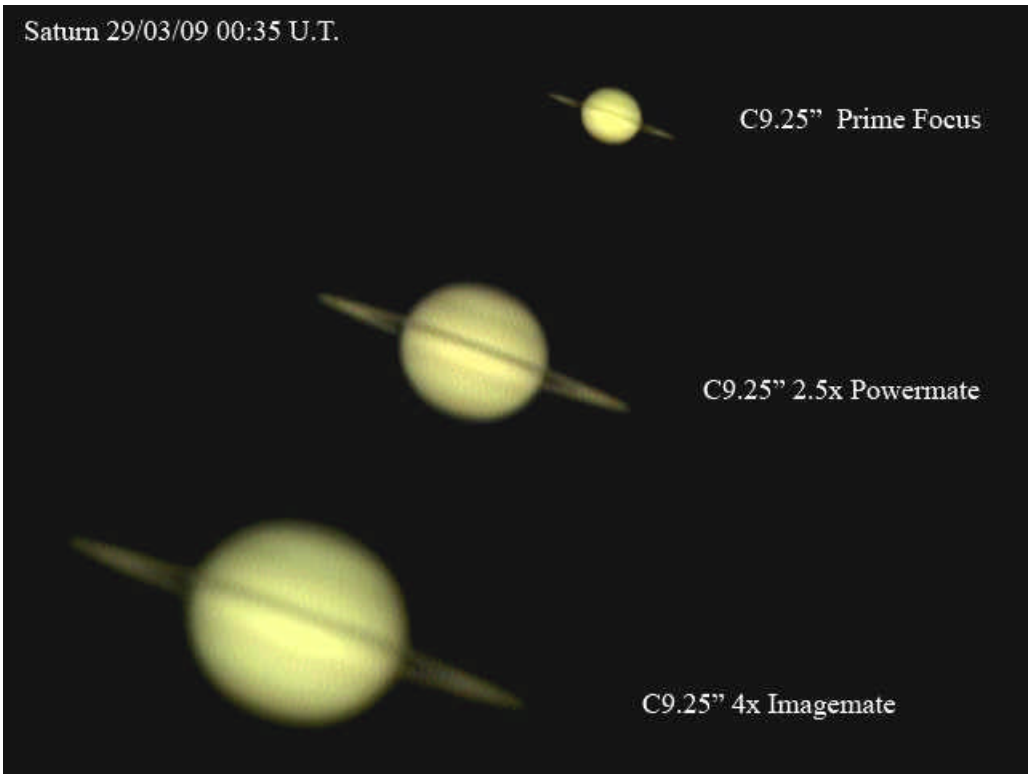
TRANSIT

The Newsletter of

Cleveland & Darlington Astronomical Society

05 April 2009



Saturn – imaged by Keith Johnson

Front Page Image –

29 March 2009 - Capturing at prime focus - it looked as though the seeing wasn't too bad so I decided to start the imaging session with a prime focus 3min. AVI - (basically this consists of the Toucam Pro. 2 web camera attached to the C9.25" Celestron).
I then attached the 2.5x Powermate and captured another 3 min. AVI, finally completing the session with a 5 min AVI using the 4x Imagemate.

A nice sharp image was achieved capturing at prime focus with nice banding evident on the disc but obviously too small of a scale to see Cassini's division.

Compare it if you will to the 2.5x Powermate capture - banding is showing on the disc and Cassini's division is now also clearly visible,

Finally compare it with the 4x Imagemate capture - it's clear that the seeing just wasn't good enough to enable a descent capture at such a high magnification - the banding isn't as pronounced and also Cassini's division is lost.

Best Regards,
Keith.

Next meeting : 17 April 2009, “A Celebration of Apollo” by Neil Haggath

Please note the venue for the next meeting :-

7.15pm for a 7.30 pm start, Grindon Parish Hall (in Thorpe Thewles, our previous meeting place).

Last meeting : 13 March : “Calendars of the World” by Dr Colin Steele of University of Manchester Institute of Science and Technology.

Dr Steele opened his talk by mentioning the complications of the date of Easter but said that there were lots of other interesting items on calendars, without that one. He was also not going to talk about calendars with pretty pictures, which hang on the walls of houses and offices. This was a talk about the recording of days and years, using astronomical observations. One recurring motif of his talk was "yes, but it's not that simple".

The day, for example, is one rotation of the Earth but there are sidereal days and solar days, which he explained. These days have been measured to extra-ordinary accuracy, to several places of decimals in the seconds unit. The Sidereal (star to star) Day is shorter than the Solar (Sun to Sun) Day. The year is one orbit of the Earth around the Sun - but it's not that simple!! This time there are Sidereal Years, Tropical Years and Anomalistic Years, depending on the definition of the start and finish points.

The Month is an orbit of the Moon about the Earth and, yes, you've guessed, it's not that simple. Here we have Sidereal Months, Tropical Months, Anomalistic Months and Synodic Months. The week seems to have been adopted as seven days for a long, long time. So, we have a day of 24 solar hours, a year of 365 plus a bit days and about 12 months of various numbers of days. Dr Steele then traced the history of how our own calendar was developed from Roman to Julian to Gregorian and all the delays and problems caused in different countries around the World. Our calendar includes Leap Years every 4 years, which allows for a 365.25 day year, which is not quite right. So, we add other adjustments every 200 years and then every thousand years etc, as required.

He then explained a large variety of other calendars used or in use throughout the rest of the World - Indian, Chinese, Islamic, Celtic, Icelandic (problem - can't see the Moon at some times of the year), Greek, all with different compromises to fit an integer number of solar days into a year, which is a fractional number of days. The complications were astonishing!!

Dr Steele's talk had taken one hour and twenty minutes before he took questions, of which there were quite a few. One asked about the French Revolutionary decimal-type calendar, which Dr Steele said had been tried but became too complicated and was dropped.

Please note. The Society dues for 2009 were due in January. The cost is only £9.00. If applicable please pay your outstanding dues to our Treasurer, Ian Miles, at the next meeting.

Letter to the Editor

Announcement of the IAYC 2009

IAYC 2009, August 2nd - August 22nd
45th International Astronomical Youth Camp
Hala Miziowa, Korbielow, Poland

The International Astronomical Youth Camp (IAYC) 2009 will take place in southern Poland, near the small town of Korbielow at Schronisko na Hala Miziowa, a mountain hotel in the Beskid Zywiecki district which is part of the outer Eastern Carpathians. The house is situated close to the 1557 meter high Pilsko mountain being the second highest peak in the region, and to the Slovakian border.

The IAYC is an international youth camp with participants from about 20 different countries. As a participant you work for three weeks in one of the 8 working

groups - together with other young people – on astronomical projects. The projects vary from night-time observations to theoretical problems, depending on your own interests. The working groups will be led by young scientists from the IAYC team. The IAYC 2009 will offer a wide range of working groups and topics, ranging from ancient astronomy, introduction to astronomy and physics and practical observation groups to computer simulations, CCD photometry and data reduction; there will be something for everyone from the very beginner to the ambitious student.

Apart from the astronomical program, there are many non-astronomical activities such as group games, sporting events, singing evenings, hiking tours and an excursion. Since it is an international camp, the camp language is English. You should be able and willing to speak English throughout the camp. It is not necessary to speak English fluently.

Anyone from 16 to 24 years old and able to communicate in English may participate in the IAYC 2009. The fee for accommodation, full board and the whole program, including the excursion, will be 570 Euro. For interested persons who are in the situation of not being able to pay the camp fee themselves, a limited number of grants is available.

Detailed information about IAYC 2009 con be found in our first info which is available at <http://www.iayc.org/next/> or if requested can be send to you by postal service. If you have any questions or wish to be notified when more information becomes available, please contact:

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Visit our new CaDAS website: http://cdas-astro.org.uk
Expertly put together by our webmaster, Don Martin. Our many thanks to him for his hard work getting it up and running so quickly.

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Are You the Astronomy Photographer of the Year?

Written by Nancy Atkinson
From Universe Today

M42 Close up. Credit: Dave Thompson (**a.k.a. Dangerous Dave in DAS – well done Dave, international fame at last. Ed**.)

Calling all astro-photo geeks! (as well as those of us that just like to look). The Royal Observatory in Greenwich, England is offering a brand new, free competition and exhibition for everyone who loves the night sky. It's open to anyone, from anywhere, including a special category for astro-photo buffs under the age of 16. There are some great prizes up for grabs and winning entries will be displayed in a special exhibition at the Royal Observatory.

This competition is an International Year of Astronomy event, and from all the photos submitted, a a giant, zoomable photo-collage of the Universe will be created. Even if you're not a photographer, anyone interested in astronomy can go to the gallery on Flickr and soak in the eye candy.

The competition has been open for awhile (and ends on July 19, 2009) and there are some awesome images taken by people from all around the world – some are absolutely breathtaking, like the image above taken by Dave Thompson.

Interested?

Here are the links to the Royal Observatory's contest website, and the Flickr Astrophoto site.

There are three main competition categories. Judges will select one winner, one runner up and three highly commended entries from each, before deciding an overall winner to be crowned Astronomy Photographer of the Year 2009. There is also a special competition category for under 16s: Young Astronomy Photographer of the Year.
The categories and prizes are:
Overall winner – Astronomy Photographer of the Year 2009
Prize: £1000
Earth and Space
This is for photos that include landscape, people and other 'Earthly' things. Your picture should also include an astronomical subject – for example the stars, the Moon, or near-Earth phenomena such as aurora.
Winner: £250
Runner up: £100
Highly commended entries: £50
Our Solar System

This is for photos of our Sun and its family of planets, moons, asteroids and comets.
Winner: £250
Runner up: £100
Highly commended entries: £50
Deep Space
This is for photos of anything beyond our Solar System, including stars, nebulae and galaxies.
Winner: £250
Runner up: £100
Highly commended entries: £50
Young Astronomy Photographer of the Year
This is the competition category for under 16s.
Winner: £250
Runner up: £100
Highly commended entries: £50

Enter, or just enjoy the gorgeous images from people from all over the world!

Terraforming Mars

A very prescient letter from Michael Roe to the “Spaceflight” magazine in January 1994

Sir,

I support previous correspondence against the terraforming of Mars or any other planet.

As an amateur astronomer and supporter of space exploration I appreciate other worlds because they are different from our own. A Solar System full of copies of Earth would be dull indeed. Bit I believe there is hope simply because terraforming will almost certainly never happen

The reason for this is the human race itself. We are increasing in population quite rapidly and, more importantly, our need for resources and energy are increasing per person all the time, thereby exhausting the Earth’s resources within several decades and leading to an end of our form of civilisation. In such a state of affairs nobody can seriously expect Mars to be terraformed in the distant future.

But the advocates for terraforming tell us that rapid advances in space travel will alter such a terrible fate for humanity and allow us to continue our expanding civilisation for many millennia, using the resources and solar energy of our whole Solar System to benefit us all. A very persuasive argument until we start looking at the real world.

We have Mars Observer, a very simple unmanned spacecraft, losing contact just before reaching Mars and, even if spacecraft do eventually successfully reach Mars again we will be very lucky to land a single person on Mars before our present civilisation ends! Yet the advocates of terraforming believe we can send sufficient equipment to Mars to change its climate completely. Do they realise what this means?

One more point. Politicians rule our activities and few of them are interested in space flight. Yet they would need to fund projects to terraform a planet costing many billions of pounds (British £10 ^{12}). No, by the middle of the next century the politicians and the scientists will be pre-occupied frantically trying to save our ravaged world and its declining civilisation.

I believe that Mars is quite safe from the ambitions of the terraformers and that previous supporting correspondents can be assured of this. Hopefully, some exploration of other planets can be accomplished in the next 50 years and future generations will be able to save at least part of humanity and civilisation.

Michael Roe, North Riding of Yorkshire, UK

Skylights - April 2009

From Rob Peeling (CaDAS)

The Moon

02 Apr	9 Apr	17 Apr	25 Apr
First Quarter	Full Moon	Last Quarter	New Moon

At around 21:00 on 1st April the Moon will pass only about 1 degree from the open cluster M35.

Planets

Mercury is visible in the evening for the second half of the month. Mercury is however a tricky planet to see because it is only ever visible close to sunrise or sunset. Your best chance is on 26th April. Wait until the sun has completely and safely disappeared below the horizon at just after 19:30. Now search above the western horizon with binoculars for the very thin new crescent moon. Mercury will be visible looking like a star just below the Moon. The Pleiades will be just above the Moon. With a telescope you may be able to see that Mercury is a crescent as well as the Moon. Can you see Mercury with your naked eye? You should be able to. If the weather is kind it will be a good show.

Venus passed through inferior conjunction (in other words it moved past the Sun) on 27th March. This means it has suddenly changed from the Evening Star into the Morning Star and is now a sight for very early risers only.

Saturn remains very prominent in the evening beneath the constellation of Leo. Notice how the various moons stay close to the plane of the rings – now seen as a line across the planet making it look rather like the well known London Underground logo. Titan and Iapetus (if you can find it), stray further away from the line marked by the rings. This is because they are further out and so the remaining small angle between the equatorial plane of Saturn in which all the rings and moons lie shows up more obviously.

Comets & Meteors

The Lyrid meteor shower lasts between April 16th to 25th with a maximum on the 21st/22nd. I'm not a meteor aficionado myself but David Levy recommends them as being capable of putting on a good show.

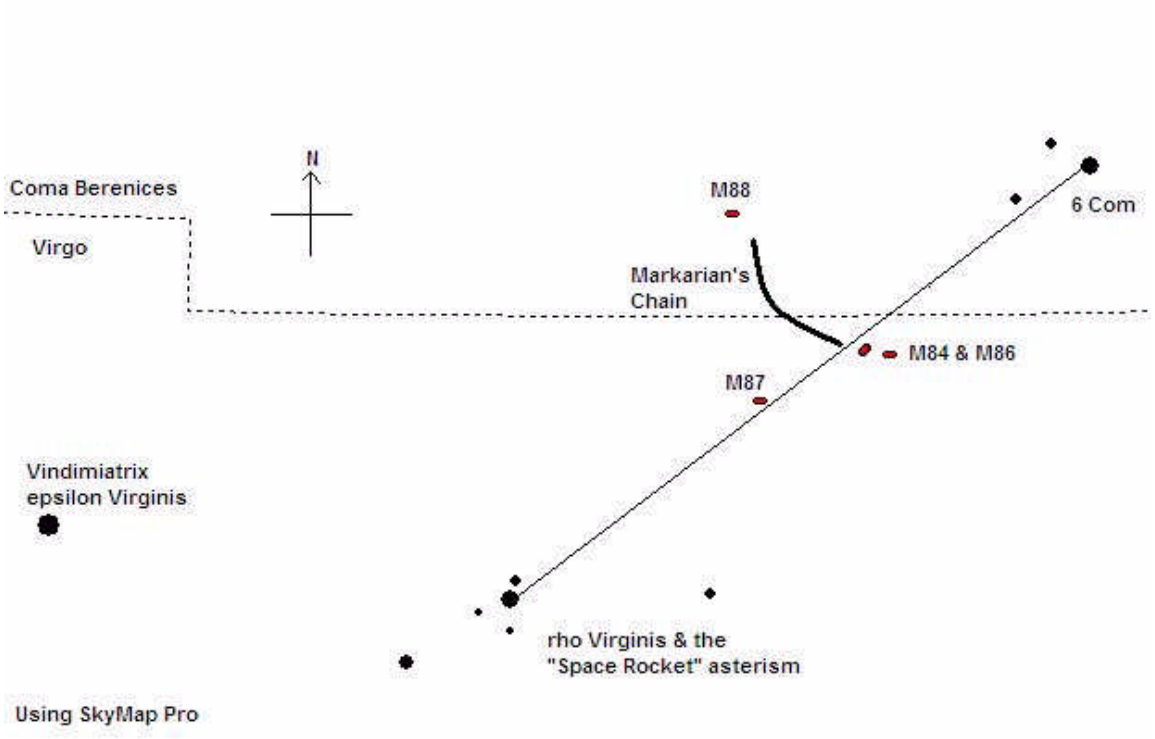
Deep Sky

Markarian's Chain

Markarian's Chain is a 1.5 degree long arc of galaxies that all belong to the Virgo Cluster, although some of the members are in fact in the constellation Coma Berenices. It was first described by the Armenian astronomer B E Markarian (1913-1985) in December 1961. A paper in 1983 by Litzroth supports that seven of the eight do indeed seem to be moving away from us at the same velocity i.e. as a group.

This area of sky is rich with galaxies. Photos easily pick out 14 galaxies along the original arc from M84 to NGC 4477. To the observer the chain appears to logically extend an extra degree further northeast to M88 and drawing in a further 4 potential members.

To find Markarian's Chain, first find the wonderfully named star, Vindimiatrix or epsilon Virginis. This is a naked eye star so it should be fairly easy to set your finder on. Now scan westwards (right) from Vindimiatrix to find a simple asterism of four stars with rho Virginis in the centre. I call this the "Space Rocket" because it reminds me of Thunderbird 3. Scan way up and to the right of the Space Rocket to find the next star as bright as rho Vir., this should be 6 Com. Imagine a line between the rocket and 6 Com and start searching with a low power lens just over halfway up to 6 Com. M84 and M86 should show up together in the same field which is how you know you are in the right place. Now work slowly first to the east (left) and you should pick up the first pair of galaxies. Continue east to some (very) faint stars and the next two are between them.

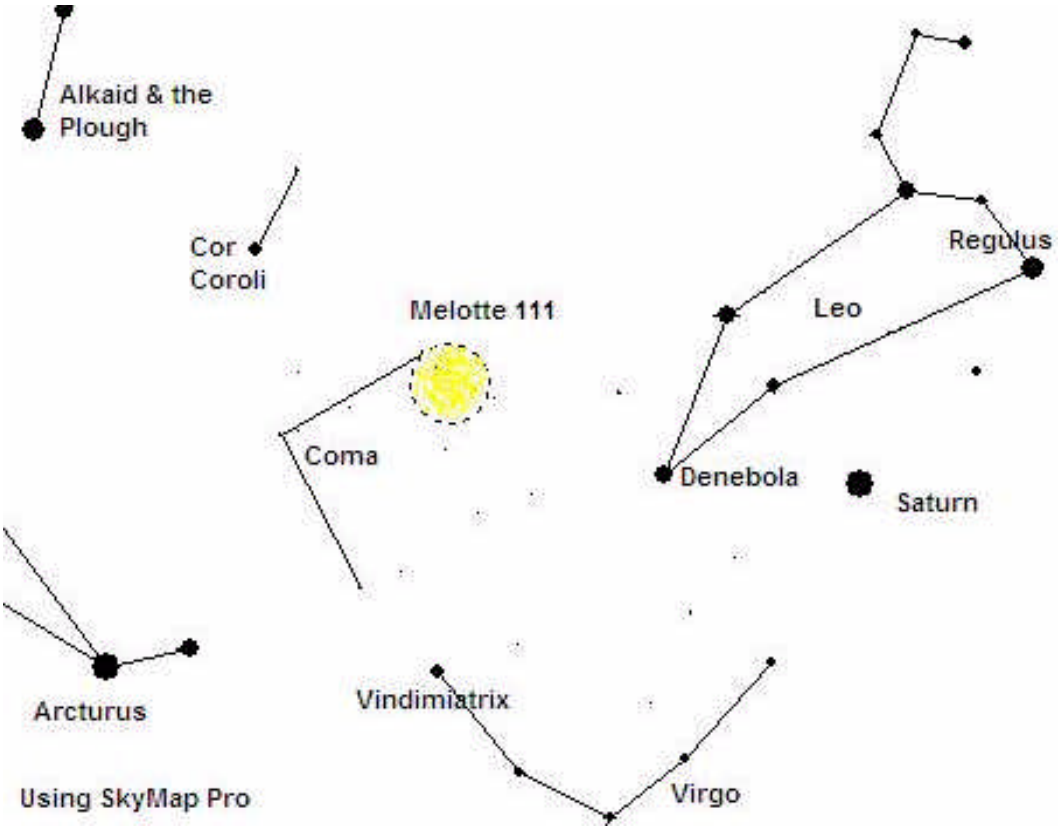


Now work north (up) to pick up two more quite separate galaxies. Then a biggish step north for one more and finally sweep eastwards to see if you can finish on M88.

Melotte 111, Coma Berenices Star Cluster

This cluster is impressively large and bright, filling the binocular view. It is the third nearest star cluster to our Sun and only about 260 light years away. It is thought to be about 400 million years old and because the force of gravity is so weak between its stars it is considered likely to disperse completely in the relatively near future – a few tens of millions of years!

Scan your binoculars along a line between Denebola and Cor Coroli to find Melotte 111. It is somewhat closer to Cor Coroli than to Denebola. Unusually, the best views of Melotte 111 are with binoculars not with telescopes. This is because the cluster covers so much sky.



Observing Report for March 2009

Comet C2007/N3 (Lulin)

I was able to see the comet on 4 nights. I also looked on March 12th but couldn't find it. On two nights M44, Praesepe or the Beehive cluster was in the same view. On 15th March, the comet shared the field with the Eskimo Nebula, NGC 2392.

Here are my notes:

Eaglescliffe, 1st March, 12" f/5 Dob, 15x70 bins

20:25 UT

Found comet to northwest of Regulus. Quite large, quite bright. Easily seen with 15x70 bins. Also with 8x50 telescope finder. Very clear, quite large with 50mm lens. In the 32mm lens the coma is clear. There is definitely nebulosity/cometary material eastwards from the coma and relatively little to the west. In this view the coma is round at the head of an ellipse stretching eastwards. Estimated magnitude ~ 6 probably. Changing to 15mm shows that the coma is very tight and compact but no other additional information. Comet is quite prettily placed against a little group of a double and a single star. Marked on map slightly south of 7 Leo. Sky is now covered with a thin cloudy haze. 7 Leo is visible in 32mm view. Definite green tinge noted with the comet.

22:10 UT

Gone back with 32mm to look at comet again. Comet has quite clearly moved from the east of the double described earlier at about the same distance west. About 20'. The double does have a very slight colour contrast. The northern one of the pair PA ~30deg is very slightly yellowish whereas the definitely brighter primary is white.

At the society meeting on 13th March, I heard from Dave Blenkinsop and Mike Roe that they too got their first view of Comet Lulin on 1st March.

Eaglescliffe, 4th March, using 15x70 bins

22:08UT

1st quarter moon. Very clear. Comet found near M44. Comet is in fact very close to X Cancri (orange colour just seen with bins). Comet is clearly visible but certainly faded since 1st March ~ 7th mag? The comet lay about the same distance away from the two stars on the right of the X Cancri group as the

spacing of the stars themselves. The visible extent was roughly the same diameter as this separation. Based on subsquent checks using SkyMap Pro, this position is almost exactly given using the ephemerides for the comet I've input into the software. The two stars are very close to 15' apart.

Eaglescliffe, 5th March, using 15x70 bins, 12" f/5 Dob

21:30UT

Comet Lulin is in the same binocular field as M44 and delta Cancri. The comet is slightly to the west and below delta Cnc. Distance about 2/3rds distance from delta Cancri to centre of M44. Comet dimensions are about the same as last night. Brightness is also similar.

Comet is not immediately apparent in the 8x50 finder but it can be seen. With 32mm lens there is a small fairly bright coma. There is a definite "blinking" effect to it in terms of the visibility and extent of the outer parts (rather like NGC 6826 the Blinking Planetary) but the comet is now quite faint and washed out. Quite possibly this is partly due to the proximity and brightness of the Moon.

Eaglescliffe, 15th March, using 15x70 bins, 12" f/5 Dob

00:26UT

Comet Lulin is in the same 32mm field (1.15 deg) as the Eskimo Nebula, NGC 2392. It lies to the east of the nebula and slightly to the north. Quite faint now. Just a blur against the background stars. Just off centre with a triangle of three of about 11th mag stars. The coma makes a fourth star to make this group an oblong. Comet is about a 1/4 of field view northeast of the planetary nebula (~0.3 deg). After checking carefully, reached conclusion that Comet Lulin is now a telescopic object only. Can't detect it with 8x50 finder or 15x70 bins. With 15mm lens (x100) the coma can be seen as a condensation in the group of stars described earlier. There is a faint hint of surrounding cometary material with an extent equivalent to open 4 or 5 times the diameter of NGC 2392 when used as a comparison.

Planets

I saw Venus as a lovely thin crescent on 12th March. I have seen and identified four of Saturn's moons at various times: Titan, Rhea, Dione, and Enceladus.

Deep Sky

1st March was a successful night for deep sky viewing. I was able to find all the Messier and Caldwell objects I suggested in March's Transit. I couldn't however see the third galaxy of the group including M65 and M66. I was however able to

find a couple of small, obsure, bright nebulae. NGC 1999 in Orion and NGC 1931 in Auriga.

A Life Under the Stars – part 9

From David Blenkinsop

Some observing using a 70mm refractor.

I start with Venus. Venus is at full elongation, east of the Sun and is easily picked out in binoculars. I set up the 70mm up about 2.45pm. I find Venus with the binoculars then I know where it is in the daylight sky, I can then find it in the finder scope.

I have been observing for weeks. On 21st January I was able to see that it was less than half phase. What to look for? Does the limb look a bit brighter than the rest of the planet? Yes it does. Is the terminator darker than the rest of the planet? Yes it is. Can the cusp extensions be seen – those are the points of the half or the crescent extended? I have seen all of these.

I use the telescope with a Barlow and a 4mm eyepiece that came with the telescope but I have to use a colour filter to cut out the colour fringing.It looks good with the blue filter but some colour is still seen. The green filter cuts out all the colours but then who would want to see Venus in a green sky? I have seen the dark part of the planet darker than the background sky, this is an optical illusion, after blinking a few times it disappears (just like Lowell's canals on Mars).

Now to the stars seen from my backyard. Gamma Andromeda seen as a double with the 20mm eyepiece at x35, good with the 12mm at x58 and wide with the 4mm at x175. The bright star looks yellow and its companion is blue.

I remember many years ago with Dave Wheldrake using a 12" Dobsonian with x600. We could see the blue star as two stars with plenty of sky in between.

Gamma Ari is an easy double at x35, better at x58 with both stars bright, what we call "cats eyes".

Lamda Ari is a double at x35, at x58 the bright component is yellow.
14 Aries very wide at x35, 30 Ari very wide at x35. I am not giving the magnitudes and separations as these are meant to be notes for anyone using a 70mm or larger telescope to have a look for themselves.

The Pleiades or Seven Sisters are well seen at x35. This power is too high for them all to be seen at once. The Little Triangle near Alcyone is seen as well as the double at the centre of the cluster.

Some doubles in Taurus – above the Hyades are two nice doubles, chi1 wide at x35 with faint companion and phi1 .wide at x35 with faint companion. South of the Hyades – star 88 wide at x35 with faint companion.

Go west to M34 in Perseus, point your telescope at beta Per, look in the finder, move up to kappa, half way between, move west to the next star. 12 Per is a yellow star with some fainter stars, some double. Using the finder move back up to M34, it fills the field of view, nice bright stars in this open cluster.

Now to Orion. When looking at M42 I see some nebula and the trapezium has three stars, the fourth star is right on the border of visibility. Going down from M42 we come to a nice star cluster containing Struve 747, a wide double as seen with binoculars. Also iota, the companion, is faint seen with x58.
Delta Or (Mintaka) is nice with x58, lamda Or is split at x175 but not at x58.

In Gemini. M35 is a big bright open cluster , it looks good at x35 and better at x58. 20 Gem is a nice easy double at x35, another pair of cats eyes. nu Gem is a wide easy double with a fainter companion. Two stars above nu in a line north to south, the northern one is a nice double at x35 with nu Gem seen in the same field. Going down from gamma Gem a bit east we come to a bright star with the finder then down and to the west and seen in the finder is
s Monoceros in the Christmas Tree cluster. This cluster stretches halfway across the field of view. From here, a little west and down to a bright star 13 Mon to a dimmer star 12 Mon and then inside the nice bright cluster NGC2244. I see ten bright stars in this cluster.

If we move further west to the next bright star 12 Mon, this another nice double. Going down to the east we find 18 Mon with below it is the Open Cluster NGC 2301, I see eight stars here. These star clusters are only poor when seen from my backyard but will be better from darker site.

I have just looked at the Eskimo planetary nebula. From delta Gem to the east is a star seen in the finder, just below are two faint stars, one above the other with the lower one looking fuzzy although I can see it at x35 and x58. Castor is elongated at x35 and just divided at x175.

Between Gemini and Leo is Cancer and M44, the Beehive Cluster. It is easily seen as a star cluster in binoculars. It looks OK with x35 but much better with a 40mm eyepiece at x17. At this point I finished observing.

Henrietta Leavitt – a Human Computer!

Written by Andrew Jaffe

That is, a computer named Henrietta Swan Leavitt. In the early 20th Century, some (always male) astronomers had batteries of (almost always female) "computers" working for them, doing their calculations and other supposedly menial scientific work.

Leavitt — who had graduated from Radcliffe College — was employed by Harvard astronomer Charles Pickering to analyze photographic plates: she counted stars and measured their brightness. Pickering was particularly interested in "variable stars", which changed their brightness over time. The most interesting variable stars changed in a regular pattern and Leavitt noticed that, for a certain class of these stars known as Cepheids, the brighter ones had longer periods. Eventually, in 1912, she made this more precise, and to this day the "Cepheid Period-Luminosity Relationship" remains one of the most important tools in the astronomers box.

It's easy enough to measure the period of a Cepheid variable star: just keep taking data, make a graph, and see how long it takes to repeat itself. Then, from the Period-Luminosity relationship, we can determine its intrinsic luminosity. But we can also easily measure how bright it appears to us, and use this, along with the inverse-square relationship between intrinsic luminosity and apparent brightness, to get the distance to the star. That is, if we put the same star twice as far away, it's four times dimmer; three times as far is nine times dimmer, etc.

This was just the technique that astronomy needed, and within a couple of decades it had led to a revolution in our understanding of the scale of the cosmos. First, it enabled astronomers to map out the Milky Way. But at this time, it wasn't even clear whether the Milky Way was the only agglomeration of stars in the Universe, or one amongst many. Indeed, this was the subject of the so-called "great debate" in 1921 between American astronomers Harlow Shapley and Heber Curtis. Shapley argued that all of the nebuale (fuzzy patches) on the sky were just local collections of stars, or extended clouds of gas, while Curtis argued that some of them (in particular, Andromeda) were galaxies — "Island Universes" as they were called — like our own. By at least some accounts, Shapley won the debate at the time.

But very soon after, due to Leavitt's work, Edwin Hubble determined that Curtis was correct: he saw the signature of Cepheid stars in (what turned out to be) the Andromeda galaxy and used them to measure the distance, which turned out to be much further away than the stars in the galaxy. A few years later, Hubble

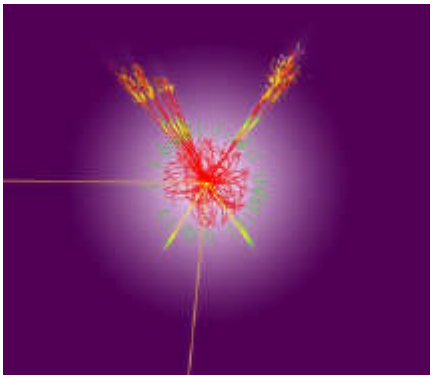
used Leavitt's Period-Luminosity relationship to make an even more startling discovery: more distant galaxies were receding from us at a speed (measured using the galaxy's redshift) proportional to their distance from us. This is the observational basis for the Big Bang theory of the Universe, tested and proven time and again in the eighty or so years since then.

Leavitt's relationship remains crucial to astronomy and cosmology. The Hubble Space Telescope's "Key Project" was to measure the brightness and period of Cepheid stars in galaxies as far away as possible, determining Hubble's proportionality constant and set an overall scale for distances in the Universe.

The social situation of academic astronomy of her day strongly limited Leavitt's options — women weren't allowed to operate telescopes, and it was yet more difficult for her as she was deaf, as well. Although Leavitt was "only" employed as a computer, she was eventually nominated for a Nobel prize for her work— but she had already died (Nobel prizes are not awarded posthumously) . We can only hope that the continued use of her results and insight to this day is a small recompense and recognition of her life and work.

Solving the Ultimate Zen Riddle of Physics - Can It Be Done?

Posted by Luke McKinney



The Higgs boson is meant to give mass to everything, including itself. It's also its own antiparticle. That isn't a boson, that's a Zen riddle written into reality by some kind of Cosmic Buddha - which hasn't stopped scientists seeking it with gigantic particle blasters, and there are very few places left for it to hide.

The idea is that we all exist in a vast Higgs field, and more "massive" objects are simply affected more strongly by it, Higgs interactions making them harder to move (or to stop once they start). Put another way: the more donuts you eat, the more the Higgs field notices you.

You might ask: If the Higgs is hammering at everything ever, why do we need five billion dollars of particle accelerator to see even one? That's a very good question, and not one with the simplest answer. The Higgs "mediates" mass interactions, the same way photons mediate electromagnetic forces. So electromagnetic interactions can only operate at the speed of light, but you don't see flashes of photons every time you wave a magnet around - the mediating

photons are "virtual". In the same way, the Higgs defines mass interactions without seeming to turn up in actual person.

But we CAN make photons come out to play, we just need enough energy and the right setup. Likewise, we're working to get the shy Higgs particle out into the open - particle accelerators are engaged to ram subatomic particles together at titanic energies. If the right ingredients come together with enough energy we'll finally see one, but "enough" energy is quite a lot. Remember that Higgs particles do have mass (if only because they play with themselves) and the energy required is then set by e = mc2.

The range of e is what's being searched right now: experiments at Fermilab, CERN and other institutes are ruling out whole swathes of the spectrum, leaving the Higgs hiding between 114 and 160 GeV/c2 (or maybe a little window from 180-185, if it's anywhere at all). The search continues, and later this year the LHC will be a gun barrel aimed at those few remaining blanks.

The "Great Attractor": What is the Milky Way Speeding Towards at 14 Million MPH?

Posted by Casey Kazan. Image credit: Wally Pacholtz

Astronomers have known for years that something seems to be pulling our Milky Way and tens of thousands of other galaxies toward itself at a breakneck 22 million kilometers (14 million miles) per hour. But they couldn’t pinpoint exactly what or where it is.
A huge volume of space that includes the Milky Way and super-clusters of galaxies is flowing towards a mysterious, gigantic unseen mass named mass astronomers have dubbed "The Great Attractor," some 250 million light years from our Solar System.

The Milky Way and Andromeda galaxies are the dominant structures in a galaxy cluster called the Local Group which is, in turn, an outlying member of the Virgo supercluster. Andromeda–about 2.2 million light-years from the Milky Way--is speeding toward our galaxy at 200,000 miles per hour.

This motion can only be accounted for by gravitational attraction, even though the mass that we can observe is not nearly great enough to exert that kind of

pull. The only thing that could explain the movement of Andromeda is the gravitational pull of a lot of unseen mass--perhaps the equivalent of 10 Milky Way-size galaxies--lying between the two galaxies.

Meanwhile, our entire Local Group is hurtling toward the center of the Virgo cluster at one million miles per hour.
The Milky Way and its neighboring Andromeda galaxy, along with some 30 smaller ones, form what is known as the Local Group, which lies on the outskirts of a “super cluster”—a grouping of thousands of galaxies—known as Virgo, which is also pulled toward the Great Attractor. Based on the velocities at these scales, the unseen mass inhabiting the voids between the galaxies and clusters of galaxies amounts to perhaps 10 times more than the visible matter.

Even so, adding this invisible material to luminous matter brings the average mass density of the universe still to within only 10-30 percent of the critical density needed to "close" the universe. This phenomena suggests that the universe be "open." Cosmologists continue to debate this question, just as they are also trying to figure out the nature of the missing mass, or "dark matter."

It is believed that this dark matter dictates the structure of the Universe on the grandest of scales. Dark matter gravitationally attracts normal matter, and it is this normal matter that astronomers see forming long thin walls of super-galactic clusters.

Recent measurements with telescopes and space probes of the distribution of mass in M31 -the largest galaxy in the neighborhood of the Milky Way- and other galaxies led to the recognition that galaxies are filled with dark matter and have shown that a mysterious force—a dark energy—fills the vacuum of empty space, accelerating the universe's expansion.

Astronomers now recognize that the eventual fate of the universe is inextricably tied to the presence of dark energy and dark matter.The current standard model for cosmology describes a universe that is 70 percent dark energy, 25 percent dark matter, and only 5 percent normal matter.

We don't know what dark energy is, or why it exists. On the other hand, particle theory tells us that, at the microscopic level, even a perfect vacuum bubbles with quantum particles that are a natural source of dark energy. But a naïve calculation of the dark energy generated from the vacuum yields a value 10120 times larger than the amount we observe. Some unknown physical process is required to eliminate most, but not all, of the vacuum energy, leaving enough left to drive the accelerating expansion of the universe.

A new theory of particle physics is required to explain this physical process.

The universe as we see it contains only the stable relics and leftovers of the big

bang: unstable particles have decayed away with time, and the perfect symmetries have been broken as the universe has cooled, but the structure of space remembers all the particles and forces we can no longer see around us.

Discovering what it is that makes up the heart of the Great Attractor -- will surely rank as one of the greatest discoveries in the history of science.
Recent findings suggest these motions are the result of gravitational forces from not one, but two things: the Great Attractor, and a conglomerate of galaxies far beyond it.

The location of the Great Attractor was finally determined in 1986 and lies at a distance of 250 million light years from the Milky Way, in the direction of the Hydra and Centaurus constellations. That region of space is dominated by the Norma cluster, a massive cluster of galaxies, and contains a preponderance of large, old galaxies, many of which are colliding with their neighbors, and or radiating large amounts of radio waves.

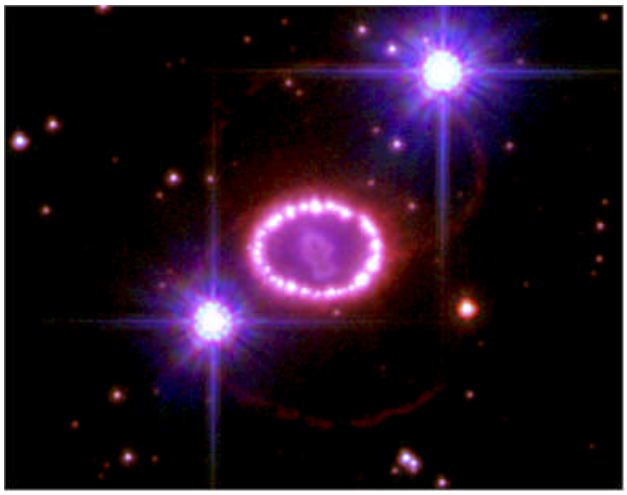
Major concentration of galaxies lies beyond the Great Attractor, near the so-called Shapley Supercluster, 500 million light-years away—the most massive known super-cluster. Mapping X-ray luminous galaxy clusters in the Great Attractor region has shown that the pull our galaxy is experiencing is most likely due to both the nearby Great Attractor and these more distant structures.
In the 1987, a group of astronomers known as the "Seven Samurai," at Cal Tech uncovered this coordinated motion of the Milky Way and our several million nearest galactic neighbors. They found that galaxies are very unevenly distributed in space, with galactic super-clusters separated by incredibly huge voids of visible ordinary matter. The place towards which we all appear headed was originally called the New Supergalactic Center or the Very Massive Object until one of the discoverers, Alan Dressler, decided they needed a more evocative name and came up with "The Great Attractor."

The motion of local galaxies indicated there was something massive out there that are pulling the Milky Way, the Andromeda Galaxy, and other nearby galaxies towards it. For a while, nobody could see what it was, because it lies behind the plane of our Galaxy --- that means the gas and dust in our Galaxy obscures the light from the Great Attractor, and it is outshone by the stars and other objects in our Galaxy.

The Great Attractor is a diffuse concentration of matter some 400 million light-years in size located around 250 million light-years away within the so-called "Centaurus Wall" of galaxies , about seven degrees off the plane of the Milky Way. X-ray observations with the ROSAT satellite then revealed that Abell 3627 is at the center of the Great Attractor. It lies in the so-called Zone of Avoidance, where the dust and stars of the Milky Way's disk obscures as much as a quarter of the Earth's visible sky.

Transit quiz questions for the April 2009 issue

From Rod Cuff



Where in the Universe? A pictorial challenge. Of what, where and when was this image taken

Q 1. What constellation is each set of objects in?
(a) Sadalmelik, the Saturn Nebula and the Helix Nebula
(b) Spica, the Sombrero Hat Galaxy and ten other Messier galaxies
(c) Al Nath, the Crab Nebula and the Hyades
(d) Rasalgethi and the brightest globular cluster in the northern hemisphere, but no first-magnitude stars.

Q 2. All of these have been discovered since the year 2000. What are they?
(a) Nix and Hydra (*not* the constellation)
(b) 2008 TC3
(c) B1938+666 (predicted by General Relativity)
(d) Ontario Lacus (a long way from Canada!)

Q 3. What are the following things, and who are they named after?
(a) a Kreutz Sungrazer
(b) Brocchi's Cluster
(c) a Hartmann mask
(d) Hawking radiation

Q 4. What are or were these?
(a) the Great Bear
(b) the Great Attractor
(c) the Great Observatories
(d) the Great Red Spot
(e) the Great Debate

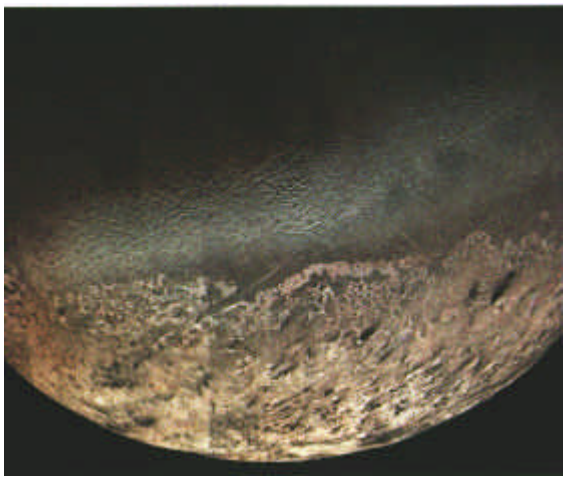
Q 5. Here's a follow-up to Answer 3(c) from last month's quiz, which mentioned

that the First Point of Aries is the point on the celestial sphere where the Sun can be found at the spring equinox. There is a companion point where the Sun is at the autumnal equinox – the First Point of ... what? And what constellation has precession taken it into now?

Q 6. Which solar system bodies have the following spacecraft visited?
(a) Magellan
(b) Messenger
(c) Clementine
(d) Viking
(e) Giotto

Transit quiz answers for the March 2009 issue

From Rod Cuff



Where in the Universe? A pictorial challenge. Of what, where and when was this image taken

Answer : This is Neptune's moon Triton, taken by Voyager 2. In the summer of 1989, NASA's Voyager 2 became the first spacecraft to observe the planet Neptune, its final planetary target. Passing about 4,950 kilometers (3,000 miles) above Neptune's north pole, Voyager 2 made its closest approach to any planet since leaving Earth 12 years earlier.

Q1. Aldebaran (Alpha Tauri) is known by many other designations in various catalogues. What catalogues do the following labels relate to?
(a) 87 Tauri (b) HR 1457 (c) HD 29139 (d) SAO 94027 (e) HIP 21421

A1. (a) This is a ***Flamsteed number*** – the designation for an entry in the catalogue compiled by John Flamsteed, the first Astronomer Royal.
(b) **Harvard Revised**.
(c) **Henry Draper** Memorial Catalogue.
(d) **Smithsonian Astrophysical Observatory**.

(e) **Hipparcos**.

All these catalogues and more are discussed at www.astro.uiuc.edu/~jkaler/sow/starname.html.

Q2. If Eagle + Pinwheel = Rosette, what is Dumbbell + Little Dumbbell?

A2. **Tarantula**. Think 'Messier + Messier = Caldwell'. The Eagle Nebula is M16 (the 16th object in Charles Messier's Catalogue) and the Pinwheel Galaxy is M33. 16 + 33 = 49; and the 49th object in Patrick Moore's Caldwell Catalogue is the Rosette Nebula.

The Dumbbell Nebula is M27, and the Little Dumbbell Nebula M76. 27 + 76 = 103; so the answer is Caldwell 103, which is the Tarantula Nebula (http://antwrp.gsfc.nasa.gov/apod/ap090331.html).

There is full coverage of the original Messier catalogue at www.messier.obspm.fr/xtra/history/m-cat.html, and http://lonewolf-online.net/astronomy/caldwell-catalogue/ covers the Caldwell catalogue well.

Q3. What constellation is each set of objects in?

(a) Phad, the Owl (planetary) Nebula, and Sidus Ludovicianum (a star between elements of a celebrated naked-eye double)

(b) Almaak, the last object in Messier's catalogue (an elliptical galaxy), and Alpheratz

(c) the double star Al Rischa, the spiral galaxy M74, and the First Point of Aries

(d) Cor Caroli, the Blue Snowball planetary nebula, and the Whirlpool Galaxy

A3. (a) **Ursa Major**. Phad, also known as Phecta, is gamma Ursae Majoris; Sidus Ludovicianum is between Mizar and Alcor (see www.geocities.com/~smalltelescope/constellations/ursamajor/ursamaj2.html). The Owl was the third planetary nebula ever to be discovered, in 1781 – see www.maa.clell.de/Messier/E/m097.html.

(b) **Andromeda**. Almaak is gamma Andromedae, Alpheratz, in the Great Square of Pegasus, is alpha Andromedae – see http://homepage.mac.com/kvmagruder/bcp/aster/constellations/And.htm. M110 is in our Local Group – see http://seds.lpl.arizona.edu/messier/m/m110.html.

(c) **Pisces** (not Aries as you might have expected!). Although Al Rischa is alpha Piscium, it's not the brightest star – see www.skyscript.co.uk/pisces_myth.html. M74 is a beautiful face-on spiral galaxy – see http://tinyurl.com/cloqbg. The First Point of Aries is the point on the celestial sphere where the celestial equator (the projection of the Earth's equator onto the sky) crosses the ecliptic (the path of the Sun), and is where the Sun can be found at the spring (vernal) equinox. It's the zero

point for both Declination and Right Ascension. Because of the precession of the Earth's axis (see www.crystalinks.com/precession.html) , although ancient observers found that the equinoctial Sun was in Aries, it's now shifted into Pisces (see www.glyphweb.com/esky/concepts/firstpointofaries.html).

(d) Sorry!!! My embarrassing mistake ... Cor Caroli and the Whirlpool Galaxy are in **Canes Venatici**, but the Blue Snowball (see www.daviddarling.info/encyclopedia/B/Blue_Snowball_Nebula.html) is in Andromeda. Apologies ... Cor Caroli, named after King Charles I by Edmund Halley is quite a peculiar star – see www.bbc.co.uk/dna/h2g2/A35977459. The Whirlpool Galaxy (M51) is another cracker of a face-on spiral – see the terrific Hubble 'tour' at http://hubblesite.org/gallery/tours/tour-m51.

Q4. What are the following concepts, and who are they named after?
(a) the Jeans mass (b) Bok globules (c) Seyfert galaxies (d) the Schwarzschild radius

A4. (a) The Jeans mass is the critical mass for a collection of hydrogen gas and dust to collapse under its own gravitation and start to form a star (http://encyclopedia.farlex.com/Jeans+mass). It depends on the cloud's temperature and density. **Sir James Jeans** was a famous English astronomer from the first half of the 20th century (http://www.answers.com/topic/james-hopwood-jeans).

(b) Bok globules are small, dark clouds of dust and gas that 'litter' the sky as dark patches, and are often places where stars are being formed (www.americanscientist.org/issues/pub/bart-boks-black-blobs). The American astronomer **Bart J. Bok** made a particular study of them.

(c) Seyfert galaxies are 'peculiar' galaxies each thought to be powered by a central supermassive black hole, and to be a relatively near and less extreme result of the same physics that powers quasars (www.seyfertgalaxies.com). **Carl Seyfert** made contributions to many areas of astronomy. He died in 1960, and an obituary is at www.messier.obspm.fr/xtra/Bios/seyfert.html.

(d) The Schwarzschild radius of a massive object is the size it would have to shrink to in order to become a black hole, from which not even light could escape. For the Sun, that would be about 3km; for the Earth, about 3mm! **Karl Schwarzschild** was the German astronomer who first calculated such things (www.answers.com/topic/karl-schwarzschild).

Q5. For a typical amateur telescope, what would be the usual main reason for employing each of the following accessories?
(a) a polar (equatorial) mount (b) a Barlow lens or PowerMate
(c) a very low-magnification eyepiece (d) a webcam (e) a Baader filter

A5. (a) To do **long-exposure astrophotography**. With an alt-azimuth mount

(one that can be easily pivoted in all directions), even when the telescope is driven by a computerised motor, an object in the field of view will appear to rotate very slowly in relation to a fixed line at the telescope, which will cause a long-exposure photograph to look blurred. See www.memphisastro.org/Mounts.html.

(b) To decrease the focal length of a telescope's optical path before light reaches the eyepiece or attached camera – this has the effect of increasing the overall system's **magnification** (www.astunit.com/tutorials/barlow.htm). 'Powermate' is the name of a range of high-quality Barlows made by Tele Vue (http://tinyurl.com/dbjzq7).

(c) To give a **wide field of view**. Some objects take up so much sky that looking at one with 'normal' magnification displays only a small part of the overall object. For instance, the North America Nebula (http://apod.nasa.gov/apod/ap000501.html) has an area four times that of the full moon.

(d) To **look safely at the Sun** through a telescope or some other optical aid, such as binoculars. It often takes the form of a thin sheet of special material that cuts out all but a tiny fraction (typically 0.001%) of the incoming light (see www.baader-planetarium.com/sofifolie/details_e.htm). A more specialist filter may (or may in addition) in addition cut out all light except in certain narrow wavebands, thus enabling you to see prominences on the rim of the Sun, for instance.

Q6. In the context of amateur observing, what is each of the following terms a shorthand for?

(a) an apo (b) a Dob (c) a chip (d) FOV (e) power

A6. (a) An **apochromatic refractor** – this is much more expensive than a conventional refractor of the same size because its optics are corrected for both spherical and chromatic aberration (coloured fringing – see www.dpreview.com/learn/?/Glossary/Optical/chromatic_aberration_01.htm) at three or more different wavelengths (typically red, blue and green).

(b) A **Dobsonian reflector** – a portable, usually large, alt-azimuth telescope made out of inexpensive materials and with a simplified design invented by a Californian amateur astronomer, John Dobson, in the 1960s. Popularly known as a 'light bucket' because of its cheap-and-cheerful approach to providing large light-gathering capability at low cost. UK enthusiasts gather at www.mydob.co.uk.

(c) A **CCD (charge-coupled device) chip** – the tiny electronic capture/storage device that records the light coming through a digital camera, for instance (www.cctvconsult.com/pages/ccd.htm).

(d) **Field of view** – usually the amount of sky (in square degrees or minutes of arc) that can be seen through an eyepiece attached to a telescope. There's a simple FOV calculator at http://firstlight.mvobservatory.com/?q=node/29.

(e) **Magnification** (www.astronomy.net/articles/26).

The Ultimate Fate of the Earth and the Sun

From Michael Roe

Recently in Transit and earlier in The Sky and Telescope magazine there has been articles claiming that in the far future, about 7,000 million years time, our Sun will expand to such a size that Earth will be engulfed or nearly engulfed by it.

I believe that the Sun will never reach such a gigantic size. True, it will grow huge compared to its present 865,000 mile diameter and the Earth will still suffer a terrible fate, all water vapourised and life incinerated, even many miles of crust melted, maybe even some of the mantle too, but I am sure the bulk of our Earth will survive.

My reasons for this are simple. Some stars do grow to 200 – 500 million miles in diameter, they are called supergiants. Antares and Betelgeuse are well know supergiants, in fact Betelgeuse has been measured at 42 thousandth's of an arc second in diameter. If the old distance of 520 light years is correct that equals 650 million miles in diameter. If the more recent estimate of 430 light years is true then Betelgeuse is 540 million miles in diameter, these measurements were made using interferometry techniques.

The important thing is that supergiant stars all have more mass than the Sun, around 4 and up to 50 solar masses. Their end is a spectacular supernova explosion, leaving a tiny but heavy neutron star or a black hole.But the Sun hasn't the needed mass. It will eventually evolve and grow into a red giant star, not a red supergiant star. A red giant is more like Arcturus or Aldebaran, both stars being about one solar mass. They will grow to 30 – 50 million miles in diameter, perhaps a little larger for a short time.

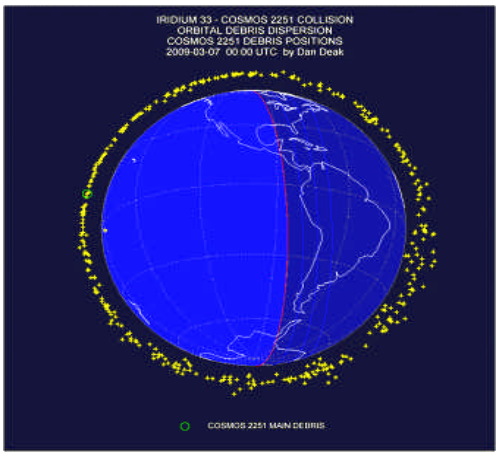
So, how did these people make this mistake? Simple, it is very easy to make wrong calculations, think of weather forecasts and then on a much larger scale of size and time over millions of years involving our Sun. A better idea would be to check any measurements of mass and diameters of existing giant and supergiant stars. Eclipsing binaries would provide the information needed.

I am pretty sure that although the Sun will grow huge it will only swallow up Mercury and scorch Venus a great deal. The Earth will survive after its molten surface freezes and the Sun becomes a white dwarf, tiny and dense. Eventually it will cool to become a black dwarf, something I wondered about when I was young. No black dwarfs exist as yet, the Universe isn't old enough.

So, the ultimate fate of the Sun and Earth will be two globes, one – the Sun - with nearly a million times more mass than the other – the Earth - but smaller in diameter and incredibly dense, continuing to be orbited by the Earth and other outer planets in total darkness.

Debris From Satellite Collision to Start Entering Earth's Atmosphere

Written by Nancy Atkinson



Map of debris from satellite collision. Credit: Dan Deak and Spaceweather.com

Debris from the satellite collision that occurred on February 10th will soon start entering Earth's atmosphere. 355 debris fragments from the collision between the Cosmos 2251 and the Iridium 33 satellites are being tracked by US Strategic Command, and one fragment will enter the atmosphere on March 12, followed by one on March 28th and another on March 30th.

According to Spaceweather.com, these are likely centimeter-sized pieces that will disintegrate in the atmosphere, posing no threat to people on the ground. Each fragment is cataloged and tracked.

The Cosmos 2251 was bigger and possessed about one and a half times more mass than Iridium 33, and appears to have produced more than twice the number of fragments. "As of March 7th, there were 355 cataloged fragments of Cosmos 2251 and 159 fragments of Iridium 33," says Daniel Deak who prepared the above orbit-map for Spaceweather.com. "The Cosmos fragments are not only more numerous, but also more widely scattered, ranging in altitude from 198 km to 1689 km. For comparison, Iridium fragments are confined to altitudes between 582 km and 1262 km."
The extra scatter of Cosmos debris is not fully understood. Impact geometry could explain the spread, but no one knows exactly how the two complex vehicles struck one another. However, Cosmos 2251 was pressurized and might have ruptured and blown apart.
The upcoming shuttle mission is not in immediate danger from debris, although the risk of impact increased by 6%. The International Space Station also is not in danger. "NASA has recognized from the first day [of the collision] that the risks to both ISS and STS-119 have increased," says Nick Johnson, Chief Scientist for Orbital Debris at the Johnson Space Center. "However, those increases have been relatively minor in comparison to the background environment."

Calling All Amateur Astronomers: Help Comb Arecibo Data for Gems

Written by Anne Minard

Einstein@Home is one of the world's largest public computing projects, with more than 200,000 people donating time on their own computers to mine gravitational wave data for the tell-tale signs of pulsars. Now, Einstein@Home will begin searching Arecibo radio data to find binary systems consisting of the most extreme objects in the universe: a spinning neutron star orbiting another neutron star or a black hole. And the project needs even more public participation.

Bruce Allen, director of the Einstein@Home project, and Jim Cordes, of Cornell University, announced that the Einstein@Home project is beginning to analyze data taken by the PALFA Consortium at the Arecibo Observatory in Puerto Rico. PALFA is the Pulsar Arecibo L-band Feed Array Consortium, an ongoing search effort.
The Arecibo Observatory is the largest single-aperture radio telescope on the planet and is used for studies of pulsars, galaxies, solar system objects, and the Earth's atmosphere.

Current searches of radio data lose sensitivity for orbital periods shorter than about 50 minutes. But the enormous computational capabilities of the Einstein@Home project (equivalent to tens of thousands of computers) make it possible to detect pulsars in binary systems with orbital periods as short as 11 minutes. The project is based at the University of Wisconsin in Milwaukee and the Albert Einstein Institute in Germany.

"Discovery of a pulsar orbiting a neutron star or black hole, with a sub-hour orbital period, would provide tremendous opportunities to test General Relativity and to estimate how often such binaries merge," said Cordes. The mergers of such systems are among the rarest and most spectacular events in the universe. They emit bursts of gravitational waves that current detectors might be able to detect, and they are also thought to emit bursts of gamma rays just before the merged stars collapse to form a black hole.

"While our long-term goal is to detect gravitational waves, in the shorter term we hope to discover at least a few new radio pulsars per year, which should be a lot of fun for Einstein@Home participants and should also be very interesting for astronomers," Allen added. "We expect that most of the project's participants will be eager to do both types of searches."
Einstein@Home participants will automatically receive work for both the radio and gravitational-wave searches.

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A Tailpiece from John Crowther

One night an American astronomer, Asaph Hall, got fed up with studying Mars and decided to go to bed. But his domineering wife bullied him into staying up and resume his observing. That night he discovered the two Moon's of Mars. Mocking his fear of his wife he named them Phobos (fear) and Deimos (panic).

(from the Universe Questions and Answers by John Farndon, Paragon 2002)

Articles : Please send contributions for the newsletter to The Editor, Bob Mullen, 18 Chandlers Ridge, Nunthorpe, Middlesbrough, TS7 0JL, 01642 324939 (b2mullen@hotmail.com) Copy deadline date is the 25th of each month).