



Gnomon

Newsletter of the Association of Astronomical Education

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WINTER 2005

GCSE Astronomy is looking up!

Some readers may remember concerns expressed a few years ago regarding the future of GCSE Astronomy. This summer's examination results from Edexcel show the qualification is now in a strong position with nearly six hundred candidates, three quarters of whom gained grade C or higher.

A significant part of the substantial increase in candidates has come from the increasing popularity of GCSE Astronomy amongst secondary schools offering it to their Year 10 and 11 students. The course continues to be popular amongst its existing audience of adults and Sixth Form students.

The GCSE Astronomy syllabus covers the key ideas necessary for a clear understanding of the Earth-Moon-Sun system and the Solar System. Candidates are also introduced to the working and evolution of stars, allowing them to cover some of the key ideas in cosmology.

Students study a brief overview of the historical development of our understanding of our place within the Universe, along with the major tech-

niques being used by present-day astronomers.

As well as the inevitable examination paper at the end of the course, students also complete two pieces of practical coursework, which account for 25% of their final grade. This ensures that all students are involved in actually observing the night sky before being awarded their GCSE! Other project titles allow students to prepare Moon or star charts, build sundials and telescopes or even to produce their own computer simulations of planetary or binary star orbits.

With increasing numbers of candidates and high standards being obtained, the future for the subject at GCSE is clearly looking up!

Further information about the GCSE Astronomy qualification can be found on the Edexcel website at:

www.edexcel.org.uk

Julien King
Principal Moderator GCSE Astronomy
Edexcel Examinations



(Let's hope that the work of the AAE has been some help in reviving the fortunes of GCSE courses, and that this reflects on our membership! – Ed.)

... and on a roll at the Royal Observatory

To the outside world, the Royal Observatory Greenwich is often seen as merely a museum, although a significant minority of visitors still views it as an active research centre. But since the 1970s it has established itself as a key centre for astronomy education catering for audiences from primary children to U3A groups.

A crucial part of this work is our GCSE Astronomy course. We began this as a pilot in 1999, working with a local school as a private examination centre but mainly offering the course to adults (See *Gnomon* Vol.20. No.4). A low-key marketing campaign gave us an over-subscribed course and I was delighted to start teaching. After a successful first year, when a superb 100% of our students passed at grade C or above, we decide to raise our game.

Negotiations with the local further education college led to a franchise agreement that provides a generous subsidy, covering our costs and funding expansion to two adult classes a week. To support the observing programme, we purchased 70-mm refractors and binoculars, not to gather dust in the Observatory cupboards but for an active - and free - student loan scheme.

The government's Excellence in Cities (EiC) programme gave us



The famous Flamsteed Building of the Royal Observatory Greenwich forms the dramatic, and appropriate backdrop for the large public gathering to watch the transit of Venus (2004 June 8). See story on page 3.
© Royal Greenwich Observatory - the home of time

☞ further impetus and now brings large numbers of local school children to the observatory on a range of programmes. To put this in context, the villages of Greenwich and neighbouring Blackheath are islands of prosperity in a region with some of the worst indices for socio-economic deprivation in the UK. Greenwich borough and neighbouring Lewisham straddle the observatory grounds. A large fraction of their cosmopolitan population consists of recent arrivals to the UK who have English as a second language and who face real challenges in adapting to life in Britain. This gives the observatory an opportunity to bring students from groups that are grossly under-represented in science into contact with cutting-edge ideas in astronomy.

Mike Sheridan and Elizabeth Peasley are two of the "Gifted and Talented" co-ordinators working for the LEAs in Lewisham and Greenwich. They deserve a special mention for their help in bringing the GCSE course to schools in the two boroughs. The G and T arm of EIC now funds more than 60 students to attend Royal Observatory classes on a weekly basis, on Saturday and Sunday mornings. Remarkably, the school pupils seem enthusiastic about giving up their weekends to study astronomy, perhaps a testament to its enduring popularity.

Working with the local schools and college our astronomy educators have seen their classes expand to a total of 120 students. They deliver results well above the national average; around 75% of exam candidates achieve grades A*- C. The tutors also receive consistently good

feedback from both students and external inspectors. Students now have better access to our 28-inch telescope and our partnership with the National Schools' Observatory offers time on the Liverpool Telescope on La Palma. We've worked hard to move to electronic delivery of the course with the notes now burnt on to CD-ROMs for everyone who enrolls and the gradual development of online resources on our website ☞ www.rog.nmm.ac.uk

Perhaps it is unsurprising that students are attracted to the Royal Observatory. We have an illustrious history and offer unique access to some of the best expertise and equipment. But I believe that other science centres and educators can make this work too.

Students are pulled in to study formal qualifications in appropriate (and unusual) settings and astronomy remains hugely popular with the general public. When we opened our courtyard for the transit of Venus, over 3000 people came to see it, a success repeated by universities, science centres and community groups across the UK.

Persuading a few percent of these to study entry-level qualifications like GCSE courses would give us thousands of new students. Centres should give this course and our partnership models serious consideration - they offer a unique way to bring astronomy to new audiences, something that I hope we would all endorse.

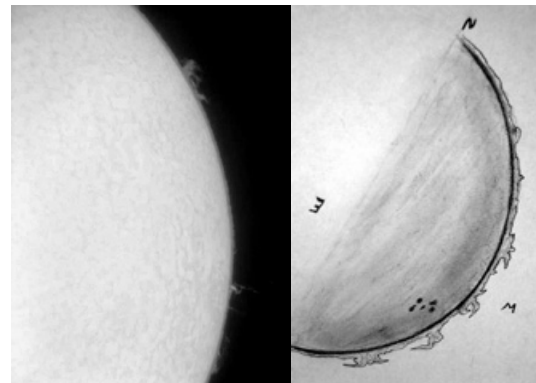
Robert Massey
Royal Greenwich Observatory

Astronomy master classes by the ROG

The summer master classes organised by the National Academy for Gifted and Talented Youth (NAGTY) and Excellence in Science and Technology (ExSciTec) runs for a couple of weeks in August and are based at Imperial College in London. Selected pupils from secondary schools all around Britain get involved in residential courses that, on this occasion covered topics from robotics to chemistry and space sciences.

Each topic was considered as a strand with a professional tutor, auxiliary teacher and mentors. The groups had around 18 pupils and were engaged in amazing activities. Most of these related to space sciences, as for example was the case of robotics, where the pupils developed an entire Martian base and a small fleet of remotely controlled Mars rovers.

In astronomy, there were three strands: *space science* (by the Faulkes telescope Group), *moon mission* (by the Royal Observatory Greenwich) and *the Sun* (University of London Observatory). Choosing the Sun as the topic gave the opportunity to do some real telescope observing in daytime. I had 16 very keen students with ages from 11 to 16 and had excellent support from a teacher and three mentors. We spent a couple of days at the University of



A photo in red light, and a drawing of the chromosphere, made by the master class students.

London Observatory where the weather was good enough for everybody to see our star and a variety of manifestations of its activity.

The students recorded sunspots and prominences by observing and digital photography through a 20cm refracting telescope and a 25cm reflecting telescope, both provided with special filters, including one that allows only a narrow band of red colour, which shows the clouds of glowing hydrogen that develop above the solar surface. There was a lot of computer work, including access to relevant web sites to gather additional information about the solar history, structure, activity and interaction with ☞

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☞ the Earth. The group was divided into four sub-groups, each of which prepared a PowerPoint Presentation which was delivered to a large audience at the end of the course.

Most of the lecture and computer work took place at the Imperial College of Science, Technology and Medicine in London, which also supplied its facilities for the last day demonstrations and presentations.

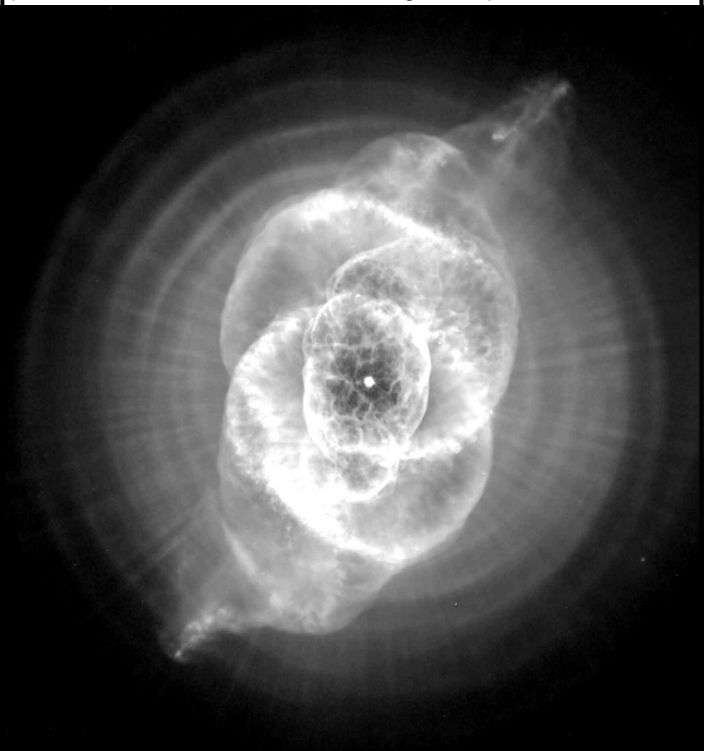
All in all this was a very rewarding experience. We felt everybody enjoyed the learning process, coming up with amazing ideas and showing a great deal of creativity. The quality of content and layout of the presentations that these young students produced in such a short time was a vivid example of quality research made accessible to a lay audience. In a couple of weeks, they became not only scientists, but also expert science communicators and astronomy educators.

Francisco Diego

Lord of the rings

Another wonderful look at detail in a familiar object that needs the HST to see properly! This shows the rings round the Cat's Eye nebula (NGC 6543), and which, it now appears, are likely to be found round most of the so-called planetary nebulae. The Cat's Eye has already reminded some people of the disembodied Eye of Sauron, The Lord of the Rings, in the three movies. The rings are thought to be associated with the last gaps of the dying star responsible for the nebula, but the way in which these concentric shells are formed is still causing heads to be scratched. There are now seen to be eleven or more concentric shells surrounding the nebula. A paper published in April this year by Romano Corradi et al from the Isaac Newton Group of Telescopes in Spain shows that the formation of the rings is likely to be the rule, rather than the exception. Images of the Cat's Eye taken by the HST over the last ten years have shown that since the nebula itself inside the rings was formed about a millennium ago it has been expanding.

(ESA, NASA, HEIC and the Hubble Heritage Team)



Help! I need somebody

Council member Eva Hans from South Tyneside College planetarium has received the following letter from Sri Lanka:

Dear Madam, we are from the Sri Lanka Planetarium and we are the only planetarium in Sri Lanka. Lot of school children from all around the country visit our planetarium every day. Lot of other students also send us letters asking for various astronomical data and information. Therefore we have decided to form an Astronomy society at the planetarium to share our knowledge among our children. For that reason we have felt the need for resources about all aspects of astronomy like history, missions, planetary data etc. As a third world country our grants are very much limited. Therefore this letter is for asking you to give us your kind participation in whatever way you can to do this task. So if you can by any means help us in this regard please do so to the following address. We greatly appreciate printed materials, photos, slides, CD/DVDs and VHS tapes. Our address is as follows:

Nalaka Abeysekera, Computer Instructor, Sri Lanka Planetarium, Stanley Wijesundara Mawatha, Colombo 7, Sri Lanka.

Thank you very much, with best regards,

Nalaka Abeysekera.

His e.mail address is ☞ webnalaka@yahoo.com – Ed.

An inspiring transit

The transit of Venus of 2004 June 8 was one of the most anticipated astronomical events of recent times. Despite the fact that transits are not very visually spectacular, they are a once-in-a-lifetime event, and provide a unique opportunity to show the motion of a planet, and how accurate observations of this event can be used to measure the distances to the Sun and Venus.

This year's transit of Venus was well-observed in Europe and Asia under good weather conditions. For 6 hours, the back disc of Venus could be seen crossing part of the solar disc. It was easily visible without optical power just using special solar filters (such as eclipse glasses) to protect the eye. But accurate timing at the ☞ to page 5

New look to Gnomon

This issue corresponds with the northern winter solstice, so it is time for seasonable greetings (see the Santa Galaxy on page 1). The AAE had to cut the costs of producing *Gnomon* so that it can remain the same value to our readers and not require a disproportionate increase in subscriptions. With the evident increase in interest in astronomy as a subject for young and old students alike, the role of the AAE becomes more important than ever, and *Gnomon* is still one of the Association's main means of contacting the membership — even in these days of instant electronic communication!

We have taken advantage of the changes in printing to make some changes to the content and layout of the newsletter: we hope you like it! But remember, it is *your* newsletter and as such a potential means for you to communicate with all the membership and several affiliates. So make use of it in 2005: send the editor your comments, beefs, success stories, anecdotes, photographs (in these days of digital cameras there should be no shortage of interesting examples), and, above all, news and practical advice for possible inclusion in future issues.

Richard Knox, Editor **3**

Aids for primary schools from Tyneside

South Tyneside College Planetarium has opened a new web site: STCPlanetarium.themoon.co.uk on which many of the interesting aids, publications and charts available from the planetarium can be seen.

As a sample, this is from a booklet produced for primary age children with the theme of games and activities connected with space. South Tyneside's Eva Hans says that the ideas are readily adaptable to other ages, and the emphasis in the design of the book is on activities using recyclable materials.

The pages shown here have just three of the 14 activities given in the booklet. Check out the web site.

 stcplanetarium.themoon.co.uk



Rings of Saturn

Materials: • Several "Hula hoops" as for waist, arms, etc.

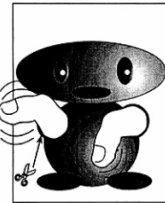
Player tries to keep first one then two hoops going.



Winner is the one who can keep most hoops in motion.

Alien Finger Puppets

Materials: • Card • Scissors
• Paint
• Decorating materials as required



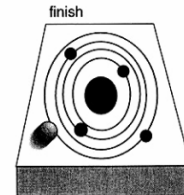
Cut the Card into A7 (74x105mm) pieces.

Each child is invited to create an alien on the card using paint, crayons, etc. Cut two holes for the fingers of the child as shown.

Joyager

Materials: • Large box lid
• Several marbles or ping pong balls

Cut holes in lid to represent Jupiter and its four biggest moons, Io, Europa, Ganymede and Callisto. Tape card under lid and paint planet and moons. Thus you have slight depression which will catch marbles.



start

The player has to roll a marble (Joyager spacecraft) across the box lid without being trapped by the gravity of the planet or moons. The marble must start and finish at opposite edges of the box lid. Any space craft going over the side is disqualified and deemed to have struck an outer moon.

Some of the clues are cryptic, and the majority of answers have an astronomical flavour in one way or another. Some of the answers may need a bit of digging! One of the astronomical calendars for 2005 reviewed on the opposite page - and an honourable mention in *Gnomon* - for the first correct solution sent by e.mail to the editor before January 12 (either as a list, or graphic copy of the grid). Don't forget your name and postal address. Good luck!

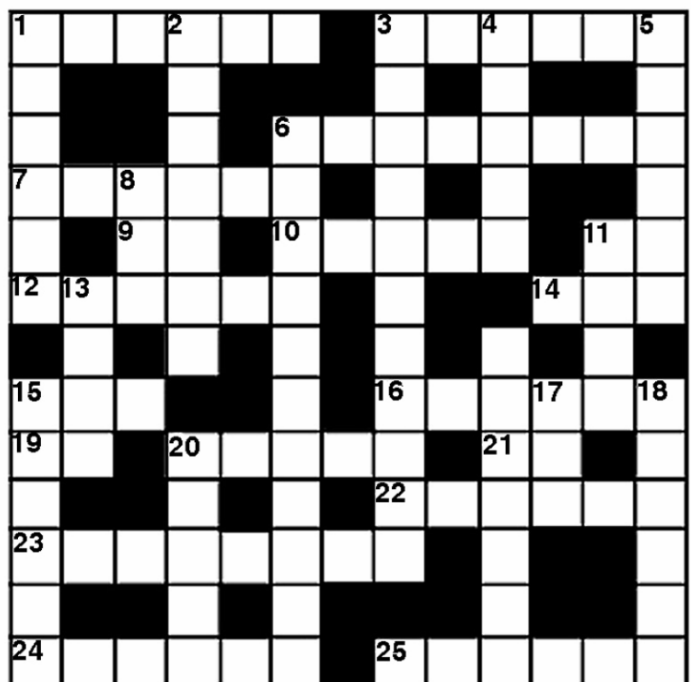
A crossword for Christmas

Across:

1. What style there is in wanting no Monday six o'clock shadow (6)
3. Bloomer won't be here next year (6)
6. Largest crater on a moon called Fear named after her. (8)
7. Star Trek? Only for Victor Mature, Janet Leigh, *et al* in 1956. (6)
9. No. 49 (2)
10. Observed famous score (5)
11. Next lightest metal (2)
12. Bright spots on the ring sounds a bright pooch! (3-3)
14. "As the sob of the breeze sweeps over the trees, and the mists lie low on the ---". (W.S. Gilbert) (3)
15. In a good evening it's poetry (3)
16. To travel aimlessly (in Latin) makes one cross (6)
19. --- blue; --- bomb; --- bloom (2)
20. Gordon's green at the end of the day (5)
21. Aenglisc (abbr.); grandchild (2)
22. "The earth on its softly spinning axle never jars enough to --- a bird or wake a child" (H.W.Warren, 1879) (6)
23. Pipe the Sun passes through?
24. Conjunction or opposition
25. Borneo would be in trouble in orbit round a giant. (6)

Down.

1. Christmas past, present and to be (6)
2. Mermaid needs 85 hours to go round (7)
3. Was a bright spot even in Samos c.300BC (11)
- 4 and 6 down. Was the Big Bang one? Barely one! (5,11)
5. Capacity in a jar, later Oort's Alma Mater (6)
6. (see 4 down)
8. Submerged propeller. (3)
11. Lovely Mr. Nash (4)
13. Cancel piece from Sound of Music. (4)
15. At 45° over South Pole? (6)
17. Mrs. Hall, --- (6 ac.). (3)
18. Deposed, by Jove! (6)
20. A good head, it seems (5)



For your Christmas Present List

Space views from the Hubble Space Telescope and Billions of light years away: the Chandra X-Ray Observatory (Scientific American 2005 Calendars. £9.99 each, incl. p. & p. Armagh Planetarium. (order by phone 028 3752 4725, or from armaghplanet.com)

The splendid astronomy calendar available from Armagh Planetarium is now not only available for your Christmas present list, but you are going to be spoiled for choice!

There are two calendars, giving you 24 (between them) different, beautifully printed and picturesque views of the universe that you are unlikely to have seen before, plus succinct explanations and background information.

The calendars are designed to hang down from the middle of one edge so that the complete spread of two 330 X 305mm pages is visible, the illustration on the top page, and a generously proportioned grid of daily spaces for the month's notes and reminders on the lower page. The calendars this year are annotated with astronomical historical anniversaries (e.g. 1962 February 20 John Glenn is first American to orbit the Earth; 1473 February 19 Nicolaus Copernicus [*sic*] born), public holidays etc. There is also a supplement giving the annual public holidays and fêtes for most of the countries of the world other than US, UK and Jewish calendar days that are included on the main pages.

The year's astronomical events (12-months of "Sky Diary") that were a feature of the 2004 and earlier years' calendars from Armagh, (produced by Astrographics) had a

more comprehensive noting of even minor, but none-the-less precious fête days - such as Guy Fawkes Day in the UK! This may be

sorely missed by some regular users, and perhaps next year Armagh can offer one of each of the Scientific American and Astrographics versions.



But either, or both of the two new publications would be perfect for a classroom display, and a great idea for your presents list - starting of course with your own!

Richard Knox

Who do you think you are kidding Mr. Murdoch



As part of the Christmas issue fun, here is a little gem that was published in the *Sunday Times* of October 31 in the Travel section. It was about holidays for those keen on

astronomy, showing where you could stay in parts of the world with clear skies, at hotels that offered telescopes etc. for guest's use. Keep this picture for practical demonstrations of how a "quality" newspaper still foists blatant fakes on its unsuspecting readership! The challenge is spot the at least three crazy errors in faking this picture.

The pull quote was "The hotel has three electronic (*sic*) telescopes which can be used to view (*sic* again) up to 68,000 stars". You have to say "Wow!" don't you? I wonder how many clear-sky-hours one would need to complete that marathon.

Sir Patrick, commenting on the same page (which of course he had not seen at the time, otherwise he would have gone into orbit) said "You don't have to go to Chile. Some of my best stargazing has been in deepest darkest Britain. Buy a solar map, take some binoculars off to your nearest field, and see what man has been marvelling at since time began". Spot the misquotes in the quote too!

☞ "An inspiring transit" (cont. from page beginning and the end of the transit was only possible by observing the image through a protected telescope. According to Dr Robert Massey, our vice-president and astronomer at the Royal Observatory Greenwich, this was on of the most successful public events seen at the ROG, where more than 3000 people enjoyed the view using a wide variety of instruments.

There were co-ordinated observing sessions in Europe, Asia and Africa, where young observers timed the event from distant locations and fed the results to web based programmes that used them to calculate the astronomical unit. Whatever the results, the experiments suc-

The improvised darkroom for observing a larger image of the Sun.

ceeded in reproducing the methods used for observations and calculations carried out more than 200 years ago. In addition, the transit demonstrated the problem of detecting extra Solar System planets when going in front of their



mother stars, the black disc of Venus in front of the Sun being the surest way of really understanding the wide difference in size between a star and a planet.

I was observing with a group in the Sinai peninsula, where weather conditions and Sun's altitude ☞ **5**

Council Corner

The AAE council meets in February and September, usually at the London Planetarium. The meetings this year have had packed agendas. In addition to the regular reports from council members, the main issues were: the need to increase membership; special astronomical events; combined Annual General Meeting (AGM) with the British Association of Planetaria (BAP); AAE presence at the ASE annual conference; our web site; the new edition of *Earth and Space*.

In recent years, we have tried to increase our membership by having a substantial presence at the annual meetings of the Association for Science Education, where we have had a proper stand and organised astronomy talks and workshops. Although we have some new members, the overall response from the attending teachers has been poor. We are working on new ideas and activities to attract more members, but we would very much welcome contributions from members as well.

Our last two Annual General Meetings have been in conjunction with the BAP and have been well attended. The programmes of activities have developed into a two-day (weekend) conference with sponsored dinners, invited speakers, planetarium demonstrations, and presentation of educational materials. In May 2003, our AGMs took place in Orkney coinciding with the (cloudy!) annular eclipse. In March 2004 our AGMs took place in Chichester, where we enjoyed the hospitality of the new South Downs Planetarium. In May 2005 we plan a joint meeting again, this time in the Museum of Science and Industry in Manchester, which has a new planetarium.

At the ASE annual conference, we are joining forces with the Royal Observatory Greenwich and the National

Schools Observatory in a larger exhibition stand. The conference takes place at the University of Leeds on 2005 January 6 - 8.

We would like to invite you to join us in these activities, and you might also consider becoming a council member to help the Association in its important work in helping to promote this wide-ranging and popular area of science and keep it in the forefront of science education. Our next meeting is on Saturday the 4th of February, 2005. Why not drop us a line!

Francisco Diego, President



The AAE stand at the last Association of Science Education meeting in Reading attracted plenty of visitors.

An inspiring transit (cont. from page 5)



Not necessarily the epitome of comfort, but very friendly and a great view of the transit was had by all. All-in-all, quite a feat, really.

were ideal. A small telescope was placed outside an improvised Bedouin style tent, which provided an environment dark enough for a large image of the solar disc to be seen by around 20 people simultaneously. A multi-region experiment was also organised in co-ordination with ExSciTec (Excellence in Science and Technology), where four schools, three in the UK and one in South Africa were involved in the observations linked live by the Internet. Overall, this was a very successful experience that left pupils and teachers inspired and motivated to explore further the roads that humanity has followed to discover little by little so many fascinating things about our Universe.

6

Francisco Diego

Meanwhile, back at the ranch

AAE members Chris Park and Alan Pickwick attended the closing event of the 'Transit of Venus' year. Held in Paris at the Ministry of Research, it brought together organisers from across Europe. Some very impressive statistics were revealed. There were 55 million hits on the VT-2004 website and 3000 groups of observers registered with the VT-2004 Observing Campaign. More than 4000 timing observations were received from which the Astronomical Unit was determined. See vt-2004.org/

Best of all for the UK, at the closing dinner in the Senate Apartments of the Palais du Luxembourg, first prize in the video competition was awarded to the Hereford Golden Valley Group, Peterchurch, for their entry *Venus Transit 2004*. Their entry was an excellent mix of children's impressions and technical detail. Based around Fairfield High School, pupils from across the Golden Valley in Herefordshire arranged to observe the Venus Transit. For their prize, the group will visit Paranal in Chile to see the Very Large Telescope.

EUROPEAN ASTRONOMY DAY

At the last session of the "Transit of Venus Experience" meeting in Paris, it was agreed that the success and momentum of the event should be capitalised upon. It was agreed that from 2006 there will be a "European Astronomy Day", with the organisation driven by the European Southern Observatory in Garching, Munich. The exact date is yet to be agreed but mid-October is likely. There will be day and night activities and clear and cloudy alternatives. The internet will be an important component of the event.

Letter from Underwood

Almost two years since the devastating firestorm which swept through Canberra, taking with it 400 homes, four lives, and much of the infrastructure of Mt Stromlo Observatory, the observatory grounds are once again open to the public. Lingered disputes regarding the insurance payout, coupled with negotiations over the heritage status of some of the burnt-out buildings, have until recently delayed demolition work and debris removal. Now that some of the last and most visible reminders of that terrible day have been cleared, the public can now see for themselves the full extent of the damage. Meanwhile, the first serious reconstruction work is about to begin.

All told, the fires destroyed the workshop complex (including an almost complete near-infrared spectrograph for the Gemini North 8-metre telescope), seven observatory residences, five of the telescopes, and the 1920s-era administration building. Excavation work has just begun for a new "Advanced Instrumentation and Technology Centre", to replace the demountable offices and temporary shed which have served as a workshop space since shortly after the fire. This building will be connected to the astronomy office buildings which survived the fire almost unscathed, bringing the astronomers and engineers closer together at last.

A duplicate of the destroyed Gemini spectrograph is almost ready to ship to Hawaii. Only one of the houses has been replaced, with a four-bedroom demountable which formerly provided accommodation for athletes and officials at the Sydney 2000 Olympics. Contracts have been signed with Electro Optic Systems Australia to construct the first replacement telescope: "SkyMapper" will be a 1.3-metre telescope, with an 8 square degree field-of-view, which will be fully automated to carry out the first digital mapping of the entire southern sky. However, due to the ever-encroaching light pollution of Canberra, SkyMapper will be located at Australian National University's other site, the Siding Spring Observatory.

What will visitors see when they come up to Mt Stromlo nowadays? For a start, the removal of the surrounding pine forest has opened up some fantastic sweeping views of south and west Canberra, including Lake Burley Griffin. The main downside to the loss of trees is that Mt Stromlo is now a much windier location than it was! Prior to the fire, the Red Belly Black café attached to the Visitor's Centre enjoyed a roaring trade as Canberra locals came up not just for the views, but also for the excellent food and catered functions inside the dome of the retired Yale-Columbia 26-inch refractor. Unfortunately, the proprietors lost even their own home in the fire, and have decided not to resume the business. Visitors can undertake a self-guided walking tour of the observatory grounds, with new sign-

boards outlining the history of each building. The shell of the 50-inch telescope makes a particularly sobering exhibit as can be seen in the photograph. The aluminium dome was super-heated in the fire and almost completely disintegrated, but not before "roasting" the telescope to the point where the support struts for the mirror cell drooped on to the mirror itself! The two CCD cameras at the prime focus, used to discover the first hints of dark matter in our Galaxy as part of the MACHO project, and once the largest arrays in the world, are missing, giving the top end a skull-like appearance. The original "Grubb Dublin 1868" plaque attached to the declination axis housing stands defiant, hinting that with yet another new mirror, tube, and mounting that the "Great Melbourne Telescope" may yet live on.

Yet another Grubb telescope, the Farnham 6-inch refractor from 1886 was about the only telescope which survived the fire intact, having sat in a dome atop the administration buildings. This telescope, and others provided by members of the Canberra Astronomical Society, will now see regular use as part of a "Saturday Night Stargazing" program, which aims to encourage visitors to the observatory at night, as well as during the day. In this way, Mt Stromlo demonstrates that it has "risen from the ashes", and in its 80th year is ready to resume its place as one of the world's premier observatories.

Stuart Ryder

 sdr#aaoepp.aao.gov.au




Vince Ford from Mt Stromlo Observatory explains to visitors what happened to the 50-inch "Great Melbourne Telescope" on the day of the bushfires. Note the warped mirror cell support struts pressing up against the mirror itself, which, although badly chipped, is still largely intact.

Sky Diary Winter 2005

The winter season in the sky has, it is frequently claimed, the best "starry sky" seen in the northern hemisphere. Most of the brightest stars, (save Vega, Deneb and Antares), are about somewhere in the evening sky, and the hours of darkness are long and deep. And cold! The most important parts of the human anatomy to keep warm are the feet and head, the extremities that have to work hardest for their energy. So if you are standing still, the feet are very vulnerable. While you may not have some convenient duckboards handy, a large flat sheet of scrap wood would be useful to stand on.

The late winter sky is still dominated by Orion, and the

mighty Hunter is prominent right through till the just beyond the end of the quarter. If you are doing a "demo" underneath the stars during these winter evenings, there is plenty that can be pointed out easily. You can start from Orion (most people will know him already anyway) and point out the three stars round his middle, known unofficially but by so many as Orion's Belt. Then you can tell your audience to imagine a line continuing Orion's Belt north-westwards (e.g., "upwards and to the right"?) and then you find an obvious V-shaped group of stars, the head of the Bull, Taurus.

Note the bright stars on diagonally opposite corners of Orion, north east (top left) Betelgeuse, and south west is Rigel. See how the line from Rigel through Betelgeuse arrives at a pair of bright stars fairly close together  **7**

☞ (Saturn has joined them for the moment – see below – and upset the obvious pairing). The stars are Castor (to the north) and Pollux, the Twins, Gemini. Later, you can challenge your students to say if these two really are “twins”. Compare their brightness (magnitude) and their colours (star classes). Do the same for Betelgeuse, and the bright star at the end of the lower arm of the V or Taurus. This is the eye of the Bull, Aldebaran. Which is redder, Betelgeuse or Aldebaran? Which is brighter?

Follow Orion’s Belt in the south-easterly direction (lower left), and you find a star always fairly low, but brighter than any other, none-the-less. This is the brightest star in the night sky, Sirius, so bright it can cast a “star-path” across a calm sea.

Extend a line straight up (north) from Rigel through Orion’s top *right* corner (Bellatrix) and at the same time imagine extensions of both arms of the V in Taurus. Where these lines cross is marked by stars of quite different magnitude that give the ends of the Bull’s horns. The northernmost of these is brighter, and looks to be part of the large lopsided pentagonal pattern that contains the bright star Capella. This can also be found by extending that line from Rigel through Bellatrix.

The five-sided constellation is Auriga, the Waggoner. The tip of the Bull’s southern horn may not be so prominent, but it is useful to be able to find it easily as it is a

the last day of the quarter, so through the period is closing increasingly rapidly with the Sun in the morning sky after its wonderful domination of the morning skies for the late autumn and early New Year.

| Rising and setting times (UT): lat.52°N; long.3°W | | | | | | |
|---|------------|---------|-------------|---------|----------|---------|
| | January 15 | | February 15 | | March 15 | |
| | Rise | Set | Rise | Set | Rise | Set |
| Sun | 08h 13m | 16h 28m | 07h 28m | 17h 24m | 06h 28m | 18h 14m |
| Mercury | 07h 12m | 14h 51m | 07h 44m | 17h 15m | 06h 44m | 20h 03m |
| Venus | 07h 09m | 14h 54m | 07h 14m | 16h 14m | 06h 32m | 17h 44m |
| Mars | 05h 28m | 13h 21m | 05h 09m | 12h 45m | 04h 33m | 12h 34m |
| Jupiter | 00h 14m | 11h 18m | 22h 09m | 09h 18m | 20h 06m | 07h 24m |
| Saturn | 16h 13m | 08h 23m | 13h 58m | 06h 15m | 12h 02m | 04h 22m |
| Uranus | 09h 53m | 20h 09m | 07h 54m | 18h 17m | 06h 07m | 16h 36m |
| Neptune | 09h 09m | 18h 16m | 07h 09m | 16h 21m | 05h 22m | 14h 36m |

Mars will reach opposition much later in the year, and will be returning from the comparative obscurity of its recent distant position. Over the quarter, Mars brightens from mag. 1.6 to 0.9, but is going south through Ophiuchus, Sagittarius and Capricorn during the quarter. The Moon passes to the south of the planet on January 7, February 5 and March 6.

On January 4 about one hour after midnight, the Moon will be 0.3° south of Jupiter, but the pair will be very low, and from the extreme west will not have risen until the Moon has increased its eastwards separation from the planet. Subsequent encounters between the two over the rest of the quarter are not so close, and take place in full daylight.

Saturn reaches opposition on January 13 and the rings are now beginning to “close” noticeably as the view from Earth moves back towards Saturn’s north pole once more. The planetary disc’s polar angular diameter at opposition just exceeds the minor axis of the rings.

Richard Knox

| Moon phases for the first quarter of 2005 | | | | |
|---|----------|---------------|-----------|--------------|
| | New Moon | First Quarter | Full Moon | Last Quarter |
| January | 10 | 17 | 25 | 3 |
| February | 8 | 16 | 24 | 2 |
| March | 10 | 17 | 25 | 3 |

wonderful location in a telescope to find the famous Crab Nebula.

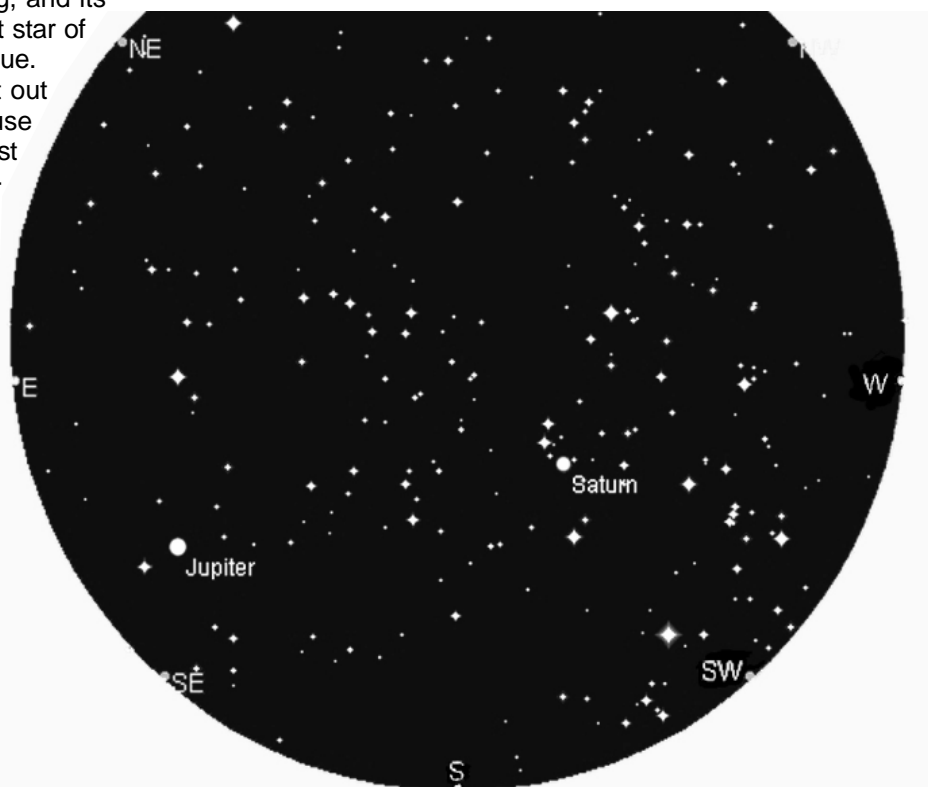
There is much to see throughout this part of the sky. The Plough is getting higher each evening, and its handle *arcs* down to Arcturus, the brightest star of the northern sky, and a wonderful reddish hue.

One final tip: there is so much to point out that, if you are not careful, you will cause information overload. Let your students digest the various parts of the sky in small morsels. After all, that’s how you did it!

Against the apparently unchanging background of the constellations, the ever-changing aspects of the planets can be carefully noted. The patterns caused by the planets among the stars also give rise to many potential photo opportunities.

Mercury makes a favourable evening apparition for northern hemisphere observers in mid-march, reaching a greatest elongation east of 18° on March 12 (see it’s setting times compared with the Sun in the planetary summary table). The Moon is 3° to the south of the planet on March 11 at 18h as they follow the setting Sun down. The Moon has a 2% phase (New Moon was March 10d 09h 10min, so at 33 hours “old” it should be a lovely bright line at about 8 o’clock from the planet. A perfect photo opportunity! Copies to *Gnomon* please as I shall not be able to take advantage of the opportunity!)

8 Venus reaches superior conjunction on



The sky at 2005 February 15d 00h 00m as seen from lat. 52°N, long. 3°W, looking south. Jupiter is now well to the south of the equator, in Virgo. Saturn is still prominent in Gemini, grouping well with α and β Gem.