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EDITORIAL The spring months brought an array of bright planets with Jupiter, Mars and Saturn all putting on a good show and with Mercury having its best apparition of the year at the end of May. The weather however was less than helpful with persistent cloud. The Sun continued to be fairly active (see Peter Paice's Sunspot Diary), but so far we have not enjoyed any of the really strong auroral displays hoped for in this maximum. There appears to be some evidence that stronger displays at lower latitudes may occur on the tail of a solar maximum – so perhaps the autumn months will be more productive – fingers crossed. 2014 celebrates the 40th Anniversary of the founding of Irish Astronomical Association – so we will be staging some special events to ensure that the occasion is suitably marked. Although the actual anniversary was in May, the current plan is to hold a day of lectures, star shows and activities in September/October, hopefully in conjunction with our long-term partners – the Armagh Observatory and Planetarium. More details closer to the time in *STARDUST* and on the IAA website. Very prominent in the evening sky, Mars has

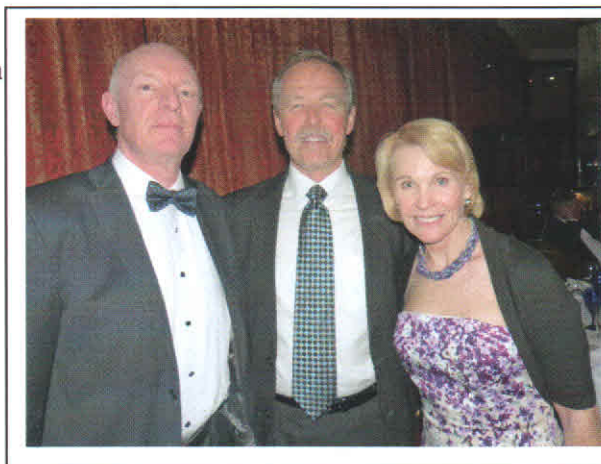
attracted lots of interest last quarter and new research has suggested that methanogens – among the simplest and oldest organisms on Earth – could survive on Mars. These micro-organisms use hydrogen and carbon to metabolise and they are found in swamps and marshes as well as in the guts of cattle. Exoplanets have also been in the news and a large extra-solar planet has been detected and imaged – Beta Pictoris b has been captured in a 60S exposure using the Gemini Planet Imager telescope (GPI) – so, astro-imagers here is your next challenge!

On the spaceflight front, the use of commercial space craft made a significant step forward when the SpaceX's Dragon docked in May with the ISS for a month long mission. This is an interesting development for the future of unmanned and possibly manned flight to the ISS and perhaps the Moon.

Lets hope for a great summer of astronomy ... and remember safe viewing of the Sun at all times.... If we get a glimpse ..
Andy McCrea, Editor, STARDUST

INSIDE YOUR STARDUST

Page 3 Members' Observations and Reports
 Page 5 IAA Fitzgerald Award and March Visit to St Pats, Armagh
 Page 5 Dark Matters – **Roy Mitchell**
 Page 7 Autographica 20 – **Andy McCrea**
 Page 10 Sky Notes July to September 2014 – **Terry Moseley**
 Page 12 Sky Diary – **Terry Moseley**
 Pages 13 to 16 **STARDUST JUNIOR SECTION – Kempston Family**
 Page 17 Spring Sunspot Diary – **Peter Paice**
 Page 21 Fitzgerald Award, CAC Visit, STFC Exhibition.
 Page 22 2014 Observing Sessions at Delamont – **David Stewart**
 Page 23 Visit to LBJ Space Centre Texas – **Paul Evans**
 Page 27 **Peter Martin's Fantastic Deep Sky Images**
 Page 28 Sky Map for 15th February at 9pm 2014



SUBMISSIONS TO STARDUST

The Editor welcomes all items, reports, letters, articles or observations for publication in *STARDUST*. Contributions are particularly welcome by email or on compact disc in MS Word format (Times New Roman, 12 point), or even typed or hand written. The deadline is 4 weeks before the next publishing date, 1st January, April, July, and October. Please send your submissions to:
The Editor, STARDUST, Andrew McCrea, 4 Ailsa Park, Bangor, Co Down, BT19 1EA.
 or email: s.mccrea980@btinternet.com; Telephone 028 91 273584.

Please Note: Photos may have to be cropped. Opinions herein are not necessarily those of the Editor or Council.

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Upper image – Stardust Editor meets with 8 times into space husband and wife Shuttle astronauts – Hoot Gibson and Rhea Seddon. *Lower*, The incredible Buzz Aldrin at Autographica 2014.

Front cover design by John Hall – Maven Mars Probe.

Members' Observations & Reports March 2014 to June 2014

Dear Andy, please find a photo of **M13** for inclusion in *STARDUST* magazine. It was taken on the 24th March 2014 with an Altair Astro 480/80mm f6 refractor and a Canon 60Da DSLR at ISO 800 attached to an I-Optron ZEQ25GT mount. An Orion SSAG guider was used with PHD software to obtain 6 x 5 minute and 4 x 10 minute sub-exposures (1 hr 10 mins). This was my first attempt at auto-guiding. The image was taken from my back garden in Limavady. Spiral galaxy NGC 6207 is visible at bottom left and you can just see the "propeller" or "dark-Y" visual feature in the core of the globular cluster. This was first noted in Lord Rosse's "*Leviathan*" in Birr, Ireland. Kind Regards, **John Purvis, Limivady**.



Hi Andy – please find images of the lunar craters **Clavius** and **Copernicus** taken on 29th March 2014 from my back garden in Glengormley. Best wishes **John Hall, IAA, Belfast**.



Andy, please find an image of spiral galaxy, **M106**. It was taken on the night of the 10 March/morning 11 March 2014 with a Skywatcher MN190 and modified Canon 600D. 24 subs at ISO 400 and two minutes along with 9 dark frames. No flat frames as I have yet to figure out how to do flat frames. Stacked in Deep Sky Stacker and processed in Photoshop. **Lawrence Hanna, Belfast**.



Hello Andy, Last night (13th May 2014) the sky was about 70% clear so I took the opportunity to take a few images. A lot of cloud to the south constantly threatened to blot out Mars and Saturn. As **Jupiter** was rapidly dropping in the West I got a few frames, but the colour dispersion was too great, so I reproduced the picture in B&W. **Saturn** lurking low in Libra was hard to locate because of a nearly full moon nearby and also due to the relatively dim aspect at around 0.07 mag and 19 degrees high. **Mars** being much higher was easily located but was lying in an area of turbulent air making imaging difficult. The hemisphere on display was the relatively featureless one. Regards, **John Hall, Glengormley**.



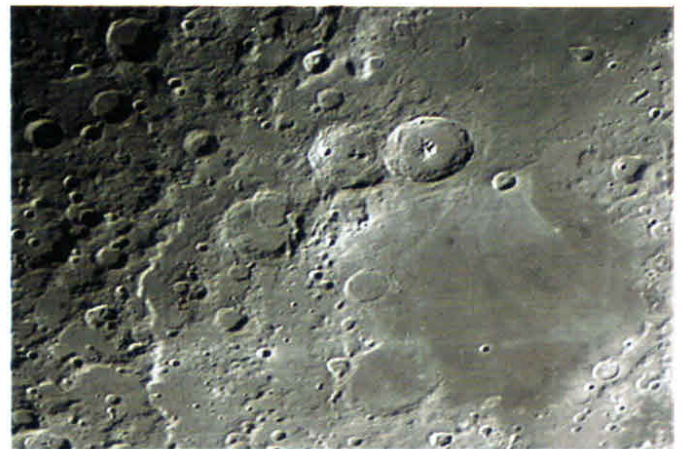
Hi Andy, please find an image of **Jupiter** for Stardust. My first attempt was a bit rushed so I concentrated on my focus and polar alignment more and got a lovely picture in return. Picture taken with a Philips SPN900NC and Ostara Achromatic 3x Barlow on a Skywatcher 200PDS with NEQ6 pro mount. Yours **Gordon Convill**.



Hello Andy, The weather has reverted to normal - that is wall to wall cloud. However the temperature is becoming more bearable now. This image of **Mars** is the last one I got last night (16th April 2014) using 2247 frames processed in Registax 6. The polar ice cap and dark markings were clearly visible through the 5" refractor. I have also included an earlier image taken on 11th April. The earlier image was taken with a Baader contrast-boost filter. Mars continues to be very sensitive to seeing conditions which can vary on a minute-to-minute basis. Regards **John Hall, Glengormley**.



John also sent me this image of **Jupiter** above (7th April) which clearly shows the red Spot and as you can see as suggested from recent reports the 'spot' appears to be getting slightly smaller. John also captured the fine view of the lunar craters **Catharina, Cyrillus and Theophilus**, highlighted in the morning lunar sunshine.



March's full Moon rises over Donaghadee lighthouse (Photo Andy McCrea).

2013/14 Aidan Fitzgerald Award - Winner Announced

The 2013 Fitzgerald award winner is **former IAA President, Brian Beesley**. The award is given for outstanding service to the Association and is named in honour of Aidan P. Fitzgerald a former IAA President, enthusiastic amateur astronomer and noted expert on the planet Mars. IAA President, Paul Evans presents Brian with his well deserved medal at the 2013/14 AGM below.



(Image: Pat O'Neill).

IAA Visit St Patrick's Academy, Dungannon. 3rd March 2014

The IAA returned once again for an evening of astronomy and observation at St Patrick's Academy. A number of pupils and their parents joined IAA members hoping for a glimpse of the stars through scudding cloud. St Patrick's has a first rate observatory in the school grounds complete with a 14" Celestron telescope (see image below) and several members used the scope to get views of the spring showpieces.



2013 IAA President Paul Evans, accompanied by Brian Beesley gave an interested audience an update on what could be seen in the evening sky. Photographs by Pat O'Neill.

Dark Matters: with Roy Mitchell

Around about the same time as I was composing the last instalment of Dark Matters, I was invited to a dinner party, the guests of which comprised, other than yours truly, a mathematician, a Catholic theologian and an Italian film director. Sadly, early on in the evening, our hostess succumbed to a combination of fatigue and maybe a glass too many of Montepulciano D'Abruzzo, and retired to her bedroom. This left me in the fascinating company of the aforementioned trio of intellectuals who had just been subjected to an ad hoc music recital given by myself ... somewhat reticently, at the behest of the above hostess! Well, as is often the case in these sorts of scenarios, conversation turned to matters concerning life, the Universe and everything, and at some point during the evening I found myself attempting to explain the so-called anthropic principle to the assembled retinue. To be honest, I was struggling to keep up with my own argument ... I was going to be driving, so this was not the result of too much alcohol (!) ... and I made a mental note to make said principle the subject of a future contribution to Stardust, as a means of hopefully crystallizing my views on the subject. Not surprisingly, the mathematician, and the theologian took very different stances concerning my observations regarding the fine tuning of the fundamental constants of nature. The

mathematician, agreed with me that there was no particular reason why we should exist; we just do, whereas the theologian who was new to anthropic ideas about cosmology got quite excited about the idea that intelligent life in the Universe was potentially a prerequisite of physical law. The film director, whose English was good but not good enough to follow the cut and thrust of the argument, simply found the whole debate rather amusing and from what I could gather, seemed to be regarding the evening as a potential plot for one of those somewhat existentialist movies about nothing much at all, that I so love to watch!

Funnily enough, a day or so ago, I found myself having a similar conversation with a friend who is a devout believer in Christian doctrine, whom I regard with much respect, but who sadly takes a rather dim view of my lack of need for faith in her God. She feels, from what I can gather, that my contentment with simply trying understanding the laws of physics as an explanation for our existence is tantamount to arrogance ... a view which has been enflamed, I would suggest by the slightly condescending way some high profile atheists appear to treat "believers", in their enthusiasm to debunk religion! Now, as I have got older I think it's fair to say that I have mellowed in my attitude towards the beliefs of others. Sadly in the last week, I have lost my second much loved uncle, in just under a year, and it has been pretty obvious to me, the comfort that many members of my family circle acquire in such sad circumstances, from their faith in God and an afterlife. At one time in my life, I could easily have given Richard Dawkins a run for his money, in my vehement objection to religion, but as I get older, I understand more and more, the importance of each person acquiring their own belief system commensurate with whatever their philosophical needs may be.

To be honest, for me personally, I'm not sure that physics ... cosmology in particular ... isn't actually a substitute for the religion which I distinctly remember ceasing to accept over the course of two specific moments in my life. First, at the age of about eight, when I suddenly thought that the Bible stories which I was being taught at Sunday school could be no more true, than the Grimm's fairy tales, Norse mythology and Celtic legends that I was lucky enough to have been exposed to and loved so much. Second, when I studied some molecular biology, in my thirties, I definitely found many loose ends regarding philosophical questions being tied up, so to speak, at which point

I definitely metamorphosed from being an agnostic to an atheist!

Of course science isn't a religion. Faith can only be acquired by some hitherto not understood process in the mind, whereby a person comes to know and feel a clearly genuine relationship with what they consider to be God. Physics, on the other hand can be taught to anyone who is interested in learning and understanding mathematics and the consequent physical laws with which we can claim to understand the Universe. For me though, scientists can never properly be accused of arrogance by authorities on religion, because scientists know and accept that they will probably never fully understand the Universe ... its origin, evolution and subsequent future ... regardless of how far they have come in their frankly remarkable attempts, to date!

So what of the anthropic principle? Well just for once it turns out to be pretty simple to explain, even to the point of being perhaps a little "trite". There are three levels of anthropic principle. The strong version, the weak version and even the trivial version ... the last of which I shall ignore! I'll come to the strong anthropic principle (SAP) presently. But first a little background to the weak version (WAP). The idea of putting the significance of the existence of intelligent life into the cosmological melting pot, so to speak, came from theoretical physicist Brandon Carter, in 1973. He was unhappy with the so-called Copernican version of the cosmological principle which states that our existence in a homogeneous and isotropic universe is of no consequence. We do not inhabit a special place in the Universe and we do not observe it from a privileged position. However, we do exist, we are quite special ... no-one can argue that the evolution of self-aware intelligent life isn't remarkable! The thrust of the WAP is basically that the conditions of the Universe are suitable for our existence. Well big deal you might say ... and many do ... but actually, early proponents of the WAP including Carter and Robert Dicke, used our existence to estimate constraints on the age of the Universe given that it would require the order of ten billion years for a stars to have evolved to the point that enough heavy elements had been cooked up, for carbon based life-forms to exist.

More remarkably, it has been suggested that Fred Hoyle used anthropic reasoning to predict the incredibly finely tuned resonance in the energy level of carbon-12 nuclei that allows the otherwise

unlikely triple-alpha process of nuclear fusion in stars to create carbon from helium nuclei. It is reputed that his belief in the existence of this resonance was simply based on his observation that we, carbon based life-forms, exist!

The discussion I described at the top of this article, was mainly concerned with the validity of the strong version of the anthropic principle, which suggests that the finely tuned parameters which define the state of the Universe are such that the emergence of intelligent life was an inevitable, indeed, even necessary consequence! Obviously, the SAP tries to deal with the “coincidence” of our Universe being perfectly suited to our appearance, when any number of alternative universes, would not have been remotely suitable for life to evolve. But the SAP does rather evoke religious ramifications, with inferences of intelligent design! For this reason, the SAP is decidedly and deservedly controversial, and isn’t particularly popular amongst the physics community as a whole. What troubles me, is not the existence of the SAP, it’s the requirement by many cosmologists to invoke the idea of a “multiverse” to get round the coincidence of the Universe being so perfectly set up for our “creature comforts”! Ironically, my Christian friend takes the SAP argument as evidence for the existence of God.

The theologian from the dinner party, took a similar view, whilst because she had studied some quantum mechanics and hence was aware of the so-called many worlds interpretation, the mathematician favoured the multiverse solution, which allows infinite universes to exist, thereby ensuring the existence of one or more that can support life. Perhaps in a parallel universe, an equally attractive mathematician actually accepted my subsequent invitation to go for a coffee sometime; however, sadly, in this Universe my rather feeble attempt at a romantic gesture was rejected ... I like to think of it as Schrodinger’s latte!

Personally, I think that we exist, simply, because we are able to ... if we didn’t exist, because the gravitational constant, or Planck’s constant, or the critical density of the Universe were such that life was impossible, we simply wouldn’t be here to question our existence. As it happens, the multiverse idea is gathering popularity, as it is a possible outcome of various inflationary theories and string theory, etc. So it may well be that there are an infinite number of universes with versions of me writing Dark Matters or its equivalent, for an

infinite number of versions of Stardust. Well, you’d think that in at least one of those universes something I wrote would eventually make some sense, and prove to be of some actual inspiration to the reader ... I can only dream! With apologies for a slightly, possibly even necessarily, weird Dark Matters, bye for now. Until next time ...

Autographica 20

March 21 to 23rd 2014, Radisson Edwardian, Heathrow

Andy McCrea

A few editions ago I did a short piece on the Apollo heroes at Autographica 19 – perhaps the greatest living spaceflight hero of them all attended March’s Autographica 20 – the second man to set foot on the Moon, Buzz Aldrin. Buzz is now in his 84th year and most think it very unlikely that he will make too many more trips to the UK. An octogenarian he may be but short of enthusiasm and ideas he is not! I was delighted to see that he had lost little of his fire and thirst for space travel and was lucky enough to hear him speak firstly at the evening gala dinner and then in a personal interview when he completed my Apollo 11 crew autographed cover (bank balance still stinging!). Buzz considers that there are a number of things which need to be done to move the space travel agenda forward and he was particularly keen to see co-operation with the emerging nations such as China and India (this he refers to as his Unified Space Vision). He is also very keen on commercial space travel with manned trips to Mars before 2035 and possibly to asteroids.

Bruce’s engineering brain is still very sharp and he needs two full-time minders to organise his hectic schedule and manage his life – after Autographica he was heading to Brazil to seek funding to further develop some of his ideas. Buzz was accompanied at the show by fellow Apollo moonwalker - fourth man to walk on the Moon, the extremely pleasant and personable Alan ‘Beano’ Bean.

Although Al Bean now regards himself as an artist, he still delights in telling us about his trip to the Moon and adventures he had there. One of the very great pleasures of Autographica is the astronaut lectures both at the show and after the evening Gala dinner event, and I have to say this batch were superb.

Alan Bean (image below by Shirley McCrea) gave an excellent talk reminding us of his lunar trip on Apollo 12 and follow-on flight on Skylab 2 which lasted 59 days. He prides himself on being the first artist to visit another world. He illustrated his talk through reference to his works of art, beginning with *'Reach for the Stars'* which is one of his personal favourites. He came over as a very family oriented man, alluding to his wife Lesley and his two Lhasa Apso dogs Moonbeam and ET.



He described the Apollo days stating that there were a few, but only a few, really brilliant, gifted individuals who stood out – mentioning Von Braun and Robert Gilruth, but he said the vast majority of the 400,000 involved with the programme were just ordinary guys. During Apollo the average age of the team in mission control was 25, but they aspired to a dream and worked together to achieve it. He also spoke about his training in geology, and how at first he had rejecting the need to understand that aspect of the job, he was after all foremost an aviator with a military background. He told us about several scary moments in the Apollo 12 mission when things had not quite gone to plan and noted his surprise at the extreme noise and vibration during take-off on the Saturn V. He felt that perhaps his most worrying moment on the Moon was when they had planted the American flag and it refused to stand upright in the lunar regolith. He described how his moonwalker colleague, Pete Conrad, had pushed the flag in at an angle to make sure the centre of gravity was in the correct place to balance the shaft precariously until the photographs could be taken – Al reckoned

that it fell over when they lifted off – perhaps time will tell. Al Bean also noted how thin and fragile the Earth's blue atmosphere appeared once the CSM moved away from orbit into its lunar

trajectory. He also talked about how close the LEM had landed to the Surveyor 3 spacecraft, praising the guidance scientists for their remarkable precision and Pete Conrad for his skilful landing. Al said that he found nothing really unusual on the Moon – no dinosaur bones nor any evidence of ancient civilisations and while he was there he threw his gold astronaut pin as far as he could – perhaps someday in the far future someone will stumble across it. Al said that one of his lasting memories was of the golden crescent Earth and how beautiful it looked from the Moon, leaving him with a clear impression that we really do live in the 'Garden of Eden', a real paradise. He said that travelling to the Moon had not changed him in any way but he did feel that it made him *'more of what he was'* and he had spent time gazing at the stars and pondering the future of life on Earth. Beano also talked about life during the Apollo years when Life magazine had paid for the astronauts to drive a new car every year – he said how much he enjoyed travelling around in his sporty Chevy and living the high life. Beano aspired to the motto of *'do a little better every day'* and he modestly referred to the new breed of astronauts, mentioning Hoot and Rhea who he had trained, as being superb and much better than himself. In a humorous reference, Al said that he regretted not taking a golf ball to the Moon or doing something *'a little crazy'* – something by which people would remember the mission – he enjoyed moving around on the Moon but found it difficult to get up once he had fallen over (which he did several times!). In another anecdote Beano recalled how he had painted Neil Armstrong on the Moon and he had included a wristwatch on Neil's right wrist (*an Omega Speedmaster!*). He said that someone had queried the fact that Neil was not seen wearing the watch in photos. Neil's response was that the watch was on the right wrist if Al Bean had painted it on But Al had to admit that in fact Neil had used the watch in the LEM as a double check against the descent clock, which timed the descent from orbit and in his haste to start the moonwalk he forgot to put it on, so Al eventually painted it out!

Other astronaut at the show included the first untethered 'space walker', Bruce McCandless, husband and wife shuttle astronauts with 8 flights

between them, Robert 'Hoot' Gibson and Rhea Seddon and veteran of shuttle missions STS-123 and STS-135 Greg Johnson. Bruce was a true veteran and because of his close involvement with the Manned Manoeuvring Unit (MMU) development programme over 17 years, he ended up being the first untethered astronaut ... untethered 'spacewalker' just seems to be the wrong term in this case. Bruce described the experience and related how he had trained in neutral buoyancy conditions under water. He said that this did not present the true case for micro gravity since the blood still flowed to the head and the body's weight fell on the collar bones when upside down – this did not happen in space. The MMU used nitrogen gas as a propellant – this was a good idea because the Shuttle carried nitrogen and it had a low specific impulse. Bruce described his untethered flight, relating how cold and uncomfortable he felt – he had the suit temperature setting at full 'H' for heat but he said that 'H' actually stood for 'a little less cold' ... he was freezing and had decided to return to the shuttle when he was told that a call from the President was coming through. He had to move back away from the Shuttle and take the call shivering violently, but it had to be done.

Bruce said the MMU had been used only twice since his 1984 trial flight and he compared the experience with the portrayal in the recent film Gravity – which he thought was great! Bruce explained that the great manoeuvrability of the shuttle with its fine control thrusters allowed the sort of work which was envisaged for the MMU could in fact be done with tethered astronauts and through the accurate placement of the robotic arm. This however is not the case with the ISS – it cannot be moved in the same way! He told us that NASA were working on a second generation MMU to use in the proposed micro-gravity of asteroids.

Bruce compared many of the aspects of the film Gravity to the real situation in space – the problem of space debris, the ability to change orbits and the difficulties of getting in and out of pressure suits. He said that the film was stretching credibility in many of these things... he particularly felt that Sandra Bullock would have had great difficulty getting to the Chinese space station and that pressing the correct buttons for the return flight to Earth would have been fairly impossible but most of all he felt that Sandra looked cool and pleasant after her ordeal – Bruce said that in his

experience spacewalking was a very sweaty exhausting activity.

Hoot and Rhea are the classic double act – and they delivered a fantastic talk giving insights into areas of space missions we don't normally get – the family, stress, and raising children as space parents. Rhea was trained as a surgeon and was particularly interested in life sciences - she flew three shuttle missions and studied the impacts of micro-gravity on the body. Hoot was a shuttle pilot (flew 5 missions) and he eventually became Head of the Astronaut Office. The couple met through the space programme and married in 1981. Rhea the third US woman to fly in space told us about how the astronauts get to design the mission patches and related her early fears following selection in 1978, that NASA would side-line the original six female candidates in favour of male astronauts (as had been done by the soviets). Rhea studied space sickness and flew with senator 'barfing Jake Garn'. Hoot described his extensive experiences as a pilot and mission commander flying on the only launch in 1986 following the Challenger disaster. Rhea told us of some of her work with rats in space. On her third flight she took 48 rats to study weightlessness and she also confirmed that women can adapt to weightlessness every bit as well as men. She also informed us that she had carried out a rat dissection in space and that the facility to do this was not currently available in the ISS.

Last up was F15 fighter pilot and veteran of two shuttle Endeavour flights STS 123 and STS 134 - Greg 'Box' Johnson. Endeavour was built as a new member of the shuttle fleet to replace Challenger and was constructed from '*spare parts*'. Flight STS 123 delivered the first module of the ISS Japanese laboratory – Kibo, and the Canadian Special Purpose Dexterous Manipulator, (SPDM) or 'Dextre' robotics arm. This mission set a record for the Shuttle's longest stay at the ISS. Greg also told us of his trip on the last flight of Endeavour – STS 134. Interestingly the mission delivered a significant cosmology satellite - the AMS, or Alpha Magnetic Spectrograph – an experiment designed to investigate some of the main puzzles in cosmology – dark matter, dark energy, naturally occurring antimatter and the origin of the universe. Greg was very friendly and described how he had to work with Russian crew mates who had also been trained as fighter pilots ... former enemies now turned colleagues and friends. Greg also told us of how his commander Mark Kelly had heard the news that his wife,

Gabrielle Giffords had been shot and critically wounded in Tucson Arizona whilst he was in training for the STS 134 Endeavour mission. The crew had to support the commander (Mark) throughout this final flight from the Kennedy Space Centre.

As usual Autographica presented opportunities to meet and chat with the astronauts and get pictures and autographs. The highlight of Saturday evening was the Gala dinner where all the astronaut guests and others gave cameo presentations over dinner. Shirley and I were guests at Box Johnson's table and he proved to be a very entertaining host. Stars of the show were without doubt were the Apollo astronauts and they were treated with due respect but it was noted by all that they are not getting any younger and the opportunity to meet these fantastic individuals must inevitably be getting very rare.

SKYNOTES: July - Sep 2014

N.B. All times are now Civil Time for convenience, except where stated.

Magnitude: this is the astronomical term used to measure an object's brightness. For beginners it can be confusing, as the lower the magnitude (abbrev: mag), the brighter the object! This arose from the convention among early astronomers of describing the brightest stars as 'First magnitude' (written as 'mag 1'); the next brightest as 'second magnitude' (mag 2), and so on down to the faintest stars they could see which were of 'sixth mag' (mag 6). Today, with powerful telescopes and CCD imaging we can extend the scale down to below mag 30. And for the very brightest stars and planets, and the Moon and Sun, we have to extend the scale in the other direction too.

So mag 0 is brighter than mag 1, and then brighter than mag 0 we have mag -1, mag -2, mag -3 etc. And each can be subdivided into decimals such as 3.8, or -2.1, etc. If no sign is shown, take the mag as positive, i.e. 'mag 3' means +3. Each magnitude is exactly 2.512 times brighter than the next one, so that stars of mag 1 are exactly 100 times brighter than those of mag 6. To remember which way the scale works, just think 'First' is better (brighter) than Second, which is better than Third, etc. Then remember that for brighter than

'First', you have to go to zero, and then minus values.

Aphelion: The Earth will be farthest from the Sun in its elliptical orbit around our star on July 4 at 01.12, when the separation will be 1.01668 AU, or 152m km.

Autumn Equinox: The Sun will cross the celestial equator southwards on Sep 23d 03h 29m, marking the start of Autumn in the N. Hemisphere, and from then onwards days will be shorter than nights.

Zodiacal Light: the best times to look this quarter will be from Sep 23 to 30, just before dawn breaks. You need a very dark sky, and a clear horizon to the East. Look for a faint cone of light extending up from the horizon at about 45 degrees to the right, along the line of the ecliptic, towards Jupiter.

The MOON: (all times in GMT)

NEW: Jun 27d 08h 08m; Jul 26d 22h 42m; Aug 25d 14h 13m; Sep 24d 06h 14m

1st Q: Jul 05d 11h 59m; Aug 04d 00h 50m; Sep 02d 11h 11m;

FULL: Jul 12h 11h 25m; Aug 10d 18h 09m; Sep 09d 01h 38m

3rd Q: Jul 19d 02h 08m; Aug 17d 12h 26m; Sep 16d 02h 05m

The Full Moon on 10 August will be dubbed a 'Supermoon', as it occurs very close to lunar Perigee. Perigee occurs at 17h 42m, only 27mts before the Full Moon, and it's a close one too: the Moon will be at its closest to Earth until Sep 2015, so expect lots of media hype. In actual fact, the difference in size and brightness compared to a normal Full Moon is not that great. For the record, the Moon's apparent diameter at 10 p.m., when it's fairly well above the horizon from here, will be 33' 36", and as it nears transit at about 01.00 (so our part of the globe is closest to it) it will reach 33' 44". Local distance will be about 356,900km.

MERCURY: Will be very poorly placed for observation from Ireland this quarter. It will have a morning elongation on 21 July, but it will lie very low in the bright dawn twilight. You could try looking with binoculars about 7 degrees below and left of much brighter Venus. But it's better to wait until November.

VENUS: Venus is visible low in the morning sky in the dawn twilight, but is not well placed for our latitudes. On 24 July it will lie about 7 degrees left of the waning crescent Moon, low in the bright

twilight. A highlight, though again not too well placed, will be a very close approach to Jupiter, so that the two brightest planets will be very close together in the morning twilight – a great photo opportunity. On the morning of 18 August, about 30 mts before sunrise, Venus will lie just 12' to the NE of Jupiter. That's about 1/3 of a lunar diameter. But you'll only see two Jovian Moons, as the outermost two, Ganymede and Callisto, will both be hidden behind Jupiter. Look from about 04.40 to about 05.30 when Jupiter in particular will be fading in the brightening twilight

MARS: Our neighbour planet, moving outwards from the Sun, was at opposition on 9 April, in Virgo, and is now fading and shrinking in apparent size as Earth moves further away from it on its faster inside track around the Sun. On July 1 it will be down to mag 0.0, and diameter only 9.5", and by late August it will be only mag 0.6 and diameter 7.0". On the evening of 5 July it will lie 2 degrees above left of the First Quarter Moon, while on 13-14 July it will pass just 1.3 degrees above Spica: look for the contrast in colour, reddish Mars vs blue-white Spica. Then on the evening of 3 August the First Quarter Moon will lie midway between Mars and Saturn. Finally, on 24 August, Mars will pass 3 degrees below Saturn, both at magnitude 0.6, low in the W twilight. The colour contrast will be less, as Saturn is yellowish to the reddish tint of Mars.

JUPITER: Will be in conjunction with the Sun on 24 July, so it won't be observable until mid-August in the morning sky, by which time it has moved into Cancer. A good time for a first look will be on the morning of 18 August when it will lie VERY close to Venus – see that section above. By the end of the quarter it will be visible moderately high up in a dark sky, so it will reward telescopic observation. Even binoculars will reveal the four 'Galilean Moons', Io, Europa, Ganymede and Callisto. A telescope will show their regular stately dance around the planet, alternately passing in front of it (a transit), or behind it (an occultation), or disappearing into Jupiter's shadow (an eclipse). The shadow of each moon crosses the disc before the moon itself, and eclipses occur before the corresponding occultations. In the morning of 7 September all four moons will be fairly near their maximum elongations from the planet: from E to W they will be Callisto, Europa, (Jupiter) Io and Ganymede. A highlight for this quarter will occur on the morning of 12 Sep when

at about 05.00 the shadows of both Ganymede and Callisto will be well visible on the planet's disc, and if you can follow the scene into the brightening twilight you'll see Ganymede enter into transit as well! The timetable will be (all times BST)

02.57: Ganymede Shadow Ingress

04.26: Callisto Shadow Ingress

05.58: Ganymede Ingress.

By 06.10 the sky will probably be too bright. Use a fairly high power to darken the sky background from about 05.30.

You can find predictions for the times of all the satellite events on various websites, such as <http://www.rasnz.org.nz/SolarSys/JovSatJul.htm>.

SATURN: Was at opposition with the Sun on 10 May, so it's now past its best and starting to move into the evening twilight. On 1 July it will be mag 0.4, the diameter will be 17.8", and the ring angle will be 21.0°. By 31 August those figures will be mag 0.6, diam = 16.2", tilt 21.6°, and it will be very low in the evening twilight.

On the evening of 7 July it will lie just right of the Moon, while on 3 August the Moon will lie between Saturn and Mars.

Don't miss a very close pass by the Moon on the evening of 31 August: at their closest the edge of the Moon will pass only 18' below Saturn as we see it. They will both lie quite low in the sky, but it will still be a lovely sight.

Saturn's satellites vary from easy to see to difficult to spot. Almost any telescope will show the brightest, Titan, at mag 8.4; the others are fainter, and easiest to see when furthest out from the planet. Rhea will reach mag 9.7, Tethys mag 10.2 and Dione mag 10.4. Enceladus and Mimas are tricky at mags 11.7 and 12.9. Further out beyond Titan lies Iapetus, the two-faced satellite; one side is dark and the other fairly bright. It is always easiest to see when at Western elongation, when its bright side is turned towards us: this will happen on 3 July, when it will reach mag 10.3

URANUS will reach opposition on 7 October, so by the end of this quarter it's nearly at its best, approaching mag 5.7, in Pisces. Look about 4 degrees SW of Epsilon Piscium,

NEPTUNE will reach opposition on 29 August, mag 7.8, about 45' NE of Sigma Aquarii, mag 4.8. The disc is only 2.4" in diameter, so you need a telescope to show that it's not just a star.

ASTEROIDS: The two brightest asteroids, 4 Vesta and 1 Ceres continue to move closer to each other in the sky, reaching a minimum separation of only 10' on the night of 5-6 July. By then Vesta will have faded to mag 7.1 and Ceres to mag 8.4; still within easy range of even a small telescope. They will lie about 2 degrees SW of Zeta Virginis, mag 3.4. They will easily lie in the same field of view of a wide or medium field eyepiece, so it's your chance to bag two at once. www.heavens-above.com gives their positions and finder charts for each day. You can also check for details of any other asteroids that are above magnitude 10 on www.heavens-above.com.

Asteroid occultation: On 26 August at about 02.40 BST, the fairly large asteroid 5 Astrae will occult the 8th magnitude star HIP 2497. It's predicted to be visible from here, and I'll give updates via my email bulletins closer to the time. Email me on terrymosel@aol.com if you're not already getting these.

METEORS: This quarter usually has only one decent shower, the **Perseids**, which peak at about 19.00 on August 12 but the just past full Moon will rise shortly after twilight, so only the brighter meteors will be seen. The shower is still fairly active for about 3-4 days after maximum, so it could be worth looking on the following nights when the Moon will rise later, and be a bit fainter too. The ZHR at maximum may peak at about 80, but given the moonlight, the observed rate might be only about 20 per hour. Try to find a viewing position where the Moon is hidden by a tree or building. See Skydiary for other minor showers.

The Zenithal Hourly Rate (ZHR) is the rate which would be seen by an experienced observer, in a VERY dark sky, and with the radiant in the zenith: actual observed rates very rarely reach the nominal ZHR for various reasons.

METEOR PHOTOGRAPHY:

If you have a digital SLR which can give longish time exposures, and you can manually focus it on infinity, and adjust it to a high ISO (film speed equivalent), you can image meteors with a bit of luck. Make a suitable lens hood, or heater, to prevent dew on the camera lens. You'll also need a locking cable release (plus a spare one), and preferably a tripod.

Point the camera about 50° up in the sky, about 40° from the radiant, for best results. Consult your

camera handbook, or experiment with exposures until the sky fogging becomes too severe.

Noctilucent Clouds. Late June and early July is the season of visibility for these ethereal high altitude clouds, visible when the sky is nearly totally dark, as they lie well above the height of ordinary clouds. They are thought to be connected with high altitude fine debris from meteors which have burned up high in our atmosphere. Look low in the Northern sky near local midnight. You will often see Capella glowing in the midst of a display of NLCs. They provide lovely photos if you get a good display. Clear skies, Terry Moseley

SKY DIARY July – September 2014. All times are 'clock time'.

See 'Skynotes' for more details of some of these events. *By Terry Moseley*

D h m

June

21 11 51 Summer Solstice
24 morning; Venus 4° 40' Left of waning crescent moon
24 Latest sunset, Belfast (22h 04m 46s)

July

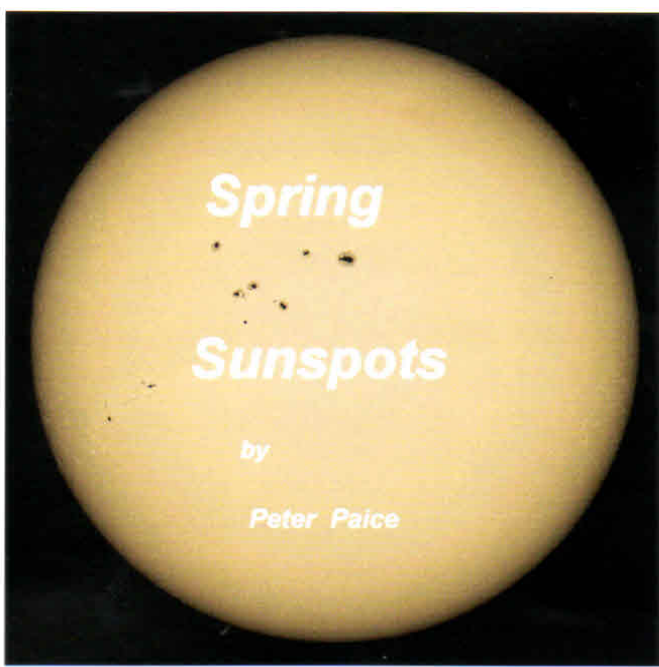
03 Iapetus at West Elongation, brightest
04 01 12 Earth at Aphelion, 152m km from Sun
04 Pluto at opposition
06 1 Ceres (8m.5) lies just 12' N of 4 Ceres (7m.1)
12 Mercury at Greatest E Elongation, 21°
13-14 Mars passes only 1.3° above Spica
28 Moon at furthest apogee of year, 406,600 km
28/29 Delta Aquarid (S) meteors maximum, low in dawn

August

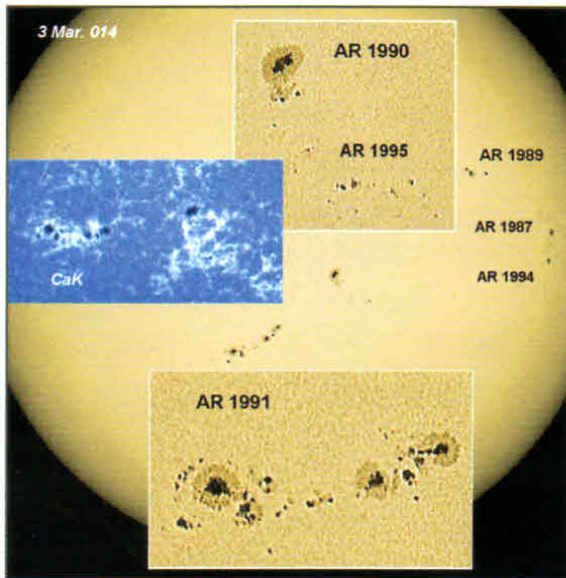
06 Delta Aquarid (N) meteors maximum, low in dawn
10 Supermoon, closest, brightest, Full Moon of year
12/13 Perseid Meteors maximum
17 14 00 **IAA Solar Say, WWT, Castle Espie**
18 a.m. Venus just 12' NE of Jupiter
24 Mars passes 3° below Saturn
26 02 40 5 Astrae occults 8th mag star
29 Neptune at opposition, mag 7.8
31, p.m. **Exclusive: IAA Observing evening at Newgrange**

September

3 12 Victoria at opposition (9m.0) 1° S of Zeta Peg
7, a.m. All four big Jovian moons near maximum elongation
12 a.m. Rare Jovian satellite events: 3 transits at once; see Skynotes
23 03 29 Autumn Equinox, Sun crosses equator southwards
23 Start of opportunity to see Zodiacal Light
24 19 30 **IAA opening lecture, Bell Lecture theatre, QUB**



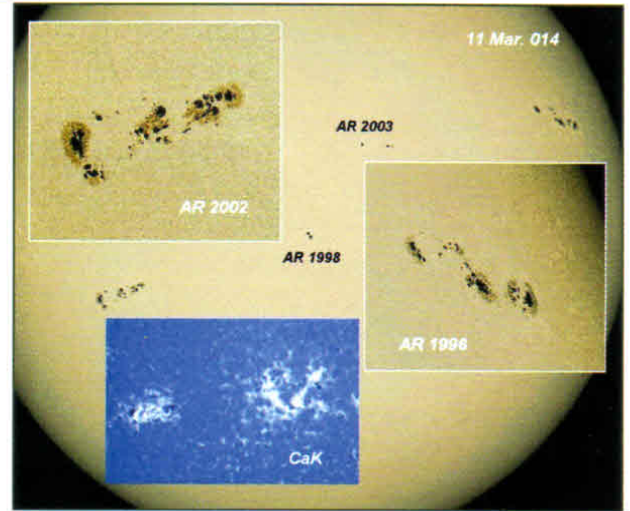
The first two days of March were dull and wet at times but **Mar. 3** had good seeing for imaging, allowing the montage below to be made showing impressive active areas **AR 1990** and **AR 1991**.



The active area **AR 1990** was on the **third** transit in company with sunspots **AR 1987** to **AR 1996**. All but two were sub Earth-size and about to exit the W. limb in a few days behind the cover of dull skies. A brief period of clear sky allowed a new sunspot **AR 2002** to be imaged.



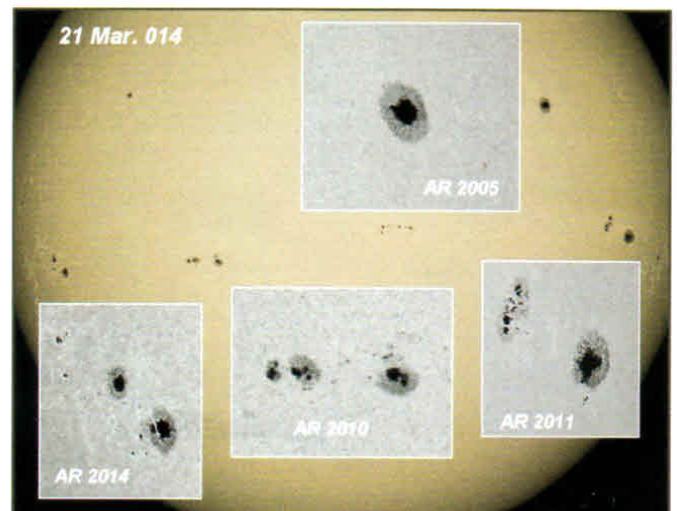
This latest sunspot enlarged to almost 10 E's in length vying with an older 'spot **AR 1996** about to depart the W. limb. The disk was imaged through thin cloud on **Mar. 11**. *See below.*



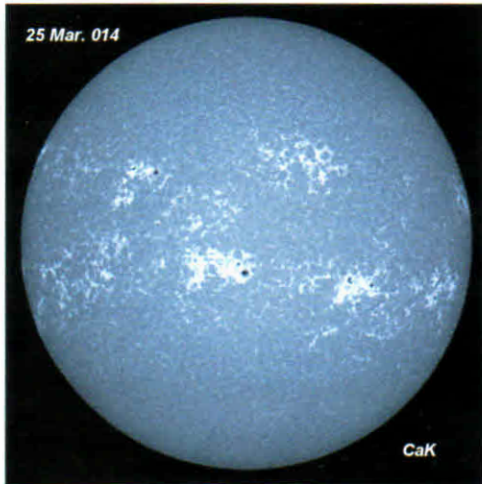
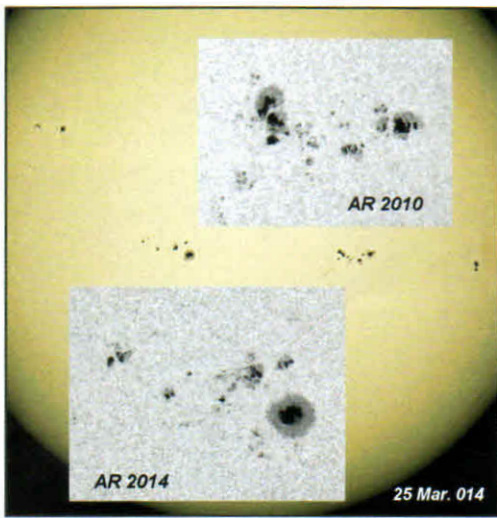
The next few days had a selection of fog, thick cloud, not imaging conditions! By reference to SOHO, active areas on the disk were **AR 2005** to **AR 2008**. There was a brief chance of imaging on Mar. 19. Some new 'spots assigned numbers up to **AR 2014** were present. One 'spot was 'old' **AR 1997** seen below at the E. limb.



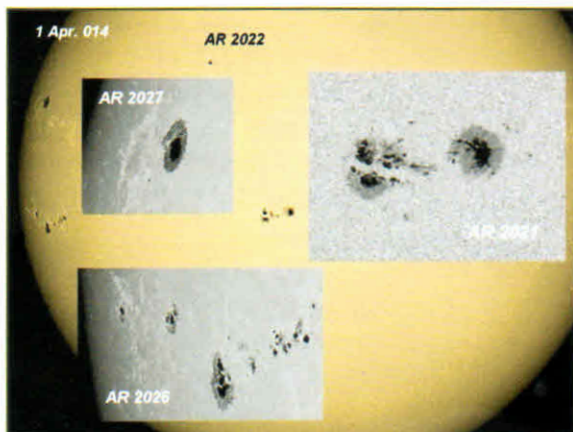
The next two days reverted to dull cold weather but improved by **Mar. 21** allowing imaging.



Seeing conditions improved by **Mar. 25**, so imaging proceeded. *See below.*



The remaining days of the month were **clouded out**. Sunspot data from SOHO showed a reduction in daily sunspot numbers, ending the month with seven. Assigned numbers were AR 2017 to AR 2027. Active area **AR 2017** produced an interesting event on **Mar. 29**. An **X-1 class solar flare** with a high UV content which caused a radio 'blackout' in the amateur bands for several hours. **April** commenced with a day with 'bright periods' revealing new active areas on the solar disk. *See montage below.*

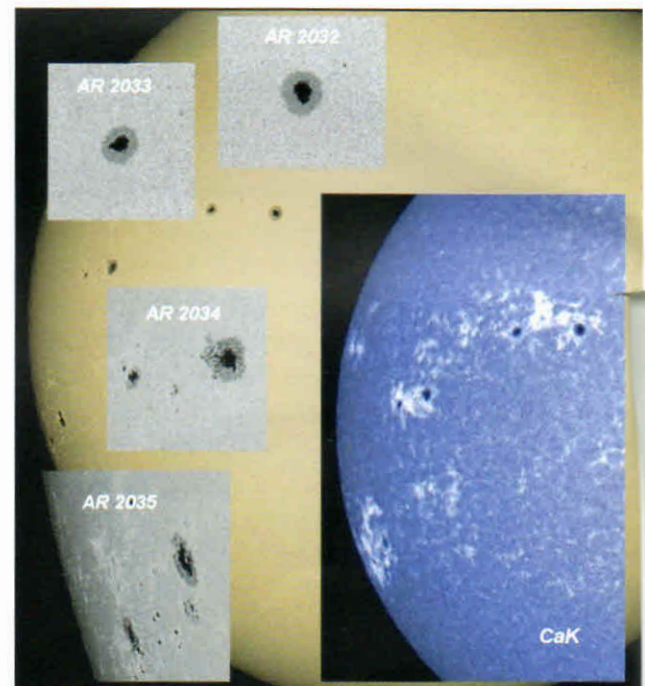


Active area AR 2027 (see previous montage) then produced an **M6-class flare** on **Apr. 2**. The next few days were almost clouded out with few glimpses of the sun. Reference to SOHO sunspot

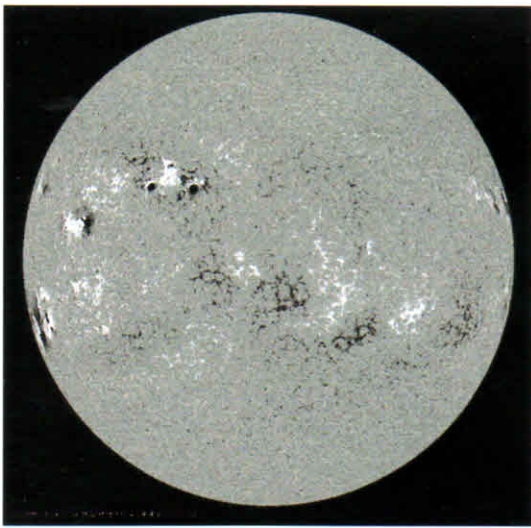
data indicated that active areas **AR 2020** to **AR 2030** were approaching the region of the Western limb. Seeing conditions improved on **Apr. 8** and **Apr. 9**, showing new sunspot groups at the E. limb. *See the images below.*



The active area AR 2032 was 'old' AR 2005 returned for a second transit. Reasonably good seeing returned by mid-afternoon on Apr. 12 giving a chance for imaging again. *Results are shown below.*



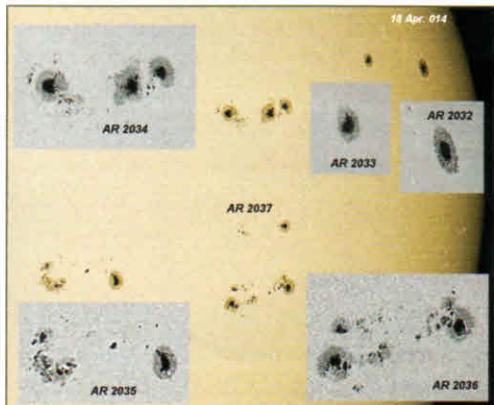
Solar activity had returned to the Eastern limb. The raised magnetic activity on the solar disk is shown on the **next side**. *Courtesy of SOHO*



Over the next few days, active areas **AR 2032** to the new **AR 2038** were present on the disk. The sunspot group **AR 2038** was 'old' **AR 2014** on a second transit. The disk was imaged in H- α on 15 Apr. using a Coronado *Solar Max II 60*.

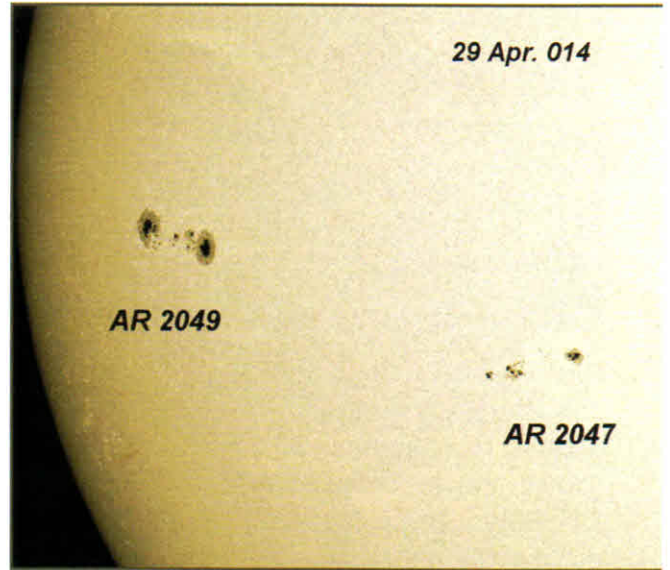


Sunspot **AR 2036** steadily enlarged and on 18 Apr. discharged a **M7.3** class solar flare. Active areas on the Earth-facing side even reached eleven. Improvement in seeing conditions allowed some imaging on **18 Apr.** and a montage produced.



The next week had variable seeing conditions. Checking on the disk it was found that the active area count had decreased to just **five** with only one,

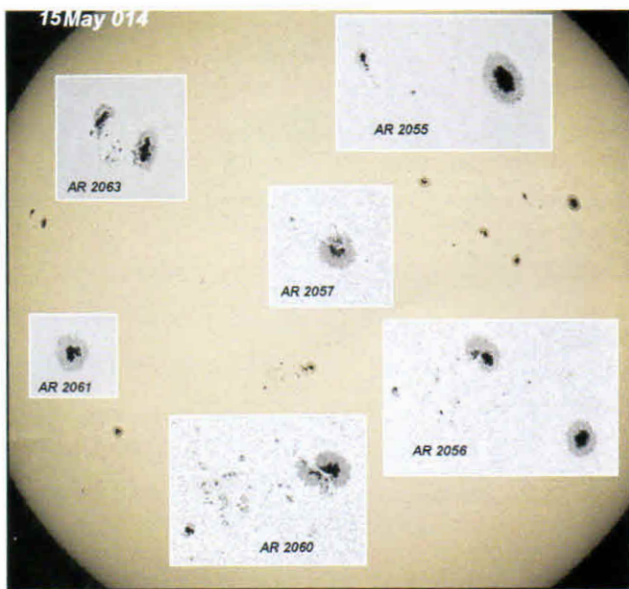
AR 2045 being 2x Earth size. By 26 Apr. the weather depreciated to dull cloud cover and high winds. Reference to SOHO indicated that there were just **four** sunspots facing Earth but by 29 Apr., **AR 2047** & **AR 2049** were imaged during a 'bright period'. See below



The first four days of **May** were useless for viewing or imaging sunspots due to dull rainy conditions. A brief sunny period allowed time to image a new sunspot arrival (see below) but no time to image the other seven sunspots.



The next five days were totally useless for imaging. Again reference to SOHO data revealed seven AA's with assigned numbers **AR 2052** to **AR 2058**. The title disk indicates their positions on **11 May**. Notice the concentration on the **northern** hemisphere. The Earth-side sunspot number count then became **10** on the 12 May. Two cloudy days followed but improved considerably by **15 May** allowing imaging again. See montage below.



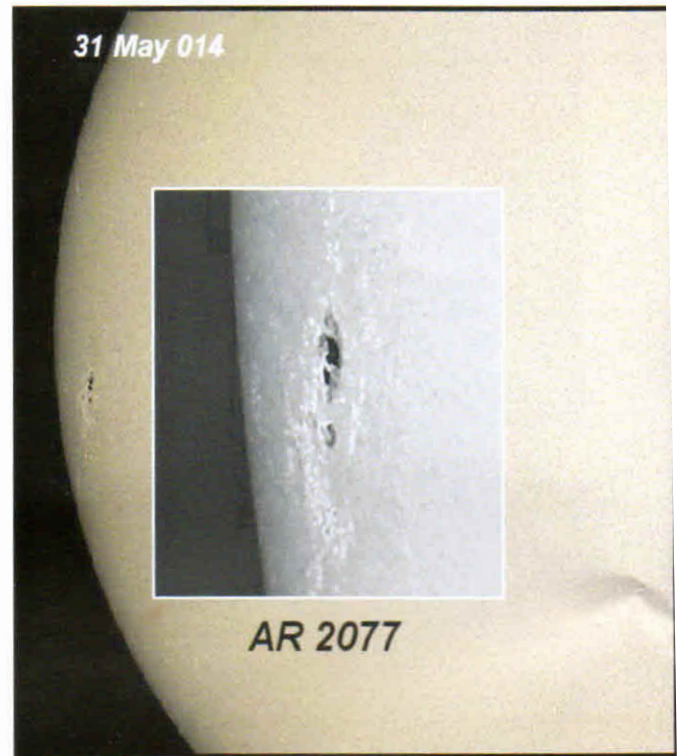
The next five days had varying meteorological conditions allowing only a brief check on the number and progress of active areas. The 'spots shown above continued to transit westwards. On **21 May** seeing suddenly improved, allowing concentration on the **new** active areas that had arrived on the Eastern limb. *See montage below.*



Weather conditions then reverted to our usual mixture of cloud, drizzle and 'fug'- no inspiration for any young 'budding' solar enthusiast. Reference to the usual 'stand-by' of SOHO showed that active areas AR 2065, AR 2072 and AR 2074 were about to exit the W. limb. The AA's AR 2071 and AR 2073 (*shown above*) were fading, leaving just **four** 'spots Earth-side – solar activity was certainly in decline by 29 May.

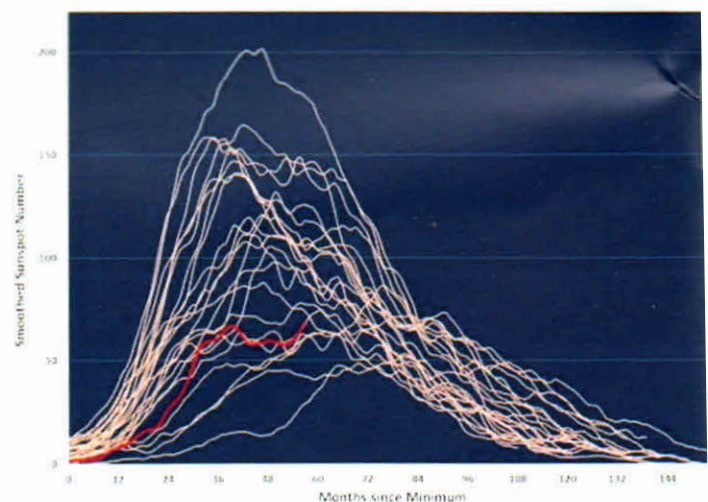
On **31 May** just to 'show-off' weather wise, the cloud cover reduced allowing imaging to leave the

month on a 'high'! A new sunspot was espied at the E. limb. *See below*



It is almost a 'tradition' for the Author to give his pessimistic forecast for the progress of Solar Cycle 24. Solar observers have noted that increasingly more active areas have been seen in the northern hemisphere. Does this herald a reversal of solar poles? Apart from days with high sunspot numbers these are on average in decline.

Finally, Doug Biesecker of NOAA at a Space Weather Workshop in Boulder, Colorado produced this graph showing averaged 23 solar cycles since 1755. The Reader may just be able to see the **red** plot for Cycle 24. Not doing too well is it!



What will the plot be like over the coming months?

2014 Aidan P Fitzgerald Award Paul Evans

One of my last duties as IAA President was one which brought me great pleasure as it was such an honour to perform. I refer of course to the presentation of the Aidan P Fitzgerald Medal.

This award, named after a prominent member of the Association from the 1940s and 50s, is given once a year to a member, usually but not always a Council member, for "Outstanding Service to the Association".

The process involved in the selection of the award winner is that a sub-Committee of the Council consisting of previous winners is convened, suggestions made and arguments for and against put forward and discussed. This year the process was straightforward as there was one member who hadn't actually received the award previously despite having worked very hard for the Association for very many years!

Brian Beesley has been a member of the Association since the 1970s and was President for two seasons from 1978-80. Indeed his successor was Terry Moseley in his first term! In recent years, having retired, Brian has become more involved with the Association and plays a major part in our activities attending nearly all of our outreach events despite living up on the North Coast. He has joined the Stardome presenter crew working on many of our outreach events, notably at Stargazing Live and recently gave a very well received talk to members of the public at Silent Valley Visitors Centre. Brian has an outstanding depth of knowledge of the subject and a gift for explaining it at all levels.

He will be speaking at the prestigious Solarfest event at Dunsink Observatory on 21st June and this will be Brian doing what he does best, sharing his extensive knowledge of Astronomy with others.

The medal itself is tastefully minted in bronze gilt, and on the obverse shows the profile of the famous South Refractor at Dunsink Observatory, while the reverse has the recipient's name and date engraved inside a laurel wreath. See a photo of Brian receiving his award on Page 5 - with image by Pat O'Neill.



Image credit: Paul Evans

CAC Visit to Armagh and Belfast Terry Moseley

The Cork Astronomy Club (CAC) brought a group of 28 for a weekend visit to Armagh Observatory and Planetarium, and then on to Belfast where they visited the exhibition. It was great to see so many visiting 'Up North'. Some IAA members joined them for a dinner in Belfast on Saturday evening. Thanks to Prof Mark Bailey & Dr Tom Mason for the excellent reception & visits at Armagh. The group also attended the STFC Exhibition (see below) on the Saturday and they spent some time taking in the Belfast tours including a ride on the open top bus and a trip to the Titanic exhibition.

STFC Roadshow at QUB, 17 - 24 May

This was a great success, particularly on the last day. Thanks to Professor Alan Fitzsimmons at QUB for inviting the IAA to have a stand at the exhibition, which also attracted a lot of interest, including Tony Kempston's Virtual Reality Universe headset. He even made a fan out of Professor Stephen Smart, the Head of the Astrophysics Research Centre (ARC). The event was presented jointly by the STFC and the ARC at QUB. Thanks to all the IAA members who helped to 'man' the IAA stand there. The exhibition then moved to Armagh Planetarium for the next week.

IAA Observing Session at Delamont David Stewart

The IAA has just completed its 5th season of observing at Delamont Country Park. The pattern of observing during those 5 years has of course been dependent on the weather. Typically, September to December usually gets at least 2 or 3 sessions with January to March being poor with no or very little observing. The 2013-2014 season was no different with observing each month from September until December, then no observing in January, February or March 2014. By this time, anyone who had bought a new telescope during the winter months would be questioning their purchase (you know who you are!) as the wet weather fronts kept rolling in off the Atlantic, preventing any possibility of first light.

Luckily the weather improved for our last observing session for the season on the 26-4-14. As the evenings are getting longer by the 26th of April, we started arriving at Delamont about 9pm to get our scopes set up. Being a moonless night, it was an ideal chance to observe some faint fuzzies later on. The regular gang of diehards were there and we had some new faces there also. I have to apologise at this point as I can't remember all your names.....you know who you are! The mighty Jupiter was first to pop out of the western twilight sky so our scopes were trained on that while the skies darkened. A little later on, we waited for Mars to clear the trees but as it hasn't been a very favourable opposition this year, telescopically it has been a challenge to see any detail. At this point a youth group happened to be at Delamont and we showed them Jupiter and Mars through our scopes. However Ivan McAllister had his big 12" dob and this gave good views for all to enjoy. We had some cloud drift in for a short time but it cleared away shortly after so we could get stuck into some deep sky observing in the Leo/Virgo region of the sky..... Ivan gave us a grand tour of the highlights.

A few sporadic meteorites were also observed. Paddy Cunningham observed 27 satellites during the course of the evening also. I headed for home after midnight but a few diehards stayed until about 2.30am! As Paddy suggested on the IAA forum, we'll do an 'all nighter' sometime! The success of the IAA observing sessions is down to everyone who supports it, lets hope the next 5 years brings continued support and enthusiasm

from everyone young and old, member and non member alike. **David Stewart, IAA Observing Coordinator.**



Dave Grennan Discovers Supernova Number Three from Raheny in Dublin

Dave Grennan from Raheny in Dublin, who gave the IAA a superb talk earlier this year about a telescope he built himself from scratch, has discovered his third supernova from his observatory at his home using the telescope. He discovered his first supernova (the result of a 290million year-old exploded star) in 2010, and his second (which was named 212EJ by the International Astronomical Union (IAU)) in 2012. His latest discovery was confirmed as a Type 1C supernova by a team of professional astronomers in China, and designated Supernova 2014AS by the IAU on 26 April 2014. The explosion occurred in a galaxy over 170 quadrillion miles away called NGC 5410. Dave told us how he built the telescope in his living room over a period of about a year and that when he first made the discovery, he and his wife (who also attended the lecture in Belfast) had a "nice strong cup of tea".



Dave Grennan with his new scope in his Raheny Observatory.



A supernova represents the dying moment of a star which explodes in a spectacularly violent manner. Even though this explosion happened 170million years ago, only now is the light reaching our eyes. This particular explosion was caused when a star is robbed of its fuel by a nearby companion star. Without fuel it is unable to support its own weight and its core collapses causing an explosion which literally blows the star apart. Astronomers believe that explosions such as this may be leave behind 'Black Holes', regions of space so dense that even light itself can't escape. Supernova explosions are important because they help astronomers to get a better handle on just how old our universe really is and more importantly, what will be its final outcome. There is probably no bigger question in science.

The discovery is all the more spectacular because Dave Grennan is an amateur who works in IT for the railways by day, and Dave told us how his computer skills have helped his astronomy work. Dave said, "what the computers do for me is they sort out where I should look in the skies and where I have already looked, so I don't look in the same place two nights in a row," he pointed out. Dave told us that "as an amateur that's a great feeling to know that you've actually contributed in a real sense". The discovery emphasizes that astronomy is one of those areas where amateurs and professionals can work alongside each other.

Congratulations Dave – look forward to hearing of discovery number 4! – Ed.



Dave Grennan's Amazing homebuilt telescope which he used to discover Supernova SN2014AS.

Brian Beesley sent in some of his amazing images of Jupiter taken during the opposition of 2012.

RGB CM1 335° CM2 058° RRGB

Jupiter 2012 Mar 26
 CPC 1100, prime focus, Astronomik filters, DMK21
 Alt 25° Dia 34.1" Seeing poor with considerable bobbing Transparency fair

Red 19:10.6 UT Green 19:11.7 UT Blue 19:13.0 UT

Ganymede > < Io

Infra Red (742) 19:15.2 UT CM1 337° CM2 060°

Visit to the Lyndon B Johnson Space Centre, Texas – Paul Evans

Last November Jude and I celebrated our 10th wedding anniversary. We usually manage to get away for our anniversary, at least for a night or two on the North Coast. But being a significant number this time we went a little further, to visit my Auntie in Galveston, Texas. Of course no trip to Texas would be complete without spending a day at the Johnson Space Center in Houston, so that's what we did.



On arrival at Space Center Houston, as the visitors' centre is called, we are greeted by a Space Shuttle at the entrance. Sadly this is a mockup - JSC didn't get a real shuttle. If you want to see a real shuttle they are located in Washington, Los Angeles and the Kennedy Space Center in Florida. However sometime this year JSC will get a new exhibit - the Shuttle Carrier Aircraft - the modified Boeing 747 that NASA used to transport the shuttles around, usually after they'd landed at Edwards AFB in California and needed to be transported back to KSC.



The visitors' centre itself contains a fantastic record of space exploration including a mockup of the ISS, not unlike the one at Armagh Planetarium, a real Mercury capsule, Faith 7, a Gemini and the Apollo 17 capsule, the last manned spacecraft to have visited the Moon.

There's a Lunar Module and Lunar Rover too. The museum includes a full timeline with memorabilia replicas of the various spacecraft used over the years including the training mockup of Skylab and a reconstruction of the labs used to analyze the Moon rocks. There are various films on show and the original lectern from which JFK delivered his famous "We choose to go to the Moon..." speech just down the road at Rice University. Apart from the museum, we took a tram tour of the Space Center proper. We took the standard tour, although I had wanted to try and get on the more in-depth "Level 9 Tour". Unfortunately the availability of this tour is very restricted and it is booked out months in advance. It is also quite expensive at a nickel short of \$90 but I'm told that it's worth every penny. But then so is the standard tour which we took!

First stop on the ride is Historic Mission Control. This has been restored to its 1969 condition although it actually saw active service in one guise or another into the 1990s after which the complex was expanded to give an enhanced service to Shuttle and ISS missions from 1998 onwards.

Our guide explained that although it looks as if there are lots of computers in use, they are in fact all dumb terminals with text only screens wired back to a mainframe computer with a 5MB hard drive, so in that regard my phone has more storage available. In fact it has 6,400 times as much storage – that's how far technology has come along! Our next stop was a place called "Building 9". This is a hangar containing many pieces of equipment, the largest of which is the training rig for the ISS. Fully equipped replicas of the real modules are here for astronauts to train on prior to a tour of duty. Other parts of the hangar included

an Orion capsule, a scale model of the upcoming Space Launch System, a shuttle training rig and many machines designed to simulate zero gravity by counterbalancing methods.



The star of the show is the final stop on the tour. It's the mighty Saturn V rocket! Of the three surviving rockets this one has the claim to fame of being the most authentic. It consists of parts taken from un-launched Apollo 18, and 19 craft, and also the unused third stage of Apollo 20, the rest of which was launched as Skylab 1. The others at KSC and Huntsville, Alabama include more prototype elements and are not completely launch ready. This one is!

Looking closely at this shows it was built to be launched, given away by the complete wiring looms visible between stages. When I last visited JSC in 1995 this was outside on the lawn. Fortunately the move to the building which was built around it "in situ" and opened in 2007 provides a degree of protection from the elements that ensures this fabulous craft will last a good while longer for future generations to see.

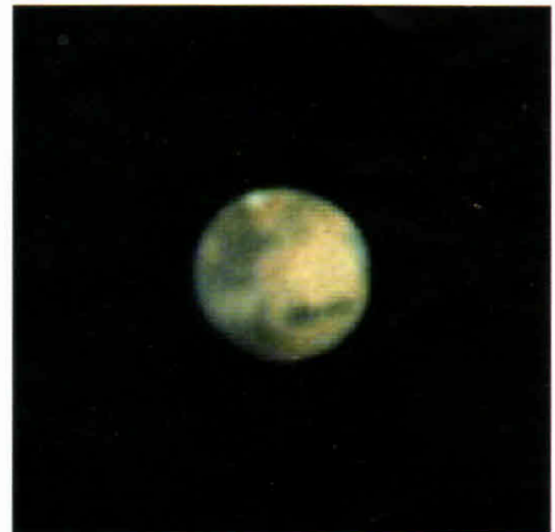


We thoroughly enjoyed our trip to the Johnson Space Center. It doesn't quite have the glamour of the Kennedy Space Center, but then launching rockets is always to going to be more exciting than managing the missions, but the depth surely lies in the detail of the mission and not just the launch. So would we go again? Well yes, I certainly would, because I'd like to plan much further ahead and get on that Level 9 tour!

Paul certainly whetted the appetite for those who may be thinking of a US holiday - Ed.

Mars Oppositions in 2012 and 2014

The Opposition of Mars in 2014 was not great due to the low altitude of the planet when it was at its best. Oppositions of Mars occur every two years and although they are rarely favourable, and in 2012 Brian Beesley was able to capture some remarkable images showing the planet at its best with well defined dark markings and the south polar ice cap. In the Members' Observations Section of this issue (pps 3-4) Brian's 2012 images can be compared with the excellent 2014 images taken by John Hall.



Peter Martin has been imaging some of the spectacular objects from the autumn sky below. The clear skies of County Fermanagh, Peter's skill and top class equipment have allowed Peter to capture the subtle detail of some of the deep sky's most beautiful nebulae and gas clouds.



Hi Andy, I eventually got my shot of M13 finished, I had to re-shoot a night's work due to the scope being out of collimation, I also had problems with the primary mirror misting up, does yours ever mist up or is it a Fermanagh problem? Astro photography can be tough at times...

M13 was discovered by Edmond Halley in 1714. It is about 145 light-years in diameter, and it is composed of several hundred thousand stars, the brightest of which is the variable star V11 with an apparent magnitude of 11.95. M13 is 25,100 light-years away from Earth.

Date of shoot: 24/4/14, 27/4/14, 30/4/14
 L: 10 subs at 60s 1*1 , 28 subs at 300s 1*1
 RGB: 10 subs at 40s 2*2 , 12 subs at 180s 2*2
 Camera Starlight Express SXVR-H694
 Sample Rate 0.98 asp at 1*1 , 1.97 asp at 2*2
 Filter Wheel : Starlight Express Mini Wheel
 Mount : Avalon fast Linear
 Scope: Orion Optics UK AG10
 Filters : Astrodon LRGB



Hi Andy ,This is my first picture with the I-Optron EQ30 and Williams Optics GT81 shot in Co Cavan, reasonable seeing and conditions.

Markarian's Chain is a stretch of galaxies that forms part of the Virgo Cluster. It is called a chain because, when viewed from Earth, the galaxies lie along a smoothly curved line.

It was named after the Armenian astrophysicist, B. E. Markarian, who discovered their common motion in the early 1960s.[1] Member galaxies include M84 (NGC 4374), M86 (NGC 4406), NGC 4477, NGC 4473, NGC 4461, NGC 4458, NGC 4438 and NGC 4435.

Date of shoot: 18/4/14 , 19/4/14
 L: 19 subs at 600s 1*1
 RGB: 8 subs at 300s 2*2
 Camera Starlight Express SXVR-H694
 Sample Rate 2.45 asp at 1*1 , 4.9 asp at 2*2
 Filter Wheel : Starlight Express Mini Wheel
 Mount : Avalon fast Linear
 Scope: William Optics GT81
 Filters : Astrodon LRGB



Hi Andy, nice and clear the past two nights but of course full moon so I shot some Ha for M51. Same data as previous version with the addition off 5 Ha subs at 900 S. It has boosted slightly the HII regions in the outer arms and in the arms tight to the core.

The very pronounced spiral structure of the **Whirlpool Galaxy** is believed to be the result of the close interaction between it and its companion galaxy NGC 5195; specifically, its passing through the main disk of M51 about 500 to 600 million years ago. In this model, NGC 5195 came from behind M51 through the disk towards the observer and made another disk crossing as recently as 50 to 100 million years ago until it is where we observe it to be now, slightly behind M51.

Date of shoot: 25/3/14, 1/3/14, 3/3/14

L: 28 subs at 600s 1*1

RGB: 8 subs at 450s 1*1

Camera Starlight Express SXVR-H694

Sample Rate 0.98 asp at 1*1, 1.97 asp at 2*2

Filter Wheel : Starlight Express Mini Wheel

Mount : Avalon fast Linear

Scope: Orion Optics UK AG10

Filters : Astrodon LRGB



Hi Andy – this was taken under pretty tough conditions the Ha was very windy but good visibility and 7 degrees , the OIII was taken through mist and high cloud 6 degrees , both had 1/2 to 3/4 moon interference. **The Heart Nebula, IC 1805, Sh2-190**, lies some 7500 light years away from Earth and is located in the Perseus Arm of the Galaxy in the constellation Cassiopeia. This is an emission nebula showing glowing gas and darker dust lanes. The nebula is formed by plasma of ionized hydrogen and free electrons. The nebula's intense red output and its configuration are driven by the radiation emanating from a small group of stars near the nebula's center. This open cluster of stars known as Melotte 15 contains a few bright stars nearly 50 times the mass of our Sun, and many more dim stars that are only a fraction of our Sun's mass. The cluster used to contain a microquasar that was expelled millions of years ago.

Date of shoot: 16/12/13 ,

8/1/14 ,10/1/14 Ha: 10 subs at 900s 1*1

OIII:13 subs at 900s 1*1

RGB: 4 subs of 60s 2*2 each, for stars

Camera Starlight Express SXVR-H694

Sample Rate 0.98 asp at 1*1, 1.97 asp at 2*2

Filter Wheel : Starlight Express Mini Wheel

Mount : Avalon fast Linear

Scope: Orion Optics UK AG10

Filters : Astrodon LRGB, Ha 5nm, OIII