Gnomon

Newsletter of the Association of Astronomy Education

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National Astronomy Week – 2009 is closer than you think

This December the UN General Assembly is set to agree that 2009 as the first ever "International Year of Astronomy". This will celebrate the 400th anniversary of Galileo's use of the telescope and include a range of events all over the world.

The co-ordinating body is the commission 46 of the International Astronomical Union (IAU). The Commission chairman Ian Robson is very keen to work with the Association for Astronomy Association (AAE) as the main UK partner.

British involvement in 2009 is centred on the next National Astronomy Week, which will take place in late July and commemorate Thomas Harriott's telescopic observations of the Moon.

Harriott is an interesting figure. He was the first person to observe the Moon through a telescope (on 26 July 1609 - a full two months before Galileo). He developed techniques in astronavigation and mathematics and studied optics. Harriott also advised Sir Walter Raleigh on the design of his ships and travelled on at least one of his voyages, during which he observed a solar eclipse.

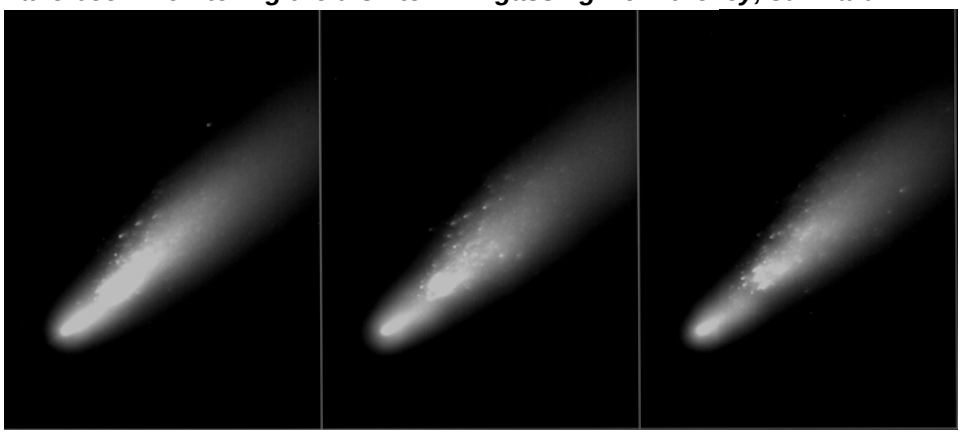
National Astronomy Week has a long pedigree. Starting in 1981 on the 200th anniversary of the discovery of Uranus, they have been organised by the UK astronomical community and marked celestial events and historical anniversaries. The most recent, in 2003, celebrated the close approach of Mars to the Earth.

The proposal for National Astronomy Week 2009 is to have a strong focus on the Moon and the history of astronomy and set up activities that allow repetition of Harriott's work, such as simple drawings through telescopes. It may also link in with the ongoing crescent Moon watch project designed to help refine the Islamic calendar.

Our very own Teresa Grafton (of the late lamented London Planetarium) is chairing the steering group for this event, which will be an important astronomical celebration: one that ☞

Hubble watches comet 73P cracking up

The Hubble Space Telescope is providing astronomers with extraordinary views of comet 73P/ Schwassmann-Wachmann 3 as it disintegrates while we watch. Recent Hubble images have uncovered many more fragments than have been reported by ground-based observers. These observations provide an unprecedented opportunity to study the demise of a comet nucleus. The comet passed the Earth on May 12, at a distance of 11.7 million kilometres, on its way to perihelion on June. The comet currently comprises a chain of over 33 separate fragments, stretching across several degrees in the sky. Astronomers have been monitoring the disintegration of this comet for years. Ground-based observers have noted dramatic brightening events associated with some of the fragments indicating that they are continuing to break up and that some may disappear altogether. Hubble caught two of the fragments, B and G, shortly after major outbursts in activity. The larger fragments are continuing to break up into smaller chunks, material that can be detected only in these very high-resolution Hubble images. Sequential Hubble images of the B fragment, taken a few days apart, suggest that the chunks are pushed down the tail by outgassing from the icy, sunward-facing surfaces of the chunks, much like space-walking astronauts are propelled by their jet-packs. The smaller chunks have the lowest mass, and so are accelerated away from the parent nucleus faster than the larger chunks. Some of the chunks seem to dissipate completely over the course of several days crumble under thermal stresses as they pass near the Sun, or pop apart explosively like corks from champagne bottles as trapped volatile gases burst out. The comet was discovered in 1930 It orbits the Sun every 5.4 years, but it was not seen again until 1979. The comet was missed again in 1985 but has been observed at every return since then. During the autumn of 1995, the comet had a huge outburst in activity and shortly afterwards four separate nuclei were identified and labelled "A", "B", "C", and "D", with "C" being the largest and the presumed principal remnant of the original nucleus. It is also likely that the disintegration of the comet is now accelerating. Whether any of the many fragments will survive the trip around the Sun remains to be seen.



☞ we hope will capture the imagination of the media and public alike. My own organisation, the Royal Observatory Greenwich, is likely to have an important role and I am keen for this project to bring in partners across the country.

Although National Astronomy Week will take place immediately after the end of the school year, there are plans for educational and outreach activities across the UK. Science centres, astronomical societies and universities will all be involved. The AAE has a great opportunity here. I am also on the steering group and am very keen that we play a big part. We would welcome ideas for 2009 so please help with any suggestions or contributions. The imagination of our membership never fails to surprise me - and together we can make National Astronomy Week 2009 a week to remember.

For more details and contact information take a look at the website:

💻 **www.astronomyweek.org.uk/**

Robert Massey

Do your bit for Dark Skies

The British Astronomical Association Campaign for Dark Skies invites you to the Sixth European Dark-sky Symposium, in Portsmouth this September. This is the British campaign's first International Symposium, but the sixth internationally for this important cause. Others have been held in Switzerland, Germany, France, Belgium and Italy.

"We intend to make the event the most successful to date, both in attendance numbers and in putting our message across" says the campaign organiser Bob Mizon.

The Symposium will be held on Friday 15th and Saturday 16th September 2006. Friday will focus on the interests of Local Government Officers and other professionals concerned with lighting. Saturday will focus on astronomers and light pollution.

The event will be opened by Lembit Opik MP, and closing remarks will be made by Robert Key MP. Speakers already secured include Dr John Mason, Dr David Crawford (International Dark-Sky Assn), Philip Perkins, Mike Simpson (past president, Inst of Lighting Engrs), Dr Chris Baddiley, Martin Taylor (BAA Council and Law School, de Montfort University), and many others.

The venue will be the Royal Sailors Home Club, which has an excellent hall and restaurant and is close to many visitor attractions (Portsmouth Naval Base, HMS *Victory*, HMS *Warrior*, the *Mary Rose*, the new 170m Spinnaker Tower, the new Gunwharf (harbour-side) shopping and leisure complex, Historic Old Portsmouth, etc.). This will enable us to arrange evening and lunchtime trips as a supplement to the event, including Clanfield Observatory and the Chichester planetarium.

All information from **www.dark-skies.org**

Progress at Lawrence House

Lawrence House is a centre dedicated to the teaching of astronomy, for any age and at any level. It is based on the grounds of an old public school on the Fylde Coast, Lancashire, although it operates independently of the old school.

The centre was opened a year ago, and now has in place a good range of academic services.

There is an introductory ten-week course in astronomy designed for the adult education sector, and this can be followed up with Level 2 advanced courses. GCSE astronomy is offered for both the general public and school sectors. Key Stage 2 and 4 INSET courses are provided for primary and senior school teachers as well as revision day course structures for student class groups. Residential courses are available for astronomy and planetary science.

In addition to the program of courses, there is a range of public lectures, including planetarium shows and tutorials, and astronomy evenings for special interest groups.

"This is all about getting people enthused in our brilliant science – giving them that all-important chance of an introduction. If ever there was a science for the 21st century then surely this is the one. Lets' get the public involved!" says organiser Dr Nick Lister.

If anyone wants to contact the centre with requests or even just for a chat then please do so, he says. If he is not in, please leave a message and he will always ring you back!

☎ **01253 772974** or 📻 **nick#astronomyhforall.co.uk**

UFOs grounded: it's official

Over most of history, science and technology has seemed to be propelled fastest by the military slant on invention. News released just as *Gnomon* was being prepared, indicated that a study of atmospheric phenomena has shown that a "plasma" can exist in the atmosphere in various shapes and sizes, and that that is the obvious(!) source of UFO stories. The study declared UFO's officially as "not extra terrestrial". Wow! How much did it cost to research to that blindingly obvious conclusion?

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Letter from Down Under

The great New Zealand physicist Lord Ernest Rutherford once said "All science is either physics or stamp collecting". In other words, before you can hope to understand how things work, and what makes them appear different, you first start by classifying them. In the case of supernovae, the Swiss astronomer Fritz Zwicky came up with 5 "types" in 1964, but over time these were reduced to just Type I or Type II, as Types III, IV, and V were found not to be exploding stars at all, or so rare that they were just misclassified Type I or II supernovae.

The main criterion for distinguishing Type I from Type II was hydrogen – if your first spectrum of the supernova showed no features due to hydrogen it was Type I; if it did show hydrogen it was Type II. This had the advantage of being a simple and quick determinant; the only other way to determine which type you had was to wait several weeks to see how it brightened and then faded.

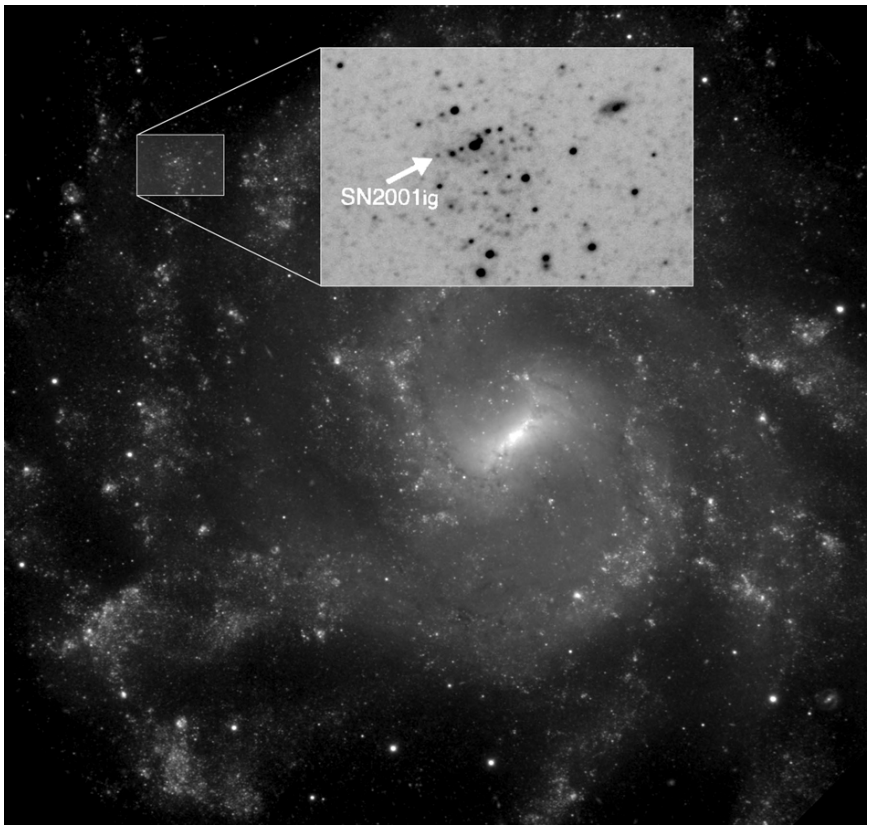

Image of the spiral galaxy NGC 7424, obtained with the GMOS camera on the Gemini-South telescope (to see a full-colour version, go to 💻 www.gemini.edu/2001igpr). The blow-up (inset) shows the region containing the site of SN 2001ig. The arrow points to the companion star left behind after the supernova has faded from view.

Eventually, the fact that Type IIs were found almost exclusively in spiral galaxy disks, while Type Is were found throughout all types of galaxy, led to the idea that they arose from two completely different mechanisms. Type I supernovae appeared to be white dwarf stars which erupted when too much gas was dumped on them by an orbiting companion star; while Type II supernovae occurred when a star at least eight times more massive than our Sun exhausted its nuclear fuel, collapsed under gravity, and exploded.

Alas, the Universe is seldom that simple: a mere handful of supernovae refused to obey this scheme. Although their earliest spectra showed hydrogen (putting them in the Type II basket), the hydrogen disappeared within weeks (moving them into the Type I basket!). How could an object which was caused by one phenomenon end up looking like something completely different? Astronomers put these in the "Type IIb" ("too hard") basket, and pretended to ignore them.

My own interest in Type IIb supernovae was sparked by getting a radio detection of one such object named SN 2001ig, discovered by Australia's most prolific amateur supernova hunter, the Rev. Bob Evans. As we continued to watch this event unfold, we saw a curious set of regularly-spaced bumps and dips in its radio brightness. It seemed the gas surrounding the supernova, shed by the star before it exploded, was not smooth but lumpy. What could cause this lumpiness? Perhaps the star underwent giant convulsions every 40 years or so before exploding? But no other star shows such slow pulsations. Alternatively, the supernova may have had a companion star on a long looping orbit, which at closest approach every 40 years would help yank more gas off the star than usual, leaving these lumps. With not much else to go on, we made the bold prediction that one day, when the explosion remnant gases had cooled and faded, the (shell-shocked but otherwise unharmed) companion star should be revealed. However, at the distance of the host galaxy NGC 7424 (37 million light years), it would likely take the exquisite resolution of the Hubble Space Telescope to see it.

By way of a reconnaissance therefore, I put in a bid for 1½ hours of Australia's precious share of time on the 8-metre Gemini-South Telescope. Not just any night would do – it had to be one of the nights when the sky was so steady that stars would not be blurred more than a half-arcsecond or so. My bid was successful, and while I slept through the night of 14 September 2004, astronomers at Gemini-South in Chile figured the time was right and activated my program. It was not until some months later, when my summer student Clair Murrowood came to me with the processed images and asked me if the yellow-green spot she could see at the site of the supernova explosion was the companion, that I realised we would not need the Hubble after all!

First we had to rule out a lot of other possibilities. Perhaps it was a cloud of glowing hydrogen gas that just happened to lie in the exact same direction? No, it was too red for that. Perhaps the supernova remnant was still too bright? No, it was too blue to be that. About all it could be was a supergiant star, some 30,000 times bigger than our Sun; just the right size to interfere with the gas streaming off the progenitor star before it exploded.

We now think the reason Type IIb supernovae "morph" from Type II to Type I is that, with a bit of help from a companion star, they shed much of their hydrogen-rich outer layers before explosion. The supernova blast wave sweeps through the remaining hydrogen in just a few weeks, after which it enters a hydrogen-poor zone and the hydrogen disappears from its spectrum. So Type IIbs are not really a new class at all – they are simply regular Type II supernovae, but with a companion star to help "pre-strip" them of their hydrogen.

There is a great satisfaction in seeing one's predictions come true (less so when someone proves you wrong!). More particularly, in reducing the number of truly distinct supernova types by one, we move out of the realm of stamp collecting, and into the realm of true physical understanding.

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Curriculum Corner

GCSE Astronomy: Constructional Coursework

This is the third and final article in the series looking in detail at the various practical projects which students can complete as part of their GCSE Astronomy Coursework Portfolio.

The previous two articles have covered the observational and graphical/computational projects which students can complete. This article looks at the Constructional project titles which are available as an alternative to graphical/computational work.

The project titles in this section allow students to construct simple astronomical instruments or models which illustrate an aspect of the subject. As part of the project, students are encouraged to try out their creations, evaluating how well they work.

The most popular project titles include:

Telescope – It is often a surprise to many students just how easy it is to construct a simple refracting telescope.

A selection of instruments and models made for the GCSE astronomy coursework

Two 5cm diameter convex lenses, borrowed from the Physics Department, at either end of a suitable piece of tubing can produce a useable if fairly low magnification telescope. As shown in the photograph, improvements can be made by using a large magnifying glass lens for the objective and by adding a microscope or telescope eyepiece. Students also gain marks for the testing and use of their telescope, making drawings of lunar features through it or by observing terrestrial objects to calculate magnification or angle of view.

Sundial – As in the Telescope project, this allows students to make an effective astronomical instrument from very simple materials. Two pieces of wood or metal are used to make the base and gnomon, which are then aligned with true north on a suitably cloudless day (!). Once again, a substantial proportion of marks is available for effective testing of the sundial in comparison with clock time. Once allowance has been made for the Equation of Time, students can evaluate the accuracy of their sundial which can often be surprisingly good. Occasionally, some students produce a Moon dial, which tells the time using the shadow cast by the Moon. This is rather more complicated to make as it needs a rotating scale on its base which is turned according to the age of the Moon. An example of this is shown in the centre of the photograph.

Eclipsing Binary model – This project involves making a mechanical model of an eclipsing binary star system, using electric motors and lamps. An LDR is used to represent the observer and its output plotted to obtain the familiar light curve of this system.

Sun-Earth-Moon system model – this project essentially involves students in making a small section of an orrery containing the Sun, Moon and Earth. This can then be used to demonstrate the phases of the Moon and eclipses. A lamp is invariably used to represent the Sun with balls of various sizes used for the Earth and Moon. Students who take the time to fine tune the relative sizes and distances of their three bodies can produce very effective simulations of phases and eclipses, which can then be recorded photographically.

As with the project work from the previous section (Graphical/Computational – *Gnomon 25/3*), many schools and colleges use students' constructional work for GCSE Astronomy as part of eye-catching displays. They can also be used by students to give presentations to their classmates on the models/instruments which they have made.

Full details of and further guidance on all the coursework project titles available for GCSE Astronomy can be found in the Specification. In addition, a comprehensive Coursework Guide is available, giving more suggestions for producing high quality coursework, as well as some marked examples of coursework from each of the three lists of project titles. Both these documents can be downloaded from the GCSE Astronomy pages on the Edexcel website at **www.edexcel.org.uk.**

Julien King
Principal Moderator for GCSE Astronomy
Edexcel Examinations

For your library

Stargazer: The Life and Times of the Telescope. Fred Watson. Da Capo Press. Hardcover $24.95. ISBN: 0-306-81432-3. 342pp.

Dr. Fred Watson is Astronomer-in-Charge of the Anglo-Australian Observatory where he is responsible for the scientific output of Australia's largest optical telescope. His book traces the history (and pre-history!) of the telescope, basically from when Tycho Brahe was the last great naked eye astronomer, or measurer of the stars, to the success of the Hubble Space Telescope.

There is a mass of fascinating details of the claimed pre-Lippershey inventions of the telescope, going even as long ago as the builders of Stonehenge! But Fred Watson defines the telescope as a device that requires a long focus objective, lens or mirror. The technology for these simply did not exist until the Dutch spectacle makers such as Hans Lippershey were at work in the early seventeenth century, so that is where Fred decides the telescope started.

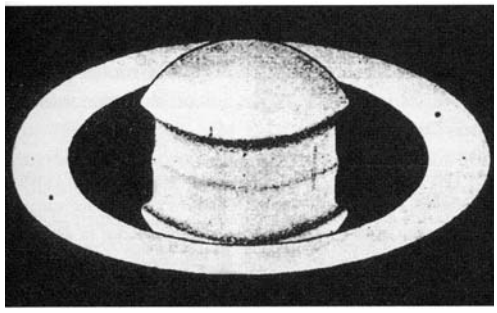
The history of astronomy is particularly fascinating during the years from Copernicus to Newton, and Fred Watson has integrated the story of the telescope into this period with a great deal of skill and detail not readily available in general astronomy books covering such a wide timespan.

As the science of optics developed, so did the progress of the design of the telescope, tackling the problems of spherical and chromatic aberration in lenses, of inverted images, and of tiny fields of view (Fred Watson's comparison is with observing through a drinking straw!). Telescopes got much longer before they got fatter, but tremendous discoveries were made with these incredibly long instruments.

An end to the ever-lengthening telescope evolved from the science and technology of mirrors, whose separate history is then described. This, the author points out, eventually led to telescopes tending to be as fat as originally they were long! Dr. Watson gives a good account of the arguments for and against the possible claimants to the invention of the reflecting telescope, and with so many contenders for the title, pays most of them the homage due. By the time we reach Herschel, we are almost half way through the book.

The narrative deals with scandals, intrigues, disappointments and triumphs over the centuries leading to the next "quantum leap", the launch and (ultimate) success of the Hubble Space Telescope.

What next? The book concludes with an epilogue dated 21.09.2108. This relates the dramatic events of 2041 when the 1km asteroid was discovered on its almost certain Earth-orbit intersecting path. The vast achievements of the human race in the first half of the 21st century such as the launch of the James Webb infra-red space telescope in the early 2010s, the establishment of the International base on Mars, and so on, paled into insignificance compared with being alerted in time to deflect this deadly lump of rock from its disastrous course. The planet had every reason to be proud of the progress made with the most fundamentally important tool in astronomy, the telescope. Later on, the hypertelescopes in space started discovering terrestrial style planets all over our area of the galaxy, shifting interest away from cosmology, most of which had been sewn up by then, to the search for ET.



A wonderful impression of an apple core Saturn, drawn by Andrew Barclay. His observations also included the smoke issuing forth from Jupiter's mountains These were seen through the telescope he was sure was working perfectly!

Fred Watson's short excursion into Sci-Fi is perhaps a tad optimistic. His speculation that cosmology will have become largely a solved problem makes one wonder why this era should be any different from all the other times when astronomers told everyone that this time they had the answer just round the corner? I bet the hypertelescopes throw the whole picture into disarray yet again!

Dr. Watson spices his script with reflections (no pun intended) and reactions to recent political events in a typically wry Aussie way (Charles II opened the Royal Observatory, and Tony Blair closed it!). His quotation from the UK Astronomer Royal of 2011-2096, and even his name (Sir Pratney Wilbert) speaks volumes! I'll leave it to you to read the memorable Sir Pratney quote from this book. It all helps bring the whole story up to date, and makes reading the book a pleasure.

There is a comprehensive list of references, and a useful index. The only beef that might be made is that the author was let down by the production of the book. The paper quality leaves much to be desired, and the binding makes turning one page at a time quite a challenge! The illustrations are far too small in most cases, none in colour, and a small section of illustrations on reasonable quality paper is inexplicably inserted in the middle of the book. This helps to do some sort of justice to, for example, such works of art as David Malin's photographs (still monochromatically, alas!) but serves only to emphasise the shortcomings of reproduction throughout all the other pages. Find out more from the author's website at

www.aao.gov.au/local/www/fgw/

RAK

The things people ask

NIGHT SKY ON MARS

Will the rovers Spirit or Opportunity take pictures of the Martian night sky? If memory serves, Asimov wrote how spectacular Phobos and Deimos should look to an observer on the Martian surface.

As far as I know there are no such plans. The cameras on the rovers are designed for looking at the surroundings of the lander, and to examine rocks. The stars and constellations in the night sky from Mars will look much the same as from Earth, except that it will probably be clearer as the atmosphere is much less dense. The planets will be in different positions, however, compared with how they look from Earth at present, but otherwise not much different. Jupiter should be brighter and Venus less bright.. Earth and Moon will be an impressive sight.

The late John Thompson took over the job of answering questions to the AAE's* Query *service for a short while in 2004.

Phobos and Deimos may well be impressive sights from Mars, but the orbiters will get much better close up views of them because they have higher magnification on their cameras than the rovers have. The cameras on the rovers have been designed for a purpose as I explained. To have equipped them with telephoto lenses for studying the night sky as well would duplicate what the orbiters can do much better, and lead to much extra expense and weight.

TIDAL EFFECTS OF VENUS ON THE EARTH

What would be the closest possible distance between Earth and Venus? A distance that would not cause such things as tidal effects?

The orbit of Venus is almost circular, while that of Earth is slightly elliptical. Venus' distance from the Sun varies by only 1.5 million km between aphelion and perihelion, while its mean distance is 108 million km. Earth's distance from the Sun varies from aphelion to perihelion by 5 million km and its mean distance is 150 million km. The nearest that the two planets can get to each other is when Earth is at perihelion and Venus at aphelion simultaneously and these occur at the same heliocentric longitude, ie Sun, Earth and Venus are in a straight line, such as will happen on 8 June 2004 and again in 2012 when transits of Venus takes place.

Although Venus' aphelion and Earth's perihelion occur at widely separated longitudes, for the sake of answering your question I will take the hypothetical case when they coincide giving a minimum distance between the planets of 38.2 million kilometres.

My calculations show that the tidal effect of the Moon on the Earth is 14800 times greater than that of Venus and is therefore absolutely negligible. This is due to Venus' great distance from Earth compared with the Moon's, the tidal effect being proportional to the mass and inversely proportional to the cube of the distance.

As a matter of interest, the Moon's tidal effect is 2.18 times that of the Sun, which is why the spring tides, when the Sun's and Moon's effects add, are appreciably higher than the neap tides, when they oppose each other.

Query

Saharan trek for amazing eclipse experience

The expedition into the Libyan Sahara to observe the March 29th eclipse of the Sun will not soon be forgotten. The site, chosen by Explorers' Tours to ensure the best chance of enjoying perfect weather, and the longest possible exposure to totality that day, was some 250 miles inland from the Mediterranean port of Benghazi. Most of the road south is as straight as an arrow across the extremely flat plain of the northern Sahara Desert and was made to furnish the oil fields, passing through one very large oasis, and then going on into nowhere.

Many from the Libyan population travelled deep into the Sahara desert as soon as they discovered a large contingent of visitors was going to brave the journey there. They reacted to totality with the same enthusiasm we all do!

The choice of Libya so soon after our new found friend Col. Gadaffi decided to make tourism a flourishing industry for his country, was, perhaps a tad adventurous. But it did not deter a large contingent, mostly of British Astronomical Association members with their wives and families, from applying in such numbers that within days of opening the bookings, the cruise ship that was to take everyone to Libya from Crete was full to the gunwales. The continued interest was such that a ship of twice the size had to be found, and in the end some 700 brave souls set out from the ship in 22 coaches (especially brought in from Egypt, but with none of the usual offices!) at 2:30am.

Space restrictions do not allow us to publish a 360° panorama of the view from the eclipse site chosen. But it can be described fairly succinctly. Looking north, the sky comes down to a straight horizontal line. Above this line, the sky is bright blue. Below, it is a sort of sandy-shade of sand in all directions, broken here and there by a similar sandy shade of sand. But turn and face south! Behold! Exactly the same view! That was, or course, before the inhabitants of the country for 100s of miles around heard that a large party of astronomers was going to this spot, probably known by most of these locals by a rude expression meaning "the middle of nowhere". So this eclipse thing they were coming so far to see and under such arduous conditions, must be worth a visit. Well they were right! And a thousand or so Libyans learned a lot that day.

Considering the vast array of high quality coverage, books, video, superb photographs etc. that are available covering eclipses of the Sun, for example, it is still stunning to experience the reality. The oldest hands at eclipse chasing still, if they are honest, are filled with wonder and emotion at the sight of the Sun's normally hidden glories. If they pretend otherwise they are bluffing! In our account of the eclipse of March 29, we are extremely lucky to have three wonderful photographs by Francisco Diego to publish, albeit in glorious green monochrome. But even his superb composite picture of the outer corona, like all those before and after him, cannot capture the beauty and delicate ethereal detail of the reality.

However, any first time eclipse watchers on the many expeditions to the Mediterranean area this March are now eclipse junkies like the rest of us. Someone of very respectable intellect and experience seriously asked me, just before my wife and I left for Libya, "You have seen several eclipses of the Sun, why do you want to see any more?" I suppose the quickest reply would have been along the lines of "You have tasted a glass of wine. Why do you want any more?" In a way, I am very glad that the camera I had ordered specifically to be used on this occasion did not work properly when I tested it before leaving the UK. Knowing it would be a total waste of time, I spent the entire eclipse (once it had got going) horizontal on the Sahara sand watching every second.

The eclipse was one of the finest any of the old hands we talked to afterwards had seen. The complex and extensive spikes in the solar-minimum corona as can be seen in Francisco's amazing photograph. There was a wonderful collection of prominences on either side of the Sun that were revealed at the beginning and towards the end of totality. The deepest, whitest diamond rings (the multiple Bailey's Beads at the start looking more like an eternity ring just before they disappeared!) and the longest lasting, tiniest point of brilliance that marked the end of totality before it turned into a multiple diamond ring, was something for the record books.

Two phenomena were outstanding in this eclipse. The first of these was the display of shadow bands before and after totality. These were voted the best ever by all who saw them. They were so obvious that many people managed to record them on video cameras. They do not show up well enough on still frames, unfortunately, as it is their shimmering motion that makes them obvious.

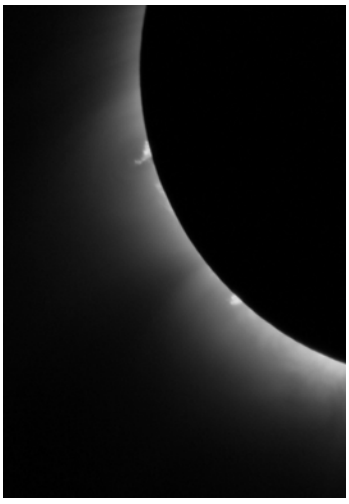
Mid-totality, and all eyes are skyward (except for a few taking flash photos of each other!). The Moon's shadow, seen all round the site, was like a 360° sunset

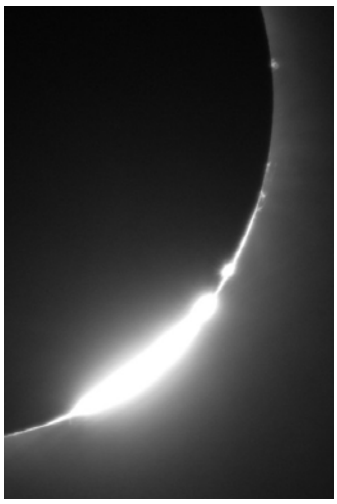
The second memorable point to arise was a question raised before the eclipse: can one see any detail on the Moon's surface during an eclipse of the Sun? During a debate on this question some days before the event,

one of the veteran eclipse watchers, who came from the USA, told us with some authority that he had seen the dark markings on the Moon's face during one such event. It had been especially interesting to be able to identify them, he said, because at that time the markings on the "dark side of the Moon" had only just been revealed by the Russian Lunik that had flown round the Moon's far side and shown these features for the first time, so it was only now possible to recognise them! Oh dear! Everyone was most polite and said nothing!

However, the question was finally answered. A photograph that must have been extremely difficult to take at the time, will be included on the BAA's DVD copy of the eclipse that is about to be published (as we go to press). This is being compiled from photographs and video taken in Libya and Turkey. This disc will show both the Earth-lit face of the Moon during totality, and the shadow bands clearly. Details are given on the BAA website 💻 **www.britastro.org**

Richard Knox





(Left) Prominences at the beginning of totality (detail). (Right). The "Diamond Ring" at the end of totality (both photographs with refractor: exposure 1/500s f/11).

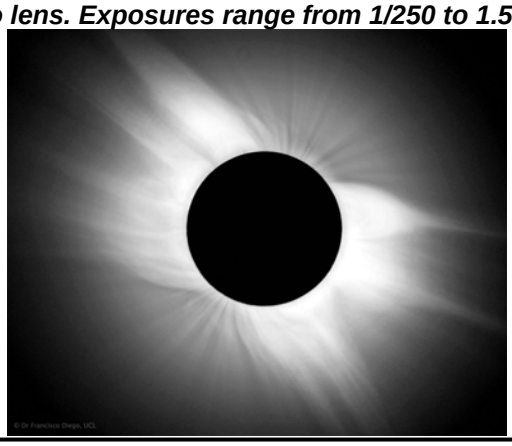
Moon shadow causes Turkish delight

A group of mature students from the Diploma in Astronomy course at University College London observed the total solar eclipse of March 29th from a small hill just north of the city of Manavgat, near the southern coast of Turkey.

This site was chosen for its spectacular views over the sea and the snowy mountains, which followed the dynamic changes of illumination as the shadow of the Moon made its silent glide over the scenery for nearly 4 short minutes. Venus and Mercury were clearly visible, and the experience was one of the best that we remember. The next total solar eclipse is in Siberia in August 2008, and we are planning already....

Francisco Diego

(Below) Composite of the corona combines 10 different exposures taken with a digital camera using a 600mm telephoto lens. Exposures range from 1/250 to 1.5s.



Sky Diary Summer 2006

People are fascinated in astronomy in the same way that many are fascinated by, just as an example off the top of the head, palaeontology. Both are examples of seemingly esoteric doctrines, but which arouse interest even in the youngest of people. Space and dinosaurs must be about top of the average youngster's agenda! Both subjects are frequently touched upon by educators, even if only as a means of trying to grab their students' attention! Many simple sights can bring delight, many simple projects or activities can spark a lifetime of interest.

When astronomical phenomena are experienced first hand for the first time, they are almost always not what the uninitiated person was expecting, and, in almost all cases, are more amazing than was expected. A total eclipse of the Sun is the most obvious case (see the preceding article) but there are many others.

A close conjunction is always a pleasure to see and makes for interesting photographs. Where the conjunction is between an orbiting body and a fixed star, it provides a perfect condition for watching the apparent motion of the

Moon phases for the third quarter of 2006

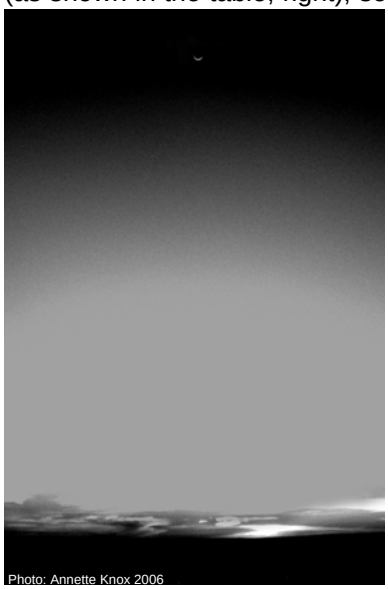
	New Moon	First Quarter	Full Moon	Last Quarter
July	25	3	11	17
August	23	2	9	16
September	22	30	7	14

A magnificent gathering of planets in Leo, 1980 May 9. Saturn is nearest bottom left, with Mars, Jupiter and Regulus (left to right, centre right). Denebola is near the top left corner, and most of the "Sickle" can be seen.

Solar System object. Multiple near-conjunctions, such as shown in the above photograph from 1980, are rare, of course, but that makes them all the more fascinating!

Trying to find the youngest possible Moon causes a great deal of healthy competition and pleasure. It can be done only in the spring evenings (in the northern hemisphere) when the ecliptic is steeply inclined to the western horizon at sunset. The same sort of conditions are needed to find the Moon just *before* New Moon, but the favourable angle of the ecliptic at sunrise is around the early autumn. The same conditions are needed for the best chances of finding any object near the Sun, such as Mercury.☞

☞ Mercury rises well before the Sun in the late summer (as shown in the table, right), so will be worth looking for in the twilight. The expression "seeing the Moon on its back" is well known, but again conditions need to be right to get closest to that position (which is actually not strictly possible from the latitudes of the UK). Once again the young Moon must be at the its highest, and in addition must be at as high a northern ecliptic latitude (the angle north of the ecliptic) as possible.



The Moon "on its back" just after sunset, from about latitude 24° 32 hours after the March 29 eclipse, see page 6 (contrast enhanced to survive printing!).

The Perseid meteor shower will peak on August 12, when the Moon is nearing last quarter, so conditions will not be too bad.

The northern autumnal equinox is on September 23. Sidereal time which is defined as the hour angle of the First Point of Aries, must therefore be 12:00hr at noon. So for this moment, the sidereal and mean time clocks coincide and thereafter the sidereal clock gains just under 4min each day till it has gained a total of 24 hours by the next autumn equinox..

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

	July 15		August 15		September 15	
	Rise	Set	Rise	Set	Rise	Set
Sun	04h 09m	20h 25m	04h 55m	19h 36m	05h 46m	18h 27m
Mercury	05h 04m	20h 01m	03h 21m	19h 03m	06h 53m	18h 48m
Venus	02h 07m	18h 33m	03h 03m	18h 54m	04h 39m	18h 15m
Mars	07h 12m	21h 49m	07h 03m	20h 20m	06h 55m	18h 49m
Jupiter	14h 14m	00h 01m	12h 25m	21h 59m	10h 49m	20h 07m
Saturn	05h 56m	21h 18m	04h 16m	19h 25m	02h 36m	17h 32m
Uranus	22h 13m	09h 12m	20h 09m	07h 04m	18h 05m	05h 56m
Neptune	21h 21m	06h 48m	19h 18m	04h 42m	04h 42m	02h 35m

It is useful to be able work out sidereal time if you are at all familiar with star positions in celestial longitude, called *right ascension.* The sidereal time tells you the right ascension of whatever is on your meridian, and so due south. If you know, for example, that the right ascension of Orion is about 5hr 30min, if the sidereal time is, for example again, 2hr 15 min, you can say that Orion will be south in 3¼ hours from now.

Richard Knox

Swanning around summer skies

Winging its way south, Cygnus the swan is a wonderful constellation set against a gloriously bright, rich starry section of the Milky Way. The stargazer can spend literally hours scanning this region through binoculars, sweeping across magnificent star fields and spending time to search for some of the more elusive deep sky quarry on offer.

As well as being the bright north-east star of the three stars that make up the asterism known as the Summer Triangle, α Cygni (Deneb) is the northernmost star of the cross (sometimes called the Northern Cross) that characterises the constellation. At the foot of the cross, near the south-western border of Cygnus, is β Cygni (Albireo), one of the most beautiful coloured double stars. A small telescope will easily resolve the companion to its golden magnitude 3.1 primary, a steely blue star of magnitude 5.1. Another wonderfully coloured double, o Cygni, is separable through binoculars, made up of an orange mag 3.8 primary and a sea-green magnitude 4.8 companion. Closer scrutiny will reveal another companion to the primary, a blue magnitude 7 star.

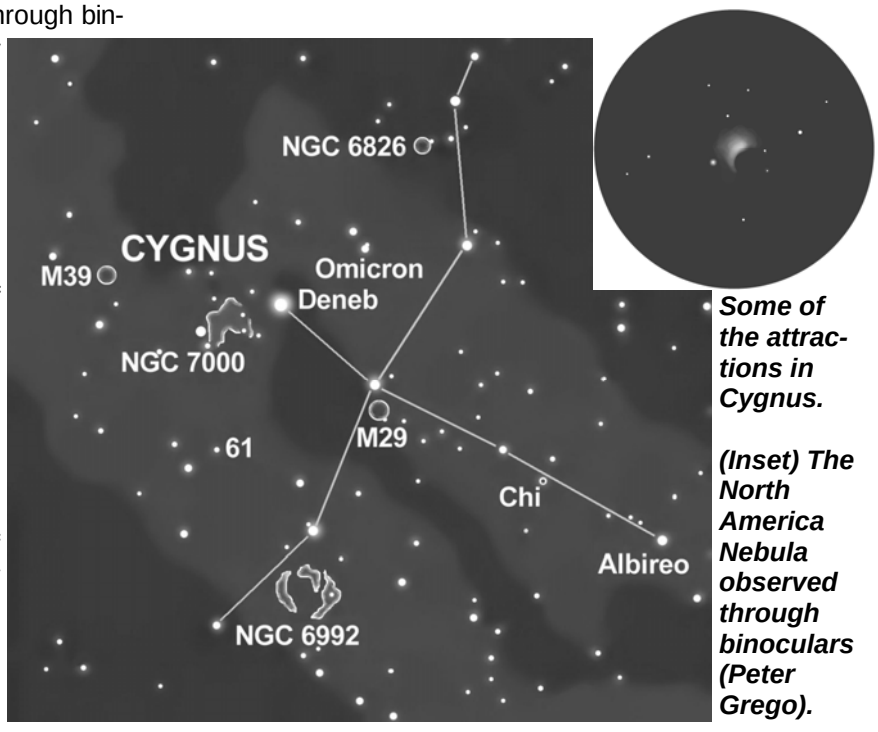
The red giant χCygni, a Mira-type variable star, can reach the 3rd magnitude at its brightest, although it normally shines well below naked eye visibility, dropping to as low as the 14th magnitude. Its period is around 400 days. Another of the constellation's most notable stars is 61 Cygni, a double star made up of two orange dwarfs of magnitudes 5.2 and 6, easy to split through a small telescope.

M29 is a loose open cluster of around 20 stars, of which several are reasonably bright, is easy to find by sweeping south of γ Cygni. M39, a much bigger big open cluster, is made up of around a dozen fairly bright stars and many more fainter ones, and makes a lovely low magnification telescopic sight.

The "Blinking Planetary" (NGC 6826) lies east of θ Cygni. It appears small and well-defined, with a slightly blue tinge, its central star visible through a 150mm telescope. The low brightness of the nebula's outer shell gives the illusion of blinking off as the observer looks directly at the object, while its bright central star remains visible.

Spread across a portion of the Milky Way in southern Cygnus, the Veil Nebula is a remnant of an exploded star, the brightest parts of which take the form of the nebula NGC 6992, which may be discerned through big binoculars from a dark site. Big binoculars will also reveal the North America Nebula (NGC 7000), appearing as a wedge-shaped brightening of the Milky Way (considerably larger than the apparent diameter of the full Moon) to the east of Deneb. Having such a large area and a low surface brightness, it tends to be elusive when attempts are made to view it telescopically at higher magnifications.

Peter Grego



Some of the attractions in Cygnus.

(Inset) The North America Nebula observed through binoculars (Peter Grego).