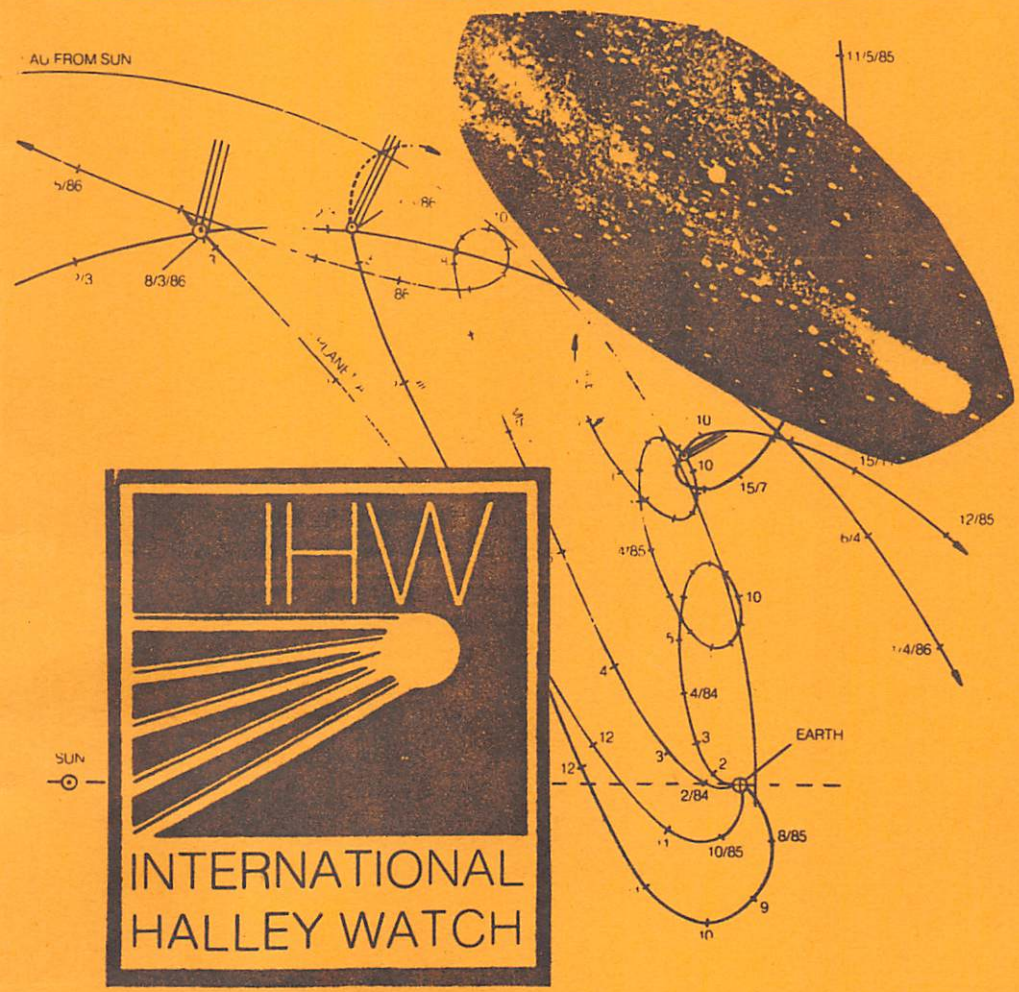
NEWSLETTER

of the

Association for Astronomy Education

Vol. 4, No.1 September, 1984



Spacecharts

A WIDELY ACCLAIMED SERIES OF SPACE WALL CHARTS

"Attractive ... well printed ... very inexpensive ... highly recommended." BAA Journal

These new charts present up-to-date information on astronomy and astronautics in an attractive format. The meticulously researched text is by Robin Kerrod, FRAS, FBIS, author of many books on science for children and the general reader. SPACECHARTS are illustrated by superb artwork and brilliant colour photographs. Measuring some 900 x 600mm - about 3 feet x 2 feet - they are printed on artpaper for the best possible reproduction.

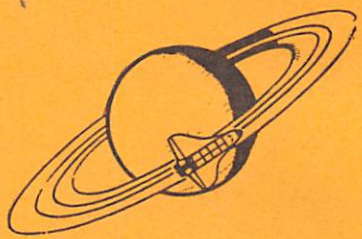
SPACE SHUTTLE features a colour cutaway of orbiter Columbia, together with pictures of its historic maiden flight.

MARS, JUPITER and SATURN include basic astronomical information about the planets and their moons and also the latest data and spectacular photographs returned by the Pioneer, Voyager and Viking probes.

SPACECHARTS are available direct from the publishers and cost only £1.95 each. To ensure that they reach you in perfect condition, they are posted rolled in a strong cardboard tube. Postage and packing costs 60p for 1 chart; 75p for 2-4 charts; and £1.20 for larger orders.

Send your orders, or write for further information to:

SPACECHARTS
Newton Tony
Salisbury
Wilts. SP4 0HF



Contents

Title	Page
Advertising	2
Editorial	4
Association News - from the Secretary	5
Investigation of Halley's Comet	7
Encouraging an Interest in Astronomy	8
Places to Visit: Armagh Planetarium	10
Reading Astronomical Society	12
Advertisement	13
Income and Expenditure Account and Balance Sheet	14
Teachers' Pages: Dialling Simplified for Horizontal and Vertical Sundials	15
Book Reviews	18
Letters to the Editor	23
AAE Council	27
Editor's Address	28

*

* * *

*

EDITORIAL

The September issue of the Newsletter is always the most difficult to compile. Contributors and readers alike are away on holiday in July and August and hardly feel inclined to submit articles or write letters. Delay is inevitable as I have to wait for copy. However, I have managed to include all our regular features except 'Introducing Astronomy to Schools', but perhaps now term has recommenced, some enterprising young teacher will feel the urge to burst into print.

In the interim, may I suggest that one of the best ways of introducing the subject at the moment, is to 'cash in' on the current interest in Halley's comet, (I recently had four questions in one afternoon!), always bearing in mind that it is up to us to reveal the disappointing truth that this is to be the most badly placed apparition of the last 2,000 years, and there is little to be seen from the British Isles. As Captain Peter Richards-Jones points out (page 6), the AAE will be producing an information pack on Halley in the near future, so, by way of an appetiser, I have briefly summarised the main channels of investigation (page 7).

I am now ready to receive all contributions for the January edition. General articles, introductory tracts for schools, reports from Clubs or Societies, equipment reviews and details of places of interest to visit are urgently required. I would also welcome an offer of illustrative material from either art teacher or student. Perhaps someone could put me in touch with a budding cartoonist? I am always delighted to hear from new members.

C. S. Goodman

* * *

The Universe is full of magical things, patiently waiting for our wits to grow sharper.

Eden Philpotts

Nothing puzzles me more than time and space! And yet nothing troubles me less as I never think about them.

Charles Lamb

* * *

ASSOCIATION NEWS - NOTES FROM THE SECRETARY

On the 12th April last at our A.G.M., Percy Seymour - due to an increase of and changes at work - had to hand in his resignation as the Association's Secretary. We will, I am sure, miss him and the unstinting work he has done for the Association. As with most Secretarial jobs, only the surface organisation is ever seen, whereas as some of you will no doubt be aware, a great deal of time is spent in correspondence and at private meetings. We would all, Percy, like to thank you so much for all you have done in the past, including the hefty and thankless task of knocking the constitution into shape.

I am now the third Secretary of the Association since its birth in January 1981. At first glance it may seem that we change Secretaries once a year, but this is not so. What is true is that if you want a job done, ask a busy man. Way back in 1981, four people met together and founded a small group intending to further the cause of astronomy in education - this project took off and mushroomed at a DES meeting. Of those original four founder members, three have now been in the Secretary's chair of the A.A.E. The first, of course, was Julian Ravest, who made an excellent founder secretary and organised our first A.G.M. Ultimately other matters outweighed his association work and he was forced to resign. As we now know, the same was Percy Seymour's fate. I do not know if David Harris, the fourth founder member, will follow me, or even whether that same fate will overtake me as it did my predecessors. What I do know is that we all intended the Association to be self-supporting and self-governing and that we were only to be a sort of initial steering committee until it really stood on its own feet. Here endeth a short history.....

One of the big stumbling blocks which faces Council Members is the high cost of travelling to the meetings; although they are helped with a small percentage of this, it is nowhere near sufficient. We have therefore decided to conduct most of the business by correspondence and telephone, thus allowing smaller council meetings to be convened for the purposes of minuting and recording such businesses. In this way no burden is unfairly placed on our council members living as far afield as Scotland, for instance.

This, incidentally, leads me to the realisation that we are two council members short, due to the resignation of Iris Allison in Plymouth and Andrew Lintern-Ball in Leicester, last month. We all thank them for their support over the last three years and are very sorry to see them go. May I remind you that to be a council member all you need to do is to have a proposer and seconder, and, of course, be a paid up member! (If we have more than two nominees, then a ballot will be made).

Due to a re-shuffle at the A.G.M., we have two new council members elected from the floor and I would like to officially welcome Ken Creamer of London, and Geoff Endacott of Wiltshire, and hope that both these teachers will help to cement the association even closer together. Don't forget that the Association is 'of teachers and for teachers'. We must not forget to welcome Undine Concannon and Dr. Eric Zucker, both of whom joined the council after the last appeal of Percy in Vol.3 No.2. Whilst on the subject, may I remind those of you who attended the A.G.M., of the gentleman who expressed the view that the Council was just a little light of Primary School representatives. May I suggest that this is an excellent time to make up that deficiency. We will welcome volunteers gladly.

Council is thinking up a sort of Halley's Comet information sheet. We are not too sure of the content and/or format. Have you any ideas yourselves? What sort on information would you like included? Please write to me at once if you have any ideas.

Now, don't forget our 'get away' weekend at Alston Hall on the 23rd-25th November (Preston, Lancs. - only £35.00).

Those of you in the London area, will be aware that the London Schools' Planetarium ran an eight-day Summer School for I.L.E.A. sixth-formers which not only stimulated present interest in astronomy, but hopefully paved the way for possible future teachers who might underline the importance of astronomy not only in education generally, but in the school curriculum.

Incidentally, for those of you interested in the "O" level examination, let's keep our ears open for any whisper of changes toward the combined CSE, GCD, 16+ examination. Please write to me if you have any ideas.

 Peter Richards-Jones

INVESTIGATION OF HALLEY'S COMET

a - From Space

A fleet of six spacecraft from four space agencies is being prepared to encounter the comet. All four have agreed to co-operate and have formed the "Inter Agency Consultancy Group" (IAGC).

The Intercosmos of the USSR Academy of Science will launch Vegas I and II in December 1984. This Soviet Mission is a combined Venus swingby - Halley flyby mission using two modified Venera spacecraft. The first spacecraft will encounter Halley on March 8th 1986; the second will flyby one week later.

The Institute of Space and Aeronautical Science (ISAS) of Japan also plans to send two spacecraft, Planet A to be launched from the Kagoshima Space Centre in August 1985 with a Halley encounter on March 8th, and, as a precursor MS-T5 to be launched in December this year. Unlike most planetary probes, Planet A will be boosted directly into intercept orbit instead of first going into a parking orbit round the Earth.

The European Space Agency's Giotto probe (named after the Florentine painter who observed the comet during its 1301 return) is a fast flyby mission near the comet's post-perihelion crossing of the ecliptic plane around March 13th, 1985 (Perihelion date is February 9th). On this date Halley will be 0.98 AU from the Sun and 1.0 AU from the Earth. Giotto is targetted to come within 500km of the nucleus, passing it at about 68km per second. At encounter the spacecraft provides for an operational 'data take' period of about four hours. The mission will probably end here as it is likely that the cometary dust particles will destroy the spacecraft. For this reason data is to be transmitted 'in situ' instead of being recorded on tape for later playback.

NASA has already launched its ICE spacecraft towards comet Giacobini-Zinner, and thereafter to Halley.

These investigations have three main scientific goals:

1 - To determine the nature and quantity of the materials that make up the nucleus;

2 - To determine the dust content of the comet and

the distribution of particle sizes;

3 - To study processes occurring in the coma and the interaction of the coma with the solar wind.

b - From the Ground

D.C. Jewitt and G.E. Davidson, using the 5.1 Palomor telescope and a CCD electronic camera recovered the comet on 16th October, 1982 when its magnitude was 24.2.

The first preparations, however, had been made two years earlier with the formation of the International Halley Watch (IHW), whose main function is to stimulate, co-ordinate and record all ground-based observations of Halley's comet throughout the apparition. Other tasks include i) Ensuring that observing techniques and instrumentation are standardised; ii) providing information to the public and media, and iii) providing liaison with facilities outside the IHW organisation, e.g. space missions and experiments.

The most important elements in the IHW are the Professional Observers and the Discipline Specialist Teams. Experts have been selected for seven DS teams in each of seven areas of astronomical technology whose job it is to assemble nets of observers willing to observe the comet. In addition, however, there is an Amateur Observation net formed with the purpose of encouraging amateur participation in the project. Overall co-ordination for the amateur net will take place from the Pasadena Lead Centre, California, U.S.A.

* * *

ENCOURAGING AN INTEREST IN ASTRONOMY

Recently I have been trying to encourage an interest in astronomy, firstly amongst the laymen and secondly amongst those already involved in astronomy.

To this end, regarding the laymen, I simply set about writing short articles on astronomy for a local newspaper and, more recently, for other publications. I found this created some interest, but noted that the interest increased when the readers became actively involved. This involvement could be achieved, for example, through them actually observing previously described celestial objects,

through simple quizzes, or by inviting the general public to view photographic exhibitions at local libraries or in their own homes. These are obviously simple, but nonetheless effective, ideas.

In trying to increase the interest of those already involved in astronomy, I very recently introduced an Award, called the British Astronomical Association Comet Section Keedy Award. The idea, specifically, was to give a small financial prize annually to a member of the Comet Section of the British Astronomical Association who makes an outstanding visual discovery of a comet, or who contributes exceptionally to the observational work of that Section. The first recipient, only a few weeks ago, was Mr. George Alcock, five times discoverer of new comets, for his discovery last year of Comet IRAS-Araki-Alcock. While experienced veterans like Mr. Alcock will always be hard to beat, determined careful newcomers could well look on this as a challenge. I hope this idea will encourage others.

What perhaps is more important is that other benefactors may introduce their own Awards in other fields of astronomy. Remember, it is not always the fancy, newfangled idea that is successful. Sometimes the more traditional, possibly seemingly ordinary, idea gets a chance to encourage an interest in astronomy.

David R. Keedy

* * *

When a man sits with a pretty girl for an hour, it seems like a minute. But let him sit on a hot stove for a minute - and it's longer than any hour. That's relativity.

Albert Einstein

The most beautiful experience we can have is the mysterious. It is the fundamental emotion that stands at the cradle of true art and true science.

Albert Einstein

* * *

PLACES TO VISIT . . . . .

THE PLANETARIUM

ARMAGH, NORTHERN IRELAND

Ireland has always played an important role in the history of astronomy, indeed at one time Ireland had the largest telescope in the world. Armagh has figured prominently in that history and so it is no surprise to find today that Armagh has the most advanced Planetarium in the British Isles.

Built in 1968 with Patrick Moore as Director, the Planetarium quickly established itself as a tourist attraction with a unique entertainment value.

Dr. Thomas Rackham became the next Director and soon reorganised the structure of the shows to include an educational content. This trend towards education has continued and expanded under the present Director, Terence P. Murtagh, and has placed Armagh firmly in the forefront of educational planetaria worldwide.

Currently the Planetarium has two modes of operation: namely school term opening and holiday opening. When schools are in session the Planetarium only opens to the public on Saturdays, leaving week days available for school parties, who are allowed free admission subject to booking acceptance. During holiday periods the public are catered for with daily Star Shows and some evening shows. It is also possible for groups or clubs to have a show in the evening, again subject to booking acceptance.

The total number of stars projected by our star projector is over five thousand, but only half of these are visible in our 'artificial sky' at the moment. Nevertheless two and a half thousand stars in our artificial sky compares very favourably with the real sky, where you need almost perfect weather and lighting conditions to see more stars. Needless to say, such perfect 'seeing' conditions rarely occur and one of the most frequent comments we receive is that our Planetarium sky is too good!

Apart from this realistic sky which we produce, other special effects can be used. A panorama system can make

you think you are standing safely here on Earth, hovering precariously a few tens of kilometres above our Sun, or even stranded on an alien planet while that planet's sun expands to first roast and then engulf us.

The grid framework that we use to measure the star positions can also be projected onto our artificial sky. Furthermore, we can observe how the sky will appear and move from anywhere on the surface of our Earth and at any given time past, present or far into the future.

One very important facility extended both to schools and groups is the availability of special lectures designed to suit the particular requirements of that group. Examples of these lectures are "Telescope Mounts" for an 'A' level project; "Navigational Astronomy" for the Polytechnic's School of Maritime Studies, and "Basic Astronomy" for the Scouts Merit Badge. The main requirement for such a lecture is that sufficient time is given for data to be prepared, and four or five weeks notice would not be considered excessive.

Apart from the Star Theatre, the Planetarium also has a large exhibition area, the Hall of Astronomy. Named in honour of the late Dr. Eric Lindsay it contains various displays and exhibits. The average lifetime of an exhibition is approximately two years, and the current display is concerned with the formation, evolution and present form of our Solar System.

Small groups (up to forty) can be given a guided tour of the Hall of Astronomy by the lecturers, who have extensive knowledge not only of astronomy, but also of subjects even slightly related, from mathematics and physics to ornithology. Larger groups can be given worksheets and are encouraged to circulate freely among the exhibits and discover the answers for themselves. Again the lecturers are available to answer questions and expand on certain topics.

As the day of the static exhibit is long dead, extensive use is made of video displays and interactive exhibits. There are also microprocessors programmed with educational software to encourage the visitor to explore things for himself.

The Planetarium's sixteen inch reflecting telescope

proves to be a huge attraction, and during the daytime visitors can get a look at the Sun and the features thereon. Needless to say this is accomplished with specialised equipment and experienced supervision, as to look directly at the Sun through a telescope or binoculars will blind one irreparably.

During the winter months nights are arranged for the public to come and view the night sky through the telescope. It is also possible, given adequate notification, for cameras to be attached to the telescope and photographs taken. Naturally telescope nights are totally dependent on weather conditions.

It is possible for a school visit to take only slightly over an hour, but to make full use of all facilities offered by the Planetarium a two hour visit is an absolute minimum.

Our last facility, but by no means the least, is our shop, which has the largest selection of astronomical goods available in Ireland, if not the British Isles. Advice can be given on the suitability of books etc. and in the unlikely event of a book not being in stock, this can be ordered.

You can always be assured of a warm welcome and a willingness to help. We hope this article will encourage some new faces at the Planetarium.

* * *

READING ASTRONOMICAL SOCIETY

Programme 1984/1985

MONTHLY SKY OUTLOOK by JAN FIOLKA

Oct 20th Planetary Observations by Peter Hunt

Nov 17th The Moon: How - When - Where? by Geoff Amery (Moon Rock Samples kindly loaned by SERC)

Dec 15th Members' Slides of Astronomical Instruments, Etc.

Jan 19th Exploding Galaxies by Guest Speaker: Miss Heather Couper (Council Member BAA).

Feb 16th Amateur Solar Astronomy by Guest Speaker: Mr. Ken Medway (Former Director Solar Section BAA).

Mar 16th Members' Meteorology Slides; co-ordinator Miss Jane Corey (Founder Member).

Apr 20th Presentations by the younger Members.

May 18th Sir William Herschel by Guest Speaker: Cmdr. Tony Farning (Herschel Astronomical Society).

Jun 15th ANNUAL GENERAL MEETING

Astronomy and Space Film

* * *

ASSOCIATION FOR ASTRONOMY EDUCATION

INCOME and EXPENDITURE ACCOUNT for the YEAR ENDING 30th APRIL, 1984

Income		Expenditure	
Annual General Meeting: Registration etc., Fees, Polytechnic of North London	204.50	Annual General Meeting, Polytechnic of North London	241.00
Subscriptions and Affiliation Fees	700.00	AAE News, Vol.3, Nos. 1 and 2	289.04
Advertising Revenue	48.00	AAE News, Vol.3, No.3 (Estimate)	140.00
Donations	6.00	Stationery, Printing and Photocopying	233.05
	958.50	Postages	60.21
Excess of Expenditure over Income	56.17	Councillor's Travelling Allowances	33.93
		Alston Hall Course	15.00
		Bank Charges	2.44
	£ 1014.67		£ 1014.67

BALANCE SHEET as at 30th APRIL, 1984

Balance as at 1st May, 1983	618.49	ASSETS	
		Cash at Bank	778.28
Excess of Expenditure over Income	(56.17)	LIABILITIES	
		Advance Subscriptions	75.00
		AAE News, Vol.3, No.3 accrued	140.00
		Sundry Accruals	0.96
	£ 562.32		£ 562.32

(Signed) R.V.J. BUTT, B.Sc., M.Sc., F.R.A.S., Hon. Treasurer and R. C. JACOB, F.A.A.I., Hon. Auditor

8th June, 1984

NOTES: (1) The vastly increased cost of AAE News is due to it being produced commercially now. It nevertheless is much larger than were Vols. 1 and 2

(2) The stationery, printing and photocopying includes purchase of a block of the AAE Logo, Membership Cards and Brochure. Recurrent costs will therefore be smaller.

(3) The cost of the AGM (in 1983) includes £40 paid in the year 1982/83. Receipts did not cover expenses because of the number of Guest Speakers who had to be accommodated and entertained.

DIALLING SIMPLIFIED FOR HORIZONTAL AND VERTICAL SUNDIALS

The making of a sundial is an instructive project for a school's astronomy programme, but in many textbooks the method described for the construction of the shadow angles by geometry is a little complicated and not easy to visualise.

An alternative method is to use the relation between the shadow angle γ, the Hour Angle (HA) of the sun and ϕ the latitude of the user given by $\tan \gamma = \tan HA . \sin \phi$, and calculate the shadow angles with a calculator with trig. functions. The derivation of this formula and its explanation is usually avoided as it involves a knowledge of advanced spherical trigonometry.

This note shows how the relation for a horizontal dial and also for a vertical South facing dial can be established by means of a simple piece of "O" level geometry, using an imaginary circular disc. (Fig.II, page 17).

In Fig.I (page 16) the style of the horizontal sundial passes through the disc at its centre C, and at right angles to the plane of the disc. The disc is shown almost end on appearing as an eccentric ellipse, to help you visualise the model.

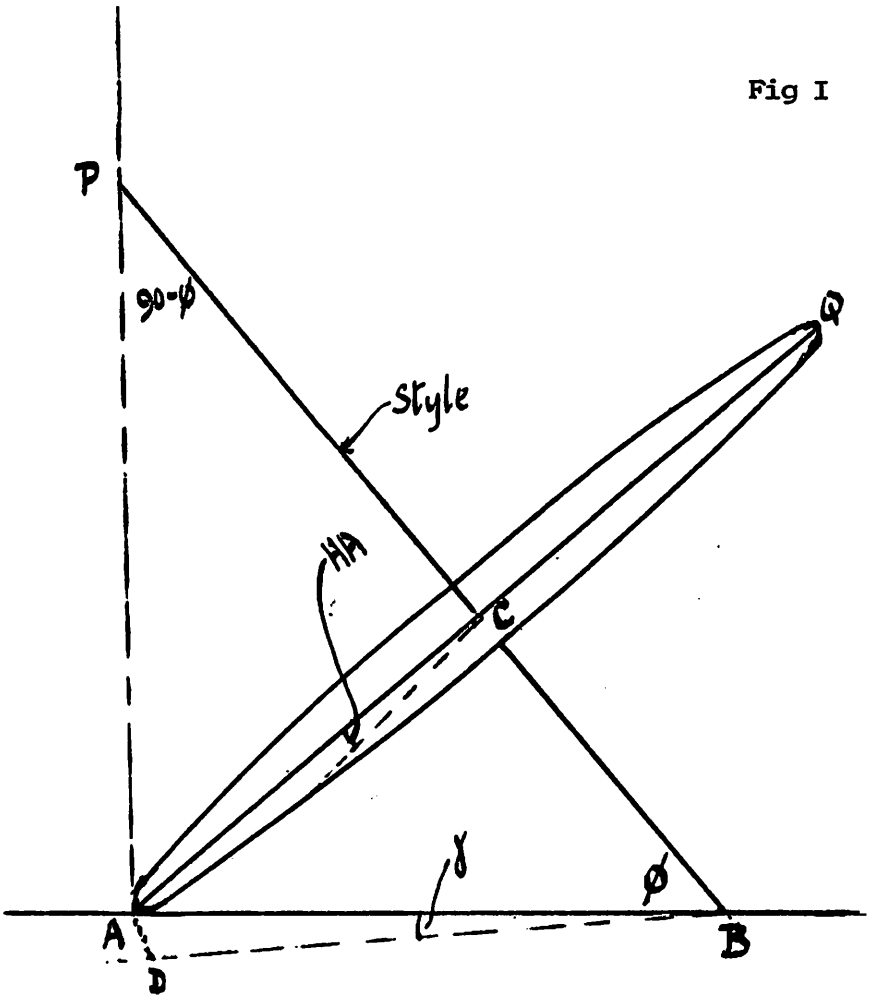
In Fig.II the disc is shown as it appears when viewed looking along the style in the direction CB.

The sun appears to move round the style, which is parallel to the earth's axis. Suppose the sun to make an angle HA with the meridian, as shown in Fig.II. The shadow of the style cast on the disc will lie along CD where D is a point on the horizontal line through A. The angle has to be projected on to the horizontal surface containing AB (Fig.I).

The point D in Fig.II is at a distance of AD from A but in Fig.I it is at a distance of AD on a line which is perpendicular to the plane of the paper. The hour angles radiate from the point C but the shadow angles γ radiate from B the base of the style.

(continued on page 18)

Fig I

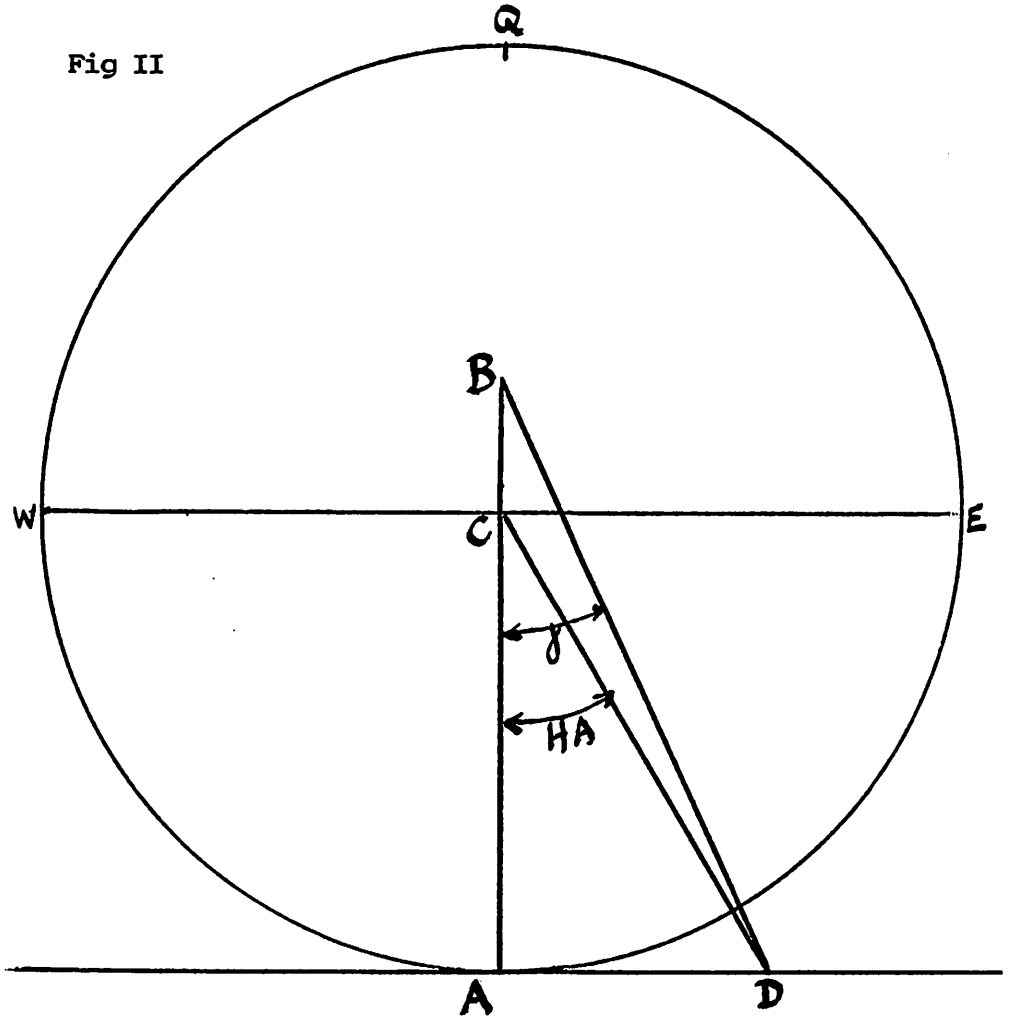


BCP is the style pointing to the celestial pole P. ϕ is the latitude.

The style passes through the centre of the disc shown in Fig.II. Here in Fig.I it is shown almost end on. The point D of Fig.II is at a distance AD on a line perpendicular to the plance CAB so that $\tan \gamma$ = AD/AB.

* * * *

Fig II



In this Fig.II the HA of the sun is ACD, tan ACD = tan HA = AD/AC . . . . . (1)

The corresponding shadow angle γ from Fig.I is tan γ = AD/AB . . . . . (2)

By dividing (2) by (1) we have $\underline{\tan \gamma = \tan HA \sin \phi.}$

For a <u>vertical</u> S.facing dial $\underline{\tan \gamma = \tan HA \cos \phi}$

* * * *

(continued from page 15)

We can now write down simple and obvious expressions for the HA and γ tan HA = AD/CA .. (1) and tan γ = AD/AB .. (2) by dividing (2) by (1) we have $\frac{\tan \gamma}{\tan HA} = \frac{CA}{AB}$ but $\frac{CA}{AB} = \sin \phi$. So tan γ = tan HA. sin ϕ .. (3) which enables all necessary shadow angles to be calculated and drawn for the latitude ϕ.

The corresponding relation for a vertical S.facing dial can also be deduced from the same two figures I and II, by projecting the hour angle HA on to the vertical plane of the South facing wall, so that the shadow angles of the deal radiate from the point P which is vertically above A. Then tan HA = AD/AC but tan γ = AD/PA .. (2); dividing (2) by (1) we have tan γ = tan HA. AC/PA = tan HA. cos ϕ which is the same as for the horizontal dial (3) but cos ϕ replaces sin ϕ .

* * * *

BOOK REVIEWS

POWERS OF TEN - Philip & Phylis Morrison and the Office of Charles & Ray Eames. Scientific American Library. 1984. £11.95 ISBN 0-7167-1409-4. 164 pages. 312 illustrations.

THE SOLAR SYSTEM - Roman Smoluchowski. Scientific American Library. 1984. £10.95; hardback ISBN 0-7167-1492-2. Paperback ISBN 0-7167-1493-0.

THE DISCOVERY OF SUBATOMIC PARTICLES - Steven Weinberg. Scientific American Library. 1984. £10.95; hardback ISBN 0-7167-1488-4. Paperback ISBN 0-7167-1489-2. 206 pages. 47 illustrations (monochrome).

Scientific American Library is a new series of science books for the general reader. The volumes are not collections of articles from "Scientific American" but works which stand alone, written by expert scientists.

POWERS OF TEN, the first in the series, is a wonderful

book. It is based on the short film "Powers of Ten: a film dealing with the Relative Size of Things in the Universe and the Effect of Adding Another Zero". In the film, we are taken from the depths of space between clusters of galaxies, all the way to Earth, into the nucleus of a carbon atom in a human hand; and on the reverse journey. The book of the film takes 41 steps in this trip through the Universe from the enormous to the minute, from a size 10^{25} metres to 10^{-16} metre; each jump represents a tenfold change in scale.

The 42 individual frames from the 9½ minute film are accompanied at each order of magnitude by text, diagrams and photographs which elaborate on the scene, whether it be a star field or the white blood-cell within which journey's end lies.

An introductory essay sets the scientific context of the voyage. Following the set of frames there are useful sections, giving the rationale for this journey made in steps of powers of ten, and on scientific notation, units of length, the electromagnetic spectrum, and the instruments used to study the world at different scales. There is also a chronology of important scientific discoveries relevant to different scales. Further notes follow, on the journey frames. A section "Resources for the Reader" gives a useful reading list and references to the original film. The index is comprehensive.

The book is a splendid production itself. I would only quibble with the use of the word "meteors" occasionally, to mean "meteoroids" (in the text of the 10^{12} m picture), and state that figure 2 accompanying the 10^{2}m view is not of a Saturn V Moon Rocket.

The book is certainly a must for libraries. It will surely add to one's understanding of any science.

*

The sixth book in the series is THE SOLAR SYSTEM. This is suitable for the "A" level science student seeking an introduction to the subject. The approach is non-mathematical but nevertheless scientific, as one would expect from a professor of astronomy and physics (at the University of Texas at Austin). The many photographs and diagrams are excellent.

The book contains five chapters which together cover the Sun, planets, satellites and small bodies in the Solar System. Three sections called essays deal with the Sun's formation, that of the planets, and the fate of the System. An Afterword discusses life in the Solar System. The text is up to date (to mid-1983).

A disappointment lies with several minor mistakes:- page 1 - the Andromeda Galaxy's structure is not readily seen in a small telescope; page 2 - that Galaxy is not the nearest to our own; page 15 - the description, of sunspot magnetic polarity in each solar hemisphere, is confused; page 30 - density units are missing from the graph; pages 42 and 43 - Venus' day length is wrongly given (although it is correct in the book's appendices); page 54 - the inclination of Earth's axis to its orbital plane is not $23^{\circ}27'$; pages 73 and 74 - different dimensions are given for the base of Olympus Mons on Mars; page 78 - "Asoph Hall" (Asaph); page 86 - different sizes are given for Jupiter's Great Red Spot; page 136 - "Ernst Chaldni" (Chladni); page 139 - it is not accurate to refer to the weight of a meteoroid entering Earth's atmosphere, when mass is meant; page 144 - "BERTRAND RUSSEL" (RUSSELL). Also, "K" and "$^{\circ}$K" are both used throughout. It would have been better to stick to the former.

Hopefully, these errors will be edited out for any second edition for the Library.

*

Knowledge of the electron, proton and neutron is essential in any study of astrophysics. Steven Weinberg's book THE DISCOVERY OF SUBATOMIC PARTICLES (number three in the Library) takes a look (mainly) at these three particles. The text is often more demanding than the two reviewed above, and would be suitable for "A" level physics supplementary reading. An historical approach is employed to build up a modern picture of our knowledge. Many formulae are derived in an appendix, and are referred to in the main text, thus the book is fairly semi-quantative in its treatment of physics.

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

* * * *

ORBITS FOR AMATEURS WITH A MICROCOMPUTER
by D. Tattersfield. Publisher: Stanley Thornes (Publishers) Ltd.

With the general availability of microcomputers for the home user, it seems reasonable to suppose that some amateur astronomers would want to use them in pursuing their hobby. One obvious application is the computation of orbits for astronomical objects in the Solar System, a task which is also suitable for a sixth form project.

For the serious amateur, observation of new comets is one contribution he can make to the field of astronomy. Nevertheless, once the object has been discovered, how may its future positions be predicted, i.e. its orbit determined? In this book the author provides methods whereby the reader can, with a microcomputer, tackle the four main problems of orbital computation, viz. the construction of an ephemeris, the determination of orbital elements, perturbation of an orbit by the planets and the differential correction of an orbit.

The book is primarily concerned with the methods of such computations, i.e. enabling the reader, who may have very little formal mathematical training, to execute the required calculation without necessarily completely understanding the theory behind such calculations. Each of the four sections gives step by step details of the required procedures. The book does not go into the theory behind either the numerical methods (e.g. the numerical integration used to calculate the perturbation of the cometary orbit by Jupiter and Saturn) or the dynamics of the orbits. However, there are many books available on dynamical astronomy for any reader wishing to investigate the background theory in more detail. Indeed, a short list of such books is provided.

It is felt that the readership for the book among amateur astronomers at large will be limited. However, the scope of the methods could be widened to cover not only comets but also the planets and asteroids of the Solar System. Of course the positions of these bodies are well known (and are tabulated in almanacs) but the methods of the book do apply equally well in these cases and could provide a basis from which one could understand the

calculation of ephermerides. While this in itself might form an interesting exercise for the amateur astronomer, it perhaps would have more relevance to the student of astronomy (either in school or university).

The book offers the basis of a number of exercises which would both teach basic astronomy and also the use of microcomputers.

Dr. I. Walker, Glasgow University

* * * *

'IN SPACE' (set of 6 booklets). J. Edelman. Ginn and Company Ltd. £4.70 softback. SBN 602-22168-4. 16 pages each. Workbook 57p. SBN 602-21841-1.

This series is intended for use by children with a reading age of 8½ to 9 years.

The books, entitled: 'Rockets and Satellites', 'Men in Space', 'A Trip to the Moon', 'Sun and Moon', 'The Planets' and 'The Stars', are meant to provide a starting point for project work in Astronomy.

The books are attractively and colourfully illustrated with a picture on each page, together with a very simple legend to each, with bold print and short sentences.

The level of information is low, and they would be particularly useful for children with learning difficulties. Generally one would expect them to be used by infant departments - an average 9 year old would find them too simple and lacking in factual information.

As the series was published in 1970 it is in need of revision and updating, in particular the booklet 'The Planets'.

Accompanying this series there is a 16 page workbook which reinforces the information given in the booklets, as well as encouraging further work on the topic.

Judith Turpin

* * * *

LETTERS TO THE EDITOR

Dear Sir,

Although microcomputers and minicomputers suitable for home or school use, are now numerous (see article by Dr. Paul Marchant in AAE Newsletter Vol.3, No.3), there is very little software available programmed for astronomical calculations and displays. Generally such programs are for specific instruments and if you do not have that one you may have difficulty adapting the programs for yours - even if the authors have claimed that conversion is easy. The instruction book for the other computer will not be available to you and the "rules" it uses may puzzle you (even if they are in a form of BASIC).

My experience with a few computers (ZX 81, Spectrum, Jupiter Ace and pocket computers CASIO FX 702P and fx 180p) has convinced me that there are far too many errors in programs, both in books and on cassettes. So I hope the comments which follow will be useful to other users of software.

My first piece of advice is: Never assume that the program is accurately written - no matter how vehemently the author has stated that it has been checked. Always make your own checks, with as many varied examples as possible. The B.A.A. Handbook and Whitaker's Almanack will give you a lot of data and results which can be relied on.

Let me give some examples of "snags" I have come across.

The Ephemeris tape supplied by Bridge Software, 36 Fernwood, Marple Bridge, Stockport, Cheshire, SK6 5BE, for Spectrum, does normally give good results for the positions etc. of planets (based on the methods in Duffett-Smith's Practical Astronomy with your Calculator, the uncorrected 1st edition). But I found it sometimes gave entirely wrong results for phases of the inner planets. The celestial longitudes of inner and outer planets make use of different formulae, and although the correct formula is used first for Mercury and Venus, the program then returns to a point where false longitudes, and consequently phases, are recalculated on the outer planet formula!

Two books are published by Sybex Inc., 2344 Sixth Street, Berkeley, California:

"Celestial Basic Astronomy On Your Computer" by Eric Burgess, 1982, has programs in the BASIC of Apple II. There are many errors in this book; one's confidence is shaken by finding several constants wrongly printed (e.g. 57.29878 for 57.29578, 1. 30 of EPOCH program and 57.299578 in 1. 80 of RISES program).

"More Uses for your Timex/Sinclair 1000: Astronomy on your Computer" by Eric Burgess and Howard J. Burgess, 1983, is adapted from the former book for the American version of ZX 81, and is appropriate also for the Spectrum. Unfortunately all the errors in constants are repeated and there are further serious mistakes. For example the TIMES program has a + printed for a * in line 3550. Consequently all uses of this program give false results - including the example in Fig.2.1 on page 7 where the LST for 23 hrs LMT on 1983 Oct 1 is recorded as 7.8294 hrs when it should be 23.5343 hrs!

Both books state "All programs have been carefully edited, run, and checked against actual astronomical observations over many years."

Some books are much better:

ZX Spectrum Astronomy by Maurice Gavin, 1984, Sunshine books, 12-13 Little Newport Street, London, WC2R 3LD, gives very good results - including some fine graphical displays - intended for ordinary Spectrum users, not necessarily astronomers. But, alas, Mr. Gavin has used the D.MMSS for D°MM'SS" angle system (often found in Reverse Polish calculators, e.g. Hewlett Packard ones). I detest this method because the first expression can easily be misread as decimal degrees. Unfortunately, in converting D.MM to decimal degrees, Mr. Gavin divides the fractional part by 100/60 instead of multiplying by it, 1.300 of the AltAz Star Point program.

The FORTH language, used in the Jupiter Ace (now discontinued) and on cassettes for BASIC-designed computers, is hardly suitable for astronomical calculations because the word dictionary rarely contains trigonometrical functions.

As you cannot depend on published programs, the best policy is to write your own. This can be a very useful exercise for people who have progressed beyond the "game playing" stage. You can even achieve great satisfaction by putting astronomical calculations on the cheaper programmable pocket calculators with limited capacity. Some examples will perhaps not be out of place here.

I always have a CASIO FX 702P in my pocket. This computer (now superseded by later very similar models) uses a BASIC dialect with 1680 steps (26 memories). Many astronomical forulae can be put in the 10 programs, P$\emptyset$ to P9, of this excellent instrument.

We should not despise the smaller calculators. The Casio fx 180P and previous fx 3600P have only 38 steps, 6 constant memories, K1 to K6 and one independent memory M. Surprisingly we can put some spherical astronomy on it, but optimum use of the memories is essential. Finding the altitude (a) and azimuth (A) of a body from its hour angle (h=LST-α) and declination (δ) at latitude ($\emptyset$) using the formulae in BAA Handbook, we need to put trigonometrical functions, not angles, in the memories. Before starting the program put K1 = sin$\emptyset$, K2 = cos$\emptyset$, K3 = sinδ, K4 = cosδ K5 = h, K6 = $\emptyset$, M = 360. Program:-

Step	Entry	Value	Step	Entry	Value	Step	Entry	Value
1	Kout6	$\emptyset$, A	14	Kin6	sin a	27	+	
2	HLT		15	$\sin^{-1}$	a	28	Kout2	cos $\emptyset$
3	Kout1	sin $\emptyset$	16	HLT		29	=	
4	x		17	Kout3	sin δ	30	$\cos^{-1}$	"A"
5	Kout3	sin δ	18	-		31	Kin6	"A"
6	+		19	Kout6	sin a	32	Kout5	h
7	Kout2	cos $\emptyset$	20	x		33	+/-	-h
8	x		21	Kout1	sin $\emptyset$	34	x 0	
9	Kout4	cos δ	22	=		35	MR	360
10	x		23	+		36	-	
11	Kout5	h	24	Kout6	sin a	37	Kout6	A
12	cos	cos h	25	$\sin^{-1}$	a	38	=	A
13	=		26	cos	cos a			

Lines 32 & 33: program goes back to beginning if h is -ve and prints A. Lines 34 to 38 print A when h is +ve. On running we get the altitude at line 16 and next the azimuth at line 2 or 38.

Ted Woods

KEY DATA ON MISSIONS TO HALLEY'S COMET

Agency	Project	Launch	Flyby date	Flyby distance
ESA	Giotto	July 1985	13 March 1986	500 km
Intercosmos	Vega-1	December 1984	6 March 1986	10000 km
	Vega-2	December 1984	9 March 1986	3000-10000 km
ISAS	MS-T5	January 1985	March 1986	0.1 AU
	Planet-A	August 1985	8 March 1986	100,000 km
NASA	ICE	22 December 1983*	28 March 1986	0.21 AU

* Lunar swingby manoeuvre to inject ICE (formerly ISEE-3) into a heliocentric trajectory to comet Giacobini-Zinner (flyby on 11 September 1985, 15,000 km on the anti-sunward side).

AAE COUNCIL

Patron . . . . . F. GRAHAM SMITH, MA, PhD, FRS.
Astronomer Royal and Professor of Radio Astronomy, Director of NRAL, Jodrell Bank

President . . . . . Mr. D. J. GOLD
(Retired HMI)

Vice-President . . . . . Professor A. E. ROY
(Glasgow University)

Secretary . . . . . Capt. P. RICHARDS-JONES
(ILEA Schools Planetarium)

Treasurer . . . . . Mr. R. BUTT
(Teacher, Kent)

Newsletter Editor . . . . . Mr. C. GOODMAN
(Teacher, Hinckley)

Assistant Secretary . . . . . Dr. E. ZUCKER
(North London Polytechnic)

Publicity Officer . . . . . Mr. G. J. DAY

Courses Organiser . . . . . Mr. D. HARRIS
(Wolverhampton FE)

* * *

Mr. D. Ashton . . . . . (Teacher, Sheffield)

Dr. D. Clarke . . . . . (Glasgow University)

Ms. U. Concannon . . . . . (London Planetarium)

Mr. T. K. Creamer . . . . (London Polytechnic)

Mr. G. Endacott . . . . . (Teacher, Chippenham)

Dr. D. McNally . . . . . (London University)

Mr. T. Murtagh . . . . . (Armagh Planetarium)

Mr. I. Nicholson . . . . . (Hatfield Polytechnic)

Mr. J. Ravest . . . . . (Liverpool Planetarium)

Dr. E. I. Robson . . . . . (Preston Polytechnic)

Dr. P. A. H. Seymour . . . (Plymouth Polytechnic)

Articles, ideas, views and letters to the Editor for publication, should be sent to the Editor:-

Mr. C. S. GOODMAN
Hastings High School
St. Catherine's Close
Burbage
HINCKLEY
Leics. LE10 2QE

*
* * *
*

NEXT ISSUE - JANUARY, 1985

*
* * *
*

PUBLISHED BY THE ASSOCIATION FOR ASTRONOMY EDUCATION

*
* * *
*

+ + + + + + + + + + + + + + + +
+ Duplicated by +
+ ELITE COMMERCIAL SERVICES +
+ Burbage - Leics +
+ Tel Hinckley (0455) 39474 +
+ + + + + + + + + + + + + + + +