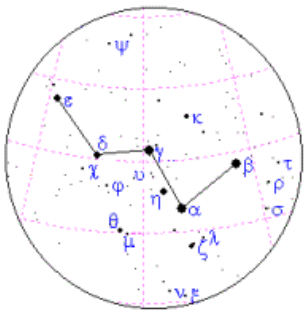


Wadhurst Astronomical Society Newsletter June 2016

GOVERNMENT LIGHT POLLUTION PETITION

At the end of the newsletter, there is a note about a petition on the Parliamentary Petitions web-site. Please take a moment to read it.

MEETINGS

COMMITTEE MEETING

Members of the Committee are respectfully reminded that there is a meeting of the Committee at Phil's house at 1930 on Tuesday the 5th of July.

THE MAY MEETING

The meeting was introduced by our Chairman, Brian Mills who welcomed members to our May meeting which was held in two adjoining rooms in the classroom block where our meetings will be held until at least December. After outlining the evening's programme and saying that there will be three mini talks in the June meeting, he introduced the evening's speaker, John Lutkin, who is the Society's Treasurer. John's background was in medical engineering and he has used a number of his skills to build an impressive combination of telescopes to perform some inspiring imaging. Here he explains some of the problems he met on the way.

Three for the Price of Six – or How to Tear Up £5 Notes in the Dark
Dr John Lutkin

John began by telling the tale of a lad who lived in a land called Hoveactually, but he was banished when they replaced him with a monkey who accepted payment in peanuts. He wandered round the countryside and found Blackboys where the sky had holes in it filled with curious stars and planets, so he settled there and bought a telescope. John never positively identified the lad but strangely, he himself found Blackboys and settled there, buying a telescope; or to be more exact, a lot of kit…

Next, John showed the first long exposure image he made and it was of the M42 Orion Nebula. He was astonished to find that it wasn't just a grey object but had colour.

He was quite rightly encouraged by the image and wanted to go further. The main problems he found were that exposures needed to be very long; even hours, and you need images in Luminance, Red, Green and Blue. The weather takes its toll and even though the weather appears clear you can still be hampered by very high clouds which may be hard to see by eye.

Other factors that have to be taken into account are such things as preparing and setting up the equipment which is often stored indoors. There is the imaging telescope, the guide telescope and the camera to align.

John had also worked on an ingenious formula that relates the weight of the equipment to the age of the observer which states that the weight of equipment increases as the age of the observer. He solved the equation which said build a shed!

Inside his shed John had sunk concrete into the ground and built a pillar to provide a stable mount for his telescope.

We were told that when imaging in colour, exposures are made of red, green and blue and also of the luminance which produces the important information in the image such as detail and brightness.

John had the bright idea of using two scopes; one to gather just the luminance and the other to collect RGB for later combining. But he came across a problem he calls Differential Flexure where the two scopes, although on the same mount and using an off-axis guide scope, moved at minutely different rates of a pixel or so; enough to cause noticeable blurring.

It was pointed out that the problem was keeping a particular star focussed onto the same minute area of the CCD sensor where a pixel can be as small as 9 microns square which demands very precise tracking. On one of John's photographs we could see the amount of care he had taken to minimise flexure by making the mount and attachments as rigid as possible. He said he had considerably reduced flexure but had never been able to completely get rid of it.

One problem of using an off-axis guide telescope is that the off-axis sensor must not obscure the main CCD and most telescopes suffer from reduced focus on the periphery of the lens although we were told that good guiders have an algorithm in the software programme that considerably reduces errors even if the guide star is a blob. John said he could get something like 15 minute exposures without trailing.

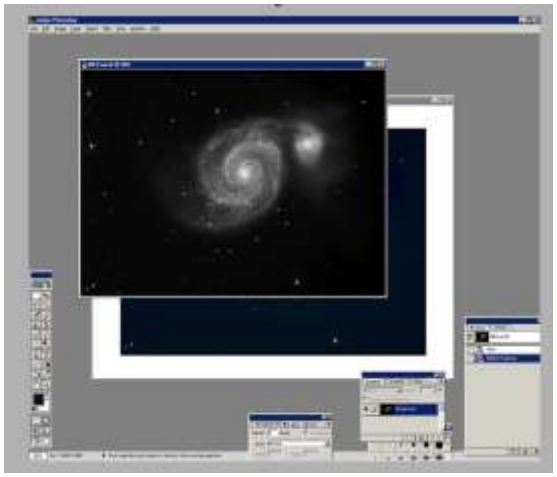
He showed a photograph of his two telescopes where the second scope runs an adaptive optics unit where several corrections can be made every second, improving the seeing and producing pin-sharp images, now enabling exposures of 3 or 4 hours at a time.

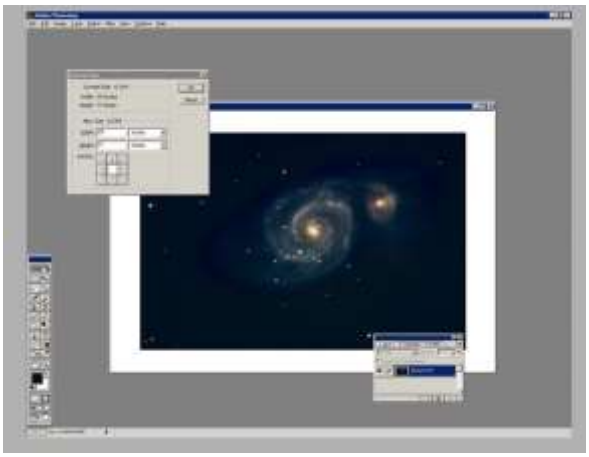
Images must also be the same size and have no skew between them.

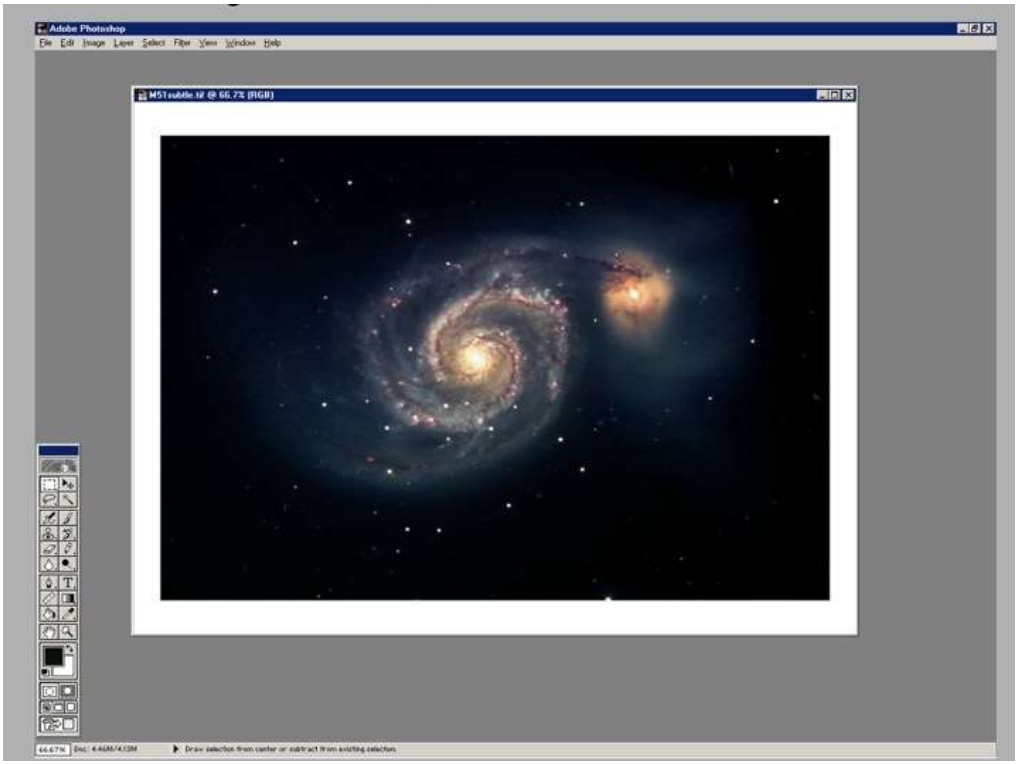
One photograph we were shown was of a number of computers John uses to run the adaptive optics unit and download his images. One problem he mentioned was that keeping them in a shed, they needed a dry atmosphere and so he uses a small fan heater to continually blow warm air over them.

Having solved many of his problems John wondered why he shouldn't use two telescopes to collect the luminance image and a third for a colour camera and he said this is why he ended up with his triple array.

Next, we were shown an excellent monochrome luminance image of M51 John had made followed, by the colour image showing colour but far less detail, and finally we were shown the combined result using Adobe Photoshop which showed an enormous amount of detail and in colour.







Size is everything!

John said he asked himself, why not increase his 90 mm refractor to a 300 mm reflector; so “either 10 times the data or reduce the exposure time by 10”. Unfortunately, this array slightly exceeded the safe working limit of the mount, so he is still working out how to regain stability…

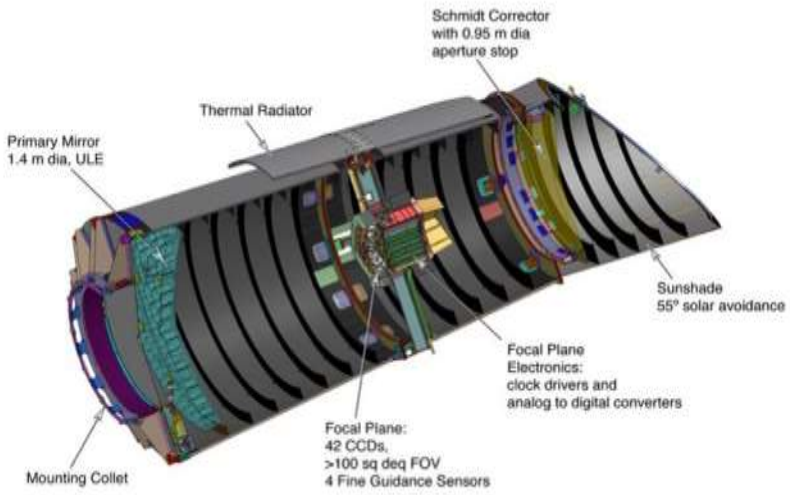
We now looked at the use of a colour sensor where 4 detectors are needed for each colour chip; two green, one red and one blue. The theoretical focus limit of a telescope is something in the order of ten or so microns but the sensors have gaps between them so an algorithm is used to fill in these gaps. Sadly, this algorithm also slightly changes the boundaries of a star so that when registering images together, problems can inherently occur and as he said, he hasn’t so far been able to address this.

Finally, John showed a recent image he had made of the Orion Nebula to compare with the first image he took years ago. Members felt the resulting impressive difference made all his work well worth while.

Snippets from the World of Science
John Wayte

Why was the Kepler spacecraft named Kepler?

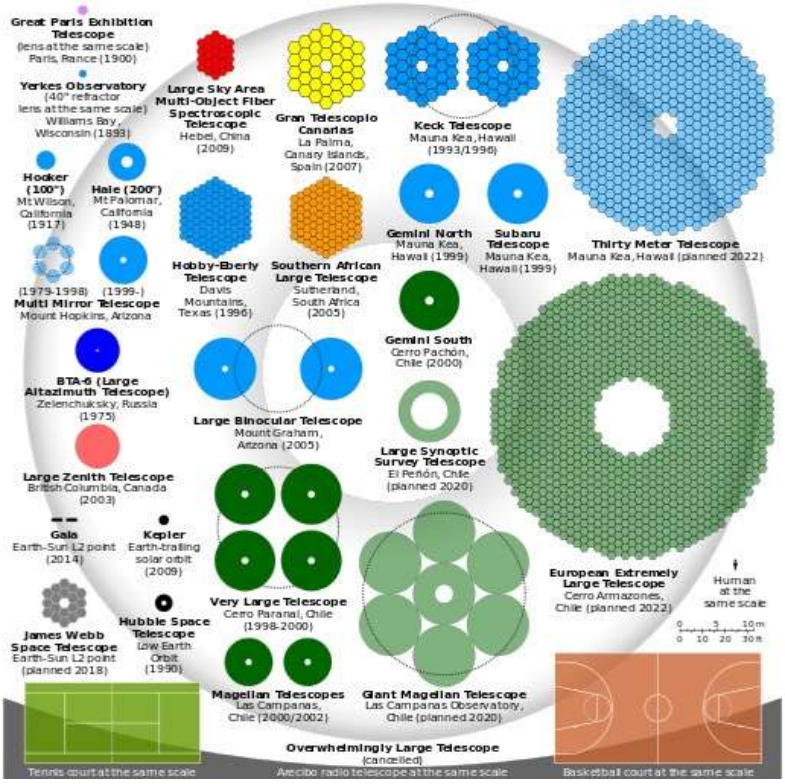
Johannes Kepler was a German mathematician-astronomer and astrologer. Born on December the 27th 1571, he was a key figure in the 17th century scientific revolution. He is best known for his laws of planetary motion and his work provided the foundations for Isaac Newton's theory of universal gravitation.



This NASA diagram is of the inside of the Kepler space telescope. It is the fine guidance sensors and the motors that have caused all the problems. The telescope is a Schmidt with a 0.95 metre (37-inch) front corrector plate feeding onto a 1.4 metre primary mirror. The spacecraft weighs 1,039 Kg. The 42 CCDs produce a total of 95 megapixels.

How does it work? Kepler simultaneously looks at 100,000 stars every 30 minutes, searching for tiny variations in the light output. For instance, an Earth-like planet in front of a star will change the brightness by only 84 parts per million. Putting it another way it is the same as viewing a flea in front of a car's headlight when viewed from several miles away.

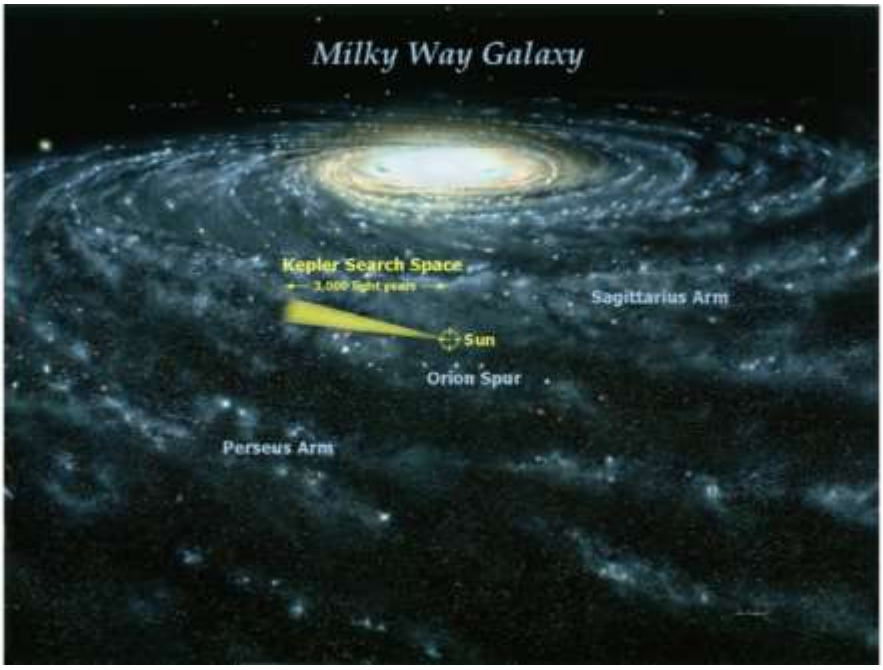
Some of you telescope buffs may find this picture interesting. It shows the relative size of various telescopes both on land and in space. Can you spot Kepler?



This NASA photograph is of the camera.

Each one of those silver squares contains 2 CCDs with a resolution of 2,200 x 1,024 pixels. There are 42 of them producing 95 megapixels of data. Each star is allocated a postage stamp of 30 pixels. The star data is read from these pixels every 6 seconds and integrated for 30 minutes before being stored for a monthly transmission to Earth. The monthly download is about 12 gigabytes of data.

The camera has been programmed to only view 100,000 target stars and each star is allocated its special space in the CCD and this gives an idea of the area Kepler is searching.



Most of you will have read that Kepler has lost the use of two of its four reaction wheels. These are used to fine tune its pointing capabilities. The loss of one wheel would have been ok and would not have harmed the operations. But two was devastating. The first wheel failed on July the 14th 2012 and the second on May the 11th 2013.

The clever engineers at NASA thought up a scheme where they could use the two remaining wheels and use the Sun's photons to balance the spacecraft. So while the spacecraft is not quite as good as previously, it is still delivering stunning results.

Sky Notes

The meeting concluded with our Director of Observation and Chairman, Brian Mills, giving the Sky Notes for the coming month. Details follow later in the Newsletter.

JULY MEETING

15th June – There will be three mini-presentations on a variety of astronomical subjects.

Meetings will take place in classrooms IL5 and 6 which are in the blue walled classroom block at the far end of the drive through the main gate of Uplands College and up by the tennis courts. Signs will direct you. There is car parking near the block. The postcode is TN5 6AZ.

Meetings begin at 1930 prompt although members are invited to arrive anytime after 1900 as this is a good time to exchange ideas and discuss problems and also help set things up before the meeting starts.

Anyone is welcome but non-members are asked if they wouldn't mind contributing £3 towards costs.

FUTURE MEETINGS

20th July 2016 – William Joyce brings us up to date with "Astronomy of the Moon".

21st September 2016 – Professor Louise Harra tells us about the latest news of "Solar Activity".

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

16th November 2016 – Jan Drozd tells about "A History of Man's Understanding of Our Universe".

14th December 2016 (NB the second Wednesday of this month) – Brian Mills FRAS tells us about "Local Astronomers".

SKY NOTES FOR JUNE 2016

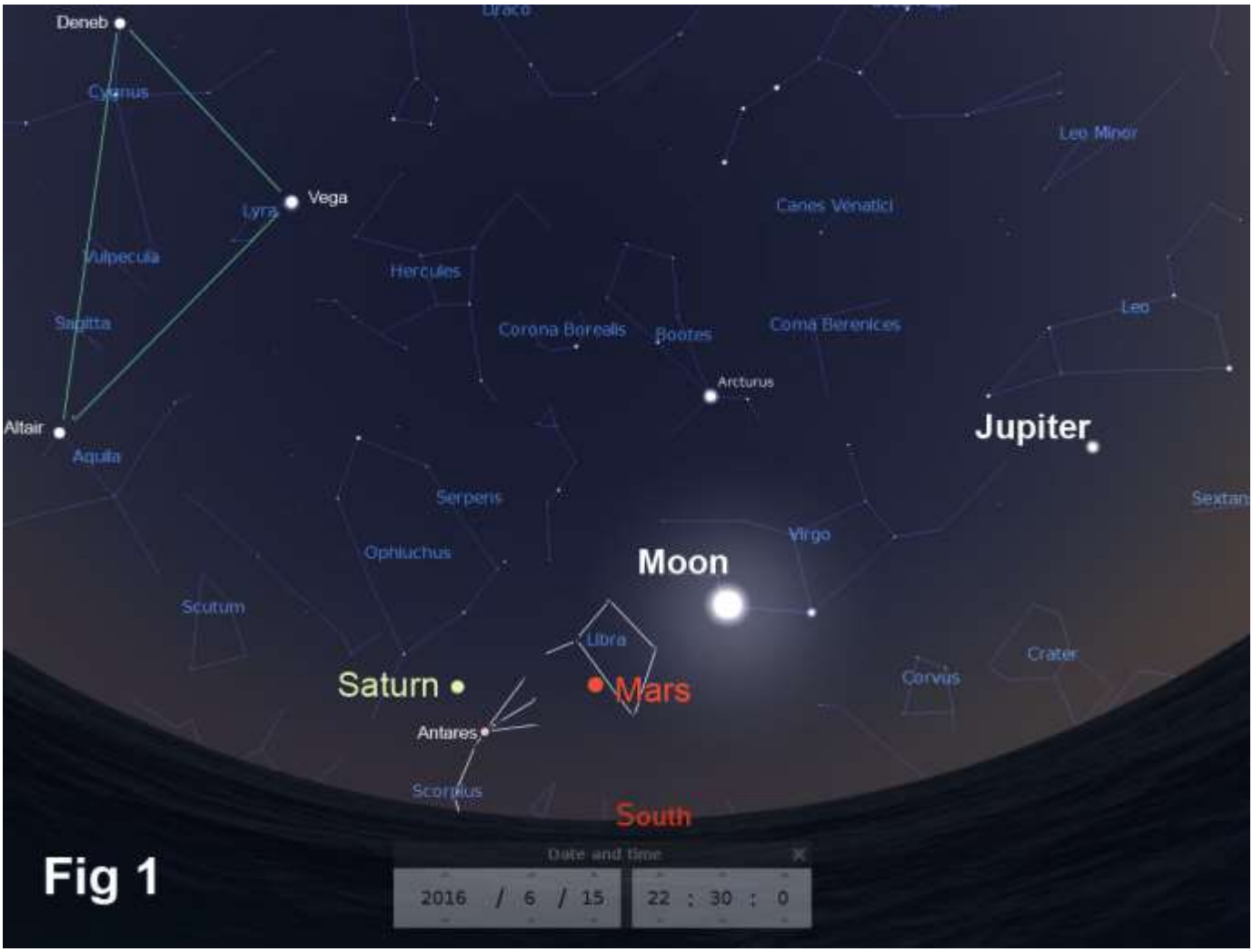
Planets

Mercury is a morning object reaching greatest western elongation on 5th June. However, the planet is almost unobservable due to the shallow angle of the ecliptic and hence the long twilight at this time of year. It reaches superior conjunction on 7th July.

Venus is too close to the Sun for observation and will reach superior conjunction (on the far side of the Sun) in early June. It will reappear in the evening skies during mid to late August.

Earth reaches the summer solstice at 23.34 BST on 20th June. This is the moment in time when the Sun reaches its most northerly declination, or to put it another way it is as high above the celestial equator as it is possible for it to get. In layman's terms it is, of course, the longest day although as we have seen the solstice occurs just before midnight!

Mars was at opposition on 22nd May and so is just past its best. It rises in daylight and crosses the meridian due south at midnight at the start of June. By the end of the month it is due south at 21.45, which is soon after sunset, and will have set itself before 02.00. Mars is moving retrograde in Libra throughout June, reaching its second stationary point on the 30th. It fades in brightness from magnitude -2.0 to -1.5 and in apparent size from 18.6 to 16.4 arc seconds. Fig 1 shows the planet's position for the middle of the month, and from that you can tell that it is very limited in elevation.



Jupiter is visible in the south west as soon as darkness falls. It is still a brilliant object although it is fading gradually as the distance between us increases. Its retrograde motion is over so it is now moving direct (eastwards) below the body of the celestial lion. The Moon is a little south of Jupiter on the evening of 11th June. Remember that if you haven't looked at the gas giant and its attendant Galilean moons, it will set around midnight by the end of the month. Fig 2 shows Jupiter's position mid-month at 22.30 and how to locate it using the two stars (the pointers) in the bowl of the plough. Although this will not point exactly to the planet, it will be close enough particularly as it is the brightest object in that part of the sky.

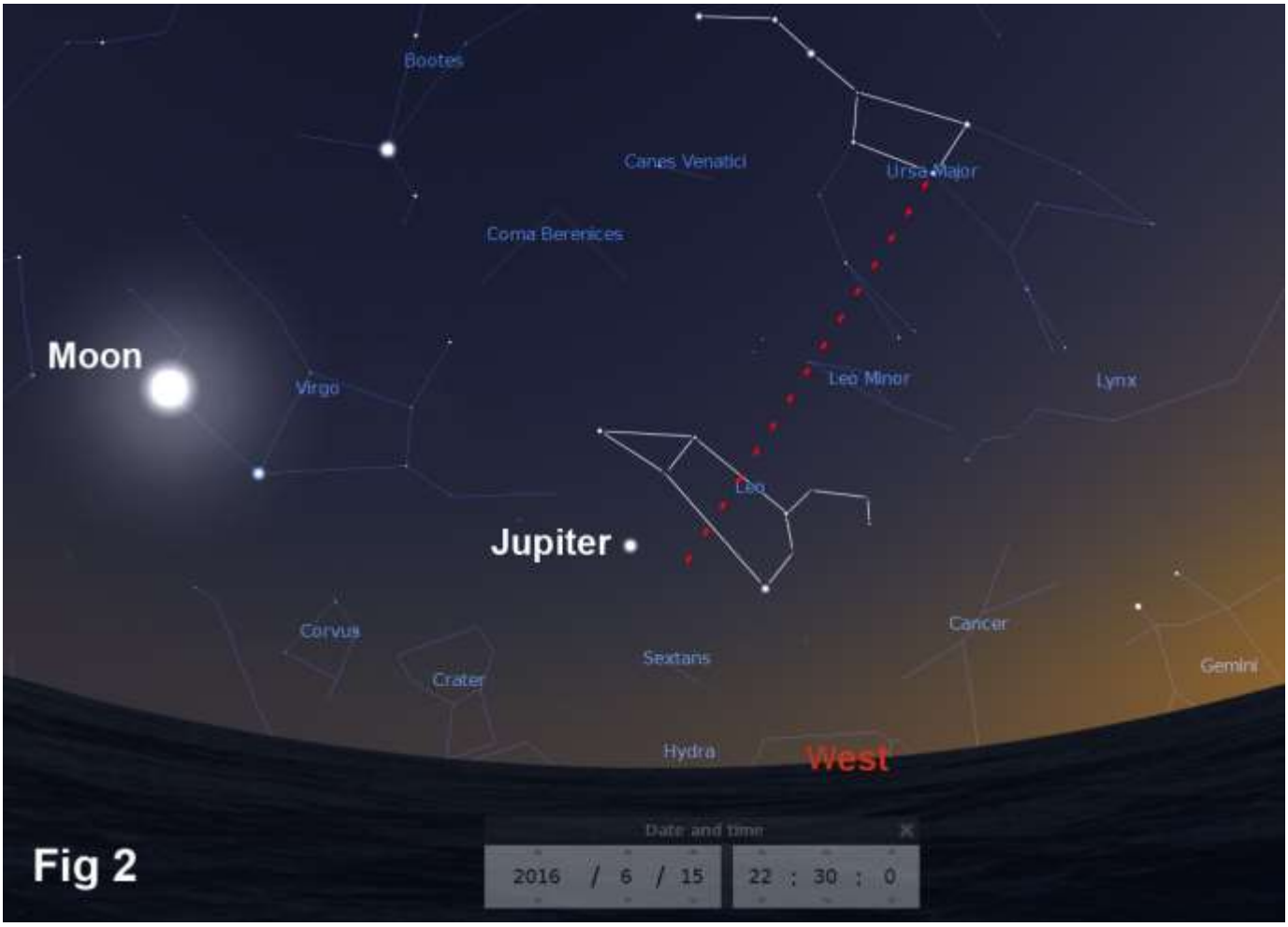


Fig 2

Saturn reaches opposition on 3rd June when its magnitude will be 0.0 and its apparent size 18.4 arc seconds. On that date, although it will be 1,350 million kilometres from Earth, it will be best placed for observation despite its low altitude.

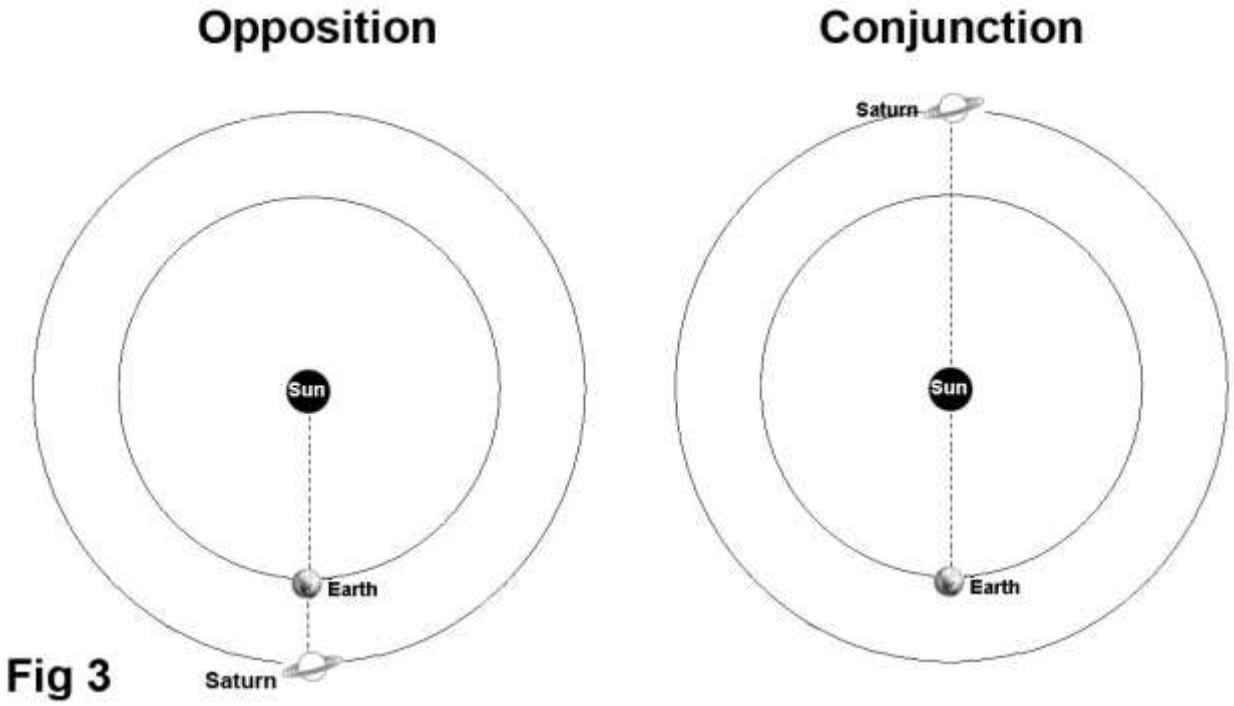


Fig 3

Opposition refers to the time when the planet in question (Saturn in this case) is opposite the Sun in the sky, or to put it another way, the three bodies are in a line with the Earth in the middle. This means that as the Sun sets Saturn rises to remain on view until sunrise. Only the planets that lie beyond the Earth's orbit can reach opposition. On the 10th December the three bodies will again be in a line but this time Saturn will be on the far side of the Sun and at that time is said to be in solar conjunction. The diagrams in fig 3 should help explain this.

Saturn presently lies just over 20° below the celestial equator which means it culminates (crosses the meridian) just 18° above the southern horizon. Of cours e, the lower in the sky it is, the more our view of it is affected by atmospheric turbulence. However, as

compensation, the planet's north pole is tilted towards us at 26° which provides us with an excellent view of the upper surface of the rings. Saturn's position for the middle of the month is shown in fig 1. The best times to look for Titan, Saturn's largest moon, are on the 10th and 28th for eastern elongation and 2nd and 18th for western elongation. Titan's brightness varies between +8.2 and +9.0 so a moderately sized telescope will show it easily.

Lunar Occultations

In the table below I've listed events for stars down to magnitude 7.0 that occur before midnight although there are many others that are either of fainter stars or occur at more unsociable hours. DD = **d**isappearance at the **d**ark limb whilst RD = **r**eappearance at the **d**ark limb. The column headed "mm" (millimetres) shows the minimum aperture telescope required for each event. **Times are in BST.**

June	Time	Star	Mag	Ph	Alt °	% illum.	mm
9th	23.40	ZC 1409	5.0	DD	5	27	40
15th	23.20	ZC 2033	4.2	DD	24	82	40

Phases of the Moon for June

New	First ¼	Full	Last ¼
5th	12th	20th	27th

ISS

Below are details for passes of the International Space Station (ISS) that occur before midnight and are magnitude **-**1.0 or brighter. The details of all passes, including those visible after midnight, can be found at www.heavens-above.com. Please remember that the times and directions shown below are for when the ISS is at it's ***maximum*** elevation, so you should go out and look at least five minutes beforehand. **Times are in BST.**

June	Time	Mag.	Alt°	Az.		June	Time	Mag.	Alt°	Az.
1st	23.06	-3.2	78	N		5th	22.48	-3.4	79	SSW
2nd	22.13	-3.3	83	N		5th	21.55	-3.3	86	N
2nd	23.50	-3.5	85	SSW		6th	23.32	-2.7	37	SSW
3rd	22.57	-3.3	83	N		7th	22.39	-3.1	54	SSW
4th	22.04	-3.2	78	N		9th	22.30	-2.3	33	SSW
4th	23.41	-3.3	60	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 . Remember that when one of these events is due, it is sometimes possible to see the satellite before and after the "flare" although, of course, it will be much fainter at those times. **Times are in BST.**

June	Time	Mag.	Alt°	Az.°		June	Time	Mag.	Alt°	Az.°
2nd	21.11	-5.6	24	341 (NNW)		18th	21.40	-6.1	57	48 (NE)
3rd	22.43	-4.9	35	36 (NE)		18th	23.14	-4.1	24	26 (NNE)
7th	22.28	-2.3	42	39 (NE)		19th	21.34	-7.5	59	48 (NE)
8th	22.22	-2.7	41	41 (NE)		22nd	23.00	-4.6	30	32 (NNE)
13th	22.01	-3.3	51	44 (NE)		23rd	22.54	-3.0	31	33 (NNE)
13th	23.34	-2.3	12	15 (NNE)		27th	22.39	-7.5	38	37 (NE)
14th	23.28	-5.7	15	18 (NNE)		28th	22.33	-3.6	39	39 (NE)

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

In the north Ursa Minor points upwards towards the zenith which currently lies on the Draco/Hercules borders. The bear's larger relation is to the west of the meridian and pointing toward the bright star Capella, in Auriga, which is just 15° above the horizon. To the east of the meridian we find Cassiopeia and Cepheus, the latter of which has a number of moderately bright open clusters within its boundaries. NGC 7510, NGC 7160 and NGC 7380 are the most obvious although there are others of which NGC 188, discovered by John Herschel, is thought to be around five billion years old. Perseus is skirting the horizon with the famous double cluster at an altitude of around 20°.

Looking east, all three members of the Summer Triangle have risen along with a straggling group of small and faint constellations that stretch between Cygnus and Aquila. Equuleus is closest to the horizon and not far from the head of the mythological winged horse. Then as we climb we pass through Delphinus, Sagitta and Vulpecula, the latter of which seems to have more than its share of interesting objects compared to its diminutive size. It contains a number of open clusters, the brightest being NGC 6940 at magnitude 6.3. It is also home to the planetary nebula M27, otherwise known as the dumbbell.

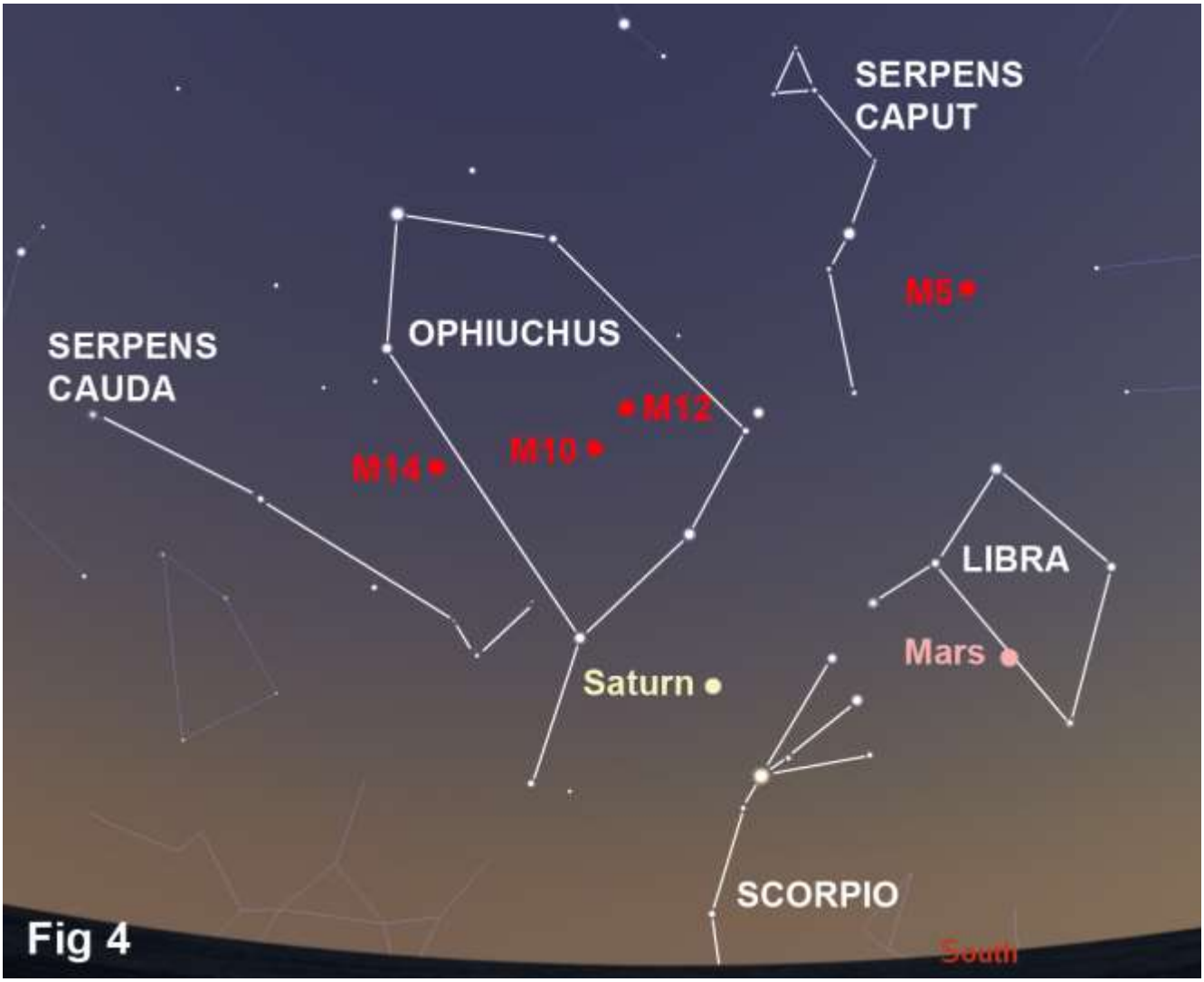


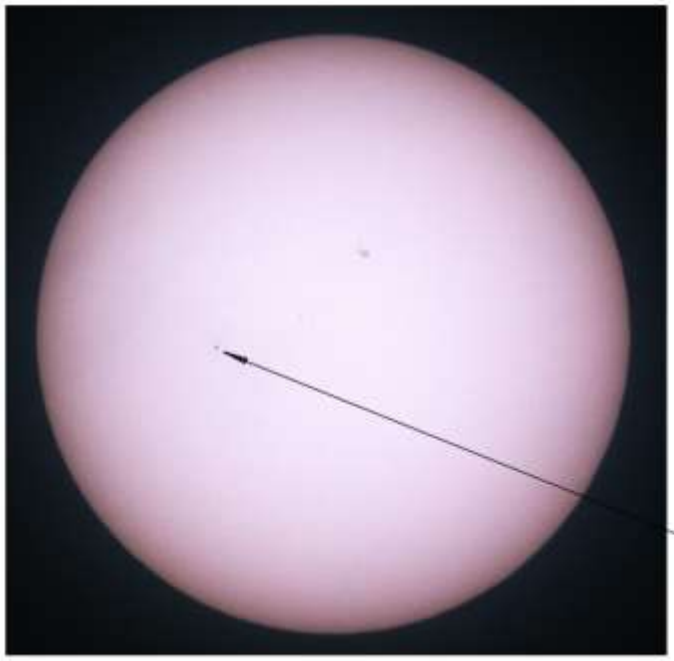
Fig 4

Towards the south the faint summer groups hold sway save for the head of the scorpion that tantalises those of us viewing from the latitudes of the UK. Closer to the zenith Boötes and Hercules are near to the meridian whilst between them lies Corona Borealis. It contains the recurrent nova TCrB which last suffered a major outburst in 1946 and which is reported to be currently brightening beyond normal limits. Could its next outburst be imminent? Immediately below Corona we find the dismembered head of the sea serpent, Serpens Caput. Moving eastwards we come first to the large and faint constellation of Ophiuchus, and then to the tail section of the unfortunate serpent. There are a few open clusters in the area including IC 4756 (known as Graff's cluster) at magnitude 5.4 and NGC 6633 at magnitude 4.6. The region also contains a large number of globular clusters of which M5, M10, M12 and M14 are the most obvious with magnitudes of 5.8, 6.6, 6.6 and 7.6 respectively. Their positions are shown on the map at fig 4 which is drawn for 23.00, around the middle of the month, to allow the Sun to sink a little further below the horizon, although even at this time it is only 10° below it. The galactic centre lies close by in neighbouring Sagittarius which itself will soon be coming into view.

In the west, Cancer is setting with Leo that still harbours Jupiter, not far behind. The position of the ecliptic at this time of year means that none of the zodiacal groups are seen at their best. Virgo, the second largest constellation in the entire sky, is one such group that suffers in this way with its considerable bounty of galaxies.

Transit of Mercury

The weather for the transit was patchy at best with Hildenborough seeing a break in the clouds from 13.45 until around 15.00. A typical image is shown below. Fortunately there were a few sunspots to add a touch of interest to Mercury's passage across the Sun.



Brian Mills

SPACE PLACE - 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 revolutionize Earth-watching
By Ethan Siegel

If you want to collect data with a variety of instruments over an entire planet as quickly as possible, there are two trade-offs you have to consider: how far away you are from the world in question, and what orientation and direction you choose to orbit it. For a single satellite, the best of all worlds comes from a low-Earth polar orbit, which does all of the following:

- orbits the Earth very quickly: once every 101 minutes,
- is close enough at 824 km high to take incredibly high-resolution imagery,
- has five separate instruments each probing various weather and climate phenomena,
- and is capable of obtaining full-planet coverage every 12 hours.

The type of data this new satellite – the Joint Polar Satellite System-1 (JPSS-1) -- will take will be essential to extreme weather prediction and in early warning systems, which could have severely mitigated the impact of natural disasters like Hurricane Katrina. Each of the five instruments on board are fundamentally different and complementary to one another. They are:

1. The Cross-track Infrared Sounder (CrIS), which will measure the 3D structure of the atmosphere, water vapor and temperature in over 1,000 infrared spectral channels. This instrument is vital for weather forecasting up to seven days in advance of major weather events.

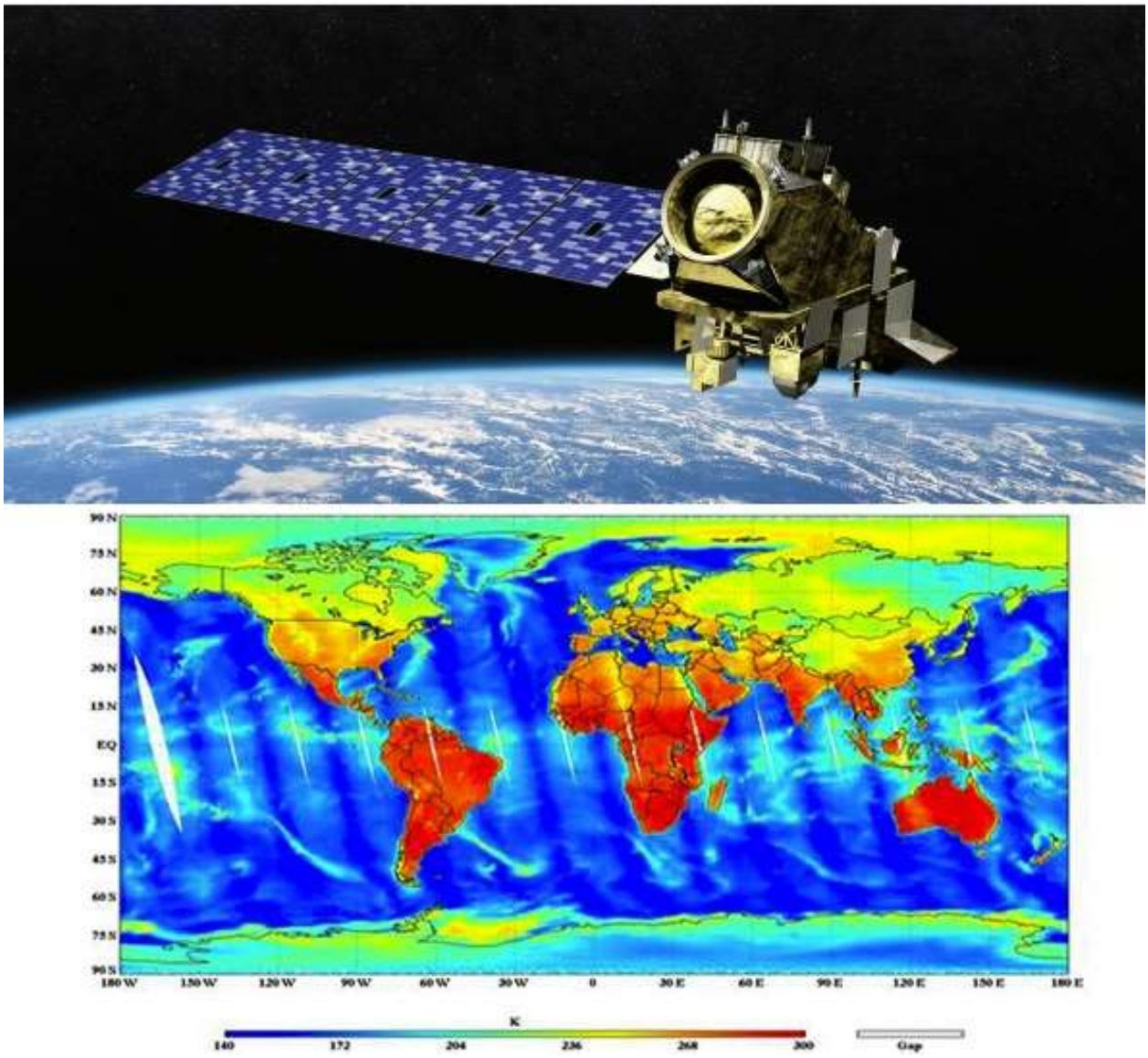
2. The Advanced Technology Microwave Sounder (ATMS), which assists CrIS by adding 22 microwave channels to improve temperature and moisture readings down to 1 Kelvin accuracy for tropospheric layers.

3. The Visible Infrared Imaging Radiometer Suite (VIIRS) instrument, which takes visible and infrared pictures at a resolution of just 400 meters (1312 feet), enables us to track not just weather patterns but fires, sea temperatures, nighttime light pollution as well as ocean-color observations.

4. The Ozone Mapping and Profiler Suite (OMPS), which measures how the ozone concentration varies with altitude and in time over every location on Earth's surface. This instrument is a vital tool for understanding how effectively ultraviolet light penetrates the atmosphere.

5. Finally, the Clouds and the Earth's Radiant System (CERES) will help understand the effect of clouds on Earth's energy balance, presently one of the largest sources of uncertainty in climate modeling.

The JPSS-1 satellite is a sophisticated weather monitoring tool, and paves the way for its' sister satellites JPSS-2, 3 and 4. It promises to not only provide early and detailed warnings for disasters like hurricanes, volcanoes and storms, but for longer-term effects like droughts and climate changes. Emergency responders, airline pilots, cargo ships, farmers and coastal residents all rely on NOAA and the National Weather Service for informative short-and-long-term data. The JPSS constellation of satellites will extend and enhance our monitoring capabilities far into the future.



Images credit: an artist's concept of the JPSS-2 Satellite for NOAA and NASA by Orbital ATK (top); complete temperature map of the world from NOAA's National Weather Service (bottom).

LIGHT POLLUTION PETITION

We have received notification of a light pollution petition towards introducing legislation by the UK Government to regulate light pollution. This petition runs until the 22nd of July and needs at least 10,000 signatures before the government will officially respond. At the time of writing we have just under 5,000 signatures so if you feel legislation is needed, take a few moments to look at the link below and register. Please note that other family members within a household can sign too.

With increasing urbanization of our countryside this has never been more important.

Here is the link:
https://petition.parliament.uk/petitions/119428

Having registered, you will need to click the link in the email you receive.

CONTACTS

General email address to contact the Committee
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Treasurer	John Lutkin
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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 July 2016 Newsletter should be with the Editor by June 28th 2016