Gnomon

Newsletter of the Association of Astronomy Education

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Major Astronomy Education Centre To Open This Spring

In the spring this year the Lawrence House Astronomy Centre will be opening its doors…to everybody!

This is an educational establishment, devoted to the *teachings* of astronomy and related sciences – any age, any level – courses, lectures, tutorials etc. The centre is located on the substantial grounds of, though independent of, an old public school on the Fylde Coast, Lancashire.

The realisation of the centre has been based upon an increasing 'demand'. Astronomy courses in adult education, teacher INSET and formal revisionalist/reinforcement lectures and tutorials, started here five years ago. All educational services were at the time presented 'wherever possible' – not ideal – and with increasing demand for more courses it soon became clear that an establishment *dedicated* to the teachings and promotion of astronomy would indeed be very viable.

After the usual canvassing for funds we were eventually granted around a quarter of a million pounds from a local source, The Lawrence House Trust. This 'seeding' has now ensured the interest of other corporate would-be sponsors/financial partners including BAE Systems and PPARC as well as invaluable media attention from BBC television, radio and the press – something I'm very keen to 'enhance'.

Building work is expected to be completed in early April. Alongside our existing Victorian *Observatory* and its associated 'Cooke' telescope, we will then have a standard *classroom*, a tiered *lecture theatre* and a housed *planetarium* – the full astronomy-teaching package – all equipped and furnished solely for this single purpose.

"My aim here is to introduce, and develop an ***enthusiasm*** *for astronomy and related space science topics. An enthusiasm that I hope can be 'passed on' through all Key Stages and into the adult sector."*

The current list of educational services on offer includes:

Key Stage 2 – Day course presentations for primary/preparatory school classes centred around Earth in Space modules, INSET for teachers and PGCE students, and training in the use of 'Starlab'.

Key Stage 4 – Pupil reinforcement/revision for GCSE, INSET revision for qualified teachers and professional development for PGCE students.

GCSE Astronomy - The Edexcel curriculum. To be offered as a 'Year 10 and 11 course' or as an accredited course within the adult sector.

Advanced Courses - Reflected in the adult education content is the goal of course *'Accreditation'.* Within the remit of "better approaches to astronomy and the teaching thereof" the outcomes would be accreditation and the subsequent awarding of points towards university entrance.

There will be Public Lectures, Planetarium Courses and Adult Education Shows.

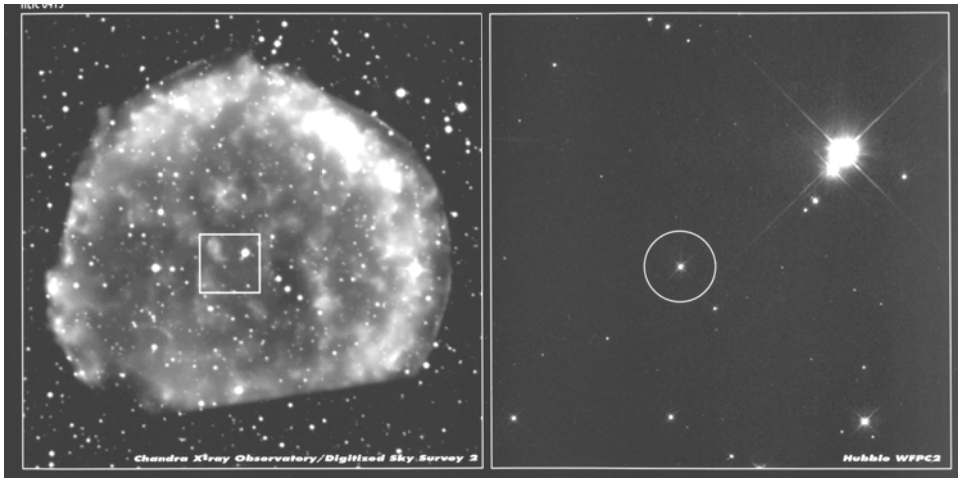
There is a ubiquitous enthusiasm for astronomy – often 'simmering just under the surface' – that needs to be 'tapped'. If this wonderful science, so full of excitement and its plethora of 'wow' factors, is made *accessible*, 9 out of 10 people will 'dip their toe in' and become 'hooked'. It is this ***'chance of introduction***' that is so important.

Contact Dr Nick Lister:

☎ **01253 774201, 07962 039832**

nlister#btinternet.com

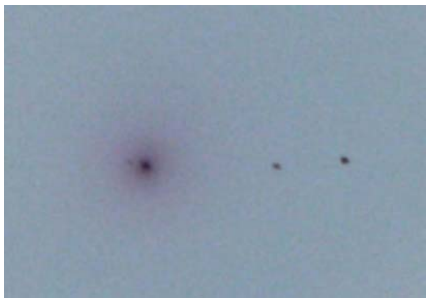
Tycho's Star makes news again 432 years on



In 1572 an event took place that was to shake the entire foundations of astronomy and philosophy. The naked eye astronomer, Tycho Brahe - arguably the *first* ***astronomer (measurer of the stars) - saw a "new star". It totally transformed the appearance of Cassiopeia. It shattered belief that the stars were immutable. Tycho's supernova has now been captured by the Hubble Space Telescope, that showed what is believed to be what is left of the star that exploded in the middle of the supernova remnant. The object (circled) is hurtling across the galaxy at three times the velocity of the surrounding stars. Investigation of the star is said to provide the first direct evidence of the long-suspected idea that Type Ia supernovae originate in binary star systems that contain a normal star, and a burned-out white dwarf. The normal star spills matter into the white dwarf, eventually triggering the explosion.***

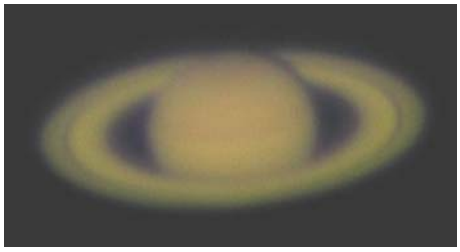
NASA/ESA, CXO and P. Ruiz-Lapuente (University of Barcelona)

Back Garden Astronomy



You don't need a special site to do astrophotography. Here is an image of Comet Machholz taken from the President's back garden using a digital camera placed against the 40mm eyepiece on an 8 inch telescope. The exposure was 10 seconds at ISO 400.

However it helps if you have a big telescope. Here is an image of Saturn taken with the 18 inch refractor at the University of London Observatory. This image, also taken by Francisco, was made by coupling a digital camera to the eyepiece. Exposure time was 1/20 sec.



European Day of Astronomy

The European Southern Observatory and the European Association for Astronomy Education will organise this event on Friday 20th October **2006** and in subsequent years. Please put this date in your diary. There will be day and night, clear and cloudy programmes. You may ask "Why bother, it's only Europe!". Well the UK joined ESO recently and contributes 20% of its budget. Only Germany with 30% pays more. For this we gain access to research on the Very Large Telescope in Chile and to the new radio-telescope project, the Atacama Large Millimetre Array - more next time. ESO is very keen to outreach to schools and the general public and provides considerable financial support via links to the EU.

UK Moves Forward On Aurora

A team of leading UK space scientists and industrialists have been appointed by the Particle Physics and Astronomy Research Council to help define the UK's participation in the European Space Agency's Aurora Programme of space exploration. Aurora is a long term programme of planetary exploration potentially leading to human missions to Mars circa 2033.

💻 **www.pparc.ac.uk and www.esa.int**

Eric Zucker 1924 - 2004

Eric Zucker was the first editor of Gnomon. He passed away in December 2004 at the age of 80.

The AAE was founded in 1980 and Eric was an early member, becoming involved when the association started holding regular meetings at North London Polytechnic.

From the early days of the AAE up to the autumn of 1995, Eric was the editor of our newsletter, Gnomon. This was the principal method of communication with the members and Eric did a great job in collecting copy and ensuring timely publication.

Bob Kibble writes: "Eric was a moving force behind PONLAF - the Polytechnic of North London Astronomy Forum. Eric was excellent company, cheerful, reflective and engaging. He was a humble man whose intellect and interests were rarely paraded. I learnt much from knowing him and know that he will be sadly missed."

Alex Barnett writes: "How sad to hear of Eric's passing. Taking over the editorship of Gnomon after it had become such a quality publication in Eric's hands was no easy task. But Eric and his wife Ethel made the transition very easy for me. I well remember a trip to Lewes to pick up all the back issues and materials that Eric had organized for future issues and spending time learning from Ethel how she managed getting everything to the post office on time! Eric was always available for questions, or to come up with a piece of news to fill a space. He will be very fondly remembered."

Tony Lacey, who was probably solely responsible for astronomy being part of the original National Curriculum, remarks that Eric was a great stalwart of astronomy education.

Eric and his colleagues who formed the AAE had great vision. They ensured that astronomy was made part of the national curriculum and provided support for teachers who were unfamiliar with it. Once established, astronomy went from strength to strength, so the education system owes Eric a great debt of gratitude.

Eric is survived by his wife Ethel and daughter Jill - contact details on request.

Alan Pickwick

Catch a Star!

The winners of the ESO 2004 Catch a Star! Competition have been announced. Spain won first prize and four other major prizes went to Bulgaria, France, Germany and Belarus. This competition is likely to run again this year and we should do our best to encourage lots of entries!

💻 **www.eso.org**

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There will generally be a 10% discount to AAE members on all publications and advertising rates.
Practising teachers may claim their subscriptions as an allowance against income tax, effectively reducing their contributions.

All communications (except those to the Editor) should be addressed to:
Association for Astronomy Education,
The Royal Astronomical Society,
Burlington House, Piccadilly,
LONDON W1J 0BQ.
💻 **www.aae.org.uk**

For all enquiries concerning the newsletter, contact the Editor:
Richard Knox
3 Alexandra Terrace
Penzance, Cornwall, TR18 4NX
e.mail:**gnomon-editor@beeb.net**
Telephone: 01736 362947
Any photographs sent to the Editor by email (preferred) should be sent in a common format (TIF or JPEG) with resolution not less than 300 dpi

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Publication Dates:
These are at the equinoxes and the solstices, that is four times a year. Copy deadlines are six weeks before these dates.

Aliens have come a long way since the 50's

Your entertaining "Mystery UFOs" feature in *Gnomon* highlights a significant trend. Those of us who seek to interest young astronomy can no longer ignore this aspect of sky observation. Children do ask about alien life, a topic which is even included in GCSE science syllabuses, and I try to be prepared for this.

While I accept that there may be life out there, I do not subscribe to the 'extraterrestrial hypothesis' where UFOs are concerned, though I may be wrong! Faced with the inevitable questions from children, whether in school or Brownie groups etc., I try to provide a balanced view, stating the vast distances involved for any visitors and giving examples of apparently strange phenomena that are in fact quite natural.

Today's science fiction presents us with so many high quality visual images and stunning concepts that it is easy to blur the line between fact and speculation. The standard 'grey alien', for example, is now a well established cultural icon, even on crisp packets. SF, UFOs and astronomy fascinated me since the 1950s, but I have managed (I think) to keep each in its place.

They can interact, of course. SF has contributed to the vision of modern space travel and there is no reason why healthy curiosity about the Universe cannot encompass UFOs. But - it is all to easy to be carried away by wild speculation.

We have a responsibility to encourage our young people to develop critical skills amid all this. A well produced television documentary can convince even intelligent adults that the Moon landings were contrived in a studio. (Thanks for the *Gnomon* article helping us to put this in proportion!)

After a meeting of our local astronomical society some years ago, we asked our speaker, a psychologist specialising in space medicine, who had done groundbreaking work on perception, about his views on UFOs. He told us about an astronaut who had seen small 'insects' hovering around the view port of his capsule in the early years of orbital flight.

Fearing he would have to ground the pilot because of hallucinations, our doctor consulted experts in other fields of space travel and solved the problem. The 'insects' were ice crystals caused by emissions of waste moisture from the spacecraft, but at the time they had appeared entirely convincing from the astronaut's point of view.

So many things depend on our point of view. There is an excellent little book called The Universe And Eye by Timothy Ferris & Ingram Pinn (Chronicle Books 1993) which postulates that a true scientist is prepared to allow a gap in knowledge to exist, however frustrating this may be. The alternative, filling the gap with speculation, is unacceptable and unscientific.

To this I would add that there is still room for that speculation, but in a different sphere of activity. With this in mind it must be progress when 'proper' astronomy and flying saucers can appear, when appropriate, on the same page.

Peter Ford

Council Corner

A Message from the President

These are challenging times for the Association for Astronomy Education. In recent years we have seen our activities increasing and diversifying:

* Our website now offers free services such as the Query Line. It also shows a catalogue of educational resources and useful links for teachers to follow.

* Our Annual General Meetings have been well attended, now in conjunction with the British Association of Planetaria. The event typically covers an entire weekend full of interesting activities. Our presence at ASE Annual Meetings has expanded. With a lot of enthusiastic effort from our members, we have offered lectures, workshops, entire astronomy days and a well presented stand. The AAE has been represented in several TV news broadcasts in relation to recent solar activity and planetary missions.

But we have challenging times ahead.

Our efforts have not yet succeeded in stopping the decline of our membership. Clearly it is time to stop and reflect. Time to come with fresh ideas and enhanced links to other groups with similar goals to ours.

Our challenge is to use the unique opportunity brought by the spectacular discoveries about our Universe, all the way from distant and ancient galaxies and the very first stars ever, to the robotic exploration of the solar system. It will not be long now until we have conclusive evidence of primitive life beyond the Earth. It will not be long until we know about extra-solar planets similar to the Earth. Astrophysics, cosmology and astrobiology have overtaken astronomy. Our task is to find ways to bring this new and rich cultural heritage to the classroom and to the general public.

I would like to ask all our members to consider our critical situation and to make a special effort to come with ideas and help in facing this challenge.

Francisco Diego

Come to the AGM - more than just a meeting!

Once again the Association for Astronomy Education and the British Association of Planetaria will hold their Annual Meetings together. These will take place on Saturday 14th and Sunday 15th May 2005 (Social rendezvous on the Friday evening) at the world-famous Museum of Science and Industry in Manchester. Situated in the oldest passenger railway buildings in the world, the Museum tells the story of the history, science and industry of Manchester - the world's first industrial city. At the weekends, many of the exhibits are 'in steam' and have to be seen to be believed!

The museum is also the home to the reconstruction of the world's first stored program computer. The original was built at Manchester University just over 50 years ago.

Come and see how Manchester has changed but is proud of its heritage.

The diverse programme will make unique and exciting weekend. It is not too late to propose to present a poster or talk.

For more details please visit 💻 **www.aae.org.uk**

Hoaxing the Moon: new study results

As reported in the last issue of *Gnomon*, in August students from all over England gathered at Imperial College for this year's residential summer schools targeting the brightest pupils in the country. They were organised by the National Academy for Gifted and Talented Youth (NAGTY) and ExSciTec – a private company contracted to run the event – and operated under a DfES approved model.

Intense concentration on the face of one of the participants at the ROG Summer School

Along with other groups including UCL and the Faulkes Telescope Corporation, the ROG organised a two-week astronomy-based course for 15 students aged between 11 and 16.

Astronomy presents a challenge for this type of event. It is genuinely popular with large numbers of schoolchildren but is a science where getting quick results is difficult. The DfES model suggested that students investigate open questions – however astronomical ideas that can be seriously investigated in two weeks are few and far between.

Duplicating the lunar conditions to test Moon-landing hoax claims: (left to right) making the lunar landscape; the LEM in place; the Moon walk begins (note the shadows)

Our course settled on posing several questions to the pupils around the overall theme of the Moon. We asked "Did people really visit the Moon between 1969 and 1972?", "Should we send astronauts to the Moon again?" and "How would we design a lunar base?"

The part-pseudoscience theme was deliberate. We chose a topic that our students were aware of and for which they had existing prejudices. The aim was not to convert them to the 'right' view but to allow them to analyse the science to test the ideas.

For example, would the radiation in the Van Allen belts really kill astronauts travelling through them? This is a key argument used by the Moon hoax theorists and we wanted our students to develop the skills to appraise evidence and ideas. President Bush's announcement of renewed American interest in crewed exploration helped to make the subject topical.

It would be unfair not to mention our previous experience in this area – in July we ran a week-long course for Greenwich under that LEA's Higher-Order Thinking Skills Summer School (HOTSSS) scheme and in early August took 60 students from Bexley through a similar one-day event.

For the NAGTY course we set out to offer the largest possible range of activities without digressing too much from the original theme. After setting the scene, the students subdivided into different themes and used the Internet to find evidence they could test. For example, petrographic microscopes generously loaned by the University of Greenwich allowed high-end analysis of the PPARC lunar samples – with these and the assistance of a geologist (Dr Alan Longstaff – better known as a writer for *Astronomy Now*) it really is possible to see how Moon rocks differ from their terrestrial counterparts.

Videoconferencing equipment allowed the students to interview an 'expert' (Greg Smye-Rumsby is an amateur astronomer who stepped in and did an admirable job after neither PPARC nor ESA could produce anyone during August – our only real criticism of their otherwise excellent support). The first lunar images from the National Schools Observatory allowed them to test angular resolution (can you really see a lunar lander using an Earth-based telescope?) and identify possible sites for a future settlement. Dr John Griffiths (ROG freelancer and former curator of technology) took them to the Apollo 10 command module in the Science Museum. Up close, this looks an unlikely vehicle for travelling through the Earth's atmosphere, let alone the 800000 km round trip to the Moon. Finally, the BBC model maker Mat Irvine helped the students to use models to simulate the shadows and lighting from the astronauts and lunar surface. Different models demonstrated their design concept for a future colony on the Moon's surface.

After an exhausting two weeks, the students assembled their findings into reports for the British Association's Crest Award. On the last Saturday of the course they presented their work to a sizeable audience of academics, teachers, parents and the other summer school theme groups. A daunting prospect for children as young as 12 years old but on the whole something they accomplished with surprising proficiency.

Overall this was a demanding and yet rewarding fortnight for all concerned. It is encouraging to see that this work is supported at the highest levels of government – Education Minister David Milliband chose it for the launch of the Tomlinson Report – and this looks set to continue.

For more information on the summer school take a look at **www.exscitec.co.uk/moon_mission** This site was assembled by our students and without revealing the details, I thoroughly recommend the video comedy/drama the pupils created – making adults laugh through tasteful humour is no small accomplishment!

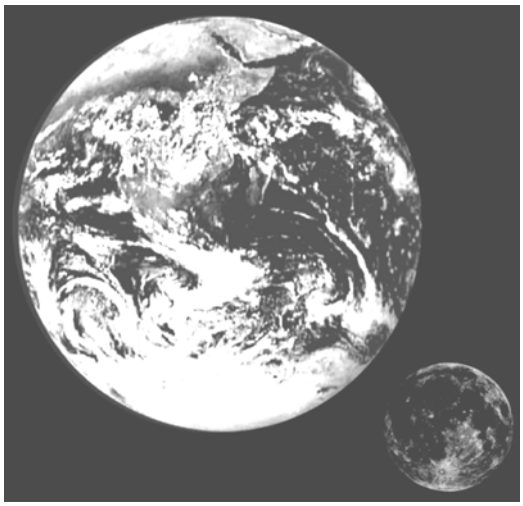
Robert Massey

Taking a shine from the Earth

The winter season, when the big, bright full Moon rides high above our heads, spare a few moments to contemplate the moonlight which always makes the winter scene so complete.

It also provides plenty of example of earthshine, the faint illumination of the Moon caused by sunlight being reflected onto the Moon by the Earth, but where there is no direct sunlight. The Earthshine is at its most obvious when the Moon is a thin waxing crescent in a reasonably dark sky, a spectacle sometimes referred to as "the old Moon cradled in the young Moon's arms" (or vice-versa).

Imagine that you were standing near the centre of the Moon's near-side at this time, somewhere in the general vicinity of the Sinus Medii (the Moon's 'Central Bay'). The Earth would appear directly above you, a huge, nearly fully illuminated blue sphere with an area some thirteen times that of the full Moon as viewed from the Earth. The full Earth lights the lunar landscape with up to sixty times as much brilliance as that due to our own full Moon. A full Earth has a visual magnitude of around -22, compared with a full Moon's -12.7.



A comparison of the relative brightness of the Earth and Moon. The difference arises from the different reflecting properties

With the naked eye, the Earthshine can be followed for several days until around the First Quarter phase, and it can be picked up again in the last quarter of the lunar month. It is best seen either in the evening skies of spring or the morning skies of autumn when the Moon is in a darkened sky. At these times the ecliptic between the Sun and crescent Moon makes a steep angle with the horizon, and the Sun is positioned well beneath the horizon, reducing twilight glow (see Sky Diary on page 7).

The brightness of the Earthshine actually varies according to a number of factors, including the Earth's phase as seen from the Moon, the reflection of sunlight from sea and land masses and the global weather conditions. The Earth's continents are more reflective than its oceans, and a cloudy globe is a good sunlight reflector. (*See footnote below.Ed.*) Anyone who regularly observes the Earthshine will soon come to notice that there are indeed times when the phenomenon seems especially prominent – so prominent, in fact, that the maria on the dark side of the Moon are clearly visible with the unaided eye.

Moonlight

Our natural satellite is a very dark object - in fact, it is one of the least reflective worlds in the entire Solar System, having an average reflectivity of just 7%. In other words, only 7 out of every 100 photons that hit the lunar surface manage to bounce back into space - the rest are absorbed by the Moon's dark surface and are re-radiated at other wavelengths. The Earth has an average reflectivity of around five times that of the Moon. Anyone who has been dazzled by a full Moon may find it difficult to believe that Moonlight's intensity is less than a burning candle placed a metre away from the observer (technically, less than 1 lux).

Most of the Moon's surface is rough and irregular, and it is largely because of the shadows thrown up by features near the lunar terminator that the brightness of the half Moon of first or last quarter phase is not one half of the full Moon's value (as might be expected) but just one ninth. If the Moon were a perfectly smooth sphere then its average reflectivity would be raised a couple of points, but nowhere near one half. The reason for this can be deduced when one begins to think about the illumination of spheres and the angle at which they are viewed – try sketching out the Earth, Moon and Sun at various phases (not necessarily to scale) and drawing in parallel rays of sunlight and their angles of reflection from the Moon to the Earth.

Peter Grego
Editor, *Popular Astronomy*
Director, SPA Lunar Section

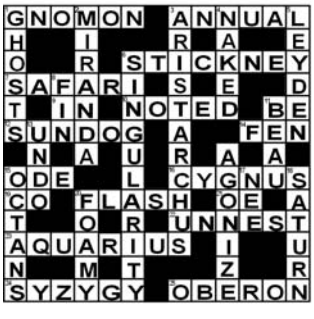
(Thanks for that Peter. With reference to the old expression about the new Moon in the old Moon's arms, it is associated with a popular piece of country lore (some would say "old wives' tale", but I'm not allowed to) that it is a sign of rain to come. From your description of the Earth as seen from the Moon, you can argue that because the Earth is brightest when covered with cloud, the cloud-cover facing the thin young Moon's crescent, when the Moon is to the west in the sky, will be over the Atlantic Ocean. Since the prevailing winds are Westerlies, the bright earthshine indicates cloud coming our way. So maybe the old folklore has a lot going for it! Ed.

Solution to the Christmas crossword

The following are some comments to help see how some of the clues were supposed to be solved. The unnumbered clue down (agonize) may have resulted in just that! Sorry! My mistake, although if I was trying to be obscure that would have done!

Across: 1.A style is a triangular gnomon, hidden in wantin**G NO MON**day, and casting a shadow. 3. "Bloomer" is a flower, but not perennial! The largest crater on Phobos (Fear) was given Asaph Hall's wife's maiden name. 7. Victor Mature, Janet Leigh 1956 film 9. Element No. 49. 10. Each of the three words can mean "noted". "Score" is the musical type. 11. Chemical symbol). 12. The parhelium, seen on a solar halo. 15. In a go**OD E**vening. 16. To travel aimlessly (= swan) in Latin (the other kind of swan). 19.All can be prefixed with "cobalt" (chemical symbol). 20. "Flash" Gordon. 21. Aenglisc is "English" in Old English, and (amazingly!) an oe is a grandchild (pronounced "oy"!) 23. A pipe is a water carrier.) 25. Anagram of "Borneo" , one of Uranus' satellites.

Down: 1. From "*A Christmas Carol"* (Dickens). Another satellite of Uranus. 3 Lunar crater 5. All come from Leiden University in the Netherlands). 8. On a fish. 13. "Cancel" and taken from So**UND O**f Music. 15. At 45° (octant) and constellation over South Pole 17. Mrs. Hall, (neé Stickney) 18. Jupiter kicked Saturn out, in mythology.



Curriculum Corner

Peter Ford was among the readers who sent in his experiences of the transit of Venus last June, and his eager anticipation of this event inspired the usual inventiveness to be able to take photographs of this once-in-a-lifetime experience. Alas it was not to be. Peter's area was one of the few that day that suffered unhelpful weather conditions. Spode really took a beating with most of us: he was obviously visiting Peter. However, the set up is a valuable example of how to carry out simple solar observation safely, so even thought the transit has faded in our consciousness a bit by now, here is his story.

I produced the rig shown in the illustrations to record June's transit of Venus. It produced a superb solar image on test, but the big day was just too hazy, despite the noble efforts of Year 8 at Skerton Community High School.

Fellow astronomy course members able to attend the celebrations at Jeremiah Horrocks's old church at Much Hoole, reported great public interest and a festive atmosphere with burgers, tea etc. for church funds. One chap could hardly get a look through his own (suitably filtered) telescope.

Another course member photographed a very good image of the transit on his bathroom door, having simply pointed his telescope out of the window. Of course, we congratulated him on his foresight in purchasing a house facing in the right direction!

In school, although our observations were unsuccessful we did a worksheet and topic involving the story of how Jeremiah Horrocks kept rushing between church and vicarage throughout the Sabbath, just catching sight of the great event with the last rays of the sunset.

The apparatus I set up was made with two tripods, masked binoculars and various odds and ends of wood and card! Here we have two views of the set-up.

I wanna go and bounce the World -

Here's a great new educational tool for homes, classrooms, sanctuaries and libraries! This 16in diameter Earth sphere is the most photographically accurate replica of planet Earth in the world.

A few years ago, I discovered an 11ft diameter, photographically accurate, spherical replica of Earth at a community festival. It was a powerful symbol of our oneness. I congratulated the artist-engineer whose company had been custom-making Earth spheres for 20 years. He felt that NASA's whole Earth images should not be wasted by being printed upon flat surfaces.

After several trial models, the Orbis Company in Washington state, USA, fulfilled the need with Earth Ball! As one young person said who saw it for the first time, "If the world is round, why do people take sides?!"

With help from Rainier Industries of Seattle, Orbis has perfected Giant spheres which soon adorned the sanctuaries of faith communities, halls of colleges and libraries, streets of great parades, convention centres, festivals and other special events.

One of the Earth spheres plays its part in an Olympic Games venue

Two 16ft diameter spheres of Earth were commissioned for the Olympic Games one outdoors and one indoors The photo shows the latter. A 20-footer filled with helium hovered over a convention recently held in Atlanta Georgia.

The Earth Ball uses digitised NASA satellite imagery printed upon an inflatable sphere to replicate continents, islands, swirling weather systems, oceans and even night time images of cities and other objects that glow in the dark. They are awe-inspiring - a realistic device that vividly illustrates our planetary "interconnectedness".

For many, they are a symbol of peace and hope. Earth Balls are enjoyed by school children, parents, teachers, librarians, environmentalists, scientists, artists and in sanctuaries, museums, centres of learning and offices. Though a "ball" by name, many hang them by a string in their office or dwelling. Each Earth Ball is inflated and tested for 24 hours before it is deflated for easy shipment.

The Orbis Company stands behind the product. An Earth Ball is inexpensive: it retails at $15, and for schools or organisations purchasing more than a dozen at a time, they have a generous wholesale opportunity. The Company can build other sizes - even one of a 100ft diameter. One-of-a-kind, giant replicas cost several thousand dollars, or they can be rented. Further information is available from: 📻 **eric#earthball.com or** 💻 **www.earthball.com**.

Gerald Elfendahl
Bainbridge Island, Washington
☎ 206-842-4164

Letter from Down Under

The Australian astronomical community has just commenced a stock-taking of where we are now, and where we wish to be in 10 years time. This "Decadal Review" process mirrors a similar one undertaken recently by the USA. The last Decadal Review in Australia was carried out in 1995 (with a mid-term review in 2001), so now is the time to again take stock, and do a bit of crystal ball gazing. The review of Australian astronomy has four main goals:

- carry out a stock-taking of its capabilities;
- assess its impact both nationally and internationally;
- provide a vision for the future;
- set priorities and develop strategies on how that vision might be implemented.

To enable this process, several working groups have been established to canvass the community's views on people (demographics, education, industry links), science (cosmology, nearby universe, stars and planets), and infrastructure (university, national, and international facilities). Each working group will hold a series of "town hall" meetings around the country so that all opinions can be heard. They will then report back to the Astronomical Society of Australia's annual scientific meeting in June, after which a comprehensive report will be written and presented to government in September.

It is interesting to look back at the previous Decadal Plan, and reflect on how quickly science changes, and how hard it can be to predict the future. Back in 1995, extra-solar planets were only a rumour, while the prospect of an accelerating Universe was not even considered. Since the "big questions" change so rapidly, the review recommended that Australia's highest priority be gaining access to the fast-growing field of 8-10 metre class optical/infrared telescopes. In particular, an opportunity was foreseen for Australia to join the European Southern Observatory, but that window soon closed. Ultimately, Australia was able to join the Gemini consortium as a 5% partner, but this has gone only partway towards meeting the needs of the community. Now we are on the verge of building 20, 30, perhaps even 100-metre optical telescopes (not to mention a radio telescope with one square kilometre of collecting area!), and once again Australia risks missing out on being a "major player" in these facilities (and the discoveries they will make) unless serious resources are committed now to joining them in the design and construction phase.

If Australia should decide that the price of being part of such an enormous and expensive enterprise as a 100-metre telescope is just too high (e.g. the closure of all smaller telescopes it has access to), then there are other options. For example, it has recently been demonstrated by a team from the University of New South Wales that under certain regimes a 2-metre class telescope on Dome C in Antarctica can outperform an 8-metre telescope at a temperate site, or even the Hubble Space Telescope. Stellar images as small as 0.2 arcsec have been measured over periods of several hours, and this was during the daytime! Indications are that conditions at "night" (which lasts for 4 months) will be even better, and much more stable.

One of the strengths of Australian astronomy is the ability of the small but diverse community to sit down together and agree on a set of priorities, even if not all of their own individual interests can be served (more than one Science Minister has commented on how unusual and forward-thinking this is for any field of science, instead of the usual set of competing proposals from within the same area). Nevertheless, the Decadal Plan must go some way towards meeting the needs of the whole community, and not just the privileged few who genuinely need access to the world's largest telescopes. Some types of science (e.g. monitoring long-term changes in magnetic fields on other stars, to better understand our own Sun) are best done with small telescopes over longer timescales. And some astronomical theoreticians aren't interested in telescopes at all – what they want most is a more powerful supercomputer, or high-speed network.

So ways need to be found to provide "all things to all people". One of the challenges that astronomy cannot overcome by itself is the increased workload on academics in universities, who make up the bulk of practicing researchers and users of national facilities like the AAT. In addition to teaching, lab supervision, and committee duties within their department, academics also must spend a great deal of time preparing research grant applications (of which only 10-20% can be funded), and supervising graduate students. All of which leaves little time for their own research and actually using all the facilities at their disposal.

Nevertheless, the next decade in astronomy promises to be just as revolutionary as the last, and Australian astronomers intend to take whatever steps are necessary to be a part of it. The Decadal Plan is just a starting point; there will still be much lobbying and negotiation to be done at ministerial level if most of it is to be put into action. But the omens are good. In the 1960s, Australian astronomy gained the Parkes radio telescope; in the 1970s, it was the AAT; and in the 1980s, the Australia Telescope Compact Array. The 1990s saw Australia join the Gemini 8-metre consortium. What will be Australia's new astronomical prize in the first decade of the 21st century? Watch this space…

Stuart Ryder

sdr#aaoepp.aao.gov.au

Sky Diary Winter 2005

Summer is icummen in, and, Oh! Those Summer nights, when twilight lasts all night! OK, so it's only astronomical twilight, but what does that mean?

If you move northwards towards the Earth's north pole in the summer - specifically, the June solstice which occurs about the 21st of the month (actually this year it happens at UT 6h 46m on that day) - you will reach a latitude where, because the Sun's extreme northerly declination results in it being separated from the North Celestial Pole by its co-declination (i.e. 66½°), and since the altitude of the celestial pole is equal in magnitude to your latitude, it follows that once you reach latitude 66½° north, the Sun will still be above the horizon, due north, at midnight.. You have reached the latitude at which the midnight sun is *just* visible at this solstice, which is the definition of the Arctic Circle.

The closer you are to that magic position, the brighter the glow of the Sun due north appears. Even from the southernmost part of the mainland UK (the Lizard Point) one can watch the twilight throughout the hours of not-quite-darkness, as moves round the northern horizon. This is the endless astronomical twilight of mid- ☞

☞ May through to mid-July. So what defines twilight? The need to increase safety on the roads as they became populated with more dangerous vehicles forced the civil authorities to switch on street lights when the ambient light levels after sunset fell to a point where drivers became more of a menace than even during the day. So there was a need for a "civil twilight".

Similarly, there came a point well after lighting up time ashore, that sailors on watch at sea needed to be able to admit with a clear conscience that they could not see the ship looming in front because it was too darned dark. So they described twilight as lasting a lot longer than car drivers were used to, and it was called "nautical twilight".

But even this was not good enough for astronomers, who needed the sky itself to be dark enough not to mask the fainter of the objects that they might be going to study, so they wanted an "astronomical twilight".

These various requirements became unified, in a way, by a definition that was adopted as follows: the three twilights would end when the Sun had dipped below the horizon (or reached a negative altitude) by 6°, 12° and 18° respectively.

The diagrams below show the Sun and planets clustered around it along the ecliptic on the evening of June 15. The view is taken from a Red Shift 4 screen showing the stars and Solar System objects immediately above and below the horizon. The sky is shown lighter in the first image, as this is near the solstice, the Sun is almost as far north in declination as it can be. Sunset was at 20:33, and though shown an hour and a half later, the Sun is only just over 9° below the horizon. So nautical twilight has still not finished, even though civil twilight ended about 30 minutes ago. The Sun's azimuth is 330°, which means it is only 30° from due north. By the time the Sun is due north (at about 13 minutes past midnight - don't forget this is the real Sun, not the Mean Sun) it's altitude is still only –14½°, so nautical twilight has ended (at about 22:40, about an hour after Civil twilight ended). However, from now on this night the Sun will start rising towards the horizon again, so Astronomical twilight lasts all night.

Moon phases for the second quarter of 2005

	New Moon	First Quarter	Full Moon	Last Quarter
April	**8**	**16**	**24**	**2**
May	**8**	**16**	**23**	**1/30**
June	**6**	**15**	**22**	**–**

The centre of England (roughly from where we are basing our figures) sees Astronomical twilight all night from mid-May to mid-July. The ecliptic cuts the northwestern horizon at a fairly shallow angle in the evening, so that though Mercury is 20° to the east of the Sun, and Venus and Saturn, which are within an arc of 6° from Mercury, are too close to the horizon at sunset to be seen. Jupiter fares better, and being fairly close to the Moon, can be seen even in the Civil twilight. The peek below the horizon in the diagrams is interesting as they show that the Sun at the northern solstice is situated in the sky immediately north of Orion, and is situated a mere 13° over his head, making the Hunter totally invisible at this time of year. The diagrams also show that at midnight, Capella is just above the north point of the horizon, making it circumpolar. I wonder if anyone has ever seen it from central England at midnight on the solstice?

Rising and setting times (UT): lat.52°N; long.3°W

	April 15		May 15		June 15	
	Rise	Set	Rise	Set	Rise	Set
Sun	05h 17m	19h 08m	04h 19m	19h 58m	03h 51m	20h 33m
Mercury	04h 46m	16h 52m	03h 53m	17h 50m	03h53m	17h 50m
Venus	05h 32m	19h 24m	04h 51m	21h 01m	04h 51m	21h 01m
Mars	03h 31m	12h 37m	02h 17m	12h 43m	00h 55m	12h 46m
Jupiter	17h 42m	05h 17m	15h 28m	03h 13m	13h 23m	01h 09m
Saturn	10h 02m	02h 21m	08h 14m	00h 30m	18h 14m	00h 30m
Uranus	04h 08m	14h 43m	02h 12m	12h 51m	02h 12m	12h 51m
Neptune	03h 22m	12h 39m	01h 24m	10h 43m	01h 24m	10h 43m

During the quarter, there are some conjunctions that may be worth the effort of getting out the camera. These include a close approach of the Moon to Jupiter on the evening of May 19, and in the early hours of June 29th close to Mars.

The red planet has begun to reach its status as a bright planet once more after its long absence round the back of the Sun. By the end of June it will have reached negative magnitude, and will be close to the First Point of Aries in the night sky. It will be prominent from this Spring for the best part of a year. Mars is one of the easiest planets to identify, once it is sufficiently bright, by its obvious red colour. It is a great planet for students and even casual observers to watch as its daily motion across the backdrop of stars is clear. It is well worth taking angular measurements of Mars (three are needed) from fixed stars to get a fix on the planet and to plot its progress across the sky. This is a satisfying experiment, that ought to be started well before the planet reaches opposition, so that its retrograde loop, or zigzag, may be discovered. The opportunity arises only after a nearly two-year wait! It would be too much to hope that this could be done with students who do not expect such a phenomenon, still less that they could then be asked to work out the reason. How many budding young Ptolemies would we find in our midst? There is still quite a bit of "Greek physics" to be found in the general public. Ask a man-in-the-street to draw the trajectory of a cannon ball!

Richard Knox