



# GNOMON

Newsletter of the Association for Astronomy Education

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*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.

## EDITORIAL COMMENT

The questionnaire reported in this issue (43 replies out of 120 FAS-affiliated societies) has come up with some interesting replies. One correspondent reports that attempts to communicate with LEAs evoked a range of expressions from enthusiasm to outright hostility. Why hostility? Fortunately this view seems to be a minority one.

\* \* \*

A representative of the British Interplanetary Society will attend AAE Council meetings and so join colleagues from the FAS, JAS, BAA and RAS.

\* \* \*

"Curriculum Corner", now a regular feature in GNOMON, gives details of classroom material which may be simply

demonstrated by teachers. Occasionally we receive articles which are not, strictly speaking, eligible for presentation under this heading but are nevertheless "on the fringe". One such article, entitled "A Community Solar System", is reproduced (by permission of the *Astronomical Society of the Atlantic* in whose journal the article appears). The Lakeview Museum of Peoria, Illinois, USA, has constructed a scale model of the Solar System, with a central Sun (11 metres in diameter) and planets and comets placed at scale distances and in various parts of the USA, including California. It is described as the largest model of the Solar System in the known Universe! UK teachers may like to follow this example, albeit on a much reduced scale.

### 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
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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:** Eva Hans, The Planetarium, South Tyneside College, St. George's Avenue, South Shields, Tyne and Wear NE34 6ET - for all general enquiries. (Tel: 091 4560403, ext. 477)

**Treasurer:** John Flynn, Armagh Planetarium, College Hill, Armagh, Northern Ireland BT61 9DB - for all financial and subscription enquiries. (Tel: 0861 524725)

**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.



Ken Marcus receiving an inscribed silver salver at the FAS Annual Meeting (May 1991).

## OBITUARY KEN MARCUS

We have to report with sorrow the death of Ken Marcus on January 13th 1993. He was 73 and had been ill with leukaemia for some time.

Ken was born near Berlin in 1920. His family was aware of the developing political situation in Germany and came to Britain in 1936, where they settled in Lewes, Sussex. His interest in Astronomy began at an early age. When war broke out, all Germans resident in the UK were interned on the Isle of Man. Reason eventually prevailed, however, and he joined the British Army where he saw service in India and Burma.

Ken became very well known in the realm of amateur astronomy - by profession he was an accountant - and he was a founder member of the Brighton Astronomical Society. He was Chairman and Treasurer of the Society at various times, and in fact was the current Chairman at the time of this death.

He was involved with the FAS from its earliest days, and was Treasurer of that organisation for a considerable time, during which the Federation's finances were transformed. He was made a Life Member of the FAS in 1987. Last year, after resigning as FAS Treasurer, he was back again on its Council as SAGAS (Southern Area Group of Astronomical Societies) representative.

Ken was a good friend of the AAE, supporting its educational activities, both at local school level and on the FAS Council.

Our sympathy is expressed to his widow and other members of his family.

ERIC ZUCKER

AAE Annual Meeting will take place at Leicester University on Saturday, 15th May, 1993. Please come along - see the separate sheet enclosed in this issue for more details.

# AAE COUNCIL, 1993 ELECTIONS

Our Constitution requires all Council posts to be relinquished for re-election at the AGM. Many officers will wish to stand again, some will wish to stand down. Here is your opportunity to play an active part in the management of the AAE. The posts on Council are:

## OFFICERS:

*President, Vice Presidents (3), Treasurer, Secretary, Assistant Secretaries (2).*

## MEMBERS:

*Resource centre representatives (3), Members (3), Editor (co-opted by Council).*

Should you be interested in serving on Council please contact me giving details of your interests and background. Should a

post be the subject of a vote the nominees will be asked to make a brief presentation at the meeting outlining their background and the contribution which they would like to make.

**BOB KIBBLE**, *Vice-President*

## AAE TREASURER

Due to unexpected circumstances, the Treasurer (Mr. John Flynn) is obliged to relinquish his post, and Mr. Bob Kibble is taking over (until the AGM) as Acting Treasurer. All membership and financial queries should now be addressed to: Bob Kibble, 34 Acland Crescent, Denmark Hill, LONDON SE5 8EQ (tel: 071-274 0530).

# CHARITABLE STATUS AND THE AAE CONSTITUTION

At the AGM on May 15th Council will propose that the AAE applies for Charity Registration. Should the meeting vote in favour of this application, it will be necessary to make some minor amendments to our Constitution. These are required to make it clear that our Association operates for charitable aims and to make this charitable status explicit.

The main advantages to us of registering as a charitable body are financial. We would be able to claim tax paid on covenanted subscriptions and be a more "recognised" body when applying for grants to support specific projects. Our audited accounts will need to be submitted annually to the Commission. The received wisdom from similar societies is that although these gains are small they are worth acquiring for the minor additional administration involved. The BAA and some local astrosocs have charitable status.

If you have any views on this matter please share them with me in writing. This is a new venture for Council and we would appreciate members' opinions. There will be an opportunity to discuss the issues at the AGM. I have set out below the changes to the Constitution which will be decided on at the AGM.

## *Proposed amendments to the Constitution in support of our application for charitable status*

### Aims

**Aim 1.** Should be amended to read:

*"To promote and advance public education in the Science*

*of Astronomy and to support the teaching of Astronomy to students at all levels of education."*

### Management

The following sentence should be added:

*"The income and property of the Association whensoever derived shall be used solely to promote the charitable objects of the Association set forth in this Constitution".*

### Responsibility of Council and its Members

#### 5. Treasurer

The following sentence should be added:

*"The Treasurer will submit a copy of the audited accounts and related information annually to the Charity Commission as requested."*

### Dissolution

The existing paragraph should be replaced by:

*"If passed by an appropriate resolution at a meeting of the Association arrangements may be made for the winding up of the Association. In the event of a dissolution the assets of the Association shall be devoted to charitable astronomical societies similar to the AAE at the sole discretion of the Trustees.*

*No amendment will be made to this Constitution which would cause the Association to cease to be a charity at law."*

**BOB KIBBLE**, *Vice-President*

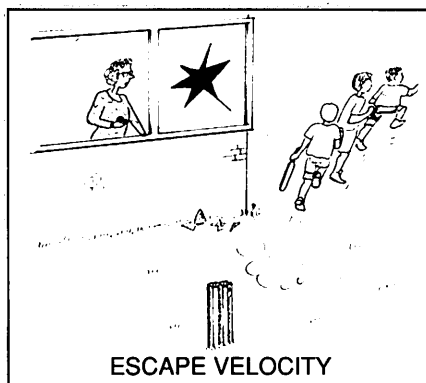
## FOR THE NEWCOMER

*Simplicimus writes:* When I was a young boy, I heard my older friends and relatives talking about "escape velocity".

I was intrigued by this term and wondered what it could mean. To me it conjured up pictures of prison break-outs, but later on I learnt that it was an astronomical term, and that it meant how fast an object must be projected in order to break away from the Earth's gravity. I can remember throwing stones upwards with ever increasing speeds, hoping that I would eventually throw one hard enough never to return. Alas, I failed in every attempt, which, with hindsight, is not surprising when I learned that the escape velocity (from the Earth) is about 11km per second! To escape from the Moon, whose gravity is smaller than that of the Earth, the

velocity is only 2.4km per second.

I also learned that the Earth's rotation (which is about 2,000km per hour at the equator) tends to fling objects off its surface and this may be used to help putting space probes into orbit.



## ADVERTISEMENT

*Members' advertisements are free as long as they are of reasonable length.*

**FOR SALE:** Selection of NASA publications etc. Badges, Russian Buran space shuttle badge sets, photographs, space shuttle audio tapes, NASA video highlight tapes.

**NEW FOR 1993:** Commemorative covers of the Russian space programme flown on board the MIR Space Station.

**SAE FOR LISTS TO:** N. E. Steggall, 38 Victoria Crescent, Birkdale Road, Dewsbury, West Yorkshire WF13 4HJ, England.

## EXAM BOARDS: INCLUSION OF ASTRONOMY

The AAE contacted examination boards about the inclusion of astronomy in their syllabuses.

The replies from the *A-level boards* were as follows:

**Associated Examining Board**, the Wessex Modular Scheme currently under trial does include an astronomy module.

**NEAB (formerly Joint Matriculation Board)** intend to retain their "Physics of Astronomy" option during the 1996 rewrite.

**Northern Ireland Schools Examination and Assessment Council**, not aware of any demand for astronomy. None currently available.

**Oxford and Cambridge Schools Examination Board**, no astronomy at present but may offer a module during the rewrite due in about 12 months' time.

**University of Cambridge Local Examinations Syndi-**

**cate**, their modular scheme offers an optional "Cosmology" module.

**University of London School Examinations Board**, no plans to include any astronomy at present.

**University of Oxford Delegacy of Local Examinations**, no immediate plans for any significant astronomy content.

**Scottish Examination Board**, Standard Grade has a 20-hour unit on "Space Physics" which deals with telescopes, spectroscopy and the electromagnetic spectrum. The Higher Grade has no significant content at present.

English and Welsh *GCSE boards* of course have to include astronomy topics as set out in the National Curriculum. Our letter to these was one of initial contact, but raised a few issues. One board asked for suggestions for experiments within astronomy which could be used for assessing Attainment Target 1.

DR. ANNE COHEN

## THE FEDERATION OF ASTRONOMICAL SOCIETIES

Formed in 1974, the FAS was conceived as a sort of union of astronomical societies, groups and individuals, liaising together for their mutual benefit. A list of Federation aims was drawn up which included such items as the encouragement of the teaching of astronomy in educational establishments, the compilation of lists of people prepared to give talks, the giving of advice on problems commonly encountered by astronomical societies and so on. These aims were to be achieved through the activities and experiences of the members themselves, or wherever the expertise lay.

The Federation has become established as an officially recognised communication centre through which useful information is passed between member societies and also between them and other official organisations such as the Department of Education. It is therefore becoming a useful resources centre for data appertaining to education in astronomy as well as for the guidance of astronomical societies with any functional problems. Thus it is quite different from other astronomical organisations in this country, but at the same time it actively seeks co-operation with these other bodies.

The main two way communication channel used by the FAS is its Newsletter, produced four times a year. This Newsletter reaches at least 120 local amateur astronomical societies and many individual members. Important and contemporary information is relayed to societies via the Newsletter, and it is a forum through which general information on all aspects of astronomy can reach a great many people. Recently the Newsletter was used to send a questionnaire asking how local societies are becoming involved with astronomy education in schools. This questionnaire was prepared jointly between the FAS and AAE. Preliminary response to the questionnaire has been good, and a short report on these first replies appears

elsewhere in this issue of GNOMON.

The Federation also produces an annual Handbook which is fast becoming recognised as being not only unique, but the most useful publication produced in this country for both the local society and the practical amateur astronomer. Articles cover matters useful to the successful running of societies as well as items of a general or topical nature.

Another annual publication of the FAS is the *Astrocalendar*,\* which gives observational details of the night sky for the forthcoming year together with a series of monthly sky charts. The *Astrocalendar* is a useful publication for anyone wishing to know what is in the sky tonight, and where to look for it! Since it is non-technical, it is easily understood by children of 8 years and above.

The FAS also organises conventions at different times throughout the year. These conventions bring together people from all over the country and are addressed by both amateur and professional speakers. They are important and enjoyable events which provide a venue for the discussion of current ideas and problems on all aspects of astronomy.

For further information about the FAS, contact the Secretary, Chris Sheldon, "Whitehaven", Maytree Road, Lower Moor, Pershore, Worcs WR10 2NY. Tel: 0386 860202.

All publications are available from the Treasurer, Alan Drummond, 27 York Road, Crawley, West Sussex RH10 5JS. Tel: 0293 535027.

PAM SPENCE

\*The 1993 *Astrocalendar* may be obtained from the FAS Treasurer (Alan Drummond), 27 York Road, Crawley, West Sussex RH10 5JS. The price is 90p which includes postage. There is a reduction for quantities: 5 to 14 copies 80p, 15 or more 75p. Please make cheques payable to the Federation of Astronomical Societies.

## ASTRONOMY EDUCATION QUESTIONNAIRE

Questionnaires are notorious for eliciting little or no response, so it was with the expectation of having only a few percent filled in and returned that the joint FAS/AAE questionnaire on societies' involvement with astronomy education was sent out with the last FAS Newsletter. It was sent to about 200 local amateur astronomical societies, 120 of whom are affiliated with the FAS. It is therefore very pleasing that a preliminary report can be issued, based on 40 replies, after only six weeks since sending out the questionnaire.

Of course, care must be taken in interpreting results based on only 20% of returns, mainly because interested societies are more likely to have responded than those not interested in becoming involved with astronomy education.

Out of the 40 replies, 85% of the societies have had contact in some way with their local schools over the past 12 months; 73% have given talks to schoolchildren, 20% have talked to teacher groups and 68% have provided information on astrono-

my to schools.

Looking at the 34 societies that have had some involvement with local schools, it is interesting to see that initial contact is fairly evenly divided between the schools and the societies: 41% of initial contact came from the schools, 33% from societies and 26% replying that it came from both sides.

Only 2 out of the 34 societies that have been involved with local schools replied that they did not wish to become further involved; these two societies are already doing a great deal.

Out of the 6 societies who have not had any involvement with schools at all, only 1 showed total disinterest in doing so. The other 5 indicated that the main reason they have not yet become involved is that they have never been approached.

The societies were asked what materials they would find most useful to be supplied to them; an overview of astronomy in the National Curriculum, ideas for talks/demonstrations or accounts/examples of what other societies are doing in this

field. The overwhelming response was, yes please: all three! Additional resources asked for were suitable visual aids (eg slides, models etc.).

It appears that many societies throughout the country are helping to inform both teachers and children about astronomy. It is also apparent that many societies feel they are working in a vacuum and would welcome more help and information.

Hopefully, as a result of this questionnaire, the FAS, AAE and other bodies concerned with astronomy education will be able to supply the information required.

Finally, out of the 49 replies, 100% had heard of the FAS and only 25% had not heard of the AAE.

A fuller report will be issued when more completed forms have been received.

PAM SPENCE

## THE STARGAZERS TRUST

The Stargazers Trust was set up as a registered charity in 1988. It was founded and endowed by E. N. Walker, a professional astronomer who worked at the Royal Greenwich Observatory (RGO) for 31 years.

The aims of the Trust, as laid down in its Deed of Trust, are "to promote and provide the education and training of the general public, and especially young people, in the Natural World and Universe; and to encourage astronomy as a popular science".

To this end, the Trust has helped a variety of public and educational observatories by providing either cash, equipment, expertise or all three. In 1991 the Trust ran and funded a nationwide competition for amateur astronomers who had been trying to make serious contributions to the science of astronomy. The prizes totalled about £2,000, and it was intended that this competition should publicise the potential for amateurs to make a significant contribution to the science of astronomy.

The Trust has also funded the development of a series of items, including instruments and software, which, in the future, will allow the amateur astronomical community easier access to some of the facilities which their professional colleagues take for granted.

The motivation for the founding of the Trust was the closure of the RGO as a working observatory. Some astronomical phenomena change slowly compared with human lifetimes, and their understanding can require observations extending over

decades or centuries; other astronomical phenomena require observations taken over many consecutive nights. British astronomers no longer have the facilities to pursue this type of research. Such observations require observers who are highly trained and fully aware of the workings and limits of their equipment. The long-term aim of the Trust is to provide a permanent base with observational and educational facilities to overcome these problems. Such a base would incorporate facilities for schoolchildren to learn and experience some of the excitement that comes from scientific discovery. The Trust also wishes to foster better communication and co-operation between the professional and amateur astronomical community. To these ends, it is seeking to enter into discussions with regard to a future role at the Herstmonceux Observatory site with the new owners.

The Trust needs to have a permanent site from which to operate, to act as a focus for astronomical activities. Herstmonceux, with its international reputation, is ideally suited for this role. In order to satisfy the requirements of the widest number of people, the Trust is actively seeking to collaborate with a variety of other respected astronomically interested organisations. It is hoped that such collaboration will produce more exciting and longer-lasting results than would otherwise be produced by organisations working alone.

PO Box 337, Hailsham, East Sussex BN27 1PT. Charity Commission Reg. No. 800023.



## SPACE - LINK NASA EDUCATIONAL BRIEFS

Article supplied by Nik Steggall

### Black Holes in Space

There is much more to black holes than meets the eye. In fact, your eyes, even with the aid of the most advanced telescope, will never see a black hole in space. The reason is that the matter within a black hole is so dense and has so great a gravitational pull that it prevents even light from escaping.

Like other electromagnetic radiation (radio waves, infrared rays, ultraviolet radiation, X-rays, and gamma radiation), light is the fastest traveller in the Universe. It moves at nearly 300,000km (about 186,000 miles) per second. At such a speed, you could circle Earth seven times between heartbeats.

If light can't escape a black hole, it follows that nothing else can. Consequently, there is no direct way to detect a black hole.

In fact, the principal evidence of the existence of black holes

comes not from observation but from solutions to complex equations based on Einstein's Theory of General Relativity. Among other things, the calculations indicate that black holes may occur in a wide variety of sizes and be more abundant than most of us realize.

### Mini-Black Holes

Some black holes are theorized to be nearly as old as the Big Bang, which is hypothesized to have started our Universe 10 to 20 billion years ago. The rapid early expansion of some parts of the dense hot matter in this nascent Universe is said to have so compressed less rapidly moving parts that the latter became superdense and collapsed further, forming black holes. Among the holes so created may be the submicroscopic mini-black holes.

A mini-black hole may be as small as an atomic particle but contain as much mass (material) as Mount Everest. Never underestimate the power of a mini-black hole. If some event caused it to decompress, it would be as if millions of hydrogen bombs were simultaneously detonated.

## A SCREENFUL OF STARS

by Roger O'Brien

A Review of the Computer Program "Skyglobe"

ON the night of the total lunar eclipse (9th December 1992), my sky clouded over as totality approached. The eclipse seemed to be a very dark one; it certainly was after the clouds rolled over. Only 20 miles north of me, at Bayfordbury, they had a fine view. This is pretty typical of the amateur's experience in this country.

Several months earlier, a friend gave me a copy of a Shareware computer program, called Skyglobe. Of course, it is no substitute for the real sky, but it is quite a useful tool and a marvellous toy. To run it, you need an IBM PC-type computer. Although it will run on any PC in monochrome, there is so much information available that colour presentation on a faster

machine has obvious advantages. Skyglobe copes with many different graphics cards and CGA, EGA and VGA. I am using Skyglobe 3.1 and it has an attractive icon for use with "Windows".

WHEN you first run the program, you get a screen full of stars, some joined by lines to indicate the constellations. If you use a mouse, there is a little graticule (not an arrow) and a display at the bottom left gives you its precise location (in terms of Right Ascension and Declination) and some details about any object you may light on. In the top left corner, another dis-

Continued on p.9

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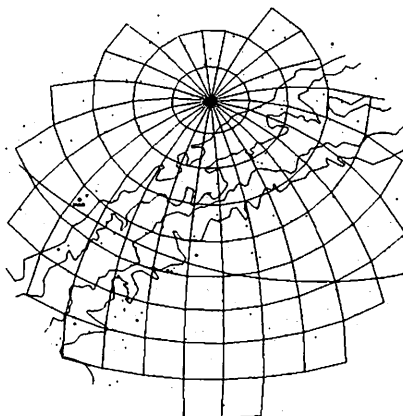
play tells you that this is the sky as seen from Caledonia Michigan USA at the time you have set on your PC. Down the right-hand-side of the screen you will find "help" which is adequate, but somewhat primitive, by the standards of, say, "Windows".

It is fun to reset "Skyglobe" to, first, a location near you and, then, one far away. You can set it to move the sky round automatically and follow a whole night or year in a few minutes. Planets can zip back and forth along the ecliptic. The Moon (annotated as "MOO") shows phases and you can set the background to lighten when the Sun rises (this is called "Twilite"). The normal setting is for the naked eye and good seeing, but you can display up to 25,000 stars (and not be able to recognise a single constellation) or raise the minimum brightness until the barren sky shows the pitiful handful of stars that city-dwellers see these days. There are three different levels of Milky Way. You can have or dispense with star and constellation names.

PERHAPS the worst feature of "Skyglobe" is that it is so easy to just sit and play with it. It moves the stars and planets a bit jerkily and can suddenly reset time and orientation. One of my favourite features enables me to centre the screen on, say,

Mars and watch it move against the background of stars. As 1993 turned Mars was retrograding through Gemini and you get some idea of the conundrum that faced astronomers from ancient times to Kepler. The best features are those that allow you to get a good idea of what is in the sky; how to find things of interest and how the whole sky appears to move.

Because it is shareware, users are positively encouraged to copy it for one another. Other files in the package give you an operator's guide (I can't pretend to have read it all yet) and registration forms. You can even use your credit card to pay the \$20 fee. I have just done that and I can't recommend anything more highly than by paying for it.



## BOOKS

**Oxford Illustrated Encyclopedia of the Universe, edited by Archie Roy, published by Oxford University Press, ISBN 0-19-869140-8, 1992, hardback, £19.95.**

This book unquestionably lives up to its title. The format is very clear and easy to use and the specially commissioned diagrams used to explain concepts, ranging from "Aberration" to "Van Allen Belts" are a treat. The coverage is remarkable for a book with only 199 pages, and many subjects are described in considerable depth. There are over 1,100 alphabetical entries and 185 illustrations, as well as eight pages of tables. The cross-referencing is extensive and useful. The production quality is excellent; preparing this review gave me hours of reading pleasure. The editor should be commended for the care taken to use, consistently, SI units (Imperial measures are used where, for example, telescopes are familiarly known by their size in inches). Special units used by astronomers are defined (eg par-

sec, light year, Jansky).

There are 140 entries on basic physics, but equations are used sparingly (eg for Stefan's Law). Nearly a quarter of the entries are on the Solar System, which is well covered. There are several biographical entries on famous astronomers (though only a few are living astronomers - are three of the four most eminent living astronomers in the world really British, or is there a bit of a UK bias?). There is also an entry for each of the constellations; these give the sources of "modern" ones.

Only a very small number of problems were found during my perusal of this book. The Hubble Space Telescope suffers from a faulty primary mirror, not the secondary. Palomar Observatory is situated on Palomar Mountain and is therefore not officially known as the Mount Palomar Observatory, and it is much closer to San Diego than Pasadena. In the table of comets, the numeral "2" has inexplicably been substituted for "-" in the apparent magnitude column. I

could not see why the crater Stickney on the martian satellite Phobos required a separate entry, as the information simply repeated that already given by the Phobos entry, but, in general, errors were few and far between, which demonstrates again the high editorial standards applied.

Who should buy this book? It is remarkably comprehensive and is at a reasonably high level. Teachers of GCSE Science or A-level Physics would find it a clear and quick way to find the answers to many of the questions asked by their most enthusiastic pupils. If a personal copy is beyond one's means then, at a minimum, it belongs in every school library where these subjects are taught. It would be a useful addition to the collection of university and observatory libraries also. Many amateur astronomers will want their own copy to browse through on cloudy nights.

*Mike Dworetzky,  
University College, London*

## LETTERS

The Editor,  
Dear Sir,

I wonder if a radio astronomer might be permitted to shed a little light on the debate about Regulus which appeared in your Autumn issue. I do not propose to discuss whether the star is in a double system or not, but I would like to point out a simple explanation for the double temperature scales adopted by your two contributors.

Stellar temperatures can be defined in several ways. A physicist often uses the effective temperature  $T_{\text{eff}}$  which is the temperature of an equivalent blackbody with the same total power output per unit area as the star (ie power integrated over all wavelengths). An optical astronomer often uses a colour temperature  $T_c$ , which is the temperature of the blackbody which best approximates the star's output in the visible region of the spectrum. These blackbody models are only approximations to the complex set of physical conditions in the stellar atmosphere. It is not surprising therefore that they give very different answers when applied to hot stars like Regulus, where most of the power output is in the ultraviolet region of the spectrum.

In Allen's "Astrophysical Quantities", 2nd edition, there is a table which lists the two temperatures for a variety of main sequence stars. Unless I am mistaken the following excerpts resolve the difficulty between your two contributors:

Spectral Type	$T_{\text{eff}}$ (K)	$T_c$ (K)	
Main sequence, V			
O5	35000	70000	
B0	21000	38000	
B5	13500	23000	- Regulus B7
A0	9700	15400	- A1
A5	8100	11100	
F0	7200	9000	
F5	6500	7600	
G0	6000	6700	- Sun G2
G5	5400	6000	

From this I deduce that Dr Dworetzky is a physicist in this matter ( $T_{\text{eff}}$ ) and Mr Lawton an optical astronomer ( $T_c$ ), and that both quote their temperatures in Kelvins (K).

You may be interested to know that a radio astronomer might well measure the temperature of Regulus by finding the black-body which best represents the power output of the star in the radio region of the spectrum, the so-called radio brightness temperature  $T_b$ . I don't believe  $T_b$  has been measured yet for Regulus.

Yours sincerely,  
Dr R. J. Cohen  
Nuffield Radio Astronomy Laboratories,  
Jodrell Bank.

The Editor,  
Dear Sir,

May I comment on "Gravity and Tides", by Dr Anne Cohen (Vol. 12, No. 2, Winter 1992).

When plotting the depth of water against time to show high and low tide over 24 hours, students should not be disappointed if they do not obtain the sinusoidal wave form that Dr Cohen was fortunate to obtain. In the open sea, one may expect a sinusoidal rise and fall of about 1m; near exposed shores it will pile up considerably but still tend to be sinusoidal. However, in confined areas such as the south UK and in estuaries, there can be major departures - in the latter rising quite rapidly to remarkable heights.

Far from lessening the value of the exercise, students are given further food for thought - why are there four tides in the Solent instead of two each day, for example?

Dr Cohen explains why we have Spring tides (very high tides) twice a month, at full moon and new moon when the moon, sun and earth are roughly in line. However, I would like to comment on the "highest" Spring tides which occur twice a year when the tidal pull is exceptionally strong. Dr Cohen experienced one on 31st July (7.5m) but I would not agree that this was much higher than any in her graph Fig 3 - April 16 shows 7.2m.

These "highest" Spring tides are called Equinoctial Spring Tides because in the open sea they occur at about the vernal and autumnal Equinox in March and September when the phase of the Moon and also the declination of the Sun and Moon are mutually assisting. Around the solstices, tides are smaller than normal and a maximum would not be expected in July.

As an illustration, if one has the good fortune to live on the Western Isles the highest tide is about March 18th and September 26th in my old tide tables (range of 5.4m). High tide is at its smallest on June 22nd and December 31st, a range of 1.4m - "theory" approximates to practice on this exposed coast.

Rather than the perigee of the Moon, it would appear that apart from the phase of the Moon it is the approximate alignment of the Sun and Moon with the Equatorial plane that causes these extremely high tides.

Yours sincerely,  
A. J. Hennessy  
Stowford College,  
Sutton, Surrey.

The Editor,  
Dear Sir,

I sympathise with Dr Fiona Vincent's grieved comments in GNOMON Winter 1992 about the perpetual use of "Man" and "he".

Has anyone noticed the comment by James Michener on the back cover of the excellent new Norton 2000 Star Atlas? I quote:

" 'This is one of the loveliest books in the world' the professor

had said, still clinging to the large flat volume, 'Norton's Star Atlas'. Half the great astronomers living in the world today started with this as BOYS."

I think this piece of unthinking male chauvinism is an insult to the considerable number of women astronomers in the world.

However a recent GCSE question referring to Venus as the Earth's "sister planet" was challenged at a meeting, on gender discriminatory grounds, but it stayed in! Maybe it should have been Earth's "sibling planet"?

Dr Frank Flynn  
Chief Examiner GCSE Astronomy,  
Bury St Edmunds.

The Editor,  
Dear Sir,

About 25 years ago my firm developed a government-sponsored stellar auto-navigation system based on the 24 hour detection and position certification of several first magnification stars. This was, of course, easy for nightwork *but* we also had to be able to do it in daylight with only a small percentage difference between the background and the stars in question. We finally evolved a masterpiece in a folded refractor/reflector 'scope which, complete with electronic filters for noise exclusions, fitted into a box the size of half a biscuit tin (and weighed as much, since it was largely machined from a solid block of magnesium for rigidity!).

I cannot give any more details for even now the full performance specification is classified. However, I can report that it worked very well!

Yours sincerely,  
Tony Lawton  
President, British Interplanetary Society.

The Editor,  
Dear Sir,

With reference to *Simplicimus'* request for daylight sightings of stars up chimneys, I would like to report the daylight observation, a couple of years ago, of a planet not up a chimney - oh, and without "no clouds, of course".

Having thoroughly disqualified myself, I do actually think this sighting relevant. Observations of planets close to dusk or dawn are, of course, commonplace; indeed Mercury can be seen at no other time due to its proximity to the Sun. This observation, however, happened at noon and close to midsummer.

Bright summer conditions are often marred by a high haze or cloud layer, but this day saw a deep blue, almost Mediterranean, sky between puffs of altocumulus. The Sun hidden by one of these clouds, I clearly saw Jupiter very close by. I remember looking about for stars since Jupiter was so distinct that I felt sure that a bright star would also have been visible, but did not see any before the Sun came out again.

In this instance, the clouds acted as my "chimney", but the deciding factor was definitely the extreme clarity of the sky between the clouds. This is highly unusual in this country: I do not recall any sunny days this year devoid of haze. I would thus suggest that the stately homes of England are probably not the best locations for this research; it would be preferable to observe in climes where deep blue skies are more commonplace.

I would be willing to engage in such research, should anyone feel like sponsoring an expedition to, say, the Bahamas. I can provide my own cardboard tube.

Yours faithfully,  
Merlin Ellis  
Woodford Green, Essex.

## Comets and Meteors

A Curriculum Corner article by Alex Lovell

A comet is a very dirty snowball, typically about 5-10km across and shaped like a rough potato. It has a highly elliptical orbit around the Sun. It often develops tails (pointing away from the Sun). The discoverer of a new comet gets it named after him.

### Suggested Activities for Children

1. Ask them to bring a dirty snowball into a warm classroom and see what happens.
2. Draw pictures of comets with white chalk on blackboard.
3. Search for pictures of comets.

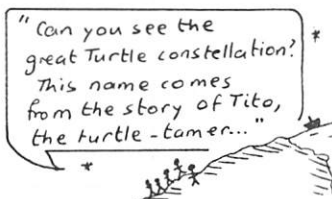
A meteor is a piece of rock which glows white hot as it forces its way through the Earth's atmosphere. Find out the best times to look out for meteors and count how many you can see.



## STORIES IN THE STARS

Learning the names and shapes of constellations is an interesting activity but why stop there? Have you ever wondered why the constellations are given their names? Who named them? What stories can be told about these names?

The answers to most of these questions can be found by looking at Greek mythology. You will read how The Great Bear was really a beautiful woman named Callisto. She was turned into a bear by the god Zeus to protect her from Hera, the queen of the Gods. You will also read about Andromeda, the lovely daughter of the Queen of Ethiopia. Andromeda was saved from a sea monster by the god Perseus who later married her. The constellations of Perseus, Andromeda and The Great Bear can all be seen in the sky on a dark night. But the night sky has been visible to all cultures across the globe. What legends are to be found in Chinese history or in the stories told by the North American Indians? They are certain to be different to the Greek legends and the star and constellation names will also be different even though they are the same stars!



A story told by the North American Indians tells us that the Coyote was given the task of carrying a bag of pebbles in to the sky to help the other animals set out their pictures. The lazy Coyote decided not to go on the long journey into the sky. He left the other animals to start their pictures but many remained unfinished. The extra pebbles didn't arrive. This is why some stars don't seem to belong to a pattern. They are part of the unfinished pictures. This is also why there is not a constellation called the Coyote. At night in America the Coyotes will look up into the skies and let out a great cry of sadness because their picture is nowhere to be seen.

You may have seen a beautiful small group of stars called the Pleiades or Seven Sisters. The North American Indians tell a story about seven brothers who ran away from home into the sky. The youngest brother didn't want to leave his mother so he cried and cried. On some clear nights you can see the seven brothers. On other nights you can only see six. This is because the youngest brother is crying and hiding his face with his hands.

What stories can you tell about the stars? Find a group of stars and sketch them. Look at your sketch for a shape, a face perhaps or an animal. Write a story about your stars and give them a name of your own. Your stories are just as important as those told by the Indians or the Greeks. Send your best stories and your sketch to Curriculum Corner and we will print them in a



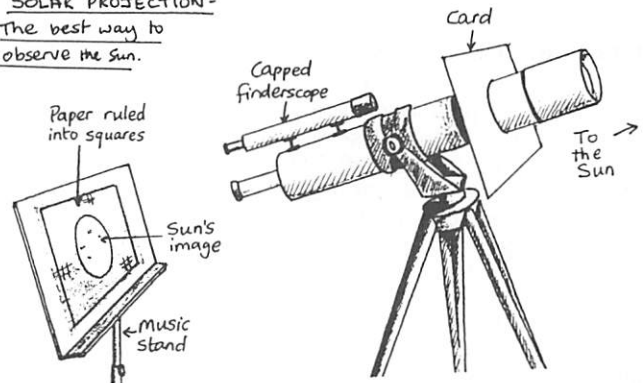
future edition of GNOMON. If you can't find a group of stars then here is a sketch of part of the summer sky. You might like to start your story by finding a shape or pattern in these stars. Happy hunting.

BOB KIBBLE

## OBSERVING THE SUN SAFELY

Eclipses of the Sun in general catch the imagination of the public to such an extent that many people who otherwise never take an interest in astronomy are willing to spend several minutes gazing at the Sun. The partial solar eclipse on May 21st 1993 is likely to be watched by thousands of people who do not realise that observing the sun can be extremely dangerous unless proper precautions are taken. Most adults are probably aware that looking at the sun through binoculars or a telescope can injure the eyes but few realise that even observing the sun with the naked eye can result in permanent damage to the retina.

SOLAR PROJECTION -  
The best way to observe the sun.



### Observing the Sun through a Telescope

If you wish to observe the Sun through a telescope or binoculars, the only safe way to proceed is to use the instrument to project the image of the Sun onto a screen (note: if binoculars are used, cover the lens not in use so that there is no possibility of accidentally looking through it). A shade should be attached to the tube of the telescope to ensure that the projection screen is in shadow. With this arrangement it should be possible to observe the eclipse in perfect safety with your back to the Sun. **NEVER** look directly at the Sun through any type of optical aid. There is no cure for the damage to the retina which can occur almost instantaneously.

### Methods of Observing the Sun with the Naked Eye

1. *Projection of the Sun's image* onto a screen via a pinhole is a safe method of observing the Sun provided the observer does not look through the pinhole or around the edge of the card containing the pinhole.
2. *Sunglasses* are entirely unsatisfactory since neither do they provide a sufficient attenuation of the sun's radiation nor do they cover a broad enough wavelength band. It is dangerous to rely on them and they should not be used.
3. *Exposed film* is not recommended as a filter. It can be safe if the degree of exposure is sufficient and uniform and if the piece of film is large enough but in general commercial films are too small and rarely adequately darkened. Colour negatives are unsuitable and should not be used.
4. *Smoked glass* is safe if the density is great enough and the piece of glass is large enough. However, it is difficult to get an adequate even density without pinholes over a large area. Also the carbon film is susceptible to finger-marks and is easily brushed away and, of course, it is possible to look at the Sun around the edge. The method, although it can be made safe, is not to be recommended.
5. *Welder's goggles* are designed to protect the eye against the glare from a welding process. This glare tends to be richer in the ultraviolet and less intense in the infrared than is the solar radiation reaching us on the Earth's surface. The goggles may not offer adequate protection against infrared even with high shade numbers (highest shade number = 0.000037% visual transmission). Generally there is so much uncertainty that welder's goggles cannot be considered as adequate protection.
6. *Photographic filters* have in recent years become a very popular means of protecting the eyes during solar observation. However a single filter is unlikely to offer an adequate safeguard due to leakage particularly at infrared wavelengths. A combination of filters may be safe but the combination would need to be chosen by a person knowl-

Continued from previous page

edgeable about solar radiation. Any old apparently dark filter is likely to be totally unsafe.

In short then, whether using a telescope, binoculars or the naked eye, safety lies in viewing a projected image where the intensity can never be high enough to inflict the kind of eye damage which can result from direct observation of the Sun.

MERLIN ELLIS

### POOR PERSON'S PLANETARIUM

Take a circular star-chart, the sort which gives the positions of celestial objects month by month. Use a pin to prick holes through about 40 or 50 bright stars, slightly bigger holes for the brightest stars, smaller holes for the faintest. When this circular disc is placed on an overhead projector, a star field may be projected on to a screen. (Using a plane mirror the image may be directed on to the ceiling, which is more realistic.) With a little ingenuity, the star disc may be rotated about the position of the north pole, slightly displaced from the north pole star, simulating the apparent rotation of the stars. If extraneous light round the outside of the disc is screened off and blinds are drawn, the illusion is improved.

This pinhole technique may also be used to demonstrate individual constellations.

Footnote: If a plane mirror is used to direct the light on to the ceiling, is the star pattern inverted (or reversed)?

ERIC ZUCKER

## Sky Diary Spring 1993

This article was produced by Eva Hans based on information from Fiona Vincent of the Mills Observatory, Dundee.

Equinox : Mar 20<sup>d</sup> 14<sup>n</sup> 41<sup>m</sup>  
Solstice : June 21<sup>d</sup> 09<sup>n</sup> 00<sup>m</sup>

### MOON

	New Moon	First Quarter	Full Moon	Last Quarter
Mar	23 <sup>d</sup> 07 <sup>n</sup> 14 <sup>m</sup>	Mar 31 <sup>d</sup> 04 <sup>n</sup> 10 <sup>m</sup>	Apr 06 <sup>d</sup> 18 <sup>n</sup> 43 <sup>m</sup>	Apr 13 <sup>d</sup> 19 <sup>n</sup> 39 <sup>m</sup>
Apr	21 <sup>d</sup> 23 <sup>n</sup> 49 <sup>m</sup>	Apr 29 <sup>d</sup> 12 <sup>n</sup> 40 <sup>m</sup>	May 06 <sup>d</sup> 03 <sup>n</sup> 34 <sup>m</sup>	May 13 <sup>d</sup> 12 <sup>n</sup> 20 <sup>m</sup>
May	21 <sup>d</sup> 14 <sup>n</sup> 06 <sup>m</sup>	May 28 <sup>d</sup> 18 <sup>n</sup> 21 <sup>m</sup>	June 04 <sup>d</sup> 13 <sup>n</sup> 02 <sup>m</sup>	June 12 <sup>d</sup> 05 <sup>n</sup> 36 <sup>m</sup>
June	20 <sup>d</sup> 01 <sup>n</sup> 52 <sup>m</sup>			

### ECLIPSES

There will be a partial eclipse of the Sun on May 21st 1993. The eclipse will be visible in the north of the British Isles. Remember **never look directly at the Sun**. This can be harmful even to the naked eye, and will certainly result in eye damage if you use binoculars or a telescope. Many of the "sun filters" commercially available are unsafe for one reason or another. If in doubt do not use them. The only safe method of observing the Sun for the amateur is to view a projected image.

Eclipse begins	May	21 <sup>d</sup>	12 <sup>n</sup>	18.8 <sup>m</sup>
Greatest eclipse	May	21 <sup>d</sup>	14 <sup>n</sup>	19.3 <sup>m</sup>
Eclipse ends	May	21 <sup>d</sup>	16 <sup>n</sup>	19.5 <sup>m</sup>

This Spring also brings a total eclipse of the Moon on June 4th. However the eclipse will not be visible from the UK.

**MERCURY** Mercury is a morning object in the eastern sky until May 8th. It then reappears as an evening object in the west from May 24th.

**VENUS** Venus is in the morning sky from early April.

**MARS** Mars is an evening object in Gemini at the beginning of this period. By late April it is in Cancer and it then proceeds into Leo.

**JUPITER** Jupiter is at opposition on March 30th and can be seen throughout the night. By the end of June it is an evening object only.

**SATURN** Saturn is in the morning sky in Aquarius.

A large poster showing the phases of the Moon for every day in 1993 is available FREE to AAE members. Please send a large stamped and addressed envelope (large enough to take A4 sheets) to:

The Planetarium, South Tyneside College, St. Georges' Avenue,  
South Shields, Tyne and Wear NE34 6ET

Please mark your envelope: "AAE Poster".

## A COMMUNITY SOLAR SYSTEM

by Ken Poshedly

Reproduced by permission from the Journal of the Astronomical Society of the Atlantic (December 1992)

### A Community Solar System

Probably most of us have seen scale models, or at least representational drawings, that show the comparative sizes of the Sun and planets. But up until recently, no scale model of this existed that also placed the models of the solar system bodies at scale distance.

The Lakeview Museum and Planetarium of Peoria, Illinois, however, made the news recently with its "Community Solar System". Centred at the Lakeview Museum planetarium dome, the model is billed as "The Largest Model of the Solar System in the Known Universe" and consists of a 11m (36") diameter Sun with the planets and a number of comets at appropriate distances away with a plaque containing details about its specific object.

For the Peoria model, the Sun was painted on the planetarium building and was, in fact, represented by the planetarium dome. Descriptive graphics are located in the lobby. At each planet location is a custom-moulded Plexiglass sphere, painted to approximate detail as best seen from Earth.

Besides the planets are 45 comets and asteroids represented by signs at locations around the country, including sites in Ohio, Indiana and the Jet Propulsion Laboratory in California. Because a comet or asteroid at scale size is just a mere speck, only a sign which describes the nature of an asteroid or comet is used.

Using Georgia locations, here are the scale dimensions and distances from a Sun located at the interchange of I-20 and the Connector (I-75/I-85) in downtown Atlanta and headed east on I-20 towards Hard Labor Creek Observatory (remember, all distances are approximate):

### THE PLANETS

<b>Mercury</b>	4cm (1.5") diameter, 0.4km (0.25miles) away.
<b>Venus</b>	10cm (3.8") diameter, 0.8km (0.50 miles) away.
<b>Earth</b>	10cm (4") diameter, 1.2km (0.75 miles) away, at the Bell St. exit.
<b>Mars</b>	6cm (2.2") diameter, 1.9km (1.2 miles) away, near the Cherokee Ave. overpass.
<b>Jupiter</b>	110cm (3'9") diameter with 190cm (76") ring, 6.4km (4 miles) away, near the Glenwood Ave. exit.
<b>Saturn</b>	95cm (3'2") diameter with 230cm (90") ring, 13km (8 miles) away, just west of Columbia Drive inside I-285.
<b>Uranus</b>	40cm (1'4") diameter with 81cm (32") ring, 24km (15 miles) away, near Lithonia.
<b>Neptune</b>	38cm (1'3") diameter with 76cm (30") ring, 37km (23 miles) away, near Conyers.
<b>Pluto</b>	2.5cm (1") diameter, 64km (40 miles) away, at Hard Labor Creek Observatory.