GNOMON

Newsletter of the Association for Astronomy Education

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Make discoveries during the lunch break

After consultation with teachers and astronomers the Faulkes Telescope Project partners are now developing operational plans for the use of the two telescopes. Schools will be able to access them live through the website and control them directly using typical school ICT equipment (just a PC connected to the Internet).

A 'real-time' session will last 30 minutes, long enough to make important observations, but short enough to fit into a single lesson period or lunch break. Longer sessions may be available simply by scheduling two live slots back-to-back. A collaborative group of schools might decide to schedule several live sessions in this way, or spread through the day, to give a longer baseline for studying variable or moving objects.

The telescopes will be controlled via the website with infrared webcams giving live views of the telescopes so that users can watch them moving as a result of their commands. The web site will contain other useful functions to assist observers, including "guided tours" of the night sky for those new to the subject, who just want to look. (Remember that the telescopes are in Hawaii and Australia, so the entire night sky is available during daylight hours in the UK). A vast catalogue of objects will allow advanced users to go directly to any set of co-ordinates that they wish to input. The on-line information will let an observer know what is currently visible, and what cannot be seen (for example, objects too close to the Moon or the horizon).

A target can be photographed with user-selected camera options such as exposure, filters, etc. and the image will appear shortly, to be viewed and downloaded as a 300kB JPEG file. Raw image files (in FITS format) can also be downloaded from the telescope later.

The intention is to involve schools in current research projects, both of their own choosing and to help professional astronomers in existing work so that the schools will be involved in real astronomical research, and will help astronomers make real discoveries. Assisting astronomers in the UK, Australia and Hawaii with research is an important aspect of the project. The universe is a big place, and astronomers are interested in many parts of it, far too many for them to observe all the objects they are interested in on a regular basis. Schools will be looking for interesting targets, and it is hoped to combine ☛

A real cool bow tie!

The Boomerang Nebula looked like that when observed by Keith Taylor and Mike Scarrott from a ground-based telescope in Australia in 1980. The incredible improvement in detail provided by this Hubble Space Telescope image shows that it should have been called the Dicky Bow Nebula! This young planetary nebula, found in Centaurus at a distance of some 5000 light years, is most peculiar because, as observations from Chile showed in 1995, it appears to be only 1° above absolute zero, colder than the background radiation of the Big Bang! It has been formed over only 1500 years or so by shedding an estimated 0.1% of a solar mass each year. This has resulted in 500,000km/hr "winds" blowing away from the central star.

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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, thereby effectively reducing their contributions.

All communications (except those to the Editor) should be addressed to:

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The Royal Astronomical Society,
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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.

☞ the two and produce a series of project topics that are not only cutting-edge in research terms, but also educational.

Anyone wishing to help evaluate some of these materials, or become involved in the Project as a teacher or student user, or if you would be interested in a talk to teachers in your area about the project, please contact Dr. Paul Roche paul.roche@faulkes-telescope.com The project web site is www.faulkes-telescope.com

Men on Mars: read all about it!

Calling all young people with an interest in space!

Imagine the year is 2040 and you, and the rest of the world, are watching the TV images of the first humans walking on the surface of Mars. The RAS Education Committee invites school pupils to create a newspaper, or a feature article, to mark this very special day.

The Make-a-Newspaper competition is for age ranges 7-11 and 11-14 years, and the feature article competition is for age ranges 14-16 and 16-19 years. Groups, or committed individuals, may enter, but based on past experience, the RAS committee strongly recommends that the Newspaper Competition should be undertaken by groups of pupils.

For teachers, this is an excellent opportunity to forge cross-curricular links and to use the Internet and your library to search for material.

The competition closing date 2003 September 1. Please consult the full competition rules before starting work. Go to www.ras.org.uk and follow the Education Committee links, or email Alan_C_Pickwick@btinternet.com

AAE plans revised publication

The February Council meeting was at the London Planetarium. The meeting started with a one-minute silence to remember the astronauts Michael Anderson, David Brown, Kalpana Chawla, Laurel Clark, Rick Husband, William McCool, and Ilan Ramon who died on the space shuttle *Columbia*.

Plans for the ASE 2004 Annual Meeting Reading University were discussed. Other topics included the revisions proposed for *Earth and Beyond*, the AAE Secondary Schools' work pack, which is currently out of print.

Council noted that there is a new Science GCSE scheme being piloted in September this year called "Science in the 21st Century". This will have six core units, one of which contains the astronomy topics and currently entitled "Earth in the Universe".

Anne Urquhart-Potts, AAE Secretary.

Physics on stage: A European festival.

At the main event 300 teachers from more than 22 countries will meet to share ideas, experiences and to enjoy performances from biology and physics on the theme "Physics and Life".

The Festival will take place in the Netherlands in November 2003. The UK has been invited to send 30 delegates and to contribute ideas for performances, presentations and workshops. The sponsors, the European Intergovernmental Research Organisations forum (EIROforum), intend that the most exciting and inspirational teaching ideas from each nation will be shared, supporting practising teachers and demonstrating to decision-makers and the media that physics and science teaching are worth their attention.

The National Steering Committee for the UK contribution to Physics on Stage 3 is asking you to consider helping, either as a delegate or by suggesting contributors. The organisers are not just looking for physics teachers. Biology, drama, and many other disciplines are involved.

Maybe you have something in your teaching or at your school that you can take to the Netherlands in November! But hurry! The deadline for suggestions for performances, workshops and presentations is 1st April 2003.

Contact the UK co-ordinator Kerry Parker (kerry.parker@physics.org) or visit the UK PoS website www.physicsonstage.co.uk

Astronomy education still alive and well

Astronomy education is thriving at Garstang High School a Community Technology College in north Lancashire.

Science teacher Bill Myall, a dedicated amateur astronomer, has begun a GCSE Astronomy course following the Edexel syllabus, with a keen group of Key Stage 4 students taking the exam in summer 2003. The course occupies only one hour a week of formal study.

The School intends to offer GCSE Astronomy to the public as an evening course beginning in September. If this happens, I hope to become one of the first adult students! As a supply teacher, I am only on the periphery of this project (e.g. lending camera with 'B' setting and fostering interest at the younger end of the school) but I feel this bodes well for the future. Garstang High has just been awarded Technology College status and these are exciting times!

Peter Ford

Letter to the Editor

As a fairly recent member of the AAE, I thought I'd drop you a line and let you know about the destination of the copy [of *Gnomon*] sent to me. I'm a geographer by trade, and although astronomy is an interest of mine my colleagues in the Young Astronomers Group in Rivne, a city in the western Ukraine, are passionate about it.

That's where the material goes, to be read over and over by scores of astronomers and physicists who are based at the Lyceum and at the State Humanitarian University there. The value of high quality English language teaching material such as *Gnomon* can't be overstated. More so as the student scientists are all keen learners of English now that Russian has receded so significantly from the scene across Eastern and Central Europe.

Material from the newsletter and from other high quality journals such as PPARC's *Frontiers* is used as the basis for a good deal of the classroom activity and debate. I suspect that in Ukraine, where astronomy and physics occupy a more central place in the scientific curriculum, there will be a little surprise at Graham Bone's comments on our problems at Key Stage 3! [*Vol. 22, No.2* Ed.]

Indeed, for Ukrainian young people the opportunities, despite the nation's economic difficulties (a science teacher earns roughly $40 a month) are sound.

Robert Morgan

(My blushes are not spared, and I can only thank Robert on behalf of all you high-quality English-writers who contribute to Gnomon *. But I thought the brief comments highlighting the differences between western Europe, and the Ukraine were most interesting and ought to be heard by us all. You can contact the Rivne group at* rissksu@mail.rv.ukrtel.net *and I think there must be plenty of our readers who might like to do just that.* Ed.)

COMMENT

At this time of global crisis, I would like to quote part of the speech by Carl Sagan, when celebrating his 60th birthday:

I had wanted, from the time of the Saturn encounter [*the Voyager project*] to take a picture of the Earth from the most remote vantage point. But it was by no means easy, even though the downside was almost nil, to turn the cameras back, and it required an actual intervention by the NASA administration to get it done.

It was clear that in such a picture, the Earth would appear only as a single picture element, a pixel. You would not even see continents. You would not tell any detail. I still thought it would be useful to do in the same sense that the great frame-filling Apollo 17 picture of the whole Earth has become a kind of icon of our age - because it said something very powerful to us, including the fact that from that perspective, national boundaries were not in evidence.

Here it is: the Earth from Voyager I. Momentarily in a sunbeam! Take a look! From the outskirts of the planetary part of the solar system, it is a pale blue dot. That is us. That is home. That is where we are. On it, everybody you loved, everybody you knew, everybody you have ever heard of, lived out their days. The aggregate of all our joy and suffering, thousands of confident ideologists, religions, economic doctrines, every hunter and forager, every hero and coward, every creator and destroyer of civilisations, every king and peasant, every young couple in love, every hopeful child, every mother and father, every inventor and explorer, every revered teacher of morals, every corrupt politician, every superstar, every supreme leader, every saint and sinner in the history of our species, lived there.

The Earth is a very small stage in a great cosmic arena. Think of the rivers of blood spilled by all those generals and emperors, presidents and prime ministers and party leaders, so that in glory and triumph they could become the momentary masters of a corner of a dot. Think of the endless cruelties visited by the inhabitants of one part of the dot on the scarcely distinguishable inhabitants of another part of the dot. How frequent their misunderstandings. How eager they are to kill one another. How fervent their hatreds. Our posturings, our imagined self-importance, the delusion that we have some privileged position in the Universe, seem to me challenged by this point of pale light. Our planet is a lovely speck in the great enveloping cosmic dark. In our obscurity, in all this vastness, there is no hint that there is anyone who will come and save us from ourselves.

It is said that astronomy is a humbling, and I would add, character-building experience. To me, this is one of many demonstrations, through astronomy, of the folly of human conceits. To me, this picture underscores our responsibility to deal more kindly with one another and to preserve and cherish the pale blue dot. The only home we have ever known.

(from *Carl Sagan's Universe*, Cambridge University Press).

The challenge has colossal proportions. This February there were two major news topics that touch on this: the Columbia disaster and the possibility of war. In both cases, heroes would be flying at supersonic speeds, but their goals could not be more far apart from each other. It was ironic to see the same politicians mourning the lost astronauts and at the same time, planning strategies for war. But the real message came from the families of the lost hero-astronauts: the best homage to their ideals will be to continue with space exploration. Ironic too, is the increased public awareness and support for space sciences as a consequence of the Columbia disaster. We are astronomy educators, and share the responsibility of helping to realise a future as pictured by the young minds behind that forest of hands when you ask "Who would like to explore the Universe?"

Francisco Diego. President, AAE

Strike a blow for dark skies

Big things are happening on the light pollution front. It seems that the noise made during the last decade by astronomers and environmentalists is finally echoing through the corridors of power.

The Committee Office at the House of Commons announced on 2003 February 4 that a Science and Technology Select Committee has been set up to report to Parliament on "Light Pollution and Astronomy". The committee will consist of eleven MPs, and their inquiry will have the following terms of reference:

To examine the effectiveness of measures taken to reduce the impact of light pollution on astronomy and to consider what further steps, if any, are required. The Committee will consider the following specific questions:

1. What has been the impact of light pollution on UK astronomy?

2. Are current planning guidelines strong enough to protect against light pollution?

3. Are planning guidelines being applied and enforced effectively?

4. Is light measurable in such a way as to make legally enforceable regulatory controls feasible?

5. Are further controls on the design of lighting necessary?

The Committee would welcome written evidence from interested organisations and individuals addressing these points.

Readers of Gnomon are invited to submit evidence to the committee. Sources inside the Commons advise us to keep submissions brief and to the point. (Michael Heseltine once said: "If someone can't explain something to me on a sheet of A4, I don't want to read it"). Evidence must be submitted by Wednesday 2003 April 30.

Write to: Clerk of the Science and Technology Committee, House of Commons, 7 Millbank, London SW1A 0AA

Also, astronomical organisations all over Europe are writing to Margot Wallström, Commissioner for the Environment at the European Union in Brussels. They are insisting that, in the spirit of the Commission's call to save energy Europe-wide, it should require governments to promote responsible outdoor lighting, reduce energy waste, control glare, stop obtrusive light trespass, and preserve the beauty of our night skies. Anyone wishing to add their voice please write to: Margot Wallström, Commissioner for the Environment, European Union, B-1049 Brussels, Belgium.

Bob Mizon

(Ammunition for your arguments is available from Bob via the British Astronomical Association Campaign for Dark Skies. **www.dark-skies.org** - Ed.)

CURRICULUM CORNER

What keeps the Moon up?

Sir Isaac Newton, arguably the greatest scientist who ever lived, made many original discoveries which came to have profound implications on the way we understand the workings of the Universe. Newton's laws of motion and the theory of universal gravitation, first published in his *Principia* (1687), gave a logical answer to questions which had not been answered correctly for thousands of years. What compels the Moon to move around the Earth? Why does the Moon not simply fall down to the ground like an apple from a tree? Newton's brilliant scientific deductions finally put paid to ancient notions of mysterious crystal spheres to which all heavenly bodies were somehow glued; his lucid insights gave the universe a solid scientific framework rather than a blindly accepted quasi-supernatural set of explanations.

Newton's law of universal gravitation states that every particle of matter attracts every other particle with a force that depends on their combined masses and distance between them. But an apple does not appear to attract another apple on the same branch because the Earth's gravity is attracting both apples with a force billions of times greater. The mutual gravitational attraction due to the mass of the apples is there alright, but it is far too insignificant to be observed and measured.

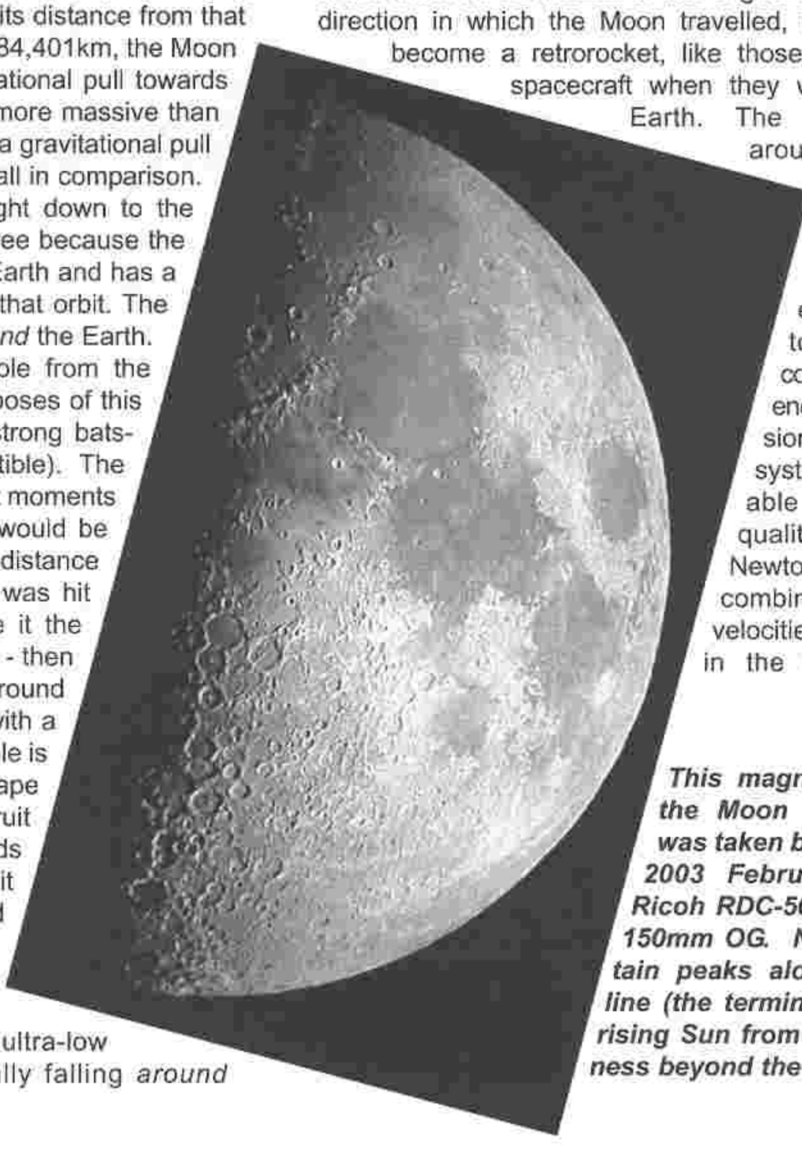
The more massive a planet, the stronger its gravitational pull will be, and the attraction experienced by a falling apple or an orbiting satellite depends on its distance from that planet. At an average distance of 384,401km, the Moon experiences a considerable gravitational pull towards the Earth, which is over 80 times more massive than the Moon. In turn, the Moon exerts a gravitational pull upon the Earth, but this is very small in comparison. The Moon doesn't plummet straight down to the Earth like an apple falling from a tree because the Moon follows an orbit around the Earth and has a high enough velocity to remain in that orbit. The Moon is falling, but it is falling *around* the Earth.

Imagine whacking a falling apple from the side with a cricket bat (for the purposes of this argument, you are an incredibly strong batsman and the apple is indestructible). The apple would land on the ground just moments later, but its path through the air would be curved and it would land at some distance from the tree. If the falling apple was hit really hard - hard enough to give it the phenomenal speed of 29,000km/hr - then the apple could assume a path around the Earth and become a satellite with a very low orbit. At this speed the apple is said to be travelling at Earth's 'escape velocity'. Our little theoretical fruit satellite would still be falling towards the Earth in a curved path but it would never hit the ground because the Earth below constantly curves away at a steeper angle than the apple's path of fall. Like the Moon, this ultra-low orbiting apple satellite is actually falling *around* the Earth.

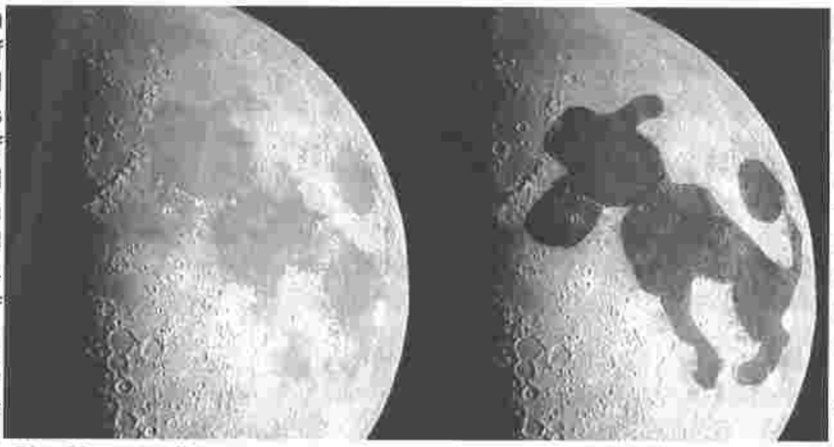
Half a century before Newton, the German astronomer Johannes Kepler (1571-1630) had.formulated a set of laws of planetary motion which stated that planets move around the Sun in elliptical orbits, and the satellites of these planets also follow elliptical orbits. Newton's theory of gravitation explained just why this was so. An ellipse is a closed curve with two focal points on its main axis; the Earth lies at one focal point of the Moon's orbital ellipse. The Moon is always in motion and always falling around the Earth in a near-circular elliptical orbit.

If you want to draw an ellipse, stick two drawing pins in a large piece of blank paper. Tie a loop of string that is, for example, about three times the length of the distance between the pins. Now put the point of a pencil in the loop and draw it tight over the two pins by moving the pencil to one side or other of the line between the pins. Keeping the loop of string tight at all times, draw the pencil round the pins till you get back to where you started. You can learn a lot about ellipses by trying different distances between the pins. When they are very close together, what you get looks like a circle, and that is roughly what the orbits of the planets are shaped like, with the Sun at one of the pins positions! Some of the mathematical properties are seen too. For example, because of the way you drew the ellipse, you should be able to see that the lengths of the two lines joining any point on an ellipse to the two foci (i.e. the pins!) add up to a constant amount.

Imagine having an incredibly powerful rocket motor - say one with a trillion horse power - attached to the leading face of the Moon. If the nozzle of this engine was pointed in the direction in which the Moon travelled, the engine would become a retrorocket, like those fired by orbiting spacecraft when they want to return to Earth. The Moon's motion around the Earth would decelerate and our satellite would begin to spiral ever-closer towards us on a course which threatened an ultimate collision.The Earth-Moon system has considerable momentum, a quality identified by Newton. It is due to the combined masses and velocities of all the bodies in the system. Newton



This magnificent image of the Moon at first quarter was taken by Peter Grego on 2003 February 9 using a Ricoh RDC-5000 digicam and 150mm OG. Note how mountain peaks along the sunrise line (the terminator) reflect the rising Sun from out of the darkness beyond the terminator.



The Moon at first quarter is an ideal time to see the "Poodle on the Moon" with the unaided eye. The shape is exaggerated by darkening in the right image. It is formed from some of the dark so-called "seas" (maria) on the Moon. The Poodle's "body" is the Sea of Tranquillity, where the first Moon landing (Apollo 11) took place.

found that momentum can be changed only if some energy is produced from it in other ways. His law of conservation of angular momentum stated that in a closed system, in this case the Earth and Moon, the total momentum remains constant. If the Earth's momentum decreases, the Moon's momentum must be increased in proportion. But the Earth's momentum *is* actually being slowly reduced. The friction of the tides in the Earth's seas acts like a giant brake on the Earth's spin. So this is gradually lengthening the Earth's day, the time it takes to turn once on its axis. Some of this "lost" energy is being transferred to the Moon by the small, but constant gravitational attraction of the tidal "bulge" which runs ahead of the Moon because the Earth spins about 30 times faster than the Moon orbits the Eaarth. So the Moon gains energy and its angular velocity increases. This serves to gradually increase the Moon's distance from the Earth. Luckily the ocean tides are not a very effective brake because Earth's days are lengthening by just over one thousandth of a second every century, and the Moon pulls away from us by about three metres in the same period. Perhaps one day, millions of years from now, the Moon will be too far away to ever appear big enough to completely cover the disc of the Sun. Then the beautiful sight of a total solar eclipse, already rare, will have become a thing of the past.

Since 1971, physicists at the CERN project near Geneva have been examining the structure and behaviour of elementary subatomic particles. The particles are generated in an experimental ring with a circumference of 27 km. Unexpectedly, they found that they had to alter the calibration of their equipment twice a day by an amount equivalent to 20 parts per million because the particles were taking fractionally longer to travel. It was concluded that the Earth's crust was stretching by one millimetre over the length of the experimental machine, in response to tides raised by the Moon in the Earth's ductile magma layer, which is beneath the surface crust.

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

Piped up north

As a result of two presentations of Pipehenge and the new Earth Space Simulator at the US National Science Teachers Association conference in San Diego there was considerable interest shown there, Eric Jackson reports.

He was invited to regional science teacher conferences, in Detroit, New York and Toronto. What teachers appreciated most about Pipehenge, Eric says, was how the astronomical observations (particularly along the ecliptic) linked with the changing seasons. These fitted the Earth Science curriculum and were easy to demonstrate and understand.

A couple of web sites that readers may like to check out are www.pipehenge.com and www.phs.mesa.k12.co.us The latter is the web site of Palisade High School, Colorado.This school has its own observatory and was the first in the United States to get a dedicated site Pipehenge.

Eric Jackson working with a group of students from the Palisade High School. Note the length of the students' shadows. Being solar noon their shadows point to the north poles (celestial and Pipe!)

Why not go to Summer School in the Austrian Alps?

The European Association for Astronomy Education is the first all-European network for teachers interested in Astronomy. Its seventh Summer School is open to all teachers who work in primary and secondary schools in European countries and will be held from 25th to 30th August 2003 at Hall in the Austrian Tyrol.

Around fifty European teachers will attend general lectures, working groups, workshops and observational sessions. Astronomers and working schoolteachers will present a wide range of astronomical and related activities of relevance to teachers, with the emphasis on the active participation of the attendees.

This will offer teachers access to specific research, to new educational materials and methods, and the chance to exchange experiences. The title of this Summer School is "Astronomy in the Mountains". There will be a maximum of 50 participants.

The Summer School is for schoolteachers interested in Astronomy even if they only have limited knowledge in this field. It is not aimed at experts.

Working languages will be English, German and Italian, but almost all of the transactions will take place in English. The closing date for registration is 2003 April 15 and the registration fee is 300 (250 for EAAE Members). Accommodation and meals from 24th to 30th August (seven nights) is in a double room, with shared bathroom in the corridor, at 231. A bank charge of 6 is also required.

For full details contact:

Alan_C_Pickwick@btinternet.com (0161 973 6796).

FOR YOUR LIBRARY

The ESA/ESO Astronomy Exercise Series; The making of GSC II - the second guide star catalogue; The Hubble Image Collection, v.3.0 *. Three CD ROMs from various sources compiled by the European Space Agency.*

These discs are all of contrasting content, but all are packed with good things, and all are free to copy for non-commercial purposes, so can be made widely available in a school, for example. Each one is briefly described below with an e.mail contact and address relevant to each.

The *Astronomical Exercise* disc would make a great preliminary tool for those thinking of joining the Faulkes Telescope Project (see page 1 in this issue). It gives the student practical observational problems to solve, such as discovering the distance to a particular star, from astronomical data presented on the disc, plus a huge amount of background information. This is a must-have for any school or college physics lab.

Hubble ESA Information Centre: **hubble@eso.org**

The *Making of the Guide Star Catalog* is a fascinating account arranged as a tutorial on the compilation of the largest list of star and deep space objects in the sky to date. It describes the many processes involved and procedures required to compile a catalog of such magnitude. The target audience is "bright final year high school students and scientifically literate public level".

Ricky Smart: **smart@to.astro.it**

The gem of the collection must be the *Hubble Image Collection vol. 3* in which some 130 of the older and familiar Hubble images are presented in an easy to browse format. There are three versions of each of the photographs of different format and resolution to suit the needs of the user, plus an appropriate web site address for further information on each one!

Hubble ESA Information Centre: **hubble@eso.org**

RK

The Moonlandings: an eyewitness account *Reginald Turnill. Foreword by Buzz Aldrin. Cambridge University Press. 465pp. Illustrations (B&W). ISBN 0 – 521 81595-9 (hardback). £19.95*

This book has a somewhat misleading title, since it is neither an "eyewitness" account, nor a book about the Moon landings alone. But you can allow for some artist's licence. From his enviable vantage point as one of the BBC correspondents closest to the action, he was one of the nearest to an eyewitness that was possible, and he has produced a wonderful account of the exploration of space by rocket-born men, women and machines.

The book covers a period of history from the V-weapons of Nazi Germany to the beginnings of international co-operation between the USA and Russia in manned spaceflight and the international space station. The "World's oldest working space correspondent" (his description, not mine) is a professional journalist of great repute, and the quality shines through in this highly personal, but none the less historically important account.

As far as the Moon landings are concerned, most of the world had forgotten about Apollo while the astronauts were still driving round the Moon (apart from the Apollo 13 cliff-hanger)! So it is fascinating to read a detailed accounts of the later missions. The author's important interview with Wehrner von Braun at the conclusion of the Apollo 17 mission, and the conclusion of the first manned Moon-landing programme, was the more poignant for the proximity of Dr. von Braun's death from cancer.

The book is well endowed with appendices such as the plans for a Mars landing and colony produced by von Braun immediately after the success of Apollo 11, complete with his illustrations of the vehicles, the orbits required to get the missions to Mars, and down to the Martian surface. There is even a little appendix to explain why there was no photograph taken of the first man on the Moon! **Richard Knox**

Out of the Blue: a 24-hour skywatcher's guide. *John Naylor. Cambridge University Press. 360pp. Full-colour illustrations. ISBN 0 521 80925 8 (hardback) £25.00*

This book is about looking up to the sky. John Naylor belongs to the happy band of people who have, from childhood looked upward with awe and wonder at the amazing number of natural phenomena visible to the understanding gaze. In this book, that understanding is presented to the reader, of age from say 8+ upwards, in a beautifully organised and effective piece of educational material.

The book covers daylight viewing and night viewing in equal measure. Daytime chapters include Daylight, Shadows, Mirages, Sunset & Sunrise, Rainbows, Coronae, and Halos. During these chapters, basic optics is brought in as necessary. Such questions as "why is the sky blue?", or "are rainbows real?" are dealt with clearly and simply.

Night-time chapters are concerned with naked eye astronomy. Basic astronomical topics such as the apparent motion of visible objects, phases of the moon, brightness, colour, twinkling, constellations and aurorae are covered, again with exceptional clarity.

This clarity is further enhanced by exquisitely designed diagrams, with a consistent colour scheme. As a bonus, the photographic illustrations are superb. The excellent index makes it suitable as a reference book, so it should be in every school and college library.

Eddie Richards

The enigma of sunspots. A story of discovery and scientific revolution *Judit Brody.. ISBN 0 – 86315-370-4. £12.99*

This delightful little book presents a comprehensive historical account of the discovery and study of the dark blotches on the Sun. It starts by considering records written by the ancient Babylonians and leads us through to twentieth century scientific understanding. However this is no dry history but a very lively story, coloured by many incidental anecdotes and set into context by insights into the theories of the day. Brody is clearly amused by Peiresc missing the transit of Mercury because he was entertaining guests and she also indulges in a little gossip about Hevelius' wife.

It took more than 200 years from the first serious observations of spots before any regularities in their appearance was detected. During this time famous astronomers of the seventeenth and eighteenth centuries quarrelled and disagreed about the nature of the spots, whether they were fixed to the Sun at all, why they changed speed as they crossed the Sun and whether they were "vapours" or smoke.

Aristotle's theories were eventually overthrown and new theories were advanced, for example Descartes' theory of the "three elements". There is material here to support the teaching of "Ideas and Evidence in Science". The book is illustrated with wonderful historical sunspot observations ☞

News from Down Under

Australia is the driest continent on Earth, after Antarctica, and as long as humans have been here, fire has been a natural part of the life cycle. Indeed, many organisms in Australia rely upon fire to help them regenerate. Sadly, Australia's most historic and prestigious astronomical observatory on Mt. Stromlo has been forced to undergo just such a re-birth.

Australia has been in the grip of an El Niño-induced drought for most of the past two years. Last summer saw Sydney ringed by major bushfires, and this year, it was the turn of northeast Victoria and the Snowy Mountains. Just after New Year, lightning strikes started a series of bushfires in the Namadgi National Park, several miles south and west of Canberra. On Friday January 17, a function was held inside the dome of the old Yale-Columbia 26-inch refractor on Mt. Stromlo to help raise funds for the volunteer bushfire brigades. The weather forecast for the weekend was ominous, with 37° temperatures and westerly winds predicted. But the fires were still a long way off, and would have to make their way across acres of plantation pine forest before posing a threat to Mt. Stromlo or the Canberra suburbs. Nevertheless, astronomer Mike Bessell took his laptop home from the observatory on Saturday morning, just as a precaution.

By 3pm on Saturday 18 January, the skies over western Canberra had darkened considerably, as the Namadgi fires grew in intensity. Suddenly, embers picked up from the fires and carried 20 miles eastwards by the updrafts started to rain down on the suburbs closest to Mt. Stromlo, including Duffy and Chapman. With almost no warning, residents were forced to flee with only the clothes on their backs. Some stayed to try and douse the embers which landed on their roofs, but it was almost futile. A freak combination of extreme heat, and violent winds generated by that heat had produced a firestorm of such intensity that trees were bent over by the wind, scorched, then left frozen in that position. On Mt. Stromlo itself, the visiting observer who had been using the 74-inch telescope the night before was woken by the stench of smoke, and rushed outside his quarters to find the mountain engulfed. Along with two other residents who stayed, he was able to save one of the dozen houses on the mountain that were home to many of the staff and students.

When the smoke began to clear the next day, western Canberra and Mt. Stromlo looked like a war zone. In all, some 400 homes were destroyed, including Mike Bessell's (who still lost his laptop). It was miraculous that not more than four people died, most of them while trying to save possessions or animals. On Mt. Stromlo, the only buildings to survive were the astronomer's office buildings (which also housed their computing equipment), and the new Visitor Centre. The 1920s-era administration block, flanked by twin domes and housing the observatory library, was completely gutted. The aluminium domes of the Yale-Columbia, as well as the 50-inch "Great Melbourne Reflector" literally melted and collapsed, bringing down the telescope tubework and optics with them. The steel dome of the 74-inch survived, but the fire found its way in through the attached control room and Coudé spectrograph room. The 74-inch reflector was essentially "roasted" inside its dome.

As tragic as the historical losses were, Stromlo's future plans rested in large part on NIFS, a new instrument scheduled to be delivered to the Gemini North telescope in Hawaii this June. Impressive progress had been made, and the instrument was undergoing final testing while its most expensive component, an infrared detector array, was held up in Customs. The fire swept through the Stromlo workshops, the roof caved in, and most of NIFS was melted inside the dewar.

Bent, but not broken, the staff of Mt. Stromlo have vowed to rebuild on the same site. The Australian National University, which funds Mt. Stromlo Observatory, has promised to re-establish observing facilities, though what sort of telescope might be built on Mt. Stromlo, as opposed to their "dark sky" site at Siding Spring Observatory, remains to be seen. The Observatory has been overwhelmed by offers of help from research institutions and individuals worldwide. Staff are already back in their offices on the mountain, and beginning work on what was to be their second instrument for Gemini, an ultra-high resolution camera for adaptive optics.

To see graphic images of the devastation caused, go to **http://www.mso.anu.edu.au/colless/StromloFire/** And please consider donating to the various bushfire relief funds, particularly those to help the students and staff who lost everything. More details are at **http://www.anu.edu.au/fires/relief.php.**

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☞ and with recent photographs. An appendix gives good instructions on how to view the Sun safely – the importance of this is driven home by several accounts of early astronomers who damaged their eyesight looking directly at the Sun.

The only modern science appears in the last two chapters where there is a brief resume of our current understanding of the physics of the solar interior and atmosphere. This is written for the layperson (no equations!) and is clear and precise.

Finally we discover that the "solar constant" is certainly not constant and so the book reviews our current efforts to link solar variation with climatic change.

This is a must for your bookshelf. You can dip into it for information on past astronomers' lives or for a jolly good bedtime read. You won't be able to put it down.

Anne Urquhart-Potts

Practical amateur astronomy *Michael Covington Cambridge University Press. Two-volume set ISBN 0 – 521 52420-2 (paperback). £39.95*

Two excellent books for the practising amateur astronomer, particularly those with the latest computer-controlled catadioptric telescopes or CCD telescope cameras.

The observing guide to the Messier marathon: a handbook and atlas. *Don Macholz. Cambridge University Press. 157pp. B&W illustrations. ISBN 0 521 80386 1 (hardback) £18.95*

Quite coincidentally it would make a very good companion to the above set, being eminently suitable for enthusiastic deep space observers who are in party mood and want to see all 103 (plus seven) Messier objects in one night! A marathon that needs careful planning, and the book tells the how, where, what with, when and even the why to tackle this marathon task. **RK**

Sky Diary Spring 2003

This quarter, or rather May, is marked by things conjunctional! In particular, three notable events will take place. The most common of these is a total eclipse of the Moon on May 16. This will be visible from all over the UK, sky conditions, as always, permitting (remember "Spode's Law"?). Totality begins in the morning twillight,however, at 03h 13min 49s when the Moon will be only 11°above the western horizon. The Moon will be well to the north of the centre of the Earth's shadow, so a bright red northern limb can be anticipated. The eclipsed Moon will have set before 04h 06min 31s when totality ends. Do not despair if you find this eclipse spoiled by the light sky: there is a much better one coming up later in the year, on November 9. More of that anon.

The New Moon following the lunar eclipse is on May 31, and it will cause an annular eclipse of the Sun. This too will be visible in the UK, from Scotland and the northern isles, but is also close to the horizon. In this case, just after, or even at sunrise, depending upon where you set up your observation site. If conditions permit a view clear down to the horizon then a rising, partially-eclipsed Sun will be seen.

Even more rare conjunctions will occur, however, in the same month. On May 7, again soon after sunrise (we *are* going to be a bunch of early risers this May!), the planet Mercury will pass across the face of the Sun.

Moon phases for the second quarter of 2003

Month	New Moon	First Quarter	Full Moon	Last Quarter
April	1	9	16	23
May	31	9	16	23
June	29	7	14	21

Transits of either of the inferior planets happen only when inferior conjunction occurs at a time when the Sun's position on the ecliptic is near one of the planet's nodes. Mercury passes through inferior conjunction every 116 days on average compared with Venus' 584 days. Mercury is also much closer to the Sun, so that, even though its orbit is inclined to the ecliptic by 7°, over twice as much as Venus' 3.4° - which gives Venus the second highest orbital inclination of any planet (worthy of the name) - the tolerance in the Sun's position to allow Mercury to line up with the Sun's disc is very much greater that needed in the case of Venus.

As a result, transits of Mercury occur about 13 times each century. Venus transits are much more infrequent, with a well-known pattern of transits at intervals of 8, 121.5, 8 and 105.5 years. The next transit of Venus, in 2004, is the first since 1882, and the next will be in 2012. Then there will be no further transits of Venus till 2117 and 2125.

In contrast, the last transit of Mercury was in 1999. First contact (to use the solar eclipse term) is at May 7d 05h 12min 56s UT. Mercury will make contact with the solar disc at a position angle of 15° (the angle around the Sun's limb clockwise from the north point). The disc of the planet will be fully against the face of the Sun within five minutes. When the black circular dot of the planet is on the point of losing contact with the Sun's limb, a spurious black "neck" appears to attach it to the limb, like the neck of a drip in the course of formation. This phenomenon, nicknamed the black drop effect, makes precise timing of the ingress difficult. Mercury will cross a northern chord over the Sun's disc, to an egress point at a position angle of about 291° at about 10h 27min 19s.

Watching the transit (and the annular eclipse) means taking all the usual precautions when observation of the Sun is involved. Eclipse glasses (the black plastic types are best) will be perfect for watching the eclipse, but not much use for the transit. A suitably mounted telescope, or powerful high quality binoculars, will be needed, using eyepiece projection to provide a large diameter image of the Sun that is safe to watch and can provide plenty of detail. Solar filters for telescopes come in two types, those that fit over the *object glass* or main aperture, and those that should be smashed with a hammer before you are tempted to put them on the eyepiece as the instructions may say you can! And do not forget the finder 'scope. That has more than enough aperture to blind you or set something on the telescope (or you) burning if you have removed the objective cover.

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 16m	19h 08m	04h 18m	19h 58m	03h 51m	20h 33m
Mercury	05h 37m	21h 13m	04h 07m	18h 35m	02h 59m	18h 36m
Venus	04h 32m	15h 56m	03h 37m	17h 24m	02h 58m	18h 57m
Mars	02h 32m	10h 32m	01h 26m	10h 09m	00h 06m	09h 32m
Jupiter	11h 37m	03h 17m	09h 49m	01h 20m	08h 13m	23h 24m
Saturn	08h 07m	00h 32m	06h 18m	22h 42m	04h 32m	20h 57m
Uranus	03h 53m	13h 58m	01h 56m	12h 05m	23h 51m	10h 04m
Neptune	03h 09m	12h 13m	01h 12m	10h 16m	23h 05m	08h 12m

Oddly, the BAA Handbook for 2003 makes no mention of the transit of Mercury. It merely notes that May 7d 07h is Mercury's inferior conjunction. Fred Espenak's eclipse web site, however, does it proud, and gives all the information you could want about all the events mentioned above, including the transits of Venus. Go to:

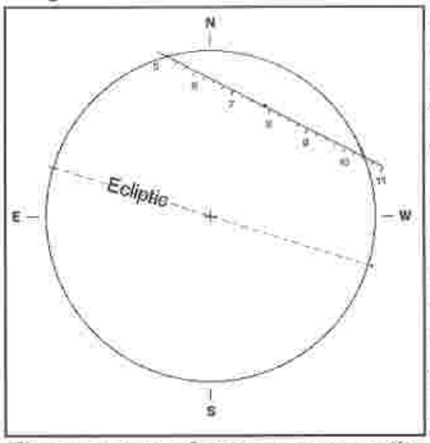
http://sunearth.gsfc.nasa.gov/eclipse/OH/transit03.html

for the Mercury transit information, and for Venus, see:

http://sunearth.gsfc.nasa.gov/eclipse/transit/venus0412.html

The other "photo opportunity" conjunctions of interest during the three months include a close approach of the Moon to Venus on May 29d 04h when the planet will pass beneath the very slim crescent of the waning Moon, missing it by less than the planet's apparent diameter. (Another early morning in May!)

June is not a good month for astronomy: twilight lasts all night, but this provides an opportunity to watch the midnight twilight move round the northern horizon, something for all those AAE and BAP members who are heading north to see the eclipse of the Sun will be able to see well.



The passage of mercury aross the Sun on May 7, marked with a time scale (UT) and the ecliptic. (Based on Fred Espenak's web site diagram - for the address, see text)

On the morning of the northern summer solstice, June 21, Venus and Mercury will be very close together, less than 24 minutes of arc, and may just be picked up in the brightening east to north-east sky just before sunrise.

The same date in June is also the best time to look for Geminid meteors. It may also be possible to do some astronomy at other than just before sunrise for a change!

Richard Knox