GNOMON

Newsletter of the Association for Astronomy Education

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A grant from The Royal Astronomical Society enables "The Universe in the Classroom", the Newsletter of The Astronomical Society of the Pacific, to be sent to members with issues of "GNOMON".

WANTED - EDITOR FOR GNOMON

Due to pressure of other commitments, your editor will be standing down after the June issue. Although the deadlines always appear faster than you think they should, GNOMON is a interesting publication to put together and to represent.

Editors duties include:

- Commissioning of articles and editing them
- Occasional writing of material
- Collation of material from a wide variety of sources, mailing lists, newsletters etc
- Soliciting advertisements
- Assembly of copy for each page
- Sending of copy to our printers
- Proof reading

Our printers create the page layout at the moment so no computer input is required. However, deadlines can be closer to publication if the editor is able to supply the printer with text on a disk. Email access is also useful for receiving many of the articles from contributors.

The principle of the editor doing the page layout on computer has been approved if s/he already has those skills.

The Council may be able to offer a small honorarium for the work and expenses will be covered.

If you are interested and have further questions, please contact the current editor. Expressions of interest together with, if relevant, a summary of previous experience should be sent to the President, Mr Alan C Pickwick, via the AAE mailing address adjacent.

Association for Astronomy Education Annual Business Meeting

Saturday 13th June, 1998, Jodrell Bank Science Centre, Cheshire.

This year we are delighted to be enjoying the hospitality of the staff at Jodrell Bank. Aside from the AGM, there will be plenty of time to experience the Science Centre and its Planetarium. After lunch, one of the leading researchers from Jodrell Bank will be giving a presentation, and a tour of the facilities should help to illuminate attendees on the work and operation of the famous radio telescopes.

For further details and to register, please complete the form in this issue. If this form is missing, please call the editor urgently for one.

AGENDA

1) Minutes of the last Annual Business Meeting
2) Reports from officers of Council -
   President
   Treasurer
   Secretary
3) Election of Council for 1998/99
4) Any other business.

Nominations for posts on Council:

All posts are elected annually at the AGM. Here is your chance to become involved - new faces are always welcome! Many of the officers are happy to stand again but due to other commitments some posts will become vacant this year.

The posts are:

Officers:

President, Vice-President (3) Treasurer, Secretary, Assistant Secretaries (2)

Members:

Resource Centre Representatives (3), Members (3) Editor (co-opted by council).

Nominations can be made from the floor at the AGM, or in advance by post. Each nomination should be accompanied by the names of a proposer and seconder.

This year we would be particularly pleased to receive nominations for the post of Secretary. This is an important post in council. There are 4 meetings of council a year, held in London. One of the Vice-President posts is also vacant.

MEMBERSHIP of the AAE costs £10.00 a year for individual members, £20 for corporate membership and £7 for retired persons. For more information address letters to: AAE, Royal Astronomical Society, Burlington House, Piccadilly, London W1V 0NL. Members receive 4 issues of GNOMON a year.

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

Subscription Rates:

Individual Members	£10.00
Retired Members	£7.00
Corporate Members (e.g. schools, colleges, etc.)	£20.00

Corporate Members will receive three copies of *GNOMON*.

Extra Copies:

0-10	£1.00 per copy
11-50	£0.75 per copy
51-	£0.50 per copy

Back numbers, not less than one year old, half these prices.

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:

The Association for Astronomy Education,
The Royal Astronomical Society,
Burlington House, Piccadilly,
LONDON. W1V 0NL.

Editor: Alex Barnett, 43 Second Avenue, Wellingborough, Northants, NN8 3PX
email alexbarnett@dial.pipex.com. - for all enquiries concerning the Newsletter.
(Tel 01933 443628)

Advertising Charges:

Whole page	£120
Half page	£60
Quarter page	£30
Inserts	£75*

* These may be of any size which may conveniently be inserted into the newsletter. There may also be an additional charge for posting if the inserts are heavy.

The prices are for *one* issue.
A 25% reduction is made for advertising in all four issues.

Publication Dates:

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

FOR YOUR INFORMATION . . .

Plenty of happenings in the world of astronomy and space this springtime. Please keep sending items of interest to the editor.

Thinking about the 1999 Eclipse?
Advance Notice: The ASE is to publish primary and secondary workbooks for the 1999 Solar Eclipse. The books will contain a number of short projects to do on the day. There will also be suggestions for preparation and follow-up tasks. Publication is due in the autumn.

Resource Catalogues
A reminder that the 1998 editions of the PPARC catalogues of educational resources for UK schools and colleges (for ages up to 18) are now available. Entries generally include suitable age ranges.

The catalogue for Particle Physics includes books, magazines and journals, videos, charts and posters, workpacks, Websites, and an up-to-date list of contacts in UK university research groups, who can help teachers with suggestions on resources, local speakers, etc.

The catalogue for Astronomy and Space has lists of posters and wallcharts, workpacks, practical activities, software, slides and videos, equipment suppliers, Websites, magazines, portable planetaria, addresses of useful places, and lots more. It lists only a few selected books with practical activities.

Copies can be requested from the PPARC orderlines, namely on Tel 01793-442123 or email to pr_pus@pparc.ac.uk. Incidentally, there is now an order form listing PPARC publications suitable for schools and colleges - this can be ordered too!

Small and National Award schemes from PPARC
See the advert for the National Award schemes in this issue of GNOMON. The Small award scheme may be more relevant to most teachers and AAE members. The next round is due in the Autumn. To give you a feel for the types of projects that have been supported by the small awards scheme, a selection of successful projects from the most recent round are listed below. Hopefully it will inspire some readers to apply. Forms and information an full lists of all successful projects supported to date can be requested from the PPARC contacts above.

£2,000 for an astronomical education project *First Light', to be run by Sunderland Astronomical Society. The Society will make available new telescopes, binoculars and planispheres, and will write educational brochures outlining the basics of astronomy and optics. Sets of these will be loaned to local schools

£1,300 for *Project Odyssey', a scheme run by Cambridge Astronomical Association. A system of telescope, CCD camera, wide-angle lenses, video projector and screens is taken to different local venues so that groups such as schools, local societies, evening classes, disabled groups etc. see something of the night sky. It is expected that around 5000 people will benefit in the coming year.

£2,950 for *Heavens Above', a community astronomy project which aims in particular to promote the practical aspects of physics and astronomy to schools. This adds to the work of the University of Sussex observatory in the Ashdown Forest. The two main new elements are the provision of five small telescopes, for use by students before, during and after their visit to the main observatory, and secondly the provision of telescope-making kits for schools. The observatory project has a particular focus on disabled and special needs pupils, and special equipment will be provided for them. It is hoped that the telescope kits may be distributed through the national *Young Engineers Clubs' scheme.

£2,000 for a one-day workshop *Drama with Stars', aimed at 14-16 year olds studying for a GCSE in drama. The students will research a topic in a PPARC science area, and then devise a short dramatic presentation based on their research. The combination of science and drama is a novel approach that aims to stimulate interest in PPARC science. Oxfordshire schools will be invited to send teams to the event, which will be held at the Rutherford Appleton Laboratory. Both research scientists and a drama consultant will act as advisers to help the students.

£4,000 towards a project *Science in the Limelight' aimed at 7-11 year olds. Primary school teachers report how hard it is to teach concepts about the Earth, Moon and Sun relationship. The idea will be to develop demonstration lectures and practical workshops about these bodies, based on use of an *Orrery', a 3-dimensional model featuring all three bodies as part of a stage set. Sensors will be placed at various points on the surfaces of the objects, and the children will be able to repeat experiments demonstrated to them for themselves. This will form part of *Science in the Limelight', a regional programme based at Norwich research Park to promote science, especially using theatrical techniques.

National Astronomy Meeting 31 March - 3 April 1998
Host: University of St Andrews
The seventh annual National Astronomy Meeting (NAM) for the UK will take place in St Andrews, Scotland, from 31st March to 3rd April 1998, starting at 9.00 a.m. on Tuesday 31st March and finishing at 12.30 p.m. on Friday 3rd April. The National Astronomy Meeting is the largest and most important gathering of astronomers in the UK each year and is sponsored by the Royal Astronomical Society (RAS) and the Particle Physics and Astronomy Research Council (PPARC). It is expected to attract about 300 professional astronomers. This year it includes the UK Solar Physics Meeting.

Further details about the meeting and the scientific programme can be found via the World Wide Web at
http://www-solar.dcs.st-andrews.ac.uk/~nam98/

TRUMP Astrophysics Booklets
Liz Swinbank at the University of York reports that the TRUMP Astrophysics series is almost complete. Suitable for A-level students and their teachers, the first three booklets: Introduction, Observation and Stars are available now and the final three: Planets, Telescopes and Cosmology will be available later this year. They cost seven pounds each. Send for a leaflet to TRUMP Astrophysics, Science Education Group, University of York, Heslington, York, YO1 5DD.

Don't forget **SET week** which will be happening as this GNOMON gets mailed out. There will be plenty of astronomy activities as well as other science activities going on.

Wanted, enthusiastic teachers and schools to take part in some trialling of new materials later this year (probably in the Autumn term) for the National Space Science Centre Millennium Landmark project. Part of the NSSC is a Challenger Centre., a concept from the USA which teaches children of 10-14 years old about communication, teamwork and technology skills. In simulated space missions which have pre and post visit activities, children work together to achieve the end result, learning a great deal about using technology in 'real' situations, working with other teams and solving problems and making decisions. The US-based material will have to be adapted for use in the UK and the NSSC will be looking for assistance with this. Anyone who is interested should contact Alex Barnett at the NSSC on 0116 252 2675 or by writing to National Space Science Centre, University Road, Leicester, LE1 7RH.

Slides from Hubble
Hubble images are perhaps the most inspiring of all. Sets of the slides are available from some US sources but usually contain many images that are not required. London Planetarium is now making available single slides to enable you to select the ones that you really want. For a list of those available, write with an SAE to Undine Concannon, London Planetarium, Marylebone Road, London, NW1 5LR. Slides are £2 each plus VAT.

Native American Sky Stories
Looking for something different to capture the imagination of students and their parents at the end of term? In the USA,

many planetaria use the Native American myths of the sky as a way to get children thinking about astronomy. The stories are told by native Americans and while usually given under the planetarium dome, can be adapted for the classroom. As a result of the International Planetarium Society conference this July in London, two of these storytellers will be in the UK and are looking to spread the word while they are over here. Ben Sherman is Lokota and talks about how the Lakota lifeways were created so that people could be at one with the Universe. His brother, Mark Sherman who lives in the UK is co-ordinating dates. Mark can be contacted on 01295 258190. Lynn Moroney, who produces beautiful tapes of the stories she tells uses slides and flute music in her live storytelling 'concerts'. Again, while these are usually done under the dome (and could work in a portable) they could be adapted for the classroom. Lynn can be contacted via email skyteller@aol.com or at 1944 NW 20th St, Oklahoma City, OK 73106 USA.

More Big Solar Systems

Following last GNOMONs announcement of South Tyneside College Planetarium's entry into the Guinness Book of Records for the largest scale model of the Solar System, Bill Dines from Techniquest in Cardiff has written to say that one of the Millennium Pan Techicon awards, administered by Techniquest, has been given to architect Richard Weston who planets to create a Solar System the size of Wales with the Sun in Cardiff and Pluto in Anglesey. There will be associated workshops, and each 'planet' will have information on where to find the others! This would equate to a scale of about 225km, rather larger than South Tyneside's record of 34km. Anyone for the UK model?

Rising Stars 1997/98

The final of this astronomy and space quiz was held at the London Planetarium on February 7th and was a great event. The final schools were Sir William Perkins School in Surrey and Maidstone Grammar School, Kent, so it was a boys V girls final! The girls had scored more points in their semi final, so it was always going to be close. After a nail biting 45 minutes during which time the teams were asked not only general astronomy and space questions, but had to unravel, anagrams, plan a trip to the Moon, sort out the astronomy in some music and poetry and play a version of Call my Bluff, the boys won by a single point in the final round! The competition was sponsored by BT who provided all expenses paid trips to Goonhilly Earth Station for both teams, and the winners walked away with an amazing 10 inch Meade telescope which had been donated by an amateur astronomer in Switzerland, who was unable, through injury, to use it any more. Maidstone are intending to build an observatory to house the instrument and will be inviting their worthy rivals over for a view. Both teams, and many of the 87 schools that entered this year will be entering for the competition 1999/2000. Depending on sponsorship, it may be possible to run this competition Nationally.

Finally, did you receive your Winter GNOMON? As we were sending to members who had not renewed (due to the missed GNOMON in September) as well as renewed members, things got a little confusing on the administrative side and in consequence, some members may have received two copies, while we have a feeling that one or two members may have slipped through the net. If you did not receive a winter GNOMON, can you please contact the Editor as soon as possible.

COMPETITION

SEA & SPACE

★ **WINNERS OF THE SENIOR COMPETITION WILL GO TO EXPO98 IN LISBON.**

★ **WINNERS OF THE GRAND FINAL IN LISBON WILL GO TO EUROPE'S SPACE PORT IN FRENCH GUYANA TO WATCH AN ARIANE ROCKET LAUNCH OR TO ESO'S VERY LARGE TELESCOPE AT THE CERRO PARANAL OBSERVATORY IN CHILE.**

★ **WINNERS OF THE JUNIOR COMPETITION WILL HAVE THEIR WORK DISPLAYED AT EXPO98 IN LISBON.**

The senior competition for 14-19 year olds is to create a newspaper, 4 pages of A3, on the SEA AND SPACE theme.

The junior competition for 10-13 year olds is to design an A3 or A2 poster on the SEA & SPACE theme.

These competitions will be organised simultaneously in most European countries and do not require Internet access.

For copies of the competition entry form, write, enclosing an A5-sized SAE, to:

SEA & SPACE, 19 Edale Grove, Sale, Cheshire, M33 4RG.

INTERNET ACTIVITIES:

For teachers who want good reasons to use the Internet, there is support for the highly interactive SEA & SPACE programme that will make it possible for pupils to perform field experiments and astronomical observations and to obtain and process satellite images.

SEA & SPACE will start as from 1 March 1998. Further information is provided on the Home Pages of ESA, ESO and EAAE. In early February, a dedicated joint SEA & SPACE Home Page will be operational where schools can register for the project and for regular mailing of new information:

http://www.esa.int/seaspace http://www.eso.org/seaspace http://www.algonet.se/~sirius/eaae/seaspace

The SEA & SPACE project is a joint initiative of the European Space Agency (ESA), the European Southern Observatory (ESO), and the European Association for Astronomy Education (EAAE). In the UK it is being administered by the Association for Astronomy Education (AAE).

BACKGROUND

The 1998 World Exhibition EXPO98 in Lisbon will focus on the oceans. This is why the umbrella theme of SEA & SPACE is concerned with the many relations between the oceans and the space that surrounds us, from ancient times to present days. Under the new programme, teaching resources are offered for three major areas, Remote Sensing of Europe's Coastal Environment, Navigation and Oceans of Water.

Remote Sensing of Europe's Coastal Environment: observations of the Earth from Space are made accessible to pupils who will appreciate their usefulness through interactive image processing and field observations.

Navigation: the capabilities and functioning of different navigation techniques are explored through experiments using navigation by the stars, with GPS, and via satellite images/maps.

Oceans of Water: What is the role of water in Nature? How can one detect water from satellites or with telescopes? How much water is there in rivers and floods, in an ocean, on Mars, in comets, in stars, in the Universe?

REVIEWS

Views of the Solar System CD-ROM.
An excellent web-like resource. It looks like the Internet but is all on the CD-ROM. It has a massive amount of structured text with appropriate images covering the Sun, planets, moons, asteroids and comets. There is also a detailed section on the space missions of the USA, Russia, Japan and Europe. There are lesson plans and articles. Ideal for project work and reference. Key Stage 2 and above. Windows and Mac on same disk.
National Science Teachers Association, 1840 Wilson Blvd, Arlington, VA 22201-3000, USA. Tel: 001 703 243 7100. Fax: 001 703 243 7177. $38 inc. Just fax your address and credit card details.

Alan Pickwick.

REDSHIFT, by Stuart Clark (University of Hertfordshire Press), 1997. Pp. 200, 24.5 x 21 cm. Price 14.95 (paper; ISBN 0 900 45866 6), 29.95 (cloth; ISBN 0 900 45879 8).
The central aim of this book is to explore the phenomenon of the spectral redshift of light in its various guises in astronomy: the Doppler effect, gravitational redshift, and the cosmological redshift of galaxies beyond our own Milky Way. Does it succeed? Well, partially.

The text itself is fairly accessible to the A-level student, first-year undergraduate, or interested lay person, and begins with an historical introduction to the discovery of the nature of light. The Doppler effect and its relation to an object's radial velocity are described, and later extended to include the effects which become important for relativistic motions. Several

examples from astronomical observation are given, though I could not help feeling that fewer of these, discussed in greater depth, would have conveyed the principles better. The example of oscillating lines in a spectroscopic binary is fitting, but the treatment of Galactic hydrogen clouds is too brief and idealised to be much use; indeed, the diagram is quite unhelpful, and potentially misleading. Where `real' data are used for illustrating P Cygni profiles, there is no adequate explanation of the unusual line shapes observed.

The concept of gravitational redshift is introduced, with some discussion of black holes and a brief commentary on the interpretation of ripples in the cosmic microwave-background radiation. Probably the most useful part of the book is the chapter dealing with the cosmological redshift, which describes the early observations of extra-galactic redshifts, through to current attempts to pin down precisely the value of the Hubble constant. The use of redshift surveys for mapping large-scale structure is described, and the time evolution of the Universe inferred from observations of high-redshift galaxies, clusters, and the cosmic microwave-background are discussed. In the last few years, astronomers have homed in on all these key pieces of observational evidence; they clearly have an important bearing on cosmological questions about the nature and age of the Universe, and its fate, so their inclusion provides some useful background for any student, though more extensive referencing would increase the book's value for the undergraduate.

So what's wrong? All the mathematical equations and derivations are (quite laudably) diverted into `notes' adjacent to the text, leaving a clear run for the non-mathematical reader. But for anybody interested in the mathematics, these notes are sometimes inadequate and contain typographical errors. The simpler treatments are probably worth having; but the space-time diagram used to illustrate the derivation of the Lorentz contraction is notable for its confusion of lines and labels. I often felt that the reader would be much better directed to a standard text, especially in the sections dealing with special relativity (to be fair, a short bibliography is included, with suggested titles for further reading).

The use of illustration offers the opportunity to amplify the text with well-designed diagrams and lively captions, but it is here that the book performs least well. On the whole, the artwork is poor. A number of diagrams lack detailed captions, and some contain errors (Hubble's tuning-fork diagram has the spiral sequence of galaxies back to front); others are quite uninformative or even misleading. In the introduction, the key figure demonstrating the redshift of a spectrum, which after all underpins the whole business of the book, is lifeless. The subject matter cries out for colour illustrations (which would, perhaps, have increased its price, but more so its value!). The glorious Hubble Deep Field, ideal for revealing the deep-red, compact image of a high-redshift galaxy, falls flat as a halftone photograph.

The final chapter on unconventional interpretations of redshift is useful for conveying to the reader that there are still many open questions in this field, though the review is fairly uncritical.

The book contains a number of typographical errors, and annoyingly (for those of us concerned with reinforcing good practice in our students), several instances where the singular and plural forms of `phenomenon', `nebula', and `spectrum' are confused—-one incriminating sentence tells us how long it took the astronomer Slipher to capture `one single spectra'. This may seem pedantic, but one would not wish the reader to gain the impression that the subject matter itself had been treated with less than great care.

Steve Fossey
University College London

ADVENTURES IN PSEUDO-SCIENCE LAND
Astronomers, both amateur and professional, are often called upon to answer queries about pseudo-science, like astrology, and UFOlogy. Teachers also will get asked such questions while in the classroom. Over the past few years and on some occasions recently, I have been dealing with several such enquiries a day, and I began to wonder to what extent I should be providing assistance.

Should I, as an astronomer, be giving out the times of moonrise and moonset to a lady whose only interest is to construct her astrological chart or to a child who wants to know their starsign? Should I assist a member of the public who turns up at the observatory and asks for assistance in locating 'their' star or how should I react to a pupil who announces that they have a star named after them? How should I deal with a member of the public who wishes to arrange a meeting to discuss the implications of the 'Face on Mars' or his/her recent abduction?

As a public service, a planetarium / science centre has an obligation to assist any member of the public that asks for help. Teachers are put in a similar position by their students However, the institution obviously does not

want that aid to be seen as endorsement when the credibility of the subject is doubtful. Astronomical Societies also have to deal with such questions, and lets face it, how many of us haven't been asked about star signs on confessing our astronomical hobby!

There are many questions to be raised in this issue and they depend strongly on the subject matter. The difficulty arises in treating all enquiries with courtesy and respect even when you have a very strong opinion as to the validity of the subject. While our natural instinct may be to laugh or give the caller a long lecture on the scruples of the International Star Registry (or whatever), this only serves to alienate the caller further against science and science institutions and frustrates both parties.

So, what is the solution? I believe that all these enquiries should be leapt upon as a chance to educate and inform. For example, assist your astrologer in finding out where the planets are in the sky, but then explain that this is different to the positions that he/she would have obtained had they consulted an astrology almanac. The discussion this provokes is always interesting and gives you a chance to introduce a few astronomy facts. Never put the caller down, just be pleasant and explain. While you may not convert the caller to a life of astronomy, they will at least be aware that something is different.

How about our Buy-A-Star friends? Should you assist a member of the public or your pupil in finding 'their' star? My answer to this is 'yes'. They've already bought the confounded thing. A simple statement of the facts is all that is required and a suggestion that if they feel let down, then they should complain. Perhaps with children, a quiet word to the parents would be more appropriate As with all gifts, in my experience with this scheme, it's the thought that counts.

The most entertaining category of callers are the UFOlogists, abductees, 'Face on Mars', and 'Chariots of the Gods' crowd. These are often situations where it takes the greatest effort not to deride the callers intelligence in some way. If it is possible, let these callers talk and do the listening. Let them tell you their opinions and 'experiences' and when they have finished, then tell them that you can provide them with an opinion or suggestion if they want it. The majority of UFO callers that I dealt with had seen Venus or Canopus and when I identified the object after asking a few questions about location and time they were happy.

The others tend to be almost fanatical about their beliefs and trying to convince them otherwise is impossible and frustrating. This is one area where there is no solution. And you are best just to be polite and end the conversation quickly. Remember the fact that some people out there think we astronomers are for weird standing out all night with only strange instruments and the odd hedgehog for company!

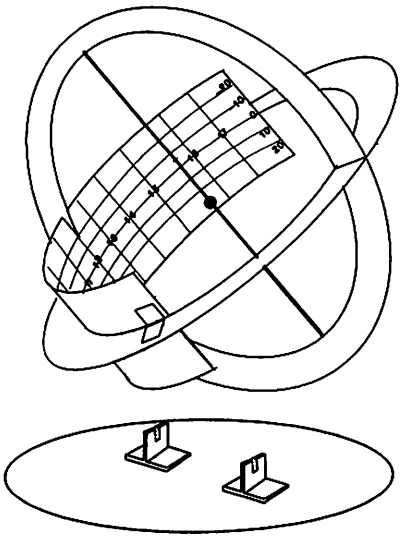
Alex Barnett

CURRICULUM CORNER

AN EQUATORIAL ARMILLARY SUNDIAL

The sundial allows you to watch the daily apparent motion of the Sun, and its change of declination throughout the year. Like all sundials, it also demonstrates the equation of time, the gain or loss of solar time due to the change of the Sun's declination, and the result of Kepler's Second Law on the Earth's orbit. It is particularly fascinating to watch the Sun reach its furthest north and south, and to watch the shadows switch between the top and underside of the equatorial ring at the equinoxes.

Cut two circles of thick (artist's) card of any inner radius R you like. The outer diameter of the ring is up to you, but when you have cut out two rings they must be fastened together at right angles by cutting radial slots of the same width as the card thickness at diametrically opposite points: on one ring, cut slots half way in from outside; and on the other ring cut the slots half way out from inside. This allows the two rings to be mounted as shown. The two intersecting joins should be filleted with a solid-setting resin glue. Make a gnomon of length 2R from a straight piece of thick wire (from a dry-cleaner's coat hanger) and fix a bead in the centre. Then glue the gnomon diametrically across the meridian ring at 90 degrees from the join with the equatorial ring.



Finally make a scale of length R times pi, so that it will extend half way round the inner circumference. Mark the 12 hours from 6:00 to 18:00 intervals from left to right with vertical lines, spaced at 0.2618 X R. The ends of the strip will be the 6and 18hr lines respectively. The height of this strip should be 0.8696 X R, to give an angle from the centre corresponding with declinations of 23 degrees north and south. Mark horizontal lines along the centre (the equator) and at plus (below the equator) and minus (above) for declinations of 10 and 20 degrees north and south. These lines, spaced at10 degrees, are separated by 0.176 X R. This scale is fastened round the inside of the equatorial ring, through a slot cut in the meridian ring, (or by cutting a slot in the scale down where it crosses this ring). The scale position can be strengthened with L-shaped card straps glued between it and the equatorial ring, as shown at one end of the scale in the diagram.

Using one of the circles originally cut out of the armillary rings, make a base with two slotted inverted T-shaped card feet, in a line, so that the meridian ring can be placed with the meridian vertical, and the gnomon at the angle corresponding to the sundial's latitude. It can then be lined up using the Sun (corrected for the equation of time) and for your longitude, if you intend to show true local solar time. The shadow of the bead indicates the Sun's declination: the shadow moves to the top of the scale in winter and the bottom in summer. This sundial makes an easy practical project that provides lots of astronomical information while being used!

Richard Knox
Penzance Peripatetic Planetarium

QUERIES

Some queries from our query service . . . *query@ulo.ucl.ac.uk*

How do astronomers measure the distances between objects in space that are extremely far away?

Simon

The distances to stars in the neighbourhood of the Sun, out to a few hundred light years, can be measured directly by means of parallax. The parallax of a star is due to the Earth orbiting the Sun. A star appears to move in a tiny ellipse against the background of very distant stars. This is simply a reflection of the Earth's motion around the Sun; an observer with extremely good equipment (and an asbestos suit !) located on the distant star would see the Earth moving in an ellipse of the identical size and shape around the Sun during the course of a year.

Parallax is measured in seconds of arc (or milliseconds of arc - the angles are very small indeed). The parallax of a star is equivalent to the angular projection of the mean Earth-Sun distance (1 AU) on the sky at the distance of the star. There are 360 degrees in a circle, 60 minutes of arc in a degree, and 60 seconds of arc in a minute. A star with a parallax of exactly one second of arc would be at a distance of 206,265 astronomical units (AU), also called one parsec and equivalent to 3.26 light years (LY). Even the nearest other star is more than one parsec away.

The recently completed European Hipparcos satellite project resulted in many thousands of highly accurate parallax measurements from space; you can explore their Web site at:
http://astro.estec.esa.nl/SA-general/Projects/Hipparcos/hipparcos.html

Objects at much greater distances than, say, 1000 LY, require indirect methods. If we can calibrate the absolute luminosity of stars of a particular type, like certain variable stars (e.g., cepheids) or stars of some particular spectral class, then we can determine their distances by measuring their brightnesses and using the inverse-square law of apparent brightness vs distance: B = constant x 1/distance^2. The constant is the absolute brightness of the star (defined to be its apparent brightness at a distance of 10 parsecs). A star 1000 parsecs away would be 1/10000 as bright as the same star at 10 parsecs. (Read the equation as "B = constant times 1 divided by distance-squared").

This method is being applied to determine the distances to other galaxies in order to fix the value of the Hubble constant.

I hope this answer helps you and that you can find out more from the Web reference given.

Best wishes,

"Query"

I am looking to buy an entry level telescope for my father as a birthday present. Please can you give me any advice on make or features I should be looking for. I am looking to spend around £120-£200 .

Many thanks

Michele

If you have browser access to the Internet (Netscape, Internet Explorer) there is a good survey of typical beginner's telescopes (but from the American point of view) at
http://www.skypub.com/testrept/lowcost.html

Entry level telescopes do exist in your price range but are very minimally equipped for astronomy. A good starting place for you to look for ideas for the UK is in the pages of a magazine like Astronomy Now, found at most larger newsagents. They carry many advertisements from retailers If you really want something that will give pleasure rather than frustration, you may have to spend more than planned unless you wish to buy a good second-hand telescope (which will not have a warranty). I would not recommend this to the uninitiated.

In general refractor telescopes (with objective lenses) are easier to handle but for the same price reflectors have larger apertures. You should look for the largest aperture for the price you are prepared to pay. Aperture is the diameter of main lens or mirror. Most starter refractors are only 60 mm diameter, too small for anything but birdwatching and looking at the Moon, or a few of the brighter planets.These small telescopes tend to disappoint their users although they are popular buys for children. Often the optics or eyepieces are poor by astronomical standards.

Reflectors are larger but bulkier to handle, and unless the handling is a real problem I would go for a reflector. Quality of eyepieces is very important; good ones do not come cheap.

All astronomical telescopes should feature a low-power easily used finderscope which can be accurately adjusted for pointing. Without this it is very difficult to find objects.

Never buy a small telescope for which the advertising boasts of the large magnifying power available. This is a sure sign that the seller is appealing to someone who doesn't know anything about telescopes. The most you should use on one of the 60mm starters is about 80x. Anything more just magnifies the natural blur of a small lens and makes it nearly impossible to find anything Look for a good solid tripod, much more solid than a photographic one

Finally, perhaps you should consider buying your father a really good pair of binoculars instead. For your budget, you will be able to find some good quality optics, in a lightweight construction, and also buy a tripod and perhaps some star maps! In addition, your father will be able to use the binoculars for many other things.

QUERY - AAE

Sky Diary Spring 1998

NIGHT SKY FOR THE SECOND QUARTER OF 1998

The constellations associated with the late spring and early summer sky are generally less familiar to observers in the northern hemisphere. This is hardly surprising since at this time of the year astronomical twilight starts to last all night, and the hours of darkness become very short indeed by the middle of June when the northern summer solstice occurs (1998 June 21d 14h). It is exciting to watch the Sun reach one of its four "milestones", such as the solstice on an equatorial sundial (which is described in a separate note in this issue) Although we cannot see the midnight sun from the UK, we can easily see the "midnight twilight", that dome of faint light that looms over the northern horizon marking the azimuthal position of the Sun throughout the night.

In addition to the shorter hours of darkness, however, the northern sky also presents some of the fainter and less obvious patterns of stars such as Ophiuchus, Serpens, Libra, and even Hercules. Why such a famous hero as Hercules should be relegated to such a sprawling group of generally insignificant stars (and upside down to boot!) compared with the magnificence of that obscure, and not particularly admirable character Orion is an intriguing mystery. It has been suggested that originally the group of stars we now call Orion was named after Gilgamesh, the Sumerian equivalent of Hercules, but that the Greeks, in translating the Sumerian name for Gilgamesh, Uru An, fitted it to their nearest-sounding

Sky Diary *cont*

mythological character Orion. Not much is known about Orion other than that he loved the daughters of Atlas, the Pleiades (and still pursues them about the sky!),and, after boasting that he was a great hunter who could kill any animal, he was slain by the scorpion. Scorpius was placed among the stars so that the two never met again, so we see Scorpius in the sky during the spring and summer, and Orion does not show his head till Scorpius has set.

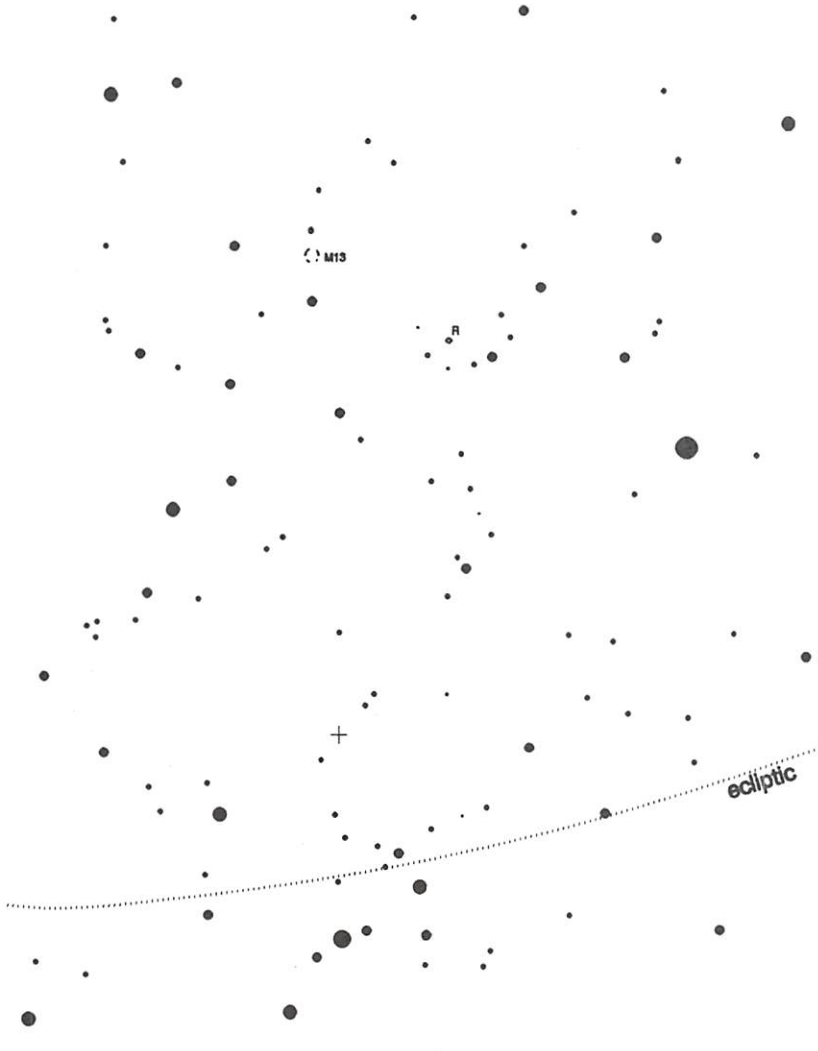
To set about a tour of the spring constellations methodically, start from the Plough. Follow the arc of the Plough's handle down to Arcturus, the red giant star, and the brightest star in the northern half of the celestial sphere. You can continue this corny mnemonic: having made an arc down to Arcturus, you can spike down to Spica, the first magnitude star at the tail of Virgo's sprawling Y. Arcturus is in a short tail trailing from a diamond-shaped "kite", the whole forming the most obvious pattern within the constellation of Bootes, the Herdsman (who also pushes the Plough around the sky).

To the east of Bootes is a small semicircle of faint stars, very easy to pick out, Corona Borealis, the Northern Crown. It contains the unpredictable variable star RCorBor which suddenly fades from sight (with binoculars) from time to time.

To the east of Corona, and a little north, one finds poor old Hercules' loins which are marked by the most obvious grouping of stars in the constellation, the trapezium-shaped grouping of pi, eta, zeta and epsilon, (reading clockwise from the northeast corner). This trapezium is sometimes referred to as "the Keystone" as it resembles the centre stone of an arch. The famous and glorious globular cluster M13 is just visible to the naked eye and is wonderful in a telescope or binoculars one third of the way down the western side of the Keystone. The whole constellation is quite big, stretching almost from the celestial equator to declination 50¯north, which is at the zenith in southern England.

When the claws of the Scorpion reach over the southern horizon, and the unmistakable bright red supergiant Antares appears, the observer has a sort of guide to the large rather blank oval that is Ophiuchus, the Serpent bearer. This large area of sky is found south of Hercules and to the north of Scorpius. A few pairs of faint stars can be seen round this oval area, and the westernmost pair lead to a straggly line of stars and a triangle that forms the head of the serpent that Ophiuchus carries. The serpent is two parts: the head, Serpens Caput, rears northwards towards Corona Borealis; the tail, Serpens Cauda, trails up to the east of Ophiuchus and points towards Altair in Aquila. The tail contains only one or two third magnitude stars not easy to distinguish (and hardly worth the effort) from Ophiuchus itself and Aquila. Ophiuchus is important as a section of the ecliptic passes through its southern regions to the north of Scorpius. The ecliptic would miss the Scorpion altogether were it not for the small part of the constellation that stretches north from the topmost " claw", beta Scorpii, which is a lovely and easy double star in a beautiful region of the sky.

Events during the three months include the April Lyrid meteors, usually a rather modest "shower", but without much Moon to interfere at maximum on the 22nd. With an unobstructed south eastern horizon you can see (and photograph) a spectacular conjunction between Venus and Jupiter, and the thin crescent of the waning Moon (three days before new) which will be about half a degree from each other on April 23. But they will be low in the morning twilight and best at about 4h 30m!



Moon Phases

Month	New Moon	1st Quarter	Full Moon	Last Quarter
April	26	4	11	19
May	25	3	11	19
June	24	2	10	17

Richard Knox
Penzance Peripatetic Planetarium

Caption to star chart: Constellations in the south at midnight through the spring. Globular cluster M13 in Hercules (the "Keystone") and irregular variable R CorBor are marked, as is the ecliptic(which passes very close to alpha Librae and beta Scorpii). The cross marks Pluto's position in Ophiuchus (May 15, but Pluto doesn't move much in three months!). The bright star in the top right of the chart (30¯ north of Arcturus) is Eta UMa, the end of the Plough's handle.