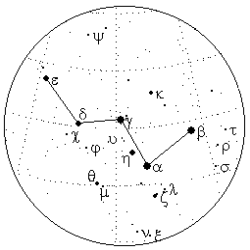


Wadhurst Astronomical Society Newsletter April 2015

SOLAR ECLIPSE SUCCESS

We have heard from Phil Berry who was on a cruise to witness the Solar Eclipse from just off the Faroe Islands and despite the overcast skies seen on Stargazing Live on BBC1, Phil was successful and managed photographs of the total eclipse. He will be showing the results in his report at the Society meeting on Wednesday the 15th of April.

MEETINGS

COMMITTEE MEETING

Members of the Committee are respectfully reminded that there is a meeting of the Committee on Tuesday 21st of April 2015 starting at 1930 at Phil Berry's.

MARCH MEETING

The March session was introduced by our Chairman, John Vale-Taylor who welcomed a well attended meeting. He explained that Phil Berry is away on a cruise to hopefully see the Solar Eclipse off the Faroe Islands and we all wish him success and look forward to hearing about his trip. Subsequently we know he was triumphant – see above.

John then went on to introduce our speaker for the evening, Chris Morris, a retired RAF air navigator.

The Use of Heavenly Bodies for Astro-navigation
Chris Morris

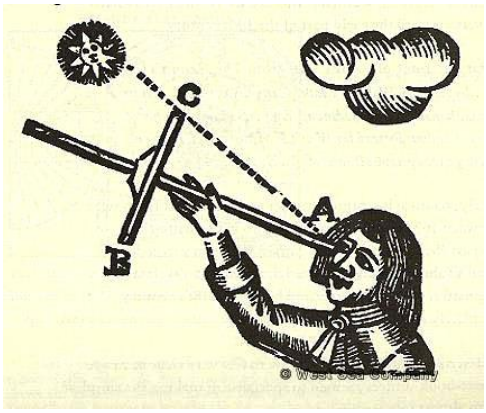
Chris began by saying his knowledge of astronomy was limited although he was to go on to show quite an understanding. He talked about the importance of astro-navigation in modern navigation and explained that even the biggest ships with their modern radio navigational aids could be in trouble if there were equipment or power failures and so all ships carry sextants and the crew must be able to use them.

Also the air force was required to carry and use sextants up until the 1990s and up until then there was a requirement to check the readings of the equipment every hour.

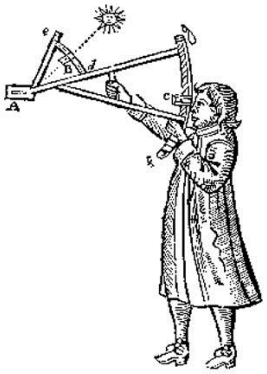
Chris defined navigation as essentially establishing the direction to one's destination and to know your present position and be able to correct the track to that destination.

In 1595 John Davis wrote a book about the use of astronomy in navigation and amongst many important notes on methods of navigation he showed how to measure the declination angle of the Sun at local midday using a cross staff and was able to tabulate declinations for any day of the year. It was John Davis who invented the back-staff so that shooting the Sun didn't cause eye damage to the navigator.

At night he was able to use Polaris but because Polaris is not precisely at the celestial pole, by using that star we were told that an error today of about 11 nautical miles could occur. As Chris explained this is due to the effect of precession on the Earth, the rotation of the Earth's axis and taking approximately 26,000 years to complete one revolution



The cross staff used in the early days of navigation



John Davis's back staff

The back-staff was superseded in 1492 by Columbus's Quadrant for measuring altitude and then in 1731 Hadley devised the more accurate Octant. Then it was possible to calculate one's latitude reasonably accurately.

A big step forward was made in 1875 by a French seaman, Commander Marcq de Saint Hilaire. From the known time and the observer's supposed position using dead reckoning, he calculates what the altitude of the Sun or known star should be. Then he measures the actual altitude and from this can work out the distance from the calculated position, so he must be somewhere on this line called the position line. Doing this for perhaps another two stars if it is night gives two more position lines and from this the observer can begin to calculate his error more accurately.

As pointed out, if doing this on board a ship in a calm sea with a clear view of the sky and the horizon, this is relatively easy, but it becomes quite a different problem when travelling at perhaps 400 knots in an aircraft and unable to see the horizon.

As an example Chris related an interesting fact about the VC10 aircraft, which was greatly admired by passengers for giving a very comfortable flight. In fact the aircraft rolled very slowly from side to side. The passengers didn't feel this but it gave navigators quite a headache using a bubble artificial horizon when doing their measurements.

In 1919 Alcock and Brown made the first air crossing from the States to Europe across the Atlantic. They intended to follow the latitude line but for long periods they were in cloud. They knew how far they had travelled but were unsure how much left or right they had veered. About midnight, the sky cleared for a brief moment and they were able to use Polaris and Vega and from their tables were able to see where they were, but then flew back into cloud. Eventually they did land in a peat bog in Ireland after a flight of just over 16 hours.

After the First World War, there was little investment in the Royal Air Force and navigation was more or less reliant on the pilot looking out of the aircraft to follow ground features and compare what he saw with his map. But between the Wars, civil aviation still used three-star fixing successfully.

Then during the Second World War, RAF bombers had to fly at night and used star fixes and the calculations were horrendous, the navigators wearing gloves, poor lighting and in very cold temperatures.

Following the War it was important to be able to fly anywhere round the world, but now it was possible to fly during the day and using the Sun, just one position at a time could be used to fly a line. But to fly at night, it became necessary for air navigators to know the position of 57 navigation stars and Chris said that in the tropics, there were so many visible stars that it became a nightmare to find them but it was essential to identify them.

Even during the Cold War, the Vulcan bomber was still using the sextant for their low level bombing raids. They carried two navigators and two sextants. Radio navigation was being used but it didn't give world-wide cover, could be jammed and was useless if there was a power or equipment failure.

RAF Mk 9A sextant

Example of a periscope sextant

We were shown a photograph of an RAF Mk 9A sextant, which was capable of taking readings continually over one minute and then averaging them out. It used a bubble horizon since the real horizon could not be used. Many errors had to be taken into account such as the distortion of the Astro-dome, atmospheric distortion, instrument error, Coriolis because of flying over the curvature of the Earth, etc.

As aircraft got faster, the astro-dome caused drag and it was replaced for navigation by a periscope sextant but the field of view was now very limited to about 15°.

Finally Chris looked at the onset of digital aids from the first hand-held calculators in 1976, through desktop computer software to navigational programmes such as NAV PAC, which plots one's position from a three star reading.

Essentials for good navigation are a good sextant; the RAF always carries two, and an accurate watch. We were told that just 4 seconds inaccuracy in time can result in an error of one mile, bearing in mind that aircraft travel at something like 9 miles a minute.

To demonstrate one of the US Naval online programmes, Chris had used it to navigate his way to our venue using a three star fix.

John Wayte's Snippets from the World of Science
John Wayte

Pi

Did anyone realize that the date of Saturday the 14th of March this year had a rather strange sequence?

Assuming that you base your dates on the American date system then on 14th of March you could have celebrated the first nine decimal places of Pi.

This can be written as 3.141592653

March	Day	Year	Hours	Minutes	Seconds
3	14	15	9	26	53

And for anyone who wants Pi to about 100 decimal places:

3.14159265358979323846264338327950288419716939937510582097494459230781640628620899862803482534211706 79…

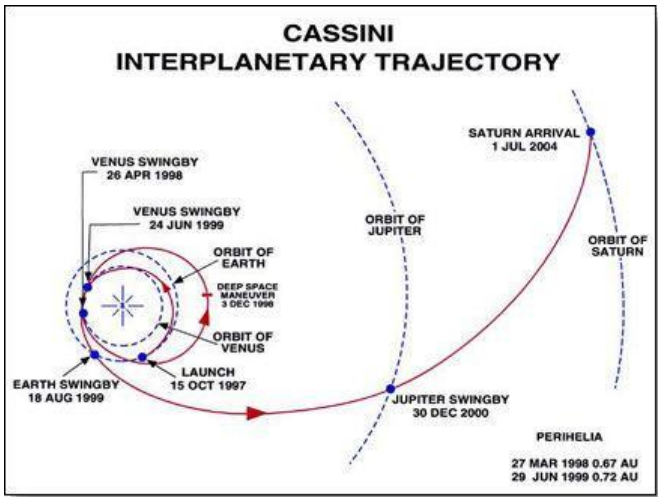
But apparently Pi has been calculated to more that a trillion digits without recurring.

Cassini Spacecraft – The Saturn Mission

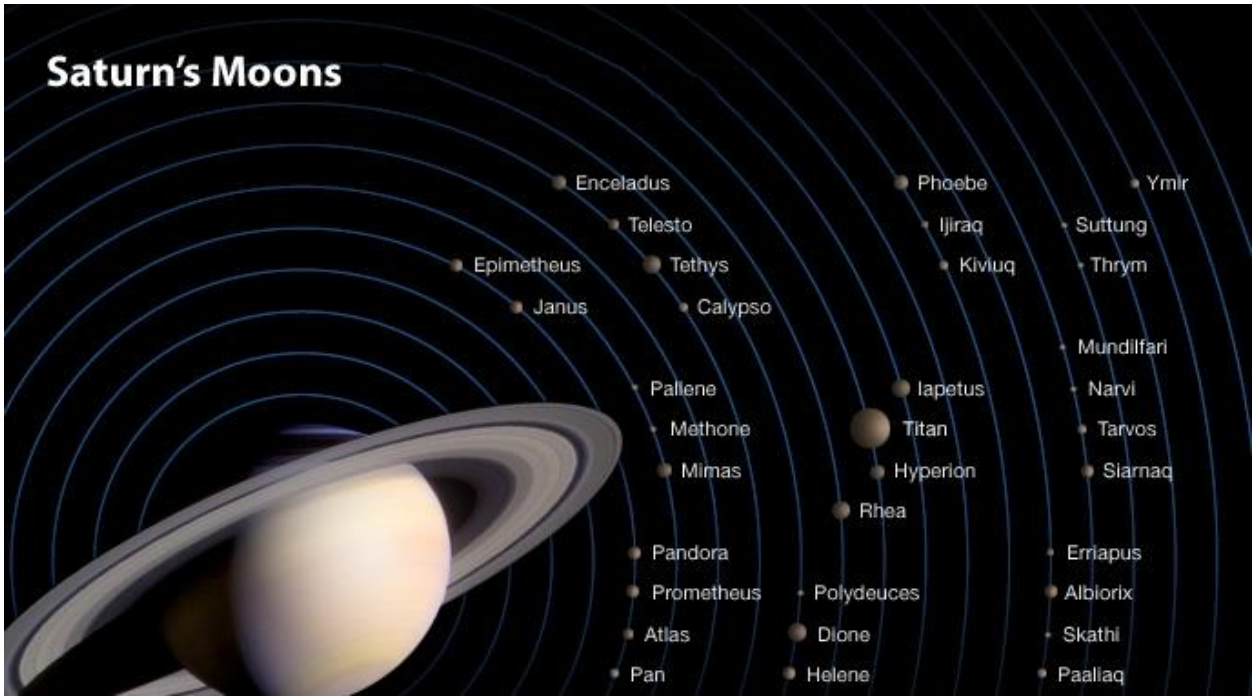
Here is a little history of the launch.

Interplanetary space missions can be launched only at certain times. These launch windows are dependent upon both the relative positions of the Earth and the target planet and also rely on the capabilities of the available launch vehicle. The primary launch period for Cassini, based on the alignment of the planets and the capabilities of the Titan IV/Centaur launch vehicle, was October 1997. The launch boosted the spacecraft into a Venus-Venus-Earth-Jupiter Gravity Assist (VVEJGA) trajectory for its journey towards its final destination of Saturn.

A gravity assist flight path is required because the spacecraft is too heavy to be injected into a direct trajectory to Saturn. Under such a plan it would not acquire enough speed to reach Saturn in a realistic time scale or have sufficient propellant left over to allow braking for orbit insertion around Saturn. Cassini arrived at Saturn on the 1st of July 2004.



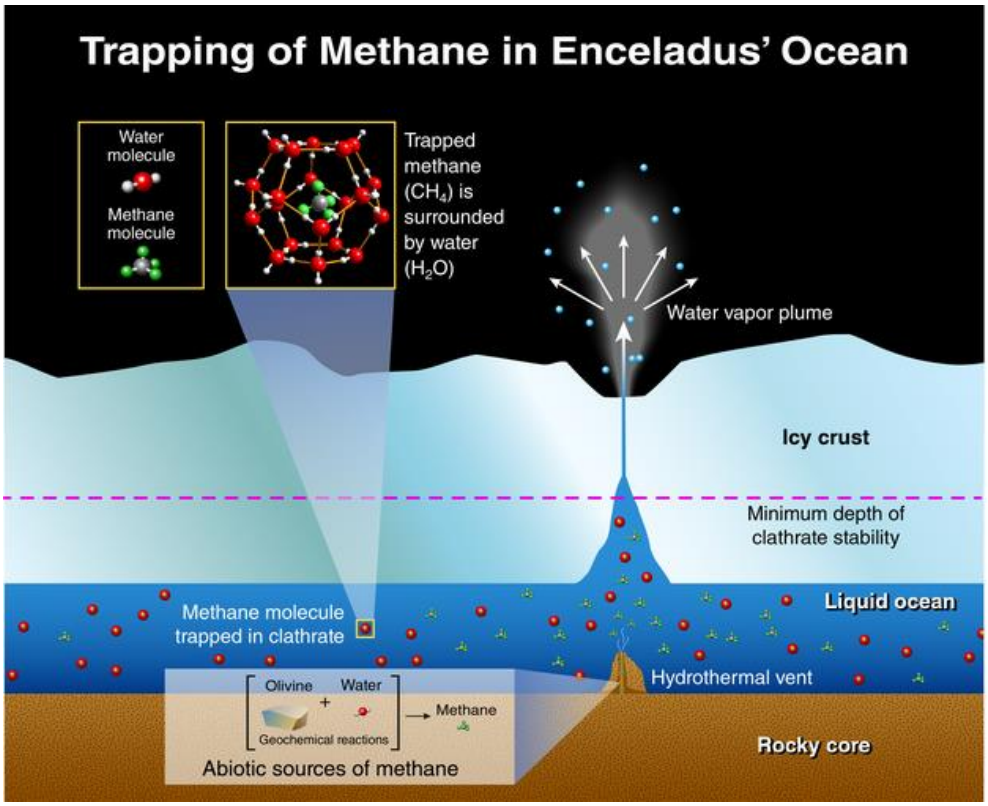
Of Saturn's moons, of which there are 53 named and a further 9 provisional moons, Enceladus is the most interesting.



Moons of Saturn - NASA

Very briefly, Enceladus is only 500 Kilometers in diameter but it has very significant water below its icy crust and it is here that this moon of Saturn is proving to be very interesting.

Below its icy crust of 30 to 40 kilometers thick is a 10-kilometer liquid ocean that is rich in salts and organic materials that spout in towering plumes of vapor to significant heights. Scientists also estimate that the temperature at the interior may be as high as 90^{o}C.



Below the surface of Enceladus - ESA

What all this adds up to is that this creates an environment suitable for living organisms.

APRIL MEETING

Wednesday 15th April 2015 – Nik Szymanek “Shooting Stars”, remote imaging

FUTURE MEETINGS

Wednesday 20th May – Konrad Malin-Smith talks about “Hydrogen in the Universe”
Wednesday 17th June - Our Chairman, John Vale-Taylor, updates us on his journey of discovery in astrophotography
Wednesday 15th July - Our Observing Director, Brian Mills FRAS, goes back to basics with “Astronomy from the Ground Up”

ANNUAL SUBSCRIPTIONS

We have now entered the Society’s new session and membership fees remain the same as they were last year. Membership for the year is £16 and £23 for two members within the same family at the same address. Children and students under 17 remain free and are always welcome.
Subscriptions can be paid at the meetings, preferably by cheque made payable to “Wadhurst Astronomical Society” or can be posted to our Treasurer;

Michael Wyles at:
31 Rowan Tree Road
Tunbridge Wells
Kent
TN2 5PZ

SKY NOTES FOR APRIL 2015

Planets

Mercury is at superior conjunction on April 10th, after which it moves east of the Sun to become an evening object. Fig.1 shows the position of the planet on the last day of the month when it will be 10° above the horizon whilst the Sun is 6° below it. If conditions near the horizon are good, you may be able to find it a few days earlier although you must wait until the Sun has set before sweeping with binoculars. It’s rather a shame that by the time Mercury is at elongation on May 7th, it will already have started to fade. However, this will be the best evening opportunity to see Mercury during 2015.

Mercury is something of a record holder in the solar system. It is the smallest planet with a diameter of just 4,878km and it also the closest to the Sun at an *average* distance of 58 million kilometres. I emphasise “average” because Mercury has the most eccentric orbit of any of the eight planets. When at its closest to the Sun (perihelion) it is 46 million kilometres away but when at its furthest it is nearly 70 million kilometres distant. To complete the trio of records Mercury also has the smallest axial tilt (just 2 arc minutes) of any of its solar system neighbours.

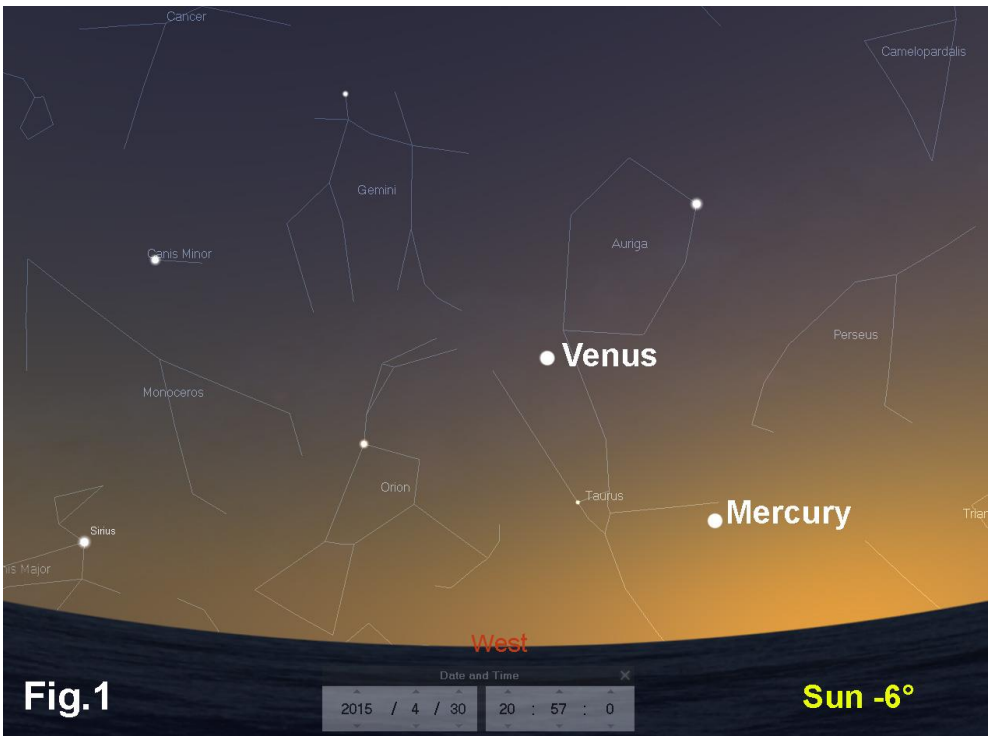
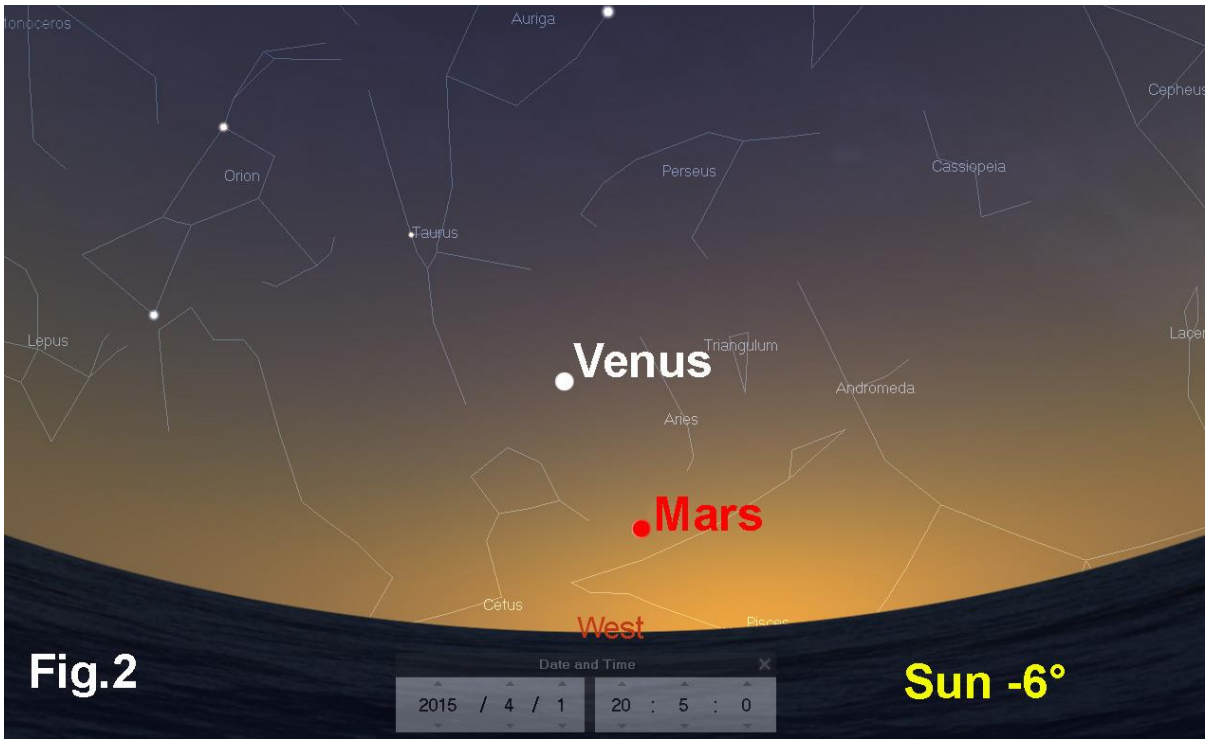


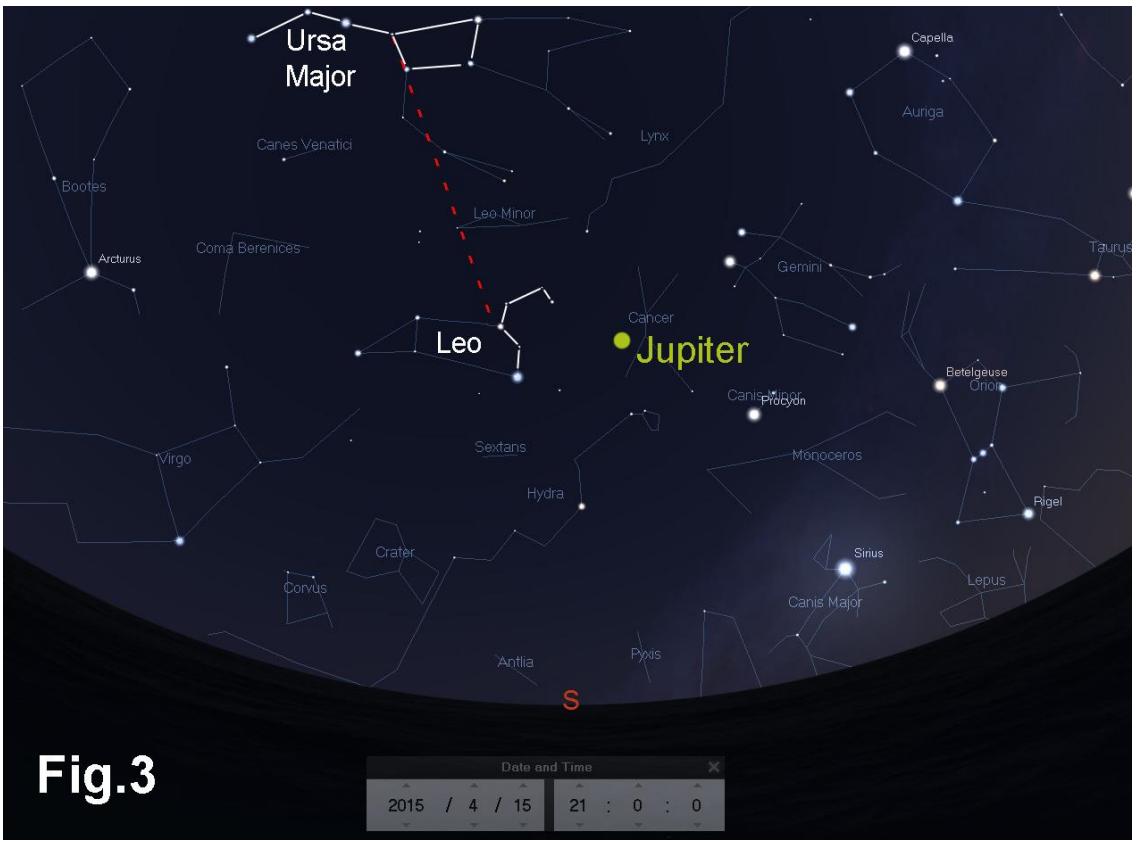
Fig.1

Venus is a brilliant evening object visible in the west soon after sunset. At magnitude -4.0 it continues to brighten and increase in apparent size as it moves towards elongation in early June. At the start of the month it is more than 25° in altitude at the end of civil twilight and remains visible for 3½ hours after sunset. By the end of the month this will have stretched to just over 4 hours. A small telescope will show its phase, which at the moment is gibbous, although a filter may well prove useful as the planet is so bright.

Mars is still making rapid eastward progress, but despite this it is gradually falling into the clutches of the Sun. Fig.2 shows its position at the beginning of the month with the Sun 6° below the horizon. Venus is included to act as a much brighter guide to the red planet which itself is now only magnitude +1.4. Mars and the Sun continue to move closer to each other until conjunction in mid June.



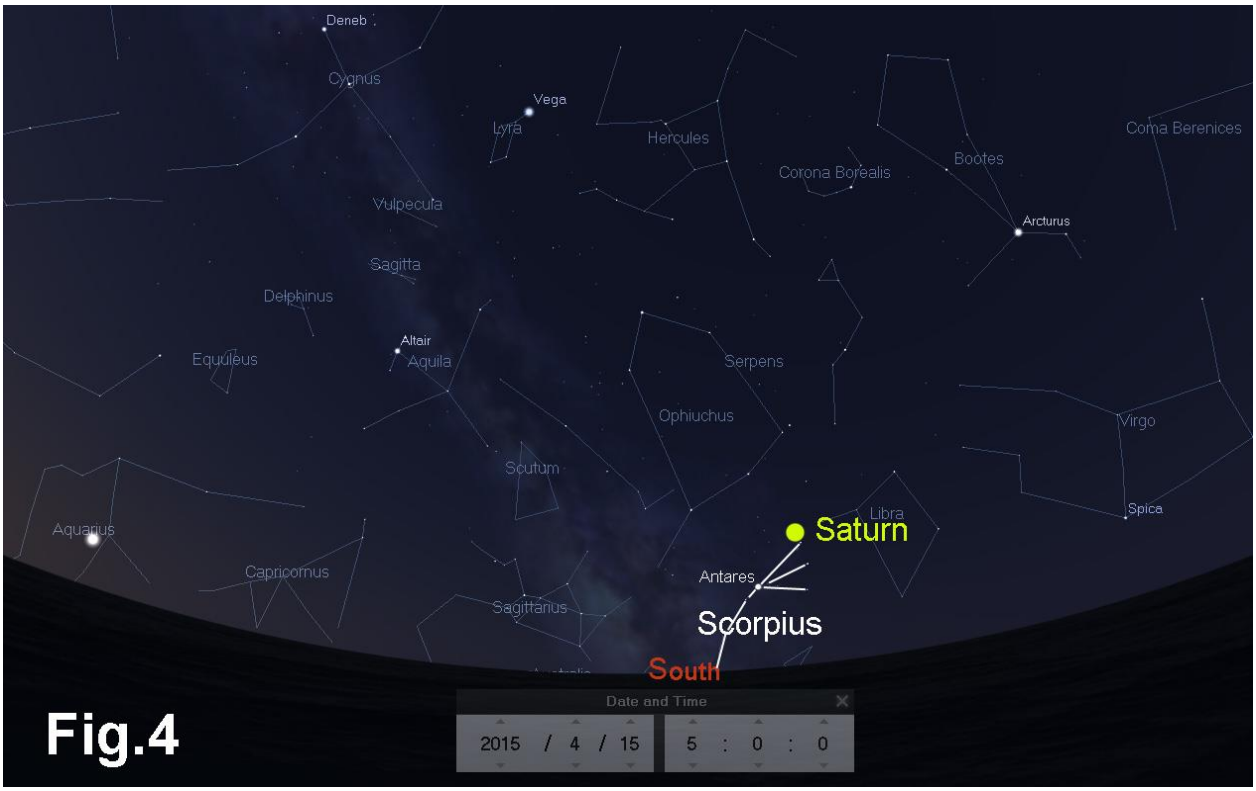
Jupiter is still a brilliant evening object in Cancer, on the meridian at 21.00 BST as the month begins. It is visible most of the night and even by the end of April it doesn't set until 03.00 BST.



It continues to move retrograde until the 8th, when it reaches its second stationary point, after which it begins direct motion once again. The gas giant's magnitude and apparent size are both falling slightly due to opposition having occurred two months ago. Fig.3

shows its location, which will change little during April, a little west of Leo. You can use the two rear stars in the “bucket” of the Plough to point you towards the “Sickle” of Leo which appears as a back to front question mark.

Saturn rises around midnight BST at the start of the month but this becomes 22.00 by the end. Currently it is moving retrograde in Scorpius towards Libra and will continue in that direction until August when it reaches its second stationary point. During April Saturn’s brightness increases slightly to +0.1 and its apparent diameter grows to 18.3” (18.3 arc seconds). The planets north pole continues to be tilted towards us at an angle of 25°, giving superb views of the ring system. Fig.3 shows its position in the early morning skies.



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 and RD = **r**eappearance at the **d**ark limb. The column headed “mm” (millimetres) shows the minimum aperture telescope required for each event. Please remember that the Society has telescopes that members can borrow, all of which are suitable for the such events. **Times are in BST.**

April	Time	Star	Mag	Ph	Alt °	% illum.	mm
Apr 22	22.21	ZC 858	7.0	DD	16	20	50
Apr 28	23.45	35 Sextantis	6.2	DD	34	77	60
Apr 30	21.39	ZC 1753	6.7	DD	35	90	90

Phases of the Moon for April

Full	Last ¼	New	First ¼
4th	12th	18th	25th

ISS

Below are details of passes of the International Space Station (ISS) that occur before midnight and are magnitude -2.0 or brighter. The details of all passes including those visible from other areas 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.**

Apr.	Mag	Time	Alt°	Az.		Apr.	Mag	Time	Alt°	Az.
6th	-3.0	20.14	44	SSE		12th	-3.3	19.40	79	N
7th	-2.3	19.20	29	SSE		12th	-3.0	21.26	59	WSW
7th	-3.4	20.56	77	WSW		13th	-3.4	20.22	89	N
8th	-3.4	20.03	67	SSE		14th	-3.3	19.29	79	N
9th	-3.3	20.45	80	N		14th	-3.0	21.05	50	SSW
10th	-3.4	19.51	89	S		15th	-3.3	20.11	70	SSW
10th	-2.3	21.27	44	WNW		16th	-2.3	20.53	31	SSW
11th	-3.3	20.34	79	N		17th	-2.8	19.59	47	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. There are a number of bright events this month and two of magnitude 8.0 or above, which are exceptionally bright and well worth trying to observe. **Times are in BST.**

Apr.	Time	Mag.	Alt°	Az.°		Apr.	Time	Mag.	Alt°	Az.°
1st	20.19	-3.1	51	85 (E)		11th	21.11	-2.7	35	59 (ENE)
1st	21.34	-6.2	19	44 (NE)		14th	21.02	-5.3	41	62 (ENE)
2nd	18.37	-8.4	69	161 (SSE)		15th	19.21	-5.1	70	110 (ESE)
2nd	21.31	-3.4	20	45 (SE)		15th	20.58	-3.1	41	63 (ENE)
3rd	21.32	-6.8	22	47 (NE)		18th	20.47	-8.0	47	65 (ENE)
5th	21.29	-5.9	26	51 (NE)		22nd	20.33	-3.2	54	68 (ENE)
8th	21.30	-4.5	30	55 (NE)		30th	22.53	-7.6	34	233 (SW)
9th	19.48	-3.3	64	97 (E)						

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

In the south Hydra, with Corvus and Crater riding on its back, is straddling the meridian. The head of the sea serpent, made up of stars whose distances vary enormously, lies just below Cancer whilst the end of the tail is just 12° south of Spica. Hydra contains a large number of galaxies, most of which are faint, a large open cluster and the "Ghost of Jupiter". The latter is more correctly known as NGC 3242 and is a tenth magnitude planetary nebula close to the border with Monoceros which needs an aperture of around 100mm to show it clearly. The open cluster, M48, is large at almost 55' across and at magnitude 5.8 is at the very limit of naked eye visibility when atmospheric extinction is taken into account. The report of its discovery seems somewhat ambiguous as Messier made an error in initially recording its position, thus allowing Caroline Herschel to be credited in some quarters. Above Hydra we find the Zodiacal groups of Virgo and Leo, and then closer to the zenith still, lies Leo Minor and Canes Venatici, both added by the astronomer Hevelius in 1687.

Turning to the west we see that, save for Auriga with the bright Capella and Gemini with Castor and Pollux , the bright winter groups have all but left the stage. M44, the open cluster in Cancer better known as the Beehive or Praesepe, is still well positioned at an altitude of 50°. Given its size and brightness and the fact that it had been identified by Ptolemy, it is something of a surprise that it was catalogued at all by Messier. It is hardly likely to be mistaken for a comet, which after all, was the original point of the catalogue. With an angular size of 95' it is an ideal candidate for binoculars or a rich field telescope.

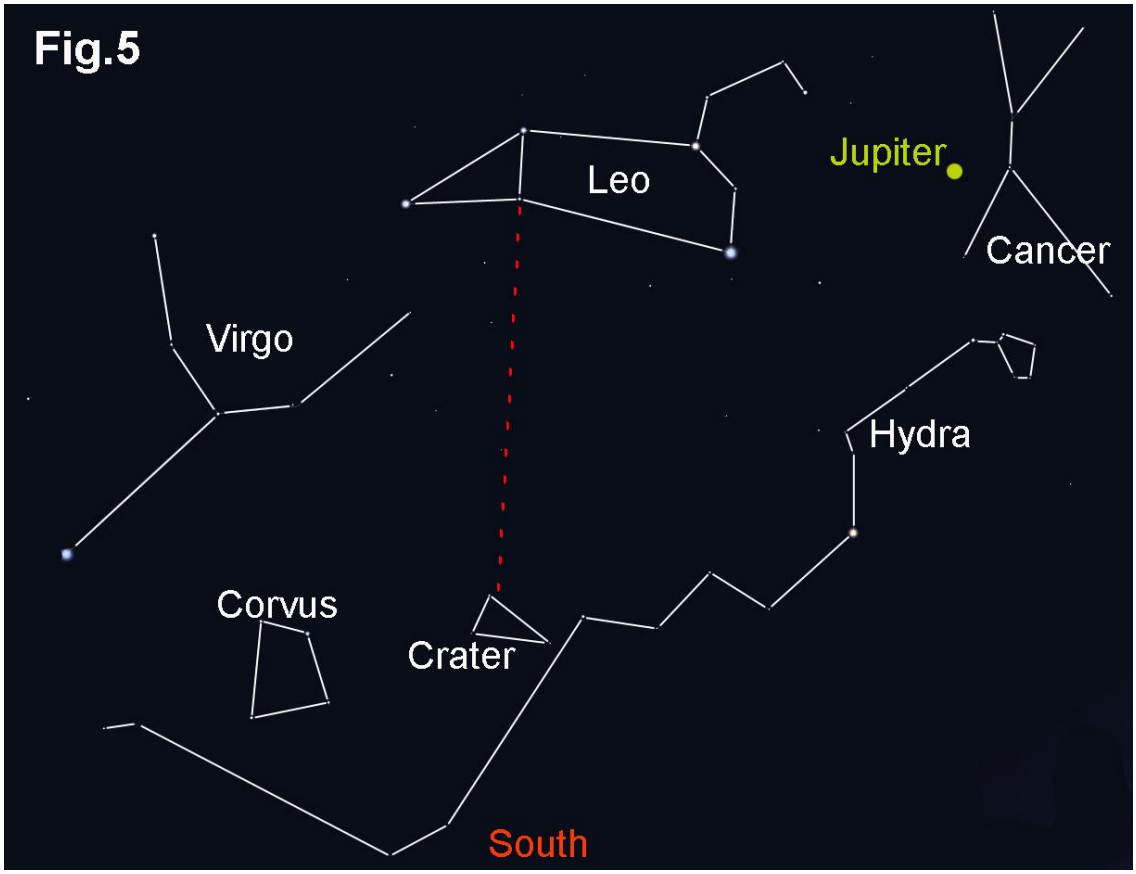
In the north the constellation of the Great Bear commands the zenith. Draco lies entirely to the east of the meridian with the head of the dragon pointing the way to Hercules. Opposite Draco lies the faint and unremarkable group of stars that loosely make up Camelopardalis, the Giraffe. There is an open cluster, NGC 1502 at magnitude 5.7, and a number of faint galaxies, but apart from a few variables there is little in the area to linger over.

To the east the brilliant Vega is already more than 15° in altitude, a sign that summer is not that far away. The faint constellations of Ophiuchus, Serpens and Libra are just coming into view, although there is compensation by way of Arcturus and the lovely Corona Borealis. The presence of Hercules means that the superb globular cluster M13 is now once again visible.

What Objects Can I Look For This Month?

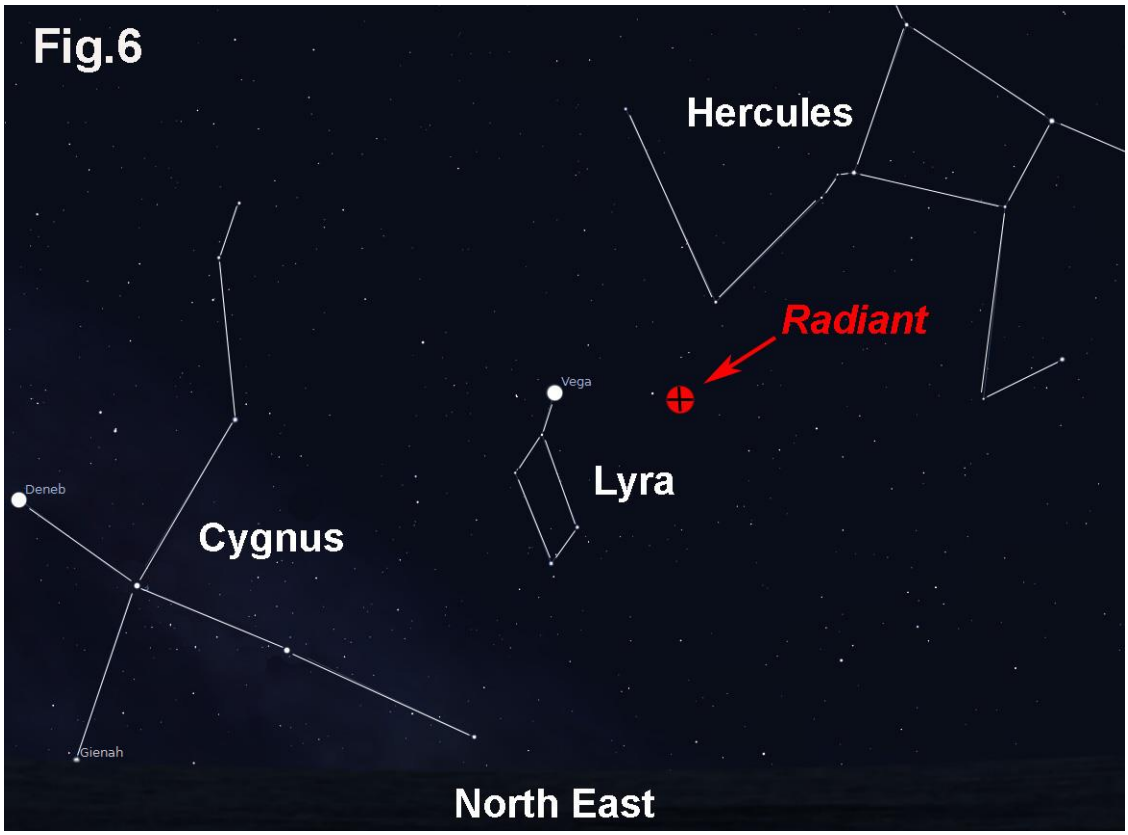
1. Crater is the cup in mythology and is one of Ptolemy's original 48 constellations. To find it use the two rear stars in Leo as shown in Fig.5 and extend a line down towards the horizon.

2. Corvus is the mythological crow or raven and lies just to the east of Crater though it is more obvious because its stars are a little brighter. It is also one of Ptolemy's additions to the sky. Both constellations are depicted as riding on the back of Hydra, the sea serpent.



Meteors

The Lyrids are active from April 18th to 25th with maximum occurring towards midnight on April 22nd. The ZHR at max is expected to be in the region of 10 but there have been outbursts, most recently in 1982, when rates rose to around 90 meteors per hour. The Moon this year will not cause any problems as it is a slim crescent in the west on the night of maximum. The radiant lies a little to the west of the bright star Vega in Lyra as shown in Fig.6.



Brian Mills

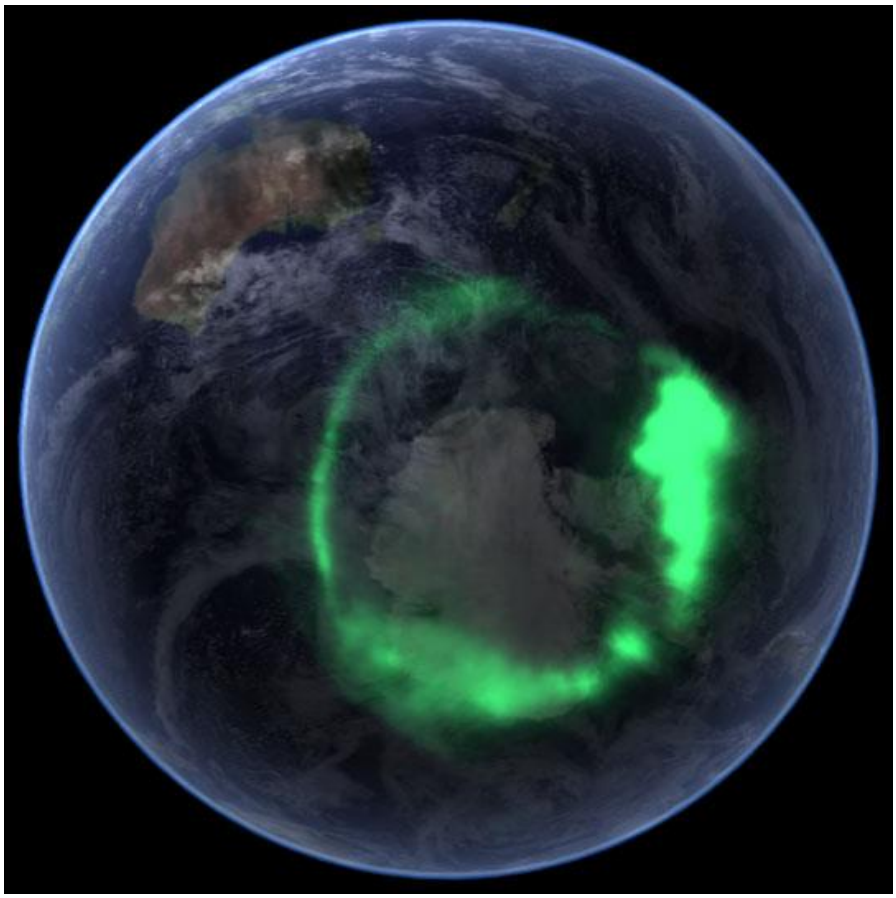
NASA SPACEPLACE

The Cold Never Bothered Me Anyway
By Ethan Siegel

For those of us in the northern hemisphere, winter brings long, cold nights, which are often excellent for sky watchers (so long as there's a way to keep warm!) But there's often an added bonus that comes along when conditions are just right: the polar lights, or the Aurora Borealis around the North Pole. Here on our world, a brilliant green light often appears for observers at high northern latitudes, with occasional, dimmer reds and even blues lighting up a clear night.

We had always assumed that there was some connection between particles emitted from the Sun and the aurorae, as particularly intense displays were observed around three days after a solar storm occurred in the direction of Earth. Presumably, particles originating from the Sun—ionized electrons and atomic nuclei like protons and alpha particles—make up the vast majority of the solar wind and get funnelled by the Earth's magnetic field into a circle around its magnetic poles. They're energetic enough to knock electrons off atoms and molecules at various layers in the upper atmosphere—particles like molecular nitrogen, oxygen and atomic hydrogen. And when the electrons fall back either onto the atoms or to lower energy levels, they emit light of varying but particular wavelengths—oxygen producing the most common green signature, with less common states of oxygen and hydrogen producing red and the occasional blue from nitrogen.

But it wasn't until the 2000s that this picture was directly confirmed! NASA's Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) satellite (which ceased operations in December 2005) was able to find out how the magnetosphere responded to solar wind changes, how the plasmas were energized, transported and (in some cases) lost, and many more properties of our magnetosphere. Planets without significant magnetic fields such as Venus and Mars have much smaller, weaker aurorae than we do, and gas giant planets like Saturn have aurorae that primarily shine in the ultraviolet rather than the visible. Nevertheless, the aurorae are a spectacular sight in the evening, particularly for observers in Alaska, Canada and the Scandinavian countries. But when a solar storm comes our way, keep your eyes towards the north at night; the views will be well worth braving the cold!



Auroral overlays from the IMAGE spacecraft.

Image credit: NASA Earth Observatory (Goddard Space Flight Centre) / Blue Marble team.

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Any material for inclusion in the May 2015 Newsletter should be with the Editor by April 28th 2015