GNOMON

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First Light images from Faulkes Telescope

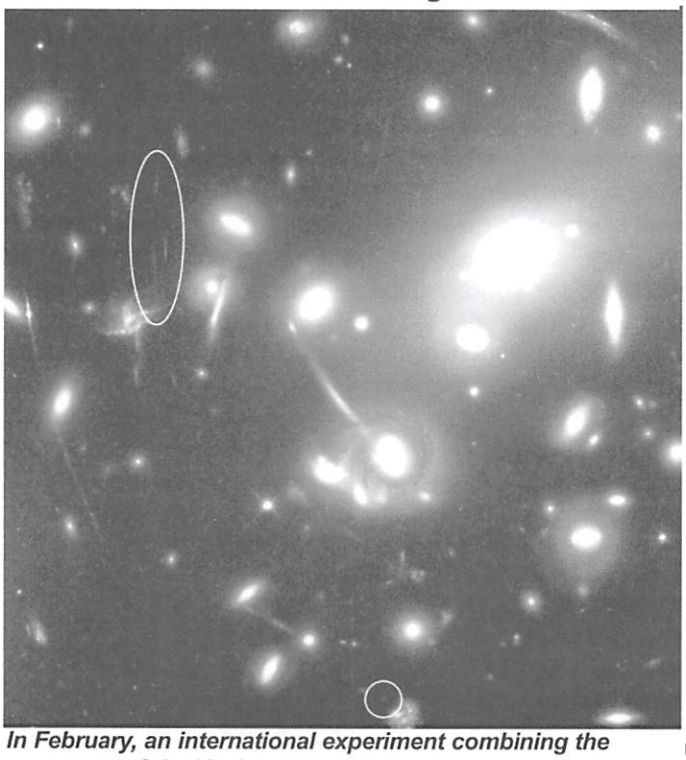
The Faulkes Telescope North in Hawaii is now well into the second phase of intensive commissioning, according to Project Manager Richard Cole. Richard has been working with assistance from Hugh Lang (Cardiff University) and Chris Mottram (Liverpool John Moores University). He says that "an exciting new phase is just beginning".

The Real Time Interface, the website that will allow users to control the telescope, has been tested and the instrument has demonstrated its ability to go into "safe" mode when bad weather sets in. Remote operations have also been carried out by staff at the Telescope Management Centre in Liverpool, proving that the telescope is well on its way to becoming fully robotic!

The Faulkes Telescope South is now mechanically complete within its enclosure at Siding Spring, and work will soon start on the electrical and optical systems. With the current timetable, the first images from the instrument in Australia will be obtained by the summer, in time for the start of the September 2004 school year. Registration has opened to the first 50 schools, and the response to date has been excellent. A development phase is now beginning where the first training and evaluation will take place.

The project has unveiled its new look website and has also set up a public e-mail group which is part of the Yahoo groups system. Anyone who has an interest in the Faulkes Telescope Project can join. The group will be used for making announcements and will also be a place where Faulkes Telescope ☞

Hubble. Keck and Nature combine in faraway look



In February, an international experiment combining the resources of the Keck and Hubble teams set a new record for finding the most distant object in the universe, a "primeval" galaxy at a distance calculated to be at 13bn light years. If this distance is correct it would put the galaxy's formation at only 750 million years after the Big Bang. The nearby (!) cluster of Abell 2218 acted as a gravitational lens amplifying the incredibly faint image of the galaxy. The object is some 2000 l.y across and is "extremely actively" forming stars. (Editor's note: the ringed sections of the photograph show parts of the "lensed" image which are very faint indeed, possibly too faint to be visible in a screened reproduction here - but the galaxy cluster is also acting as a gravitational lens to much brighter (nearer) objects also, as can be easily seen). - European Space Agency, NASA, J.-P. Kneib [Observatoire Midi-Pyrénées] and R. Ellis [Caltech]

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A 25% reduction is made for advertising in all four issues.

Publication Dates:

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

This photograph of NGC4535 was taken as part of the FT North system tests on February 19. (c) Faulkes Telescope LLC.

☞ users as well as non-users will be able to ask questions. Images taken during the commissioning phase of the North telescope can be found on the new website at

💻 **www.faulkes-telescope.com**

The latest Faulkes Telescope Project Newsletter #6 is available on the above site or from

⌨ **info@faulkes-telescope.com**

Hire Jupiter

(This item's title is a rip-off of Azimov's short story title, *Buy Jupiter*) Just a warning to anyone who may not have noticed, among the errata in this year's *BAA Handbook*:: on page 47, all Jupiter's declination values through the year are shown negative (south of the celestial equator) and of course should be north (positive), until the end of December. So, for most of the year, Jupiter is "higher".

Venus competition: read all about it

Calling all young people with an interest in astronomy! This year we celebrate the transit of Venus across the face of the Sun, first observed in 1639 in Lancashire. The Royal Astronomical Society invites school pupils to create a newspaper, or a feature article, to discuss Venus from its distant mythology to the present day.

The Newspaper Competition is for age ranges 7-11 and 11-14 years and the Feature Article Competition for age ranges 14-16 and 16-19 years. Groups or committed individuals may enter, but based on past experience, it is strongly recommend that the Newspaper Competition be undertaken by groups of pupils.

For teachers, the highly successful RAS interdisciplinary competition has been running for seven years. It is an excellent opportunity to forge cross-curricular links and to use the Internet and your library to search for material.

The competition is organised by the Education Committee of the RAS, and the closing date is 2004 September 10. 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**

Summer School for Teachers in Holland

The European Association for Astronomy Education is holding its eighth Summer School for secondary teachers from 2004 July 19 to 24 at De Glind, near Utrecht in Holland.

Around sixty European teachers will attend general lectures, working groups, workshops and observational sessions on astronomy.

The event is not aimed at experts, and the presentations will be in English.

The closing date for registration is 30th April and the approximate cost of registration and accommodation is 745. British Council support may be available.

Contact: (⌨ **Alan_C_Pickwick@btinternet.com** or ☎ 0161 973 6796) as soon as possible please.

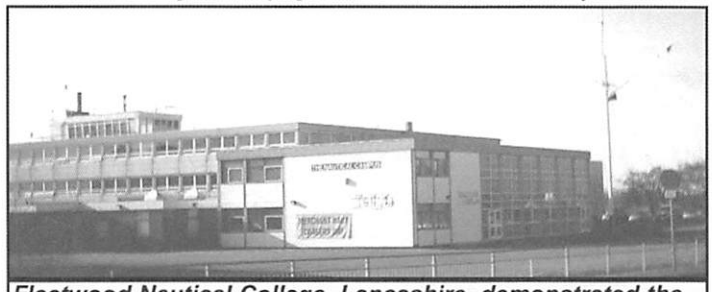
Astro-navigation still lives

Fleetwood Nautical College on Lancashire's Fylde coast trains young people for Merchant Navy careers, and navigation is an essential part of this. At their recent Open Day, on February 7, I asked lecturer Captain John Hayes about the part played by astronomy in this area of the College curriculum.

Captain Hayes, a keen amateur astronomer, told me that the Nautical Almanac, besides being essential equipment on the bridge of any ship, is also of great value to astronomers. The Almanac lists every star visible from any point at any given time for navigational or observational purposes and has been produced by astronomers for the Royal Navy since the time of Samuel Pepys.

Only 57 stars are required as the basics for navigation, based on Aries, and a Starlab planetarium is used to familiarise students with these. Up to a dozen or so students enter by lifting the edge of the dome at any point and they then sit on the floor. The longer you stay in, the more stars you see, just as under the open sky. At the Open Day space was at a premium for the many stands and exhibitions available for young people considering careers at sea.

Planets can also be used for navigation, according to their visibility. It is quite common to pick out Jupiter and Venus in daylight using a sextant, provided you know where to look. Mercury is too close to the Sun to be used in this way, but last autumn, Mars was visible in Captain Hayes's sextant during a daylight observation, a very unusual occurrence and evidence of its brightness near last year's perihelic opposition of Mars.



Fleetwood Nautical College, Lancashire, demonstrated the importance of astronomy at the recent Open Days, part of the drive to encourage young people to take up careers in the merchant navy.

I also had an interesting conversation with the Fleetwood Coastguard. It seems that a stationary flashing light, such as a buoy marking a river channel, appears ☞

☞ to jump about from side to side at night in the absence of clear reference points, giving the impression of moving lights.

Astronomy and navigation are only part of what happens at the Nautical College. On campus is the Fleetwood Offshore Survival Centre where, among other techniques, helicopter passengers learn how to escape from a sinking aircraft using a simulated cabin lowered into a tank by a crane, attended by divers! . We were made to feel welcome by smart and confident young people who know where their lives are going. Here, astronomy education is leading students directly to lifelong careers!

Peter Ford

Help the SunSHIP take off

SunSHIP is the Sun Shadow Investigation Program. In about one-half of an Earth orbit around the Sun, two seasons from now, you are encouraged to take part in a science collaboration as a participant in the global Eratosthenes Project. The Project is named in honour of Eratosthenes (275-195 B.C.) of Cyrene (now known as Libya, North Africa). Erastothenes was a scholar, and for many years was the Director of the Library of Alexandria. He made many contributions to Science and Mathematics but it was his accurate measurement of the Earth's circumference, using the differences in the Sun's altitude at two different locations that we seem to remember him mostly for.

On the day of the 2004 September Equinox it is planned that students from both the southern and northern hemispheres will measure the midday altitude of the Sun and combine this with measurements made from directly on the equator, in Quito Ecuador, to determine the circumference of the Earth, much as Eratosthenes did several centuries ago.

For additional information as the project develops please visit the project web site (still under construction) to see what was done last year at

eratosthenes-project.currentsky.com, or contact Bob Riddle at **eratosthenes-project@currentsky.com** to discuss possible participation.

FOR YOUR LIBRARY

Practical Statistics for Astronomers. J.V. Wall and C.R. Jenkins. Cambridge University Press. 277pp. Diagrams (B&W). ISBN 0 – 521 45416 6 (hardback). £55.00 (US$85.0). and ISBN 0 – 521 45616 9 (paperback). £19.99 (US$35.0)

This book is intended for self-study at advanced undergraduate or graduate level, as a reference for professional astronomers and as a textbook basis for courses in statistical methods in astronomy, so is not suitable for the majority of readers. But, as the introduction says, experimental subjects need statistical methods to interpret data, and this is intended to form a practical handbook, presenting the most relevant statistical and probabilistic methods for use in observational astronomy.

Classical parametric and non-parametric methods are covered, and there is a strong emphasis on Bayesian solutions and the importance of probability in experimental inference. Chapters cover basic probability, correlation analysis, hypothesis testing, Bayesian modelling, time series analysis, luminosity functions and clustering.

It claims to avoid the technical language of statistics while demonstrating astronomical relevance and applicability. It contains many worked examples and problems that make use of databases which are available on the Web.

RAK

Visions of the Cosmos Carolyn Collins Petersen and John C. Brandt. Cambridge University Press. 218pp. Illustrations (4-col). ISBN0-521 81898 2 (Hardback). £25.00 (US$40.00)

The Hubble Space Telescope and a whole new generation of Earth-based instruments have transformed the availability of images of the Universe, whether in the form of photographs or in the form of non optical data.

The stunning beauty and incredible variety of the objects now seen deep in space must have caused one of the most significant boosts in the general interest in astronomy since the Moon landings (but see Bob Mizon's comments on page 6 of thihs newsletter).

This book contains material produced from telescopes all over the world, very well reproduced on large pages (276 X 235mm) in full detail and colour. The reader can browse through these pages with jaw dropping ever lower for hours. All this in a very smart hardback production at a very reasonable price.

But the text throughout the book, and the order of the photographs, is a bit muddled in both the content, and sometimes the context. The authors are from the United States. One is a journalist, the other an astronomer, and this is reflected in the somewhat gee whiz style of the principal writer, who is clearly the journalist. Here are some samples:

"Telescopes are in some ways like time machines .."

"The earliest known observatories are little more than stone constructs (*sic*) like Stonehenge in England . . "

"the universe was not slowing down, but was, in fact, speeding up . . "

"Uranus literally rolls around on its side as it orbits the Sun."

The writer of astronomy books should not always write as if it were a learned paper (perhaps the writers of learned papers should not either!) but in making a science subject readable it important not to become too glib and use sloppy expressions such as these.

Popular accounts that aim to pack all modern astronomy, cosmogony and cosmology into, in this case, about half of the 193 pages of narrative not taken up with illustrations, can get into difficulties when dealing with the very latest ideas. It is not usually long these days before the latest theories have to be modified, sometimes out of recognition. Astronomy authors have a duty to their subject and to the readers to make clear what is well-established and what is a new, but still contested theory, and what is highly speculative. As Sir Patrick Moore has so often said " . . . there is still a great deal we do not know!".

But what illustrations! It is worth getting the book for these alone. Figure 2.7d intrigues me very much. One of the Mauna Kea observatory domes is shown in a long time exposure to capture the dramatic swirl of yellow and red lights from the rear of a vehicle passing up the mountain and round behind the dome. The background stars of Crux, Centaurus, Carina and the Milky Way shine brilliantly in the sky behind the dome, showing the Coal Sack and the Eta Carinae nebula very clearly, and showing stars easily fainter than magnitude 6, all without the slightest hint of trailing. [Cue *Twilight Zone* music!]

RAK

Throughout my astronomy career, supernovae and I have had something of a love-hate relationship. I never set out to study them: I was always more fascinated with the processes of star birth, than with the manner of their self-destruction. Given that the process of forming even one star can take hundreds to thousands of years however, there is something appealing about an object whose brightness and spectrum changes from one night to the next. And sometimes, they do something completely unexpected.

First though, a confession. Of the three photographs which unwittingly captured Supernova 1987A before its discovery by Ian Shelton, Oscar Duhalde, and Albert Jones some 17 years ago, one of them was taken by me.

I was still an amateur astronomer then, trying out some of the new Konica ASA3200 film with the Dunedin Astronomical Society's 30cm reflector. Among the objects I photographed on the night of Feb 23 1987 was the Tarantula Nebula in the Large Magellanic Cloud. In the corner of the image is an innocuous 6th magnitude star, which I realised to my horror some days later was on its way to becoming the first naked-eye supernova in almost 400 years. As inspirational as this event was, I could never help thinking that I had missed a golden opportunity. Score 1 to the supernovae, nothing to me.

It took another 6 years before I was able to even the score. Even then, I had to resort to dredging up a historical supernova which had been overlooked by others. In mid-1978, a supernova burst forth unnoticed in the nearby barred spiral galaxy NGC 1313 (now there's an auspicious number!). It was also unwittingly captured on film by Alan Sandage with the Las Campanas 2.5m telescope, and later published in his "NASA Atlas of Galaxies", but still no-one noticed. It wasn't until I gathered together a lot of key data from optical, radio, and X-ray observatories in the course of doing my PhD thesis that I finally realised what it was. Thus, Supernova 1978K in NGC 1313 received belated recognition, and I had finally laid to rest the ghost of SN 1987A.

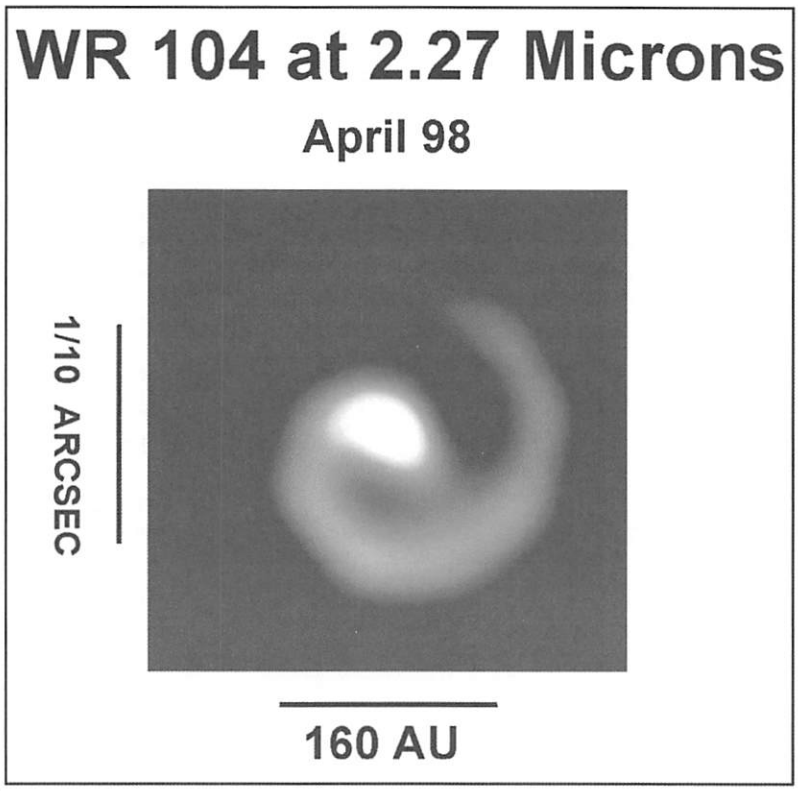
That is until SN 1998cf in NGC 3504. I had taken some images of this galaxy using the United Kingdom Infrared Telescope (UKIRT) in Hawaii on Apr 23 1998, but again neglected to do a thorough check for anything out of place. Indeed, it was not until the end of May when an astronomer using the Canada-France-Hawaii Telescope finally noticed it and alerted the International Astronomical Union's Central Bureau for Astronomical Telegrams. Another one had slipped through my fingers!

It wasn't until late 2001 that I was able to make up for that oversight. On Dec 15, I was "Duty Astronomer" at the Australia Telescope Compact Array when I was asked to check out SN 2001ig, the latest discovery by the prolific Rev. Robert Evans. We already knew this one was a little weirder than most. Supernovae come in two flavours: those which show evidence of hydrogen in their spectra (Type II), and those that don't (Type I).

SN 2001ig started out looking like a Type II, but within weeks the hydrogen disappeared, and it transformed itself into a Type I. What could have happened? There was speculation that the star which exploded must have puffed off most of its outer hydrogen atmosphere in a last-ditch, futile attempt to stave off gravitational collapse. If so, then as the supernova blast wave caught up with and slammed into this material, it should become a bright radio and X-ray source.

Indeed it did, and for the past 2 years we have been monitoring its radio brightness, to see if we can glean more clues about its nature. The radio "light curve" of most supernovae reaches a peak a few weeks to months after the explosion, then slowly but steadily fades into obscurity. But SN 2001ig once more did not do what it was supposed to. Instead, there were bumps and dips in its radio brightness, which seem to recur about every 150 days. Perhaps the progenitor of SN 2001ig ejected "shells" of gas, instead of a regular stellar wind? But the timescale for such pulsations just does not seem right.

Another possibility is that SN 2001ig was not one, but two massive stars orbiting each other in an intricate dance, with the companion star occasionally stripping gas off the progenitor star. As the gas is pulled outwards, it is wrapped into a spiral, like water from a lawn sprinkler. What might such a system look like?



WR 140, imaged using a special technique called aperture masking interferometry on the Keck 10m-telescope by Peter Tuthill at the University of Sydney

The figure shows one such star called WR 140, imaged using a special technique called aperture masking interferometry on the Keck 10m-telescope by Peter Tuthill at the University of Sydney. Sadly, SN 2001ig may have heralded the destruction of one of these wonderful "pinwheel" nebulae.

So my habit of being in the right place at the wrong (right?) time has seen me miss two supernovae completely, but also conduct some exciting research into what happens when stars die. Supernovae could be called "time machines", which, as the blast wave sweeps outwards, allow us to run back the clock of time, and replay the last, dramatic days of their lives.

CURRICULUM CORNER

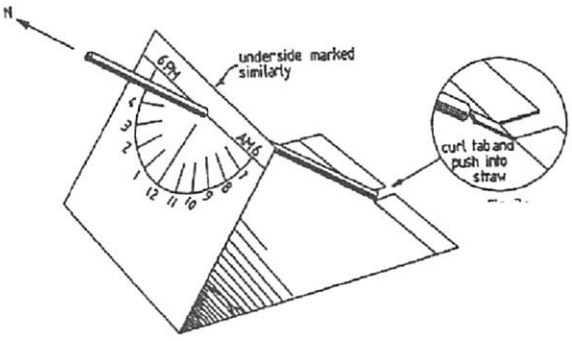
Ingenious sundial projects to demonstrate the principles of a sundial and ensure that you end up with a sundial which tells accurate time by the Sun are given on the British Sundial Society website on this page:

www.sundials.co.uk/projects.htm. This is well worth a visit for a wealth of practical projects in gnomonics, and the home page gives a wide-ranging spectrum of sundial activity, including special services for teachers, and an order form for the Society's book *Make a Sundial* . This site gives all the information you could want on sundials, but also refers you to many other internet sites. A veritable gnomonic Google!

The projects include an equatorial dial, two different horizontal sundials, a diptych dial and an equi-angular dial. All are copiously illustrated. The sample here is project no.3 in the Society's book. It shows how to make the most important of sundials, an equatorial dial, from a piece of card and a drinking straw, or knitting needle. Apart from a protractor, that is about all you need! The dial plate has 15° angles marked on it, and is mounted parallel to the equator. The straw forms the gnomon parallel to the earth's axis.

To ensure this, the angle of the gnomon must equal your latitude, which can be arranged by working out the appropriate dimensions of the model, so that, for example, the noon line extended down the dial to the base divided by the distance of the base of the straw to the fold of the card is the sine of the latitude. Since the Sun appears to revolve round the Earth's axis once every day, it will revolve around the straw at one 15° interval every hour.

The instructions also include simple experiments, or demonstrations, such as why an ordinary garden sundial can't have equally spaced 15° intervals marked around the dial, but the equatorial dial allows you to see why any dial position other than the one in this type of sundial, will result in the distortion of the hour line angles. **RAK**



Making a simple equatorial sundial demonstrates not only some gnomonics, but also simple trigonometry!

Celestial pole demonstration during the daytime

In January last year I attended an international camping conference in Melbourne, did some daytime astronomy sessions and demonstrated the portable Pipehenge.

Several members on the American Camping Association executive were there. One evening I did a nightsky viewing session to show the northern hemisphere attendees some southern hemisphere constellations, including the Southern Cross. The upshot of all this is that I was invited to do sessions at the American Camping Conference next month in San Francisco.

Because of the high costs for just a few days, I instead wrote an article on daytime astronomy for their bi-monthly magazine that goes out to 8000 camps across North America. They were so pleased with it that it is now to be their feature article and accompanied with photos, one on the front cover and reproduced in greyscale here. The three children are looking to the Celestial Pole (NCP in the northern hemisphere) using three forms of viewing. A telescope (an 18in Dobsonian telescope handmade by an amateur), binoculars, and eyes.

Looking towards the celestial pole in full daylight, using different optical methods is good practice for later use at night. In the northern hemisphere, there is a conveniently situated "pole star" that can be found in the night sky as shown by the girl

The photo illustrates that unaided viewing, using our eyes, is the best way to start. The girl has made a circle around her eyes and nose by touching the tips of her thumbs and fingers together. She then does this again at night, aligned along the direction of a shadow marked on the ground at true.solar noon. This points to the true north pole and was recorded earlier in the day at the time found by dividing in two the total time the Sun is in the sky locally, which can be found from the local sunrise and sunset times for that date.

Looking through this hand-made circular "frame" she will find Polaris in the centre , the Little Dipper around the inside of the circle and the Big Dipper and Cassiopeia around the outside.

Eric Jackson
jacksone.j@xtra.co.nz

Astronomy? Nothing to do with me . . .

A riposte to those who see astronomers as a race apart, and believe that our science has little to do with their lives

One of the more frustrating aspects of being amateur astronomers, even when we are not being confused with astrologers (my postman asked me if I did "readings" the other day), is the frequent assumption by many non-astronomers that we are a race apart from "normal" beings (whatever they might be).

To some, our particular craft or science, whatever you like to call it, is an alien and irrelevant body of knowledge pursued in the dead of night while others sleep, and we are seen as eccentrics, as curiosities who know a lot about things that don't really impinge on everyday life. Surely all that stuff up there has little in common with what goes on down here.

Perhaps it's time to set the record straight. Astronomy is the science of everything. Just about every atom in every material object around us was made inside a star. We have all no doubt heard that the various elements that make up our own bodies and are vital to their functioning can be reduced to a large puddle of water, an assortment of nails, match-heads, sticks of chalk and the like. But few of us ask ourselves where they came from in the first place. We are made of star-stuff, as are the things around us and the planet we stand on.

The calcium in our bones, the iron that colours our blood, the nitrogen in our DNA, the various elements that facilitate the electrical activity in our brains and the intricate interplay of our organs, all were cooked up, built from lesser atoms, in the interiors of old, collapsing stars billions of years ago. Many of those stars are now white dwarfs, invisible to the largest telescopes, swept into the distant reaches of the giant Milky Way galaxy by its majestic 200-million-year rotation.

Further back still, at the very beginning of time, all the hydrogen that now makes up most of the Universe and, as a component of water, a large proportion of the bodies of living creatures, was formed in the Big Bang, the stupendous explosion which kick-started the cosmos as we know it today. The faint background hiss that is the echo of this event of 15-20 billion years ago is still detected by sensitive radio telescopes.

MORTAL REMAINS

Whatever is left of our long-departed bodies in, on or around this planet when it finally ceases to exist, vaporised by the dying, swelling Sun in a few billion years from now, will be redistributed into the clouds of dust and gas which swirl within our Galaxy. Indeed, most of our atoms may already have been recycled through planetary systems more than once, and some may even have been part of other living organisms on distant planets in the dim past.

So the stars in the sky are certainly part of our lives in a very wide and real sense. Though they remain a symbol of remoteness, they are massively relevant to our being. In what other ways does the cosmos outside the Earth intrude into our everyday existence?

The Sun, our neighbourhood star, keeps us alive every second of the day and night, and powers our every action and thought, by growing our food. It warms and circulates Earth's air so that we do not freeze to death at night, and provides our motive power as we use the sunshine energy stored millions of years ago in the fossil fuels we burn.

Other stars, having created the basic elements from which our planet and its biomass are made, have also forged atoms heavier than those of iron, for example gold and uranium. These are made in the immense "cookers" of supernova explosions, when giant stars explode at the end of their lives. Because these events are rare, the heavy elements they add to the cosmos are rare, and are therefore expensive and sought after. It is an interesting fact that all the gold in the world, mined and unmined, would form a cube about 17 metres on a side. So, the relative abundance and value of the commodities around us are determined by their stellar origins.

THANKS TO THE MOON

The Moon has, over millions of years, allowed life not only to function at night, but may well have been instrumental in bringing life out of the sea and onto the land. Creatures evolved to live on the land via an amphibian stage, and the tides caused by the Moon provided a wet-dry-wet area where they could survive in this mode. If the Earth had had no Moon, would we all be clever fish? Our only natural satellite, especially when full, does seem to have an effect upon certain susceptible people (hence "lunacy"), although the causes are little understood. Many creatures regulate their behaviour, especially in breeding and egg-laying, according to the full Moon, and the human menstrual cycle's mimicking of the Moon's cycle may be no coincidence.

Perhaps the most important contribution of the far universe to our evolution is the fact that genetic mutations, which drive natural selection, are incessantly being triggered by the impacts on living cells of high-energy cosmic rays. These originate in supernova explosions, so it is an ironic fact that the progress of life on Earth is driven partly by the deaths of distant, supermassive stars.

On a more mundane note, our clocks and calendars are set by the motions of heavenly bodies. A day is one rotation of the Earth, and the position of the Sun sets the time: when the Sun is at its highest over your time zone, it is midday. Months are "moonths", time periods based on the changing phases of the Moon. Why are there 24 hours in a day, and 60 seconds in a minute? The ancient Babylonians had a base-12 counting system, and divided the sky, time and angular surfaces accordingly - hence the twelve houses of the Zodiac. Why are there seven days in a week? They are the days of the seven naked-eye bodies (gods and goddesses) which move around in the sky against the starry background: Sun (Sunday), Moon (Monday), Mercury (French: mercredi), Venus (French: vendredi), Mars (French: mardi), Jupiter (French: jeudi) and Saturn (Saturday). When is Easter Sunday? It is the first Sunday after the first full Moon following the vernal equinox (the moment in spring when the Sun crosses the equator of the sky in its apparent annual journey through the stars).

Last, but by no means least, is the part the starry night sky has played in human culture, science and religion. Our faculty of wonder was stimulated during the dark nights of millions of years by the apparently unknowable vault of stars above, and the human love of research may stem from our aching need to understand such natural wonders which long ago seemed beyond our reach. Astronomy, developed from astrology, and was already 2000 years old when physics and mathematics flowered. In its modern form, it embraces most other scientific disciplines, and overflows into philosophy and theology. The apparently unchanging cosmos was long ago compared with the

corruptible and ever-changing Earth below, and appropriate conclusions were drawn about the perfection of the Gods and the fallibility of humankind.

There is of course one overwhelming reason why many people feel cut off from the rest of the universe, and why a generation is growing up assuming that the Earth is all that exists: a dangerous vanity. One of the saddest manifestations of the damage which human technical progress can do to the environment, and indirectly to the human spirit, is the slow eradication of the visibility of the night sky to modern people because of light pollution. Lighting schemes in urban areas, and unregulated lights in rural areas, throw light into the night sky and take away the stars. The current and completely unproven belief that very bright lights deter criminals, and the lack of any regulation or law about light spill and intensity, mean that most people nowadays see little of the rest of the Universe. Michael Crichton wrote in his autobiographical work*: The natural world, our traditional source of direct insights, is rapidly disappearing. Modern city-dwellers cannot even see the stars at night. This humbling reminder of Man's place in the scheme of things, which human beings once saw every twenty-four hours, is denied them. It's no wonder that people lose their bearings, that they lose track of who they really are, and what their lives are really about".

Bob Mizon
(Coordinator of the British Astronomical Association's Campaign for Dark Skies 💻 **www.dark-skies.org**)

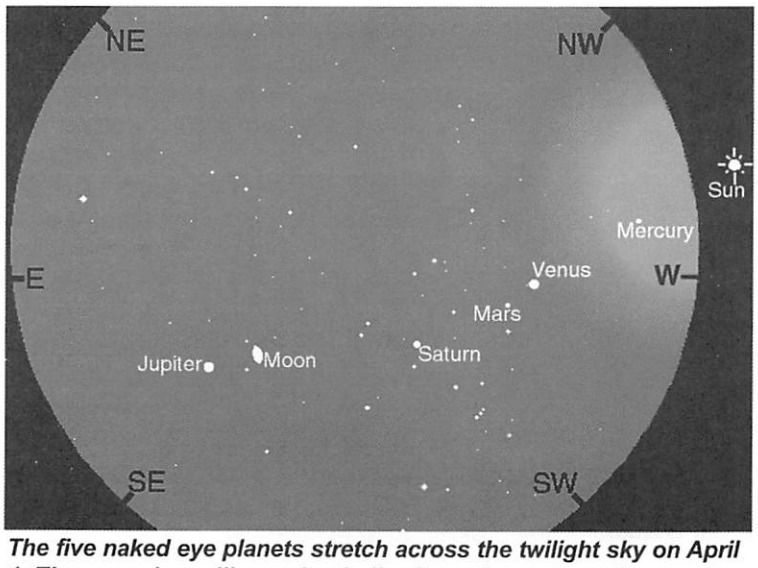
** Michael Crichton, Travels (Pan/Macmillan, 1988. ISBN 0-330-30126-8)*

Sky Diary Spring 2004

The diagram shows a large chunk of the sky just at the end of Civil Twilight on April1 (I promise this is not a leg-pull!). Mercury will be almost at maximum eastern elongation and is making its most favourable evening appearance for 2004 around the few days at the end of March and beginning of April. It is most favourable because the ecliptic (and hence the Zodiac) is inclined steeply across the western horizon after sunset in the early spring of the northern hemisphere. So this is a good time to look out for otherwise difficult objects such as Mercury or the very young crescent Moon. Sometimes, when the moments of conjunction and the time of moonset are favourable at this time of the year, one may spot the pale thin curved line of the Moon, like a closing parenthesis -), only hours after new Moon. The evening of May 19 would be the best bet this year, when the Moon will be just over sixteen hours since New, and sets about 45 minutes after the Sun.

In addition to Mercury, all the other naked eye planets are in the sky at the same time. (I don't count Uranus as a naked eye planet, even though I have watched it over the weeks crossing the night sky on an occasion when it was in a sparsely populated part of the Heavens).

Unlike the five-planet line up in May 2002 (see photo in *Gnomon* vol. 21 no.4) on this occasion all the planets were close enough to each other to include on one photograph. This April 1 they will be spread across 130° of the ecliptic from Mercury, just north of west, to Jupiter in the south-east. Mars, now fading markedly, will be at magnitude 1.5, not easy to see in a twilight sky. Look first for Saturn, using the line of the ecliptic from Venus towards the Moon. Then Mars may be found one third of the angle from Venus to Saturn.



The five naked eye planets stretch across the twilight sky on April 1. The grouping will remain similar for a day or two afterwards

There will be a total eclipse of the Moon on May 4, but it is not best seen from the UK, as totality begins just after the Moon rises in eastern England with plenty of twilight still in the sky. Totality ends when the Sun's altitude is about 11° below the horizon, so nautical twilight is almost ending. It will be quite a challenge to see if you can find the Moon at Moonrise, or before totality ends!

The Moon will occult Venus on May 21, during daylight hours. Finding Venus in full daylight is not too difficult with a bit of practice and reasonably clear conditions, but it must be done systematically. The same applies for the very young Moon when high in the daylight sky. The Moon will be only two days since New, and the phase 4%, with the Moon only 25° east of the Sun. So the Moon's very slim crescent will hardly be an easy target, and there is a high potential hazard for anyone scanning the sky with binoculars or telescope of getting the Sun in the field of view.

If a careful scan in about the right area doesn't bear fruit, and you have an instrument on an equatorial mount, you could try the following procedure. Find the Sun in your binoculars or telescope by projecting its image onto a screen of some sort (just a piece paper would do). This could be from the finder, or the main eyepiece. This is the only safe way to inspect the Sun by optical means for most people, and any temptation to take a quick peep through the eyepiece must be resisted at all times. Then carefully move the instrument eastwards by 25°, without changing the declination.

You must then turn the instrument carefully north on the declination axis by just over 6°, and that should find the Moon. If you have no such refinements, or are using an alt-azimuth mount, find the Sun by eyepiece projection as described at 9h 13m UT (don't forget to add the hour for BST to all quoted times) and fix the telescope in that position. At 11:00 carefully tilt the telescope as close as you can judge 6° upwards, and then the Moon should be in your field of view, or very nearly. After that, you will just have to keep tracking it till the occultation is over. If you have a computer controlled 10-inch Meade or Celestron etc., then just tell it what to do!

Venus will also appear as a large, but slim crescent, the phase being only 9%. The angular diameter will be almost 50". It will disappear behind the Moon's dark limb at 11:09.9 UT, to reappear from behind the illuminated crescent at 12:19.6 UT.

Two comets, designated C2001 Q4 (NEAT) and C2002 T7 (LINEAR) are going to be of interest in May in particular. NEAT comes into the northern hemisphere's evening sky at the very end of April. But it will be about ☞

☞ May 8 before arriving sufficiently far north for observers at latitude 50° to expect (I suppose "hope" would be a better word) to see something of it. It will.pass closest to the Earth on May 6 at 0.32AU and about 10° to the north-east of Sirius and 20° south of Procyon (in the Milky Way just south of the southern boundary of Monoceros).

It will move towards the east of Procyon over the next three evenings, passing 8° east of this star on the 9th. It continues heading towards Cancer, reaching 2° south of the Praesepe cluster on May 14. The next day it reaches perihelion and will be to the north west of Praesepe by 2°. It then crosses the sparse areas of Leo Minor into Ursa Major. By May 24 it will be near the pair iota and kappa UMa, the westernmost of the three pairs of stars that cross beneath the Plough and mark the Bear's feet on ancient star maps. (Sometimes these three pairs of stars are called "the Doe's Leaps"). By now it will be beginning to recede fast from the Earth. By June it will have faded, but still in Ursa Major, and possibly easily followed with binoculars.

In the meantime, comet LINEAR will approach closest to the Earth on May 19 at a mere 25 million miles (0.27AU) but not yet visible from the northern hemisphere. When it moves into the bright twilight sky of May and June will not be easy to find without optical aid. Predicting comet behaviour (brightness, and hence ease of sighting) is always fraught, so the best thing is to keep an eye on the BAA website 💻 **www.britastro.org** or specialist sites such as 💻 **www.iac.es/galeria/mrk/comets.html**

Moon phases for the second quarter of 2004

Month	New Moon	First Quarter	Full Moon	Last Quarter
April	19	27	5	12
May	19	27	4	11
June	17	25	3	9

The climax of this quarter occurs on June 8 when Venus finally gives up her brilliant turn as this Spring's Evening Star, and reaches inferior conjunction. But on this occasion, for the first time in our lifetimes, Venus' disc will cross part of the Sun's disc as seen from Earth.

Transits of Venus are rare. More than a century passes between them, but then two occur only about eight years apart. To cross the Sun's disc Venus must reach inferior conjunction at a position in its orbit close to a node, when it crosses the ecliptic going north (ascending) near December 9, or south (descending) close to June 7. This happens around the same dates because the position of the nodes change very slowly indeed, only about 3 arcmin per century. By coincidence, five of Venus' synodic periods are very close to eight Earth years. The latter amounts to about 53 *hours* longer. So when the Earth, Sun and Venus first line up with one of Venus's nodes in June or December, they will do so again 8 years later since 53 hours' of Venus' motion still leaves it close enough to the node. But another eight years years later it is just too far, and the next line-up has to wait till the planet's position at inferior conjunction is once more sufficiently close to a node. The next time it will be over 100 years later, and at the opposite node to the previous transits.

There were transits of Venus in 1874 and 1882. Next will be on June 8 this year and then on 2012 June 5. After that you will have to wait till December 2117 and December 2125. The figures also dictate that usually the first transit of the pair is better seen from one hemisphere of the Earth, and the second from the other. The 2012 transit takes place close to 00.00h UT so will be seen best from the antipodes. But the 2004 June 7 transit will be visible from the UK (Spode always permitting). The ingress of the planet is timed at 5:15UT from London, with internal ingress at soon after 5:30UT. The transit will last till just after 11:04UT (see the diagram below).

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

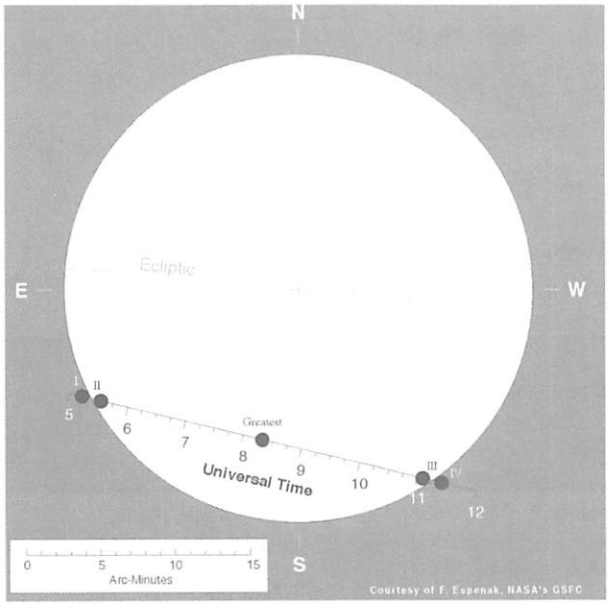
	April 15		May 15		June 15	
	Rise	Set	Rise	Set	Rise	Set
Sun	05h 16m	19h 08m	04h 19m	19h 58m	03h 51m	20h 33m
Mercury	05h 10m	19h 37m	03h 47m	17h 15m	03h 32m	20h 17m
Venus	06h 29m	23h 49m	05h 31m	23h 13m	03h 27m	19h 22m
Mars	07h 14m	23h 58m	06h 33m	23h 29m	06h 11m	22h 34m
Jupiter	14h 34m	04h 19m	12h 33m	02h 20m	10h 41m	00h 17m
Saturn	08h 58m	01h 29m	07h 12m	23h 38m	05h 24m	21h 46m
Uranus	04h 00m	14h 20m	02h 04m	12h 28m	23h 55m	10h 24m
Neptune	03h 15m	12h 26m	01h 18m	10h 29m	23h 08m	08h 22m

To observe the transit needs a good pair of binoculars, at least, securely mounted, and projecting the image of the Sun onto a shaded screen. A solar filter can be applied to the oculars, but because of the extreme potential danger to the observer's eyes, particularly if inexperienced, this can be done only if you know exactly what type of filters are feasible. And only oculars can be filtered. Never trust filters at the *eyepiece* end of any telescope.

Readers are highly recommended to see Fred Espenak's eclipse web pages (NASA)

💻 **sunearth.gsfc.nasa.gov/eclipse/transit/TV2004.html** from which the diagram is taken. The site gives information about several educational projects that are being based on this event, including one by the NASA Goddard's Sun-Earth Connection Education Forum, which has selected the transit as its theme for 2004. It will organise a series of resources and activities for every classroom and age group. See

💻 **sunearth.gsfc.nasa.gov/sunearthday/2004/index_vthome.htm**



ESO is organising a project in which students worldwide will work together to measure the Astronomical Unit. More on this from

💻 **www.eso.org/outreach/ eduoff/vt-2004/**

The northern summer solstice is on June 21st, at 57minutes after midnight, and the whole month ofers the ideal opportunity to watch the glow of the twilight mark the passage of the Sun below the northern horizon through midnight, as seen from the "land of the midnight twilight".

So for a three month period much of which is poor for amateur astronomers in our latitudes when astronomical twilight lasts all night for much of the quarter, it is actually going to be quite fascinating.

Richard Knox