GNOMON

Newsletter of the Association for Astronomy Education

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EDITORIAL COMMENT

Firstly, an enjoyable annual meeting at the Institute of Astronomy, Cambridge, not only for the scheduled programme but also for the lunch break held *al fresco* in near heat wave conditions. This provided a useful means for those attending to speak to their colleagues in relaxed and informal surroundings.

Secondly, I have in the last few days been bombarded with material for publication in *Gnomon*. I must apologise to those contributors whose articles have not been included, due to such pressure on space.

Finally, just for the record, the format of *Gnomon* has been modified with the addition of colour. Hopefully, this will brighten up our Newsletter.

Annual Meeting – 23 May 1992

This year the venue was the Institute of Astronomy, University of Cambridge. In these beautiful surroundings, members held their annual business meeting, and thanks are due to the IOA and to Dr David Dewhurst for hosting the meeting.

In the morning members received reports from the Secretary and Treasurer, which followed the annual Presidential address. New members of the Council were elected. During the transitional period for the new Council to take office, members are requested to contact the 'old' officers whose names and addresses appear in the list on the front page.

THE NEW OFFICERS ARE:

President:	Julian Ravest
Vice-Presidents:	Donald Gold, Anne Cohen, Bob Kibble
Secretary:	Eva Hans
Asst Secretaries:	Teresa Grafton, Nik Steggall
Treasurer:	John Flynn
Resource Centre Representatives:	Ian Griffin, Teresa Chilton, Alan Bowden
Members:	Alan Pickwick, Mike Dworetsky, Alex Lovell

The Editor is chosen by the Council at its next meeting – the present incumbent is Eric Zucker.

SUMMARY OF PRESIDENTIAL ADDRESS

The AAE was born on 16 May 1981 at an inaugural meeting in Liverpool. It differs from other organisations in that its chief concern is for the educational aspect of astronomy. We work with those other organisations, in particular the Earth Sciences Teachers' Association (ESTA). Recently the Association has become involved in 'space' activities; children are fascinated by the whole concept of 'space'. We are also very interested in cross-curricular ventures.

The Association has produced a primary teachers' work pack, and the secondary work pack will be available in the next few weeks, with a preface by Professor Arnold Wolfendale, the Astronomer Royal. We also continue to produce the Newsletter (*Gnomon*).

AFTERNOON PROGRAMME

This included a very interesting talk and demonstrations by Chris King of ESTA, who explored the possible common ground between our two organisations.

This was followed by an enjoyable trip through the Cosmos conducted by Professor Malcolm Longair – who succeeded in the space of about half an hour in obtaining an expression for the critical density of the Universe, and whether it was an open or closed Universe, using only Newtonian mechanics, and requiring only a basic familiarity with calculus and Newton's laws of motion and of gravitation.

* * *

We are pleased to inform members that Robert Mills, a regular contributor to these columns, was made an Honorary Life Member of the Association, an honour well deserved.

SPACE COMPETITION WINNERS

The results of the competitions (details in last issue of *Gnomon*) are:

Debra Morris, Dane Valley High School, Congleton, Cheshire (Space School, £200)

David Feinstein, St Pauls School, London (Young Astronauts, £100)

Liese Marks, Ballyclare High School, Northern Ireland (Young Astronauts, £100)

Congratulations on such splendid entries!

Also to other candidates for such high quality submissions – better luck next time.

This issue of 'Gnomon' has been sponsored by The Royal Astronomical Society

This enables the newsletter of the Astronomical Society of the Pacific, 'The Universe in the Classroom', to be included as pages 5–8 of this issue.

Subscription Rates:

Individual members	£7.50
Retired Members	5.00
Corporate Members (e.g. schools, colleges, etc.)	15.00

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.

Addresses for Correspondence

Secretary: Bob Kibble, 34 Acland Crescent, Denmark Hill, London SE5 8EQ – for all general enquiries. (Tel: 071–274 0530)

Treasurer: Nik Steggall, 38 Victoria Crescent, Birkdale Road, Dewsbury, West Yorkshire WF13 4HJ – for all financial and subscription enquiries. (Tel: 0924–454718)

Editor: Eric Zucker, 35 Gundreda Road, Lewes, East Sussex BN7 1PT – for all enquiries concerning the Newsletter. (Tel: 0273–474347).

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.

BOOKS

THE SKY, by David Levy, published by Cambridge University Press (hardback, £16.95), 1991, ISBN 0 521 39112 1.

At first glance, David Levy's book appears to be a less than user-friendly guide to the night sky. The format is unappetising. On a bookshelf full of astronomy books, this is easily eclipsed by the colour photographs and designer graphics which we have come to expect in books for the beginner. I can imagine few amateurs willing to part with £16.95, half way to a new eyepiece, for a hardback user's guide. Yet I find myself recommending this book to you.

The secret lies in the fact that David Levy has done it and wants to tell you about it. This book is a guide through his eyes. Not only is the reader given a comprehensive guide to all possible observations, from town and country locations, but she is treated to an almost autobiographical account of the trials and triumphs of David Levy, keen amateur, boy and man.

Starting with a naked-eye introduction the book proceeds to planetary, lunar and solar observations. It continues through minor bodies to deep sky objects. Each section includes references to naked-eye, photographic and telescopic possibilities and pitfalls and is liberally peppered with references from the literary world. The reader is given advice on how best to record details and where to find up-to-date information. Local astronomical societies are given a boost but the author does issue a word of warning to all those over-enthusiasts who unwittingly terrify the new observer.

A particularly welcome section called 'passing the torch' is written for educators. It flies the flag for school astronomy and makes a number of useful practical suggestions. The book closes with a resources section, of mostly Canadian and American references.

David Levy's *The Sky, a User's Guide*, will appeal particularly to those already converted to amateur astronomy, readers of *Gnomon*, no doubt. It is a handy bedtime read and would make an ideal present to a stargazing friend, perhaps someone who is saving up for that new eyepiece.

Bob Kibble

FIRESIDE ASTRONOMY, by Patrick Moore, published by John Wiley, ISBN 0471 93164 0 (hardback, £14.95), 1992.

This is a book with a difference. Very aptly described as 'An anecdotal tour through the history and lore of astronomy' it contains a wide range of miscellaneous information within a compass of 107 short chapters.

It would be desirable for readers to have some knowledge of the subject in order to enjoy what it has to offer to the full. But, having said that, it is essentially a book which Patrick Moore tells us 'to dip into'. As he says in the preface, it is emphatically not a textbook and its purpose is to entertain the reader with facts and episodes which may not have been encountered before.

A few examples will illustrate its aim and interest. 'The Hubble Telescope: Failure or Success?' describes the great ambitions engendered by the launch of the telescope in April 1991. But, as most of us know, the mirror had been wrongly shaped and the star images are surrounded by fuzz instead of being sharp and clear. There are other faults too.

One wonders how such mistakes could have been made at the design stage by engineers who presumably are at the top of their careers.

Other chapters randomly deal with the possibility that manned spacecraft will reach Mars within the next twenty years; the probable existence of 'planet X' beyond the orbits of Uranus and Neptune. There is an interesting reminder in one chapter that space is becoming cluttered up with miscellaneous debris, in an account of the astronauts in the Shuttle Discovery when they found that the craft was on a collision course with some debris but were, of course, able to change course to avoid it. It highlights the fact that such debris is hard to locate and therefore highly dangerous. It has been calculated that about 700 objects are orbiting the earth, and that a clearing-up operation should be undertaken.

There is a chapter about a suggestion by a Danish astronomer that there may be much more dust in the universe than had been so far believed. He suggests that we see far fewer edgewise-on galaxies than we ought to do if they were oriented at random. It follows therefore that we only see 15 per cent of the total starlight in a spiral galaxy and all the rest is concealed by dust. The basic idea is not new but it has been previously assumed that the dust takes the form of a smooth layer right through a galaxy rather than being contained in definite clouds.

In a chapter on Pluto we are told that it is a strange body and that little is known about it. Indeed, the discovery of Charon, its attendant satellite, showed that the two bodies are not alike. The surface of Pluto is coated with methane ice, Charon's with water ice. Pluto has a thin atmosphere, Charon none. Pluto appears to be much the same as Triton in size and mass. What is needed, of course, is a Pluto probe but finance is scarce.

Something else which is badly needed is a lunar telescope which will operate under the ideal conditions of a complete absence of atmosphere. Radiations from all parts of the electromagnetic spectrum will be available, and with gravity on the Moon at only one sixth that of Earth, the handling of heavy materials will be much easier. A large mirror of the Moon will be much easier to operate than it is on Earth.

Radio telescopes are also planned. There is increasing trouble on Earth with military and commercial interference, and on the far side of the Moon there can be no interference at all.

This book is, as Patrick Moore says, a book to dip into. I enjoyed reading it and I wish you 'Happy Dipping'.

Donald Gold
Former HMI and Past President, AAE

PHYSICS OF CLIMATE, by J.B. Piexto and A.H. Oort, published by the American Institute of Physics, ISBN 0 88318 712 (paperback, £31.25) and ISBN 0 88318 711 (hardback, £66.00), 1992.

The book begins with a general introduction to the subject, including several pages of definitions of symbols which have to be remembered when you come across them later in the text. There follow sections dealing with the basic physical equations of the atmosphere – ocean system and the observed data, before more detailed formulations of various aspects of the climate system such as the radiation balance, atmospheric and oceanic circulation, angular momentum transfer, etc. Surprisingly for a modern text, 'chaos' does not crop up once.

This book is aimed at 'a broad audience of scientists' according to the authors. It is, however, not a book for the average physics teacher, but is more suitable for applied mathematicians and postgraduate physicists with a strong mathematical background. The concept of 'modern mathematical level' seems to be very different in this field compared to the average astronomical textbook. The authors seem more at home with mathematical treatment than with descriptive explanation and some descriptive sections seem to have been inserted for padding. There are a few items of potential interest to astronomy teachers, but you have to do a lot of work to find them, and some statements such as 'solar radiation comes from a very distant point-like source' show the sort of approximations that are made.

My immediate impression of the book, which is filled with equations (I admit to being experimentally inclined), was that the major part of it had been written ten years ago, with paragraphs tacked on here and there to bring it more up to date; however, it should be remembered that the basic physics does not change with time. There are large numbers of graphs, which have obviously been computer drawn especially for the book, and these provide a good illustration of the observations and their theoretical interpretation. Occasionally different fitting parameters for the curve drawing routines have been used and it is not always stressed that the data do not form either a complete or a 100% reliable set.

Overall the book cannot be recommended as an introduction to the study of the Earth's climate for a general audience, as the emphasis on a mathematical treatment obscures the descriptions of the climate system and is off-putting to the non-specialist. In its favour, it provides a comprehensive mathematical description of climate processes and could provide a starting point for a theoretical astronomer wanting to model the atmosphere of other planets, especially as we have even less data for them than we do for the Earth!

(Dr) Jonathan Shanklin
British Antarctic Survey, Cambridge

SATELLITES OF THE OUTER PLANETS: Worlds in their own right, by David A. Rothery, published by Oxford University Press, ISBN 0 19 854290 9 (paperback, £19.50; also available in hardback), 1992.

The prospect of writing a book solely on the satellites of Jupiter and the planets beyond would have been non-existent less than twenty years ago. The fact that such a book can now appear is due almost entirely to the Voyager missions and in particular to the fly-by past each of the gas giants of Voyager 2.

This is a geology book, but the geology related here is very different from that of the Earth. These worlds are admixtures of rocky and icy materials, showing evidence of intense cratering in their early history, and in some cases, continuing evolution.

Following a brief introductory chapter, an overview of the formation of the satellites is given. This chapter, and one on icy lithospheres, are essential to understanding what follows, because the differentiation processes in an icy body are very different to those of a rocky body like the Earth. The debt this book owes to Voyager is of course acknowledged, with a chapter recounting the mission.

The real meat of the book is the description, more or less detailed according to the images available, of the satellites of substantial size. For this purpose they are divided into three classes: dead worlds, those whose surface shows little evidence of change since the intense bombardment of the early solar system; recently active worlds, which as well as cratering show evidence of tectonic or volcanic activity, and in some cases disruption, in their history; and active worlds, of which Io naturally merits most attention. The only major worlds not given this treatment, because of our present state of ignorance, are Titan and the Pluto-Charon system.

Many of the familiar principles of geology are used in this part of the book, but there are also features needing more exotic interpretations. These are likely to prove hard going for a non-geologist (your reviewer would fall into this class), but will repay perseverance.

This must be just about the only monograph on the geology of the outer solar system. It is written in a quite technical style, and would not appeal to the average sixth-former, for example, although the text is clear, and a glossary is included. The book is crammed full of Voyager images, including eight colour plates, half of which are of that most colourful world, Io, and these leaven the text considerably. There are also plenty of line drawings, and the production cannot be faulted.

The book will appeal mainly to astronomers with an interest in the solar system, and to geologists, but the general reader may find it worthwhile too. Probably not a book for the school library, however.

Alan Drummond
(Member of the Council of FAS)

SCOTTISH ASTRONOMY WEEKEND

4 – 6 September 1992

The sixth annual SCOTTISH ASTRONOMY WEEKEND is being hosted by Stirling Astronomical Society this year at the University of Stirling. We hope that many who have attended previous Weekends at St Andrews and Dundee will join us, together with many new faces!

Accommodation

The University has a beautiful parkland campus. Accommodation will be available in single study bedrooms in the Halls of Residence. Residential guests will also have access to the wide range of recreational and leisure facilities on the campus. Full meals and refreshments are included and will be provided throughout the Weekend. Vegetarian food and special diets can be catered for if indicated in advance.

Cost

The inclusive charge for the Weekend is £75.00, from Friday evening (including dinner) to Sunday afternoon. Alternatively, the charge for non-residential attendance (i.e. without bed and breakfast) for the Weekend is £35.00. If you wish to extend your stay in the Stirling area, the University can provide further accommodation for this – please indicate on the booking form.

Programme

The main speakers at the Weekend are:
The Astronomer Royal, Professor Arnold Wolfendale
The Director of the Edinburgh Royal Observatory, Dr Paul Murden
Iain Nicholson, Hatfield Polytechnic
Other invited speakers at this stage include Alistair Simmons, Colin Steele, Neil Bone, David Gavine and Sandy Mackenzie.

Topics to be covered include Solar Activity, Aurorae, Noctilucent Clouds, Cosmic/Gamma Rays, Meteors, Space Exploration and Cosmology. As usual, an informal Members' Session is also planned. Participants are encouraged to bring a portable telescope or binoculars. There will be some free time on Saturday afternoon and local excursions or other activities will be available.

Facilities for Society stands, bookstalls and trade stands are being arranged. Interested exhibitors are asked to contact the organisers for information well in advance.

Travel

Stirling has excellent road and rail links and can be easily reached from all parts of Britain. There is ample parking space at the Halls of Residence. The University is two miles from Stirling main railway and bus stations. There are frequent bus services into the University from Stirling, and taxis are of course also available.

Organisers

Roger Lynn, Secretary, Stirling Astronomical Society,
25 Pullar Avenue, Bridge of Allan, Stirling FK9 4TB.
Tel: 0786–832689

Derek Allen,
1 Ogilvie Road, Stirling FK8 2HF.
Tel: 0786–72771. Fax: 0786–64081

Booking Details: obtain booking forms from Roger Lynn at the above address

Please complete and return the booking form with your deposit as early as possible to avoid the risk of disappointment, as accommodation is limited. Any queries should be addressed to one of the organisers.

The charges are:	Fully residential:	£75.00
	Non-residential:	£35.00

The non-returnable deposits per person are:

Residential:	£15.00	to be received by 15 May
Non-residential:	£8.50	to be received by 30 June

The remaining balance should be paid by the end of July. No refunds will be possible after 28 August.

Cheques should be payable to 'SCOTTISH ASTRONOMY WEEKEND 1992'.

Secretary's Report (abridged), AGM, 23 May 1992

Council Meetings

During the past year, Council has met on five occasions The meetings were held at the London Planetarium and our thanks go to Teresa Grafton and the London Planetarium for hosting us.

Invited guests to the meetings have included: Rodney Buckland, who made a presentation concerning Space School; Robert Mills, representing the BAA; Anne Cohen and Margaret Penston, representing the RAS; Stuart Malin, the JAS; and Eric Zucker, the FAS.

Council meetings are opportunities not only to plan AAE activities, but allow us to review our objectives and explore ways in which we can further the aims of the Association.

This year the AAE has sponsored four students to attend Space School and the Young Astronauts conference through an essay competition.

Curriculum

This year we have added two major curriculum support packs to our publications output. The flatpack and the poster pack have both been well received.

We sent a free poster pack to Romania to help the charity Muzika in Romania who are at this moment working with disadvantaged children in schools.

The AAE presented a teachers' workshop at the annual meeting of the Association for Science Education in Sheffield earlier this year. Thanks to Dave Mannion, John Flynn, Anne Cohen and Martin Suggett for running this event.

Robert Mills has represented AAE interests at BAA meetings and Eric Zucker represents us at FAS events.

Individual members have continued to present workshops for schools and societies. In January I presented a teachers' workshop in Sussex for the ASE. Our network of resource centres continues to provide a programme of events for teachers, pupils and the public.

We are supporting the UKSEDS Space Education Day in Reading on June 4th.

Journals

We are now exchanging journals with a number of related organisations. Added this year to the exchange lists are ESTA (Earth Sciences Teachers Association) and UKSEDS (UK Students for the Exploration and Development of Space). Eric Zucker coordinates journal exchange and is happy to share journals with members.

Gnomon has changed format to incorporate suggestions which were made by members last year. Curriculum Corner has been well-received.

We say farewell to David Mannion who has stood down from Council this year and extend our thanks to those members of Council whose four year term ends today. They include David Hughes, Nik Steggall, Eva Hans, Martin Suggett and myself. I know that they will continue to support the AAE in their many and varied existences.

I should like to thank all members of Council for supporting the AAE and helping me as Secretary during the last four years.

Treasurer's Statement (abridged), AGM, 23 May 1992

Over the last four years we have turned the AAE from a state where the income of the AAE has been reversed from an excess of expenditure over income of £278.93 to an excess of income over expenditure of £1039.71. This is not a bad state of affairs. The first quarter of last year had nearly exactly the equivalent volume on monetary turnover as for the complete year, i.e. 1990/91.

The second quarter was considerably slower but in that time there was a considerable amount of consolidation work going on behind the scenes. Two resource packs were available and the Earth and Space Secondary pack was nearing completion.

From this a base has been formed from which the AAE can expand. I would hope for the next year or two to see an increase in membership as it is along these lines which we need to go to form this base in which to work and to promote the AAE as the National and indeed Internationally renowned body for Astronomy Education.

Bob Kibble

3 DAY SPACE EDUCATION COURSE FOR TEACHERS

Organised by UKSEDS (see last issue for an explanation), this course will be held from 8.30am on 11 August 1992 until 4.00pm on 13 August 1992. This is a residential course at the College of Aeronautics.

For full details contact
Alex Ellery (UKSEDS chairman)
College of Aeronautics
Cranfield Institute of Technology
Cranfield, Bedfordshire MK43 0AL
(Tel: 0234–750111, Ext. 2216)

Members are advised to apply for this course as soon as possible

A 3D STARFINDER AND IDENTIFIER - *by Robert Mills*

Many beginners have difficulty in relating a star's position as seen in the sky with its position as depicted on a star map having the usual coordinates based on Right Ascensions and Declinations. Observers are generally advised to face a particular direction and hold the map or planisphere overhead, illuminated by a torch. This manoeuvre is not always a success, and can become uncomfortable. The device shown in Fig.I shows skywatchers precisely where to look on a specified date and time for any particular star given its Right Ascension and declination. To use the device, first find the Sidereal Time from the nomogram Fig.II by aligning the date and the Local Mean Time, then position the hemisphere so that the RA Mark corresponding to the local Sidereal Time is on the meridian, that is, in the vertical plane passing through the North celestial pole and the centre of the hemisphere as in Fig.I. The figure shows for example the setting of the hemisphere for 21 April at local time 23^h and sidereal time 13^h and also shows the star having RA 10^h08^m and declination 12°N in the line of sight from the eye to E to Star (Regulus). The converse procedure can of course give the RA and dec. of a star from a cursor sighting on a particular date and local time. So an unknown star or celestial object can be given its correct celestial address in terms of its RA and declination.

It will be appreciated conversely that if we know the RA and dec. of a star. then we can deduce the sidereal time by setting the device with the line of sight on the star and then noting the sidereal time that is in the meridian plane. From this sidereal time and the date we can read from Fig.II the Local Mean Time. The device can thus be used to tell the time by observing one known star. It will be noticed that Fig.I shows the equatorial rim of the hemisphere marked suitably for observing stars in the Northern hemisphere of the Celestial Sphere; but it can be instantly adapted for observing stars in the Southern celestial hemisphere, simply by reversing the polar axis EP to point to the South Celestial pole. It will thus still be parallel to the Earth's axis, and inclined to the horizontal at an angle equal to the Latitude of the observer., The RA gradations will, however, run round the equatorial rim in the reverse direction, i.e. clockwise in the Southern hemisphere, but anti-clockwise in the Northern hemisphere. Only about 25% of visible stars are in the Southern hemisphere for observers in latitudes around 50°N.

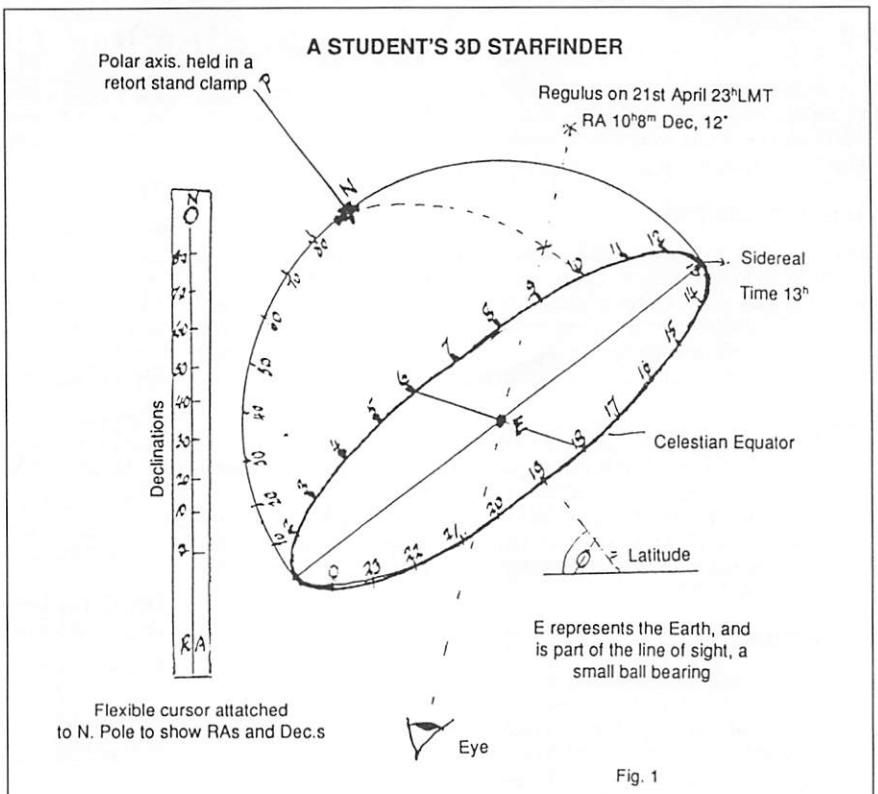


Fig. 1

Fig.1 shows a hollow clear transparent plastic hemisphere about 150mm diameter, graduated in 24 divisions of Right Ascension. The cursor is a narrow strip of polythene graduated as shown in degrees of declination from 0° to 90°, i.e. from the equator to the celestial pole

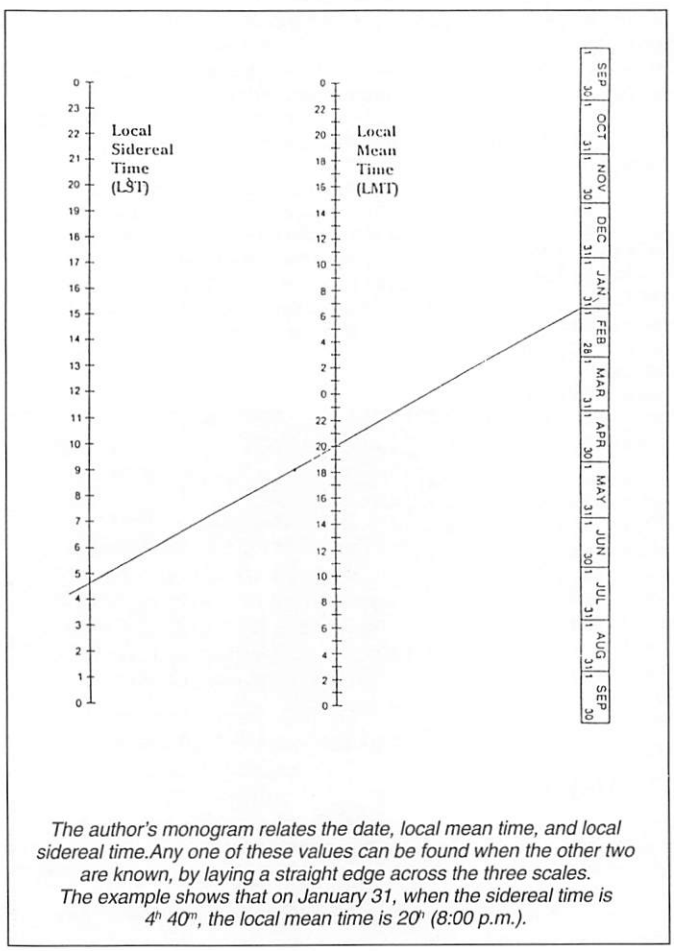
The device can be used to demonstrate the working of an equatorial sundial, by setting the hemisphere with its 12^h mark in the meridian. The cursor is then positioned so that its line casts a shadow on the central bead E (use a small slip of paper to receive the shadow); then the Hour Angle of the Sun (Sun Time) is the angle round the equatorial rim between the cursor and the 12^h mark in the meridian.

Users will be able to devise for themselves alternative ways for setting the device, as any conveniently placed bright star of known Right Ascension and declination can be used for this purpose. When set, the hemisphere will instantly show the Sidereal Time, by the RA on the meridian, and can be checked by the sidereal time given by the nomogram Fig.II or from astronomical tables.

An additional instructive demonstration can be effected by placing the hemispherical rim on a horizontal plane surface so that the Right Ascension hourly gradations (at 15°) intervals, when suitably renumbered clockwise, then measure Azimuth angles. These will be run from 0°(N) to 90°(E) to 180°(S) to 270°(W). The declination cursor now is in the position to measure altitudes up from the horizon toward the Zenith. Thus a useful distinction is made between the heavenly coordinates of RA and declination of the celestial sphere, and the Earthly coordinates based on our own particular place on Earth and our own Earthly horizon.

The device at present is for 'Do it yourself' enthusiasts. Clear transparent plastic spheres and hemispheres are available from firms dealing in decorations, light fittings and toys can be adapted with a little workshop ingenuity to produce a 3D starfinder which can serve as a useful learning aid.

The photograph shows some models of particular 'Astronomy Education' interest which were displayed at the recent annual Winchester Meeting of the BAA. Testing the 3D Starfinder is Miss Rossie Atwell, Secretary of the BAA



The author's monogram relates the date, local mean time, and local sidereal time.Any one of these values can be found when the other two are known, by laying a straight edge across the three scales. The example shows that on January 31, when the sidereal time is $4^h\ 40^m$, the local mean time is 20^h (8:00 p.m.).

LETTERS

Dear Editor and all at AAE,

Thank you for the continuing arrival of *Gnomon* in the backwater of Creswick (pop. 2,500). I was particularly interested in the results of your questionnaire. One surprising thing was the low overall numbers of people who responded, as your total membership must be quite large by now.

I see, from your last issue, that astronomy is continuing to lose its identity as a separate scientific subject in schools. Astronomy has also disappeared from the curriculum in many secondary schools here – in line with the much-maligned VCE (Victorian Certificate of Education). A physics teacher known to us has said that, although his students will be more able to research material for themselves, whilst doing their CATs (Curriculum Assessment Tasks), they will end up knowing far less about physics, to the extent that they will be under-educated in the subject. This is a step *forward* to a new, 'clever country'?? 'Earth-Sciences' is the current buzz-word.

We are hoping that the observatory will survive as a purely astronomical facility, as it has been for over 100 years. The public education role which it serves in the local community can be expanded to cater for the increasing public interest in astronomy.

One of the newest educational additions to the observatory is 'Pipehenge'. A truly 'Why didn't *I* think of that?' sort of thing! It was thought up by a New Zealand teacher, Eric Jackson, and developed with the help of two amateur astronomers.

Three Pipehenges were made for the Scout Jamboree, held in Ballarat in January of this year. These were later donated to the City of Ballarat by the Scout Association. One is a permanent fixture at the observatory, one has gone to the Pax Hill scout camp in Ballarat and the third one will go to a school in this area. Eric Jackson demonstrated them at the jamboree and has since been to the observatory and entertained a group of local primary school children with our Pipehenge. Eric has a wonderful way with the children. His idea is to make the children central to their own observations, by sitting them in the 'navigator's seat'. As he says, the children's perception of directions, angles in the sky, the path of the Sun in different seasons, the rotation of the Earth, and so on, can be 'taken away in their heads and applied, wherever they happen to be'.

Pipehenge is also, of course, instantly attractive to younger children as a climbing frame and, as such, it is solidly constructed. Once they have learned what the different parts indicate, they love to 'swing from the Tropic of Capricorn' or 'walk along the western horizon'. It sinks in!!

For more details about Pipehenge, contact either: Eric Jackson, 30 Mariposa Avenue, Lynfield, Auckland, New Zealand, or The New Zealand Education Foundation, CPO 3443, Auckland 1, New Zealand.

Note:
Each Pipehenge has a serial number and is registered, for insurance purposes, and there is a world copyright on the design. They are, at the moment, being manufactured by Wolff Steel Pty. Ltd, in Melbourne.

I have enclosed one of the leaflets printed for the jamboree.

This is a totally unique concept, which will probably sweep the astronomical world and result in millions of children better understanding their celestial environment. Many of them, hopefully, will start off on a path towards a lifetime in science.

There's hope for you!

Yours sincerely,
Karenza Burk
RMB 210, Creswick
Vic. 3363, Australia

*Karenza Burk has supplied the leaflet on **Pipehenge**. The substance of this leaflet is given in the **Curriculum Corner** section of this issue of **Gnomon**. We are very grateful to Karenza and her colleagues for supplying this information which holds out so much promise, and we wish her the best of luck. Since she wrote her letter, we have learnt that astronomy will still form part of the national curriculum, albeit closely woven with other subjects, so there is still hope.*

Far from being a backwater, Creswick (pop. 2500) appears to be a beacon of enlightenment – maybe in a sea of darkness. Incidentally, Karenza Burk is our most distant member, about 8,000 miles away by the direct route.

Dear Sir,

When introducing astronomical ideas to children, we always have to be careful not to use words they don't understand. Sometimes, though, the children use words *we* can't understand! One thank-you letter from a recent visit by a Primary 3 class read:

funcu for liting us see tHe Big TelAscop and froue tHe litl telescope and finQu for leting us looking ole a rond and tHe ciDeon sarse were gode and tHe pichers of tHe planit and evryfing.

We eventually decoded it. 'CiDeon sarse' = 'kiddy-on (or 'pretend') stars' = the planetarium!!

Yours faithfully,
Dr Fiona Vincent
The Mills Observatory
Dundee.

WHAT TIME IS IT?

A permanent new gallery devoted to Time entitled 'What Time Is It?' was opened at Sir Christopher Wren's Old Royal Observatory, the home of Greenwich Mean Time and the centre of the world's time zones, on 28 February 1992 – just hours before Leap Year's Day. The gallery was opened by 'Tim' (Brian Cobby), the infamous voice of the British Telecom Speaking Clock.

The gallery tells the story of time in several ways. Exploring different kinds of time; telling time without a clock and presenting the history of time at Greenwich. Visitors will discover why there are 60 seconds in a minute and 24 hours in a day; what time it is all over the world and the age of the world's oldest clock. Many varied time-telling devices including hourglasses and astrolabes are displayed, as well as modern equipment: quartz clocks and fashion watches.

The history of timekeeping is told – from the earliest hourglasses and astrolabes to the latest 'Swatch' watch – using a large selection of the unique and valuable scientific instruments from the Observatory's world-famous collection. Amongst the highlights: a tiny Japanese sundial, the 6-foot square Turret Clock modelled on Big Ben, a Mickey Mouse watch and a state-of-the-art Mega Clock donated by 'Junghans' (manufacturers of precision time-pieces) which is activated by the Time Pips from the Atomic Station at Rugby.

The gallery was opened only hours before Leap Year's Day, which was created during the reign of the Roman Emperor Julius Caesar. The year was divided into 365¼ days, leaving the problem of how to account for the extra ¼ day. Caesar decreed that, every four years, an extra day would be added to the end of the last month in the Roman year, February.

The presentation is highly entertaining for the whole family, as well as being informative and educational.

The Old Royal Observatory is currently undergoing restoration and refurbishment work following an award of £245,000 from The Museum and Galleries Improvement Fund. The 'Octagon Room', one of the most historically significant scientific rooms in the country, will re-open in the spring.

For further information, please telephone 081–858 4422 or write to the National Maritime Museum, Greenwich, London SE10 9NF.

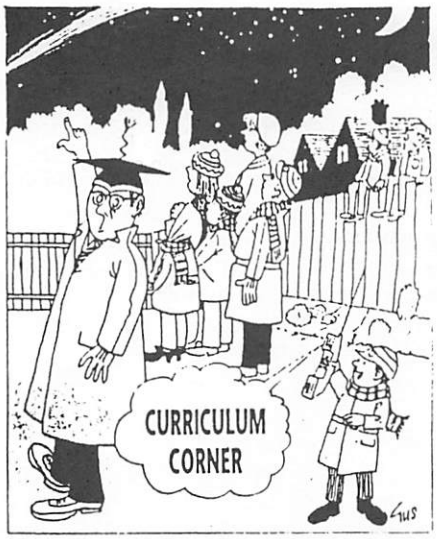
HELP WANTED

A student at Leeds Polytechnic has contacted the AAE for advice and help.

He is planning to build a telescope system linked to a BBC microcomputer and CCD device for the use of disabled people who would not normally be mobile enough to see through and move a standard telescope.

Can you help with either: advice on the system, cheap/free parts or equipment, experience as a disabled astronomer?

Contact:
R.L. Moriarty
16 Reeth Road, Hartburn
Stockton-on-Tees, Cleveland TS18 5HB.



THE SOLAR SYSTEM

from South Tyneside College with design by P. Farwell

This is an inspiring little book which should appeal to younger schoolchildren.
There are pictures of all the planets, the comets and meteorites.
There are also puzzles, such as a maze with the caption:
'The absent-minded Professor has lost his telescope. Can you help him find it?'

Further details from Eva Hans at South Tyneside College, South Shields NE34 6ET

Sky Diary Summer 1992

Solstice:	June	21^d	03^h	14^m
Equinox:	Sept	22^d	18^h	43^m

MOON

New Moon	First Quarter	Full Moon	Last Quarter
			June 34^d 08^h 11^m
June 30^d 12^h 18^m	July 7^d 02^h 43^m	July 14^d 19^h 06^m	July 22 22 12
July 29^d 19^h 35^m	Aug 5 12 58	Aug 13^d 10^h 27^m	Aug 21 10 01
Aug 28^d 02^h 42^m	Sept 3 20 39	Sept 12^d 02^h 17^m	Sept 19 19 53

MERCURY
Mercury is visible low in the west after sunset until July 26th. It reappears in the morning sky, rising just before the Sun, from August 11th to September 6th.

VENUS
Venus is too close to the Sun to be seen until the second half of July when it will appear as an evening object in the west after sunset.

MARS
Mars is in the morning sky passing from Aries into Taurus.

JUPITER
Jupiter is in the evening sky but by the beginning of September it will be too close to the Sun to be seen. In late August Venus and Jupiter appear close in the western sky. Venus is the brighter of the two.

SATURN
Saturn is still in Capricornus. It begins the summer as a morning object but by August 7th, when it comes to opposition, it will be visible throughout the night.

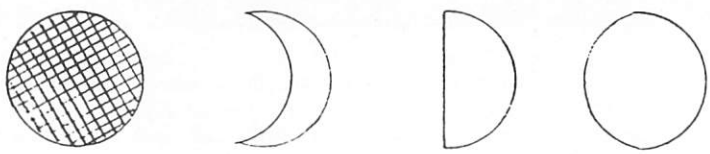
ECLIPSE
There is a total eclipse of the Sun on June 30th but it is not visible from UK. You will have to travel to central South America or south-west Africa if you want to see it.

METEORS
August generally brings the best opportunity during the year to observe 'shooting stars' or meteors. The Perseid meteor shower occurs from about July 23rd to August 25th with the best nights being August 12th–14th. However, this year a full moon on August 13th will mean that most of the familiar meteors will be masked by moonlight.

MOON STRUCK

During one month the Moon seems to change shape as it moves round the sky. The different shapes are called the PHASES of the moon. The names of the phases are CRESCENT, FULL, GIBBOUS, HALF and NEW moon. New moon is when you cannot see the moon at all. That is when the dark side of the moon is turned towards the earth.

The phases are shown in order below. Write the correct name under each phase.



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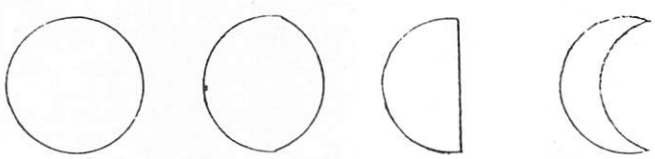
Moon's phase growing



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Moon's phase shrinking

When the Moon's phase is growing it is said to be WAXING. When it is shrinking it is said to be WANING.

LETTER

Dear Simplicimus,

Thank you for your comments on the discussion of the solstices and equinoxes. These instants are determined with reference to the centre of the Sun's disc. I did not, in my article, distinguish between true equator and equinox and mean equator and equinox as the piece was intended for beginners.

However, any readers who want more exact information may find the following publications helpful:

1. Norton's Star Atlas and Reference Handbook, ed. Ian Ridpath, ISBN 0-582-03163-X.
2. Spherical Astronomy, W.M. Stuart, Cambridge.
3. Elementary mathematical Astronomy, Barlow and Bryan, University Tutorial Press.

Yours sincerely
E.M. Hans

Correction:
On the planet work sheet for young children 'has moons on?' should read 'has most moons?'

Curriculum Corner ▶

PIPEHENGE® *(Received from a Scout Jamboree in Australia)*

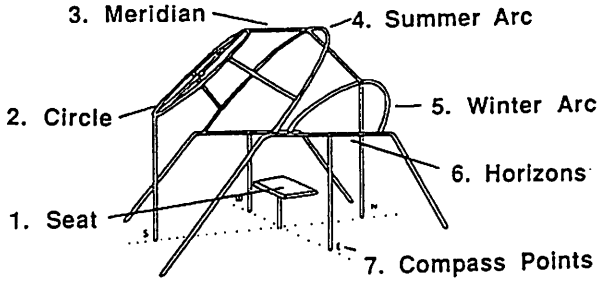
Activities to try while at the Jamboree:
(They are ranked from one to three stars according to time and difficulty.)

1.** Use a Magnetic compass to check the accuracy of the North Point shown on the map in the centre of the Jamboree Handbook. Give its bearing in degrees.
2.** Inside the cover of your jamboree handbook draw a circle (using a cup or mug). Mark in 12 and 6 o'clock. Show where North is, using the time method by putting in the time at which calculation was done and the direction of North. Remember to allow for daylight saving.
3.* Take a bearing at either sunrise or sunset from your tent and record it on your map in the centre of your Jamboree Handbook. Check your calculations with the **Pipehenge** calculation.
4.** Set up a 200mm shadow stick and record its shadow every half hour between 10am and 2pm on a sheet of paper. Determine the direction of **True North** and the time when it occurred.
5.* Take a bearing of the position of the moon rising or setting. Record date and time as well.
6.*** Draw a circle on paper up to 100mm diameter. Mark the position of the **Southern Cross** just after dark. Record date and time. Draw its position again two hours later. Mark in the position of two other bright stars found near the circle forming a triangle with a cross. Identify them.
7.** Draw on a piece of paper, using conventional map orientation, how your tent or home lies to the sun at **Solar Noon**. Comment on what you consider are the advantages or disadvantages of this position.

Activities to try at home:
8.*** On a sheet of paper draw a plan view and **elevations** of a house designed to take advantage of solar heating throughout the year.
9.*** Make a **PEThenge Suntracker** and plot the apparent path of the sun between sunrise and set at least twice, a week apart.
10.** On a street map of your home area, locate the compass bearing and name the streets that lie at 0/180 degrees, 90/270 degrees.
11.* On a sheet of paper draw a circle 100mm in diameter, draw the **cardinal points** of the compass and their bearings in degrees.
12.*** Stand in the sun at midday and get someone to draw around your shadow. Record its length from head to heels. Do this again at the same time on the same day two weeks later.
Repeat again another two weeks later. Compare the results.
(NB! Avoid changes in daylight savings or allow for it.)
Find out what would cause any variation in the data recorded. What is the significance of this information?
13.** From the daily newspaper find the times of sunrise and sunset and work out when Solar Noon is. Find out and write an explanation why Solar Noon occurs at this time.
14.* Find out what a.m. and p.m. are the abbreviations for, what they mean and how they relate to Solar Noon.
15.*** Find out the difference between **True North** and **True South** Poles and **Magnetic North** and **Magnetic South** Poles.
What is important about the magnetic poles? How does this affect us when using maps for navigation? Write a brief description about them including a map of where they are found.
16.* What is the difference between 'clock' noon and solar noon? How is 'clock' time determined for your location?
17.*** What is the **South Celestial Pole**? How is it abbreviated on a star map. What is its importance in relation to stars of the Southern Sky? How many degrees around the **South Celestial Pole** is the path of the Southern Cross? What is the height of the Southern Cross at its lowest point above the horizon at your **latitude**?
18.*** What does the term **Solstice** mean? How many are there in a year? When do they occur? What is their importance? What is the altitude of each **solstice** at your latitude? How is this information important in designing an energy efficient home?
19.** Roll a sheet of paper into a tube with a diameter of about 20mm and tape onto the top of a straight stick or pole. (Broom handle will do.) At Solar Noon put the base of the stick on the ground and move the top around until the sun shines down through it to make the minimum shadow of the tube on the ground. With a protractor measure the angle of the stick from the North South line. This angle is the **elevation** of the sun at Solar Noon. Repeat this activity a month later and explain why this difference occurs.
20.*** Measure the length of the shadow of your body from head to heels every half hour from 9am until it is at its shortest. Record as a graph.
a. At which point was the length of your shadow the same as your height? At this time all shadows are at the same height of the object.
b. At what time was your shadow shortest? At this time all shadows lie true North/South.
Repeat this activity three months later and compare with a. and b. Explain why there is a difference.
At any time the **ratio** of the length of your shadow to your height can be used to determine the height of an object. Show an example of this **formula** and how it was used to work out the height of an object.
21.*** Fix a 20 to 30cm drinking straw, stick or straight wire vertically in the middle of one side of a board or box. Put in a sunny position at 11am and note the direction of the shadow. Fix a piece of paper or card on the box on which to record the shadow. Commencing at 11am mark the outline of the shadow, particularly its length. Repeat this every half hour until 3pm. Make sure that the board or box is left in the same position. Join the ends of the shadows with a line. Determine the point and time when the shadow was the shortest. That point is when the sun was on the **meridian** and **True North**. The shadow was lying true North/South.
Check this calculation with the time of **Solar Noon** worked out from a newspaper.

Teachers in the northern hemisphere should adapt this article to utilize northern constellations.

PIPEHENGE® sundial, calendar, observatory, climbing frame



1. SEAT. This is the crossing point of the true NORTH/SOUTH and EAST/WEST lines, from which compass bearings are taken and from which observations looking North between the Summer and Winter arcs, and looking South through the circle, will be most accurate.
2. CIRCLE. The pointers of the Southern Cross touch the inside of the circle as they move around the South Celestial Pole during the night. This Pole is at the centre of the circle.
3. MERIDIAN. This line divides AM from PM, East from West. When its shadow runs in a straight line from North to South it is Solar Noon local time.
4. SUMMER ARC. The path of the sun on the longest day (21 December) when it is directly overhead on the Tropic of Capricorn (Our summer, Northern winter).
5. WINTER ARC. The path of the sun on the shortest day (21 June) when it is directly overhead on the Tropic of Cancer (Our winter, Northern summer). BETWEEN these two ARCS will be found the sun, moon, planets and many major star constellations.
6. HORIZONS. On 21 March and September the sun rises exactly on East (green pipe) on the Eastern Horizon and sets exactly on West (yellow pipe) on the Western Horizon and travels half way between the two arcs. It is directly overhead on the Equator. Day and night are of equal length. Between 21 March and 21 September the nights are longer than the days (black section). Between 21 September and 21 March the days are longer than the nights (white section).
7. COMPASS POINTS. NORTH (red), EAST (green), SOUTH (blue), WEST (yellow) have been set out using SOLAR (true) North (see 3 MERIDIAN).

PIPEHENGE® GLOSSARY

Cardinal Points: North, South, East and West – being the main points on a compass.
Elevations: An angle from the horizontal.
Formula: A rule or symbols expressing a solution.
Latitude: The location of a place – North or South of the equator.
Magnetic North: North Pole of the Earth's Magnetic field.
Magnetic South: South Pole of the Earth's Magnetic field.
Meridian: A line between True North and South Poles.
PEThenge Suntracker: A model made from a PET drink bottle.
Pipehenge®: A Sundial observatory made from steel pipe.
Ratio: Relation between two similar sets of numbers.
Solar Noon: When the sun is on the meridian.
Solstice: When the sun is overhead on the Tropics of Capricorn or Cancer.
South Celestial Pole: South Pole of the sky about which southern stars appear to rotate.
Southern Cross: A constellation in the Southern Sky.
True North: The Earth's Geographical North Pole.
True South: The Earth's Geographical South Pole.

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MAKE A MODEL OF THE SOLAR SYSTEM

How many Planets are there? How far away are they? How big is Jupiter?

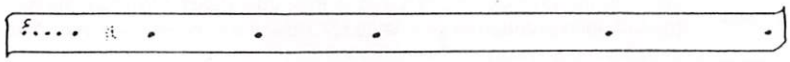
Just a selection of popular questions asked in school every day. Where do pupils and their teachers find the answers and will pupils understand them?

Here are some suggestions to help convey the relative sizes and distances of planets in your classroom.

1. The Solar System in your pocket

Based on an idea of AEE Member, Nigel Hudson

For this you will need a strip of paper one metre long and a few cm wide. (A class set of thin strips can be made from a few metres of spare wallpaper.)



Mercury	8mm		
Venus	1.5cm	Jupiter	10cm
Earth	2cm	Saturn	19cm
Mars	3cm	Uranus	38cm
Asteroids	6cm	Neptune	60cm
		Pluto	79cm

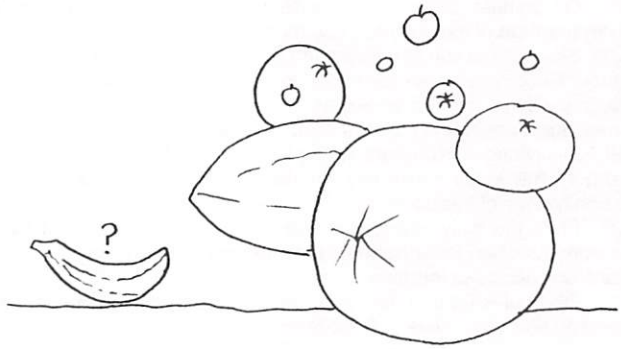
The strip can be rolled around a pencil and kept as a handy pocket reference

2. The Fruit Salad Solar System

In the above model each planet was shown as a dot. It is impossible to show both the relative sizes and distances on the one model **to the same scale**. If you expand the above scale ten times then there will be enough space to place an object to represent a planet. This can be done as a display in the corridor or along the side of a large classroom. You will need a distance of eight metres for the whole set of planets. (The Sun will have a diameter of about 2 metres but tends to 'drown' the planets if added. You might need to have an arrow indicating 'to the Sun'.)

Suggestions for Planets in your fruit salad Solar System:

Mercury:	a small grape
Venus:	a larger grape or baby tomato
Earth:	same as Venus
Mars:	a cherry, just larger than Mercury
Jupiter:	a watermelon
Saturn:	a 'yellow' melon
Uranus and Neptune:	a grapefruit
Pluto:	a small grape



FOR THE NEWCOMER

UNIVERSAL TIME

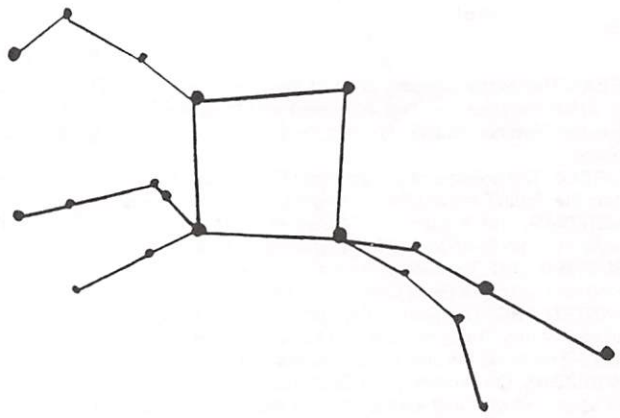
Astronomers use two time systems: *sidereal time*, based on the apparent motion of the stars, and *solar time*, based on the Sun's apparent motion. Solar time varies from place to place on the Earth's surface. By chosing Greenwich as a standard location, we have Greenwich Time, and this becomes Greenwich Mean Time (GMT) when variations in the Sun's motions are smoothed out. Greenwich Mean Time is also called Universal Time (UT).

In the last issue, Simplicimus asked whether sunset, and sunrise, were measured from the instant the Sun's limb or the centre of the Sun's disc, was on the horizon. Eva Hans confirms that it is the *centre of the disc* which counts.

CONSTELLATIONS

People have been looking at the sky for centuries. When people long ago looked at the stars they thought they could see pictures there. They often thought that they could see people and animals out of stories and legends they had heard. These star pictures are called CONSTELLATIONS.

For example:



This is Pegasus. He was flying a horse in Greek legends.

You may also have a map showing part of the sky in winter. You might be able to recognise one or two of the constellations such as Orion. See if you can make up any pictures of your own using the stars.