NEWSLETTER

June - August 2015 Issue 171

The Pleiades taken by Ed Cloutman (CAS Member) on 9th Feb. 2015 using 1000mm FL Takahashi Refractor working at 760mm FL with 645 reducer & field flattener

Editor ***John Richards 17 Lan Close Graigwen, Pontypridd CF37 2HB***
Tel. (01443) 480 987 email Publications.Officer@cardiff-astronomical-society.co.uk

Junior Editor Kayleigh Churchill, 34A Swansea Road, Merthyr Tydfil, CF48 1HT.
Tel. (01685) 382 866 email Junior.Representative@cardiff-astronomical-society.co.uk

Editorial John Richards

Well as the summer nights temporarily retreat and with hope the Sun bathes the country in warmth, we've reached the end of the Society's 39th year. Looking back it's been an exciting year of star parties, astronomical festivals, deep sky observing at Dyffryn, solar viewing events (including the eclipse), and not forgetting of course the thoroughly interesting talks on a wide range of astronomical interests held at the University.

While the society takes its customary 'talks' break for the summer, and before the excellent programme for the 40th year begins there's plenty to look forward to in the interim. The NASA Dawn mission continues to investigate the minor planet Ceres. As comet 67P hurtles closer to the sun, there is still hope that the little Philae probe will awaken and start sending results back. July 14th marks the day when New Horizons, will have its closest approach to Pluto, the last as yet un-visited 'planet' in the solar system. And finally in August the Perseid Meteor show puts on its annual show. Enjoy the summer.

Wishing you dark skies - John

Contact Details

Have you changed your email address or other contact details recently? If so, you could be missing out on receiving important society information. Please keep us up to date with any changes. Send your revised details to either our Membership Secretary (membership.secretary@cardiff-astronomical-society.co.uk) or Secretary (secretary@cardiff-astronomical-society.co.uk).

Publication Dates

The CAS newsletter is published at the first society meeting of September, December, March & June. The deadline for submissions is 4 weeks before the publication date, and is the 7th August for issue 172.

Visit CAS on the web @

http://www.cardiff-astronomical-society.co.uk
General enquiries email: info@cardiff-astronomical-society.co.uk
As a CAS member you can use the Members' Area of the web site. You will need your password to access this area. If you don't know your password it is your surname followed by your membership number.

CAS is now on twitter, to follow us, follow **CardiffAS**

CAS on facebook at
http://www.facebook.com/CardiffAS

Behind the scenes Dave Powell

The February star party was clouded out but we entertained over 20 members of the W.I. plus some guests and CAS members.

The “Sky at Night” magazine, March 2015 edition contained an article about Urban Astronomy, and featured the Cardiff Astronomical Society. Excellent publicity.

At Dyffyrn, the observatory roof now has bigger wheels that make it easier to push and a new motor that means you can just press a button and hey presto.

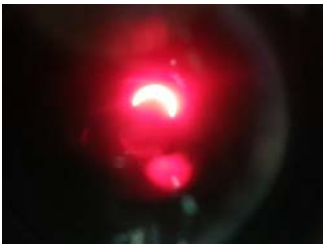
Bob Sutton, has resigned from committee, so we looking for a new curator of instruments. If anyone is interested, please contact any of the committee. In recognition of the immense contribution made to the society, we have decided to name the library in honour of Joan Thomas, who as you may be aware, recently passed away.

The March star party was a great success, clear skies, and a good turnout that included members of the public, new and established members, and Comet Lovejoy. What more could one ask.

March 20th Eclipse of the Sun.

We arrived in the car park at St Fagans at an unheard of hour. The birds had not yet woken up, the sheep were still asleep and people wandered around asking directions to their beds. Then the organisers lined us up and we were taken on a route march. In the wrong direction! Then we went in the right direction, down narrow paths, past old and dilapidated buildings, on we went, by now I wondered was I really born too late to have missed National Service, because this felt very much like what soldiers do. I asked the camp commandant if we could stop for a while but orders are orders, so we marched on, and on, and on. Destination the Oakdale Institute.

A colander at the ready



Once there, we set up the scopes, sat down on chairs, at least the ones who remembered to bring them sat down, and before long the

eclipse began under a clear blue sky. Children came and went, looked through the scopes, said "WOW" a lot, tried to take photos, asked us lots of questions and then came back for another look.

There were lots of breakfast cereal boxes that had been turned into pinhole cameras. As the maximum eclipse approached, the temperature went down, as did the light. After it ended, some stayed on well into the afternoon and allowed the public to view the Sun.

Could the clear sky carry on into the evening? Yes it did, we arrived at Dyffryn for a BBC Stargazing Live event with different scopes, opened the observatory, and set up on planet Jupiter.

During the next couple of hours we had over a hundred people in the observatory and I began to recognise some faces, because although the queue stretched from the Cory Centre building up to the observatory, I was told people came in, had a look, went out, joined the back of the queue and came in for a second/third look. They also took photos, and asked a lot of questions. I know there were several other scopes lined up outside but I never got to see them because i spent the whole evening inside the observatory. I do

know another team were kept busy inside the Centre selling CAS merchandise. We had a large team out, and boy were they needed.

British Science Week culminated on Sunday March 22nd with the society visiting Techniquest, the Welsh science and Discovery centre in Cardiff Bay. This venue is always busy, and we were kept on our toes all day. We had three telescopes on site and a globe of Saturn. Lots of interest was expressed by those who attended, from children of all ages as well as adults.

The April star party was also a success. The weather was good and about 20 people enjoyed the night. We had splendid views of a lovely crescent Moon, Venus, and Jupiter with three Moons and lots of detail to look at. We were able to see more than a dozen Messier objects including M53 a fine globular cluster in Coma Berenices, M85 an elliptical galaxy also in Coma Berenices and M87 another elliptical galaxy, this time in Virgo.

I leave the last words to Theresa, who having grabbed the handset remarked, “This is the best thing we have ever bought”. I am not one to argue with her. Why not come to the next one and see for yourself?

Several changes to the committee have taken place. First we welcome three new faces, Peter Crabb as an ordinary member, Alan Stephens takes on the role of Curator of Instruments, and Phil Wallace is our new Vice Chairman. Mark Major takes a break and his portfolio has been divided between other committee members already carrying out similar work. We also have a new Librarian in Andy Thompson. I'm sure you will wish them well in their new roles

A report on the Festival of Astronomy at the National Museum of Wales Saturday April 18th 2015.

We thought we had everything worked out and the event would pass without any problems. But this being Cardiff Astronomical Society there was little chance of this happening.

The Museum told us when the traders could access the building to set up, then after we informed everyone the Museum staff changed

the times. Still we managed to relay the new times to everyone accept Techniquest who were supplying the Planetarium.

Dr Rhodri Evans who was booked to do a book signing, turned up but his books did not. It seems a lead time of 3/4 weeks is not long enough for the publishers.

The big blow came a few days before when Astronomia ceased trading and we had no time to book a replacement supplier.

Still the morning dawned with a clear sky and spring like weather. We had lots of volunteers on hand so getting everyone and their stock in went very smoothly. In fact from the bottom of the Museum steps it looked for all the world like a giant ant colony. Our volunteers were fit, and needed to be, as we only had fifteen minutes to get eight traders out of the cars, unload everything up the Museum steps and onto their stands. It was close but we did it. Now all that remained was for each trader to sort out their own stand. Ours of course was packed with goodies to buy, give-a-ways and looked splendid. In addition we had a cut-out Buzz Aldrin, flanked on each side by two magnificent lunar prints by Mike Foley. In front we had a chair and visitors could sit and hold real lumps of Moon rock. This proved a great draw for all the children as proud parents took many pictures. Even though all this goes back to the 1960/70's to see the kids faces, knowing they held real pieces of the Moon was priceless, as was the Moon rock. Never mind we had the right man on hand to see it did not go missing. Jim Hennessy has a way with kids and his style shone through all day as he charmed the parents and interacted with the kids. His hands must have been sore by the end of the day as every time I looked he was high fiving anyone and everyone.

Our stand was so busy we started another one. This one we used to promote the society and give out newsletters and handbooks. Spencer Grennan and Mike Foley ably managed this. Owen Cornelius brought so many laptops, computers from home complete with lights, moving images and lots of things I did not understand so that it was impossible to ignore our stands. This young man has a brilliant future in front of him. At lunchtime he came with me when I took the speaker Andy Lound for lunch. Within two minutes they were talking websites, computers, technology. I

not required. Owen is so enthusiastic, he reminds me so much of me when I was his age, apart from he is better looking, smarter, far more intelligent, and he would have passed his 11+ exam.

In fact to show how out of touch I am, I noticed Kayleigh Churchill putting Alka-Seltzer in a bottle of liquid. I asked if she had a bad stomach, only to be informed it was to make bubbles or something. She made sure that Twitter and Facebook knew we were at the Museum. Kath Compton did the work of filling in where needed.

Theresa Cooper made sure we all did what we were told. One stern look is usually enough to bring me back into line, and Bob Sutton and Claude Vallee spent the whole time on the Museum steps showing the punters active views of our Sun.

Not only is CAS helping to bring astronomy to the people, did you know we are also helping the economy as well? One trader, a husband and wife team stayed over in the city on Saturday night as they had booked a “Gavin and Stacy” tour at Barry Island the following day. Both are avid fans.

The one blot on the landscape was that only 22 people went to hear the Andy Lound talk. Half of those were committee members. Lucky for us, as a favour to me we did not have to pay his travel expenses.

At 4pm everything went in reverse, and we helped our traders dismantle stands, and carry out all the equipment to there waiting cars.

Lots of other people helped out as well from time to time and I am very grateful to everyone who turned up on the day and helped and supported the event. Now all we have to do is be ready in October to do it all over again. I for one can't wait.

****STOP PRESS**** CAS has received an invitation from Techniquest to attend an event celebrating the launch of Tim Peake (British astronaut) to the space station in late 2015. There are tie in events around the UK to celebrate his launch, and Techniquest is hosting one. Watch this space for more information. When he launches, Tim will become the 1st Briton to fly into space without a private contract or American Citizenship. To find out more information about Tim, see Kayleigh's article in the Junior section of this edition.

The Sky June to August 2015 Robert Lang

The planets

By June **Mercury** will be an early morning object, reaching greatest western elongation (West 22 degrees, magnitude +1.8) on June 24th. It's a favourable apparition for southern observers, but not so well placed for us to observe in the north. Perihelion of the planet occurs on June 16th, and superior conjunction on June 23rd. In August Mercury pairs up with Jupiter from the 5th until the 8th (Mercury, magnitude -1.2. Venus, magnitude -4.2.) and will get as close as two moon diameters of each other, that's an angular separation of just one degree, between June 6th and 7th; unfortunately this event is best seen from the Southern hemisphere. Aphelion occurs on August 29th.

Venus reaches its greatest elongation (East 45 degrees, magnitude -4.6) on June 6th. Venus and Jupiter will be closing in on each other, and by June 30th these planets will be separated by (Venus magnitude -4.6, Jupiter Magnitude -1.7) just over half a moon diameter (That's 0.3 degrees.) Looking through a small telescope will show both planets with almost identical disk diameters. (Venus 32.3 and Jupiter 32.4 seconds of arc) Venus brightness continues to increase to magnitude -4.7 by July 10th, but the planet will be rapidly moving towards the Sun and in inferior conjunction by the 15th August and so not visible. Venus will then reappear just before sunrise at month's end.

Mars vanished into the solar glare in mid-April and re-appears in late August. (Magnitude +1.7) The planet will be very low in the evening twilight sky. There will be a rather distant conjunction with Venus, on August 29th (Mars magnitude 1.8, Venus magnitude -4.8) the planets will be separated by about 9 degrees; this is the second of three conjunctions between Venus and Mars occurring this year.

By mid-June, and through July, **Jupiter** will be seen getting ever lower in the evening sky. On June 9th Jupiter (Magnitude -1.9) moves into the constellation of Leo, now setting just before midnight. Jupiter vanishes into the solar glare in early August, and

will in conjunction with the Sun on the 26th of that month. Jupiter is in conjunction with Mercury on the 7th, but will not be easily observable.

Saturn (Magnitude 0.1, apparent disk diameter now 18.1 seconds of arc. Ring diameter 38 seconds of arc) moves into the constellation of Libra around middle of May and reaches opposition on the 29th of that month, (Now magnitude 0.0) meaning it will rise as the sun sets and sets as the sun rises, however its only reaches some 19 degrees above the horizon, so clarity suffers due to viewing through a thick murky atmosphere. At opposition Saturn's rings north side will be presented to us and will span some 42 seconds of arc, the globe diameter at 19 seconds of arc. Saturn will then start to retrograde in Libra, with this motion ending in early August (magnitude 0.4,apparent disk diameter 17 second of arc,) when the planet will be setting in the evening sky just after midnight.

Uranus (Magnitude 5.9,apparent disk diameter 3.3 seconds of arc.) is currently residing in the constellation of Pisces and can be seen low in the east in the dawn twilight sky and setting late evening throughout June; the planet becomes more accessible to late night observers by July when the planet will be rising near midnight. Retrograde motion begins on July 26th in the constellation of Pisces and Uranus will be visible for most of the night.

Neptune (Magnitude 7.9, apparent disk diameter 2.2 seconds of arc.) June see's the planet rising just after midnight, and retrograde motion begins on the 12th. The planet stays in Aquarius, rising mid-evening in August and reaches opposition by the 1st September, some four light hours from earth (29 Au), with an apparent diameter of 2.4 seconds of arc at magnitude +7.8 so you will need a pair of binoculars to spot it.

The Night sky

Mid June This is the start of the Noctilucent (night shining) cloud season. These clouds form at some 8-120 Km high in the Earths exosphere. Temperature at this height is some minus 120 degrees centigrade. These clouds are believed to be caused by water

vapour condensing out and freezing onto meteoritic or volcanic dust grains, making them reflective to sun light. These clouds have a distinct electric blue colour and can be seen low in the North West about 90-120 minutes after sun set and in the North East about the same time before sun rise. They generally photograph well and are sometimes mistaken for Aurorae.

In mid-June, the asterism known as the summer triangle that's made up of three bright stars Deneb (in Cygnus), Vega (Lyra) and Altair (Aquila) is rising into the southern sky. Scorpius and the red giant star Antares are now rising low in the south, while the group of stars down due south east make up the constellation of Sagittarius (Within the constellation some of the brightest stars, that's Delta, Epsilon, Gamma-2, Lambda, Zeta, Phi, Tau and sigma Sagittari form the asterism known as the teapot. If you're in a dark location look also for the Milky Way running through Scorpius, Sagittarius, Aquila, Cygnus and Cassiopeia in the east quadrant of the sky. Now rising low in the east, keep an eye open for Capricornus the sea Goat, it's not a great constellation, but well worth looking amongst its stars for Messier 30, a rather nice looking, and one of the brighter globular clusters. Its' distinction is that it's the only Messier object that cannot be observed during the twenty four hour Messier marathon that takes place in the spring. The obvious 'W' shape of Cassiopeia and square shape of Pegasus are now rising in the east. Perseus and Auriga (with the bright yellow star Capella) are low on the northern horizon but they rise to become prominent objects in the early morning sky. There are a number of objects that will be well worth chasing down during these summer months. **M57** the Ring Nebula situated between the two lowest stars of the Lyra. **M16** the Eagle nebula in Serpens, containing the famous Pillars of creation, though you would need a 300 mm telescope in order to glimpse it. **M29** and **M39**; both open cluster in Cygnus, **M27**, the Dumbbell Nebula, that's really spectacular in a small to medium sized telescope. Quite a number of Globular clusters, though **M30**, in Capricornus is the one to look out for. **M74**, a face on spiral galaxy in Pisces. **M8**, The Lagoon nebular. **M17**, the Omega nebular. **M20**, The Triffid Nebula. Open clusters **M18**, **M21**, **M23**,

M24, and **M25**. Globular clusters, **M22**, **M28**, **M55**, **M69**, **M70**, and **M75**. These last 14 objects all located in Sagittarius!

Moving on to mid- end of July, Libra has all but set in the West, the Milky Way is arching right over head; the bright star Altair in the constellation of Aquila is due south. Below, and to the west side of the Great square of Pegasus is the water constellation of Aquarius, and east of Aquarius rising is Pisces. Low in the South-south east Capricornus is approaching the south meridian. Above this constellation are two smaller constellations; Equuleus and slightly higher and to the west Delphinus; again moving slightly higher and to the west. Sandwiched between Aquila and Cygnus and buried deep in the Milky Way is Vulpecula, the little fox with the dumbbell nebula **M27** (now best observed,) and found close by another easily missed constellation of Sagitta the arrow. Aquarius the water bearer is low in the south east, and just poking its head above the south eastern horizon is Cetus the Whale.

Another two sidereal hours pass (Mid-August.) Ophiuchus is close to setting in the west, Capricornus the sea goat is due south. Aries and Taurus are starting to rise in the east, Capricornus is south, and Pegasus is high in the western sky. Look for the great square of Pegasus, this is not a constellation but an asterism, a pattern of stars which can be part of an official constellation, or a pattern composed of many bright stars from a selection of constellations. The Key stone in Hercules (Now in the west.) is also an asterism as is The Kite, composed of the stars in Bootes (Low in the West.) The House, composed of the stars of Cepheus, (High nearly overhead.) The Plough, made from some of the stars of the great bear, now low on the North west horizon, and the Circlet (Low in the south east) composed of some of the tail end stars of Pisces and not forgetting the steering wheel, part of the head of Aquarius, they are all examples currently seen in the night sky. Finally August has one of the best meteor showers of the year; the Perseids. Peak for this shower occurs on the 12th August, with a maximum zenith hourly max rate of around a 100 (More likely 50 to 80 seen.) The shower is favourable as it occurs close to New Moon (14th Aug) this year..

The Bill Sutherland Award Martin Chicks

This award was set up in memory of Bill Sutherland an early member of CAS, who passed away in 1990. It is awarded each year at the AGM, to a CAS member who has shown outstanding enthusiasm for astronomy and the Society.

Work for the award can be of any Astronomical or Society nature and may include (but not exclusively) things like observational drawings, photographs, CCD images, newsletter articles, talks given to the Society and promotion of the Society etc.

Obviously some work comes to the attention of the awarding committee automatically (such as a newsletter article), other work by its nature may need to brought to the attention of the awarding committee by it author (e.g. photographs).

Remember we are not necessarily looking for technical excellence but rather enthusiasm for astronomy and the Cardiff Astronomical Society, so enter your work for consideration for this award.

This year we are pleased to present the award to Hugh Lang. Hugh has been involved with the society since its formation. Hugh was also an active member of a group using the public observatory at Penylan, Cardiff prior to the formation of the society which started out at the observatory. Hugh has held a number of positions on the committee over the years. Hugh has been a very active and dedicated supporter of the society, he has assisted at outreach

events, frequently carrying out work at our observatory, and so much more. Although Hugh is currently not a committee member he continues to be our liaison point with the University at Cardiff organising room bookings and assisting with speakers. Hugh is part of the Physics and Astronomy Department.

If you would like to nominate yourself or someone else for this award, send an email to BSA@cardiff-astronomical-society.co.uk stating who you are nominating and the reason for the nomination. If appropriate you may also attach samples of work to the email, and see what it returns.

Space Flight Roundup John Richards

It's NOT a good time to be a Russian rocket scientist at the moment I would suspect. On the 28th April a Progress resupply mission to the International Space Station (ISS) failed soon after launch. Russian flight engineers lost contact with the ship soon after launch and though contact was established later on, the video released (https://www.youtube.com/watch?v=OG6sX7u-XPQ) showed a craft spinning rapidly. All steps taken by the Russians subsequently failed as the resupply vessel re-entered the Earth's atmosphere on May 8th , burning up completely over the Pacific Ocean. If that wasn't bad enough, the next Russian launch, that of a Mexican telecommunications satellite (MEXSAT-1) crashed in Siberia nearly 8 minutes after launch on May 16th. Initial suspicions suggest excessive loads caused by an imbalance in the 3rd stage rocket, literally shook it to bits.

In more encouraging news for the Russians, on March 28th,a **Soyuz TMA-16M** was successfully launched from the Baikonur cosmodrome to the ISS. The crew consisted of Russian commander Gennady Padalka, and flight engineers Russian Mikhail Koriyenko and American Scott Kelly. Scott and Mikhail plan to stay aboard the ISS for a year, rather than the usual 5-6 month missions to investigate the effects of long term exposure to zero gravity. A battery of tests will be done during the flight, and these will also be conducted on Scott's twin brother Mark to study the

differences of living on Earth and in orbit.

In contrast to the issues the Russians are having, its business as usual at **Space X** with two successful launches. The first, on the 14th April was their 5th resupply flight to the ISS, carrying the world's first zero G coffee machine. Once again, Space X tried to land the first stage on a barge in the Atlantic, but again the attempt failed, when it landed too heavily on the platform, toppled over and exploded. Along with the ISS resupply, the Falcon 9 also carried the Arkyd 3. This is a small telescope manufactured by Planetary Resources to search for asteroids that could be mined or pose a threat to the Earth. The 2nd launch, on 27th April, was the launch of a telecommunications satellite for Turkmenistan; their first ever. After claiming that ULA had an unfair monopoly on launching military payloads for US Air Force, they have now been officially certified to fly some of the Air Force's most critical payloads aboard their Falcon 9 rocket.

From left: Russian cosmonaut Gennady Padalka NASA astronaut Scott Kelly. Russian Mikhail Kornienko is 5th in the image

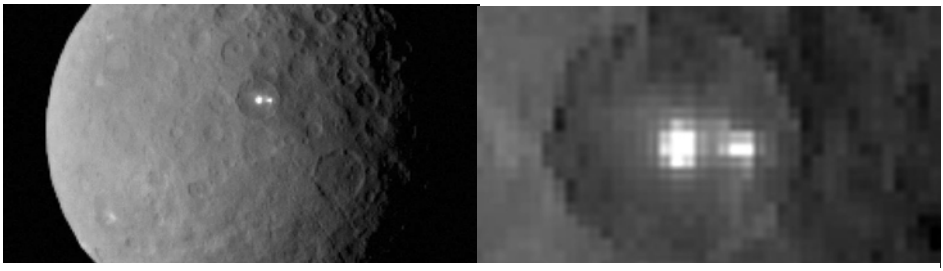
SPLATT!!

After an active mission spanning 4 years and running low on propellants, NASA perhaps controversially decided to crash their **Messenger** probe into the surface of Mercury on April 30th.

During its mission, which launched in August 2004, entering the Mercury orbit finally in 2011, the Messenger probe has greatly assisted in unravelling the history and evolution of the Sun's

nearest permanent neighbour, including the discovery of water ice at the poles, and mapping the topology and landscape of the planet with incredible accuracy. During its 7 year journey to Mercury the craft travelled nearly 5 billion miles, including 15 trips around the Sun, and flybys of Earth once, Venus twice, and Mercury itself 3 times. Scientists estimated that Messenger impacted the Mercurian surface at more than 8,500 mph and created a new crater 16 metres (52 feet) in diameter. It impacted around the area of the crater named Shakespeare, located at 49.7°N, 150.9°W.

NASA engineers and scientists are readying themselves for the close flyby of **New Horizons** of the (minor) planet Pluto on July 14th. Also **Dawn** continues to investigate Ceres, the largest object in the asteroid belt. There is continued interest in the 2 white dots that appear on the surface, and scientists are generally confused as to what they could be. Exposed ice, cryo-volcanoes or (bizarrely) artefacts from an alien civilisation are some of the proposals being suggested at the moment.



Left: Image of Ceres showing two bright spots. Right: 2 spots enhanced showing distinct

Over at ESA, scientists at still hopeful of contacting the little Philae probe currently on the surface of Comet 67/P, but no contact as been made as of the end of May. Due to the recent issues with the Russian rockets, it was decided to extend the current mission of Samantha Cristoforetti, which means she is now the woman with the longest single flight in space history.

Jeff Bezon, the billionaire founder of Amazon has finally entered the rocket business when his company Blue Origin launched a surprise sub-orbital test flight on 29th April.

The test was the first by Blue Origin and the flight consisted of the

launch of the rocket to just under 100km, before the proposed crew compartment separated from the booster, and parachuted safely to Earth.

Photographing the Night Sky

Ed Cloutman

In the first part of his excellent article on photographing the night sky, Ed outlined his journey in stellar photography, his personal setup and the things worth considering when undertaking a typical observing session. In the second part of the articles he discusses filters, exposure times, processing steps and the tools he uses to make his stand out photographs of the night sky.

Setting up the filters and exposure times

Now that the camera is set up and is tracking accurately, it is time to set the filters and exposure. This is shown in Figure 8 where I have set the red, green and blue for 600 seconds, binned 2x2, and the luminance and H Alpha for 1200 seconds, binned 1x1. I have set them all to repeat three times which will give a total exposure time of 3 hours and 50 minutes.

You will notice something in the widow called dither. This moves the mount by 1.5 pixels in this example, between frames. The result is that any artefact on the sensor will be averaged out, rather than added to in the series of images when ALL the images are accurately stacked and aligned in the software so that all the stars

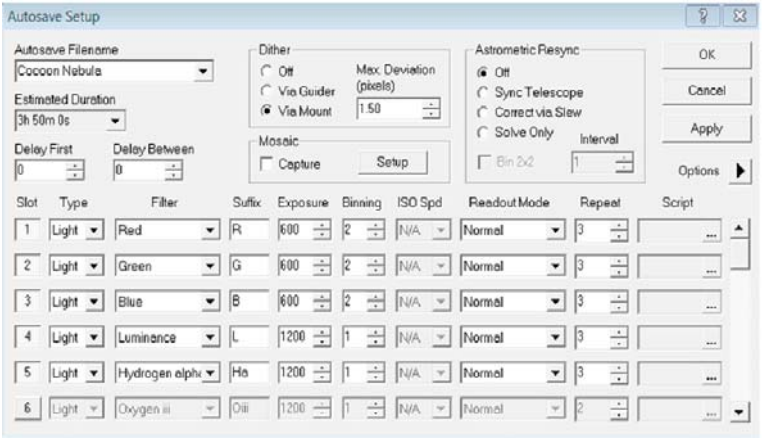


Figure 8

exactly coincide and lie over one another.

Processing

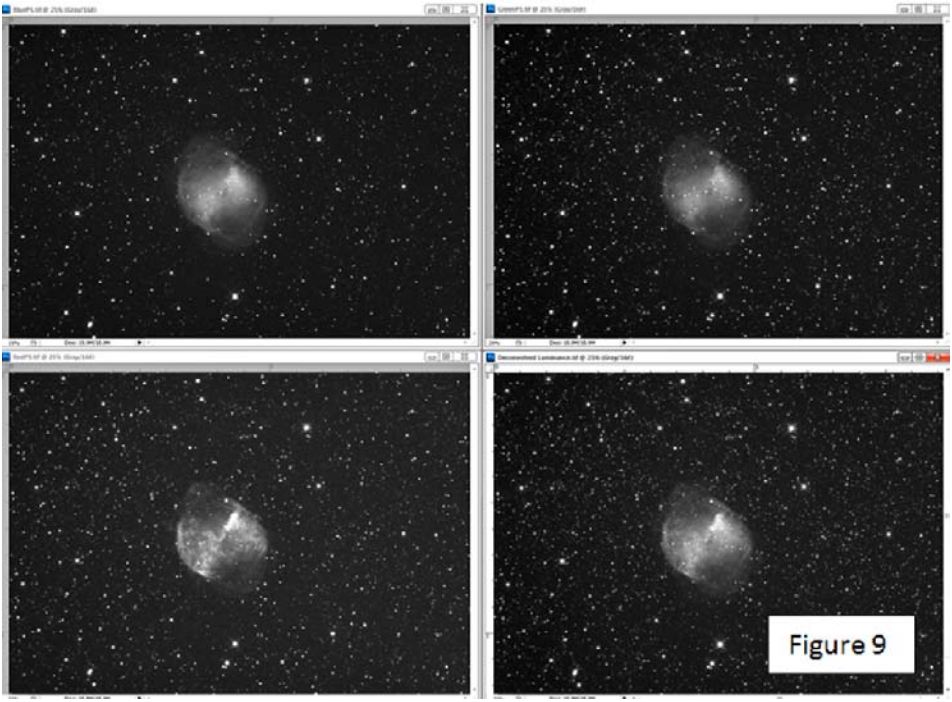
Again I have to thank Ian, Nik and Graham Carter for helping me out with this complicated process, turning raw images into, hopefully, a beautiful result. I cannot achieve the results of many of the amateurs, but ultimately one has to do ones best and I console myself in that I do not have the wonderfully clear skies that some have in the USA and other parts of the world.

Removing noise (calibration) and aligning the images

So we now have a set of images, three each of red, green, blue, luminance and H Alpha taken at a temperature of -20 degrees C. The first job is to remove noise by subtracting the dark frame images. I already have a 600 and 1200 second master dark frame taken at -20 degrees C and these are processed with my light frames in Maxim DL Pro. I also have to convert the 2x2 binned images to 1x1 so that the stars can be aligned accurately. Fortunately, the Maxim software does this for me, and it also groups the images into their respective colours. In this instance I have grouped the H Alpha frames with red. Thus I have four master frames (Figure 9) which I can now put into Photoshop and blend into the final image.

Working on the luminance image

Just before doing this it is time to work on the luminance image, as this is the one that will give me the quality. There is a lot of software



on the market to help achieve a good result and this is where experience counts, and where I am lacking. I read a lot of articles and take advice from experienced astro-imagers, but this is a field where reading a book is not enough and I feel that some one-to-one tuition would be very valuable. Never-the-less I try some of the filters that come with Maxim, and use the one that I think works the best. Once I am in Photoshop I am on firmer ground as I use this a lot in processing my photographs.

Producing the colour image in Photoshop

A blank image is opened in Photoshop and the mode changed to RGB. The channel window is opened and the black and white RGB images in Figure 9 are cut and pasted into their respective channels. Switching to the RGB channel will show the colour image, which will probably need adjusting for colour balance.

Adding the luminance frame on its own layer

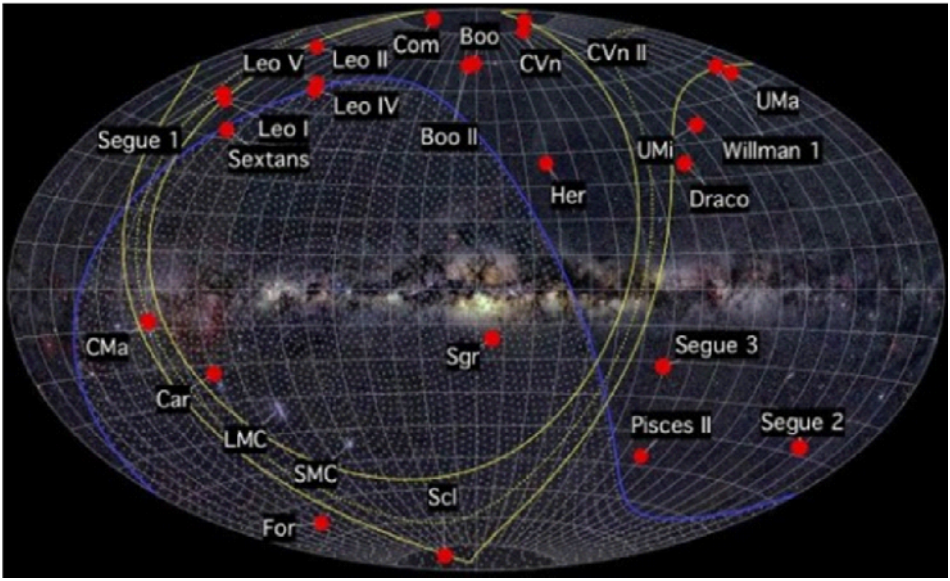
A new layer is opened and changed from a Normal to a Luminance layer, and the high quality luminance frame is cut and pasted onto this layer. This sits on top of the colour base layer and an

immediate improvement is seen. The basal colour layer can then be adjusted using the colour balance or colour saturation tools in Photoshop. There are many other techniques in Photoshop to enhance the image that are too complicated to go into here. Hopefully one ends up with an acceptable image that can be added to ones' collection or made into a book using internet software such Booksmart by BLURB. Some of my images can be seen on the CAS website and I have included a couple of my favourites here. Also you can browse through my book 'The Night Sky' by typing into Google - The Night Sky Ed Cloutman. This should take you to the BLURB website.

Front cover image details: The Pleiades 4x600 second frames each through red and green filters, binned 2x2. 4x1200 second frames through a blue filter and Luminance, binned 1x1. Camera SBIG STL-11000M temperature was -20 degrees C. Telescope 1000mm FL Takahashi Refractor working at 760mm FL with 645 reducer and field flattener. Date: 9th February 2015 between 20.55 and 23.54 UT. Processing in Maxim DL Pro and Photoshop.

The Brighter Galaxy groups in our local Universe.

Observing the sky on a clear night, at a dark location you will very likely see the Milky Way, a subtle but fairly broad glow crossing from one horizon to the other. What we are looking at is an edge-on view through our own galaxy which contains between 200 and 400 billion stars of which our Sun is but one member. If we are more adventurous, had a space ship and took a trip to some distance place outside our own Milky Way, and then looked back, you would see that our galaxy is in fact a barred spiral galaxy. Looking around you would also notice that the Milky Way is not a solitary object. In



fact the Milky Way galaxy is in the company of about 54 others are galaxies all members of what we call the Local Group (See above map.)

Stepping on our infinite improbability drive, now moving even further away, you'd see that the Local Group is just one of many collections of clusters that are composed of galaxies of all different shapes and sizes (morphologies) from beautiful barred spirals like our Milky Way, to faint, oddly-shaped dwarf galaxies, to the large round, fuzzy balls of stars that we call elliptical galaxies. How the galaxies in the universe formed as they did is an important question not fully understood, and is still been extensively researched.

If we now really pile on the warp speed and move to a hypothetical centre point in our universe, stopped, and then looked around, we would see the Universe stuffed full of galaxies randomly placed everywhere one looked. Overall the Universe would look homogenous and isotropic (That is smooth and looking the same in every direction.) However on smaller scales, the Universe can be seen to be quite lumpy, composed of condensed regions of many hundreds to many thousands of groups of galaxies connected together by filaments again been composed of galaxies, with vast

empty regions of space known as ‘voids.’

Coma Virgo Cluster.

One of these clumps is home to our own little area in the Universe. This particular lump (known as the Coma Virgo Cluster) stretches to over 100 and 10 million light years in diameter, is made up from around one large group and perhaps a 100 smaller groups of galaxies. The large group, called The Virgo Cluster, is believed to be at the physical centre of the Coma Virgo Super Cluster while our own Local Group of 54 galaxies is placed some 65 million light years from the edge of the Virgo Cluster.

The closest galaxy clusters placed randomly around our local group, in order of distance are the M81 group, located 11 million light years away; the M101 group, at around 23 million light years away, then the M51 group at 30 million light years away. The M66 group (Leo II) is 34 million light years away, M96 group, (or Leo I) placed some 37 million light years in distance. The NGC 5866 group, also known as the Draco group, is at 39 million light years away, and The Ursa Major group been 53 million light years away.

Virgo cluster.

The Virgo Cluster is a truly massive cluster of galaxies of which its mass dominates the Coma Virgo Super Cluster. It is quite bright and can be seen by eye as a faint patch of light covering a few square degrees between the constellation of Leo and Virgo from a dark observing site on a moonless night. There are roughly 2000 galaxies in this cluster; 160 are large galaxies, the remainder all dwarf galaxies. This cluster has a diameter of approximately 15 million light years, which is not much larger than our Local Group, but it contains 50 times the number of galaxies! In the centre of this cluster resides the giant elliptical galaxy M87 with its roughly 2 billion solar mass ‘black hole’. A significant number of these 160 known large galaxies can be observed with a modest size telescope including the Messier objects M49, M58, M59, M60, M61, M84 , M85, M86, M87, M88, M89, M90, M91, M98, M99, M100.

Local group and others

The Local Group is the group of galaxies that includes the Milky Way and comprises of more than 54 galaxies, including dwarf galaxies. The gravitational centre is located somewhere between Milky Way and Andromeda Galaxy and covers a radius of 5 million light-years and has a binary (dumbbell) distribution. The group is estimated to have a total mass of $1.29 \pm 0.14 \times 10^{12}$ Solar masses and a velocity dispersion of 61±8 km/s. The two most massive members of the Local group are Milky Way and Andromeda Galaxy. These two spiral galaxies each have their own system of satellite galaxies and there could easily still be more companion galaxies yet to be discovered.

The Andromeda galaxy is a spiral galaxy situated around 2.5 million light years from Earth in the constellation of Andromeda. Also known as M31 or NGC224 is also referred to as the Great Andromeda nebulae. This name is historical; as it was thought to be nebulae residing in our own 'Island Universe' until the early part of the 20th century. M31 is the nearest large galaxy to our Milky Way, but not the closest. The Andromeda Galaxy is also the largest galaxy of the local group. This group also includes the Triangulum Galaxy and about 30 other smaller, that is 'dwarf' galaxies. The Andromeda Galaxy is bright at magnitude 3.4 and very large, covering an angle over 3 degrees; that’s 6 moon diameters on the sky.

M 31 is estimated to contain 1 trillion stars which is at least twice the number in our own galaxy, currently believed to be home to some 200-400 billion stars. The Milky Way and Andromeda Galaxy’s current paths put them on a collision course in roughly 4 billion years, when their combined stellar mass are expected to merge and morph into an elliptical galaxy. The Triangulum Galaxy may also be part of this merger.

The Triangulum Galaxy M33 is a spiral galaxy approximately 3 million light years from Earth and as its name suggests, is located in the constellation Triangulum. It is catalogued as Messier 33 or NGC598. It is sometimes informally referred to as the Pinwheel

Based on data from the Hubble Space Telescope, Milky Way galaxy and Andromeda galaxy are predicted to distort each other with tidal pull in 3.75 billion years, as shown

Galaxy, a nickname it shares with Messier 101. The Triangulum Galaxy is the 3rd largest member of the Local Group of galaxies, which includes the Milky Way Galaxy, the Andromeda Galaxy and about 30 other smaller galaxies. It is one of the most distant permanent objects that can be viewed from a dark site by the naked eye and its light is spread out over quite a large area.

The Milky Way's satellite system consists of the Large and Small Magellanic Clouds,as well as many dwarf galaxies including Sagittarius, Canis Major, Ursa Minor, Draco, Carina,The Sextans, Sculptor and Fornax, Leo I and II, and Ursa Major I and II.

The main members of the Andromeda's satellite system comprises of M32, M110, NGC147, NGC185, and many smaller dwarf galaxies some discovered as recently as 2011, due to their diffuse nature.

The Triangulum Galaxy is the only unbarred spiral galaxy in the Local Group and could be a companion to the Andromeda Galaxy. The Pisces Dwarf group is equidistant from the Andromeda and Triangulum Galaxies, so may be a satellite of either.

The membership of NGC 3109,with its companions Sextans A and

the Antlia dwarf is also uncertain due to extreme distances from the centre of the Local Group.

The Triangulum Galaxy. Credit: NASA

The other members of the group are gravitationally secluded from these large subgroups: IC10, IC1613, Phoenix Dwarf, Leo A, Tucana Dwarf, Cetus Dwarf, Pegasus Dwarf Irregular, Wolf-Lundmark-Melotte, Aquarius Dwarf and Sagittarius Dwarf Irregular.

The M81/82 group of galaxies.

Messier 81, NGC3031 or Bode's Galaxy is a spiral galaxy about 12 million light-years away and is located in the constellation Ursa Major. Due to its proximity to our galaxy, its large size and active galactic nucleus (harbouring a roughly 70 million solar mass super massive black hole), it has been studied extensively by professional astronomers. This galaxy's size and relatively high brightness also make it a popular target for amateur astronomers. The galaxy was first discovered by Johann Elert Bode in 1774; consequently, the galaxy is sometimes referred to as "Bode's Galaxy". In 1779, Pierre Méchain and Charles Messier re-identified Bode's object, which was subsequently listed in the Messier Catalogue as Messier 81. It's the largest galaxy in the M81 Group, a group of 34 galaxies

located in the constellation Ursa Major. At approximately 12 million light years from the Milky Way, it makes this group and the Local Group, containing the Milky Way relative neighbours on the outer edge of the Virgo Super Cluster.

Messier 82, (Also known as NCG 3034, Cigar Galaxy, or M82) is the prototype nearby starburst galaxy and is approximately 12 million light-years away,located in the constellation Ursa Major. The starburst galaxy is 5 times as bright as the whole Milky Way and 100 times as bright as our galaxy's centre. M82 hosts a super massive black hole at its centre with an approximately mass of 30 million solar masses.

Gravitational interactions between M81, M82 and NGC 3077 have stripped hydrogen gas away from all three galaxies, forming gaseous filamentary structures within the group. Moreover, these interactions have allowed interstellar gas to fall into the centres of M82 and NGC 3077, leading to vigorous star formation.–The M81/82 group system comprises of the following galaxies.

Arp'Loop,Ddo78,F8d1,FM1,HIJASSJ1021+6842,HS117, Holmberg I, II and IX, IC2574, IKN.KKH57, Messier81 and Dwarf A, Messier82, NGC2366, NGC2403, NGC2976, NGC3077, NGC2436, PGC28529, PGC28731, PGC29231, PGC31286, PGC32667, UGC4459, UGC4483, UGC5428, UGC5442, UGC5692, UGC6456, UGC7242, UGC8201 and UGCA133

The Ursa Major group of galaxies is a distinctive band of galaxies in the northern hemisphere, but unlike the dense environment of the Virgo Cluster most of the galaxies here are spiral, there are no elliptical galaxies. 60 of these spiral galaxies have a diameter of greater than 30 thousand light years. The band is split up into two separate groups. The Ursa Major North group region, which lies north of fifty degrees in our sky and below that lies the Ursa Major South group region. The boundary is actually arbitrary as there is no actual spacing or difference in distance between these galaxy groups. The brightest of the galaxies in the North group are NGC3556, NGC3953, NGC3992 (M91), and in the south group are NGC3762, NGC4051 and NGC3938.

The M101 group is a loose collection of galaxies located in Ursa Major. The group is named after the brightest galaxy in the group, M101,The Pinwheel Galaxy and most members of the group are companions of the Pinwheel, including NGC5204, NGC5474, NGC5477, NGC5585, UGC8837, and UGC9405.

The M51 group is a group of galaxies located in Canes Venatici. The group is named after the brightest galaxy in the group, the M51A, the Whirlpool Galaxy. Other notable members include the companion galaxy to the Whirlpool Galaxy 51B or NGC5195, NGC5023, NGC5229, UGC8313 UGC8331 and the Sun Flower Galaxy M63.

The NGC5866 (Draco) group is a small group of galaxies located in the constellation of Draco. The group is named after NGC5866, the galaxy with the highest apparent magnitude in the group; although some galaxy group catalogues list NGC 5907 as the brightest member. The other member is NGC5879.

There is a strong suspicion that the M51, M101, and NGC 5866 Groups are actually part of a large, loose, elongated structure, though most group identification methods do identify these three groups as separate entities.

The M66 group is a small group of galaxies in the constellation of Leo. It is commonly referred to as the Leo triplet consisting of the spiral galaxies M65, M66, and NGC3628. In addition NGC3593 is also sometimes identified as a member.

The M96 group of galaxies also resides in the constellation of Leo. The group is composed of 8 definite members, including three objects from the Messier catalogue. They are M95, M96, M105, NGC3299, NGC3377, NGC3384, NGC3412, and NGC3489. Another 16 known galaxies may also be members of this group.

As previously mentioned quite a number of these objects can be easily located with small, and resolved in medium sized telescopes,especially if the telescope is fitted with ‘Go to’ device. They can also be viewed by the members at observing meetings, so when clear: **‘Go out and look up!’**

SOLAR CRUISE MARCH 16th-30th 2015

Pam Cowburn

The Fred Olsen Cruise ship Black Watch left Southampton on 16th March 2015, heading for the Faeroe Islands. The main purpose of the voyage was to be in the best position to observe the total solar eclipse, on March 20th, and then to continue Northward into the Arctic Circle, in the hope of seeing the majestic Aurora Borealis. Onboard VIP Guest Speakers included the 14th Astronomer Royal Sir Arnold Wolfendale FRS and "Space Scientist" Professor David Southwood. Over the fortnight's trip, these gentlemen entertained and informed us on a number of subjects, ranging from "The Sun" to the Huygens probe on Titan, and the Philae lander on Come 67P.

The Faeroe Islands were one of the only two places where this total Eclipse would be visible from dry land (the other being the almost uninhabited Svalbard, Northern Norway), but not for the maximum time, so, after a drizzly day at Runavik, Kongshavn, the ship sailed overnight approximately 200 miles north to be positioned directly in the centre of the totality shadow at the correct time.

On the morning of Friday 20th March everyone was up for an early breakfast and was full of anticipation. It had been raining overnight, but was now dry with a lot of clouds scudding past. The Captain stopped the ship in his chosen place and we all gathered on the starboard side at 8.30 am, ready for the big show. As the eclipse started, we all waited with varying degrees of optimism/pessimism and an eye on the clouds. Sir Arnold was on the Bridge commentating on the event over the ship's tannoy. Despite the given advice just to enjoy the spectacle EVERYBODY had their cameras ready, some with tripods (which I, personally, could not see the point of, as the ship was bobbing about quite a lot). We had all been given solar viewing goggles to use, but the variable cloud-cover actually assisted the photographing of the partial eclipse, which would have been almost impossible with clear skies. As totality approached, our esteemed Astronomer Royal started describing the different cloud formations, but we were not really listening at this point. We watched the sky with bated breath, and

when the totality started, very fortunately visible in the gaps in the clouds, the sighs of relief and gasps of joy were accompanied by the clicking of almost a thousand camera shutters. We were very lucky, as we'd managed to view the spectacle for almost the full 2 minutes 45 seconds, whereas one of our sister-ships, The Braemar, positioned a mere 30 miles north of us, missed most of it. We all felt satisfied, and that an item had been ticked off the bucket list.

The ship continued its voyage north, crossing the Arctic Circle, and stopped for a port visit at Tromsø, Norway on Sunday 22nd March. There was an organised tour to Tromsø Planetarium, where we were given a lecture and display on the subjects of the eclipse and the Northern Lights. The Planetarium also housed a hands-on science museum, much like Techniquest. When we exited the museum, there was a blizzard blowing, adding to the already thick snow lying on the ground.

Overnight, we headed for Alta, Finnmark, Norway, which was to be our northernmost destination. Plenty of snow falling here too, which did not bode well for our planned evening trip to attempt to track

down the furtive 'Northern Lights'. As the day progressed, the snow eased up but there was still a fair amount of cloud cover. The tour was organised by the GLØD Expedition Company (who'd been involved with the Joanna Lumley TV's show about the Northern Lights) and they use a number of dark sky sites, depending on the weather predictions. A 60 km drive took us to coastal Isnestoften, on Alta Fjord, where the skies did, indeed, begin to clear, with just a few bands of light clouds. To our delight, the aurora put on a display - not brilliant or of particularly long duration, but certainly enough to be able to get photographic evidence and to tick off another item from my list.

This is my best photograph, taken hand-held on my Canon PowerShot D10 set on long-shutter. The colours were not visible with the naked eye (which is, apparently, quite usual) but are genuine when they show up on camera and are due to the ionisation of different gases in the atmosphere.

Later in the week, we crossed the Arctic Circle, travelling South, and there was another burst of aurora, easily visible from the ship, for almost half an hour on the evening of Wednesday 25th March. This was a bonus, as we were navigating the inshore passage between the dozens of small islands which make up the West of Norway, and the sky was not particularly dark, due to light pollution from various town and village. We had 2 more shore visits, at Trondheim and Ålesund, and then we headed home, arriving in Southampton on March 30th.In the next couple of years, we hope to travel to Antarctica, where, hopefully, we may see the Aurora Australis - something else to tick off the bucket list.

Up-coming CAS Public Events

Date	Time	Event	Venue
27th June	10:00 - 5:00pm	CAS stand at British Astronomical Association Meeting	St David's Hall
25th July	see web site for details	Solar Viewing	Brecon Beacons Visitor Centre

CAS Lectures June to July

Date	Title	Lecturer
11th June	Comets, Enigmatic and Beautiful Visitors	Dave Eagle, Northants.
25th June	Three short talks	Members of the Cardiff Astronomical society
9thJuly	The Penylan Observatory	Dave Powell, Cardiff Astronomical Society

Observing Sessions

There are currently no observing sessions arranged during the months of June, July or August. The next dates in September are as follows:

Date	Day	Time	Venue
11th or 12th Sept..	Fri or Sat	20:30 - 24:00 GMT	Dyffryn Gardens
25th or 26th Sept.	Fri or Sat	20:30 - 24:00 GMT	Mountain View Ranch

NOTE:- Where two dates are given we will attempt to hold the session on the first date, weather permitting, otherwise we will try again on the subsequent date. All dates are subject to weather conditions. For confirmation of any session please check on the CAS Web site or the CAS Observing line. 07817 723 883 for more information.

Mountain View Ranch was formerly Castle Heights Golf Club.

Observers Club Meetings & Dave's Star Parties

NOTE: The Observers club meetings have moved and are now held at Dyffryn Gardens. The event now takes place on the same evening as Dave's star parties.

Date	Day	Time	Venue
16th June	Tuesday	20:30 to 23:30	Dyffryn Gardens/Observatory
14th July	Tuesday	20:30 to 23:30	Dyffryn Gardens/Observatory
11th August	Tuesday	20:30 to 23:30	Dyffryn Gardens/Observatory

Almanac

Compiled by John Richards

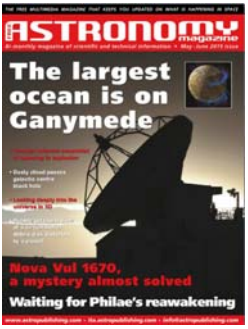
Sun Rise/Set & Twilight

Date	Astronomical Twilight Begins	Sun Rise	Sun Set	Astronomical Twilight Ends
01st June	--:--	04:01	20:19	--:--
08th June	--:--	03:57	20:25	--:--
15th June	--:--	03:55	20:30	--:--
22nd June	--:--	03:55	20:33	--:--
29th June	--:--	03:58	20:33	--:--
1st July	--:--	03:59	20:33	--:--
8th July	--:--	04:05	20:30	--:--
15th July	--:--	04:12	20:24	--:--
22nd July	00:38	04:21	20:16	23:59
29th July	01:28	04:31	20:07	23:09
1st August	01:43	04:35	20:02	22:55
8th August	02:09	04:46	19:50	22:27
15th August	02:32	04:57	19:37	22:01
22nd August	02:53	05:08	19:23	21:38
29th August	03:11	05:19	19:08	21:16

Meteor Showers

Date	Meteor Shower	RA	DEC	ZHR
10/06/15	Ophiuchids	17h56m	-23°	5
21/06/15	Ophiuchids	17h20m	-20°	5
08/07/15	Capricornids	20h44m	-15°	5
16/07/15	Capricornids	20h44m	-15°	5
21/07/15	Apha-Cygnids	21h00m	+48°	5
26/07/15	Capricornids	21h00m	-15°	5
30/07/15	Delta-Aquarids	22h36m	-17°	20
01/08/15	Piscis Australids	22h40m	-30°	5
03/08/15	Alpha-Capricornids	20h36m	-10°	5
07/08/15	iota-Aquarids	22h10m	-15°	8
13/08/15	Perseids	03h04m	+58°	75
22/08/15	Alpha-Cygnids	21h00m	+48°	5

FREE Astronomy Magazine



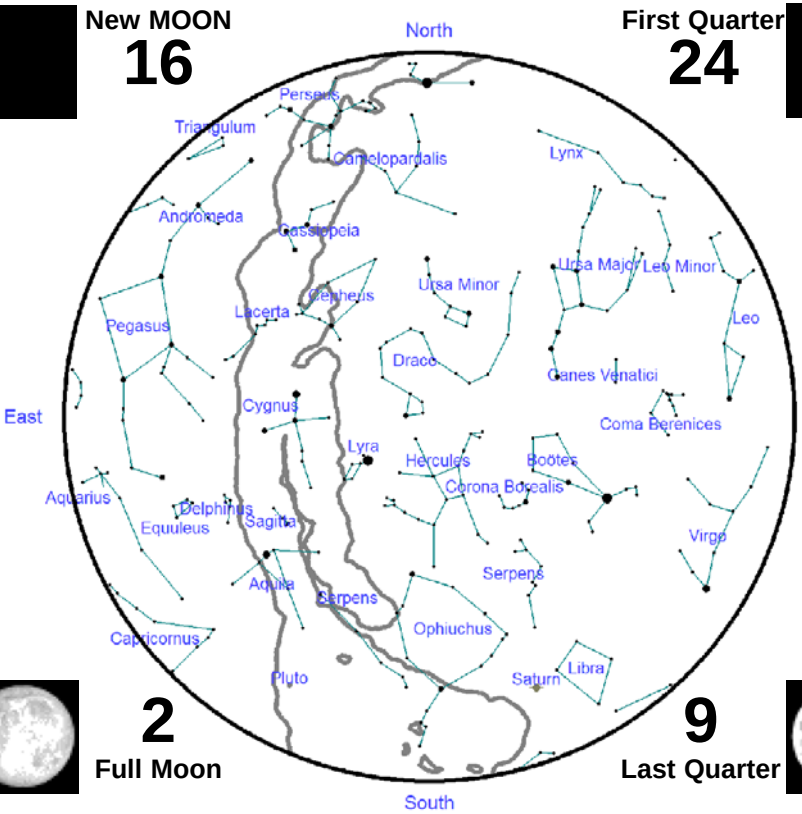
Our friends at Astro Publishing have provided us a free link to their latest **Free** bi-monthly astronomy magazine. The link for the magazine is shown below:

http://www.astropublishing.com/FreeAstronomyMagazine_MayJun2015/index.html

Almanac June

New MOON
16

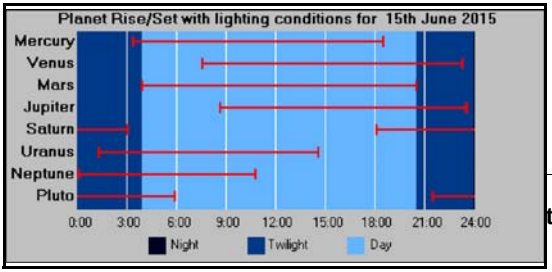
First Quarter
24



2
Full Moon

9
Last Quarter

	Constellation	R.A	Dec	Rises	Sets	Mag.
Mercury	Taurus	04h15m04s	+16°57'15"	03:20	18:26	+1.8
Venus	Cancer	08h46m46s	+20°02'55"	07:32	23:16	-4.4
Mars	Taurus	05h31m37s	+23°53'49"	03:51	20:28	+1.5
Jupiter	Leo	09h25m52s	+16°01'37"	08:35	23:30	-1.9
Saturn	Libra	15h53m07s	-18°02'39"	18:02	03:00	+0.2
Uranus	Pisces	01h14m10s	+07°09'52"	01:14	14:32	+5.9
Neptune	Aquarius	22h46m29s	-08°38'20"	00:03	10:44	+8.0
Pluto (Dwarf)	Sagittarius	19h11m31s	-20°53'18"	21:38	06:00	+14.2



Planet Events

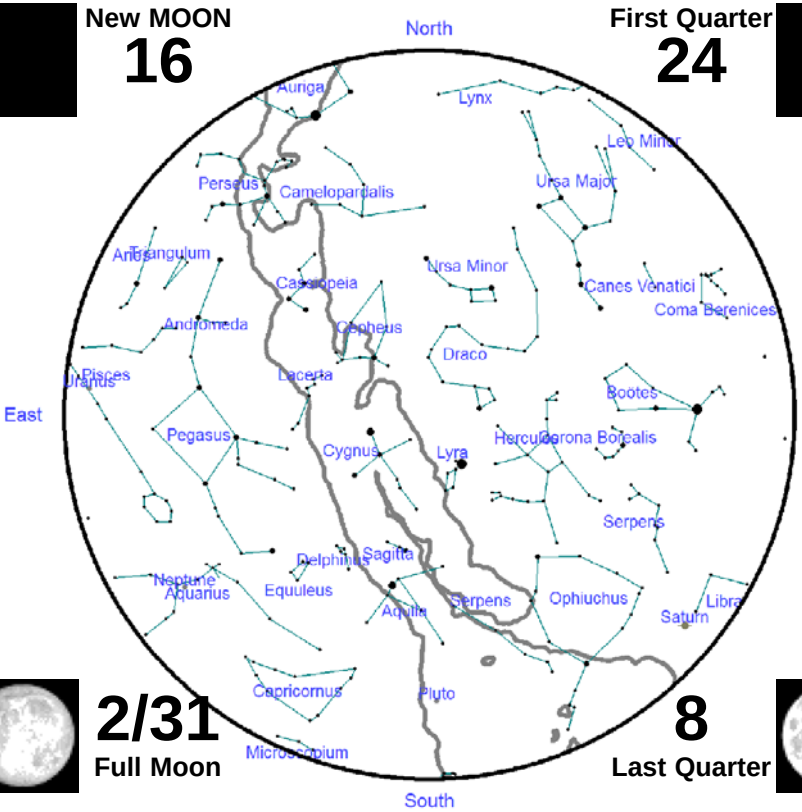
14th Mars at Conjunction

The data presented here is for the 15th June. Positional data is at 00:00 GMT/UT

Almanac July

New MOON
16

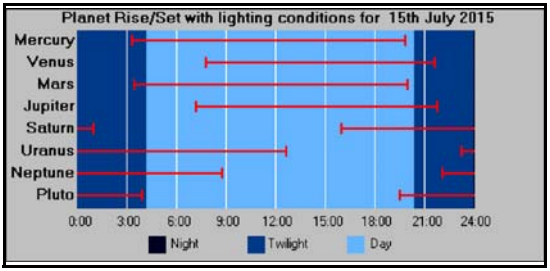
First Quarter
24



2/31
Full Moon

8
Last Quarter

	Constellation	R.A	Dec	Rises	Sets	Mag.
Mercury	Gemini	06h52m21s	+23°25'03"	03:17	19:47	-1.4
Venus	Leo	10h01m338s	+10°22'54"	07:45	21:37	-4.5
Mars	Gemini	06h59m41s	+23°34'53"	03:23	19:56	+1.6
Jupiter	Leo	09h47m27s	+14°14'17"	07:09	21:44	-1.8
Saturn	Libra	15h47m04s	-17°49'41"	15:57	00:57	+0.3
Uranus	Pisces	01h16m32s	+07°23'20"	23:13	12:37	+5.8
Neptune	Aquarius	22h46m38s	-08°37'30"	22:05	08:46	+8.0
Pluto (Dwarf)	Sagittarius	19h11m36s	-20°53'12"	19:40	04:02	+14.2



Planet Events

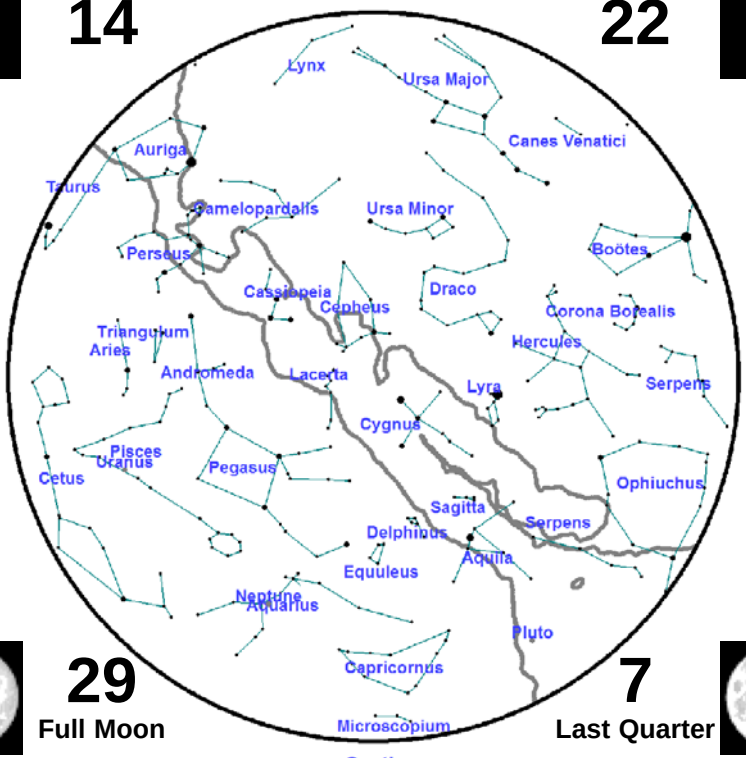
16th Mercury at Perihelion(0.31 A.U.).
23rd Mercury at Superior Conjunction

The data presented here is for the 15th July, positional data is at 00:00 GMT/UT

Almanac August

New MOON
14

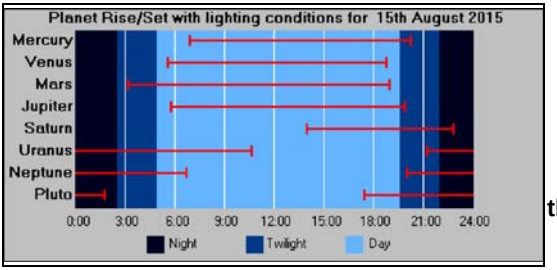
First Quarter
22



29
Full Moon

7
Last Quarter

	Constellation	R.A	Dec	Rises	Sets	Mag.
Mercury	Leo	10h54m42s	+07°34'45"	06:51	20:13	-0.3
Venus	Leo	09h31m46s	+06°27'26"	05:34	18:44	-3.9
Mars	Cancer	08h25m53s	+20°17'38"	03:09	18:57	+1.7
Jupiter	Leo	10h12m31s	+12°00'30"	05:45	19:54	-1.7
Saturn	Libra	15h46m25s	-17°55'16"	13:55	22:50	+0.4
Uranus	Pisces	01h16m11s	+07°20'20"	21:11	10:35	+5.8
Neptune	Aquarius	22h46m46s	-08°36'40"	20:03	06:45	+8.0
Pluto (Dwarf)	Sagittarius	19h11m41s	-20°53'07"	17:38	02:00	+14.2



Planet Events

15th Venus at Inferior Conjunction
26th Jupiter at Conjunction
29th Mercury at Aphelion (0.47 A.U.).

The data presented here is for the 15th August, positional data is at 00:00 GMT/UT

Because you know I'm all about that space, 'Bout that space, no .... Tribble!

Tim was born in Chichester, England, on 7 April 1972, he is married with two sons. Among his leisure activities he enjoys skiing, scuba diving, cross-country running, climbing, and mountaineering. He has also completed the London Marathon. Other interests include quantum physics and aviation.

Tim graduated from the Royal Military Academy Sandhurst as an officer in the British Army Air Corps. He received a Bachelor of Science degree in flight dynamics and evaluation from the University of Portsmouth in 2006.

Between 1994 and 1998 he served as a reconnaissance pilot and flight commander in Germany. He also qualified as a Combat Survival and Rescue Instructor, and a Flight Safety Officer.

Tim qualified as a helicopter flying instructor in 1998 before being selected for an exchange posting with the US Army (1999–2002). On his return to the UK, he became an Apache helicopter instructor from 2002 to 2005, before being selected for test-pilot training.

He retired from the British Army as a major in 2009. During his career, he logged over 3000 hours' flying time on more than 30

types of helicopter and fixed wing aircraft, including the Hawk, Dakota, Harvard and Mi-17. He maintains his flying as a major in the Territorial Army, and also holds a private pilot's licence.

Tim was selected as an ESA astronaut in May 2009. With five other astronauts, he joined a 2011 mission as part of an international team living underground for a week and exploring a cave system in Sardinia, with the focus on human behaviour and performance in extreme environments.

Blue Peter presenter Lindsey, competition winner Troy and UK ESA astronaut, Tim Peake.

In June 2012, Tim spent 12 days in the Aquarius habitat 20 m below the sea off the coast of Florida for NASA's Extreme Environment Mission Operations, or NEEMO. NEEMO allows space agencies to test technologies and conduct research for future missions. In 2012 Tim completed training and certification for spacewalks using both the Russian Orlan spacesuit and the US Extravehicular Mobility Unit.

He was appointed an ambassador for UK Science and space-based careers in 2009 and is involved in working with the UK Space Agency in developing the UK's microgravity research programme. He is keenly interested in promoting science and engineering as career possibilities for school pupils and students.

Tim is based at ESA's European Astronaut Centre in Cologne, Germany. He is currently training for his Principia mission, a long-duration flight to the International Space Station, to be launched at the end of November 2015. He will be the first British ESA astronaut to visit the Space Station.