GNOMON

Newsletter of the Association for Astronomy Education

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

EDITORIAL COMMENT

There has been a delay in including "The Universe in the Classroom" (newsletter of the Astronomical Society of the Pacific) with recent GNOMONS. This means that the two newsletters have been slightly out of step with each other. It is hoped to have the matter clarified in the near future.

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The recent furore concerning Signs of the Zodiac has affected astrologers in a predictable way. For years they have accepted that there are 12 zodiacal constellations - now a group of astronomers has come forward with the claim that the number should be 13, not 12, due to the variations in the Earth's axial inclination. The "extra" constellation is Ophiuchus. In fact, according to a not-so-old text-book of astronomy, the number should be 14! The fourteenth constellation is Cetus.

Whatever the number should be, it must be remembered that the ancient, mythological names we still use have no purpose other than dividing the sky into roughly equally spaced star patterns. What would the astrologers say if we identified the zodiacal patterns by giving their coordinates (e.g. RA and declination) rather than using names?

AAE ANNUAL GENERAL MEETING, 17 JUNE 1995

This year we have been invited to University College London for the AGM and then to the London Planetarium to see the new Digistar projector which is now being installed. This is our special day and all members are extremely welcome. The Business Meeting will take place from 10.30 to 12.15 at UCL. You are reminded that this is your opportunity to vote on key issues, and to take part in the nominations and elections for Council.

After lunch at UCL there will be two presentations, one by Prof John Tennyson on the impact of Comet Shoemaker-Levy 9 with Jupiter, and the other by Bob Kibble on sundials. Then the whole meeting will transfer up the road (walking distance) to the London Planetarium to view the new star show. We envisage finishing around 5pm although there may be an opportunity for those who are interested to stay on for a while. Non-members are also welcome for the afternoon events.

Please use the reply slip enclosed with this issue to inform us of your intention to be there. We need to know numbers in advance so that we can book sufficient lunch and the correct number of Planetarium seats.

AGENDA

1 Minutes of the last Annual Business Meeting (14 May 1994)
2 Reports from the officers of Council
3 Fulfilling our Aims - our future direction
4 Election of Council for 1995/6
5 Any other business

Nominations for posts on Council:

All officer posts are elected annually at the AGM. Some officers may wish to stand again for another year, some may wish to stand down. Here is your chance to become involved in AAE issues - new faces are always welcome at Council. The posts are:

Officers:

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

Members:

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

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

MEMBERSHIP of the AAE costs £7.50 a year for individual members, £15 for corporate membership and £5 for retired persons. For more information, contact Nik Steggall (address letters to: AAE, Royal Astronomical Society, Burlington House, Piccadilly, London W1V 0NL). Members receive 4 issues of GNOMON a year.

GNOMON - definition from the **Concise Oxford Dictionary:**
Pillar, rod, pin or plate of sundial, showing time by its shadow on marked surface; column, etc. used in observing sun's meridian altitude

Subscription Rates:

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

Corporate Members will receive three copies of *Gnomon*.

Extra Copies:

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

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

There will generally be a 10% discount to AAE members on all publications and advertising rates.

Practising teachers may claim their subscriptions as an allowance against income tax, thereby effectively reducing their contributions.

All communications (except those to the Editor) should be addressed to:

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

Editor: Eric Zucker, 35 Gundreda Road, Lewes, East Sussex BN7 1PT - for all enquiries concerning the Newsletter. (Tel 01273 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.

Publication Dates:

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

EU/ESO WORKSHOP ON THE TEACHING OF ASTRONOMY IN EUROPE'S SECONDARY SCHOOLS

1. INTRODUCTION

Astronomy is the oldest science. For thousands of years, it has had a great influence on human perception of ourselves and our surroundings. Recently, astronomy and astrophysics have come to play a central role in the natural sciences, with many direct links to other sciences (e.g. many aspects of physics, mathematics, chemistry, the geo-sciences). They have an important cultural content including our distant origins, the recognition of the location and restricted extent of our niche in space and time, cosmological considerations as well as philosophy in general. Its recent successes are largely dependent on advanced technologies and methodologies, e.g. optics, electronics, detector techniques at all wavelengths, computer techniques such as image processing and the transfer, storage and retrieval of very large data sets.

Astronomy is undoubtedly one of the sciences that enjoys intense public interest, as testified to by the very large number of popular astronomical journals, planetaria, amateur clubs and interested individuals in all countries. It also has great media appeal, in part because of its exploratory ("adventurous") character and ability to produce spectacular images. With increasing public awareness of the Earth's fragile ecosystems and the obvious influence of external, that is, "astronomical", forces (solar irradiation, variations in the Earth's orbit, collisions with other bodies, radiative effects from nearby cosmic explosions), this science has taken on a new significance in the minds of many people.

Nevertheless, the teaching of this multi-disciplinary science in European secondary schools has been the subject of many vacillations during the past decades. In several countries it is not taught at all, or at the most at a very rudimentary and "old-fashioned" level: in others, some of its elements are included, but most often in a seemingly haphazard way: it is rare that an overall, holistic view is presented. This is despite the obvious fact that many areas of astronomy are relatively easy to comprehend (at least qualitatively) and that this subject is a most illustrative example of the interplay between science, culture and technology in all its historical and modern aspects. It moreover demonstrates the unity of science, gives a host of educationally useful examples of the scientific method, and may also serve as a natural stepping stone into a large number of other areas of human knowledge and activity.

With this background, the EU/ESO Workshop on Teaching of Astronomy was held at the ESO Headquarters, Garching near Munich (Germany), on November 26-29 1994, with participation of more than 100 European teachers with particular experience of teaching astronomy and astrophysics at secondary school level. Several representatives of national ministries and local authorities also participated, as well as professional astronomers.

This document presents some important recommendations for the future teaching of astronomy in European schools, as a result of the wide-ranging deliberations during this meeting. If adopted, they will provide a significant contribution to bringing current teaching of this and related subjects more into line with the present status of this science. It will enhance the students' comprehension of its importance for a great variety of human activities and also ensure that they understand our place in the Universe with all its cultural implications.

Dr. Anne Cohen

The participants in this conference unanimously agreed the following aims and initial actions to achieve them.

2. AIMS OF ASTRONOMY TEACHING

Astronomy should contribute towards the consciousness that, in a complex society abounding in science and technology, a scientific education is essential for the choices that every citizen has to make in the democratic life. Students should feel that the Earth is a wonderful place in the Universe, and to be cared for and defended.

The following particular goals are desirable:

i. Astronomy education should be started as early as possible in the primary school and progress in the following years. Through the media, students are nowadays exposed to a multitude of mainly unstructured impressions from the space sciences and associated areas; the teaching of astronomy in schools will establish the structure and the desirable organisational concepts.

ii. By the end of compulsory education, students should be involved in observation, experimentation and discussion of the following ideas from astronomy:

   a. Our place in the solar system and in the Universe;

   b. The nature of objects we see in our sky, for instance, planets, stars, galaxies, comets;

   c. Examine thinking from the past ages and more recent times to explain the character, origin and evolution of the Earth, other planets, stars and the Universe.

iii. In initial training of teachers and the subsequent in-service of teachers, these ideas (ii a-ii c) must be introduced and reinforced. Recent studies of students' misconceptions and ideas in astronomy provide a useful basis for further development of teaching methods.

iv. Since astronomy can provide a unique opportunity for fascinating, whole school activity, support should be provided for optional courses and extra-curricular work in astronomy.

v. Astronomy teaching can contribute to an understanding of the physical laws which start from the human level and reach the macro-cosmos to give a scientific organised outlook on our world and to appreciate the uniqueness of the Earth for the human race. Astronomy locates mankind's niche in space and time.

vi. Astronomy teaching conveys the fundamentals of the scientific method, including the associated doubt and lack of answers and the interplay between experiment and theory, thereby forcing students to adopt a critical attitude towards the many pseudo-sciences.

vii. Astronomy knows no national frontiers - the sky is the same above all of Europe - and the teaching of astronomy therefore contributes to international collaboration between students and teachers everywhere.

3. INITIAL ACTIONS

3.1 Establishment of a European Association for Astronomy Education

In order to achieve these aims, the participants unanimously decided to form a "European Association for Astronomy Education" (EAAE), an organisation consisting of individual and corporate members, within the following framework:

a. A provisional executive committee is established to prepare a constitution and bylaws (including specific proposals for the organisation's goals and aims, procedures for election of officers, membership requirements). It consists of a president, a secretary, a treasurer and an editor.

b. All those who participate in astronomy education in Europe may become a member. Each member will contribute so many ECU as his/her charter membership fee to cover the preliminary costs of the organisation.

c. The provisional executive committee will work towards the organisation of a constitutional conference within the next twelve months in a place and with means which they will deem appropriate.

d. All members are urged to contribute to the editor any article or other item which they feel will benefit the association's members.

e. The editor will have the responsibility of setting up a newsletter published at regular times per year (hard and soft copy), the first of which should be distributed by May 1995. At the same time he should look into the possibilities of setting up various other means of communication and collaboration among the association members, including electronic networking.

ESO pledged to support the aims and ideals of the EAAE.

3.2 Teaching of European Teachers

All teachers, primary as well as secondary, whether of physics, mathematics, earth sciences or geography, should be educated in astronomy during their university courses. They should be instructed in the scientific matters as well as in teaching methods.

Teachers will need to receive in-service education in order to be able to teach astronomy. They need special training, access to scientific research, to new educational materials and methods and the possibility for exchange of experience.

This may be done during single day meetings, summer schools, teaching at a distance, as well as by a special newsletter. It may be organised by the local educational authorities of each country, as well as by the organisation now created by the European Association of Astronomy Educators. Tuition could be given by professional astronomers as well as by experienced teachers. Occasionally, it would be desirable for this contact to be at an observatory.

3.3 Special Activities for European Students

For students, astronomical olympiads, summer schools, astronomy camps, or exchange of experience by network will contribute to increasing the interest in astronomy as well as getting in contact with each other on a European level, and perhaps by the use of a dedicated microsatellite.

3.4 Development of Astronomy Courses

The main purpose of astronomy teaching is to make the pupils aware of humankind's place in the Universe, its bearing on the real world the pupils live in. Thus, the pupils will be able to appreciate the singular nature of the Earth in the Universe and the importance of its preservation. Presently, however, this purpose cannot be fully achieved because the relevant topics are scattered over several subjects, such as geography, physics, chemistry, biology and philosophical education. Also, the present curricula in Europe do not fully exploit the natural curiosity of young children for astronomy-related topics, and thus limit what can be achieved at a later age.

To remedy the present situation, we propose the following:

To take advantage of the natural curiosity of young children, astronomy teaching should start at the junior level. In that phase, the teaching should concentrate on the place of the Earth in the Solar System as most of the astronomy-related questions that preoccupy children derive from daily experiences caused by the movement of the Earth, the Moon and the Sun. In order to achieve a good understanding, the following are essential:

a. Models should be used extensively to aid pupils in obtaining a three-dimensional understanding of the world around us.

b. Simple observations are necessary to relate the teaching to the real world.

By the age of 14, pupils should have acquired knowledge and understanding of the Sun, the Moon, the Earth and their principal relations (the seasons and their effects, the movements in sky and space, the nature of these bodies, etc.); and a first view of the solar system. In addition, they should have acquired a basic understanding of what the stars are and performed simple observations of the day- and night-sky. It is felt that this is the minimum all people should know about astronomy.

Beyond the age of 14, we also propose astronomy for all pupils continuing with their education. Astronomy teaching at this phase may be based on the concept of "the powers of ten" (study the Universe and its components in a series of steps, each representing an increase in scale of a factor of ten) in order to achieve the desired

global picture of the place of humankind in the Universe. In this way, some of the most important elements of astronomy can be covered, such as:

- physics of the Sun, the Solar System and the Stars
- stellar evolution
- measurement of distances
- astrophysical tools (instruments, methods)
- the use of artificial satellites and space probes
- evolution of the Universe

It is the long-term goal of the EAAE to study the possibility of assembling a universal astronomy course based on the above topics.

A "quick-look" course of this type could be given at the beginning of this phase to provide a first survey of the subject and to ensure that those who leave education early have had contact with these important concepts.

With the acquisition of more knowledge about all the natural sciences, the same type of course, but more complete and comprehensive, could be given towards the end of school.

The course would illuminate *astronomy as a human endeavour, with associated doubts and lack of answers, the interplay between experiment, observation and theory, the philosophy of science and the scientific method.*

The AAE President, Dr. Anne Cohen, will serve on the Executive Committee.

HANDS ON UNIVERSE

Hand on Universe is an exciting new initiative from The Royal Greenwich Observatory.

Based on the idea behind the successful American schools progamme of the same name, several interlinked projects aim to bring the excitement of astronomical research directly into the classroom through a series of National Curriculum related activities with in-service teaching support.

Using a variety of professionally produced materials, students at all Key Stages will be able to work on real image data and explore for themselves some of today's current research problems.

Hands On Universe is being developed by a team of practising teachers, astronomers and educational publishers; as the project grows in scope and scale they will be joined by experts from around the world with information, data, workshops, news and ideas rapidly disseminated via the Internet, CD-ROM, posters, curriculum resource packs and visits to working observatories.

Hands On Universe intends to place astronomy as a major player in modern science, communicating the enthusiasm and excitement of involvement at the very cutting edge of science research.

The Launch Pack

Hand On Universe will arrive in the UK in mid-1995 with The Launch Pack - designed to help teachers of Key Stage 1 and 2 students discover the fascinating history and exploration of the Universe as we know it today.

The Image Bank

At the heart of Hands On Universe lies access to the wealth of wonderful images available from space and the telescopes of The Royal Greenwich Observatory. A useful selection of images has been brought together expressly to support National Curriculum and advanced learning through The Image Bank.

The Image Bank will be published as an easy-to-use index for mail-order posters and photo-images, Internet files and CD-ROM.

The Royal Greenwich Observatory is currently seeking the views and comments of science teachers in order to ensure that The Launch Pack meets real classroom needs. If you would like to join the informal assessment team or simply find out more, please write to Neil Parker, The Royal Greenwich Observatory, Madingley Road, Cambridge CB3 0EZ (ref ASE).

BOOK REVIEW

THE GUIDE TO AMATEUR ASTRONOMY, by Jack Newton and Philip Teece. Publisher: Cambridge University Press, ISBN 0521 444 926, hardback, pp 355, price $CAN 34.95, 1995.

I reviewed the first edition of this book five years ago, and I was surprised to see the publication of a second edition so quickly after the first. Often a second edition makes alterations and minor amendments to the earlier work, but it is immediately obvious that this edition makes many substantial changes.

This is a work which every amateur (and also professional) astronomer should have on his or her shelf. Picking out some of the chapter headings, we have the first introductory part dealing with basic ideas (finding your way in the heavens). Then we have an account of the Solar System, followed by a guide to "deep sky astronomy".

Throughout the book emphasis is on the practical. In the introductory part, the authors concentrate on naked eye astronomy, and this soon expands into simple instrumentation (binoculars and simple basic telescopes). One chapter is entitled "The build-it-yourself astronomer", introducing the budding amateur to this very satisfying pursuit.

But the practical side does not concentrate solely on visual techniques. A considerable part of the book explains CCDs and their applications. If you want to find out what CCDs really are, and why their use is not confined to the professional, then this is the book for you.

There is a useful section on making your own telescope, including how to grind your own mirror, followed by how to make your own Dobsonian, the "people's telescope".

I thoroughly recommend this book to all amateur astronomers: professionals would also benefit from acquiring this excellent book.

Eric Zucker

LETTER

Dear Editor

I read Tony Lawton's article "Trashing the Triumphs of the Past" with an uncomfortable mixture of feelings. Not having met an astronaut, I cannot speak about them with authority. Yet, I have to admit that I would not be surprised or distressed to hear of some petty jealousies among them. I have always wondered how the Command Module pilots, who stayed in orbit, felt about those who landed and got all the attention.

Tony prompted me to take a long, cold look at the Apollo flights and the progress of space exploration in general. If the astronauts were godlike beings then to have achieved so much was merely to be expected. As they were human, the triumphs are thrown into sharper relief, when allowance is made for natural human failings. The degree of co-operation and success, which was achieved, is all the more remarkable.

It seems that another natural human failing is to dig for dirt about those whom one practically worshipped but a short while earlier.

There was a film based on the idea that NASA could fake, "was it Mars?", landings. I didn't see the film; I'm told it was quite good. Conspiracy theories make good newspaper stories. The whole UFO business is based on them. There are stories about the 'Face on Mars' as well. I confess that it worried me that NASA felt so little confidence that it had to reply to those stories. It seems to me that ridicule and contempt are the best responses.

To conclude, I am not wholly in agreement with Tony, but I do applaud him for writing his mind. Astronomy and space research are not about deceiving the public. I think more of us should stand up to be counted and state loudly why we think these subjects are important and, above all, fascinating.

Roger O'Brien
London, N15

OBITUARY: KEN CREAMER

We regret to announce the death on 9th December 1994 of a very well-known figure in the amateur astronomy field, Ken Creamer. He was 74 years old.

He was a founder member of the Astronomical Society of Haringey (ASH) whose meetings he attended even before the Society became formally established. For many years he served on the ASH committee, and was Vice-Chairman.

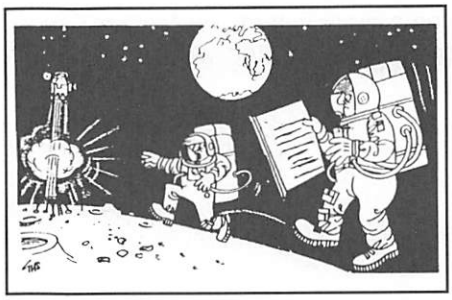
His interests outside astronomy led him to employment in the Post Office Telephone Engineering Department. Later, he started his own electrical business, expanding into other fields of construction. He was elected to the Marylebone District Council in 1940.

He turned to education in 1970, when he took a Teaching Diploma. Subsequently he taught Science at secondary level. He retired early in 1981, due to ill-health. Despite this, he was always active in exhibitions held at the Alexandra Palace, where ASH, risen from the disastrous fire, now has its headquarters.

He was a founder member of PONLAF (the Polytechnic of North London Astronomy Forum). He continued to attend PONLAF meetings, and joined the AAE, where he was yet again a founder member and served on its Council. Ken was the vital instrument in the AAE's application to become a charity, and AAE members may recall the article in Gnomon on the Alexandra Palace project.

It was agreed that any memorial to Ken should be long-term. Thus the forthcoming Lecture Hall and Library at Alexandra Palace will be named after him, and a Fund has been set up in his name. Anyone wishing to contribute to this Fund should approach the ASH Chairman or Secretary: Jim Webb (0181-441 7421) or Jerry Workman (0171-607 7751).

Ken had been married three times, and had four children. We send our sympathy to the whole family.



SPACE - LINK

Compiled by Nik Steggall

SPACE SHUTTLE - MIR RENDEZVOUS

During early February the US Space Shuttle Discovery made a close rendezvous of the Russian Mir space station to within 35 feet from the Kristal module docking port. The STS-63 mission of Discovery then made a fly-around of the Mir station. The purpose of this exercise was to verify flight techniques, communications and navigation aid sensor interfaces for shuttle/Mir proximity operations in preparation for the STS-71 docking mission scheduled for June 1995.

On board the STS-63 mission was cosmonaut Vladimir Titov, he was the second Russian cosmonaut to conduct a US Space Shuttle flight. Other notable highlights of this mission included the first woman to pilot the Shuttle, Eileen Collins, first Briton to walk in space, Michael Foal, and the test of a new thermal spacesuit.

Shuttle - Mir Missions

A summary of the proposed Shuttle/Mir missions is as follows:

- STS-60 (Jan 1994) and STS-63 (Feb 1995) the first US spaceflight to carry Russian cosmonauts.
- Soyuz TM-21, the Mir main crew No. 18 (March 1995), launch the first US astronaut to Mir for a 3-month stay.
- STS-71 (June 1995) docks with Mir, brings up the Mir main crew No. 19 and returns with the Mir 18 crew.
- 10 Shuttle flights to Mir are planned during the 1995-97 time-frame to assist in crew exchange, resupply and transport Mir system replacements (such as solar arrays).

BRITAIN'S PLACE IN SPACE

In the future, the 1990s will be seen as the age in which space took over as the source of information about our Earth, and when multimedia took over as a source of information about space.

Today, there are many multimedia packages about space - but none can tell you more about the structure of UK space activity than BNSC's new and unique multimedia index 'Britain's Place in Space'.

Available as a CD-ROM, this index replaces the familiar BNSC Space Directories, and provides:

- Up-to-date lists of the space activities of UK schools, industry, research centres and universities, and
- A colourful and informative survey of UK space policies and programme.

The new ROM was launched by Ian Taylor MP, the Space Minister, at the Farnborough Air Show, where BNSC co-hosted a major Space Pavilion with UK space industry and with ESA, the European Space Agency.

Britain's Place in Space details are available from BNSC or from HMSO and its bookshops.

This article emanates from British National Space Centre, Bridge Place, 88/89 Eccleston Square, London SW1V 1PT. Tel: 0171 637 9111.

ROGER O'BRIEN'S COLUMN

NEW YEAR'S RESOLUTION

In this column, I have often waxed lyrical about the beauties of the night sky. Perhaps I should mention the other side?

As part of the third year project for an astronomy degree, I have been attempting to observe the star SW Andromedae. It is a short period variable and its maximum brightnesses are about ten and a half hours apart. I used the half-metre Cassegrain telescope at Bayfordbury (the observatory of the University of Hertfordshire). Since my set task is to evaluate a particular Charged Couple Device (CCD) used as a photometer, I have the EEV (maker's name) CCD attached to the telescope. A half-metre instrument is pretty large - twenty inches in real money. It and a massive counterweight sit on either side of an axle about 10 feet long. This turns on piers so that it is aligned with the poles of the sky. The telescope is electrically driven and there are repeaters so that the observer can check the co-ordinates at which the instrument is pointing. The EEV also works in 'video mode', which means that you can see a low definition picture, using the CCD as a television camera.

The telescope takes some getting to know; it is heavy and quite difficult to swing about. To get to the stage where I could try to line it up on a bright object and have some hope of seeing the object through the telescope, needed practice. The telescope has a 200mm Schmidt Camera attached to it and a very nice 150mm refractor as a finder. The latter has a refreshingly familiar feel to it, but I found it quite difficult to grasp the difference in the field of view of the finder and the much narrower one of the main telescope. What seems to be smack in the centre in the finder may not even be in view when you look at the CCD image on screen.

After a while you get the hang of it. No object that I have ever searched for is precisely on the co-ordinates given in reference books. This can be because the co-ordinates are out of date or the display, which tells you where the telescope is pointing, does not give the co-ordinates to the necessary accuracy or because the clock, which keeps sidereal time (the time by the stars - a day about four minutes shorter than our normal, or solar day), is running a little slow or fast. I had better explain about the display: usually this gives declination in degrees and decimal parts of degrees. Unfortunately, the reference co-ordinates are given in degrees, minutes and seconds and 0.1° is 6 minutes. Similarly, the right ascension reference is in hours, minutes and seconds, but the display shows only hours and minutes. The skill that has to be acquired is shifting the telescope around within the little zone defined by the minimum units of the display.

This is a good moment to mention right ascension and declination (usually abbreviated to dec or ∂), which is a sort of celestial latitude. It is measured in conventional degrees away from the celestial equator towards the celestial poles. Stars on the equator have a declination of 0.0° and, if there were stars at the north and south celestial poles, they would have declinations of +90° and -90° respectively. Right ascension is normally claimed to be a bit more difficult to understand. If you imagine the sky divided into twenty-four hourly strips stretching from the north to the south celestial poles, then one strip passes over your telescope in an hour (so long as you don't move the telescope!). The minutes and seconds of right ascension (usually shortened to RA or α) represent angles 15 times as big as the minutes and seconds of arc (used in declination).

Then, one day, you set up the telescope: swing it round to the settings that you have calculated and there is the object quite near the centre of the field of view of the finder. A little jiggling and you have it in the field of the CCD as well. Yippee! At this point, you will probably find that the CCD, which is a sort of electronic camera, is playing up or the computer, which presents and stores the images, is not co-operating. This is not a cause for despair, since you learn how to tackle these problems and, quite often, you overcome them. At worst, you can, as I have, at least obtain some data, which analyses what is going wrong.

At last, there comes a night, when you feel you are in complete control. Then the motor, which rotates the dome, catches fire.

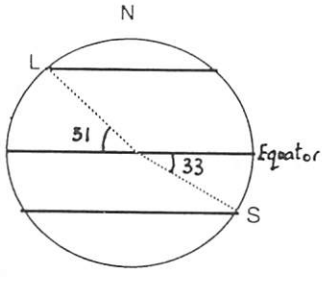
I hope this tale does not put anyone off. I really have enjoyed the vast majority of the work done with the half-metre reflector. It is clear that using such a big telescope has attractions because there is very little difficulty in getting accomplices to come out to a cold, windy ridge in the middle of a winter's night. The message I want to transmit is this: if you are learning about astronomy and it suddenly seems a bit hard and everyone else seems to know more than you do, don't worry. The people, who seem to know, all went through the problems you are encountering and they are now struggling with problems of their own. The really important bit is the return you get: the excitement, when you see a difficult object for the first time or get some results that make sense or (here comes the purple prose) when what you see is just so beautiful that all you want to do is look at it. There are lots of those magic moments in the company of your accomplices - a bunch of nutters, who are every bit as excited about it as you are.

Finally, can I just remind readers that the SKY AT NIGHT's 500th programme will be screened in April 1995. The producer, Pieter Morpurgo starts his 15th year with that programme. If you can think that far ahead, the 40th anniversary is coming up in April 1997.

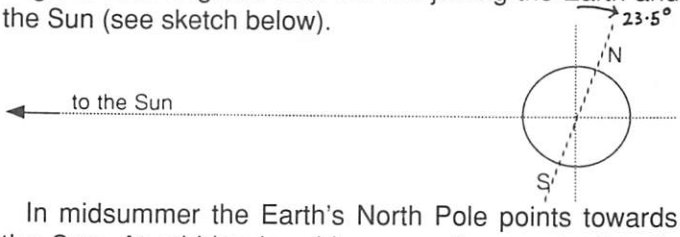
CURRICULUM CORNER

'Ere Miss what are all those lines for?

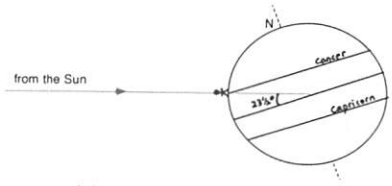
The lines shown on an Earth globe are of course circles. The **equator** is perhaps the best known circle. This is one of the Great Circles (largest circumference circle) and divides the Earth into northern and southern hemispheres. Circles parallel to the equator are smaller in diameter. They are not Great Circles. They mark **latitudes** north or south to the equator. London lies at a latitude of about 51 degrees north of the equator. Sydney, Australia, lies at a latitude of about 33 degrees south of the equator. The north pole is at a latitude of 90 degrees north.



The lines at latitude 23.5 degrees north and south of the equator have particular significance. They mark the edge of the **tropics** of Cancer and Capricorn. But why 23.5 degrees? To understand this you need to consider the Earth and the Sun. The Earth's axis is tilted at an angle of 23.5 degrees from the line joining the Earth and the Sun (see sketch below).



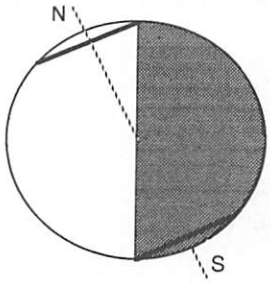
In midsummer the Earth's North Pole points towards the Sun. At midday in midsummer the sun is directly overhead at the place with latitude 23.5 degrees. This is the most northerly place where the Sun appears directly overhead. There is no shade at midday for example in Habana, the capital of Cuba. (Use an atlas to find this town.)



Using the same idea you will see that when the South Pole points towards the Sun it is midsummer in the southern hemisphere. The place farthest south where the Sun is directly overhead at midday marks the edge of the tropic of Capricorn. Such a place is for example . . . ?

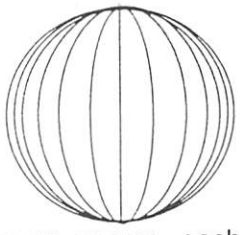
(Use a map to find out.)

The sketch again shows the Earth at midsummer for the northern hemisphere. Note that as the Earth turns there is an area around the North Pole which never goes

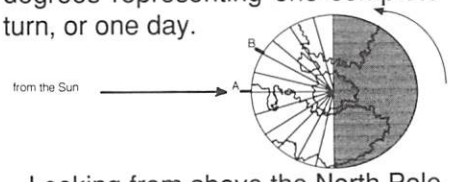


into shadow. Here in midsummer it is light all day. The Sun is above the horizon even at midnight. This is the **Arctic Circle** - the land of the midnight Sun. The limit of this circle is at 23.5 degrees from the North Pole. Once again a feature of the tilt of the Earth's axis. Note that during this time the **Antarctic Circle** is in total darkness for 24 hours a day during midwinter.

Look closely at a globe and you will see a whole set of lines running around the Earth from the North to the South Pole. These are lines of **longitude** and are Great Circles. They divide the Earth into segments rather like an orange, each segment being 15 degrees. The line marked 0 degrees runs through Greenwich and is called the **Greenwich meridian**. At the Old Royal Observatory at Greenwich there is a line marked on the ground to show this famous landmark.



Each segment of 15 degrees shows how far the Earth turns in one hour. 24 times 15 degrees is 360 degrees representing one complete turn, or one day.



Looking from above the North Pole the lines of longitude show how far a sundial will move in one hour. In the sketch the sundial at A is reading midday but the one at B is two hours earlier at 10am.

Bob Kibble

FANTASY OF FLIGHT:

Solutions to Crossword in GNOMON, Winter 1994.

Across:	*Down*
4 Galileo	1 Copernicus
6 Eagle	2 Mercury
7 Rocket	3 Mars
8 Cyrano	4 Geese
10 Milky Way	5 Icarus
12 Somnium	9 Tarzi
14 Kaikaus	11 Montgolfier
15 Babylonium	13 Pythagoras
16 Venus	

Sky Diary for Spring 1995

By Eva Hans

Equinox: Mar 21^{d} 02^{h} 14^{m}
Solstice: June 21^{d} 20^{h} 34^{m}

MOON PHASES:

New Moon	First Quarter	Full Moon	Last Quarter
			Mar 23^{d} 20^{h} 10^{m}
Mar 31^{d} 02^{h} 04^{m}	Apr 8^{d} 05^{h} 35^{m}	Apr 15^{d} 12^{h} 08^{m}	Apr 22^{d} 03^{h} 18^{m}
Apr 29^{d} 17^{h} 36^{m}	May 7^{d} 21^{h} 44^{m}	May 14^{d} 20^{h} 48^{m}	May 21^{d} 11^{h} 36^{m}
May 29^{d} 09^{h} 27^{m}	June 6^{d} 10^{h} 26^{m}	June 13^{d} 04^{h} 03^{m}	June 19^{d} 22^{h} 01^{m}

There is a partial eclipse of the moon on April 15th and an annular eclipse of the Sun on April 29th. Unfortunately neither is visible from the UK. However two occultations can be observed during Spring 1995. The Moon passes in front of the star Spica into Virgo on May 12^{d} 20^{h} and occults the planet Venus on May 27^{d} 07^{h}.

MERCURY
Mercury is a morning object until April 6th, it is visible in the evening sky from April 22nd to May 26th, then resumes its morning position from June 15th.

VENUS
Venus is in the morning sky. It is in conjunction with Saturn on April 13th and with Mercury on June 19th.

MARS
Mars is in the evening sky.

JUPITER
Jupiter begins this period in the morning sky, reaches opposition on June 1st when it can be seen for the whole night in the recently famous Constellation of Ophiuchus, then moves into Scorpius in the evening sky.

SATURN
Saturn is in the morning sky in Aquarius. It is in conjunction with Mercury on March 26th and with Venus on April 13th.

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