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

Reminder: Please do not forget to pay your annual subscription (£7.50 for individual members; £15 for corporate members, Corporate members receive 3 copies of each issue of GNOMON. A renewal form is included within this issue. GNOMON is a forum for members to contribute articles, write letters, etc.: these are always welcome. Members' advertisements are free, as long as they are of reasonable length. The costs of commercial advertising are given alongside front page of GNOMON.

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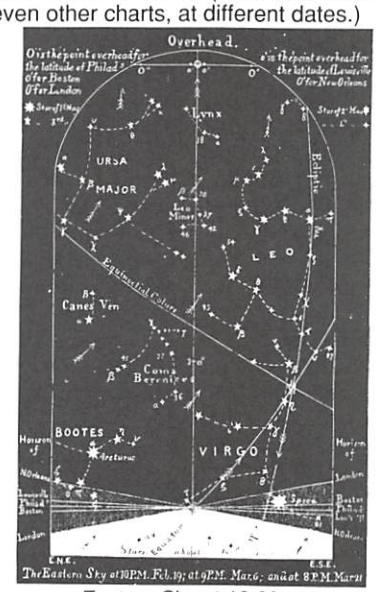
Browsing through some books published round about 1870, I found one called "Stories for Children". This suffered the practice common in those days of giving no hint at all of the publisher, date of publication, etc. - you are on to page 1 as soon as you open the cover.

Flicking over the pages, I found a number of star charts, one of which is reproduced here. A bit of research revealed amongst the authors a Mr. R. A. Proctor who had produced the star charts. Notice the peculiar projection - a semi-circular chart of the sky sitting on straight sides.

Could anyone shed some light on this rather odd star-chart? (The book illustrates seven other charts, at different dates.)



Eastern Sky at 10.00pm.

GCSE ASTRONOMY

At the Downlands Centre for Mature Students

by Bob Kibble

This is a modular course over thirty weeks requiring one evening a week attendance: Mondays 6-8pm. The GCSE course is suited to anybody with an interest in astronomy but you needn't be an expert or own a telescope. I shall take you through the course unit by unit using demonstrations, slides, lectures and discussions. Each week there will be a set of notes for you to use. You needn't enter the exam if you don't want to but it would be good to gain a certificate in Astronomy if you can. We will do some evening observation work and make some visits during the course. The cost of a year's course is £50 plus an examination entrance fee.

Contact the college secretary or course tutor, Bob Kibble, at: The Downlands Centre, Coulsdon College, Placehouse Lane, Old Coulsdon, Surrey CR5 1YA. Tel: 01737 551176.

We are on the 50 and 409 bus route and off the A23 south of Croydon. There is parking on site. Term starts on September 16th but we will be enrolling until the end of September.

Note: If you can't attend the College it is possible that you could follow the course at home through a distance learning scheme. If you would like to register your interest as a "distant" student please contact the college. I would need to assess the scale of interest in this mode of learning before embarking on a full programme. I am hoping to start the distance learning mode in September 1996.

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
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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)

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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.

ANNUAL MEETING REPORT - 17 JUNE 1995

This year's annual meeting was hosted by University College London. As is customary we held our business meeting in the morning and followed this with a buffet lunch. The Association received reports from President, Secretary and Treasurer and had a lively discussion on subscriptions. It was agreed to leave subscriptions as they stand for a further year with a strong feeling that we will need to raise them next year. There were elections for officers and members of Council and, whilst many "old" faces remained in office agreeing to serve the Association for another term, we welcomed some new names onto Council in the form of Ian Crawford as a member and Techniquest as a Corporate member.

Following a substantial buffet lunch during which participants, twenty-three in all, had a chance to catch up on developments and meet friends and colleagues, we were joined by a further thirty members and friends for the afternoon programme. Professor Jon Tennyson from UCL gave an enlightening presentation on the Shoemaker Levy event. He combined tales of advanced physics, astronomy and the media to ensure that we were kept on the edge of our seats. After a short break Bob Kibble gave us a light-hearted slide tour of London Sundials before we embarked on a short journey to the London Planetarium. Full marks to all participants for arriving on time in a real downpour. We were treated to a preview of the new public show using Digistar technology and, following refreshment, met some of the key staff responsible for putting the show together. It was a fitting way to end what had proved to be a really successful day.

Our thanks must go to Mike Dworetsky and the UCL team for hosting the main part of the day, to our speakers and to the staff at the London Planetarium. Finally a thank you to all AAE members and their guests for making the trip to London, some from over three hundred miles away. The annual meeting is the one occasion when the Association, through its members, can confirm both its identity and its direction. We look forward to the next annual meeting to be held in Liverpool on May 11th, 1996. Make it a date to remember.

Bob Kibble

FURTHER NOTES ON THE AGM

The AAE has had another active year. The Association was one of many organisations which successfully lobbied for some astronomy to be left in the revised national curriculum.

Members have run a variety of workshops and Inservice Training courses. Our annual presentation at the ASE's January meeting was well received, with 21 teachers attending.

The AAE now enjoys charitable status.

The AAE primary pack is being rewritten; the current edition continues to sell well.

The AAE has maintained its links with a number of other organisations (BAA, RAS, FAS, NAW, UKSEDS, BIS); also the Space Education Council and the European Association for Astronomy Education.

The Treasurer reported that the financial standing of the Association was quite healthy.

ELECTION OF OFFICERS

The President, both Vice-Presidents, Treasurer, Secretary and both Assistant Secretaries having all expressed willingness to stand for a further year, Eva Hans proposed that they be elected, Mike Inglis seconded, and the proposal was passed by acclamation.

The AAE has three Ordinary Members on Council. The nominations were: Sue Tritton (proposed by Anne Cohen and seconded by Teresa Grafton), Eva Hans (proposed by Bob Kibble and seconded by Mike Dworetsky) and Ian Crawford (proposed by Mike Dworetsky and seconded by Anne Cohen). Mike Dworetsky proposed that they all be nominated, and this was seconded by Anne Cohen.

The post of Editor will, as usual, be decided at the next Council meeting.

ASIAN ECLIPSE, 1995 October 24

A magnificent 10-day cruise in the luxury liner Marco Polo. The eclipse of the Sun may be observed in the China Sea. Guest lecturers include Patrick Moore. Cost, £990. Further details from Orient Lines, 38 Park Street, London W1Y 3PF. Tel.: 0171-409 2500.

ROGER O'BRIEN'S COLUMN

AUTUMN SKIES

We are coming up to autumn and, for once, I shall resist the temptation to quote Keats. I would still like to recommend (as always!) that it is worth looking at the night sky. If you are under a good sky, or can get to a nice dark site, there is plenty to see. The Milky Way stands like a huge arch of silver chiffon from south-west to north-east and passes through the very zenith. It is a lovely sight and well worth some effort to see it. Of course, that delicate stippling of light is actually thousands upon thousands of relatively nearby stars, too faint to be seen individually. It is all we can see of the giant spiral Galaxy in which we live. Yet it does give some valuable clues to the structure of the Galaxy: the myriads of stars and the dark drifts that are the huge dust clouds where new stars are being born.

Some further idea of the possible structure of our Galaxy may be gained from looking at two nearby galaxies: M31, in Andromeda, and M33, in Triangulum. Both of these are spiral galaxies. M31 is a massive galaxy with tightly wound spiral arms and a very large, dense nucleus. M33 is the same size, but much sparser with a small not very regular nucleus and sprawling spiral arms. Probably, the Milky Way is an intermediate type.

Last year, Drs Mike Irwin and Gerry Gilmore and their PhD student, Rodrigo Ibata, discovered a peculiar dwarf elliptical galaxy almost hidden by foreground stars in the constellation of Sagittarius. The discovery involved a great deal of painstaking work to identify the stars belonging to the dwarf from the larger numbers situated in our Galaxy and covering an area of sky eight degrees across. The new satellite galaxy was clearly in distress. Our Galaxy has enormous mass and the consequent tidal effects on the dwarf were literally dismembering it.

Rodrigo Ibata has moved from Cambridge, but the study of this strange little galaxy continues. Professor Simon White and his student, Hector Velázquez, have tried to model the interactions between the Milky Way and the Sagittarius Dwarf Galaxy (I would have called it Ibata 1, but modest scientific propriety had its way). They use computer programs incorporating the most likely orbital parameters and the best estimates of the masses of the two galaxies. It is, perhaps, surprising to realise how uncertain many of these quantities are. Their best mathematical models show the Sagittarius Dwarf suffering greater and greater disruption with each close passage. It has plunged through the outer part of our Galaxy something like ten times. It may have passed as close to the centre as the Sun's orbit. The previous encounter was around one billion years ago and tore the galaxy into a shower of virtually independent stars. Of course, they continued to travel along quite similar orbits - rather like the debris of Comet Shoemaker-Levy 9 - and the current encounter with our Galactic rim is completing the dissolution of the dwarf. This situation may well support the ideas of those who contend that spiral galaxies grow by accumulating the remnants of satellite and other smaller galaxies that get trapped by the huge gravitational fields of the giant spirals.

Remember, our Galaxy is truly a **giant** spiral, though a long way from being the largest known specimen of the breed.

This autumn will not be too good for the casual planet watcher. Saturn will be available, but the Earth is crossing and recrossing the ring plane this year so the glory of the sixth planet's image will be much dimmed. In fact, the edge-on rings are quite hard to see at all. There is an obvious and important conclusion to draw from this: the rings are extremely thin in the north-south direction, whilst spreading out for hundreds of thousands of kilometres east-west. I have personally never forgotten the sight of the ringed planet through the 28" refractor at Greenwich. It (the planet) was like a gleaming golden toy. There was an irresistible sense of spin about the image and the delicate golden, flaxen and just a few darker hues were a sheer delight to the eye. It is little wonder that Saturn has fascinated scientists for so many years. One of the greatest British scientists, the Scot, James Clark Maxwell, did his first serious theoretical work in a paper proving that the rings must be made up of swarms of individual small particles since no liquid or solid could possibly stand the differential tidal forces across their immense width.

Those with access to better instruments and star maps should be able to find Uranus and Neptune in the early part of the evenings, if the sky in Sagittarius near the south-western horizon is not murky or clouded. If the planets are too difficult, there is always the Moon. It is sometimes forgotten that the Moon is really a small planet in its own right (after all, it is much bigger than Pluto) and a remarkable body displaying an interesting variety of terrains. Seen through a telescope, with a high-powered eyepiece, it is a real landscape below you not a dim, flickering disk high above. In fact, it is possible to drift the field of view across the Moon and give yourself the impression you are flying over the landscape.

Meanwhile, my favourite spaceprobe, Ulysses, is completing its investigation of the north polar region of the Sun. Note the careful choice of the words "north polar region" because the Sun does not have true magnetic poles, that is strongly localised small areas of concentrated magnetic fields resembling those near the ends of a bar magnet. It is less than a year since Ulysses overflew the solar antarctic and discovered the absence of a south magnetic pole. Ulysses' orbit is highly inclined to the general plane of the solar system - a consequence of a carefully planned and unique encounter with Jupiter.

Some books and some astronomers give the impression that the Solar System is now all sorted out and documented. I'm very glad to say that this simply is not true. The frequency with which small, Earth-grazing asteroids (or are they old, inactive comets) are detected shows us just how much there is to find out about even the most local parts of the system. It is true that men have been to the Moon, but not one expedition landed on the far side, so there is an area less than a quarter of a million miles distant of which we know really very little. It is one of my favourite truisms that every spacecraft discovers something unexpected and, indeed, there would be little point in sending the things out if all they did was to confirm what we already know. Another lack of precise knowledge concerns the outer planets. Their orbits are not modelled with the sort of mathematical accuracy that astronomers would like.This is one of the reasons why there is the continuing debate about the existence or non-existence of a tenth planet. Personally, I am tending more and more to the view that Pluto is not a real planet, so there are only eight anyway. Pluto, it seems to me, is merely the largest of a swarm of distant, icy bodies, many occupying families of orbits resonant with that of Neptune. Pluto is in such an orbit and the 3:2 resonance with Neptune ensures that the two bodies can never collide although Pluto regularly, as at present, swings closer to the Sun than Neptune, which has a proper, virtually circular, planetary orbit.

Over recent years, several teams of astronomers have searched promising areas of the sky for slow-moving objects anything from 30 to 40 times as far from the Sun as we are. Jane Luu and Douglas Jewitt make up one team; Ieuan Evans and Alan Fitzsimmons lead the British team. Their searches used ground-based telescopes and CCD cameras. Between them they found about 20 bodies, which are quite likely to be similar to the planetesimals from which the planets probably formed. One of these was informally dubbed "Smiley" after the elusive George in John Le Carré's spy novels - it now has a more prosaic designation. They may well have been left over from the processes, which formed our Solar System and never got into dense enough swarms to start coalescing into planets.

Four decades ago, Gerard Kuiper re-analyzed a still earlier theory advanced by Jan Oort. The latter suggested that there was a vast hollow sphere of comets surrounding our system at distances ranging from say 100 to about 1000 astronomical units (an astronomical unit [usually abbreviated to AU] is the average distance between the Earth and the Sun). Although the comets would be very thinly spread throughout this truly enormous space, there would still be incredible numbers of them. Perturbations (causes unknown) in their orbits could occasionally result in a comet plunging into the inner Solar System. Hopefully, it would then put up a good show for Earth-based astronomers. Kuiper's contribution to this theory was to postulate an inner flattened belt of cometary type objects reaching in to the edge of the planetary system (i.e. to around 30-40 AU).

Now a team from the University of Texas has been using the Hubble Space Telescope to search for similar objects and they have found still more. It seems that Kuiper was right. I wonder if there is any way of detecting the Oort Cloud?

Meanwhile, there is another interesting object that made a modest splash in the news. It is comet 1995 01, which is over 500 million miles away in the constellation of Sagittarius. Preliminary measurements seem to indicate that it is a whopper - more like the size of that strange outer asteroid/comet Chiron than something like Halley's Comet. It may even be 100 miles in diameter. There was an immediate rush to reassure the public that it would not hit the Earth. In fact, it requires prodigiously accurate aiming for a body falling from the outer parts of the Solar System to hit the small, rapidly moving planet on which we live. This is not to say the danger does not exist, but it should be kept in proportion. If this really is a big comet and it is favourably placed for viewing when near the Sun, it may show a spectacular tail and brilliant head with an extended detailed coma like some of the brilliant comets of the nineteenth century. We must wait and see.

The comet is more popularly known as Comet Hale-Bopp after Alan Hale, of Cloudcroft, New Mexico, and Thomas Bopp, of Stanfield, Arizona. These two amateur astronomers spotted the comet with a 40cm telescope when it was near a globular cluster in Sagittarius. Rob McNaught of the Anglo Australian Observatory has traced Comet Hale-Bopp to an earlier survey plate taken 27 April 1993, which has greatly aided calculations of its orbit. I still find it gratifying that amateurs can make important contributions to the science of astronomy.

EUROPEAN COMMUNITY MEETING OF STUDENTS

ANYONE INTERESTED?

This aims to bring together about fifteen A-level students from each of the following EC countries: France, Great Britain, Germany, Italy and Portugal. The main purpose is for students to get to know each other and to encounter new languages and customs. However the meeting will work on some topics in astronomy.

An initial meeting of teachers who are interested in this exchange will be held in Brescia (Italy) on 10 October 1995. Grants to attend this preparatory meeting should be available through the Lingua programme (Action IV). The first meeting of students will follow in one of the participating countries, during the academic year 1995/6. They will be lodged in private houses, with the families of the students of the host school. Anyone interested in organising the UK end of this initiative should write directly to the Spanish organiser: ***Ederlinda Vinuales Gavin, Instituto de Bachillerato, Avda. Goya, 45, 50006 - ZARAGOZA, SPAIN.***

Dr Anne Cohen, 9 Hurst Lane, Bollington, Nr Macclesfield, Cheshire SK10 5LN.

EUROPEAN ASSOCIATION FOR ASTRONOMY EDUCATION

PROVISIONAL EXECUTIVE COMMITTEE'S FIRST MEETING AT ESO HEADQUARTERS

Issue Newsletter No. 1

The members of the provisional Executive Committee (EC) met in Garching in May 6, 1995, and discussed the topics that were put in the agenda by the president, Dennis Simopoulos. As a brief summary, I would mention the following:

The EAAE constitutions and by-laws as they were first proposed by mail to the EC members and then modified according to their comments by the secretary, Roland Szostak, were thoroughly discussed and adopted; they will be submitted for the approval of EAAE members at the Athens Conference. It was also decided that the EAAE headquarters will be located in Garching.

The treasurer, James More, reported that he was not able to open an account until the association is officially created; consequently, he has temporarily put on its own account the fees collected from the 86 members who were registered during the Workshop. It was discussed how new EAAE members could pay their fees to the treasurer in the cheapest way, owing to the taxes which have to be paid for money transfer: there is generally a minimum tax charge which, for example in the UK happens to be greater than the provisional fee which was adopted during the Workshop. It was decided that each of the National Representatives, who, according to the proposed constitution, are intended more generally to work as accommodation addresses and assist the council in its work concerning their country, will act as sub-treasurers: they will have to open an account for collecting the fees in their country.

The president reported on the progress of the organisation of the November Conference. A proposal has been submitted to the European Commission in the frame of the 1995 European Week for Scientific and Technological Culture; it has not yet been accepted: in particular, more emphasis has to be put on technology. There seem however to exist some reasons to be optimistic:

As it was submitted, actually, the proposal is made not only by the EAAE but also by the European Planetarium Association (EPA). The president reported indeed that, in July 1994, about 40 participants at the International Planetarium Society Conference in Cocoa Beach (Florida, USA), representing Planetaria from 12 European countries, declared their express interest in forming a "European Planetarium Association" (EPA). In the discussion it appeared that there are obvious reasons for the two associations, EAAE and EPA, to meet and work in close contact; some of us, however, expressed their preference for having separate constituting meetings. The president stated that joining the two under the title of "European Astronomy Integration" appeared to give more weight to the proposal.

Michael Reichen reported on the progress in editing of this Newsletter; he acknowledged receiving many interesting papers.

Claus Madsen and Richard West presented the ESO project "Europe towards the stars", a Europe-wide contest, which will also take place during the 1995 European Week for Scientific and Technological Culture.

At the end, all the EC members expressed their warm thanks to ESO and Richard West who made this meeting possible and welcomed us in the same efficient, generous and friendly way that all the participants to the November workshop were so happy to experience.

Lucienne Gouguenheim

HST EDUCATIONAL PROJECTS (HSTX)

Extract from an e-mail to the editor of EAAE Newsletter

The first project produced by the HSTX Project team was presented at the EU/ESO Workshop on Teaching of Astronomy in Europe's Secondary Schools in Garching in November 1994. Following this meeting and a subsequent article in the February 1995 issue of the ST-ECF Newsletter, we have received much interest in the project. In response to this, the following mail was sent out (and is being sent out) to all those who had expressed/express interest:

"Dear Colleague,

Thank you for the interest you have expressed in the prototype educational project using HST data (HSTX). Following the large response to the article in ST-ECF Newsletter No. 22, we are in the process of setting up a scheme for data handling, project writing and testing etc., both here in the ST-ECF and amongst the teaching community.

The prototype was produced by purely in-house effort, but the manpower does not exist to cover all aspects of the production of further projects. What the ST-ECF is offering is as follows: (a) Selection and preparation of datasets from HST archive. (b) Some ideas for projects using such data. (c) Distribution of datasets and ideas to the teaching community. (d) Assimilation and distribution of ideas presented by the teaching community. (e) Preparation in a standard format of project designs received from teachers. (f) Distribution of draft projects for initial testing. (g) Editing of drafts using feedback obtained from testing phase. (h) Distribution of final version. Depending on the nature of the project this could be purely in paper form or could include digital material.

What we are looking to the *TEACHING COMMUNITY* for is: (i) Ideas for projects. (ii) People who would be willing to write up their ideas (project for students accompanied by appropriate teachers notes) using the datasets from the HST archive. (iii) Teachers who would then try out the project with their students and report feedback.

An email account has been set up for the HSTX projects (hstx@eso.org) which will normally be read once a week. Please send any comments or queries to this account. Before we can proceed much further, we need to know who would be willing to take on some or any part(s) of the process (see (i) - (iii) above."

Patricia Fosbury
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Fax: +49 89 320 06 480
Internet: hstx@eso.org

HOU (HANDS-ON UNIVERSE)

Extract from an e-mail to R. West

Over the past five years, based on the Berkley Automated Supernova Search technology, we have piloted and field tested a system (called the Hands-On Universe, or "HOU") allowing students in their classroom to access our remote 0.75m automated imaging telescopes in America (and hopefully a Swedish telescope soon in the Canaries). We have developed an extensive set of tools to make the system work, in collaboration with our pilot teachers. When we started, we naively thought that all teachers needed were images,

and then they could succeed. Since then, we have found out we need a relatively complete set of tools to create solutions for the classroom (most technology creates problems). We now are releasing image processing software, telecommunications software, telescope request systems, supernova search partnerships, a set of 18 curriculum units, teacher training tools, and connections with real astronomers, with whom students and teachers can undertake genuine research. We will be developing a CDROM with tutorials, images, the units, software, etc., next summer. This project has cost about $2m (US) to piece it all together. It has succeeded with virtually all levels of students, from gang members to valedictorians. Two students in Oil City, Pennsylvania got the first images of SN1994I.

Many teachers talk about being "re-born" through collaboration with us. We can guarantee many students not only loving astronomy, but also learning information technology, math and science skills of the 21st century. The appeal of astronomy is one that most humans feel. With HOU, astronomy and the Universe can be made accessible to the most disenchanted, most dis-empowered student or teacher.

Carl Pennypacker

BOOK REVIEW

THE ORIGIN OF THE SOLAR SYSTEM: Soviet Research 1925-1991, edited by A. E. Levin and S. G. Brush, published by the American Institute of Physics Press, ISBN 1-56396-281-0.

This book is for the serious student of astronomy and/or the history of science; Honours students or postgraduates might gain a great deal from it but to the casual reader it is very daunting. The style and setout of the book is not encouraging. The translations are variable. Some of the papers are rendered in a very archaic and opaque style which no doubt reflects the original but is unwelcoming to the modern reader. The mathematical content is considerable requiring in places a postgraduate command of the subject.

The book consists of a selection of articles and abstracts by Soviet scientists relevant to the study of the formation of the solar system. Particular emphasis is given to the work of Otto Schmidt, the founder of the Soviet school of planetary cosmology. Other papers are grouped under the headings: The Protoplanetary Cloud: General Theories of Planet Formation; Rotation of Planets; Formation of the Earth and other Terrestrial Planets, Origin of the Moon and other Planetary Satellites; Formation of the Giant Planets, Asteroids, Comets and Meteors, and Other Planetary Systems.

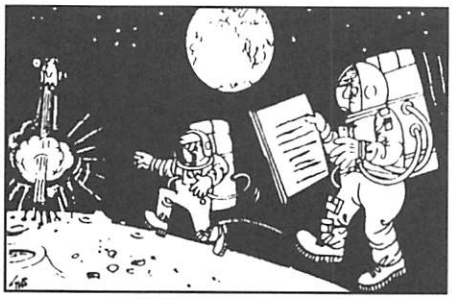
The book also contains an impressive bibliography of Soviet publications likely to be very valuable to the serious student.

The two introductory essays by the editors are the most accessible parts of the book to the general reader. The first, by A. E. Levin, discusses theories of the origin of the solar system as they developed in the USSR. It also necessarily includes a brief biography of the remarkable Otto Yalievich Schmidt. Schmidt began as a mathematician then progressed by way of politics and polar exploration to the founding of an institute for the study of cosmogony. The essay gives a fascinating account of the interplay between politics and science in the Soviet Union and also provides a gentle prod to the complacent mind of the westerner convinced of the objectivity of science.

The second essay by S. G. Brush gives the more familiar western account of the development of our understanding of the birth of the planets with considerable reference made to the influence of the work carried out by Safronov and Ruskol in Moscow. It discusses in particular the formation of the Earth-Moon system, listing the various theories and indicating how competition between them provided a scientific spur for the exploration of the Moon. However, in spite of direct analysis of lunar samples, at least two theories still enjoy strong support, a variation on the co-accretion theory seeming to be slightly the more popular.

The book is fascinating and refreshing in that it gives a different perspective. It is also very welcome since it represents a coming together of scientific effort too long subject to artificial division.

E. M. Hans
South Tyneside College Planetarium



SPACE - LINK

These articles have been compiled by Nik Steggall

THE FIRST SPACE SHUTTLE/MIR SPACE STATION DOCKING MISSION

The US Space Shuttle mission "STS-71" was not the first space shuttle mission to the Russian orbital space complex Mir, but it was the first to dock with Mir. Previously STS-63 had met up with Mir in April 1995 but not docked. On board this flight were Russian cosmonaut Vladimir Titov and British-born Michael Foale.

The STS-71 mission was the first Shuttle flight to take up one crew and bring back another. The Shuttle crew of five consisted of Hoot Gibson, commander, Charlie Precourt, pilot, and mission specialists, Bonnie Dunbar, Greg Harbaugh and Ellen Baker. Also on board were two Russians, Anatoly Soloveyev and Nikolai Budarin. As part of the STS-71 crew, they were also the Mir 19 crew.

Once the Shuttle orbiter Atlantis had docked with Mir, Soloveyev and Budarin would take charge over the Mir station from the Mir 18 crew. The Atlantis would then return to Earth with cosmonauts Gennady Strekalov, Vladimir Dezhurov and American Norman Thagard.

After two launch attempts, STS-71 was launched on 27 June 1995 at 19:32 GMT. This flight was also the 100th American-crewed space mission and nearly 20 years after the first joint US/Soviet space flight, the Apollo-Soyuz Test Project (ASTP).

Docking between the two vehicles occurred on the third day after launch of the Shuttle at 13:00 GMT as they passed over Lake Baikal in the east of Russia. The orbiter/Mir station then became the largest and heaviest man-made object to orbit the Earth at nearly 200 metric tons.

During the time the two vehicles were docked, the crew members undertook ceremonies for the joint mission, 15 medical experiments and the transference of supplies to the Mir. These supplies included 200kg of food, clothing and science equipment, 170kg of water and 50kg of fresh air. The Mir 18 medical samples and materials associated with their flight were also loaded into Atlantis for return to Earth.

The STS-71 mission concluded with a landing on the runway at the Kennedy Space Center on July 7 at 14:55 GMT after a flight lasting 9 days, 19 hours and 23 minutes.

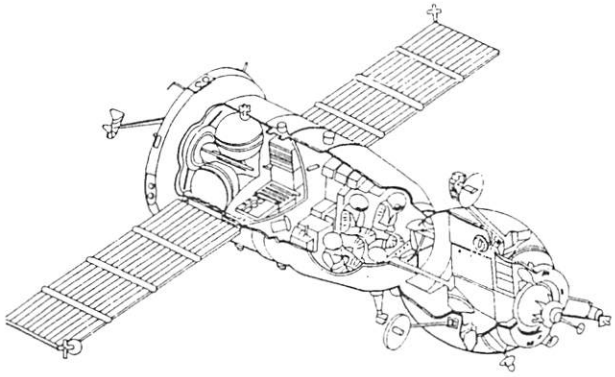


Diagram of the Russian Soyuz-TM manned ferry craft. Used to transport cosmonauts to the Mir orbital space complex. Diagram shows cutaway of, from right to left, Orbital Module, Descent Module, Service Module.

BRITAIN'S PLACE IN SPACE

This CD-ROM, compiled and written by BNSC (British National Space Council), and published last October by HMSO, carries a great deal of information on how Britain puts space to work. The key section within the CD-ROM is an Index of all known UK industrial and educational space activities: the index is supported by colour video and still image details of Britain's space programmes. There is a substantial section on educational uses of space.

An essential guide to Britain in space today, Britain's Place in Space is available from HMSO (ref ISBN 0 11 701975 5) at a reduced price for schools.

The indexes on the disk are updated annually. 1995 copies became available during June as floppy disks, price £4 + VAT inclusive. Enquiries to BNSC Information Unit, on fax 01071-215 0936.

SPACE DIARY - SOME INTERESTING FACTS

11-15 September	University of Newcastle: British Association Annual Festival of Science (theme "Discoveries and Invention") Further details Fax 0171 973 3051.
11-14 September	University of Southampton: RSS95, Remote Sensing in Action. Further details, Remote Sensing Society Fax 0115 951 5249
11-12 November	In London, National Student Space Conference Further details, UKSEDS Fax 01795 520880
24 November	Doncaster. Resource IT - The New Technologies and the New Curriculum. Further details, Fax 0113 255 0752

EUROPEAN REMOTE SENSING SATELLITE-1

The European Space Agency has issued a CD-ROM carrying 88 images and results from the ERS-1 mission between 1991 and 1994. The images may be used freely for the purposes of information, training and education.

For further details write to ESA PR Division, 8-10 rue Mario Nikis, 75015 Paris, France.

FOR SALE - PLANETARIUM AT CALGARY, CANADA

The London Planetarium has received a letter, summarised below, which should appeal to anyone contemplating purchasing a planetarium:

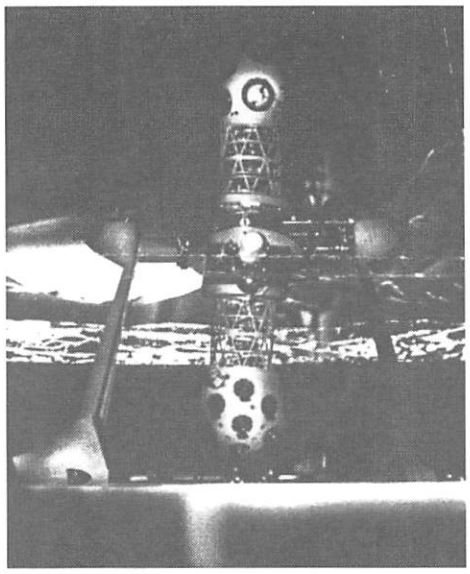
The Zeiss Planetarium Projector is a remarkable machine! Its impressively realistic representation of the night sky has introduced millions to the splendours of the universe and inspired generations of children to pursue career interests in science and technology. The Zeiss Projector is recognised world wide for its speciality in representing clear, bright, incredibly accurate stars and planets. It is a superb space and astronomy simulator; the training instrument for both astronauts and cosmonauts.

Until now, the cost of Zeiss Projector has limited the purchase of a machine of this calibre to only a select group of institutions. Due to imminent building renovations, the Alberta Science Centre's major Zeiss Planetarium Projector is now for sale at a price of less than 10% of the cost of a new machine.

This Zeiss has been superbly maintained by factory-trained technicians and will function in domes ranging from 16-22m in diameter. It was overhauled in the mid-1980s and continues to function flawlessly. Consultations with automation suppliers indicate that Calgary's Zeiss could be economically adapted to full computer control, with specifications similar to a new instrument.

The availability of this projector brings the cost of a planetarium within the reach of a college or university that needs to accommodate large classes or a military or civilian training centre that requires Zeiss quality to provide excellent navigation education. A school, museum or science centre could upgrade an existing planetarium with this Zeiss Planetarium or add a major new planetarium to the facility at remarkably low cost.

The projector may be inspected in daily operation at the Alberta Science Centre and it will be available for transit in mid-1994. Further details from the London Planetarium, Marylebone Road, London, UK.



The Calgary Planetarium.

CURRICULUM CORNER

UNDERSTANDING TELESCOPES - IN TWO PARTS

by Bob Kibble

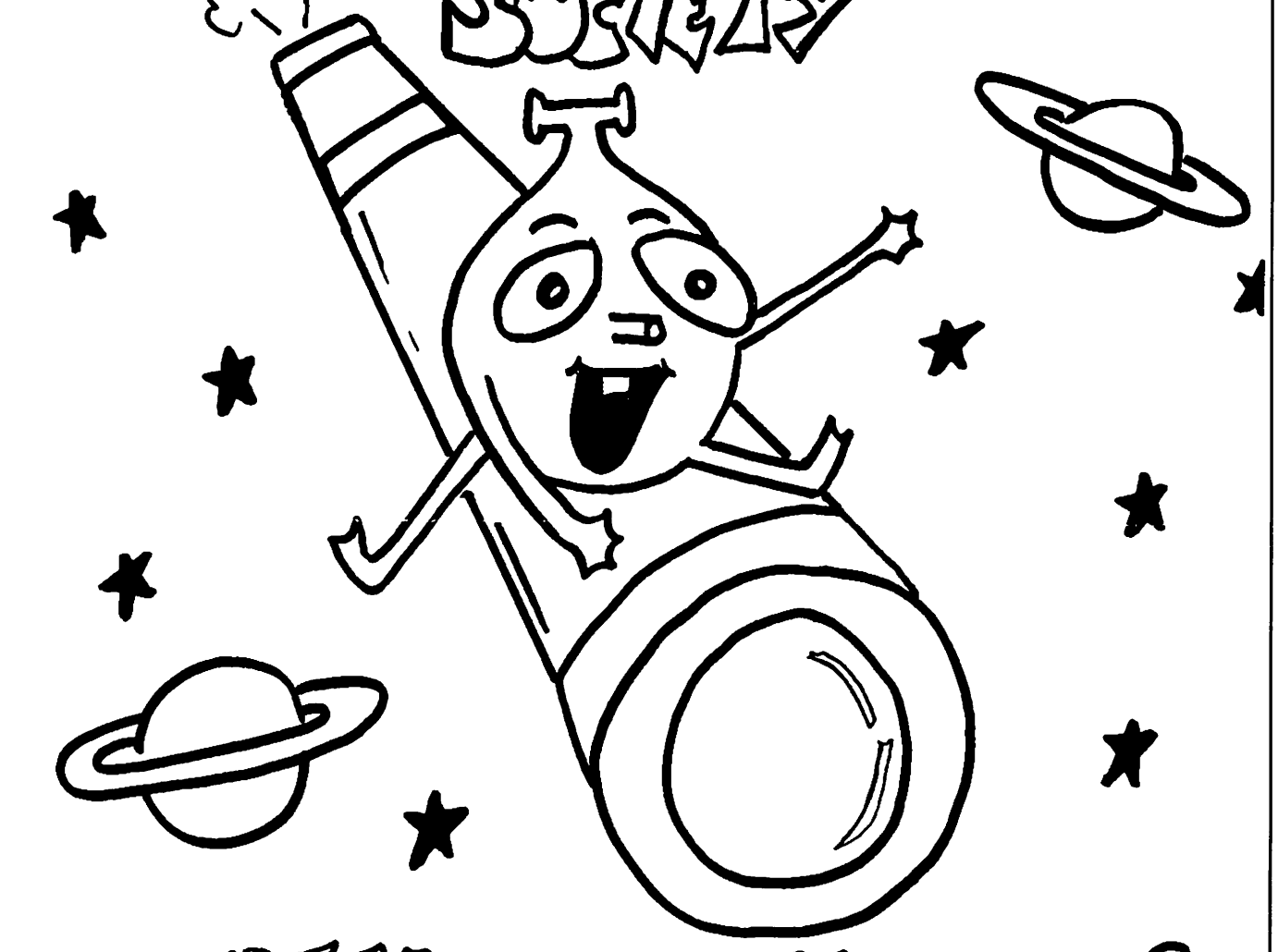
PART 2. MAKING OBSERVATIONS

In part 1 I introduced reflecting and refracting telescopes from a non-technical point of view and gave some advice on buying a first 'scope. In this part we look at some of the features which will help you to understand how best to use your telescope.

One of the first things you will notice when using a telescope for the first time is that the Earth is moving. If you are looking at a planet it will move across your field of view and at high power this might take less than a minute. To keep up with this movement you must "track" the object in question. If you are using a Dobsonian reflector or inexpensive refractor you will have to nudge your 'scope up a little, sideways a little and so on to keep pace with the object. The two axes of movement are up and down and side to side. Unfortunately stars and planets don't move vertically or horizontally. However it is possible to buy a special equatorial telescope mount. This has a polar axis tilted towards the pole star. Having found your object you can track it easily by moving your telescope around the polar axis. The object will remain in view. It is even possible to fit an electric motor to drive the polar axis around and so track star

continued on page 8

JUNIOR ASTRONOMICAL SOCIETY



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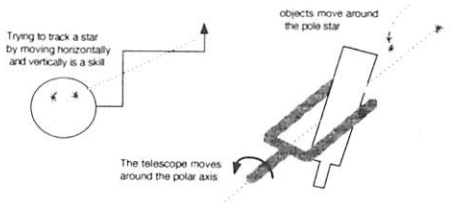
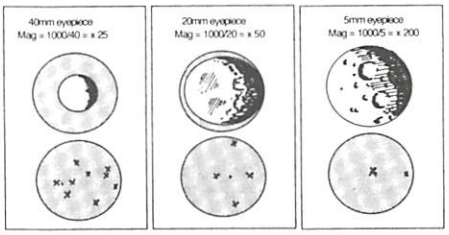


automatically. But this is for serious observers and is especially useful for long exposure photographs.

A question often asked is "how powerful is your telescope?" I'll interpret this in two ways. The first is "how much larger/closer does the Moon appear?" and secondly "what is the faintest/farthest thing you can see?" The clue to the first question is the magnification of the telescope, the clue to the second is the telescope aperture.

HOW BIG OR HOW CLOSE?

In part 1 I explained that the telescope eyepiece is a magnifying glass. The stronger the eyepiece the greater the magnification. Any telescope can be made to magnify more by changing the eyepiece. This means that the size of the Moon, say, depends mainly on the eyepiece. A simple calculation of the magnification factor is to divide the focal length of the objective lens or primary mirror by the focal length of the eyepiece you are using. A reflecting telescope with a primary mirror of focal length 1000mm might be used with either of three eyepieces, focal lengths 5mm, 20mm and 40mm. Figure 2 shows what this might mean if you are looking at the Moon and then a star cluster.



Low powers are best if you want to look at wider areas of sky such as a complete cluster of stars or if you are searching for a galaxy or comet. High powers are better if you want to look at details on the Moon or at a pair of very close stars for example. However the high magnification the faster the object appears to move across your field of view. Tracking becomes more difficult. Remember that all the vibrations caused by a breeze or your hands will also be magnified.

HOW FAR, HOW FAINT?

A tiny fraction of light from distant objects reaches the Earth. Large diameter lenses and mirrors are needed to capture as much of this feeble light as possible. High magnification can't produce more light. It just enlarges the light already there, in fact as you increase the magnification of a telescope the image appears dimmer because you are spreading the already feeble light over a wider viewing area. The only way to see more distant objects is to use larger mirrors and lenses to capture more light. One advantage of using a 150mm reflector rather than a 75mm refractor is that the larger reflector produces brighter images for you to see. Double the diameter of your mirror and you capture four times as much light. You'll be able to see fainter stars and more distant galaxies. However if you want to look at something bright like the Moon or Venus the extra aperture isn't so important.

GETTING THE MOST FROM YOUR TELESCOPE

Whether you have a 60mm refractor or a 300mm reflector here are some useful hints to help you succeed.

- Take care of your instrument. Cover the aperture when not in use.
- Avoid bright street lights or garden lights.
- Let your telescope and your eyes adjust to the darkness and to the outside temperature. Spend some time looking at the sky with just your naked eye.
- Have targets for your evening's viewing. Plan ahead. Keep a record of your observations either on sketch book or in a notebook.
- If you are observing away from home take a friend or adult for company and safety.
- Wear sensible warm clothing (socks, scarf, hat and gloves) - it always gets much colder than you expect.
- Don't fall into the magnification trap. There is much to enjoy at low powers.
- Get your friends, family, neighbours and teachers interested. Show them some of your favourite views.

Enjoy your astronomy.

Sky Diary Winter 1995-96

By Eva Hans

Solstice: 1995 Dec 22^{d} 08^{h} 17^{m}
Equinox: 1996 Mar 20^{d} 08^{h} 03^{m}

MOON PHASES:

New Moon	First Quarter	Full Moon	Last Quarter
	Dec 28^{d} 19^{h} 06^{m}	Jan 5^{d} 20^{h} 51^{m}	Jan 13^{d} 20^{h} 45^{m}
Jan 20^{d} 12^{h} 50^{m}	Jan 27^{d} 11^{h} 14^{m}	Feb 4^{d} 15^{h} 58^{m}	Feb 12^{d} 08^{h} 37^{m}
Feb 18^{d} 23^{h} 30^{m}	Feb 26^{d} 05^{h} 52^{m}	Mar 5^{d} 09^{h} 23^{m}	Mar 12^{d} 17^{h} 15^{m}
Mar 19^{d} 10^{h} 45^{m}			

MERCURY

Mercury is an evening object until January 13th when it becomes too close to the Sun for observation. It reappears in the morning sky from January 25th to March 19th.

VENUS

Venus is very bright in the evening sky. It comes into conjunction with Saturn on February 3rd.

MARS

Mars is too close to the Sun for observation.

JUPITER

Jupiter is in the morning sky in Sagittarius.

SATURN

Saturn is an evening object in Aquarius until the end of February when it becomes too close to the Sun for observation. It is in conjunction with Venus on February 3rd.

OCCULTATION

An occulation of Venus by the Moon happens on February 22nd. It is not visible from the UK.

METEORS

The Quadrantid meteor shower takes place between January 1st and 5th. The best night to view is January 3rd/4th. Before midnight the radiant is low and few meteors may be seen: however after midnight you may have more success. The hourly rate is variable but may be 50-100. The best direction is east. Unfortunately the Moon is almost full and its light will mask all but the brightest meteors.

For a free set of astronomical postcards please send a large sae to:
THE PLANETARIUM, SOUTH TYNESIDE COLLEGE, ST. GEORGES AVENUE, SOUTH SHIELDS, TYNE AND WEAR NE34 6ET.
TEL: 0191 427 3589.