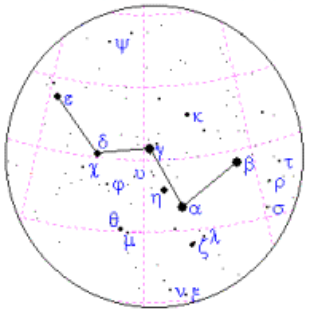


Wadhurst Astronomical Society Newsletter December 2017

MEETINGS

NOVEMBER MEETING

Phil Berry presided over our November meeting, welcoming members and visitors. He began with an important update on the new security gates to Uplands College. From now on, these gates will be shut at 1930 and then opened again at 2100 to close for the night at 2300. People arriving for our meetings after 1930 will be able to park in the car park on the right just before the security gates, and then press the button on the pedestrian gate which links to Reception who will then open it. Cars inside the gates will be able to drive out by driving up to the gates and a detector under the road will open them just for exiting. The College warns that the gates open inwards and it is important not to get too close to them.

After this saga, Phil introduced our speaker for the evening, our own Jan Drozd who has given many excellent talks covering a range of subjects.

Astronomical Blunders in Science Fiction
Jan Drozd

Jan said that he enjoys science fiction and there is plenty of it to be found in books and films. Science fiction covers many astronomical topics such as space travel, alien life, time travel and robotics.

He said that there are two types of science fiction. One form bases itself around credible science he called Hard Science Fiction and mentioned some of the writers who have tended to follow this line, such as Arthur C Clark and Fred Hoyle, and films such as Gravity and The Martian.

What Jan referred to as Soft Science Fiction explores the idea of science fiction that doesn't follow accurate science and much is pure fantasy. This enables tales that include fictional societies, empires and characters to be written about. Writers such as H. G. Wells with The Time Machine and Frank Herbert and the Dune series use this kind of imaginary science. Films along these lines include Star Trek and Star Wars and on TV, Doctor Who.

Some examples in Soft Science Fiction included the concept of gravity without there being any artificial system to provide it, or the sound of spaceship engines or explosions in the vacuum of space. We often see spacecraft changing direction without any visible thrusting activity and instant communication over huge astronomical distances. Jan gave us many more examples.

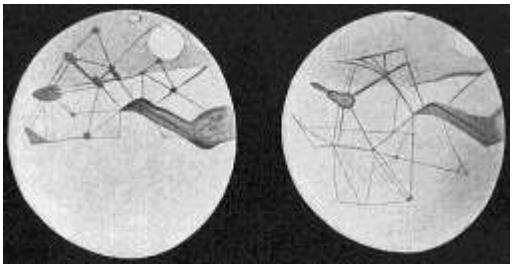
Jules Verne, we were told, is regarded as the father of hard science fiction and in 1865 wrote a book called "From the Earth to the Moon" where he tried to use real calculations to support the story. At that time, rockets had not been imagined and Verne used the idea of using a huge canon although as Jan pointed out, the human body could not have taken the forces now calculated to be something like 22,000 G!

At the beginning of the twentieth century, H. G. Wells wrote "The First Men on the Moon" solving the problem of high G by *inventing* "Cavorite", a material that negates the force of gravity. By sliding blinds of Cavorite beneath the spaceship it could escape the Earth's gravity. Having landed on the moon, Wells' astronauts wore normal everyday clothes and were able to breath. But it made a good story.

In his 1979 novel, "The Fountains of Paradise", Arthur C Clarke imagines a huge tower built in the 22nd century that reached out to geostationary orbit height of about 36,000 kilometres with the idea of raising payloads to orbit without having to use rockets. Jan said that this wouldn't be totally impossible and said NASA had even done calculations and showed a diagram of their idea.

An artist's impression of a space elevator from earth up to a geostationary orbit position and beyond to a counterweight.
NASA

Jan said that he remembers reading H G Wells' "War of the Worlds" when he was a boy and hiding under the bed sheets in fear of what might be outside whilst reading about Martians landing on Earth. It was published back in 1898 (of course, Jan read the book well after then…) when all that was known about Mars was from telescope observations and reports from Percival Lowell at Lowell Observatory in the States said that he had seen what he called "canals" on the surface, suggesting that there was life on the planet.



Drawing made by Percival Lowell of what he thought he saw on the surface of Mars.
This turned out later to have been aberrations in the lenses of his telescope

The Classic novel "War of the Worlds" by H. G. Wells

Jan said that up until very recently, astronomers believed the dark areas on Mars were in fact vegetation and it wasn't until Mariner 4 flew past in 1965 it was confirmed that there wasn't any.

Next, we looked at the recent film, "The Martian" which we were told had much of its scientific background supplied by NASA, but right at the beginning of the film we see a huge dust storm with winds up to 120 mph causing considerable damage but as Jan said, with such a week atmosphere, forces would hardly have blown a feather around, although much of the rest of the film is scientifically quite accurate.

One big problem facing science fiction writers is the enormous distances encountered in space. Our nearest star is 4.24 light years away and as Jan said, faster-than-light travel remains fantasy at the moment so using methods of travel known today, it is going to take thousands of years. Jan said that some theoretical drives could one day reduce travel time, such as a Fusion Rocket or Anti-matter engines but without a major breakthrough it remains purely theoretical.

Wormholes are theoretically possible by warping space as we believe it to be, but if they could be used as short cuts from one point in space to another a huge distance apart as we understand it, problems may exist such as tearing the traveller to pieces as they pass through.

Star Trek gets around the problem by conceiving the idea using soft science's fictional Warp Drive where time and space are bent conveniently around the spaceship.

The idea of hibernation for deep space travel has often been used in science fiction but we were told there are very many problems with it. It has been far from shown to be possible for human beings. Using cryogenics, ice crystals could present serious problems and as Jan said, what might happen to memory. Also, he said that the aging process would still continue.

To travel through space at speeds nearing that of light would result in a huge increase in mass according to Einstein. This would require enormous amounts of energy.

The Joint Propulsion Conference in 2008 thought that it would be improbable that humans would ever travel beyond the Solar System.

In the film "Interstellar", humans go far beyond the Solar System. Jan said that Kip Thorne was the scientific consultant on the film to help make the depictions of wormholes, black holes and relativity as accurate as possible. If wormholes are possible then a great deal of energy would be required to keep it open for any length of time. A Black Hole would be a one-way trip but in the film when one is encountered in the film, the Visual Effects team took a great deal of trouble to depict it as accurately as we understand it to date.

NASA has a website https://www.nasa.gov/topics/technology/features/star_trek.html that looks at the soft science fiction in Star Trek. It is well worth a visit.

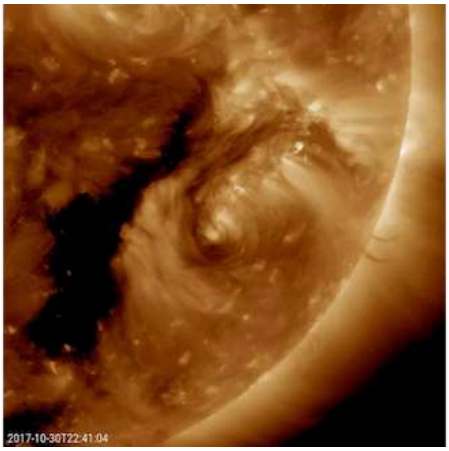
We looked briefly at robotics and we were told that Martin Rees the Astronomer Royal said recently that future space missions would be by Artificial Intelligence.

Jan ended his talk by saying he watches and reads a lot of science fiction and has always thoroughly enjoyed it but just hoped he hasn't spoilt it for anyone else.

Snippets from the World of Science
John Wayte

Our Sun

A NASA spacecraft watching the Sun has captured a rare view of a true space oddity; something scientists call "an Encircling Filament" near a "hole" on the surface of Earth's parent star.



Encircling Filament adjacent to a hole on the surface of the Sun

NASA officials wrote in an image description, “Only a handful of times have we seen one shaped like a circle. The black area to the left of the brighter active region is a coronal hole, a magnetically open region of the Sun”

Solar filaments are vast clouds of charged particles that hover over the Sun’s surface and are tethered in place by invisible magnetic fields.

Normally, these filaments appear as elongated, ropy strands across the star’s surface, so the circular formation spotted by NASA’s Space Dynamic Observatory caught scientists’ attention. “While it may have no scientific value, it is noteworthy because of its rarity” said NASA officials.

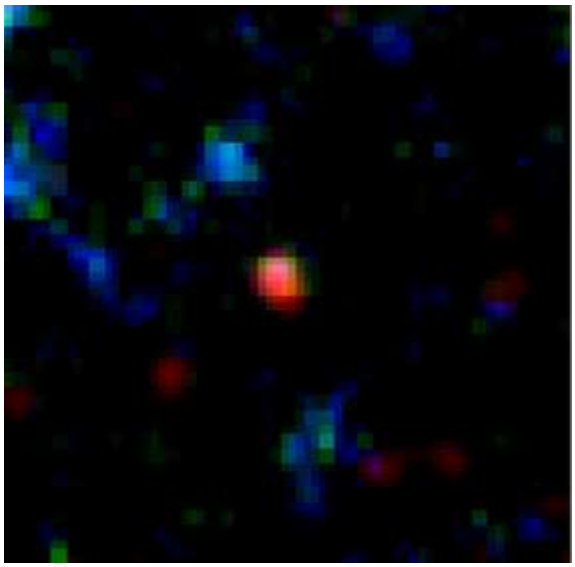
This photograph was taken by NASA’s $850 million SDO launched in 2010. It stares unblinkingly at the Sun to record weather across many wavelengths and thus helps scientists study and track solar weather events.

To see what the Sun is doing now, go to the NASA’s SDO website: https://sdo.gsfc.nasa.gov/

Herschel discovers a galaxy merger in the very early Universe (hot off the press just 2 days before the meeting)

What seemed at first like a rare instance of a huge ancient galaxy revealed itself to be an even rarer pair of extremely massive early galaxies seen on the brink of merging when the Universe was only a billion years old.

Herschel Space Observatory, 2009 to 2013, was a large Infrared telescope.



Having scrutinised several hundred thousand galaxies, this image was the original image that had been found using follow-up data from Herschel’s earlier stored observations.

Further observations from ALMA, the Atacama Large Millimetre/sub-millimetre Array in Chile’s Andes Mountains discovered that this red blob was in fact two massive galaxies merging after only a billion years after the Big Bang.

These two galaxies are only about 30,000 light years apart and they are expected to merge in the next few hundred million years or so.

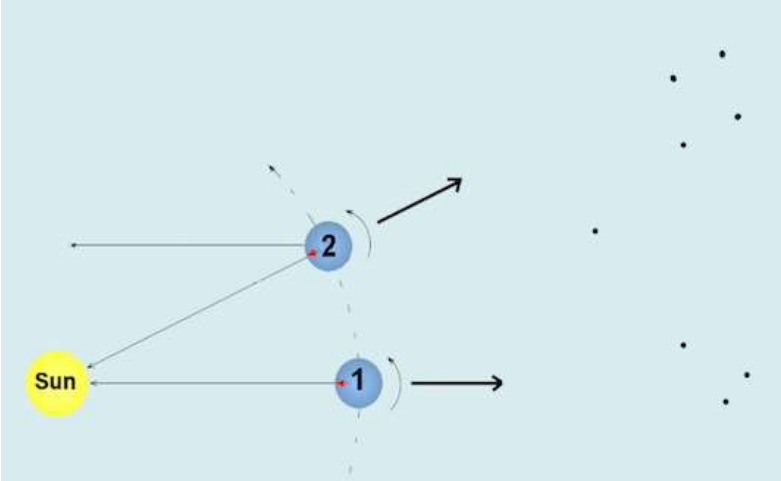
But don’t forget that this has already happened but we don’t know about it yet…!

Oh, and by the way, these two galaxies have been called the Horse and the Dragon.

Continuing the new GSCE course material
Brian Mills FRAS

Brian continued his bi-monthly talks covering material for the new GCSE Astronomy Course. This month his subject is Celestial Observation.

We very briefly looked at why the stars appear to move to the west progressively each night.



Every 24 hours the Earth moves just under a degree in its orbit around the Sun.

So, each night the stars will appear to have moved to the west

Celestial observations include the Sun, the Moon, the planets and stars. Brian next looked at nebulae, clusters and galaxies.

He explained that Messier in the eighteenth century was searching for comets and because he kept coming across known objects he catalogued them to save time. The first object he listed was the Crab Nebula, which he labelled M1. The Orion Nebula became M42 and so on. We were shown a number of other objects.

M1 The Crab Nebula

M42 The Orion Nebula

The Horse Head Nebula close to the left had star of Orion's Belt

M57 The Ring Nebula in Lyra

M13 - an example of a cluster

M101 - an example of a galaxy

Next, we looked at Transients. The first was meteors. As an example, Brian used a composite image of last year's Perseid Shower.

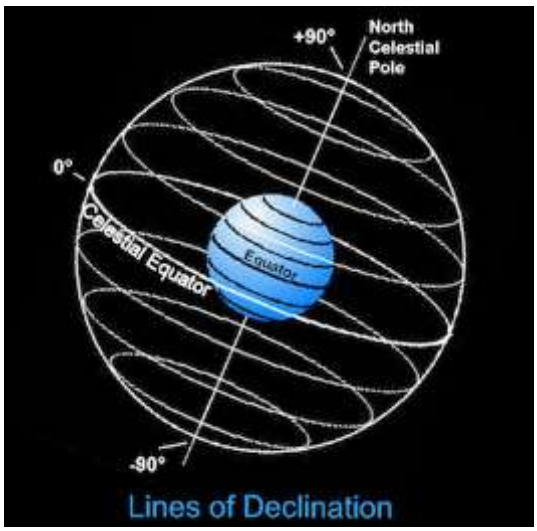
The Perseid Meteor Shower showing the radiant point

He explained that the position from which the meteors appear to radiate gives the name to the meteor shower. From this, random meteors passing through can be identified because they do not appear to come from this point.

Other Transient features are Supernovae (when a star explodes) and Aurorae, which are the result of particles in the Solar wind reacting with the Earth's magnetosphere. The Aurora are seen mainly at the poles.

Finally, Brian used the Celestial Sphere to show how points in the sky can be identified by imagining them as if seen from the centre of the Earth and remembering that the Earth has a tilt of 23.5 degrees to the plane of its orbit around the Sun.

Declination is similar to Latitude on the surface of the Earth and is measured in degrees from the Celestial Equator to +90° at the north celestial pole and -90° at the south celestial pole. The Celestial Equator is the same as the Earth's equator projected out into space.



The equivalent of the Earth's Longitude is Right Ascension and is divided into 24 hours and subdivided into minutes and seconds.

The start point is the point where the Celestial Equator crosses the Ecliptic going north, known as the ascending node. The Ecliptic is the plane that the Earth is on during its orbit around the Sun. This starting point is known as the First Point of Aries, but owing to precession, the 26,000-year rotation of the Earth's axis, this point has moved into Pisces. This point is known as the Spring Equinox and occurs close to the 20th of March each year.

Brian finished by talking more about Precession, saying that today we regard Polaris as being close to the North Celestial Pole but over a period of 26,000 years the location will change, such that Polaris will again become the north celestial pole again.

DECEMBER MEETING

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

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

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

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

21 March 2018 – A welcome return from William Joyce whose subject his time is "Asteroids & Comets"

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

SKY NOTES FOR DECEMBER 2017

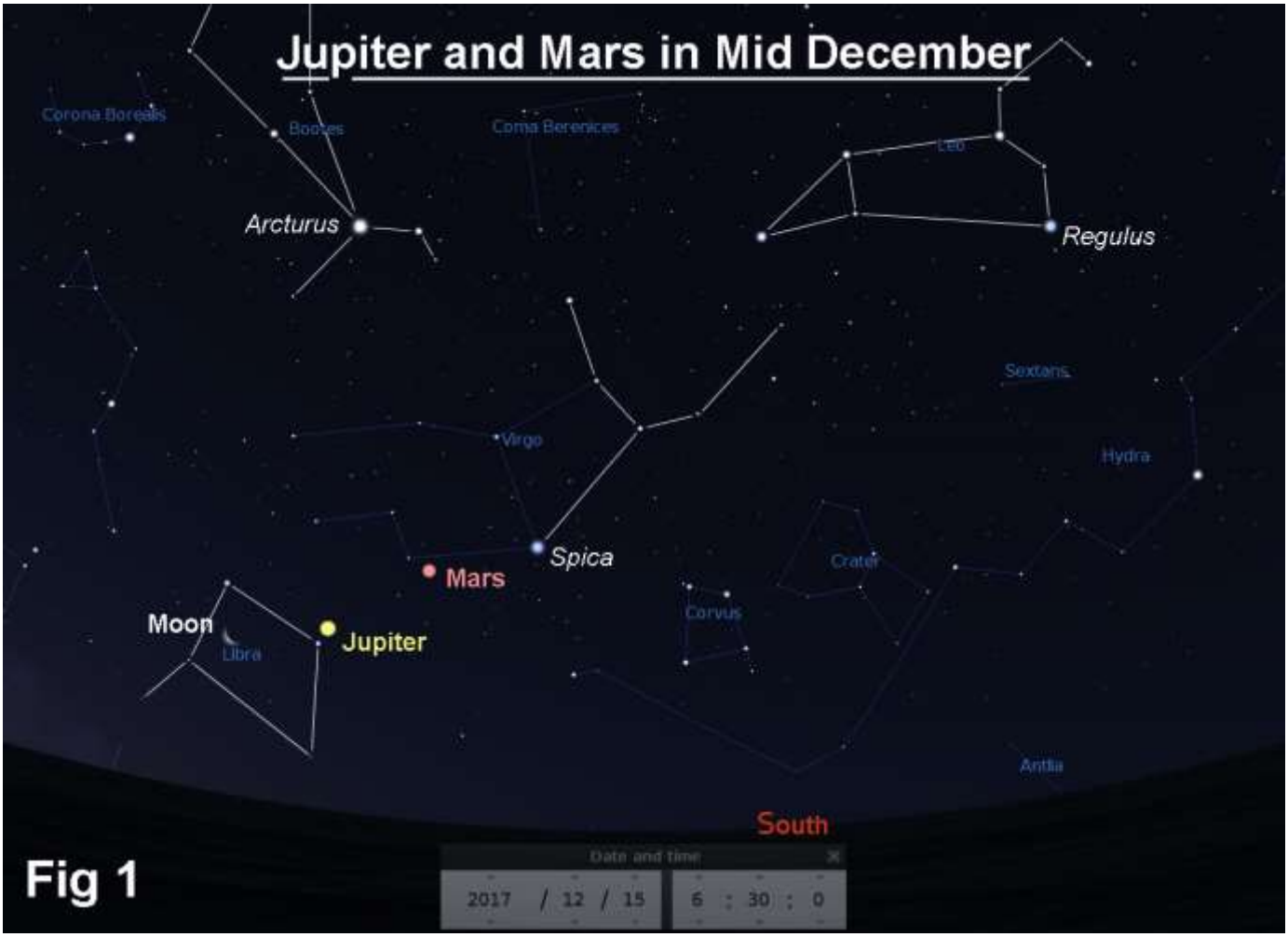
Planets

Mercury was at greatest eastern elongation on November 24th, so it is now moving back towards the Sun. On the first of December it is 6° above the south western horizon at sunset, setting just an hour after the Sun. It moves swiftly into the solar glare and reaches inferior conjunction on December 13th after which it appears in the morning skies once more. On the last day of the year Mercury rises 1¾ hours ahead of the Sun and will be 12° high in the south east at the moment of sunrise. It arrives at greatest western elongation on January 1st.

Venus is still a brilliant morning object but is extremely low in the south east and even allowing for its extreme brilliance (-3.9) will be difficult to locate because of its proximity to the Sun. It reaches superior conjunction on January 9th. It then moves into the evening sky.

Earth reaches the winter solstice on December 21st at 16.28 GMT. At that point the Sun will have reached its lowest point below the celestial equator giving us the shortest period of daylight.

Mars continues its easterly journey and on the 21st moves across the border from Virgo into Libra. Fig 1 shows the position of the red planet in the middle of the month when it lies between Jupiter and the bright star Spica. The planet is very gradually increasing in both brightness and apparent size as it approaches opposition in July 2018. It passes 0.2° south of Jupiter in early January.



Jupiter is also a morning object and shown in Fig 1 as it lies within the boundaries of Libra. At the beginning of the month it rises at 05.00 which is more than two hours before the Sun. The gas giant moves steadily eastwards passing close to the star α2 Librae whose full name is Zubenelgenubi on Christmas Eve. During December the planet brightens slightly from -1.7 to -1.8 whilst its angular diameter grows from 31 to 33 arc seconds.
Saturn is now too close to the Sun for observation, passing through solar conjunction on December 21st. It is likely to be mid to late February before the planet can be easily identified in the morning skies and mid June before it is seen as an evening object once again.

Lunar Occultations
In the table below I've listed events for stars down to magnitude 7.0 that mostly occur before midnight although there are many others that are either of fainter stars or occur at more unsociable hours. DD = **d**isappearance at the **d**ark limb. RD = **r**eappearance at the **d**ark limb. The column headed "mm" (millimetres) shows the minimum aperture telescope required for each event. Once again the Hyades are visited by the Moon bringing about a large number of occultations which includes one of the bright star Aldebaran. See figs 2 and 3.
Times are in GMT.

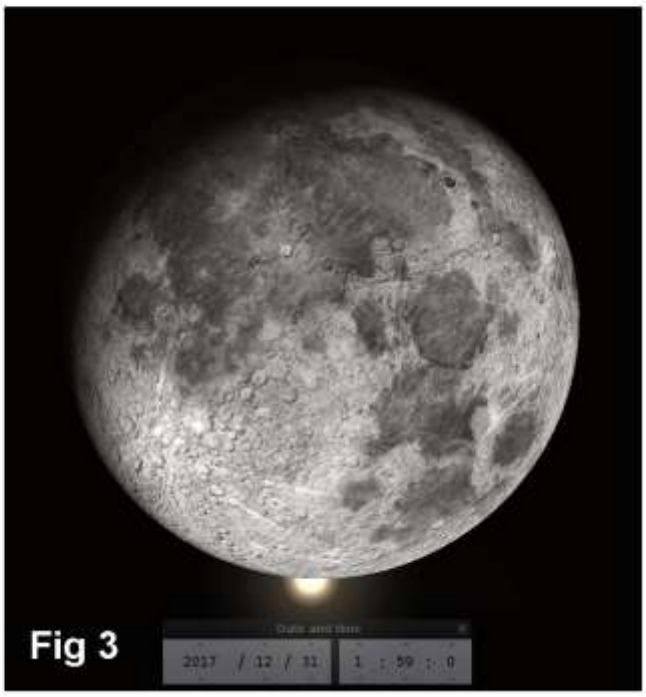
Dec.	Time	Star	Mag	Phase	Altitude °	% illumination	mm
6th	22.58	ZC 1241	6.5	RD	30	84	80
23rd	18.48	ZC 3268	5.3	DD	17	25	40
28th	19.22	ZC 364	4.3	DD	47	74	40
29th	19.07	ZC 491	6.0	DD	46	84	60

29th	20.54	ZC 498	6.3	DD	52	85	70
29th	23.04	ZC 508	4.1	DD	44	85	40
30th	17.05	ZC 635	3.7	DD	25	92	40
30th	19.56	ZC 659	6.6	DD	48	92	80
30th	21.20	ZC 667	5.0	DD	55	93	40
30th	21.44	ZC 672	6.7	DD	55	93	90
31st	**01.14**	**Aldebaran**	**0.9**	**DD**	**38**	**93**	**40**
31st	**01.59**	**Aldebaran**	**0.9**	**RB**	**31**	**93**	**40**
31st	20.03	ZC 823	6.7	DD	44	97	100
31st	21.25	ZC 832	4.3	DD	53	98	40
31st	22.07	ZC 836	5.7	DD	56	98	60

Aldebaran Occultation - December 31st 2017

Disappearance

Reappearance



Phases of the Moon for December

Full	Last ¼	New	First ¼
3rd	10th	18th	26th

ISS

Below are details for the evening passes of the International Space Station (ISS) this month where its brightness is in excess of -2.0. The details of other passes, including those visible between midnight and dawn, can be found at www.heavens-above.com. Please remember that the times and directions shown below are for when the ISS is at it's ***maximum*** elevation, so you should go out and look at least five minutes beforehand. **Times are in GMT.**

Dec.	Time	Mag.	Alt°	Az.		Dec.	Time	Mag.	Alt°	Az.
1st	17:52:53	-3.1	40°	SSE		7th	17:28:55	-3.9	79°	N
2nd	17:00:49	-2.4	27°	SSE		8th	16:36:38	-3.8	87°	N
2nd	18:35:48	-2.2	35°	WSW		8th	18:12:51	-3.6	71°	W
3rd	17:44:52	-3.7	64°	SSE		9th	17:20:53	-3.9	80°	N
4th	16:52:44	-3.1	45°	SSE		10th	18:05:04	-3.7	66°	SSW
4th	18:28:12	-2.7	44°	W		11th	17:12:48	-3.8	84°	SSW
5th	17:36:54	-3.9	89°	SSE		12th	17:56:51	-2.7	41°	SSW
6th	16:44:40	-3.7	71°	SSE		13th	17:04:36	-3.3	59°	SSW
6th	18:20:31	-3.1	53°	WNW		15th	16:56:16	-2.2	36°	SSW

Iridium Flares

The flares that I've listed are magnitude -2.5 or brighter although there are a lot more that are fainter or occur after midnight. If you wish to see a complete list, or obtain timings for somewhere other than Wadhurst, go to www.heavens-above.com . When one of these events is due, it is sometimes possible to see the satellite before and after the "flare" although, of course, it will be much fainter then. **Times are in GMT.**

Dec.	Time	Mag	Alt°	Az.°		Dec.	Time	Mag	Alt°	Az.°
4th	17.12	-4.4	28°	191° (S)		16th	17.53	-7.3	31°	172° (S)
7th	17.03	-6.6	24°	198° (SSW)		17th	17.11	-5.5	19°	290° (WNW)
8th	18.23	-3.1	33°	153° (SSE)		18th	16.56	-6.2	22°	287° (WNW)
12th	16.51	-2.7	19°	207° (SSW)		20th	16.35	-5.4	26°	283° (WNW)
14th	17.56	-2.9	10°	299° (WNW)		20th	17.38	-4.3	30°	180° (S)
15th	16.52	-5.2	13°	216° (SW)		29th	17.11	-3.2	22°	201° (SSW)
15th	17.41	-4.9	13°	296° (WNW)		31st	18.25	-7.2	33°	160° (SSE)

Meteors

The Geminids, one of the few showers that don't originate from a comet, are the year's most prolific shower with a zenithal hourly rate (ZHR) of over 100. Activity lasts from December 8th to the 17th with maximum taking place on December 14th at 02.00 so it is best to look during the late evening of the 13th and into the early hours of the following morning. The meteors travel comparatively slowly at approximately half the speed of the August Perseids. A 14% waning crescent Moon in Libra will rise at 03.30 but will cause little interference. Fig 4 shows the location of the radiant.

The Ursids are active from December 17th to 25th and reach maximum activity on the night of December 22nd/23rd when up to 10 events per hour can be expected given ideal conditions. There will be no interference from the crescent Moon as it sets around 20.00 on that night. See fig 5 for the location of the radiant.

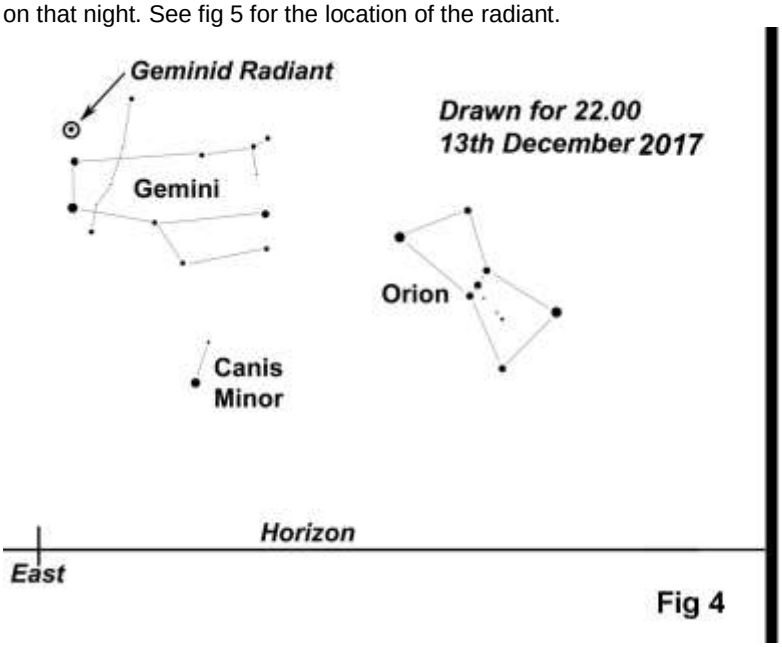


Fig 4

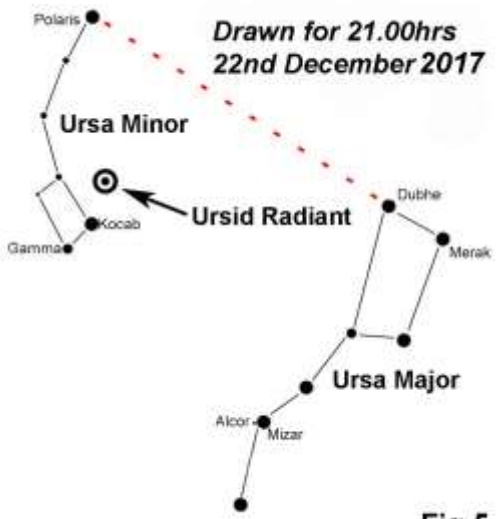


Fig 5

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

In the east we see that Leo and the head of Hydra have now risen. Above the water snake's head lie the faint and indistinct stars of Cancer. Of course Cancer contains one of the best known open clusters, the Beehive or Praesepe designated M44 by Messier when he compiled his catalogue of fuzzy objects to avoid when searching for comets. When Galileo observed the cluster he noted forty stars with his new telescope, though today we know of at least one thousand group members. The cluster is 95 arc seconds across meaning it is three times the size of the full Moon, although it is quite diffuse. The other open cluster in the Crab is M67, considerably fainter than the Beehive being only magnitude 6.9, which places it a little below naked eye visibility.

At this time of the year the skies to the south are dominated by the Hunter and the variety of constellations that surround him. Generally we think of these as being two dogs (Canis Major and Canis Minor) a bull (Taurus) and the twins (Gemini). However, he is also flanked by a hare (Lepus) a unicorn (Monoceros) and to add a little variety, the river (Eridanus). You could be forgiven for thinking that with Beta Eridani being in such close proximity to Rigel, it must be a member of Orion, but this is not the case as the boundary passes between the two. Eridanus is the sixth largest constellation by area and winds its way from the foot of Orion to within 15° of the Small Magellanic Cloud.

Monoceros though has far more in the way of bright objects to recommend it. It is home to M50, NGC 2232 and NGC 2244 all of which are open clusters. The Christmas Tree is another such cluster with an aggregate magnitude of 3.8 which suggests it should be a moderately easy naked eye object.

The bright star Capella lies fifteen degrees from the zenith whilst below it only Taurus from Orion's more popular retinue has reached the meridian.

Towards the west we see that Aquarius is on the horizon although Andromeda points towards the zenith and M31 is still more than 50° in altitude. At magnitude 3.4 it is a naked eye object but photography really brings out the best in it. It is an excellent target for the DSLR user who takes numerous exposures and then stacks them. You will also be able to record two of M31's satellite galaxies - M32 and M110. Also in Andromeda at magnitude 5.7 is a large open cluster NGC 752 which has around sixty members.

Not too far from the Andromeda spiral lies M33, known as the Triangulum or Pinwheel galaxy, which is a spiral that is face on to Earth but much more difficult to detect due to its low surface brightness.

In the north Vega is close to the horizon and will set briefly from the south of England, though its fainter companion from the Summer Triangle, Deneb, is circumpolar from there. Ursa Major is once more climbing away from the horizon whilst on the opposite side of the north celestial pole Cepheus, that lies partly within the Milky Way, is descending. Cepheus contains IC 1396, an emission nebula that is said to be visible to the naked eye when conditions are exceptional. It is also home to Mu Cephei, more popularly known as the Garnet Star due to it having a deep orange hue.

Advance warning for 2018

May 9th – Jupiter at opposition
June 28th – Saturn at opposition
July 27th – Mars at perihelic opposition
July 27th – Total lunar eclipse
August 13th - Very favourable Perseid maximum

Brian Mills

WADHURST ASTRONOMICAL SOCIETY OUTREACH EVENTS

On Wednesday 22nd November Brian Mills visited Colliers Green C of E Primary School and spoke to them about basic astronomy. Phil Berry should also have been present but unfortunately he was unwell. The children in class 4 had already been studying space during lessons and were allowed to quiz Brian on any astronomical subject of their choosing after the main talk.

On Friday 24th November Brian hosted one of the science groups from the Tonbridge U3A. The evening began with a talk covering most aspects of general astronomy with some time for questions and answers. Then, following a visit to the observatory to observe the Moon and M31, there was a period of constellation recognition. Lastly, with a return inside to the warm, members were given a short presentation on types of telescopes.

SPACEPLACE - NASA

Studying Storms from the Sky
Teagan Wall

The United States had a rough hurricane season this year. Scientists collect information before and during hurricanes to understand the storms and help people stay safe. However, collecting information during a violent storm is very difficult.

Hurricanes are constantly changing. This means that we need a lot of really precise data about the storm. It's pretty hard to learn about hurricanes while inside the storm, and instruments on the ground can be broken by high winds and flooding. One solution is to study hurricanes from above. NASA and NOAA can use satellites to keep an eye on storms that are difficult to study on the ground.

In Puerto Rico, Hurricane Maria was so strong that it knocked out radar before it even hit land. Radar can be used to predict a storm's path and intensity—and without radar, it is difficult to tell how intense a storm will be. Luckily, scientists were able to use information from a weather satellite called GOES-16, short for Geostationary Operational Environmental Satellite – 16.

The "G" in GOES-16 stands for geostationary. This means that the satellite is always above the same place on the Earth, so during Hurricane Maria, it never lost sight of the storm. GOES-16's job as a weather satellite hasn't officially started yet, but it was collecting information and was able to help.

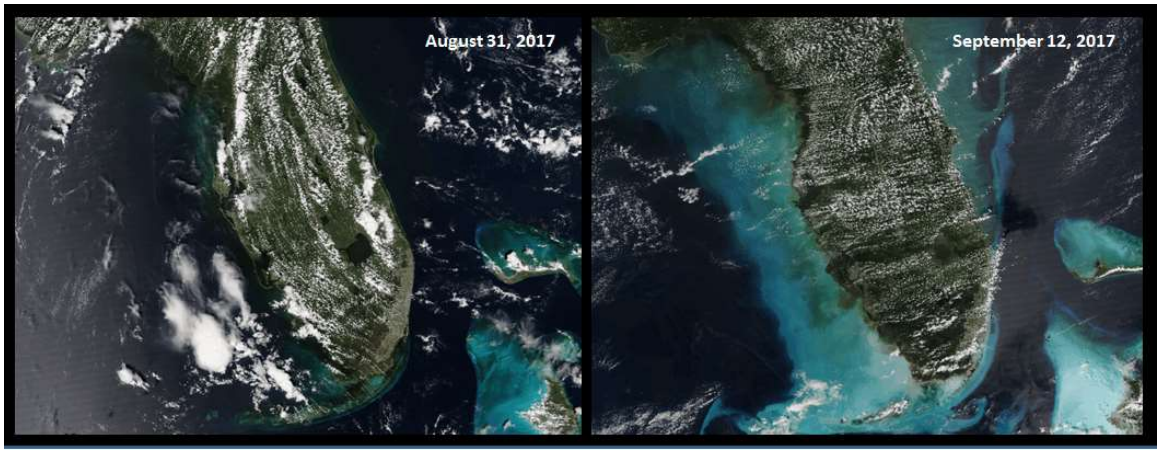
From 22,000 miles above Earth, GOES-16 watched Hurricane Maria, and kept scientists on the ground up to date. Knowing where a storm is—and what it's doing—can help keep people safe, and get help to the people that need it.

Hurricanes can also have a huge impact on the environment—even after they're gone. To learn about how Hurricane Irma affected the Florida coast, scientists used images from an environmental satellite called Suomi National Polar-orbiting Partnership, or Suomi-NPP. One of the instruments on this satellite, called VIIRS (Visible Infrared Imaging Radiometer Suite), took pictures of Florida before and after the Hurricane.

Hurricane Irma was so big and powerful, that it moved massive amounts of dirt, water and pollution. The information captured by VIIRS can tell scientists how and where these particles are moving in the water. This can help with recovery efforts, and help us design better ways to prepare for hurricanes in the future.

By using satellites like GOES-16 and Suomi-NPP to observe severe storms, researchers and experts stay up to date in a safe and fast way. The more we know about hurricanes, the more effectively we can protect people and the environment from them in the future.

To learn more about hurricanes, check out NASA Space Place: https://spaceplace.nasa.gov/hurricanes/



Caption: These images of Florida and the Bahamas were captured by a satellite called Suomi-NPP. The image on the left was taken before Hurricane Irma and the image on the right was taken after the hurricane. The light colour along the coast is dirt, sand and garbage brought up by the storm. Image credit: NASA/NOAA

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