Wadhurst Astronomical Society Newsletter December 2014

MEETINGS

NOVEMBER MEETING

Our November meeting was introduced by John Vale-Taylor who began by talking about the Society's imaging session on Ashdown Forest when about a dozen members came along to find out more about the practical side of astro-imaging under the direction of Brian Mills. John personally found focussing interesting in it self and how important it was to turn off auto focus.

There had been quite a lot of success and we were shown some of Phil Berry's excellent images although it still remains to arrange a session where members can come along and learn about processing those images and stacking them using free online software and other available imaging programmes. More about this in the Sky Notes later in the Newsletter.

John now turned to the evening's programme and introduced the first of several short talks.

SOFIA – The Stratospheric Observatory For Infrared Astronomy
Brian Mills FRAS

Brian introduced us to SOFIA, the Stratospheric Observatory For Infrared Astronomy being a joint venture between NASA and DLR, the German Aerospace Centre. NASA provided the means of carrying the telescope, the German contribution.

SOFIA

Infrared radiation was discovered by Herschel when he was investigating the temperature of different parts of the visible spectrum through a prism and found that a thermometer placed just beyond the red end of the visible spectrum registered quite a high temperature.

We were shown the wavelengths of different colours and were told that wavelengths towards the red end of the spectrum are the more resilient wavelengths and Brian used the eclipse of the Moon to illustrate this where the Moon becomes reddish due to higher

wavelengths being absorbed by the Earth's atmosphere and the reds are diffracted. We were also told that infrared is divided into bands of Near, Mid and Far infrared.

To show how infrared affects observational astronomy, we were shown an image of Orion in conventional light compared with one in infrared and the difference was very revealing, showing how dust can block out visible light but the infrared detail showed an enormous amount of gaseous turmoil.

In another example we saw images of the Horse Head Nebula taken in visible light, Near infrared and Mid-infrared, again showing how much detail is lost when viewing only in visible light.

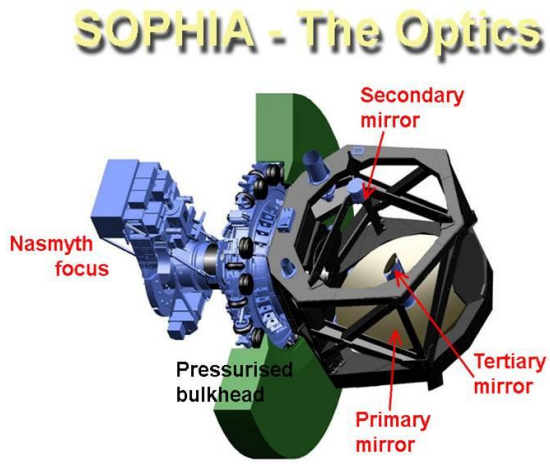
Then Brian spoke of the purpose of SOFIA, able to fly above most of the Earth's atmosphere that contains water vapour, reducing infrared. One aim is to collect data about star formation in our galaxy and another is to learn more about the physics of interstellar medium. Planetary formation in nearby star systems is also providing new data and the structure of comets and planetary atmospheres and rings are being discovered.

Back in June 2011, SOFIA observed the occultation of a distant star by Pluto and learnt about the pressure, temperature and density of Pluto's atmosphere. SOFIA was able to observe the actual point of occultation by flying 1,800 miles out to it over the mid Pacific Ocean.

SOFIA is also able to observe activity close to the black hole at the centre of the Milky Way and measure any influences on that part of our Galaxy.

The aircraft is a Boeing 747 SP (Special Performance) that has a range of over 7½ thousand miles with the telescope placed towards the rear of the aircraft behind the pressure bulkhead in an area that also contains the telescope's environmental and guidance systems.

The telescope is a 2.7 metre Classical Bent Cassegrain although only 2.5 metres are clear and the total weight is 17 tons. In a Bent Cassegrain telescope, apart from the secondary mirror, there is also a tertiary mirror, which directs the light out through the side of the telescope to a Nasmyth focus so that the telescope only needs to move in one plane. The light path is through the bulkhead to equipment on the pressurised side. It is also possible to work in visible as well as infrared light.



The Bent Cassegrain arrangement

Looking to the rear of the aircraft and the bulkhead

SOFIA has various advantages. It can be operated almost anywhere in the world and different instruments can be used. It is cheaper than a space telescope and is far less dangerous for the crew who might have to carry out repairs and upgrades.

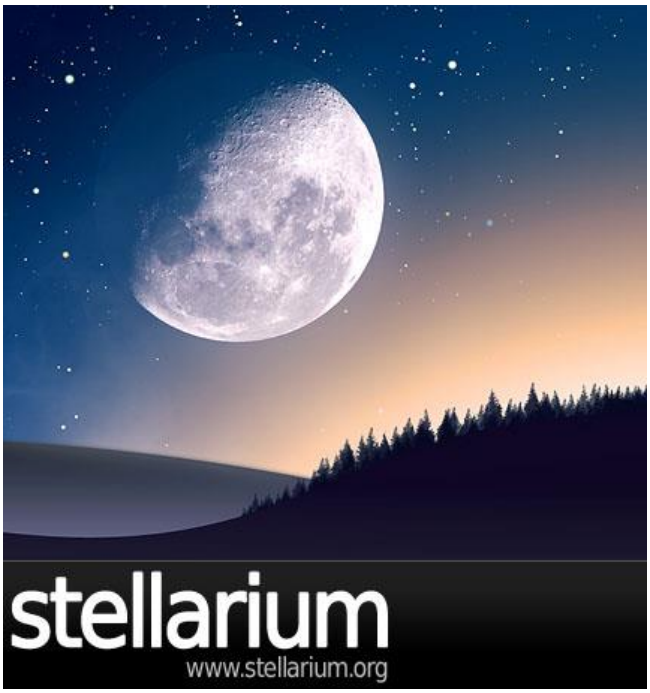
Finally Brian reviewed the history of airborne observatories such as "Galileo" used between 1965 and 1973 but back then the windows were replaced with optical glass. The problem was that this reduced the infrared light, yet the observatory did find water ice in Saturn's rings and proved that the clouds over Venus were not water.

A Learjet was used between 1967 and 1997. This time the telescope didn't have to look through glass because the aircraft was semi-pressurised with the astronomers wearing facemasks. It found that Jupiter and Saturn radiated more energy than they absorbed and also discovered sulphuric acid in the clouds of Venus.

Between 1974 and 1995, the "Kuiper Airborne Observatory" was operating from a Starlifter transport plane that carried a 36-inch Cassegrain. Pluto's atmosphere was discovered and Uranus was found to have rings and water molecules were found in comets.

Brian concluded by saying that SOFIA continues to carry out research and collect data.

Stellarium – A Free Software Planetarium Programme
Geoff Rathbone



The Stellarium logo

In 2000 a French research scientist wrote Stellarium, a planetarium programme for computers when he was just 20 year's old and it is still with us today having been updated many times since, although it still looks visually the same as it did, but with a considerable amount of new data and facilities added. Despite being free for download from the Internet, it has a database of 600,000 stars, is very accurate and easy to use There is also a comprehensive user's guide that can be downloaded.

The basic operation was explained and examples of some of the images of objects imbedded in the Stellarium sky when zoomed in to were shown. When a star or object is selected by pointing to it with the mouse and then clicking, a number of relevant details are displayed on the screen such as visual magnitude, position and distance from Earth. The object could then be centred using the keyboard space bar so that it was possible to zoom in showing more detail of the surrounding area.

It was demonstrated how the clock could be speeded up to show various events such as transits and eclipses in accelerated time.

One facility available was to remove the atmosphere by pressing "A" on the keyboard and giving a clearer view of the night sky and even to view the black sky during times of daylight. Another facility was to remove the ground by pressing "G", so that the southern hemisphere became visible and the Magellanic Clouds and Southern Cross could be seen and even α-Centarui, our third nearest star at a distance of only 4.7 light years (the Sun being the nearest and Proxima Centauri being only a magnitude 13 star).

Next we were introduced to the lower toolbox along the bottom of the screen which gave access to choices on screen such as the equatorial and alt-azimuth grid lines as well as the constellation lines and their names. It is even possible to display the mythological figures over the constellations such as the hunter in Orion and the bear in Ursa Major.

The left hand side tool bar enables the user to select what he sees of the on-screen night sky such as the names of stars and nebulae. Many other aids to help in viewing the night sky were also demonstrated.

To illustrate the use of the "Object Finder", the star with the greatest proper motion, Barnard's Star was selected and then by using the clock we were able to see how Barnard's Star moves through the background stars, moving through an angle of 16 minutes in fifty years.

Still using the clock, we looked at The Plough as it is today and then again using the clock, advanced 90,000 years into the future. Now the shape of this part of the constellation had distorted with Dhube moving way off to the right and Mizar shifting well up to the top left. No longer did the two right hand stars of The Plough point to the Celestial North Pole. In fact due to precession the North Celestial Pole had moved considerably over to the east (or perhaps we should say the Earth has moved to the west) and was now marked by the star Vega.

Finally, we changed our location to Mars, having also selecting the landscape to that of Mars as well. By looking back towards the Earth and zooming in we could see the continents and in another demonstration of the accuracy of Stellarium we could see the Earth rotate in time, showing the continents as they really would be seen from Mars at that precise time.

A View from Mars from Stellarium

Stellarium is free to download from www.stellarium.org but be careful not to download any of the advertising programmes at the same time because they can be a nuisance. It is a great tool for observation, education and is great fun just to look round the sky.

Two Videos from the World of Science
John Wayte

Once again, John has found some interesting facets from the scientific world.

He began by asking if we remember the time when Tunbridge Wells was the hub of our local villages such as Wadhurst and Crowborough in those far off comfortable days when we called ourselves the Local Group. Then he asked if anyone knew what the Local Group is in astronomical terms. He told us that it refers to the local group of galaxies, which includes about thirty galaxies including the Great Andromeda Galaxy, the Triangulum Galaxy and ourselves. But it seems we have just joined a much larger group, Laniakea, a super cluster containing about 100,000 galaxies. The common link is their gravitational pull towards a point known as the Great Attractor.

John then showed an interesting video describing what Laniakea is. It was both informative and in some way verging on art. It can be found by going to www.youtube.com and in the Search Box enter 'Laniakea', then selecting 'Our home supercluster – youtube'. The video lasts 4 minutes and 11 seconds and with sound describes our new extended neighbours.

Finally, John asked if we had ever wondered about the scale of our Universe, from the absolute smallest to the biggest, and then invited us to sit back and enjoy a roller coaster ride. This time the video can be found again at www.youtube.com but searching for "The smallest to the biggest thing in the Universe".

DECEMBER MEETING

Wednesday 17th December 2014 – Our Director of Observations will be giving another of his popular talks. Brian Mills calls the December talk "The Story of Longitude".

FUTURE MEETINGS

Wednesday 21st January 2015 – The AGM followed by John Wayte who is giving a talk he calls "The Big Bang".

Wednesday 18th February 2015 – Rob Cray takes as his subject "Steps to Apollo: the Mercury and Gemini Space Programs".

Wednesday 18th March 2015 – Chris Morris talks on "The Use of Heavenly Bodies for Astro Navigation".

SKY NOTES FOR DECEMBER 2014

Planets

Mercury suffers a superior conjunction on 8th December and is consequently poorly placed for observation this month. The smallest planet then moves east of the Sun to become an evening object, reaching greatest eastern elongation on 14th January next year.

Venus itself passed through a superior conjunction at the end of October making it a difficult object to spot in the evening twilight until the end of the month. On the last day of the year the planet will shine at magnitude -3.9 some 8° above the south western horizon at sunset. It will provide a moderately good showing during the first half of 2015, reaching elongation on 6th June when, in angular terms, it will be 45° from the Sun.

Earth reaches the winter solstice on December 23rd at 23.03 UT which, generally speaking, means we have reached the shortest day.

Mars is still visible as an evening object although it is now growing fainter (currently magnitude +1.1) and its angular size is just under 5 arc seconds. Its position on the first of the month is shown in fig. 1 with the Sun at the end of civil twilight when it is 6° below the horizon. Mars, at that time, will be 15° in altitude in the south-south-west.

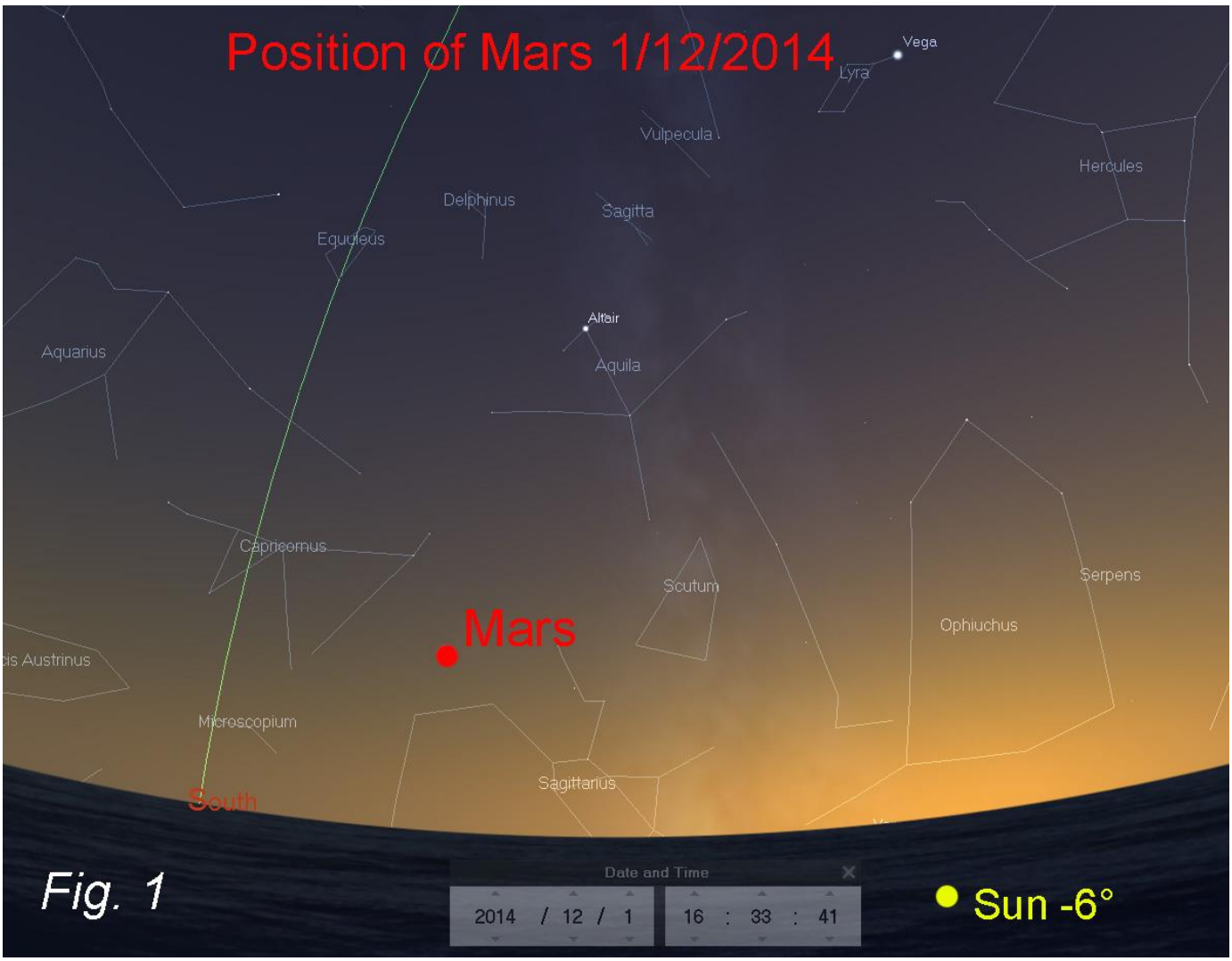
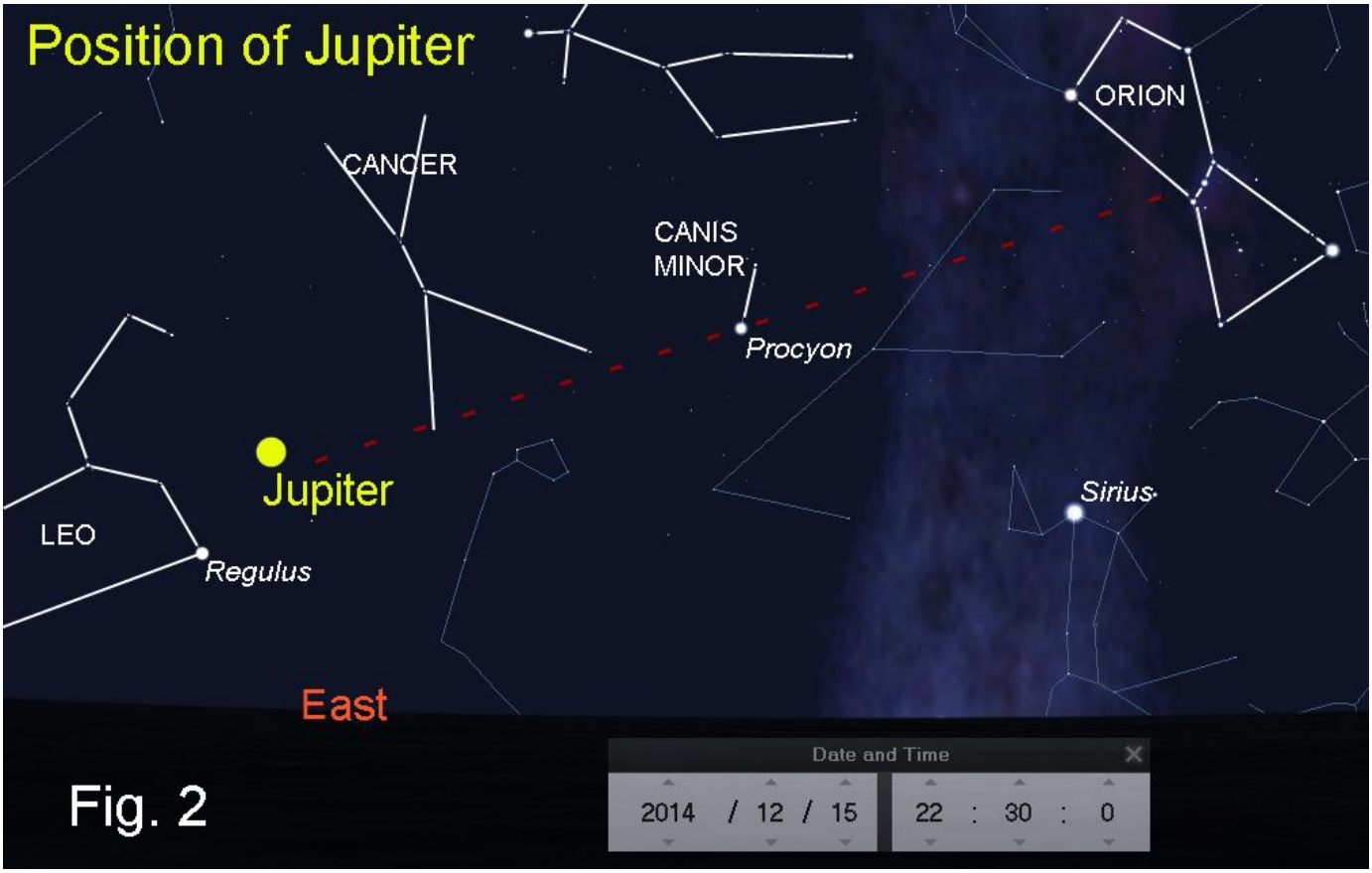
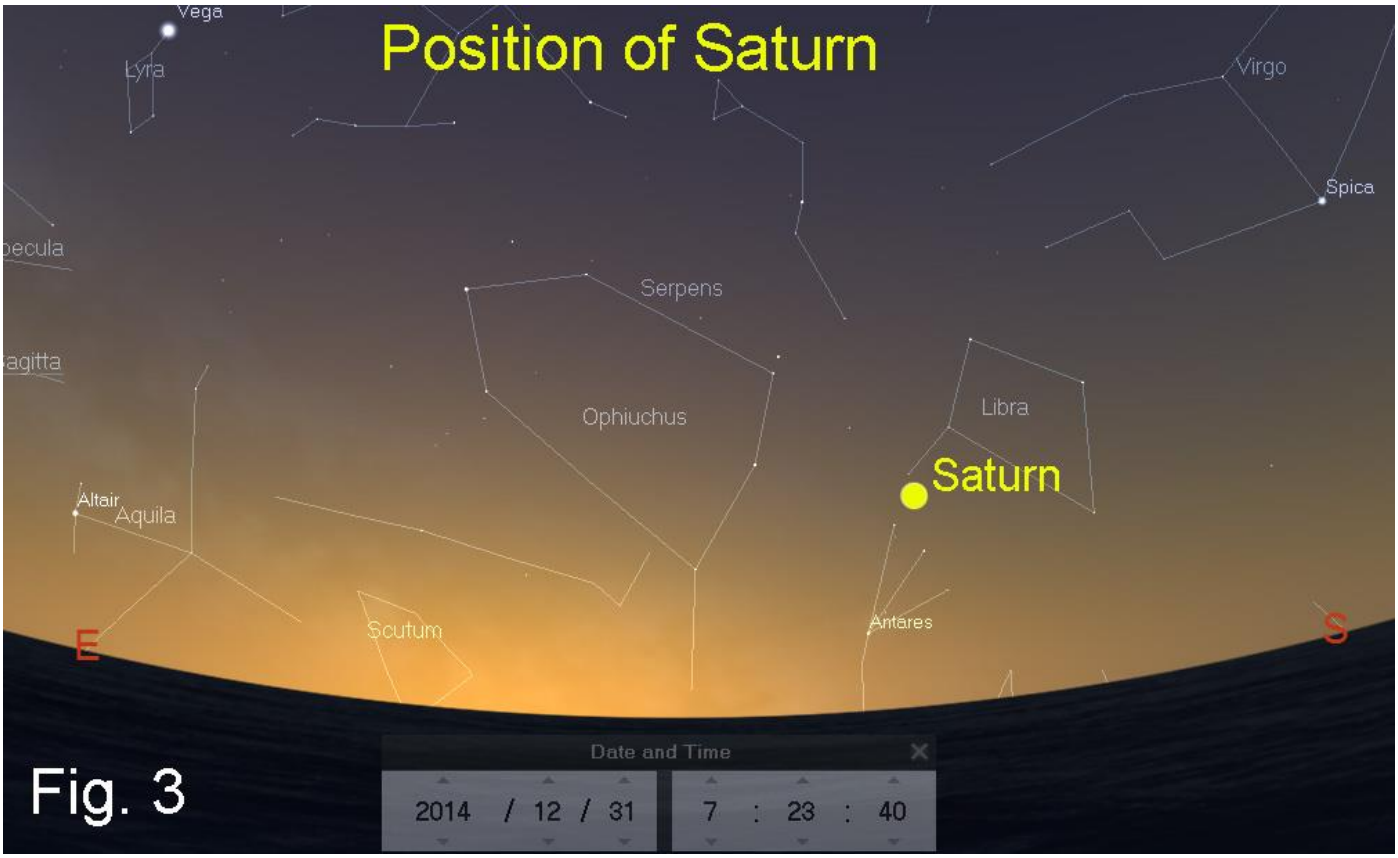


Fig. 1

Jupiter, in the constellation of Leo, rises at 21.45 at the start of the month although this has improved to 19.40 by the end. Fig. 2 shows its position close to the "Sickle" of Leo and the bright star Regulus in the middle of the month at 22.30. The giant planet begins the month moving direct (west to east) but reaches its first stationary point on 8th December and thereafter it travels retrograde (east to west). This motion, which causes it to move into neighbouring Cancer, continues until April next year when it once again resumes direct motion. If you are in any doubt about locating Jupiter, you can use an imaginary line from the belt of Orion through the star Procyon in Canis Major which will pass close to the planet. Its brightness (magnitude -2.4) and apparent size (42") are both rising as opposition, which occurs on 6th February 2015, approaches.



Saturn was in conjunction with the Sun on 18th November, but despite this the ringed planet is moving swiftly west and will be 25° away, in angular terms, by the middle of the month.



At that time it rises more than two hours ahead of the Sun and will be visible low in the south east. The situation improves rapidly and by month's end Saturn is 16° high with the Sun 6° below the horizon which signifies the end of nautical twilight and the beginning of civil twilight. Fig. 3 shows this situation with the planet a little to the north of the bright star Antares in Scorpio. Despite the separation of Saturn from the Sun increasing swiftly, it will be April 2015 before the ringed planet is once again an evening object. If you do manage to view the planet through a telescope of moderate size you will see that the rings are extremely well presented to the Earth. Thanks to the tilt of Saturn's axis of rotation, this is something that will improve gradually through December and into the first quarter of 2015.

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 such events. I have included two morning events because they are of bright stars and are at reasonable times. **Times are in GMT.**

Dec	Time	Star	Mag	Ph	Alt °	% illum.	mm
Dec 2nd	17.17	ZC 214	6.2	DD	30	84	70
Dec 2nd	20.06	ZC226	6.5	DD	46	85	70
Dec 9th	07.04	ZC 1106	3.6	RD	23	92	40
Dec 10th	22.05	ZC 1309	5.6	RD	16	81	50
Dec 11th	07.41	Alpha Cancri	4.3	RD	27	79	40
Dec 11th	22.51	ZC 1410	5.1	RD	14	73	40
Dec 25th	18.41	ZC 3169	6.1	DD	15	18	40
Dec 26th	16.26	ZC3308	6.2	DD	32	27	40
Dec 26th	17.04	ZC 3311	6.9	DD	31	27	50
Dec 27th	18.08	ZC 3459	6.3	DD	35	38	40
Dec 27th	20.52	ZC 3474	5.9	DD	20	39	40

Phases of the Moon for December

Full	Last ¼	New	First ¼
6th	14th	22nd	28th

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 GMT.**

Dec	Mag	Time	Alt°	Az.		Dec	Mag	Time	Alt°	Az.
12th	-2.5	17.48	37	SSE		19th	-2.9	18.19	62	W
14th	-3.1	17.44	62	SSE		20th	-3.4	17.28	82	N
15th	-2.6	16.53	45	SSE		21st	-3.3	16.37	78	N
15th	-2.2	18.28	44	W		21st	-3.0	18.14	61	SSW
16th	-3.4	17.39	89	SSE		22nd	-3.3	17.23	80	SSW
17th	-3.2	16.48	72	SSE		23rd	-3.3	16.31	86	N
17th	-2.5	18.24	50	WNW		23rd	-2.0	18.08	37	SSW
18th	-3.4	17.33	79	N		24th	-2.5	17.17	52	SSW
19th	-3.3	16.43	85	N						

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 . 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 GMT.**

Dec	Time	Mag.	Alt°	Az.°		Dec	Time	Mag.	Alt°	Az.°
5th	18.01	-3.1	48	35 (NE)		16th	17.03	-2.7	65	55 (NE)
6th	17.55	-3.5	50	36 (NE)		17th	16.57	-8.3	65	59 (NE)
7th	17.49	-3.0	50	39 (NE)		25th	18.12	-7.8	46	36 (NE)
15th	17.09	-2.3	63	52 (NE)		26th	18.06	-3.9	47	38 (NE)

Now might be a good time to reiterate what causes an Iridium flare. The Iridium group of communication satellites carry three highly polished antennae which reflect sunlight in a very predictable way. An observer on the ground who happens to be located in exactly the right spot on the Earth's surface sees one of these reflections as a bright flash that lasts for just a few seconds. Some flares are bright enough to be seen in daylight if you know exactly where to look. The satellites are due for replacement in the next few years, so whether they will still provide flares remains to be seen.

The Night Sky in December (Written for 22.00hrs GMT mid month)
If we look due east we find the brilliant star Capella, in Auriga, at an altitude of more than 70°. Below it we see initially one of Orion's retinue, Gemini the twins, and then closer still to the horizon come Canis Minor and Cancer. Right on the eastern horizon, in the act of rising, are Leo and Hydra, the latter of which is notable for being the constellation that covers the largest area of sky at 1,303 square degrees.

In the south Orion has not yet reached the meridian although Eridanus, the river, lives up to its name, meandering from Orion's left foot, west and east several times before disappearing below the horizon. High up and almost at the zenith is Perseus with its brightest star Mirphak (alpha Perseii) less than 3° from that overhead point. The area immediately west of the meridian is taken up with the rather large and featureless constellations of Cetus and Pisces, the former of which is famous for hosting the well known variable star Mira.

Looking towards the west we find the Square of Pegasus standing on one corner and about to slip below the horizon. Despite that the Andromeda galaxy, M31, is still at a respectable altitude of 60° and should be just visible to the naked eye if the sky is reasonably dark. See the September Newsletter for a map and directions about locating it. Of the three bright stars in the Summer Triangle, Altair has already set, but Vega and Deneb are still visible. Vega will soon be lost but Deneb is circumpolar from these latitudes and will never be lower than 6° high even when crossing the meridian below Polaris.

To the north Ursa Minor points down towards the horizon whilst its larger namesake has completed its skirmish with the horizon and is now climbing once again. That this is happening means Cassiopeia and Cepheus are descending on the opposite side of the meridian. The faint and rather shapeless constellation of Camelopardalis lies immediately above Polaris and is well situated for identification.

What Objects Can I Look For This Month?

1.The Hyades
Catalogued as Melotte 25, Collinder 50 and Caldwell 41, this is an open cluster in the truest sense of the word, and resembles a letter "V" lying on its side. Although the brightest star in Taurus, Aldebaran, appears to lie within the cluster it is simply a line of sight effect. The cluster is some 150 light years away whilst the orange giant Aldebaran is a mere 65 light years distant. It contains in the region of 200 members, many of which are on the outer reaches of the group and are thought to be escaping from its gravitational influence. Use binoculars to see the group at its best.

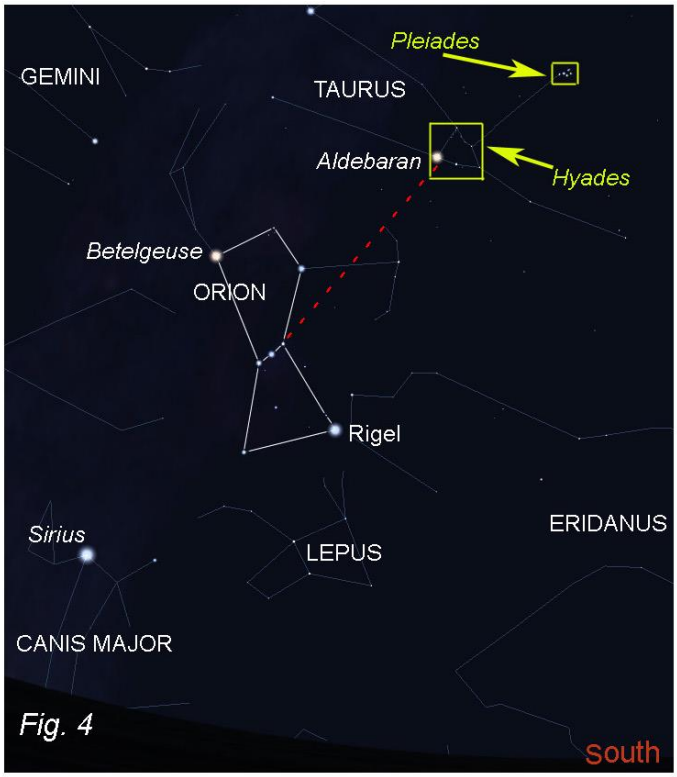


Fig. 4

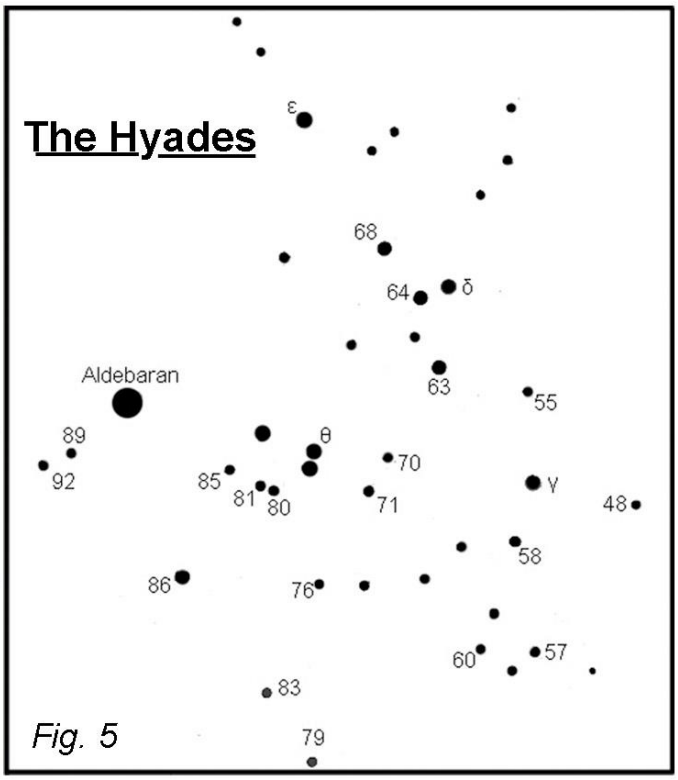
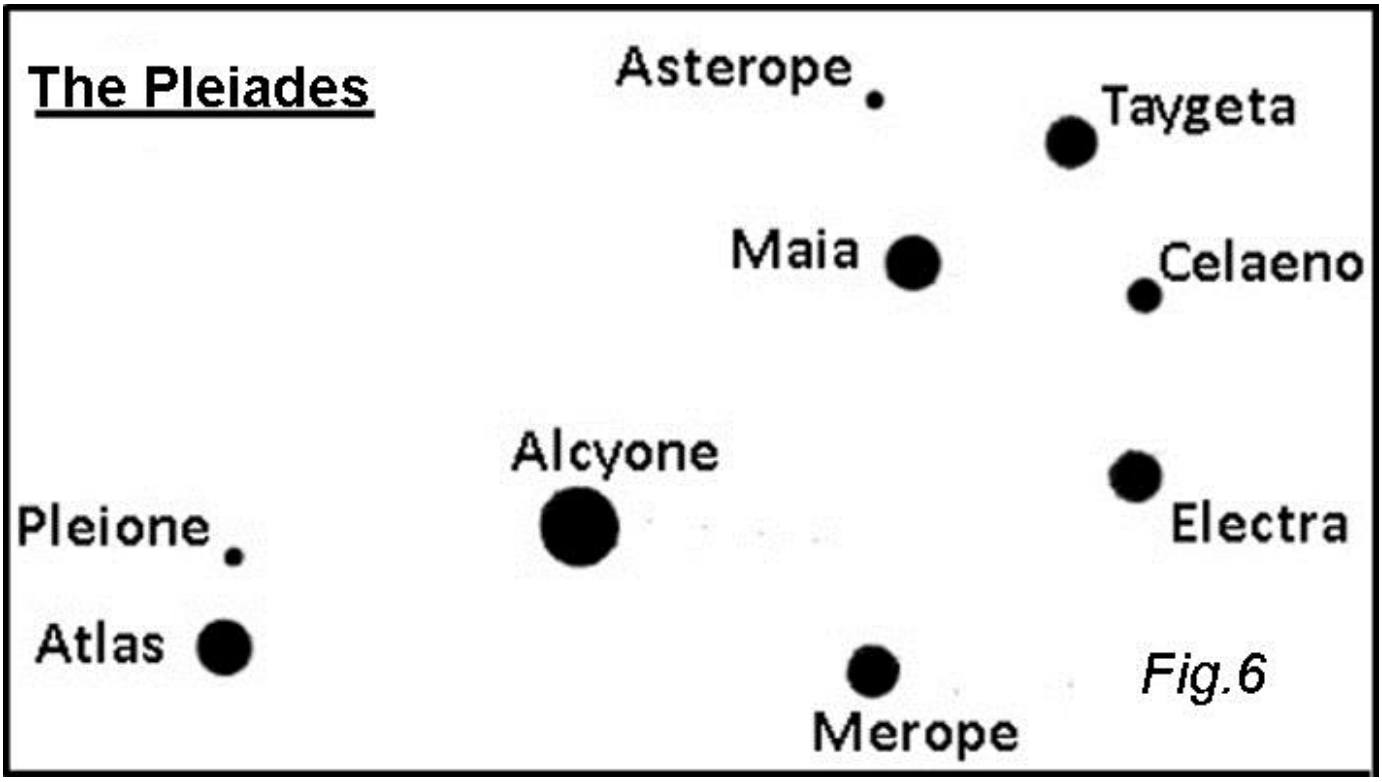


Fig. 5

2. The Pleiades
This is the best known of the winter's open clusters and possibly one of the best known and most photographed in the entire sky. The cluster was designated M45 by Charles Messier when he was compiling a catalogue of fuzzy objects to ignore when searching for comets. There is still some conjecture about why he should include such a bright and obvious group as this that had been known since antiquity. One suggestion is that his French rival Nicolas Lacaille was preparing a similar catalogue, and it seems Messier wanted his to be the most comprehensive of the two.



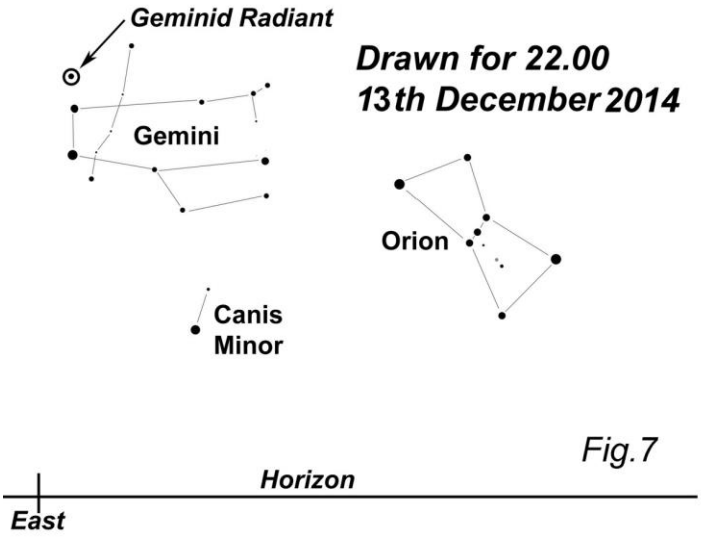
The group is often referred to as the “Seven Sisters” because it was said that was the number of members visible to someone with good eyesight. However, from a really dark site more than that have been seen and in fact there are reports of fourteen having been recorded. The Pleiades contains mostly hot blue stars with an average age of one hundred million years. It was always thought that the nebulosity around the stars was gas left over from their formation, but this idea has lost favour because given the age of the group, the material would have been dispersed into space by the pressure of radiation from the stars. Instead it is thought that the gas is simply part of the interstellar medium that the cluster happens to be passing through.

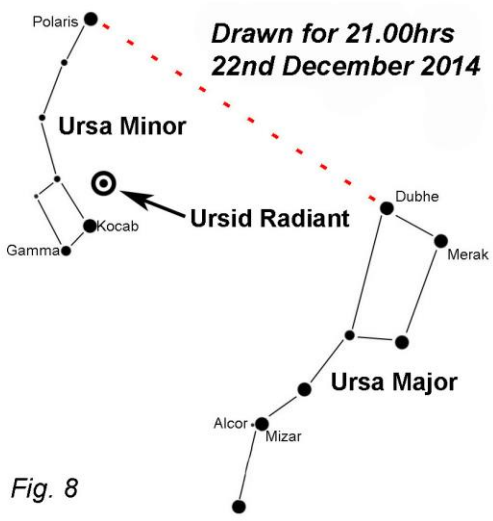
Find the Hyades first by locating Orion in the south east and use the three stars of the belt to point you towards Aldebaran as shown in fig. 4. Having done this, continue the line in roughly the same direction and you will reach what appears at first glance to be a misty patch but is in fact the Pleiades.

Meteors

The Geminids are one of the most active of the year’s showers with estimates of events being promising. They are active from December 8th to 17th with maximum occurring at 07.00 GMT on December 14th when the ZHR could reach 100. The radiant (see fig.7) lies just above the ”Twins” and has reached almost 50° in altitude by 23.00 GMT. Unfortunately, as per last year, the Moon will interfere to some extent, as on the night of maximum it is at last quarter and located in southern Leo, rising at 23.15 GMT. Given the time of maximum it would be worthwhile looking on the nights of 13th/14th and 14th/15th.

The Ursids are an under-observed shower and would benefit from increased watches despite the proximity of Christmas. They are active from December 17th to 25th and reach maximum during December 22nd to 23rd. The radiant lies close to Ursa Minor as shown in Fig. 8. The Moon will fortunately play no part in this event this year. Around 10 meteors per hour are expected.





DSLR imaging Evening

The imaging evening took place as planned on Ashdown Forest in October under unusually clear skies. Twelve people were present and most obtained images of some kind. The plan is to now arrange an evening to stack the images together to improve image quality and then manipulate them to enhance the final image. One of our members, Ian King, who is a renowned expert in this field has agreed to guide us through the relevant stages of this process. By a show of hands at the November meeting a large number of people were keen to take part in this event, so it would assist me in arranging to hire the hall if you could e-mail me to let me know if you are interested. I ought to stress that you do NOT need to bring images to process, you are welcome to attend to observe what we are doing. We hope to make some of our initial images available to members who weren't able to attend at Ashdown Forest but would like to be guided through the process by one of the country's leading experts. Please use my e-mail address at the end of this Newsletter.

Advance warning for 2015

January - Comet 2014 Q2 Lovejoy may reach 4th magnitude.
February 6th - Jupiter at opposition
March 20th - Total solar eclipse. A large partial eclipse is visible from the UK.
May 23rd - Saturn at opposition
August 13th - Perseid maximum with the Moon close to new.
September 28th - Total lunar eclipse, visible from the UK.
December 14th - Geminid maximum with the Moon just after new.

Brian Mills

SPACEPLACE

Where the Heavenliest of Showers Come From

By Dr. Ethan Siegel

You might think that, so long as Earth can successfully dodge the paths of rogue asteroids and comets that hurtle our way, it's going to be smooth, unimpeded sailing in our annual orbit around the sun. But the meteor showers that illuminate the night sky periodically throughout the year not only put on spectacular shows for us, they're direct evidence that interplanetary space isn't so empty after all!

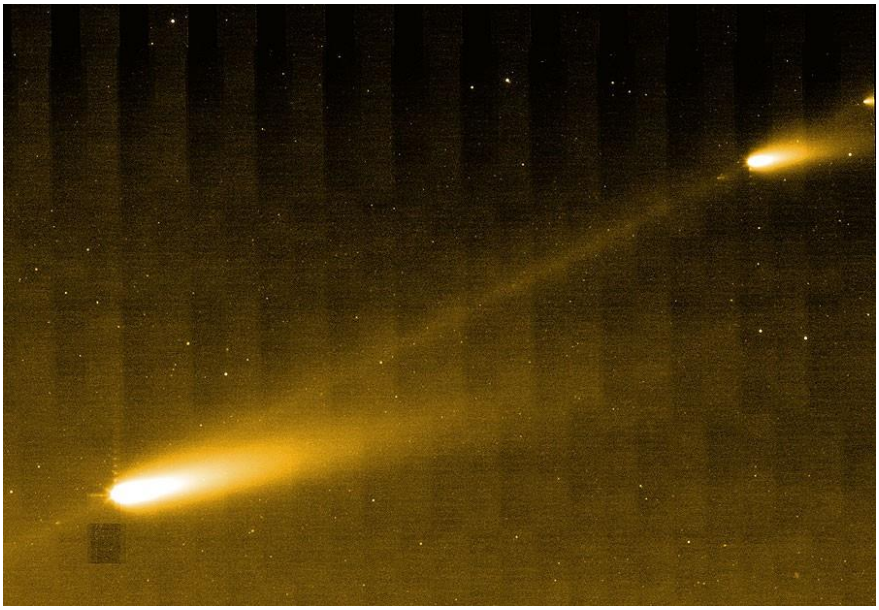
When comets (or even asteroids) enter the inner solar system, they heat up, develop tails, and experience much larger tidal forces than they usually experience. Small pieces of the original object—often multiple kilometers in diameter—break off with each pass near the sun, continuing in an almost identical orbit, either slightly ahead-or-behind the object's main nucleus. While both the dust and ion tails are blown well off of the main orbit, the small pieces that break off are stretched, over time, into a diffuse ellipse following the same orbit as the comet or asteroid it arose from. And each time the Earth crosses the path of that orbit, the potential for a meteor shower is there, even after the parent comet or asteroid is completely gone!

This relationship was first uncovered by the British astronomer John Couch Adams, who found that the Leonid dust trail must have an orbital period of 33.25 years, and that the contemporaneously discovered comet Tempel-Tuttle shared its orbit. The most famous meteor showers in the night sky all have parent bodies identified with them, including the Lyrids (comet Thatcher), the Perseids (comet Swift-Tuttle), and what promises to be the best meteor shower of 2014: the Geminids (asteroid 3200 Phaethon). With an orbit of only 1.4 years, the Geminids have increased in strength since they first appeared in the mid-1800s, from only 10-to-20 meteors per hour up to more than 100 per hour at their peak today! Your best bet to catch the most is the night of December 13th, when they ought to be at maximum, before the Moon rises at about midnight.

The cometary (or asteroidal) dust density is always greatest around the parent body itself, so whenever it enters the inner solar system and the Earth passes near to it, there's a chance for a meteor storm, where observers at dark sky sites might see thousands of meteors an hour! The Leonids are well known for this, having presented spectacular shows in 1833, 1866, 1966 and a longer-period storm in the years 1998-2002. No meteor storms are anticipated for the immediate future, but the heavenliest of showers will continue to delight skywatchers for all the foreseeable years to come!

What's the best way to see a meteor shower? Check out this article to find out: http://www.nasa.gov/jpl/asteroids/best-meteor-showers.

Kids can learn all about meteor showers at NASA's Space Place: http://spaceplace.nasa.gov/meteor-shower.



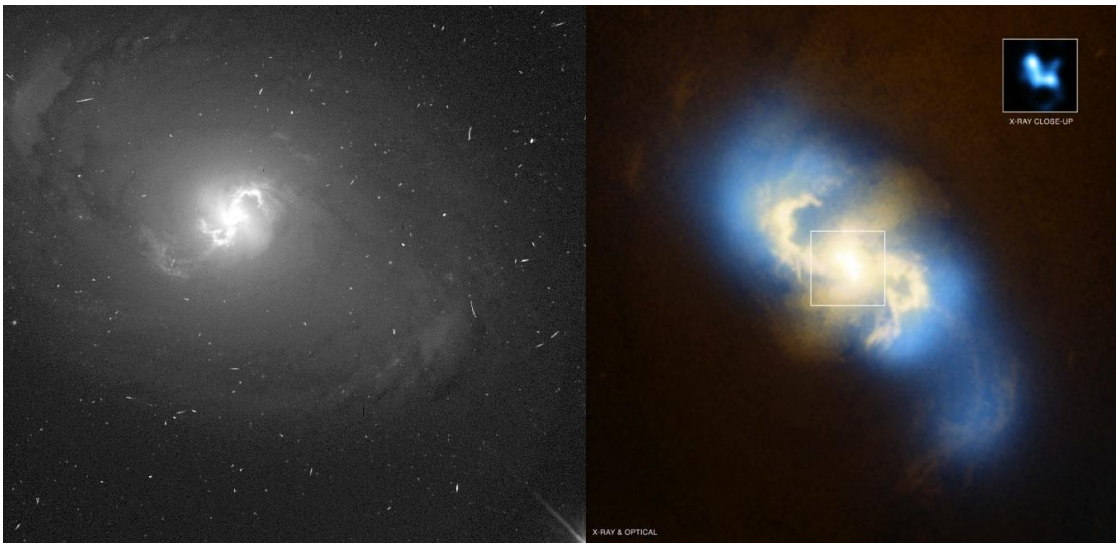


Image credit: NASA / JPL-Caltech / W. Reach (SSC/Caltech), of Comet 73P/Schwassman-Wachmann 3, via NASA's Spitzer Space Telescope, 2006.

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Any material for inclusion in the January 2015 Newsletter should be with the Editor by December 28th 2014