the curve of Ursa Major's tail. Then draw an imaginary line from Arcturus through Alphekka, the brightest star in Corona Borealis that lies just to the east of Boötes. This line will bring you to the quadrilateral of stars that makes up half of the strong man's body. Alternatively use the portion of Draco that lies immediately behind its head to point you towards Hercules. Below Hercules lies Ophiuchus along with the two parts of the dismembered sea serpent, the only constellation to be comprised of two distinctly separate entities. Closer still to the horizon we come to Scorpius and Sagittarius, the latter of which contains the galactic core and provides us with a multitude of galaxies and clusters.

In the west Leo is about to set, with Virgo containing the planet Jupiter, not far behind. Above these we find initially the two small groups of Coma Berenices and Canes Venatici and then closer to the zenith, the brilliant Arcturus. Canes Venatici is home to another of the finest northern globulars, M3, whose brightness at magnitude +6.2 should mean it is just visible from a dark sky site.

#### **Meteors**

The Delta Aquarids are essentially a southern shower because the radiant, on the night of maximum, has a declination of -17° and rises at 22.30. The predicted ZHR is around 20 although a number will, of course, be lost below the horizon. The shower is active from July 15<sup>th</sup> to August 20<sup>th</sup> with maximum occurring on July 29<sup>th</sup>. The shower has a double radiant although the second one, despite being slightly further north, is the weaker of the two.

The Perseids, which is one of the year's stronger showers, begins on July 23<sup>rd</sup> but doesn't reach maximum until August 12<sup>th</sup>. The build up to peak activity is slow with meteors appearing to emanate from the area of Perseus that lies just south of Cassiopeia. More details next month.

*Brian Mills*

## **SPACEPLACE - NASA**

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### **The Shape of the Solar System**

By Marcus Woo

When Stamatis (Tom) Krimigis was selected for the Voyager mission in 1971, he became the team's youngest principal investigator of an instrument, responsible for the Low Energy Charged Particles (LECP) instrument. It would measure the ions coursing around and between the planets, as well as those beyond. Little did he know, though, that more than 40 years later, both Voyager 1 and 2 still would be speeding through space, continuing to literally reshape our view of the solar system.

The solar system is enclosed in a vast bubble, carved out by the solar wind blowing against the gas of the interstellar medium. For more than half a century, scientists thought that as the sun moved through the galaxy, the interstellar medium would push back on the heliosphere, elongating the bubble and giving it a pointy, comet-like tail similar to the magnetospheres—bubbles formed by magnetic fields—surrounding Earth and most of the other planets

"We in the heliophysics community have lived with this picture for 55 years," said Krimigis, of The Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland. "And we did that because we didn't have any data. It was all theory."

But now, he and his colleagues have the data. New measurements from Voyager and the Cassini spacecraft suggest that the bubble isn't pointy after all. It's spherical.

Their analysis relies on measuring high-speed particles from the heliosphere boundary. There, the heated ions from the solar wind can strike neutral atoms coming from the interstellar medium and snatch away an electron. Those ions become neutral atoms, and ricochet back toward the sun and the planets, uninhibited by the interplanetary magnetic field.

Voyager is now at the edge of the heliosphere, where its LECP instrument can detect those solar-wind ions. The researchers found that the number of measured ions rise and fall with increased and decreased solar activity, matching the 11-year solar cycle, showing that the particles are indeed originating from the sun.

Meanwhile, Cassini, which launched 20 years after Voyager in 1997, has been measuring those neutral atoms bouncing back, using another instrument led by Krimigis, the Magnetosphere Imaging Instrument (MIMI). Between 2003 and 2014, the number of measured atoms soared and dropped in the same way as the ions, revealing that the latter begat the former. The neutral atoms must therefore come from the edge of the heliosphere.

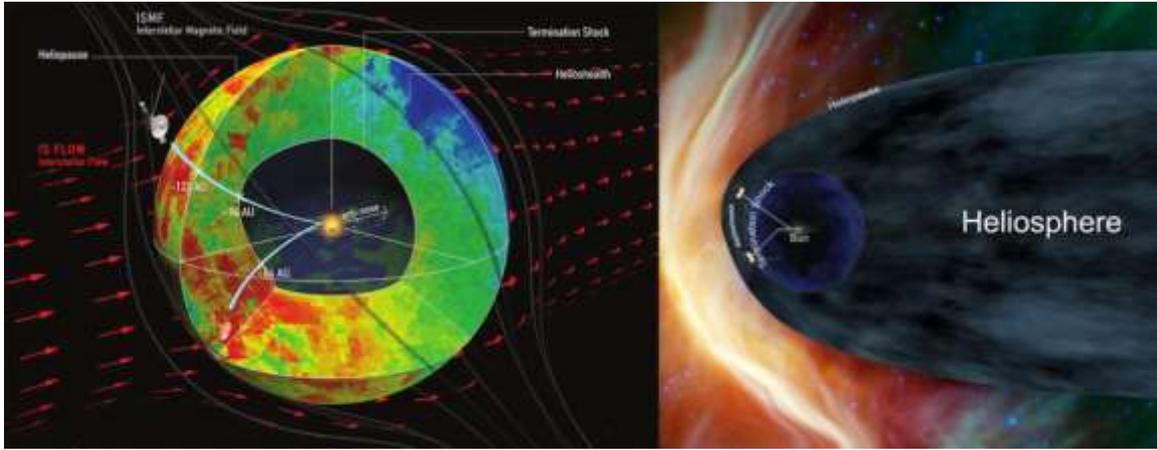
If the heliosphere were comet-shaped, atoms from the tail would take longer to arrive at MIMI than those from the head. But the measurements from MIMI, which can detect incoming atoms from all directions, were the same everywhere. This suggests the distance to the heliosphere is the same every which way. The heliosphere, then, must be round, upending most scientists' prior assumptions.

It's a discovery more than four decades in the making. As Cassini ends its mission this year, the Voyager spacecraft will continue blazing through interstellar space, their remarkable longevity having been essential for revealing the heliosphere's shape.

"Without them," Krimigis says, "we wouldn't be able to do any of this."

To teach kids about the Voyager mission, visit the NASA Space Place:

<https://spaceplace.nasa.gov/voyager-to-planets>



Caption: New data from NASA's Cassini and Voyager show that the heliosphere — the bubble of the sun's magnetic influence that surrounds the solar system — may be much more compact and rounded than previously thought. The image on the left shows a compact model of the heliosphere, supported by this latest data, while the image on the right shows an alternate model with an extended tail. The main difference is the new model's lack of a trailing, comet-like tail on one side of the heliosphere. This tail is shown in the old model in light blue.

**Image credits: Dialynas, et al. (left); NASA (right)**

### CONTACTS

**General email address to contact the Committee**

wadhurstastro@gmail.com

- |                                 |   |
|---------------------------------|---|
| <b>Chairman</b>                 | Brian Mills   |
| <b>Secretary &amp; Events</b>   | Phil Berry 01580 291312                             |
| <b>Treasurer</b>                | John Lutkin   |
| <b>Membership Secretary</b>     | John Wayte  |
| <b>Newsletter Editor</b>        | Geoff Rathbone 01959 524727                         |
| <b>Director of Observations</b> | Brian Mills 01732 832691 email: bwmills65@gmail.com |
| <b>Committee Members</b>        | Jim Cooper<br>Eric Gibson                           |

**Wadhurst Astronomical Society website:**

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**Any material for inclusion in the August 2017 Newsletter should be with the Editor by July 28<sup>th</sup> 2017**