GNOMON

Newsletter of the Association for Astronomy Education

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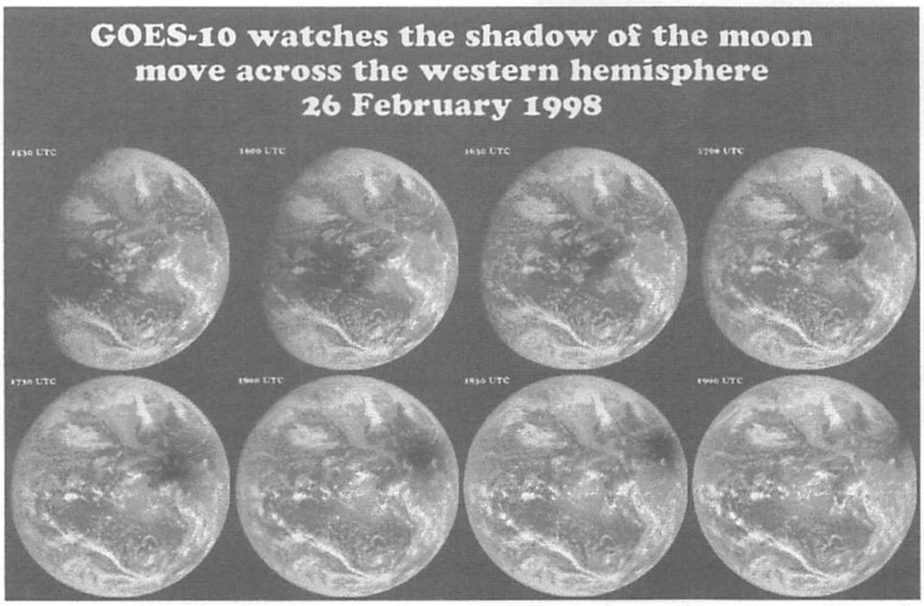
A Happy Christmas, and Best Wishes for 1999

THE MOON'S SHADOW CROSSES THE EARTH



This dramatic view from a geostationary weather satellite, GOES-10, shows the shadow of the Moon moving across Central America and the Caribbean during the eclipse of the Sun on 1998 February 26. The gulf of Mexico and the northern coastline of South America show up particularly well. It answers many of the questions and misconceptions that are proliferating now as the 1999 August 11 eclipse gets nearer.

The satellite is moving eastwards in its station over the Pacific close to the equator, so that we can also see the Earth turning eastwards. In the first frames, the western terminator is clearly visible where the Sun is rising over the Pacific. As the Earth and GOES turn eastwards, so the terminator disappears. This shows that the shadow of the Moon is moving eastwards faster than the rotation of the Earth, so the effect of the rotation of the Earth is to prolong the duration of the solar eclipse. If the Earth rotated faster, the eclipse would last longer. The same effect has been achieved by flying Concorde eastwards along the eclipse path.

From a favourable viewpoint for a solar eclipse, watch towards the west for the oncoming lunar shadow. The size of the umbra is not clear on the pictures, since the inner penumbral region is also fairly dark, but it does show that it is small compared with the size of the Earth, and it also indicates the rapid decrease in illumination levels close to totality.

For those who would like their own copy, it is available from a NASA web site: ftp://climate.gsfc.nasa.gov/pub/chesters/goes/980226.eclipse/

GNOMON - definition from the **Concise Oxford Dictionary:**
Pillar, rod, pin or plate of sundial, showing time by its shadow on marked surface, column, etc. used in observing Sun's meridian altitude.

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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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Publication Dates:

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

Observations

GCSE SUPPORT HAS DOUBLED

GCSE Astronomy has now been running for over ten years, and during that time the number of candidates and centres has more than doubled. There have been two major revisions of the syllabus to keep it in step with corresponding changes in the other GCSE sciences, and to update the content.

Quite a lot of astronomical material is, of course, included in a range of physics and science syllabuses, but the only stand-alone GCSE examination in astronomy itself in the UK is administered by EDEXCEL, the former University of London Examination and Assessments Council.

GCSE Astronomy is a minnow in a sea of whales in terms of number of candidates (550 expected in 1999). But this is not surprising as it is not a National Curriculum subject and it is very difficult for schools to squeeze it into mainstream curriculum time. Nevertheless many do manage by one ingenious means or another to find some time and produce candidates. Quite a number of boarding schools feature, as astronomy can slot more comfortably into an evening "club" type activity.

Entries come from a great diversity of centres well spread all over England, Wales and Northern Ireland, together with some overseas candidates. The candidature is very varied and falls loosely into three populations: school candidates in years 10 and 11 doing astronomy as a science option; science or mathematics sixth-formers throwing in an extra GCSE in a relevant subject as a useful complement to their A levels (sometimes Arts A – level candidates feature as well); and a significant number of adult students, either lone amateurs doing it for interest, or sometimes evening class students.

An encouraging recent trend has been a significant growth in the average number of candidates from a centre, implying that more taught classes are being scheduled, rather than lone candidates or twos and threes receiving maybe only scant help on the side by a sympathetic teacher, as was often the case in the earlier years.

The latest revision to the format and style of the papers will see first light in Summer 1999 when there will be TWO tiers: Foundation and Higher, as distinct from the last three years when there has also been a third (intermediate) tier. The two new tiers will interlock and there will be some common questions. Each tier will have two short examinations, of 1¼ and 1½ hours duration, and the coursework element has been upgraded from 20 to 25%, of the whole assessment.

Further information, including past papers on the old syllabus, copies of the new syllabus and specimen papers, details of the grading system, and coursework exemplar material can be obtained from: EDEXCEL (GCSE Astronomy), Stewart House, 32 Russell Square, London WC1B 5DN.

In the future we would welcome a greater airing of some of the issues involved. We know that many AAE members are actively involved in preparing students for the exam and would welcome this.

Frank Flynn, Chief Examiner

THE THINGS PEOPLE ASK!

The following are heavily edited extracts from our "Ask an astronomer" service to give a flavour of the questions young people ask rather than to give the full, excellent replies they received! It never fails to surprise how often these same questions occur, in one form or another.

Tunstille seemed worried enough to ask:

- *That comment about a comet hitting the earth in 30 years time. is it true? if yes, what can we do to save ourselves from frying to a crisp or drowning or something?*

As far as Query is aware, there are no comets currently expected to hit the Earth. I would be very alarmed indeed if that were the case - you know, buying tinned food, a nuclear reactor, gold bullion, rifles, etc.

If such an event were to be predicted, the only way to save the lives of those in the target zone (which could be a large part of the Earth) would be to move everyone to the other side of the planet. If the object was large enough, even doing this would not matter. The only hope for survival would be to have a very much more active space programme. It may be possible to deflect asteroids which could be reliably predicted to be impactors, but this would require a big investment in space technology. Sleep well.

Stacey - who seems to be a student at Leeds University - asked several questions (that look suspiciously like homework problems.)

- *1. Why are solar eclipses less frequent than lunar eclipses?*

The frequency of the two types of eclipse is about the same, being anywhere from two to five solar eclipses or lunar eclipses per year. These figures include partial eclipses. The annual number of total or annular eclipses of the Sun ranges from none to three, as does the annual number of total lunar eclipses. But a total eclipse of the Moon can be seen from any location on an entire hemisphere of Earth (actually a bit more because the Earth rotates through a considerable angle during a lunar eclipse). To see a total solar eclipse the observer has to be positioned in the narrow band of totality, a very small part of the Earth's surface.

- *2. If the Moon is 3400km in diameter, why is the "path of totality" only about 300km across?*

The short answer is because the Sun is not an infinite distance away. The shadow of the Moon is a long cone pointing directly away from the Sun. Most of the time dur-

Omissions and delays!

In the rush to get the last issue to press I forgot to thank Eva Hans, South Tyneside College Planetarium, for the lunar calendar that she generously donated to members, which was a loose insert in the last issue. My apologies, Eva, and many thanks. Did you spot the "Blue Moons"? (See the Sky Diary, page 7!)

Talking of going to press, we must apologise for the delay in getting the last issue out after it was completed. This was due to a delay in receiving *The Universe in the Classroom*, the next edition of which should appear in the Spring *Gnomon*.

ing an eclipse the tip of the shadow just grazes the surface of the Earth. If the Sun were a lot further away, the cone would be longer and the path of totality wider whenever the Earth passed into the shadow of the Moon.....If the Moon were even 10 percent further away than its present average distance, no Solar eclipse would ever be total.

● *3. Describe in a paragraph - the appearance and spectra of the chromosphere and corona during an eclipse.* – etc. etc.

Stacey, if these replies got an "A" on your homework then Query would appreciate your sending a small donation to the Association for Astronomy Education in furtherance of its work.

Simon Kirkby asked us to settle an argument:

● *Location Leicester. Clear sky. Southerly direction, what is the brightest body on that day. I thought it may be a planet (possibly Venus) but my friend thought it was the Polar Star as the Polar star is always the brightest*
Can you help?

The AAE Query Service has settled many "bar disputes" in his day. Unfortunately you do not give the time of day when this object was seen. If between 12 noon and 2pm, Query would guess that the object was the Sun! However, you are probably referring to an object in the evening sky. The object is certainly not the Pole Star as this is far from being the brightest star in the sky. (*It would also be rather unusual to see it in a southerly direction from Leicester! - Ed.*) The most likely identification for the date given is that you are seeing the planet Jupiter, which is the brightest object in the current evening sky aside from the Moon.

Dr. Mike Dworetsky

The AAE "Ask an Astronomer" Service: query@ulo.ucl.ac.uk

A Quick Steal

At the first meeting of the Cornwall County Council to consider planning for next year's total eclipse, one worried participant wanted to know how the police will cope, when all the roads are gridlocked, and all the local burglars will be able to take advantage of the darkness during totality!

A new kind of eclipse-viewing filter

The ubiquitous aluminised Mylar filter used as a solar viewer now has a serious rival for unaided eye use. A black polymer viewer can be supplied as either a pair of spectacles (fun, but not very practical) or a simple wide slot in card, suitable for quick or prolonged glances at the Sun to watch the partial phase of eclipses, search for naked eye sunspots, and so on.

The polymer is guaranteed to the same Standards as the Mylar filters, and offers the same performance, but it is much tougher than Mylar, resists pinholes and scratches, and lasts a long time (the aluminium coating on Mylar tends to oxidise with age and blurs the view). It also gives a more "natural" appearance to the Sun, a rich orange compared with aluminised Mylar's blue hue. It is available in either format, printed with instructions for use, at £1.50 each in quantities up to 100, with discounts for larger orders. Please contact the Editor of *Gnomon* (see address details on page 1, col. 3)

A FORESIGHT SAGA

The following quotes from famous people in science and technology may help reassure those of us who despair at our forecasting ability, or who worry about making bloomers in print:

"*Professor Goddard does not know the relation between action and reaction and the need to have something better than a vacuum against which to react. He seems to lack the basic knowledge ladled out daily in high schools*" – 1921 New York Times editorial about Robert Goddard's revolutionary rocket work.

"*I must confess that my imagination... refuses to see any sort of submarine doing anything but suffocating its crew and floundering at sea.:*" – H. G.Wells, 1901

"*Everything that can be invented has been invented*" – Charles H. Duell, Commissioner US Office of Patents, 1899

● The cognoscenti of the computer world have remarkably foot-shaped mouths:

"*I think there is a world market for maybe five computers*" – Thomas Watson, chairman of IBM, 1943.

"*I have travelled the length and breadth of this country and talked with the best people, and I can assure you that data processing is a fad that won't last out the year*" – The editor in charge of business books for Prentice Hall. 1957

"*There is no reason for any individual to have a computor (sic) in their home*" – Kenneth Olsen, president and founder Digital Equipment Corp. 1977.

"*640K ought to be enough for anybody*" – Bill Gates, 1981.

● And in the world of entertainment, anything goes:

"*The wireless music box has no imaginable commercial value. Who would pay for a message sent to nobody in particular?*" – David Sarnoff's associates in response to his urgings for investment in the radio in the 1920s.

"*Radio has no future*" – Lord Kelvin, 1897

"*We don't like their sound. Groups of guitars are on the way out*" – Decca Records rejecting the Beatles, 1962.

"*Who the hell wants to hear actors talk?*" – Harry H. Warner (Warner Brothers) 1927.

For Your Library

Phenomena. A set of 20 square (2in) mount 35mm slides of astronomical and meteorological events. Armagh Planetarium. £15:00 incl.p.p.
This is quite a refreshing change from deep space or close planetary views that make up most of Armagh's wonderful slide collection. These are the sort of phenomena that teachers and presenters so often need and don't have, unless they've taken them themselves! Pictures of Comet Hale Bopp as we saw it, of aurorae, of planets glowing in the twilight sky or amid the background stars, a lunar eclipse, a double rainbow, noctilucent clouds, the Space Shuttle crossing the night sky and many more.

These were all taken in Northern Ireland by experienced amateur astro-photographers, and are highly recommended. Two tiny criticisms: several topics are still missing, such as meteors, parahelium phenomena, "ordinary" comets, and so on, but that gives scope for the publication of *Phenomena II* (I wish Armagh could think up a better title). The most important carp is that these are the type of photos that anyone could take, given some instruction and practice, so why leave out the details of exposures, and how they were taken (some photographs of the techniques used could be included in the next set)?

R.K.

*Wonders of the Universe.*1999 Calendar: Armagh Planetarium £8.50 incl. p.p.

The zodiacal light frames an organ-pipe cactus, seemingly pointing out the Pleiades from the Arizona desert - just one of the 12 magnificent monthly (colour) photographs in the Hansen Planetarium calendar for 1999, available from Armagh Planetarium.

This is a splendidly detailed double-page vertical spread calendar with a spread per month presentation. The beautiful printed photographs include some of the most original astronomical pictures you will have seen. Just one example: a multiple exposure of the Sun describing an analemma in the twilight sky of Arizona above a boulder covered in native petroglyphs! Published in the USA by Hansen Planetarium, the 250mm square calendar pages are packed with astronomical events, notable dates – not just North American – international holiday dates etc., and there's still room for your own notes for each day. Entries range from "Total solar eclipse (see box inset): 1st Martian satellite, Diemos, discovered by A. Hall, 1877" (August 11), to "Bank Holiday (UK). Three hours after sunset, and rest of night, Moon near Jupiter" (August 30).

If you know anyone interested in astronomy, or who would just appreciate the splendid illustrations, your Christmas present problem is solved! If you are making your own list, put this one on it! **R.K.**

New trends in astronomy teaching. Editors L.Gougenheim, Derek McNally and J. R. Percy. Cambridge University Press. 352pp. ISBN 0 521 62373 1 (hardback) £45:00
This perhaps must be at the top of any list of publications for our readers (other than *Gnomon* itself!) or anyone in the world of science teaching, education development, planetariums, and policy-making in the area of science teaching etc. at all levels. Although these are the edited proceedings of the IAU Colloquium no. 162, held jointly in July 1996 by the University of London and Open University, it holds together well as a book in its own right, and, being made up of short papers, is packed with information, and issues for further investigation and discussion. It's a pity about the price, however!

Since the first IAU meeting on this topic in 1988, the most significant new development is the rapid growth of the Internet. A section of papers on "distance learning and electronic media in teaching astronomy" delves into many of the unprecedented developments that have taken place, from the availability of on-line data from quality sources such as the Hubble telescope, to the contribution to education in remote areas and developing countries. This section presents experience and advice that will at least provide a partial cure for the daunting task of someone (over the age of 40?) facing the www for the first time!

There is a wealth of practical experience, challenging problems, tips and wrinkles and new ideas in areas of education from university to primary schools, from public education, astro-navigation and planetarium work through to specialist needs of handicapped people. I am told that there are no plans for a paperback edition for some time yet.

Richard Knox

GCSE Astronomy - A Guide for Pupils and Teachers by Nigel Marshall. Mickledore Publishing, 26 Whitethom Mews, Lytham St. Annes, Lancs. FY8 3XE. Free of charge.
This book has been funded by PPARC as a study guide for the new EDEXCEL (London Examinations) GCSE examinations. The support for this examination is welcomed and the free availability is generous. This book had the potential of being just what was needed. In the event, however, it is a poorly produced book, with badly reproduced photographs, poor layout and lacking the structure which would have made it easier to use. It is far too dull and wordy and might put students off. Astronomy at GCSE needs to be practical, interactive and far more task-orientated.

There are many missed opportunities for including practical work, or explaining techniques of great potential use to the student (e.g. astrophotography). There are too many errors of fact, some quite serious (diagram apparently showing the Earth's shadow as divergent); many 'half truths' (a solar day as defined is not exactly 24 hours); careless misspellings, or misprints, (Cephus - twice! Canis Venatici, Oceanus Procularum, etc.); oversimplifications (the explanation of the tides, so simplified as to be wrong); and pedantic expressions ("decrescent" Moon; "de-excitation" of atoms).

Astronomy at GCSE level is a practical science. Project work is one of the strengths of the syllabus. It is a great regret that the book does not include clear references to practical projects, either in each chapter or in a separate chapter. Practical details in the text are lacking, and the little included can be misleading. Much has been achieved with cheap cameras, tripods and cable releases by students, for example, and 100 ASA Boots own print film is good enough for students to capture star trails, for example, in colour with exposures ranging from 30s (not 30 sec – "sec" is not an SI unit, contrary to the stated policy of the book!) to 10min. Local light pollution can be examined using the same kit, a subject not covered in this book.

The decision of the author not to take on board differentiation of the content was a mistake. The examination is differentiated, and pupils following the course are wide-ranging in their skills. There is a whole cohort for whom mathematical work is a non-starter. They need to find a their comfortable place in the book. Others are potential maths A level students and they can handle Kepler's Laws and the magnitude equation etc. We would have liked to have seen a set of boxes or appendices which clearly offered extension work to the more mathematical reader.

Bob Kibble and **Richard Knox**

More ideas from the space camp

Last year I reported on several activities that had proved successful at a Science Camp run in Dorking for 8 – 11 year olds. The camp (in a Field Studies Centre, not under canvas!) was made possible again this year by the support of the FSC and the teachers involved. I had a group of eight children (ranging from nearly 8 years old to nearly 12) to occupy for three days with activities to do with space and astronomy. I used the activities previously reported – Lining Paper Solar System, Constellation Projectors – and some newly devised for this camp, for example, "Postcards from a Planet".

The objective of this activity was to provide a personal conclusion to a series of activities about the planets where the students were learning information about the differences between the planets. A good thing about this activity was that it was accessible at many different levels.

Equipment list: large assortment of slides of the planets, moons, Sun and other solar system objects; slide viewers; assorted books about the planets, astronomy magazines and posters (many NASA freebies); CD ROM about the planets on a suitable machine; box of Paper Direct blank white notecards with envelopes (these are more expensive than just folding a sheet of paper, but they go nicely through a printer and the professional edges etc. make the end product something extra to be proud of); stamps; Solar System Bingo Game (uses planet features rather than numbers); The Great Planet Hunt Workbook (available from South Tyneside College Planetarium).

Quiz sheets

Each student was given a set of the nine quiz sheets from the Great Planet Hunt. These contain questions about each of the planets and you get points for identifying the planets correctly. The groups were divided into three parts, and each spent some time on the three "information stations" (i.e. sorting through slides, going through the CD ROM or finding out information about the planets from books and magazines). Fifteen minutes were allocated to each station.

At the end of the information session, we went through the Great Planet Hunt worksheets to identify the planets and discussed what we had found out about each planet. This helped to reinforce differences and similarities.

A break from the activities was provided by the Solar System Bingo, where the features of the planets are used to provide the basis for a bingo game (with suitable prizes).

The next activity involved the children deciding on the blackboard how far out from the Sun the various planets were. Predictably, we ended up with almost equal spacing, although some of the older children weren't 100% sure that this was right and discussed the fact that it seemed to take spacecraft a long time to get to the outer planets.

Solar System model

The Lining Paper Solar System was used as a group activity to reinforce the relative distances of the planets from the Sun, with the students each drawing a planet (not to scale impossible unfortunately) on the paper. A typical roll of lining paper is 10m long. At this scale, the first four planets get within the first metre or so, and then they really spread out!

Postcard from a planet

Finally, with all the new-found knowledge and enthusiasm for the planets fresh in their heads, the students sat down to compose a postcard home to their parents from a planet of their choice. Each student did this in draft first and read it out to the others. The peer review enabled the facts in each postcard to end up correct because where there was a mistake, the other students soon leapt on it! I provided nice blank notecards, envelopes and stamps and the results were then posted with some considerable pride.

Science Camp does allow for an entire day to be spent on one topic, a luxury that rarely occurs in a classroom situation. However, the progression of finding out information in a structured way and then using it in a variety of serious and fun ways to reinforce the information could be a process followed over the course of several lessons.

The material here would split into three distinct lessons: the Great Planet Hunt; Lining Paper Solar System and Postcards, with the Bingo game being a suitable filler for fast workers.

Alexandra Barnett

Curriculum Corner

THE AGE OF THE MOON

A piece of practical astronomy lore that I learned from J. Leslie White, one of the BAA's ex – Presidents and once an astronomy teacher of adults at Morley College and many other establishments, may cause a smile. It is an interesting piece of number manipulation into which you may want to delve, but Speaking for myself I have always cheerfully admitted that I have not had time to discover why it works! But it does (well, more or less!). This "procedure" gives the age of the Moon in days, to within a day – usually better – for any date (Gregorian Calendar).

The "age" of the Moon is given in days since New Moon. If it works out to zero, that is New Moon. 15 days is about Full Moon; 7 and 22 are the First and Last Quarters, respectively.

Start with the date in the form of year (CCYY) month (MM) day (DD), where CC marks the number of centuries (19, for this year).

1. Take the ~~years~~ YY ~~in the~~ date and reject multiples of 19 (i.e. divide by 19 and take the REMAINDER).
2. Multiply this result by 11
3. Reject multiples of 30 from this result (i.e. divide by 30 and take the remainder again)
4. To this result add the century number (CC) divided by 3, IGNORING ANY REMAINDER!
5. Then add the century divided by 4, also ignoring any remainder.
6. To the new total add 6 plus the month (MM) plus the day (DD)
7. Subtract the century (CC)
8. If necessary, reject multiples of 30.

And (as someone used to say) that's all there is to it! Note that steps 4 and 5 are constant for any one century, possibly two. For example it amounted to a total of 10 for the 19th and 20th centuries, but will be 11 in the next century.

An example

If we check out one of next year's "Blue Moons" (see Sky Diary, page 7) on March 31 we have (with the above step numbers in brackets)

(1) YY = 99. Rej. mults of 19, result: 4
(2) 4 X 11 = 44
(3) Rej. mults. of 30, result 14
(4) Add 19/3 (6, ignoring remainder), gives 20
(5) Add 19/4 (4, ignoring remainder), result 24
(6) Add 6 + 3 + 31, giving 64
(7) 64 – 19 = 45
(8) Reject 30s, giving the age of the Moon as 15 days, Full Moon!

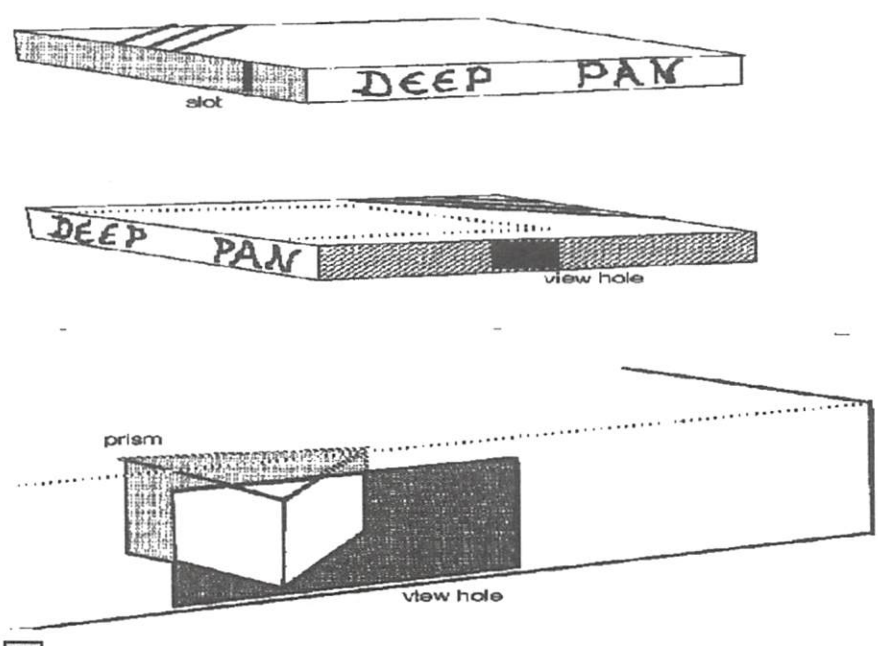
Clearly, 30 days previously will mean automatically rejecting a multiple of 30 at step 6 to give the same answer!

Richard Knox

A PIZZA BOX SPECTROSCOPE.

Here is a simple device to help young learners appreciate the visible spectrum.

Many schools have 60° prisms available, and pupils are frequently encouraged to look through them in a classroom, or even to direct light from a raybox through the prism. Here is an alternative use. You will need a 60° prism, a flat pizza type box (I have used a Kleenex tissue box as well!), some Blutac and a pair of scissors.



Cut a thin slot, say 2mm – 4mm wide, near to one corner of the box as shown in the sketch. Cut a viewing hole in the centre of the opposite edge. It is useful to cut a large folding flap from the top of the box to help you gain access to the inside, so that you can show the children that there is nothing magical about the contents. Secure the prism inside the box in front of the viewing hole so that one apex points to the right hand edge of the box.

Hold the box, pointing the slot towards a bright light, perhaps a window or a classroom light source. Looking through the viewing hole, you should see a spectrum to the right of your field of view. You might also be able to see the slot to the left. The darkness inside the box offers a good contrast to enhance the apparent brightness of the spectrum.

An extension.

Find a glass or clear plastic container, perhaps a small bottle. Fill it with water and add a few drops of colouring dye. Try food dye or ink or potassium permanganate if available. The solution should be weak and transparent but the colour should be visible. Now hold this up to your slot and look once again at your spectrum. Different dyes will absorb different shades in your spectrum. Note down the changes using a good set of coloured crayons or pencils.

Bob Kibble

Letter from Hawaii

Aloha! One of the questions I am often asked is "What's it like being an astronomer?" A common misconception is that we work all night, every night, and sleep all day. In fact, most astronomers are lucky to spend more than a half dozen nights per year observing with a telescope, and some, who specialise in theories and computer models of the universe, never come near a telescope!

For most of us here, preparing for a night on Mauna Kea starts almost a year in adavance. Twice a year, the Particle Physics and Astronomy Research Council (PPARC) issues a call for proposals to observe with the United Kingdom Infrared Telescope (UKIRT) on Mauna Kea. Astronomers from the UK and elsewhere fill out forms describing the sorts of observations they wish to make, and then have one page in which to make a case for why their program is scientifically important. Typically, there are 34 times more nights requested with UKIRT than are available, so the task of deciding which proposals most deserve to get time falls to a committee of astronomers drawn from the community of UKIRT users. Based on input from scientific and technical assessors, the committee ranks all proposals, and the available time is allocated in order of merit. Successful applicants are notified 36 months before their scheduled observing nights, while unsuccessful applicants usually revise their proposals, and try again the next time around.

A few days before the scheduled observing time, the observer (or observers, as there may be many collaborators on a proposal) fly out to Hawaii, and meet with their Support Astronomer, who helps the visiting observers prepare all the necessary files for the observations, trains them in the use of the instruments, and makes magnetic tape copies of the data at the end of a run. A day before observing commences, the observers drive up to Hale Pohaku to begin acclimatising to the altitude. Hale Pohaku ("House of Stone") is located 9000 feet up the slopes of Mauna Kea, and consists of dormitories, kitchen, dining hall, lounge, library, and offices where visiting astronomers sleep, eat, and work. The effects of altitude are lessened by ascending in stages, and sleeping here is easier than at the summit.

On the first night, observers meet up with their Telescope Operator, who is responsible for the safety of observers and equipment, and remedying faults as they occur. After eating dinner at 4pm, they travel to the summit in fourwheel–drive vehicles. The road to the top is mostly unpaved and rough, and can be treacherous in conditions of ice and snow. Arriving at the telescope, the operator opens up the dome shutters and mirror covers, while the observers start up the instrument (camera or spectrograph) they plan to use, and give it a complete checkout. Once the Sun has set, the operator slews the telescope to a bright star to check the pointing, the observers take some calibration exposures, and then observing begins. In the infrared, observations can be made in twilight, since we are more sensitive to airglow emission than scattered sunlight.

Over the next 10 to 12 hours, we will observe a multitude of targets, stopping only if the weather turns bad (foggy or windy). Just before sunrise, the telescope and instruments are shut down, and everyone drives back down to Hale Pohaku for a hearty breakfast. After a few hours sleep, the observers spend the rest of the day reviewing the previous night's data, and planning for the next. Then after dinner, it's time to do it all again. The privilege of travelling to telescopes in exotic locations is just one of the many rewards that makes astronomy such a satisfying profession. Above all, it is the thrill of discovery, and the quest to understand the Universe, which drives most of us. But our job is not complete until we have been able to share what we have learned with the public, through the media – including publications such as *Gnomon*. So watch this space!

Stuart Ryder
Joint Astronomy Centre; *sryder@jach.hawaii.edu*

Sky Diary Winter 1999

My apologies for inconsistency in naming the seasons - it arose from the use of "Spring Term" in Schools, meaning January to Easter! From this Sky Diary on, "Winter" means January to March (Spring actually begins at the Equinox of 1999 March 20.

The chart for this quarter shows the sky looking just west of south (azimuth 200°) in mid-February, 1999, from mid-Britain.

Castor and Pollux are good examples to use when people tell you that all stars look the same colour. These are called "Twins", but on, say, the second examination are clearly different. Ask the question "Are they the same brightness?", and Castor (visual magnitude 1.88) the northernmost of the pair, is clearly dimmer than his brother (magnitude 1.1). "Are they the same colour?". A good look shows that Castor (spectral class A1) is clearly whiter than yellowish Pollux (class K0).

The chart includes part of the spectacularly brilliant constellations of the northern winter, but there are also large areas that are overshadowed by Orion, Gemini, Canis Major, Leo and the like. Roughly half way along the Zodiac between Castor/Pollux and the head of Leo (a backwards question mark whose dot is Regulus, and nicknamed "the Sickle") are the faint stars of Cancer the Crab. The constellation makes an inverted Y, the centre of which is a small quadrilateral surrounding the star cluster Præsepe, the Beehive (also called the Manger, or if you were in ancient China, you may have it called the "exhalation of the pile of rotting corpses"!. Well-worth study in binoculars or by taking simple photographs. A very much fainter, but still worth a binocular look, is M67 about 2° west (preceding) of alpha Cancri which marks the southern end of the eastern arm of the inverted Y.

Much of Canis Major is too far south for most observers in Britain, and although made up of bright stars, they are outshone by Sirius, the brightest star in the night sky.

Approx. rising and setting times

	January 15		February 14		March 15	
	Rise	Set	Rise	Set	Rise	Set
Sun	08h 14m	16h 48m	07h 35m	17h 38m	06h 37m	18h 26m
Mercury	07h 44m	15h 37m	08h 02m	18h 17m	06h 32m	19h 15m
Venus	09h 18m	18h 22m	08h 34m	19h 56m	07h 37m	21h 23m
Mars	00h 54m	11h 46m	23h 56m	10h 10m	22h 23m	08h 27m
Jupiter	10h 37m	22h 11m	08h 50m	20h 46m	07h 07m	19h 30m
Saturn	11h 45m	01h 08m	09h 50m	23h 20m	08h 01m	21h 42m
Uranus	09h 08m	18h 14m	07h 14m	16h 26m	05h 20m	14h 41m
Neptune	08h 35m	17h 22m	06h 40m	15h 31m	04h 45m	13h 42m

About 5° south of Sirius (say the angular diameter of a typical binocular field – measure yours sometime!) is a bright open cluster M41, frequently overlooked because of its proximity to Sirius.

A large, obscure area to the east of Orion and found between Orion's greater and lesser dogs, Sirius and Procyon (αCMa and αCMi) is Monoceros, the Unicorn. The brightest stars in the constellation are only about magnitude 4! But two of them (beta and gamma) can be found about half way along the line from Sirius to Betelgeuse. Beta, the eastern -and dimmer - star of the pair, is a dramatic triple of comparable magnitudes (two are about 5 and the third, 6) and easy in a small telescope. A fourth component, magnitude 12, is harder to spot! About one third of the way from Betelgeuse to Procyon is another of Monoceros' brighter stars, the 4.4 magnitude epsilon, from which a fairly straight line of four stars can be seen leading north east into Gemini. About 3°to the east of epsilon (towards Procyon) is 12 Mon, a 5 magnitude star buried in the remarkably large Rosette nebula, a possible target for finding in binoculars on a colour photograph.

The Hydra curls his way across an enormous angle of sky, some 90° from its head rearing up to the south of Cancer, to the tip of its tail south of Arcturus! Although the largest of the 88 constellations, it is not easy to identify except, perhaps, the head end. It's head is a distinctive group of six faint stars in a trapezium shape, the north east corner leading to the long trail of stars which mark the body of the monster that was slain by Hercules. The trail makes a right angled turn south to magnitude 2 Alphard, the name means lonely star, and it certainly appears so.

Events in this first quarter of 1999 include two so-called "Blue Moons" (or one interpretation of it anyway) when in both January and March there is a Full Moon twice in one month. This happens "once in a Blue Moon"! (Next double blue Moon will be the same dates in 2018!).A penumbral eclipse of January 31 will not be easy to make out. The associated annular solar eclipse on February 16 (the last before the long-awaited Cornish one) is not visible in the northern hemisphere. But in the twilight of February 16 there is a slim chance to spot the Moon aged 11 hours - just about as soon after New as it is possible. It will be only 5° above the Sun, and about 2° below Mercury. This planet in turn will be some 16° south west of Venus along a favourably inclined ecliptic.

Moon phases for the first three months of 1999

Month	New Moon	First Quarter	Full Moon	Last Quarter
January	17	24	1 & 31	9
February	16	22	-	8
March	17	24	1 & 31	10

This is a classic example of looking for rare solar system sights in the Spring evenings, or the Autumn mornings, because the ecliptic then makes its maximum inclination to the horizon. Jupiter will be close by, for good measure, and Saturn not far away.

The young Moon will mark its eastwards trail just below this line of four planets over the next few days. Venus will be making its long-awaited return to become an increasingly prominent "evening star" throughout the quarter. Jupiter will be very close to Venus the last week in February - so get out the cameras, and wait for the reports of UFO sightings! Finally, Mars will be getting very bright in the morning hours as it moves towards opposition in April.

A good subject for a project

This is the time to launch an interesting project: to make a photographic record of Mars' motion against the background stars using, say, 200ASA film and a 30 second exposure at full aperture, using the "standard" lens (50mm on a 35mm camera).

The table of approximate rising and setting times through the quarter is now based on the dates half way through each month so that they will be equally spaced with those published in subsequent issues.

Richard Knox

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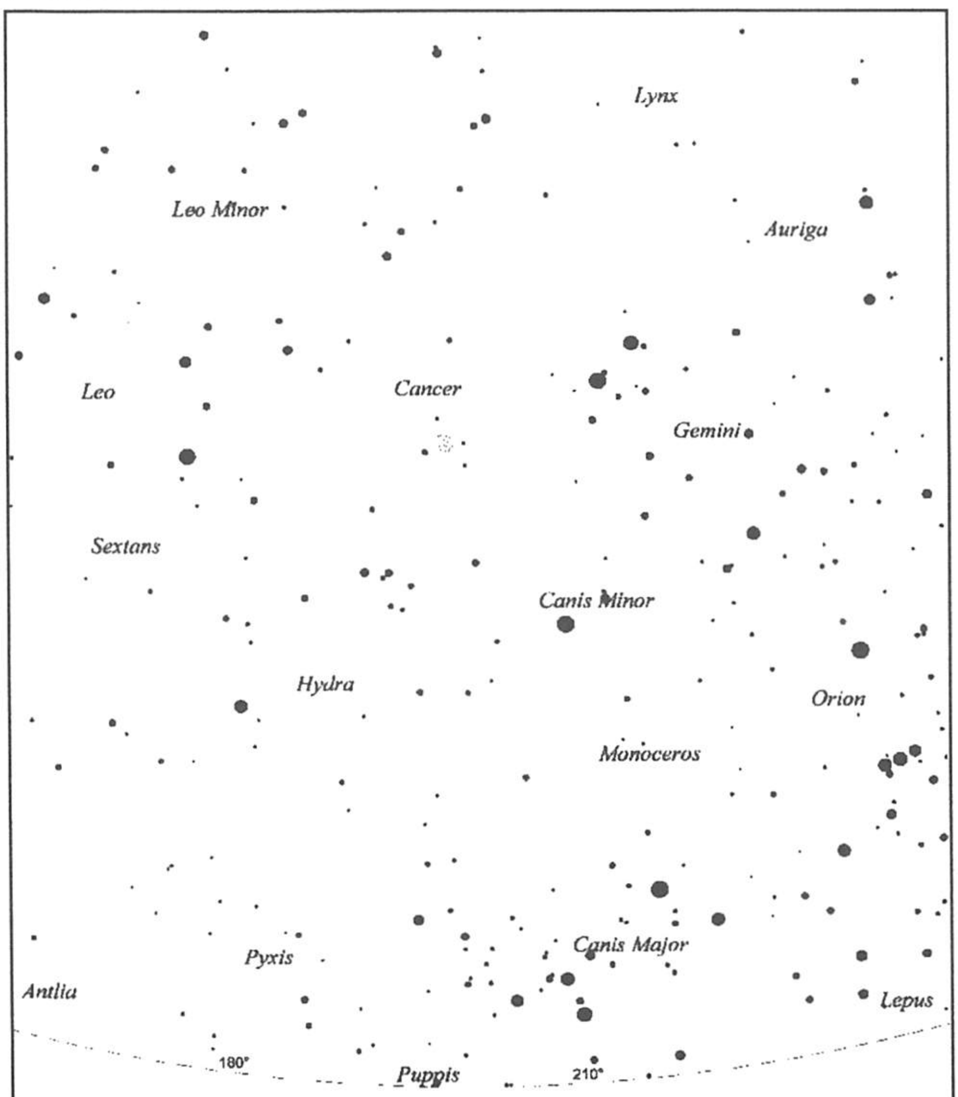

Looking south at midnight, mid-February 1999