

M.H. Sr.
Bech to VC please.



Newsletter

PUBLISHED BY THE ASSOCIATION FOR ASTRONOMY EDUCATION

Vol. 3, No.1

September, 1983

Socrates: Shall we set down Astronomy among the subjects of study?

Glaucon: I think so, to know something about the seasons, the months and the years is of use for military purposes, as well as for agriculture and for navigation.

Socrates: It amuses me to see how afraid you are, lest the common herd of people should accuse you of recommending useless studies.

Plato

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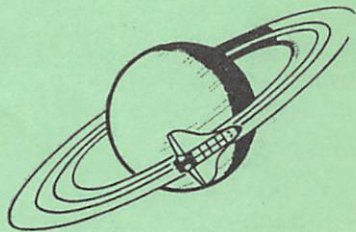
SPACE SHUTTLE features a colour cutaway of orbiter Columbia, together with pictures of its historic maiden flight.

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EDITORIAL

As regular readers of the Newsletter will know, this issue (the 7th) is the first under my editorship. Knowing little about such undertakings I sought help from many sources; I am particularly grateful for the assistance given to me by my predecessor, Dr. David Clarke, of the University Observatory, Glasgow and from Mrs. M. Morris.

At our last Council meeting we discussed the future of the AAE News. We felt that an effort should be made to widen its scope and increase both the number and variety of its articles. This, we realised, could only be accomplished at an increased cost to the Society, and by receiving regular contributions from our readers. I would like, therefore, to appeal for material from any reader who feels that he has something to offer, either as part of a series of articles, or merely as a "one-off". Please send copy to me at the address shown on the back of the cover.

We were very anxious to include "Teachers' Pages", providing help and advice at all levels. I particularly hope that practising teachers will feed in relevant information. To "start the ball rolling", Dave Harris has kindly contributed "First Steps in Introducing Astronomy", (page 9) and Peter Richards-Jones has worked through a couple of "O" level type mathematics questions (page 11).

We were equally keen to produce a series of articles on "Places to Visit", and where better to start than at the London Planetarium with an article contributed by Undine Concannon (page 14).

In addition we wish to receive regular reports on the work of Local Societies (Secretaries please note). As an introduction to such a series, Rosemary Naylor writes a short note on the "Federation of Astronomical Societies". Our aim is to compile a more comprehensive "Diary of Events" but we do need information concerning projected meetings or courses. Perhaps larger Societies could appoint a correspondent to regularly submit a calendar of events?

Other suggestions included an equipment review, a question and answer page and more Letters to the Editor. If you feel such items would be useful or have any further suggestions please let me know. Your comments will be most welcome.

This is really quite an auspicious moment at which to commence editing a Newsletter on Astronomy. Derek McNally's report (page 7) is one of the most hopeful I have seen. Obviously he needs more case histories to provide him with ammunition. If you have successfully taught Spectroscopy, or Gravitation, or any other core science topic, using Astronomy as a vehicle, please inform him as quickly as possible.

Peter Drew and company (page 22) have launched one of the most exciting ventures in amateur astronomy for many years. I am sure that it will receive much active support from our members.

ASSOCIATION NEWS - FROM THE SECRETARY

Annual General Meeting

As you will remember, the venue of the 1983 A.G.M. was changed at very short notice, because very few people were able to travel to Glasgow. However, Mr. Eric Zucker of the Physics Department, North London Polytechnic, approached his Director, and within days we were kindly offered the facilities of the Polytechnic. We received a great deal of help from Mr. Zucker and his colleagues in organising the meeting and preparing the leaflet, and the AAE members who were heavily involved in administration of the A.G.M. appreciated this help very much. I have written to the people concerned on behalf of the AAE to express our thanks.

The Friday evening session was well attended by people staying overnight, as well as visitors from London. We were treated to a balanced programme of video tapes on astronomy supplied by the Open University and by Armagh Planetarium. There were also several interesting exhibits.

On Saturday, the formal business of the A.G.M. was followed by a session on astronomy and the media, in which several people interested in the use of radio and television in astronomy education, gave short talks. After this, Dr. David Malin, from the Anglo-Australian telescope gave us an excellent lecture on "Astrophotography with the Anglo-Australian telescope".

Many members have commented that it was an interesting and stimulating meeting, although more time was needed to appreciate the exhibits fully.

Directory of Expertise

I receive a large number of enquiries on matters astronomical. Quite often I am unable to supply the information requested, and am not always sure to whom to redirect specific enquiries. At the last Council meeting it was agreed we should state on the membership list the specialist areas of interest of members, both in astronomy and astronomy education. Could you please inform our Membership Secretary, Captain P. Richards-Jones, London Schools Planetarium, Wandsworth School, Sutherland Grove, London SW18, if you would be willing to answer enquiries in a specific area.

PERCY SEYMOUR

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ASTRONOMY AND THE SCHOOL CURRICULUM

The Association has made representations to the Secondary School Science Curriculum Review and has received considerable encouragement that the time is now ripe for a serious consideration of how astronomy may be introduced into the curriculum. The following paper was submitted to the Secondary Science Curriculum Review and as a result a meeting between Dr. McNally and Dr. West took place in which further action was discussed.

"ASTRONOMY AND THE SECONDARY SCHOOL SCIENCE CURRICULUM"

by the Association for Astronomy Education

Astronomy is the oldest of the sciences, born of the fact that man evolved on a planet from which he could see the sky. While it is likely that an origin was earlier, there is evidence to suppose that for the last five thousand years man has studied the heavens and attempted to understand what he saw day by day and night by night. There is no doubt that what he saw and deduced from his observations has had extraordinary effects upon his life in many lands. In our own time astronomy has undergone a renaissance in the past twenty-five years, partly due to the advent of the "Space Age", and partly through the application of advanced technologies to the science.

In our own country, man's quest for knowledge about the universe continues, as is reflected in the amount spent each year on research into astronomy and the space sciences - some 8.5% of the SERC's total annual budget.

However, public awareness of astronomical science is, in general, abysmal, even of those areas where astronomy and daily life overlap. Very little astronomy is at present included in the school curriculum at any level.

It is therefore the Association's strongly held conviction that astronomy should have a significant role in future science education at secondary level; although we would not wish to argue a case for the separate study of astronomy, distinct from the other science subjects, for all pupils. Astronomy is an exciting physical science and pupils of all ages are well disposed to it. Few scientific subjects of our present age convey the wonder of exploration better than those of manned space missions to the moon and robot probes to the planets. Few scientific subjects offer a better vehicle for demonstrating the application of chemical, mathematical and physical techniques.

We live in an era in which we are continually reminded that we live on a planet - the 'global village' - and all human activity is ultimately determined by this fact. Therefore all should have a true perspective of man's home and his place in the universe at large. We should be made aware of our total dependence on our nearest star - the Sun. Thus, it is not surprising that astronomical and space topics can, with considerable advantage, be used in many subject areas; for example: in Physics, astronomical examples may be used to elucidate principles of gravitation, spectroscopy, atomic and nuclear physics, as well as dynamics; in Mathematics, Statistics and Computing, real situations and examples may be drawn extensively from astronomy; in Chemistry and Biology, the organic evolution of life may be given a universal perspective; Geological and Geographical concepts can now readily be applied to the study of the solar system of planets, as a result of spacecraft observations. In addition, the History of Astronomy clearly shows the development of the nature of science generally and of the scientific method. Few sciences have the advantage of both qualitative or quantitative treatment to suit class abilities and requirements.

As it is essential that a pupil's interest in science be carefully nurtured, it is our experience that astronomy holds a unique position for so doing. The subject matter

of astronomy is broad - it encompasses the universe but remains intimately related to many other science subjects. Our cosmological awareness even has an impact on our views of politics and society. Astronomy's role as an integrating subject is paramount, and is an important route towards providing coherence in science teaching throughout the school curriculum.

A. W. LINTERN-BALL

D. McNALLY

P. A. H. SEYMOUR

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The general tenor of the above paper found a warm reception with the Secondary Science Curriculum Review. However, there is now a matter of some urgency in order to establish precisely how a contribution can be made from astronomy. For example, some knowledge of astronomy must find its way into the lower school science curriculum and one must also be clear where astronomy can introduce some concrete examples.

One immediately thinks of areas such as dynamics and gravitation theory, the interaction of the transfer of heat and the theory of radiation and the use that astronomy makes of atomic physics, specially through spectroscopy. These examples should suffice for starters but there are clearly many other areas where astronomy could present a good illustration of physics. One of the objections to astronomy in the school curriculum has been that astronomy is usually done at night. However, the Sun is available in school hours and though it could have dangers, these dangers could be minimised by suitable safety precautions, as is done currently with the school radio-active source.

Since action is needed urgently, I am writing this in order that interested people who have ideas to contribute in this area, can get in touch with me fairly quickly with specific proposals of where they have had success in using astronomical examples in physical science which includes mathematics for the age group 11 to 16+. I am also interested in the design of demonstrations in these areas as well with particular reference to where computer demonstrations may be of value in illustrating mathematical and physical points. It would be of particular value when going back to the Curriculum Review to be able to say these

particular demonstrations or ideas have proved of value to specific age groups so that we know where weight has to be placed to make changes in the existing curriculum.

At the present time thought is being given to the basic physics, chemistry, biology and mathematics curriculum, and it is in tandem with this that we are thinking around the astronomical input at this time. Clearly, both things have got to go in parallel so that once a basic physics curriculum has been considered, for example, the astronomical illustrations can be considered at the same time. This will then of course inform the necessary science that has to be taught at an earlier stage. I wish to emphasise the urgency with which this needs to be done, and I would appreciate having replies so that a considered document can be presented to the AAE Council in November.

The submission by the AAE to the Secondary Science Curriculum Review was drawn up by Andrew Lintern-Ball and modified by D. McNally and P.A.H. Seymour. However, it would be an advantage to send all suggestions only to Dr. D. McNally at the University of London Observatory, Mill Hill Park, London NW7 2QS, so as to maintain a central file of these suggestions.

I look forward to hearing from you.

D. McNALLY,
University of London Observatory

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FEDERATION OF ASTRONOMICAL SOCIETIES

The Federation of Astronomical Societies was formed in 1974 to draw local societies together for their mutual benefit.

A Handbook is published annually, containing lists of addresses of suppliers of astronomical equipment, places to visit, speakers etc. Most importantly, a list of Astronomical Societies is kept, though this is never entirely up to date.

Journals and Newsletters appear at intervals, so that societies read what other societies are doing and thinking.

With an annual meeting in May, new ideas arise which keep the FAS moving forward to meet the needs of members. At the October meeting there is an opportunity, not only to listen to lectures, but to meet commercial firms who attend. The pursuit of excellence in photography, magazine production, etc. is encouraged through competitive displays and generous prizes.

The Federation also sponsors the production of an annual calendar, giving monthly sky maps. Members may also offer their best transparencies to add to the list of slides sold through the slide scheme.

A major aim is to foster an interest in astronomy, and hence education is important. So we try to generate an awareness of the pleasures to be gained by understanding the universe in all its complexities. At the same time we benefit from the social relationships which meeting fellow astronomers can bring.

Societies pay £7.50 membership per year (small groups pay £4.00). More information can be obtained from the Secretary, Rosemary Naylor, 24 Julia Crescent, STONEBROOM, Derbyshire, DE5 6LS.

* * *

FIRST STEPS IN INTRODUCING ASTRONOMY

When any teacher in a school first decides that he/she would like to introduce Astronomy to the pupils, the first questions that arise are usually How? and When? No-one will ever wake up one morning with a sudden and firm resolve to "push it" into the teaching programme. My suggestion is that first steps be taken very "softly-softly" during those informal chat times that do arise at odd moments. The last few days of the term are ideal. Youngsters need a change; preferably some topic far removed from the normal curriculum.

A discussion may arise spontaneously on "that bright star last night" or "Did you see the Shuttle on television" etc. I have always found that the enthusiasm is instant and surprisingly intense. I defer to all my colleagues as to how the teaching may be done, but I find that if pupils think they are bringing we "old" teachers (over 18 seems to be the dividing line!) up to

date on modern space achievements they really bubble with enthusiasm.

The idea of a weekly discussion may arise and this could very easily lead to the formation of a "Science Club". I strongly advise keeping it general both in nature and programme. Bear in mind that, particularly with a new topic, albeit informal, overkill is a serious hazard. Let things develop, and then, if all goes well, enthusiasm will be maintained and an embryo Science Club, biased towards Astronomy, may form. The Head and Head of Department will now begin to be curious. (They should be witnessing the pupils' response). I feel that this is the time to talk Astronomy to them, not before. A sudden announcement to 99% of Heads that "I would like to introduce Astronomy to the children" occasions a reflex action such as "too complicated" or "if you've got time to do that you ought to be...." I advise playing it cool. Your own burst of enthusiasm could be a disadvantage.

Having found a nucleus of interested pupils, DO something practical, preferably in the evening, knowing full well that any number of parents will arrange to collect offspring from a club evening. Go outside and count meteors or run through the visible constellations. The main aim being to allow curious parents to see what you are doing. They will show off their bit of knowledge, of course. Let them. Parental interest is vital. I did quite extensive meteor counts some years ago and found that once parents became involved they provided a substantial back-up. Mums made cups of tea; dads brought along binoculars and so we progressed.

At this early stage no equipment is needed. A notepad and a red torch for dark adapted star chart work is sufficient. After this, try adding a couple of deck chairs! They allow one to recline in comfort and the sky takes on a new and further interest. Worry about telescopes as a last consideration. Concentrate on those practical things that the pupils can do at home with little help.

One final suggestion I will offer; keep any club or society wide open to all ages and abilities. Astronomy can do much for the not so able child whilst the brighter ones get a kick out of helping them find their way around the sky. If some of them wish to start a radio or

electronics group, so be it; the less-able will watch or listen and maybe start to sort out components for the builders or even try their hand at soldering.

If I have set some of you thinking about how you might achieve something with Astronomy in schools I shall be happy. There is a surprising amount of thoughtless opposition to this subject, particularly from senior staff who ought to know better.

Do not be discouraged. Take it gently. All should go well.

DAVE HARRIS

* * *

"To try to see more and better is not a matter of whim or curiosity or self indulgence. To see or to perish is the very condition laid upon everything that makes up the Universe, by reason of the mysterious gift of existence. And this, in superior measure, is man's condition."

Teilard de Chardin

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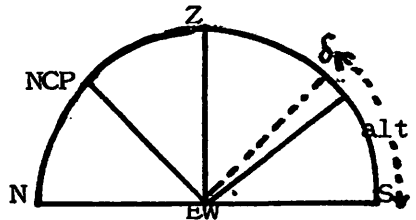
A GUIDE TO 'O' LEVEL MATHS

The star Betelgeuse was observed in transit at the observatory of Pic-du-Midi in Latitude $48^{\circ}30'N$, Longitude $2^{\circ}12'E$. The Right Ascension of the star being 5^h50^m and the declination $+7^{\circ}12'$; calculate the UT of transit and at what expected altitude. The GST at UT 00^h00^m being $13^h42.6^m$.

(i) At UT. 00^h00^m GST	=	13 . 42.6
Long. $2^{\circ}12'E$ converted into time	=	<u>8.8</u>
At UT. 00^w00^n LST	=	13 . 51.4
As the R.A. = LST at Transit	=	<u>05 . 50.0</u>
Then the time interval in sidereal time =		08 . 01.4
But a Meantime interval is required	=	<u>01.3</u>
∴ Meantime interval (before midnight) =		<u>08 . 00.1</u>
Thus: GMT (UT)	=	<u>15 . 59.9</u>

(ii)

Zenith is	$90^{\circ}00'$
Observer's Latitude	$48^{\circ}30'$
Co-Latitude	$41^{\circ}30'$
Add declination	$7^{\circ}12'$
\therefore Altitude	$48^{\circ}42'$



Zq = Latitude
 $q\delta$ = Declination

$$\therefore ZS - Zq = S\delta$$

$$S\delta + q\delta = S\delta$$

where $S\delta$ = altitude

Teacher's Page

A radio telescope is tuned to receive radiation from a distant source of neutral hydrogen. The wavelength of the radiation is 210mm, however, the telescope has to be tuned to a wavelength which is 0.07mm greater in order to receive this radiation.

Calculate the velocity of the source relative to the telescope (speed of radio waves = 3×10^8 m/sec).

Formula $\frac{\delta\lambda}{\lambda} = \frac{V}{C}$ Apparent wavelength is greater, therefore the source is receding.

Where $\delta\lambda$ is the change in wavelength, λ = real wavelength.

V = velocity of the source, and C the velocity of light

$$\therefore \frac{0.07}{210} = \frac{V}{3 \times 10^8}$$

$$\therefore V = \frac{3 \times 10^8 \times 0.07}{210}$$

$$\text{Velocity of Source} = 10^5 \text{ m/sec.}$$

* * *

The avoidance of taxes is the only intellectual pursuit that still carries any reward.

John Maynard Keynes

ASSOCIATION FOR ASTRONOMY EDUCATION

Income and Expenditure Account for the year ending 30th April, 1983

<u>Income</u>		<u>Expenditure</u>	
Registration Fees for Annual General Meeting, Greenwich	177.00	Annual General Meeting, Greenwich	76.83
Subscriptions	453.00	AAE News	39.04
Advertising Revenue	62.00	Stationery, Printing and Photocopying	129.36
Publication Orders	15.00	Postages	56.00
Donation	2.00	Hire of Rooms for Council Meetings	15.00
		Production and Despatch of Astrophotography Compendium	9.16
		Alston Hall Course	55.65
		Advertising	18.20
		Amount set aside for Production of Constitution and Bye-Laws, but not spent	<u>(28.00)</u>
			371.24
		Excess of Income over Expenditure	<u>337.76</u>
	<u>£ 709.00</u>		<u>£ 709.00</u>

BALANCE SHEET as at 30th April, 1983

<u>GENERAL FUND</u>		<u>ASSETS</u>		
Balance as at 1st May, 1982	280.73	Cash at Bank	672.61	
Excess of Income over Expenditure for the year 1982/83	337.76	Prepayment for 1983 A.G.M.	<u>40.00</u>	712.61
		<u>LIABILITIES</u>		
		Subscriptions paid in advance	94.00	
		Sundry Creditors	<u>.12</u>	<u>94.12</u>
	<u>£ 618.49</u>			<u>£ 618.49</u>

(Signed) R.V.J. BUTT, B.Sc., M.Sc., F.R.A.S., Hon. Treasurer

(Signed) R. C. JACOB, F.A.A.I., Hon. Auditor

EDUCATION AT THE LONDON PLANETARIUM

or

Not just a long queue

The queue which snakes round Mme. Tussaud's during the summer months is certainly good for the wax business, but is very much a mixed blessing to the Planetarium. "I would come to your Planetarium, but it's always so hard to get in" is a comment heard frequently, even in the snows of December and January. The fact is that it's not true. You can certainly queue to get a ticket for Mme. Tussaud's and the Planetarium combined, but to visit the Planetarium alone, even in July and August, rarely involves waiting more than half an hour.

Another misconception commonly held is that all our programmes are short, taped, and on a very popular level - aimed at non-astronomers and tired English and foreign tourists - tourists desperately looking for somewhere to sit down.

Fortunately, a large number of teachers know better. They know that a comprehensive range of talks is given, catering for every level of ability - from those with learning difficulties to A-level students; also that the talks are given 'live', and that the lecturer will make personal contact with every group before he, or she, starts.

The largest school groups for whom we cater come from the 7 to 12 age range. For them there are two different programmes, the most popular of which is "Earth, Sun and Planets", given three or four times a week during term time. The children are taken on a voyage of discovery through the solar system, 'landing' on the moon, and taking off from there to visit each of the planets, and finally establishing the place of the solar system within the galaxy. The 'question' session which follows this talk often baffles the teachers, and even, sometimes, the lecturers!

The second programme for 7-12 year olds is "Night Skies of Britain". This is chiefly concerned with identifying some of the constellations relevant to the time of year, and illustrating the legends attached to them, ending with a discussion of the make-up of various

individual stars, including the sun.

The subject matter can, to a certain extent, be adapted to suit particular groups; on occasions, special lectures may be arranged, providing the group is large enough.

All enquiries receive a sympathetic hearing!

For Secondary Schools, a lecture given by the Director, John Ebdon, originally based on the Nuffield Physics O-level course, and now called "Basic Astronomy", is given every Friday morning. It contains a comparison of classical and modern cosmology, together with a demonstration of the various movements in the sky which can so much more easily be understood by watching the Zeiss star projector at its work. The lecture ends with an entertaining 'celestial Derby', which never fails to bring the house down, and if anyone seeing it ever forgets what retrograde motion is, then astronomy's obviously not for him.

Perhaps the most rewarding of all, however, is the reaction from children with learning difficulties of all kinds, for whom "Our Skies", a very simple explanation of the sky and its wonders, has now become a regular part of the Schools' programme. It is from these children, particularly, that we receive the most delightful letters and drawings.

At the other extreme, and linking the disciplines of science and the arts, are two lectures designed for A-level English students, to illuminate the astronomical and astrological references in mediaeval and renaissance literature. For years now Geoffrey Chaucer's "The Franklin's Tale" has been the major subject for one of these; but more recently a wider-ranging lecture, covering Chaucer, Shakespeare and Milton, to name but three, is becoming even more popular.

By special request from a Leicestershire school in 1980 John Ebdon devised another astro-literary talk, this time using poetry and prose about the night sky to illustrate the basic astronomical principles. We have repeated the lecture several times - a fine example of one teacher's 'hobby-horse' breaking out of his stable. The teacher in question - Colin Goodman.

On a regular basis, however, at a time when younger children particularly are showing enormous enthusiasm for space, the Planetarium's constant aim is to send them away

being more aware of the wonders of the heavens, and of their own place in the universe. The impact of the stars on the dome is not seen simply as a scientific one; in an article in the Times Educational Supplement in 1973, John Ebdon wrote, "In the right hands, astronomy can be the key to a greater understanding and enjoyment of a diversity of subjects", and this is a belief which still colours much of what the London Planetarium aims to achieve, and which distinguishes it from other planetaria in the country.

Undine Concannon

1st September, 1983 (copyright)

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COSMIC HORIZONS

R. V. Wagoner & D. W. Goldsmith. W. H. Freeman and Company Ltd. 1983. £16.30 hardback ISBN 0-7167-1417-5. £7.95 paperback ISBN 0-7167-1418-3. 195 pages. 48 illustrations (monochrome)

. Subtitled "Understanding the Universe", this up to date book is a text on cosmology, written by an astronomer (Goldsmith) and a physicist (Wagoner). In its nine chapters it takes an "astronomy" and a "physics" view of the cosmos: thus there are in the former category chapters on the history of cosmological thought, the astronomical constituents of the Universe, stellar evolution, and the expansion of the Universe as deduced from the observations of Edwin Hubble and others; the physics comes along in chapters on the microscopic state of matter and considerations of the early condition of the Big-Bang Universe. Actually, the physical content underlines the book in general, but I think that it is fair to make the above-mentioned distinction about the book's layout.

I think that the book is better on its more conventional astronomy than on the more "theoretical cosmological" and fundamental-particle physics discussion. These latter sections require more prior knowledge from the reader than the former.

The book is more suitable for part of an undergraduate astronomy or physics course, than for A-level background reading (for which the same publisher's Cosmology +1 collection of "Scientific American" articles would be more

appropriate). And indeed the book developed from a course taught at Stanford University by Professor Wagoner. It was first issued in 1982 as part of a Stanford University series of books. The account is largely non-mathematical but does depend, as mentioned, on a fair amount of physics.

There are several novel presentations of facts and their interpretations, plus several amusing cartoons. A very useful reading list appears at the end.

A few small quibbles: the African description of the "backbone of night" (page 12) applies to the Milky Way only and not to the whole starry sky as stated; the luminosity scale on the Hertzsprung-Russell diagram on page 57 is reversed below one solar luminosity; it is not quite true to refer to the Jovian planets as being mostly gaseous, because of the high-pressure liquids present (page 165); and IRAS is the Infrared Astronomical Satellite not "Survey" Satellite (page 176).

Geraint Day
Science and Engineering Research Council Central Office

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PUPIL FANTASMAGORICALS 1983

Hedging one's bets is a well known art, but

Red Dwarf: "consists of a new old dying star"

Elliptical Galaxies: "elliptical galaxies come in all shapes and sizes"

Venus: "If Venus rises late at night it can be seen early in the morning"

This following one can only be expressed as a Freudian slip, "When the Sun is at its climax directly over the observer". Perish the thought. But if all this seems a trifle obscure to you, there is the pupil who was far sighted enough to observe that it was "possible to see Venus on the far side of the Sun at superior conjunction". However, as we are always racing against time nowadays and there never seems to be enough hours in the day, we have the explanation at last: "This is because the real Sun has spurred ahead and fallen behind". Hmmm.

Goodbye for now.

Sad-al-Sud

SOME SOURCES OF SPECIAL INTEREST TO SPACE EDUCATORS

There are several excellent publications that cover astronomy and space, which are freely available even in the current economic climate. Some of these are listed below, along with the address from which each may be obtained.

In the United Kingdom the Science and Engineering Research Council, which funds much astronomical research, issues SERC BULLETIN three times per annum. This is available from the Council: write to Ms J. Russell at the Science and Engineering Research Council, Polaris House, North Star Avenue, Swindon, Wiltshire, SN2 1ET, to add your name to the mailing list.

The UK is a member nation of the European Space Agency (ESA). The Agency issues two fine journals free of charge. These are ESA BULLETINS and the rather more technical ESA JOURNAL. Write to the Distribution Office, ESA Scientific & Technical Publications Branch, ESTEC, Postbus 299, 2200 AG Noordwijk, The Netherlands, and ask to receive them (they are issued quarterly, and back issues are also available free of charge). ESTEC is the European Space Research and Technology Centre, one of several institutions of the thriving ESA organisation.

Further afield, but of interest to Solar System enthusiasts, is the United States' Lunar and Planetary Institute's LUNAR AND PLANETARY INFORMATION BULLETIN. This lists newly-published papers and books on Solar System topics, of particular relevance to the planetary and lunar programmes. Topical short articles also appear. Write to: Ms Frances B. Waranius, Lunar and Planetary Institute, 3303 NASA Road One, Houston, TX 77058, USA.

The Solar System Exploration Committee of the National Aeronautics and Space Administration's Advisory Council has issued the first part of a two-part report on ideas for future United States investigation of the Solar System. I have several copies of this illustrated, glossy booklet (Planetary Exploration Through Year 2000). If you would like one then please write to me enclosing a stamped addressed envelope at least 27 cm x 21 cm, pre-paid for the GPO rate for letters not over 150g.

Geraint Day, 7 Poulton Street, Swindon, Wiltshire SN2 1BH

to be out of focus. For the asking price, cheap printing is inexcusable.

Another criticism is that there are no place names printed on the Moon - not even one maria. Another legend tells us that foil on the lunar module's legs is to keep it cool, but we are not told how or why, especially as at home foil is usually used in the oven.

There is a superimposed drawing of the sections of the rocket and modules. Unfortunately the various stages are not labelled and therefore no indication of where the lunar module itself fitted into the structure of the payload. Neither did I like the example of using 25 double decker buses on top of each other to indicate the height of the Saturn V rocket. It is conceptually easier for children to compare a well known upright structure such as St. Paul's Cathedral, Nelson's Column or the G.P.O. Tower. These are well known structures even to children in the provinces, whereas double decker buses do not exist in many rural areas (mine is one).

So there are a number of points that the publishers, for all their educational experience, have missed.

Notes:

I found the notes good and comprehensive. They contain labelled diagrams of an astronaut's suit and the lunar module, together with a unique timetable diary of the main parts of a flight, which helps to make the whole product 'come to life'. I liked this and found the notes generally worthwhile.

The price of £3.20 plus VAT of 48p = £3.68. This is rather high for the quality of the printed photographs, but if you require a potted and pictorial history of the Moon flights and are aware of how to augment this with further information, then the address to write to is:

27 Kirchen Road, West Ealing, London W13 0UD.

Peter Richards-Jones

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Astronomy is the cutting edge of science.

Arthur C. Clarke

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