



CAPELLA

CAMBRIDGE ASTRONOMICAL ASSOCIATION

Newsletter 141. November/December 2009.

www.caa-cya.org

Registered Charity No. 800782

CAA 1959-2009
Golden Anniversary Year



(Left) At the end September fifty people toured Duxford air museum during a CYA visit. Tony is in front of the Gibraltar gun talking about the problems that people would have encountered if they had used Jules Verne's method of getting to the Moon by being fired from a giant gun.

(Right) The Eggsperiment. Tony and Brian watch as a small capsule containing Eggbert is launched (Thumped by Tony with a mallet) into orbit - well nearly! Upon retrieving the capsule they eggsamine Eggbert who has eggspired (He's eggstinct!) he didn't survive the rapid eggcelaration.



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*Cambridge Astronomical Association and Cambridge Young Astronomers.*President: Dr. David DewhirstVice-President: Jim HysomChairman: Brian ListerSecretary: Stanley TraffordTreasurer & Membership Secretary: Michael PallettCommittee: Dave Allen, Barry Crellin, Paul Drake, Paul Fellows, Clive Gilchrist, Clive Holt Barry Maddox and Barry WarmanCapella: Members should send contributions for Capella to: Ken Day, 28 Waddelow Road, Waterbeach, Cambridge, CB25 9LA. e-mail ken.day@lineone.net **Please make sure e-mail contributions are in .TXT format.**Cambridge Young Astronomers (both groups): Brian Lister Tel: 01223-420954, (evenings) or e-mail btl21@cam.ac.ukTelescopes for hire to members: Stanley Trafford Tel: 01223-880624 or book on-lineLibrary: Barry CrellinWebmaster: Paul Fellows.Website: www.caa-cya.org**Chairman's Comment**

We can all remember astronomical sights that have left us amazed: the first view of Saturn through a 60 mm refractor nearly forty years ended up changing my life. Like many I bought a telescope, looked at the Moon and stars, but the stars were just dull ol' points of light and I was beginning to think that astronomy was boring. The intervals between getting my telescope out were getting longer and longer, until one night Saturn swum into the field of view - and that's the only reason I'm with the CAA. Now I rarely look through a telescope; however I still see lots of astronomical goodies on the big screens of our Wednesday night observing sessions. I still remember vividly the impacts of comet Shoemaker-Levy on Jupiter and the spiral structure of comet Hale-Bopp on the screen. Although sometimes memorable astronomical sights don't need a telescope to be etched into the little grey cells. A very bright fireball seen during the day, a total Solar eclipse and a spectacular auroral display are 'locked away.'

Recently I had another shock to the system that I wasn't expecting. I was designing a spectroscope (the idea pinched from the web) ready for a young astronomers meeting. The spectroscope was made from a cardboard housing stuck to a CD with a cardboard tube with a 1mm slit at one end glued into the housing. I pointed the prototype towards a fluorescent light and got an emission spectrum from the light - wow this good! Then I pointed the spectroscope towards the sky, when along ambles one those unexpected slaps in the face with a wet herring moments. Fraunhofer lines! But don't you need your telescope attached to the spectroscope to see Fraunhofer lines? Obviously not, just a crudely cut and folded piece cardboard and a CD stuck at the right angle. Visible was the prominent alpha and beta hydrogen, sodium, iron and the double magnesium lines, and upon closer inspection over two dozen finer liner lines - I was absolutely stunned (and very impressed).

However, some sights offer much promise but can be a damp squib. I'm sure I was the only one who was more than a little disappointed with the impact on the Moon by the LCROSS mission. I sat watching the images live, just as the point of impact approached an electrician called in the office. I explained to him what was happening, and he responded by saying 'Is anyone on board?' While I was pointing out that there was not a huge requirement for kamikaze astronauts, I kept an eye on the timer counting down to impact. Zero came and went - not a flippin' sausage! This must have been the biggest non-event since the millennium bug. I just wonder what sights the future will hold.

Brian.

*Speaker Meetings*Friday 20th November 2009 Nik Szymanek**"Photographing the Night Sky"**

Nik is Visiting Research Fellow at the University of Hertfordshire and is well known for his exceptional and award winning work in astrophotography.



He has travelled as far afield as La Palma and Hawaii in search of the perfect conditions and created some of the most stunning images as a result of this, and his undoubted sky and talent for the subject.

Nik's talk covers all forms of modern astrophotography, and he would also like to show a short film at the end showing what it's like to work from high-altitude Observatories.

Friday 18th December 2009 Dr. Frazer Pearce
"Exoplanets: the search for other Earths"

Modern observational techniques have revealed the presence of hundreds of planets orbiting nearby stars.

Frazer will review the main methods used and ask:-

Why the planets we have found so far are certainly not what we expected?

Why we have currently failed to detect any Earth-mass objects?

What are the implications of the modern theory of planet formation?

Frazer is a Reader in Astrophysics at Nottingham University where he studies the formation and evolution of galaxies.



As usual, these speaker meetings will be in the Sackler Theatre at the Institute of Astronomy, Madingley Road, Cambridge. The doors will be open from 7.30 p.m. with the talks beginning at 8.00 p.m. and we need to remind you that, for security reasons, the doors will be locked shortly after the start of the talks.

Coffee, tea and biscuits afterwards for convivial chats after the talks. And the Library will be open both before and after the talks.

After the December meeting, there will be the usual Christmas Quiz with items for you to identify supplied by last year's winner, Tony Philips.

Special event at St. John's College

There is an astronomical exhibition at St John's College over the next few months. It is open to all and entry is free.

"The Way to the Stars: a history of College astronomy"

5th October until 21st December 2009, from 9am to 5pm on weekdays.

Exhibits will include:

- * medieval manuscripts
- * eighteenth-century astronomical instruments
- * archive photographs and prints
- * the papers of eminent Johnian astronomers such as John Couch Adams, one of the men who discovered the planet Neptune.

Visit St John's college website for further info:-

(www.joh.cam.ac.uk/library/special_collections/hoyle/past_events)

Members' Contributions

First, modify your microwave oven.....

by John Savage

The plate should spin in one direction only at about 8 rpm. You will need a much larger plate than normal, about 9m in diameter would be ideal. Rather than using microwave heating, you will have to use conventional electric heating - 800kw should be sufficient.

Do not to forget to hire the crane.

The end product has a honeycomb base with a smooth top, so make the mould and put it onto the plate. Slowly add the ingredient which is, of course, glass. 5 kg lumps of glass are easy to handle but it is still heavy work when you need a total of 20 tonnes of low expansion glass.

Heating the glass takes a week and, at 1180°C, the glass is as viscous as honey and thus it fills the mould. Because the mould is spinning, the top surface of the molten glass is not flat but conforms to the shape of a parabola.

Carefully cool the glass, remove it from the oven and accurately grind the parabolic surface (as it is already preformed by the spinning process, this saves, literally, years of grinding time), polish and finally garnish with a 100nm layer of reflective aluminium.

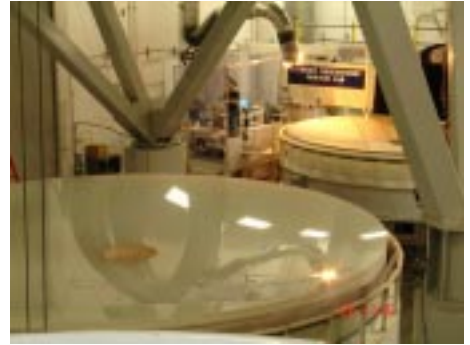
Makes:- One 8.4 metre diameter astronomical mirror
Preparation time:- about 4 years

Cost: about £12 million

The idea for this technology came when Englishman Dr. Roger Angel, Director of the Steward Observatory Mirror Laboratory, University of Arizona, first fused together several Pyrex custard cups nearly 30 years ago.

Acknowledgement: Steward Observatory Mirror Laboratory, University of Arizona, USA

This article first appeared in The Glass Seller, the newsletter of the Worshipful Company of Glass Sellers of London.



The mirror on the left is 8.4-metre (now installed in the Large Binocular

400 Years of the Refracting Telescope

By Jim Hysom

The year 1609 saw Thomas Harriot and Galileo pointing their newly-constructed refracting telescopes at celestial bodies. These telescopes consisted of two lenses, one was called the object glass, being nearest the object being viewed, and the second the eyepiece, being nearest the eye. If the object glass (objective) is of plano-convex form i.e. flat on one side the other being spherical and thickest at the centre and the eyepiece being bi-concave i.e. curved on both sides and thinnest at the centre then we have the components to make a telescope like theirs. If the radius of curvature of the convex is the same as on the bi-concave, then because the concave is curved on both sides it will be twice as powerful, and properly spaced will give a x2 telescope. They soon had telescopes magnifying x3, x9 and even x30. There was a major disadvantage with the Galilean type of telescope and that was using a concave eyepiece gave a very small real field of view. At the highest powers you could not see the whole of the lunar disc at one time. This could be solved by using a convex eyepiece, one got a wider field of view, but the image was now upside down! This could be cured by adding another convex lens but it would absorb more light, add to the cost, and gave more errors - aberrations. A major error was that a simple lens gave false colour, so-called chromatic aberration. One way of reducing this effect was to make the curve on the objective shallow and hence the focal length of the objective was longer. Telescopes got longer and longer and most ungainly. A 6-inch lens would be of over 100 feet focal length i.e. more than $f/200$. A result of

this was that the lens had great depth of focus - and a very wide field. Once acquired, an object could be followed for several minutes without touching the main telescope - just by moving the eyepiece sideways; but it must have been slow, frustrating and tiring work.

And then 124 years after the telescope's application to astronomy, Chester Moor Hall discovered that a much better objective lens could be made using glasses of widely dissimilar optical properties, the so-called crown/flint combination. These achromatic doublets usually take the form of an equally bi-convex crown lens in contact with a plano-concave flint lens, the concave radius being equal to the biconvex. With small lenses, say below 3 inches diameter, they are often stuck together with a transparent optical cement, this increases transmission. A great advantage was that they could now be made $f/15$ or shorter. With a single lens objective each colour had its own focal length, blue being shortest and red longest. With the so-called achromatic combination the designer could make blue and red to be the same. Green would then be different by about $1/2000$ or less. There is a simple formula for calculating the minimum focal length a lens can be to keep the residual colour down to an acceptable amount and it is: $-5xA^2$ where A is the aperture in inches. Thus with a 3 inch lens it is; $5 \times (3 \times 3) = 45$ inches i.e. $f/15$. A six inch lens is 180 inches focal length $f/30$. Clearly we have to compromise.

If you want a refractor and you need a shortish tube length then you will have to put up with some secondary

spectrum (false colour). In the mighty 36-inch Lick refractor at Mount Hamilton and the 40-inch Yerkes refractor they were only about one tenth they should have been to stay within the Rayleigh limit on colour. These two telescopes were both working in the late 19th century. What can be done about the secondary spectrum? Convert it into a much smaller tertiary spectrum! This is usually done by adding an extra lens. Unfortunately it has to be made from a glass very expensive to produce. The German firm of Schott came up with a glass that allowed apochromatic triplets to be made. This new glass was placed between the two "normal" types, but even there, if moisture got in, corrosion set in and the lens went blind. The middle element had to be repolished. It was also very sensitive to precise alignment; a slight error and all stars would look

like little comets - coma. H. Dennis Taylor for Cookes of York designed these photo-visual lenses - their residual colour aberration was less than one fifth of an ordinary achromatic lens. They gave superb steady images.

Very recently a number of glass manufacturers have come up with some unusual glasses which have allowed exceptionally colour-free lenses to be made - but one not cheap and one limited to fairly small apertures, mostly around 5 inches. After 400 years glass is still being used for telescope lenses. Moulded aspheric plastic lenses seem to be limited to small elements i.e. camera lenses such as built into mobile phones. Long may it continue that astro opticians will grind, polish and figure glass lenses for object-glasses!

Visit to the Clanfield observatory - Home of the Hampshire A.G.

by Paul Fellows

The Clanfield observatory was established in the mid 1970s - on top of a 300 foot down a little way north of Portsmouth. It is situated on the site of a water-company reservoir - one (in fact two) of those large hill top earth works. Of course we don't have them around here because we don't have hills - so we see concrete water towers. Anyway, enough talk of plumbing...

Robin Gorman, the chairman of the local society tells the story of how he was cheeky, ambitious and lucky enough to make just the right contact with the right person to be able to do an almost overnight deal whereby the water company granted them a lease to the land surrounding the reservoirs - for the princely sum of £5 a year... I think it has shot up to £10 since - which is not bad in 30 years. So, I had occasion to pay the place a visit in August - and was treated to a guided tour and a slide show by Robin, who is now president and leaves the actual running of the society to his younger chairman.

The centre piece of the array is the large 24-inch reflector, in a rather unusual shape dome and mounted on a very substantial English style equatorial mount. On the site they have also built a very respectable and solid looking club house, which is equipped with all mod cons, a room for meetings and talks, five domes, and of course a workshop. All in all a most impressive set-up.

So why was I there? Well the story goes back a very long way to the days when the first turf was cut for the building of the principle dome, and the time when I was just 14 years old. My father, was at the time head of science teaching at the school in Paulsgrove and at the start of the Christmas holidays he brought home a small four inch reflecting telescope. This instrument sat there in the dining room of our house at 42b Stakes Road, Purbrook, waiting and tantalising me with its magnificence. Finally the time came: it was dark, clear and Dad was home. We had had dinner and the chance came to set up the machine outside in the backgarden on its tripod. What to look at? There were stars all across the sky, but no Moon otherwise I am sure that is what we would have pointed it at. I pointed heavenwards and selected a likely looking bright star, without much thought as to what it was and said 'What about that one?'. Dad aimed the scope and lined it up on the chosen target and, when the image he saw came

into focus he said, 'Wow, just look at this' and moved away to make room for me to take my place at the eyepiece. I lined up for my first peek through an astronomical telescope and WOW what a sight. It was the planet Saturn in all its glory with its rings, belts and a moon or two clearly visible. That was it... I was hooked. This was just awe-inspiring. We spent the evening marvelling at Saturn and little else, though we did also locate the Orion Nebula (M42) and this, too, was just astonishing.

Sadly the telescope had to return to school after just a couple of weeks. What was I to do? Now, it turned out that my father had an acquaintance through the badminton club, a young man who needed help with his maths homework - and who had been grinding his own mirror for a small reflecting telescope. This was one Robin Gorman, a man who turned out to be the driving force behind the Portsmouth Astronomical Group.

What could be more logical then than to bring me to the meetings of the group and for me to become a young member of that organisation! Many a Friday evening was spent up at Swivelton Lane at the group's HQ - the former AckAck emplacement on top of Portsdown Hill. We had at that time a 12-inch Newtonian reflector in a dome beside the clubhouse and I remember to this day my first view of M13 with it! Down in the basement in the old ammunition rooms was a workshop, where the group had built a mirror grinding machine, and where they laboriously worked day after day making a 20-inch mirror for the new telescope - which was destined to be housed at the new site at Clanfield.

While Friday evenings were consumed with hopes of a clear night, and a trip up to the top of Portsdown Hill for observing, Saturday and Sunday afternoons saw me cycling out to the new site making the floor for the new dome and getting completely covered with creosote. We did all this without masks or gloves and today the health and safety trolls would have stopped it in an instant. However, I would point out that those boards are still there today over thirty years later and so it worked.

Eventually the great day came for the wooden frame of the dome to be lifted on. The floor was done. The walls and rails were ready. So, twenty six of us gathered for the



That's me at the back pretending to lift it...

great lift. My father was there to help, and we lifted, moved and placed the dome on its runners. It seemed awfully easy - but I think that is what happens when you have good planning and organisation.

The H.A.G. has now got an impressive array of five domes. Aside from the main 24-inch reflector pictured here, two others are equipped with moderate sized



...and this is Dad and me outside the dome thirty years later!

refractors which the group has been gifted, while the other small domes have reflectors.

Next year, they are celebrating their 50th anniversary - one year younger than Cambridge - and I have been invited to go back and talk to them about astronomy here in Cambridge and what we get up to - as one of their 'alumni' from the early days. ✍

The Elephant's Trunk nebula by Paul Beskeen.

An image of the Elephant's trunk nebula (part of IC1396) taken by Paul at the Pumpkin Patch observatory, Bourn, Cambridge with his Astro Optik 400mm Cassegrain. Details, and the original images are on Paul's website - www.beskeen.com/gallery/nebula/ElephantsTrunk.shtml

The area photographed is part of a cloud of gas and dust in the constellation Cepheus. It's estimated to be about 2,400 light years away from Earth. You can see where it gets its name!. The bright outline is the surface of a dense cloud that is being lit up and ionized by UV rays from a bright, massive star that is just to the west. The Elephant's Trunk nebula is believed to be a stellar nursery, containing lots of very young stars which can be seen in infra-red images. A pair of fairly young stars have carved out the bubble in the head of the globule using their stellar winds. ✍



CAA/CYA News

Loan Telescopes

There are usually no long waiting periods for the loan telescopes, visit our website and click on book a telescope, or give Stanley a ring on 01223 880624 (after 8pm). He will then be able to give the current state of affairs as to which instruments are available. ↙

Website

The new website is now up and running. Our thanks to Paul Fellows for grabbing the bull by the horns and going for it! Also our thanks to Ian Hunter who has maintained our current website for the last five years even when he moved away from the Cambridge area. ↙

Reminder Service

Don't forget that on our website www.caa-cya.org reminder service you now have the option of being informed when *Capella* is ready for downloading. ↙

Public Observing Sessions

Doors open at 6.50pm with a talk at 7.15pm by a researcher from the Institute followed by observing just before 8pm using the historic telescopes and our telescope/big screen set up, where we give guided tours of the night sky. See the IoA website (www.ast.cam.ac.uk/public/public_observing) for the list of speakers. ↙

CYA Meetings

7-11 Age Group

Saturday 28th November 2009

Missions to Comets and Asteroids

Since the first mission to Comet Halley in 1986 there have been several missions to comets and asteroids, with many more visits planned. These minor bodies of the Sun have had samples taken, been landed on and even clobbered by the various probes - some visiting more than one object during their extended travels around the Solar system.

We will be showing you what we have learned and what we expect to learn from missions past, present and future.

Saturday 19th December 2009

"Murder at the Observatory."

For our annual pantomime we've presenting a whodunit.

Dr Bleak's body has been found in the Northumberland, there are numerous suspects:-

Professor Plump,

Colonel Custard,

Mr Ballcock (a plumber),

With twists and turns plus the odd red herring to confuse the audience.

Added to the script is the usual collection of really dire jokes, and it is left to the audience to decide from the evidence given, who is the culprit.

These meetings will be held in the Hoyle Building at the Institute of Astronomy, Madingley Road from 10 a.m. till noon. Free to CYA members; for non-members there is a £1.00 fee.

11+ Age Group

Monday 7th December 2009

Discovering in the Inner Solar System.

We'll be looking at the exploration of the inner solar system, to see how probes have visited Mercury, Venus and Mars, as well as the asteroids and comets that have ventured inside the orbit of Jupiter. There have been orbiters, landers and impactors (some impactors have been intentional - others have not!) which have improved our knowledge of this region around a typical yellow dwarf star.

Monday 11th January 2010

Discovering the Outer Solar System.

Please note this is not the usual first Monday of the month.

This month it the turn of the outer solar system. The exploits of the voyager spacecraft are well known, but there are not so many probes frisking about in the region beyond the orbit of Jupiter compared to the inner part. So information has to be gleaned from other sources, like the Hubble space telescope and other orbiting observatories as well as ground based observatories.

These meetings will be held in the Hoyle Building at the Institute of Astronomy, Madingley Road from 7.15 p.m. till 8.45 p.m. Free to CYA members; for non-members there is a £1.00 fee.