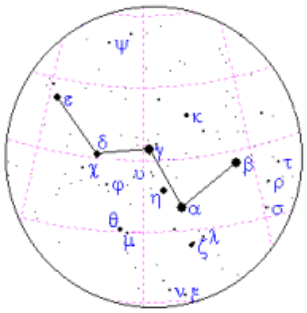


Wadhurst Astronomical Society Newsletter May 2017

MEETINGS

APRIL MEETING

Our April meeting was opened by Phil Berry who said that the library consists of a number of books covering most aspects of astronomy. It also has some new additions and any can be borrowed by members. There is a review of one example later in the newsletter.

Phil went on to say that Brian Mills has been in touch with Herstmonceux and is trying to arrange an evening visit to the Space Geodesy Facility there.

The NERC (National Environment Research Council) say that the facility operates multiple observational techniques to make a major contribution to the formation of a highly-precise global geodetic reference frame and to support satellite missions that study the dynamic Earth.

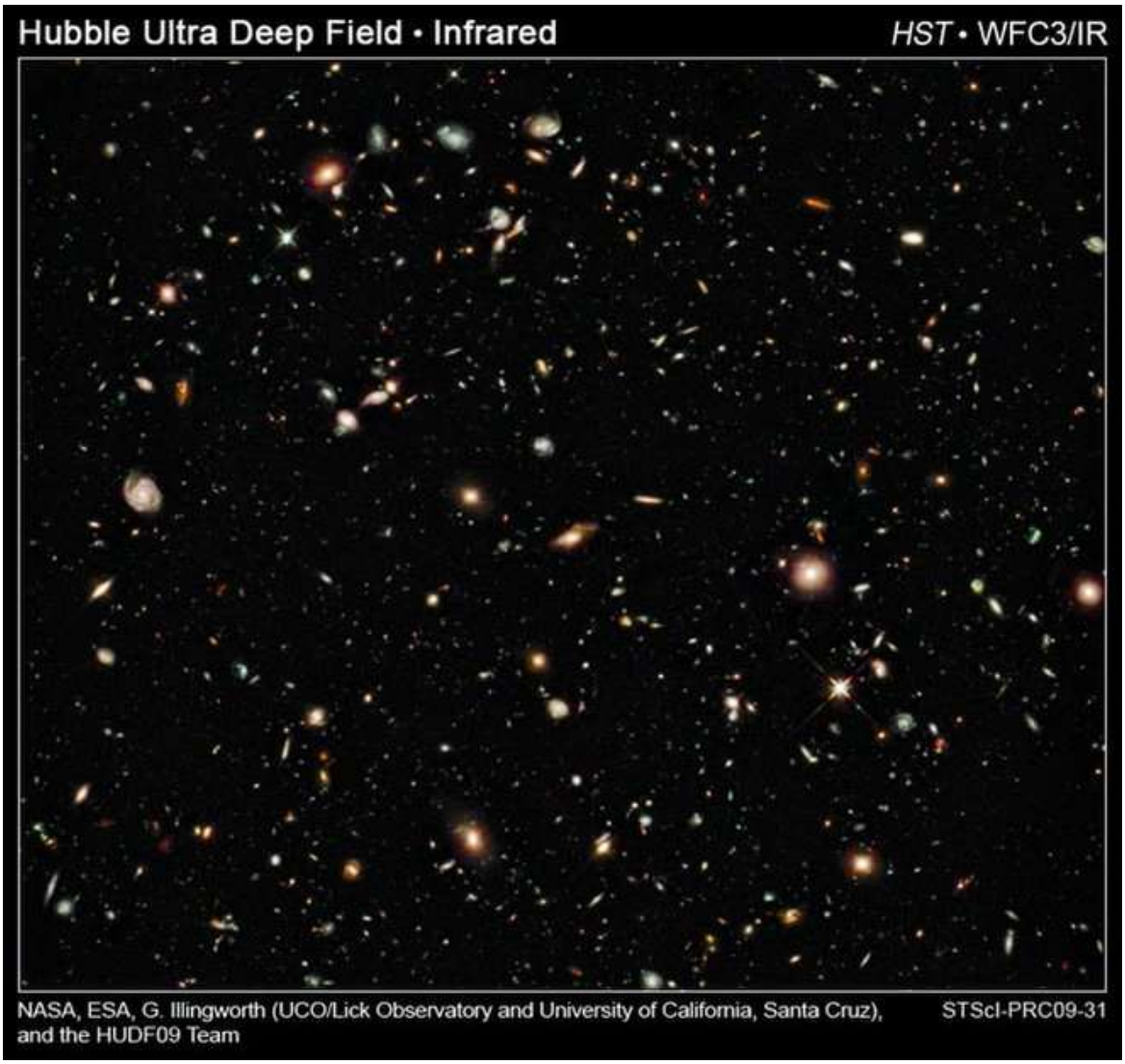
The visit would be arranged for this summer between the 2nd and 14th of August This year.

In a show of hands, there were 20 present supporting the visit which would replace a visit to the Royal Astronomical Society library which would now probably take place next year.

Phil then introduced the evening's speaker, William Joyce on a welcome return visit. William lectures in astronomy, astro-physics and planetary science and as well as a communicator, is also an avid observer. He has a BSc in physics and astronomy; a BSc in Earth and Planetary Science; is a Fellow of the Royal Astronomical Society and is currently studying for a PhD in Lunar Remote Sensing Science.

Interacting and Active Galaxies
William Joyce FRAS

We were shown deep sky images taken in the 50s showing distant faint galaxies as 'hairy blobs' taken by the 200-inch Mount Palomar telescope. This was then compared with an image taken by the Hubble Ultra Deep Field camera.



Ultra-Deep Field Image – NASA Hubble

William explained that this image was of only a thirteen-millionth part of the sky! He said there are just four stars in the image; the rest are galaxies.

There are three main types of galaxies; Elliptical (about 13%) and can contain up to 10^{13} stars, Spiral (about 33%) and Irregular galaxies (about 54%), each containing hundreds of billions of stars. These percentages apply just to our local group of galaxies, but this may be different the more distant they are.

We were told that many of the galaxies have arms like ours, although we may be seeing them edge on. There are Ring Galaxies with stars orbiting the disk and other galaxies that are interacting with each other when they are either close together or passing through each other. William said in fact Canis Major Dwarf galaxy has been discovered passing through our galaxy only 25 light years from Earth.

We were shown an image of two interacting galaxies, NGC 4038 and 4039, 60 million light years away.

Antennae Galaxies - NASA

William said that only very rarely do stars collide but the effect of the passing large gas clouds can trigger star formation.

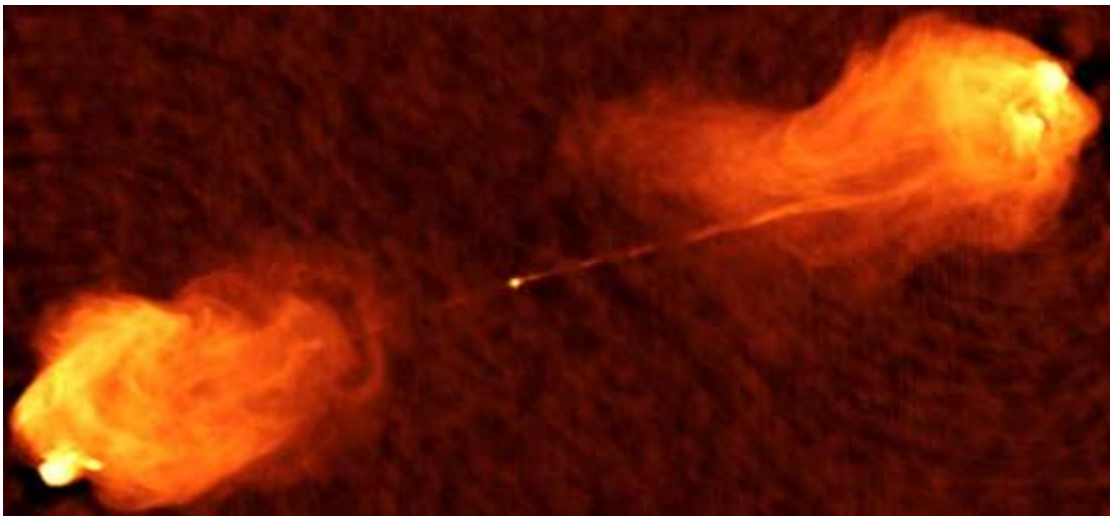
Another image we were shown was of two galaxies having passed through each other were being attracted back together again and will probably continue to swing until they eventually merge to form one galaxy.

Our own galaxy and the Andromeda Galaxy are approaching each other and William said that they will pass through each other in about 3.6 billion years-time, then approach each other again and eventually merge to form a much larger galaxy. There is a video computer simulation of the collision that can be seen on YouTube called 'Milky Way's Head on Collision' by NASA.

We were told about another active galaxy called a Starburst Galaxy where it is thought a nearby interacting galaxy is causing intense star formation far faster than in our galaxy, with many more supernovae being created seen in infra-red and x-ray wavelengths, so that there must be a great deal of activity being powered.

The next class of galaxy William talked about was the Seyfert Galaxy which in normal light looks very similar to a normal spiral galaxy but has a very intense central core that cannot be accounted for by the number of stars. Many of these galaxies are also strong radio sources, and we were told that something is going on at the centre.

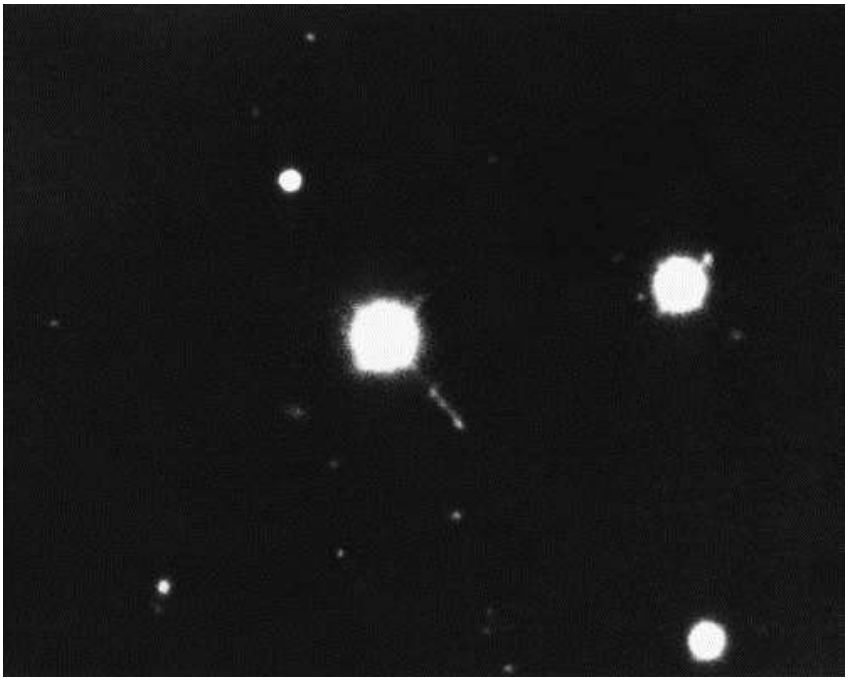
We talked next about Radio Galaxies. These are galaxies that have powerful radio emissions but the radio source is not the centre of the galaxy but is detected in lobes or jets on either side.



Cygnus A was the first indication that some galaxies radiate in radio wavelengths
The galaxy is in the centre and visible in normal light - NASA

Quasars were the next on William's list.

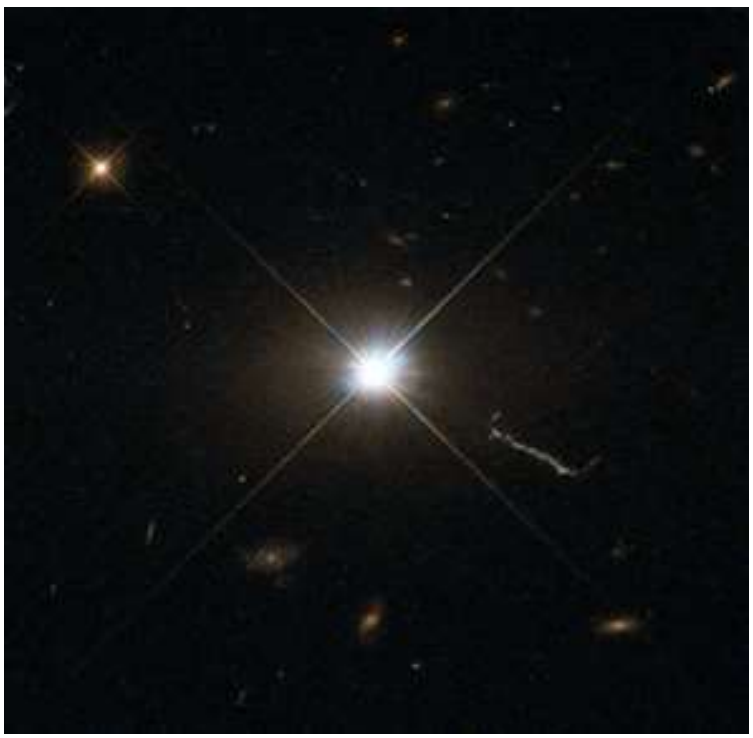
The first was discovered as a radio source in 1963 in Virgo but only the faintest star-like object could be found in visible light at that position and it also seemed to have a jet coming from one side.



This is the first image of a Quasar (Quasi-Stellar Object) and taken at Kitt Peak observatory in 1963.
3C 273 – Credit NOAO/AURA/NSF

The object, 3C 273 was found to have an enormous red shift corresponding to a distance of about 2 billion light years away. William reminded us that absolute magnitude is calculated as though an object is 32 light years away and if 2C 273 was that far away, it would be about as bright as the Sun making it an extremely bright object.

By masking out the central source, a faint galaxy surrounding it can just be seen indicating this energy is coming from its nucleus. The jet can be seen in this Hubble image. We were told that this jet appears to us to be moving away from the nucleus faster than the speed of light.



2C 273 taken by the Hubble Space Telescope - NASA

More recently discovered Quasars also have a jet appearing to be travelling even faster away from its nucleus. William explained how the angle at which we see the jet is causing an optical illusion and in fact the jet is travelling just less than the speed of light. He also said that we see objects that have travelled billions of light years but in that time, the Universe has expanded even more and they will be even further away now.

Also, since Quasars are only seen at such great distances, this suggests they are part of a younger universe.

Finally, William moved on the Blazars. We were told that these appear very similar to Quasars but their spectrum has no lines that could be used to measure red shift.

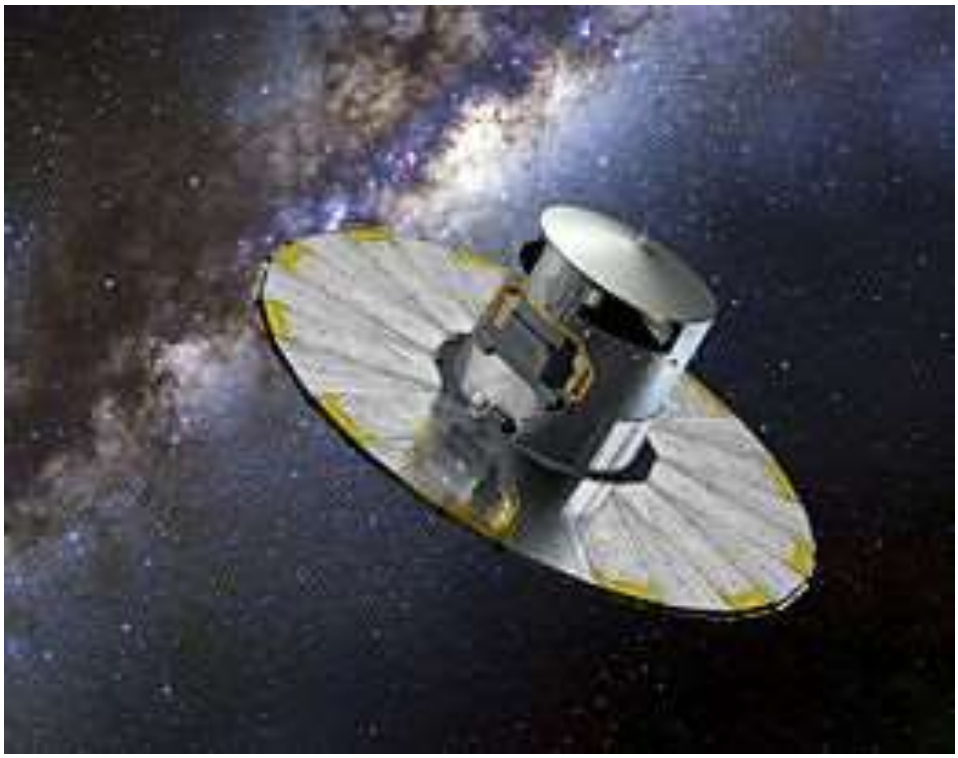
Looking back generally at Active Galaxies, Hubble has shown that there is an accretion disk surrounding a super-massive black hole. If the orientation is suitable it is possible to see a jet coming out of the nucleus in both directions.

William described the particles in the actual jets as synchrotron radiation, giving no spectral lines. Also, the radiation will be in the direction of the jet's travel. This is why many active galaxies are seen with only one jet coming towards the Earth.

To end William summarised by saying a lot is now understood but still there is plenty more to find out such as why are the jets so narrow.

Snippets from the World of Science
John Wayte

This month John gave an update of his talk on the ESA GAIA Mission.



An artists impression of the GAIA satellite - NASA

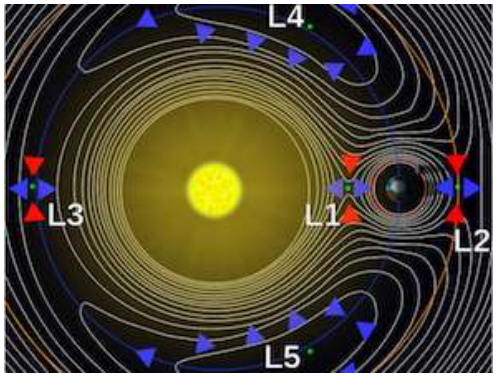
GAIA will map I billion stars in 3D, which is about 1% of our Milky Way stars. Its accuracy will be about 40 times as great as the Hipparchus mission and 40 million measurements will be taken each day.

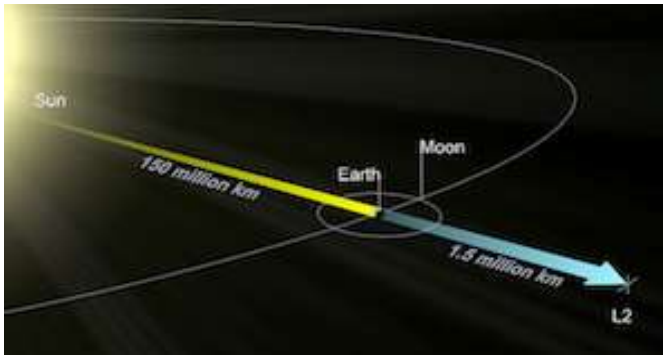
The CCD array measures half a square meter and contains a billion pixels. During its planned life of 5 years it will scan each star 70 times. It has two primary mirrors, each one approximately 1.5 x 0.5 meters in size. The angle between these two mirrors is 106.5 degrees. This angle must be known to pico-metre accuracy. A human hair is about 10 pico-metres wide. Or to put another way it is the thickness of a pound coin when placed on the Moon and viewed from the Earth.

It is expected to discover up to 8 extragalactic supernovae every day. GAIA will observe about half-a-million asteroids, including potentially hazardous near-Earth objects. It will also find hundreds of Kuiper Belt objects. It is hoped to find new variable stars, novae and supernovae. It is expected to find up to 30,000 exoplanets, not by transit (light-dipping, as Kepler) nor by radial velocity variations but by Reflex Motions – slight wobbles caused by the gravity swing around a parent sun.

Because of its superior accuracy, GAIA is easily expected to recognise old stellar streams – remains of dwarf galaxies that have been absorbed by our Milky Way. It will deliver several petabytes (1,000 terabytes) of information.

The location of the satellite must be as stable as possible and it was decided that the most appropriate position would be at Lagrange 2 (L2) which is one of the points where gravitation forces balance out. It is 1.5 million km beyond the Earth and in line with the Sun.





This point will be shared with a number of other satellites such as Herschel and the James Webb Space Telescope.

John also showed a clip of a computer representation of how the Milky Way will change over the next 5 million years. The YouTube clip can be found by searching for 'ESA - The next 5 million years of the Milky Way'.

What Observing Can I Do?
Brian Mills FRAS

Rather than give the Sky Notes this month, which appear later in the newsletter, Brian is talking about objects to observe in the sky, beginning with the Sun.

He began with an important warning not to look at the Sun directly without any filtered optical aid or it may be the last thing you see!

How big a telescope can you use? Brian said almost any size of telescope is suitable. The simplest method is to project the image through a telescope or binoculars and focussing onto a screen behind it using a card surrounding the object lens to look through, making a shadow around the screen.

For direct viewing, a solar filter must be used in front of the object lens such as Mylar or Baader which reduces the light to 1/10,000th of the energy.

Using a Baader Solar Filter

The Herschel Wedge

Another method Brian told us about is the Herschel Wedge. Here a wedge reflects just 4½% of the full spectrum; the rest of the light gets reflected out of the back. Another internal filter reduces the light still further to a safe level. Some versions also have an adjustable polarizing filter.

There are several Solar Telescopes such as the PST (Personal Solar Telescope) and a larger one such as the Coronado Solar Telescope, although they can be expensive but allow the observer to look at the Sun in a very narrow band of the spectrum called Hydrogen Alpha light so that it is possible to see the granulation of the Sun's surface and the detail surrounding sun-spots. By slightly tuning the filter it is possible to see prominences.

The finder cannot be used so Brian said lining up on the Sun is possible by watching the shadow of the scope on the ground behind the telescope for a minimum shape.

Sunspots can be interesting to observe in white light and are really areas where the magnetic field is breaking through the photosphere. These can be seen using a telescope and Solar filter.

There are many different ways of observing the Moon. Occultation observing is something the Society has done as a group. This is where a star is accurately timed at the instant the dark side of the Moon passes in front of it. Also, in a waning Moon, the instant the star reappears is recorded, although as Brian said, this is much more difficult to anticipate. A grazing occultation allows observations of the star as it passes behind mountains on the limb of the Moon from several positions at right angle to the path of the Moon and at the same time. These timings are used by reporting centres to refine the position and tilt of the Earth and also to predict Baily's Beads during a Solar Eclipse where the Sun momentarily shines between Lunar mountains just before it fully reappears.

Transient Lunar Phenomena (TLPs) are temporary flashes, glows and obscurations observed on the surface of the Moon. Brian said there is still much discussion about what they might be.

General lunar photography is something anyone can participate in.

Mercury can be difficult to observe because of its closeness to the Sun, only being easily observable at elongation when the vertical distance is greatest, but can be seen using a moderate sized telescope.

Venus is larger making it easier to see the phases and in bigger telescopes it might be possible to make out cloud features.

A good observing object is Jupiter with its size and cloud belts. The Galilean moons are interesting to watch as they transit with shadows on the planet's surface that can be observed with a larger telescope.

Saturn is always worth looking at with its ring system and moons, the largest of which is Titan with a magnitude of 8.5 and so is visible in even smallish telescopes.

Uranus and Neptune have little or no surface detail but Uranus, with a magnitude of 5.7 should be visible with the naked eye in really dark skies. Neptune has a magnitude of 7.8 and should be visible in a smallish telescope, but as Brian said, they are both very small.

Asteroids are faint but larger ones can be observed at occultation with the Moon and in the United States, observers have spread themselves out far enough to enable the size and shape of the asteroid to be roughly determined.

A number of amateur astronomers in the USA made occultation measurements of
Asteroid 345 - "Tercidina" to approximate its shape and orbital characteristics

Brian described in some detail how it is possible to estimate the magnitude of a variable star by comparing it with nearby stars with known magnitude. This can often be done with the naked eye, binoculars or a telescope.

Meteors are usually seen in Meteor Showers. The showers are named after the point they appear to radiate from. Below is a list of the better-known showers.

Name	Max. date	ZHR at max.
Quatrantids	Jan. 3rd	80
Eta Aquarids	May 5th/6th	40
Perseids	Aug. 12th	80
Orionids	Oct. 21st - 23rd	25
Leonids	Nov. 17th	20?
Geminids	Dec. 14th	100+
Ursids	Dec. 23rd	10?

Star Cluster, Nebulae and Galaxies usually need a telescope to see them, but even then, they are not like we see them in photographic images because the eye is limited to what it can see whereas the CCD chip sees more in timed exposures.

Brian completed his talk by talking about how faint an object we can see. With the naked eye, we can see down to about magnitude 6.5. The scale is based on magnitude 1 being 100 times brighter than magnitude 6.

3" (80mm)	12.1
4" (100mm)	12.7
5" (125mm)	13.2
6" (150mm)	13.6
8" (200mm)	14.2
10" (250mm)	14.7
12" (320mm)	15.2
14" (400mm)	15.4
16" (400mm)	15.7
20" (500mm)	16.2

Table of limiting magnitude for various telescope sizes

HIGHLIGHTED BOOK OF THE MONTH

The Strangest Man: The hidden Life of Paul Dirac, Quantum Genius

'This is a beautifully written, remarkable biography of a remarkable man. It paints a sensitive portrait of his character, puts into words his science in a way that will capture every reader's attention and memorably conveys Dirac's achievement.' Anyone with a passing interest in physics will be enthralled.
About the Author
Graham Farmelo is a By-Fellow at Churchill College, Cambridge, and an Adjunct Professor of Physics at Northeastern University, Boston, USA. He edited the best-selling "It Must be Beautiful: Great Equations of Modern Science" in 2002. His biography of Paul Dirac, The Strangest Man, won the 2009 Costa Biography Award and the 2010 Los Angeles Times Science Book Prize.

MAY MEETING

17th May – **This meeting will take place in the Drama Studio** – The Science and Astronomy writer Colin Stuart sets out "13 Journeys Through Space and Time: Christmas Lectures From the Royal Institution"

Meetings will take place in the Drama Studio, just to the left inside the gates. 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

21st June – Melanie Davies returns to tell us about "Mission to Mars – Fiction vs Reality"

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

There is no meeting in August.

20th September – Barry Soden recalls NASA's Disasters (and Some Causes).

SKY NOTES FOR MAY 2017

Planets

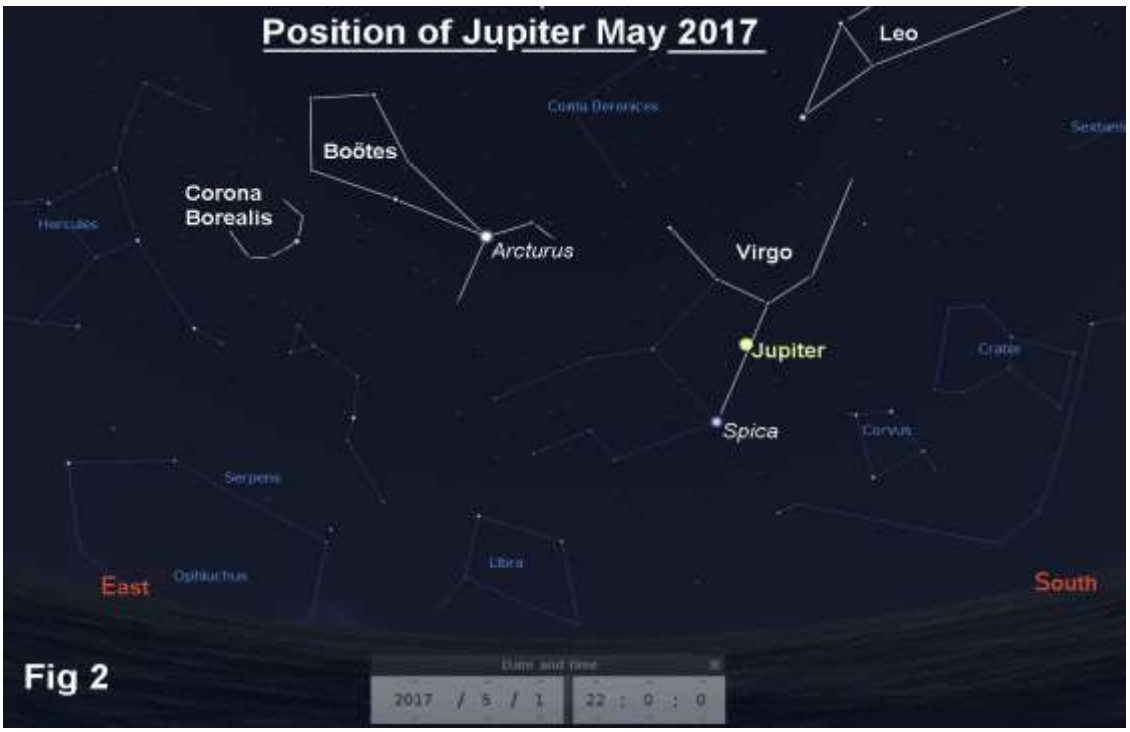
Mercury is a morning object reaching greatest western elongation on May 17th when it will be 26° from the Sun. However, the ecliptic at this time of year in the early mornings makes a very shallow angle with the horizon meaning that despite its large angular separation from the Sun, Mercury rises just thirty five minutes before of sunrise. This will make the planet, at magnitude +0.6, almost impossible to detect in the early morning twilight despite the fact that it is a few degrees north of the celestial equator. Following elongation Mercury moves back towards a superior conjunction on June 21st.

Venus is also a morning object rising 1½ hours before the Sun by the middle of the month. On that date at 04.30 it will lie due east at an altitude of 6° while the Sun is 6° below the horizon. Its apparent distance from the Sun will continue to increase until it reaches elongation within the first few days of June. Venus is also hampered by the low altitude of the ecliptic and even at elongation it only has an altitude of 7° at the end of nautical twilight although its brightness will be its saving grace. Throughout May it shines at magnitude -4.5.

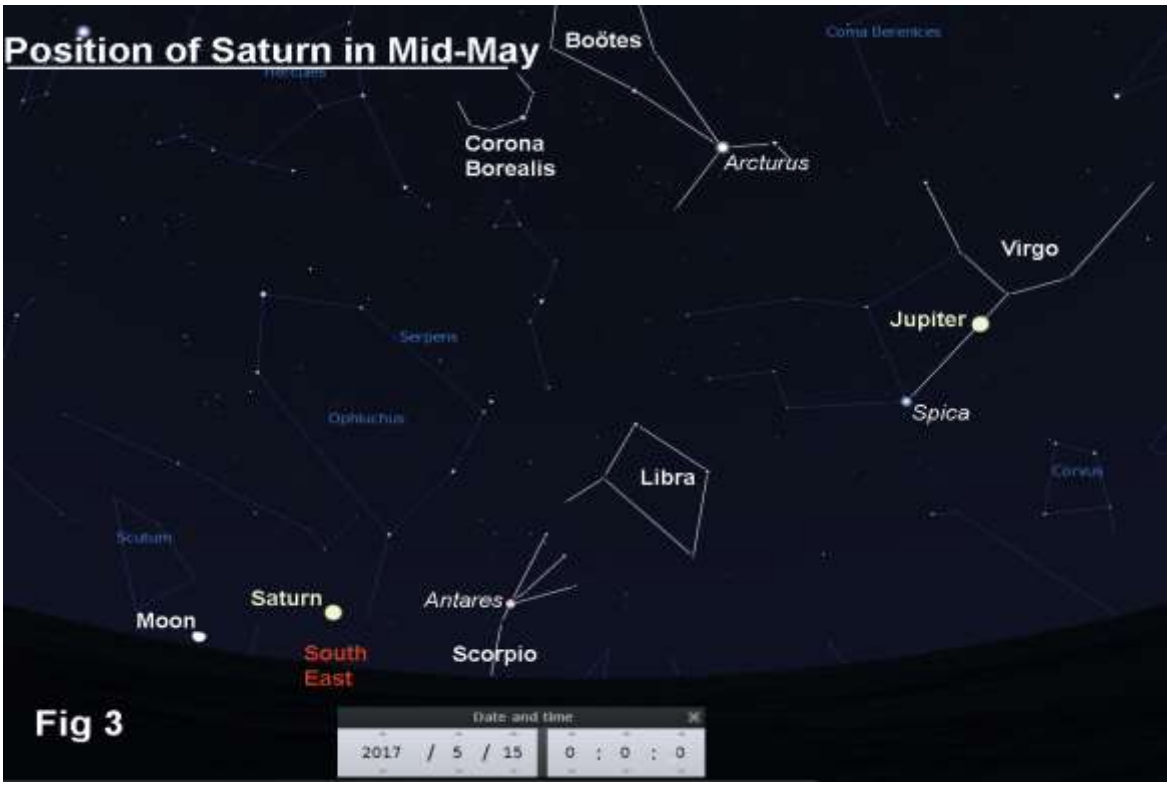
Mars may still be glimpsed in the early part of the month low down in the west. At the start of May it sets at 22.45 and by the end this has slipped a little to 22.30 although the planet is now being lost in the solar glare.

Fig 1 shows its position on May 1st when it is 14° in altitude at the end of civil twilight. The planets brightness falls to +1.7 and its apparent diameter shrinks to just 3.8" (arc seconds) as Mars heads towards a solar conjunction in late July.

Jupiter was at opposition in early April and so is still extremely well placed for observation in the constellation of Virgo where it is still moving retrograde. Due to its proximity to the Earth it is around 42" (arc seconds) in size and shines at magnitude -2.3. The gas giant now rises in daylight and by the middle of the month will be on the meridian at 22.00. Make the most of Jupiter at this opposition because subsequent years will see it culminating lower and lower in the sky until in 2019 it will be just 16° above the horizon though it will appear slightly larger and brighter. After that its altitude begins to recover until in 2024 and 2026 it is riding high at 61°.
Fig 2 shows the location of the planet on the first of the month although its position relative to the stars of Virgo will not change significantly. On the night of May 7th the waxing gibbous Moon passes just north of Jupiter.



Saturn rises just after midnight at the start of the month but by the end this has become 22.00.



The planet grows in size to 18" (arc seconds) and reaches a magnitude of +0.1 as it approaches opposition on June 15th. The ringed planet begins May by moving retrograde (east to west) in Sagittarius, but this motion carries it across the border into neighbouring Ophiuchus on the 18th. Even when at its best Saturn will be low in the sky during this opposition, thanks to a negative declination of -22°. However, in moments of better atmospheric stability it will still be a superb sight with the northern surface of the ring system tilted towards us at more than 26°. Saturn's largest satellite, Titan at magnitude 8.5, is best seen to the west of the planet on the 3rd and 19th and to the east on the 12th and 28th. Fig 3 shows Saturn's position in the middle of the month.

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. **Times are in BST.**

May	Time	Star	Mag	Ph	Alt °	% illum.	mm
3rd	21.21	ZC 1422	6.7	DD	47	58	60
28th	22.05	ZC 1124	6.9	DD	13	13	60

Phases of the Moon for May

First ¼	Full	Last ¼	New
3rd	10th	19th	25th

ISS

Below are details for passes of the International Space Station (ISS) when it is magnitude -2.0 or brighter. The details of all 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 BST.**

May	Time	Mag.	Alt°	Az.		May	Time	Mag.	Alt°	Az.
23rd	23:20:55	-3.6	44°	SSE		28th	22:11:57	-3.9	76°	SSE
24th	22:28:42	-3.0	30°	SSE		28th	23:48:29	-3.8	80°	N
25th	21:36:32	-2.4	20°	SE		29th	22:56:03	-3.7	78°	N
25th	23:12:37	-3.9	69°	SSE		30th	22:03:36	-3.8	85°	N
26th	22:20:18	-3.7	50°	SSE		30th	23:40:09	-3.9	86°	S
26th	23:56:44	-3.8	80°	N		31st	22:47:43	-3.8	82°	N
27th	23:04:20	-3.9	88°	NNW						

Iridium Flares

The flares that I've listed are magnitude -2.0 or brighter although there are a lot more that are fainter or occur after midnight. If you wish to see a complete list, or obtain timings for somewhere other than Wadhurst, go to www.heavens-above.com . When one of these events is due, it is sometimes possible to see the satellite before and after the "flare" although, of course, it will be much fainter then. **Times are in BST.**

May	Time	Mag	Alt°	Az.°		May	Time	Mag.	Alt°	Az.°
2nd	23:10:55	-3.3	11°	22° (NNE)		9th	22:56:26	-6.9	25°	36° (NE)
4th	21:50:30	-7.6	49°	57° (ENE)		9th	23:24:29	-2.9	30°	45° (NE)
5th	23:08:07	-5.8	14°	23° (NNE)		11th	22:51:49	-3.2	25°	34° (NE)
7th	23:03:25	-2.4	17°	28° (NNE)		14th	22:56:34	-3.8	35°	47° (NE)
8th	23:00:14	-2.5	19°	29° (NNE)		15th	21:02:12	-8.4	66°	64° (ENE)
9th	21:29:29	-3.1	55°	60° (ENE)		22nd	22:13:05	-2.7	43°	45° (NE)

Meteors

The Eta Aquarids are visible from April 24th until May 20th and reach maximum on May 5th/6th. This is essentially a southern shower, as the radiant doesn't rise as seen from southern England until 02.00 BST.

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

If you look towards the south you will see Virgo, which currently contains the planet Jupiter, is on the meridian. It is the second largest constellation by area and contains a large number of galaxies, partly because rather appropriately, it is home to the Virgo Cluster of galaxies thought to contain some 1500 members. One of them is M100, which actually lies across the border in Coma Berenices, and was one of those with a spiral form that Lord Rosse observed with the 72 inch "Leviathan of Parsonstown". Coma contains the widely spread cluster Melotte 111 whose 50 members cover more than 7° of sky by area as well as a number of globulars, the brightest of which is M53 at magnitude 7.7. Above Coma we find the small and faint group of stars that make up Canes Venatici occupying the zenith. Within its boundaries lies M3 which is probably the best northern globular after M13 in Hercules.
Turning to the west, Orion and Taurus have disappeared with only Canis Minor, Auriga and Gemini remaining from the bright winter groups that surround the hunter. A little higher in the sky the open cluster M44 is still well placed at an altitude of 35°, whilst its less well known neighbour, M67, can be found mid-way between M44 and the head of Hydra.

Looking north the familiar "W" of Cassiopeia lies on the meridian and as close to the horizon as it can get, meaning that the Plough is at its greatest altitude with its tail wrapped around the zenith. To the west of Cassiopeia is Perseus with the double cluster between them and to the east we find Cepheus, whose shape has often been described as a child's image of a house, and the faint group of stars that make up Lacerta. To find it extend a line from gamma Cas. eastwards through beta Cas. and on until you reach the group of four stars that form the lizard's head as shown in fig 4. Lacerta contains a number of open clusters of 6th magnitude but no bright galaxies or globulars.

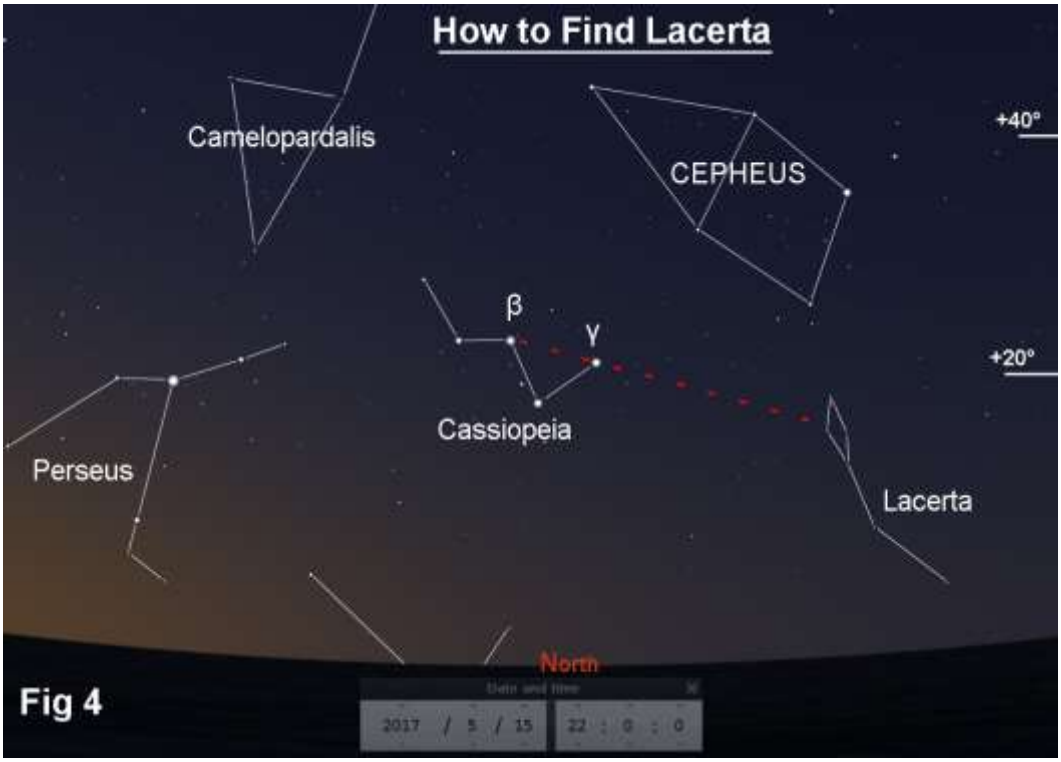


Fig 4

Towards the east, two of the stars that form the Summer Triangle, Deneb and Vega, are becoming obvious with Vega already 30° in altitude. The main body of Ophiuchus has risen containing the globular clusters M10, M12 and M14 all of which are 6th or 7th magnitude. Above the serpent bearer is the rather indistinct shape of Hercules which in simple terms is made up of two irregular quadrilaterals which form the strongman's body. His head is represented by the star Rasalgethi (Hercules is drawn upside down in mythology) which looks as if it ought to belong to Ophiuchus due to its proximity to the northern boundary of that constellation. The easiest way to locate Hercules is to draw a line from Arcturus, through alpha Coronae Borealis and on eastwards until it reaches one of the previously mentioned quadrilaterals appropriately known as the "Keystone".

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!

NOAA's Joint Polar Satellite System (JPSS) to monitor Earth as never before
By Ethan Siegel

Later this year, an ambitious new Earth-monitoring satellite will launch into a polar orbit around our planet. The new satellite—called JPSS-1—is a collaboration between NASA and NOAA. It is part of a mission called the Joint Polar Satellite System, or JPSS.

At a destination altitude of only 824 km, it will complete an orbit around Earth in just 101 minutes, collecting extraordinarily high-resolution imagery of our surface, oceans and atmosphere. It will obtain full-planet coverage every 12 hours using five separate, independent instruments. This approach enables near-continuous monitoring of a huge variety of weather and climate phenomena.

JPSS-1 will improve the prediction of severe weather events and will help advance early warning systems. It will also be indispensable for long-term climate monitoring, as it will track global rainfall, drought conditions and ocean properties.

The five independent instruments on board are the main assets of this mission:

- The Cross-track Infrared Sounder (CrIS) will detail the atmosphere's 3D structure, measuring water vapor and temperature in over 1,000 infrared spectral channels. It will enable accurate weather forecasting up to seven days in advance of any major weather events.
- The Advanced Technology Microwave Sounder (ATMS) adds 22 microwave channels to CrIS's measurements, improving temperature and moisture readings.
- Taking visible and infrared images of Earth's surface at 750 meter resolution, the Visible Infrared Imaging Radiometer Suite (VIIRS) instrument will enable monitoring of weather patterns, fires, sea temperatures, light pollution, and ocean color observations at unprecedented resolutions.
- The Ozone Mapping and Profiler Suite (OMPS) will measure how ozone concentration varies with altitude and in time over every location on Earth's surface. This can help us understand how UV light penetrates the various layers of Earth's atmosphere.
- The Clouds and the Earth's Radiant System (CERES) instrument will quantify the effect of clouds on Earth's energy balance, measuring solar reflectance and Earth's radiance. It will greatly reduce one of the largest sources of uncertainty in climate modeling.

The information from this satellite will be important for emergency responders, airline pilots, cargo ships, farmers and coastal residents, and many others. Long and short term weather monitoring will be greatly enhanced by JPSS-1 and the rest of the upcoming satellites in the JPSS system.

Want to teach kids about polar and geostationary orbits? Go to the NASA Space Place: https://spaceplace.nasa.gov/geo-orbits/

Caption: Ball and Raytheon technicians integrate the VIIRS Optical and Electrical Modules onto the JPSS-1 spacecraft in 2015. The spacecraft will be ready for launch later this year. Image Credit: Ball Aerospace & Technologies Corp.

CONTACTS

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

Chairman	Brian Mills
Secretary & Events	Phil Berry 01580 291312
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 June 2017 Newsletter should be with the Editor by May 28th 2017