GNOMON

Newsletter of the Association for Astronomy Education

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EDITORIAL COMMENT

The EARTH AND SPACE SECONDARY WORKPACK is now available. Copies may be obtained from Nik Steggall, Association for Astronomy Education, 38 Victoria Crescent, Birkdale Road, Dewsbury, West Yorkshire WF13 4HJ, England. Please send cheques made out to "AAE" for £9.70 per copy (add £1.20 per copy for overseas postage). AAE members are entitled to a 10% discount.

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Sales of the primary workpack have exceeded 10,000.

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We apologize to all those contributors who have sent in articles which were received too late for publication, and therefore do not appear in this issue. As explained in an earlier issue, we have to adhere to strict deadlines - these are the 19th of October, January, April and July.

* * *

We have not received the latest copy of the ASP "The Universe in the Classroom". To fill the breach, the centre pages in this issue are devoted to "NASA Educational Briefs". Readers' views on this publication are welcome.

* * *

A Merry Christmas and Happy New Year to all our readers.

FROM HELIOMETERS TO HAMBURGERS

Would you like to see the 72 inch mirror with which Lord Rosse discovered the spiral arms of the galaxies, the great Repsold heliometer used to measure early stellar parallaxes, and hundreds of other astronomical instruments? If so, don't go to the Science Museum, South Kensington, which officially curates them, for the entire astronomy collection has been removed from display to make way for the J. Sainsbury-inspired "Food for Thought" gallery. Heliometers are out, and hamburgers (plastic display models, of course) are in. To add insult to injury, you cannot even get a snack at the reproduction 1980's cafeteria which now stands where the telescopes once stood. "J. Sainsbury & Co." is everywhere.

The Nation's astronomical heritage is in store two miles away on the 3rd floor of the former Trustee Savings Bank Central Office building in Olympia. I am told that the buildings' real claim to fame is as a film set for Arthur Daley and company. But there again, you have to be pretty quick off the mark to get in, unless you are invited.

I know that professional and amateur astronomers are disgusted at what has happened, and that a petition is afoot to apply pressure to have our astronomical treasures to be made accessible once again. I can only encourage people to sign this petition if they get the chance. But you can also write to your local M.P. and Euro-M.P. But best of all, Societies can write to Dr Neil Cossons, Director of the Science Museum, asking for group visit admissions (costly for the Science Museum to organise and supervise) to the Olympia store, for if this inconvenience becomes regular enough, the telescopes might well get put back onto proper display. They are the Nation's property after all.

And if the Science Museum tells you that the collection is out of bounds, why not write to the Minister for Education and Science? (I would also appreciate a copy of any Science Museum refusal letters.) Let's have the heliometers back on display and the hamburgers in our mouths (real ones, of course), before "Arfer" offers the great Ramsden Equatorial to a punter at the Winchester Club.

ALLAN CHAPMAN

The above article is reproduced from the Newsletter of the FAS, by permission. Dr. Chapman is an eminent historian of science, in particular of astronomy, at Oxford University.

FAS HANDBOOKS

There are a few copies left of the Federation of Astronomical Societies Handbooks for the Years 1989, 1990 and 1991. They are available for the special price of £1.00 each from N. Steggall, Association for Astronomy Education, 38 Victoria Crescent, Birkdale Road, Dewsbury, West Yorkshire WF13 4HJ.

The 1993 FAS Handbook will be ready early in the new year. Anyone interested should get in contact with N. Steggall so the AAE will know how many to order.

A limited number of space items such as photographs, NASA press kits, publications, emblems, film, video tapes and NASA audio highlight tapes are available from N. Steggall. Please enclose a SAE with enquiry.

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.

Addresses for Correspondence:

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

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

Editor: Eric Zucker, 35 Gundreda Road, Lewes, East Sussex BN7 1PT - for all enquiries concerning the Newsletter. (Tel 0273 474347)

Advertising Charges:

Whole page.....£120
Half page £60
Quarter page.....£30
Inserts.....£75*

* These may be of any size which may conveniently be inserted into the newsletter. There may also be an additional charge for posting if the inserts are heavy.

The prices are for *one* issue.
A 25% reduction is made for advertising in all four issues.

NEW GALLERY AT THE OLD ROYAL OBSERVATORY

The Economist is sponsoring a new gallery at the ORO to mark the 300th anniversary of the birth of John Harrison, inventor of the Marine Chronometer. This will feature in the 150th birthday celebrations of *The Economist* in 1993. The gallery will be the centrepiece of the extensively redeveloped public displays at the Observatory, due to open on 24th March, 1993.

John Harrison (1693-1776) was one of Britain's greatest empirical scientists. His life was dedicated to the development of precision time-keeping. He is best known for his invention of the first usable chronometer which allowed the accurate determination of longitude at sea. This played a vital part in the charting of the globe and, by extension, in the growth and development of the British Empire.

Harrison's four extraordinary marine time-keepers will be the visual and thematic focus of the exhibition.

Their significance and their workings will be explained with the help of specially commissioned computer graphics. Harrison's work will be displayed in the context of the continuous search at Greenwich during the eighteenth century for a way of determining longitude by astronomy. During 1993 - Harrison Year - the gallery will include a number of important exhibits lent to the Observatory by other museums and institutions.

The day of the anniversary, 24th March, 1993, will mark the opening not only of the Harrison Gallery but also of the whole refurbished Old Royal Observatory complex, closed to the public since June 1992. Other remarkable features include the newly restored Octagon Room of Christopher Wren and a new gallery on modern astronomy.

For further information contact Susan Barber or Michael Barrett in the Press Office on 081-312 6725/45 direct or 081-858 4422 Museum line.

SPACE - LINK

Compiled by Nik Steggall

Space Shuttle Trivia

The US Space Shuttle Orbiters are able to withstand temperature ranges from –250°F in the cold soak of space to nearly 3,000°F at re-entry. During their first 49 flights, the Orbiters and their 148 astronauts have deployed more than 650,000lb of payload in space and have travelled more than 125 million statute miles during mission times of nearly five years. In addition to conducting more than 500 experiments, crew members have enabled at least seven malfunctioning spacecraft to achieve mission successes that could not have been accomplished by other means.

The Earth From Space

From space, Earth is characterised by its blue waters and white clouds that cover a major part of the planet. The Earth is surrounded by an ocean of air consisting of 78% nitrogen, 21% oxygen and 1% argon, neon and other gases. Atmospheric pressure is about 1033 gm/cm at sea level. Temperatures range from a maximum of about 60°C in places along the equator to a minimum of –90°C in its polar regions. In between, temperatures are more benign.

The Earth spins rapidly and has a molten core, giving rise to an extensive magnetic field. The atmosphere and magnetic field shield us from nearly all harmful radiation coming from the Sun and other stars, and the atmosphere burns up most meteors before they strike the Earth.

Satellites have added to knowledge about our planet. We now know, through them, that the Earth is surrounded by an intense radiation zone, the Van Allen radiation belts. We know that our magnetic field tends to arrange itself like the iron filings around a bar magnet, but is distorted into a teardrop shape by the solar wind. The narrow end of the Earth's magnetic field does not fade off into space, but has definite boundaries.

NASA's Hubble Telescope Explores Jupiter's Volcanic IO

Extended observations by the Hubble Space Telescope indicate that Jupiter's moon IO has a small atmosphere than previously thought with very dense regions possibly over volcanoes and surface frost.

The observations also show that despite continual volcanic activity, IO's surface has remained largely unchanged since first photographed by the Voyager spacecraft when it flew past the moon in 1979.

The Hubble observations mark the first time astronomers have been able to directly gauge the size of IO's tenuous atmosphere. Sulphur and oxygen emissions from the atmosphere indicate that it is at least three times smaller than previously thought - 1.5 IO diameters across instead of the previous upper limit of 5 IO diameters.

These observations show that the atmosphere may be patchy, with very dense regions having 1000 times higher pressure than adjoining, low-density regions. Likely sources for the atmospheric gas are sulphur dioxide from the volcanos, evaporation of surface frost in sunlit areas or material knocked out of the surface ("sputtered") into the atmosphere. The observations also confirm that the surface contains sulphur dioxide frost.

THE ASTRONOMICAL SOCIETY OF GLASGOW

Programme for 1993

All meetings are held in Room M403 of the University of Strathclyde's James Weir Building, Montrose Street, Glasgow, with the exception of Members' Night which is held in Room M413.

Meetings are at 7.30pm and our Beginners' Class takes place at 6.45pm, prior to the main meeting in Room M403.

21st January	MEMBERS' NIGHT	*Video, Slides, etc.*
18th February	TRANSIENT ASTRONOMICAL PHENOMENA	*Dr. Alastair Simmons*
18th March	THE HUMAN PERSPECTIVE - HOW BIG IS SPACE?	*Professor Archie Roy*
22nd April	UNDER THE SOUTHERN CROSS	*Mr. Malcolm Kennedy* (Presidential Address)

Admission to meetings is free and visitors are very welcome.

Subscription rates are £6.00 (adults) and £2.50 (16 years and under).
For this you will receive eight monthly newsletters and have access to a local observatory.

Ample opportunity is given at meetings for questions and discussion.

For further details contact Iain Cumming on 041-959 2795.

COLD AND CLEAR

by Roger O'Brien

Winter begins on the shortest day of the year, 21st December, 1992. When the clouds take a holiday, we get those famous, cold, clear winter nights. The stars glitter gem-like on a background of midnight blue velvet. You will hardly get a better chance to see the colours of some of the brighter stars - Betelgeuse and Aldebaran are reddish, Rigel is blue, Pollux is yellow and so on. As for planets, we are losing Saturn but Venus sets after sunset once the year turns. Don't forget that Venus is visible whilst the Sun is still up.

FOR autumn, I concentrated on the northern skies. Now, turn right around and look south. You will see a most striking group of constellations. The centrepiece is Orion. Three bright stars mark out the "belt"; they are evenly spaced in a straight line. Below the belt hangs the sword, which is made up of fainter stars. One of these looks rather fuzzy because it is not a star. It is the light of the very bright stars of the "Trapezium", reflected off a huge hollowed-out gas cloud, that we see as the Great Orion Nebula (also known as M42). It is only the brightest part of a vast cloud, which stretches way up through Taurus and Auriga. In the dark, hidden depths of this cloud and revealing themselves only by infrared and microwave radiation there are infrared sources, which are just starting out on the path of being true self-luminous stars. It is a kind of stellar nursery.

Below and to the right (west) of the belt and sword you can find a brilliant bluish star, Rigel. It is a super-giant star, very hot and very, very brilliant. To match the illuminating power of Rigel requires tens of thousands of our Suns. Perhaps it is a good thing that this fierce star is 900 light years distant from us. As far above and east of the belt as Rigel is below and west, you will see another bright star. It is definitely red in colour and not quite as bright as Rigel. Betelgeuse is another super-giant, but it has reached a later stage than Rigel. Betelgeuse is big enough to get the orbit of Mars inside it. Its surface glows a red colour because it is much cooler than Rigel; cooler, even, than our Sun. Many people think that Betelgeuse is the best candidate for a nearby supernova. However, images made by satellites and big telescopes show that Betelgeuse has already shed vast quantities of gas into huge spherical shells around it. If it does explode, its distance of 520 light years may seem rather close for comfort. Two other white stars complete the somewhat lopsided oblong outline of Orion. Bellatrix is the other "shoulder" (some say armpit) from Betelgeuse and Saiph is another knee from Rigel. Groups of fainter stars show Orion's head and right arm holding up a great club and left arm holding a shield (actually, I think it looks more like a bow).

You can do a bit of signposting and get some directions from Orion's belt. Take the line down and east and you'll run into a dazzling star. This is Sirius, the brightest star in the entire sky. It needs to be bright to stand out of its rather dull constellation, Canis Major, against the brilliance of Orion. Sirius is only 8.5 light years distant, which helps it to be bright from our point of view although it is about 25 times as bright as our Sun. Use Orion's shoulders as a signpost and run east along the line, till you come across a bright yellowish star. This is Procyon, the leading star of Canis Minor. It is odd that both the "dogs" are essentially one-star constellations for the naked-eye astronomer operating from Britain.

Now, try following the line of the belt upwards and locate a lovely rich constellation, Taurus (the Bull). This is an ancient zodiacal group. Aldebaran is the bull's angry, red eye. It is another bloated giant star: somewhat hotter than Betelgeuse, big enough to hold the Earth's orbit. A "V" shaped group of stars, nearby, is taken to represent the bull's snout. These stars are a true group and the ancient Greeks called them "the Hyades". At 130 light years, the Hyades are about twice as far from us as Aldebaran. Astronomers study the Hyades because the cluster contains a rich variety of different types of stars and is near enough to be well seen. When you let your gaze stray over to the west, you will see the Pleiades. This is a more distant group of younger brighter stars "fireflies caught in gossamer". There used to be quite a competition to judge who could see the most stars in the Pleiades, but you can only see the three or four brightest stars from built-up areas.

To the west of Taurus, is Gemini - another grouping that was decided upon in ancient times. There are two bright stars, Castor and Pollux, and two lines of not very bright stars. In January 1993, Mars will be in Gemini. You will be able to spot it because the planet is very red and brighter than any star nearby. And Mars will be retrograding until mid-February. You can track it between Castor and Pollux and down the railway of Gemini towards Taurus until it stops and resumes the "normal" motion back through the Castor/Pollux gate and on into Cancer, the crab. It was this occasional "wrong way" movement of planets that first gave astronomers the clue that the Earth goes round the Sun, not the Sun round the Earth. What happens is that the earth overtakes the planet at "opposition", when the Earth is between the planet and the Sun.

In the next issue, Roger O'Brien reviews a programme called "Skyglobe", used for generating star charts.

TELL THE TIME BY THE STARS

A star dial, which tells the time by the stars, has been devised by the Guernsey Astronomical Society (La Société Guernesiaise). It uses the changing orientation of the Plough, always visible from the British Isles, at different times of the day, month and year.

The cost is only 50p and there is a 50% discount for bulk purchase (25 or more).

The star dial is available from: David Le Conte, Belle Etoile, Rue du Hamel, Castel, Guernsey, Channel Isles (Tel: 0481 64847).

MEMBERS' ADVERTISEMENTS

These are free as long as they are of reasonable length

STARLAB portable planetarium for sale, complete with spare Northern Hemisphere cylinder. Mythological character cylinder. Lunar phases and miniature planets complete with spare bulbs and manual. £3,000. Tel: 0846 651135 - Sam Lyttle, 18 Helen's Drive, The Willows, Aghalee, Craigavon, Co. Armagh BT67 0HE.

POPULAR ASTRONOMY magazine, April 1981 to October 1991 (approximately 40 issues), £12.00. SPACEFLIGHT NEWS, 1-12, in binder, £10.00. SKY AT NIGHT, Volumes 1-7, £15.00. ASTRONOMY AND SPACE magazine complete (first 2 volumes bound), £10.00. YEARBOOK OF ASTRONOMY, 1962-1991, offers welcomed. Buyer pays postage. Brian Jones, 32 Myers Avenue, Bradford, West Yorkshire BD2 4ET.

ON THE ROAD

by Bob Kibble

I am writing this article following a hectic week during which I made two presentations on astronomy to two diverse audiences. As with most AAE activities these were in response to letters received and had to be fitted in to a full-time teaching schedule. The first was a one-hour workshop, one in a series of four, for the Greenwich Health Authority. My audience was a group of five residents, plus staff, in the psychiatric care centre at the Memorial Hospital. The patients (my term) made me most welcome and took an active interest in my slides and star boxes. This was perhaps the most mixed ability audience I have ever addressed. At one end of the table Mick insisted that Mars didn't exist and that Star Wars was in fact reality, at the other end Graham was keen to tell me about proper motion. Simone sat motionless and said nothing for an hour. Next week the group will visit Harry Ford at the Greenwich Observatory (no Mick, *not* Harrison Ford) and I return a week later. I am looking forward to hearing the group's stories about their visit -

we are all learning, perhaps none more so than me.

The following day I spent the afternoon at a primary school in West Wickham. My brief was to teach some Key Stage 2 National Curriculum astronomy to classes in year 6 (10-11 years). Armed with worksheets, wallpaper, sundials and telescope I arrived during lunch break to be advised that one teacher was on a course and "could the classes double up in one room for a two-hour session with you?" And what a session! I didn't need my activities as for most of the time we entered into a question and explanation session which covered everything from "Which is the biggest planet?" to "Is it possible that parallel universes exist?" I've rarely worked so hard or felt such rewards as I did with those fifty youngsters crammed into one room. At this tender age we explored concepts such as the curvature of space-time, time before the Big Bang and the scale of the Galaxy. I think that we covered ideas up to level ten, that's enough astronomy to last them up to A level. The important point to make here is for us in the AAE to recognise the amount of enthusiasm and wonder waiting to be triggered by a visiting "expert". It is worth juggling your work schedule to free yourself for a few hours to support local teachers and their classes and if you're dieting it's a sure way to lose pounds.

By way of a postscript, I received today a package containing fifty thank-you letters. Three pupils have already found Pegasus, two want to be astronauts and one wants to know if, as the Universe is shaped like a doughnut, is there jam in the centre?

Calling all Members

A fellow member, Howard Ilett, has written to me seeking assistance. Howard has been asked to provide an astronomy display in the Portsmouth and Southsea Natural History and Science Museum. He would like help, either advice or tangible financial support, in establishing an Archimedes computer + monitor and a video player + monitor (both with touch switch time control). If you can help Howard please contact him at: 22 St. George's Avenue, Warblington, Havant, Hants PO9 2RX.

Bob Kibble

LETTERS

Dear Editor,

Oh dear, oh dear; I am much grieved by all three of the winning entries in your Space Competition.

"Man has always looked up to the skies . . ."; "Man can travel to space . . ."; "Man has always gazed at the celestial heavens . . ."; "He can . . ." do this and "he has . . ." done that and the other.

Yes, I know that "man" is supposed (in some contexts) to mean "man and woman", and that "he" can (sometimes) mean "he and/or she". But there is an ambiguity between that occasional neutral use, and the normal gender-specific use.

Unthinking use of the male form just goes to reinforce people's unconscious assumptions. Think of "an astronomer" or "an astronaut"; unless you know a female one personally, I bet you think of a male figure.

It's so easy to avoid sexist forms. Try: "People have always looked up . . ."; "Humans can travel to space . . ."; "they can . . ."; "we have . . ." and so on.

After all, in Britain at least, man hasn't travelled into space, but woman has!

Yours sincerely,
Dr. Fiona Vincent,
Mills Observatory,
Dundee.

Dear Editor,

Simplicimus (*Gnomon* v. 12, No. 1) asks whether it is possible to see stars in the daytime by looking up a chimney. The evidence for this very old story was examined carefully by Dr. D. W. Hughes of Sheffield University (*Quarterly Journal of the Royal Astronomical Society*, v. 24, p. 246, 1983). Suffice to say that Dr. Hughes discovered that no *astronomer* who actually tried the experiment was ever able to see daytime stars in this way. All other such reports either were hearsay, or came from untrained observers: miners, navvies, excavation engineers, chimney sweeps, etc.

Taking into consideration the small area of sky subtended by various types of chimneys and mineshafts, Dr. Hughes concluded that the average likelihood of even a 4th magnitude star appearing in the opening at any one time was fairly low. In a brightly-lit urban sky, such stars are difficult to spot even at night! He suggested that the most likely explanation for such reports was sunlit debris blown upwards by the natural updraft of the chimney or mineshaft.

Observing a star in daytime (or, for that matter, at any time) is a problem in *contrast:* the light from the star must exceed the background light per unit area of sky by a certain amount to render it detectable. Glare is a secondary problem; the use of a chimney does not reduce the light per unit area from the sky. Aside from the Sun and Moon, only Venus, Jupiter and Mars (near favourable oppositions) might be seen against the daylight sky even through a chimney. Venus is bright enough to see easily in full daylight without a chimney, and I have often made this observation myself. Jupiter is a far more difficult target, and I cannot claim more than marginal success although I was able to follow it for a few minutes past sunrise, many years ago, in an exceptionally clear sky.

We sometimes give successful public demonstrations of the visibility of daytime stars using telescopes at the University of London Observatory. The contrast between the star and sky is enhanced in proportion to the aperture of the telescope relative to that of the unaided eye. But finding the stars requires accurate setting circles!

Yours sincerely,
Mike Dworetsky
University of London Observatory.

INTERNATIONAL SPACE YEAR - 1992 COMPETITION

(Sponsored by the Michael Penston Fund of the Royal Astronomical Society)

Design a poster with the theme SPACE EXPLORATION and write a paragraph of up to 200 words explaining the main concepts of the work.

The First Prize is a trip for the winner and an accompanying adult to ESA's European Space Research and Technology Centre at Noordwijk, Holland, including a tour of the facilities. There are other prizes.

Every entry will be acknowledged.

1. The entries must be the original work of the entrant and should be no larger than size A2 (410 x 594mm).
2. The competition is open to those aged over 14 years but under 19 years on 1st September 1993.
3. Entries should be sent to: ISY Competition, c/o The Executive Secretary, The Royal Astronomical Society, Burlington House, London W1V 0NL., to be received not later than 11th December 1992.
4. The entrant's name, date of birth and address for correspondence must be clearly written on the back of any material submitted.
5. The winners will be notified by post by the end of January 1993. The full list of winners may be obtained by sending a stamped addressed envelope with your entry.
6. A selection of winning entries will be displayed at the Royal Astronomical Society.
7. The winning entry and a list of the main prizewinners will also be published in "Astronomy Now".
8. The Royal Astronomical Society reserve the right to use the material in any other circumstances.
9. The judges decision will be final and no correspondence can be entered into.

This notice was received too late for RAS's deadline, but late entries *MAY* be considered.

CO-ORDINATED BY BOB KIBBLE

FROM THE NORTHAMPTONSHIRE SCIENCE CENTRE

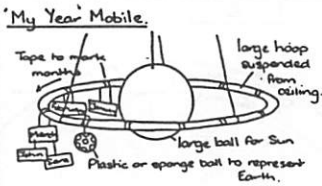
A book is being prepared (published in 1993) suitable for primary school children. Some extracts from the book, **which is still in draft form**, are reproduced below. Congratulations to Mick Revell from the Science Centre for producing this work.

Objective: To observe and record the annual cycle.

- It is not necessary at this stage for the children to know that the Earth is moving round the Sun but this may be a useful way of introducing the idea.
- Remember - the Earth goes round the Sun in an anti-clockwise direction as seen from above.
- Alternatively this may be displayed as a wall chart using 'Velcro' tabs to attach a tennis ball or sponge ball 'Earth'.

You will need:
Large hoop. Large ball (Sun), small ball (Earth), string, hook, coloured tape, steps!

'My Year' Mobile.



1. Use coloured tape to divide hoop into twelve sections to represent months.
2. Suspend hoop and large ball from ceiling.
3. Hang small ball from the hoop to represent Earth and move each month.
4. Add birthdays, festivals and other special events as Earth passes the month.

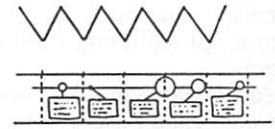
Objectives: To appreciate the scale of the Solar System.

- Use a long piece of card that has been folded in zig-zag fashion to form ten pages.
- Use a scale of 1cm = 100 million km.
- Children mark the position of the planets which may not correspond exactly with a complete page.
- The reverse pages of the book could be used for creative writings, poems, imaginative drawings etc. about the planets.

You will need:
Sugar paper or thin card for book 12½cms long, reference material.

Zig-Zag Book

- Fold your piece of paper or card to make a zig-zag book of 10 pages.



- Start with the Sun on page 1.
- Find out all you can about each planet.
- What do you think it might be like to live on a different planet?
- Draw a picture of what it might be like.

Objectives: To appreciate the relative sizes of the Planets.

- A feely bag is easily made by threading elastic through the top of a shoe bag.
- As the children identify a planet they pull it out and place it in its correct order so that, having pulled them all out, they can see whether or not they were right.
- Look in the Fact File to find out which planets are visible in the night sky.

You will need:
A collection of appropriately sized balls and beads. Feely bag.

Lucky Dip.

- Don't Look! Put your hands in the Feely bag.
- Feel the relative sizes of the spheres in it.
- Which 'planet' do you think you have in your hand?

Objectives: To learn the names of the planets in order.
To develop creative language.

- A mnemonic may help the children to remember the names of the Planets.
e.g. My Vessel Emptied Melon Jam Suddenly Upon Nonna's Pinny.
- It's also fun.

Extension Activity.

- Try to invent an acrostic.
- Write a jingle or song.

You will need:
Paper, pencils, crayons etc.

Mouldy Jam Sandwiches.

- Most Volcanoes Erupt Mouldy Jam Sandwiches Under Normal Pressure.
- A mnemonic is a short sentence that helps us remember the names of things.
- Can you make up a mnemonic to help you remember the names of the Planets in order?
- Draw a cartoon of it.

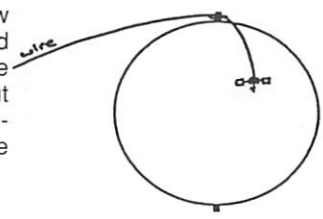
MAKE SPACE FOR A SATELLITE IN YOUR CLASSROOM

by Bob Kibble

Some schools are lucky enough to have a direct satellite link station. Commercial stations which display weather images are available from lab equipment suppliers. Many pupils will have a satellite TV dish at home or at least will identify one in their street. This piece illustrates a few ways in which a focus on satellite links can provide learning opportunities which directly address a number of statements of attainment in science at Key Stages 3 and 4, particularly at the higher levels. The work is presented to you from an interested amateur and as such incorporates a degree of teachers' artistic licence.

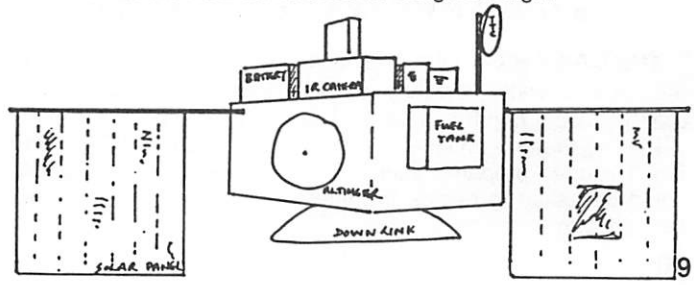
1. Extending your Earth Globe

With some steel piano wire and cardboard models you can show the scale of geostationary and polar orbits. From a 30cm globe a polar satellite will orbit at about 2cm from the surface and a geostationary at about 1m from the surface.

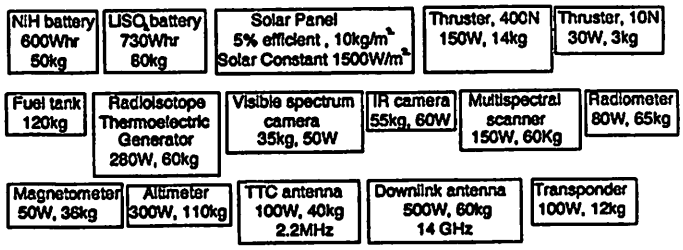


2. Build your own Satellite

Don't throw away all those boxes which you unpack each year in September. Save them and use them to build a satellite. University students have recently designed their own satellite and launched it via the shuttle. Here is your chance to make a model of your own. In my model each component is identified by a labelled box. Solar panels can be made from newspaper and dowelling, transmission dishes from circles of card. The prototype of BOBSAT 1 was assembled at the recent "Training the Trainers" session at Jodrell Bank. BOBSAT 2 will be launched at the ASE conference in Loughborough.



The DIY, a la carte, satellite menu:



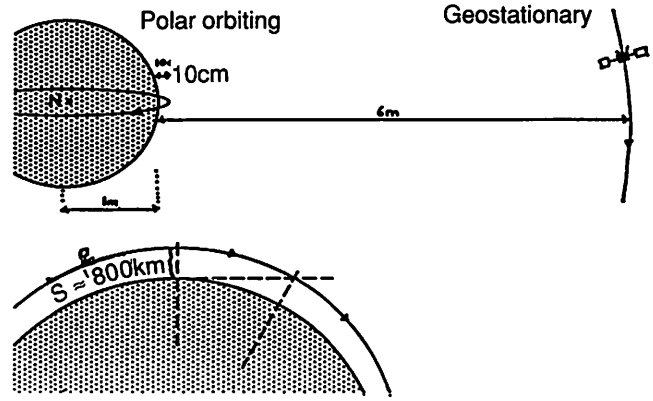
With the satellite assembled, pupils can calculate total mass and power requirements. Calculations using F = ma and momentum are possible. Also time of flight calculations using the speed of light in time delay and downlink contexts. Problems of launch energy, potential energy and gravitational force are developments. The language used during this exercise employs ideas from dynamics, radiation, forces and astronomy.

Your finished model is likely to be about 1/4 full size and will look remarkably like any of photos or drawings of the real thing. Just large enough to suspend from a ceiling at the next parents' evening!

3. Calculating the Period

A geostationary satellite will orbit with a period of 24 hours, hence its apparent fixed position. Domestic TV dishes point to such satellites. Three satellites are needed to cover virtually the entire planet. Polar orbiting satellites are used to record images from the ground. Their results make for excellent wall displays. Posters are available.

With some chalk and a length of string you can sketch the paths of both types of satellite on your classroom floor. Use a scale of 1m = 6000km.



The Polar Orbit Period

Assume g = 10m/s² use $s = \frac{1}{2}at^2$ to calculate the time to free-fall to the Earth. In this time the satellite will have reached the dotted line in our sketch. On your scale diagram measure the angle of orbit and then extrapolate to a complete revolution. This will give the period of a typical polar orbit satellite. Now look out on a dark night and see one for yourself!

GRAVITY AND TIDES

by Dr. Anne Cohen

While on holiday at the beach, we experienced exceptional high tides. The water pounded the sea wall and washed over the jetty in spectacular fashion. "Spring" tides are higher high tides than normal and occur about twice a month, but this particular week we had even higher high high tides than usual. (YES! Three "highs"). It set me along a train of thought that can be followed in the classroom in pursuit of the Programme of Study for Key Stage 4 of the Science National Curriculum which specifies that "The idea of gravitational force should also be applied to tides . . .".

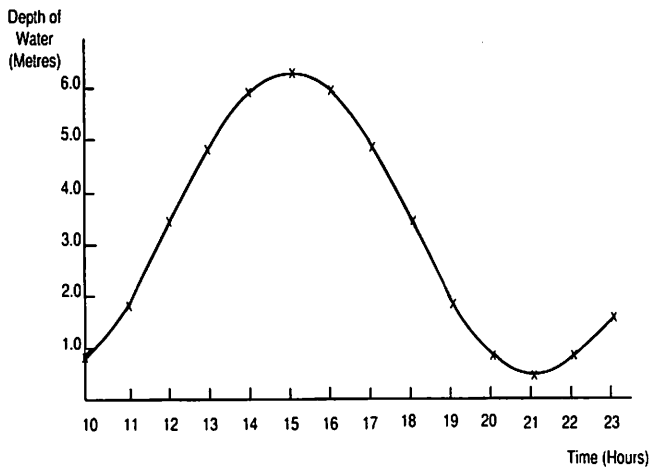


Fig. 1. Depth of Water at a Jetty during one Day.

THE DAILY HIGH TIDES (The first "high") - by measuring the depth of water at a jetty at hourly intervals during a day, a graph of water depth against time can be plotted Fig. 1.

Plotting these is an exercise most classes could achieve, and Fig. 1 is one I prepared earlier (in Blue Peter style). The pupils could be asked to decide the time of high tide, low tide, next high tide etc.

The explanation of this involves the Moon and the Earth's daily spinning on its axis. The Moon's gravitational pull on the oceans raises a bulge on that side of the Earth. As the Earth spins, this bulge of water passes round the Earth. But this does

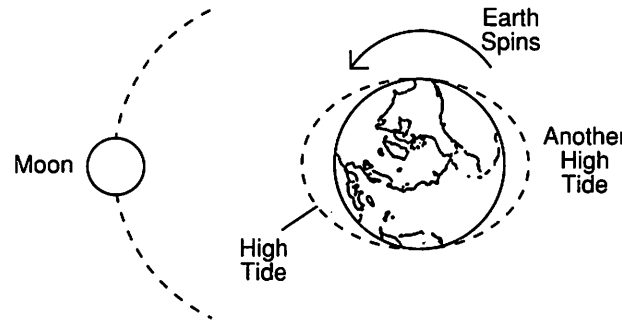


Fig. 2

not explain why there are two high tides in every 24 hours. To understand this you have to know that the force due to gravity diminishes with distance. The Earth's rocks also feel the Moon's pull, but less so than the water on the Moon's side. The water on the far side from the Moon feels the pull even less and is "left behind" in the second bulge:

SPRING TIDES AND NEAP TIDES (The second "High") - every month the height of high water varies (and so does the level of low water). By taking data from a local Tide Times publication, it is possible to plot a graph of the height of high tide against the date. This is shown in Fig. 3, which also shows the dates of Full Moon and New Moon: April 17, May 16 for Full Moons, April 3, May 2 and June 1 for New Moons.

The explanation of this effect requires the understanding of how the Moon and Sun are positioned with respect to the Earth at these times (Fig. 4), since the Sun's gravitational pull also helps to raise tides.

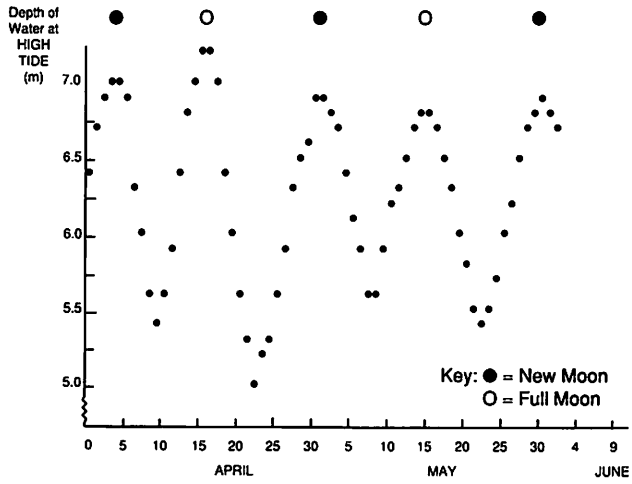


Fig. 3

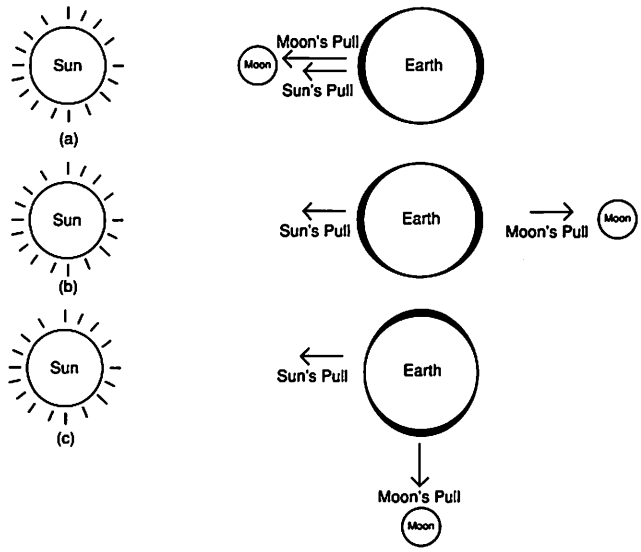


Fig. 4
NOT TO SCALE

Spring Tides occur when the Moon and Sun line up in our sky and pull in the same direction, (a). This is at New Moon. It also happens at Full Moon (b).

Neap Tides occur when the Moon and Sun pull the tides in directions at right angles.

THE HIGHEST SPRING TIDES (The third "High") - variations in the height of the Spring Tides are caused by the slightly varying distance of the Moon from us. Thus its gravitational pull changes enough to change the tide height. The Moon's orbit is slightly elliptical and if it happens that the time that it is nearest Earth also coincides with the time of New Moon the tidal pull is exceptionally strong. This happened on July 31 this year, and the corresponding height of the highest Spring Tide on that night was 7.5m, much higher than any Spring Tide in Fig. 3.

BOOKS

The Amateur Astronomer's Pathfinder, by Colin Humphrey, published by John Wiley & Sons, 1992, ISBN 0-471-93452-6, £14.95, hardback.

The term Amateur Astronomer covers a broad spectrum from rank beginner to seasoned members of a local society. Here is a book to whet the appetite of those who are just starting out on the grand tour.

The book is divided into three sections. The first starts with a brief introduction of historical background, basic terminology and scale and then explores the Solar System, each object being given a double page spread. The tables of planetary data, the colour illustrations and photographs are produced to a high quality on large, glossy pages. They will no doubt capture the imagination of aspiring young minds. The layout of text and illustrations is well planned and complementary, however sentence length and complexity will be off-putting to the younger or slower reader. In general this first section works well.

To introduce the next section, Looking at The Night Sky, John Wiley has teamed up with Broadhurst Clarkson and Fuller to provide a discount of about 15% on each of two telescopes, a 4.5" reflector and a 60mm refractor. This development is to be commended. A similar discount on a pair of binoculars would have completed the trio especially as the author recommends them in this section. Unfortunately the newcomer with such an instrument will be disappointed following this middle section. It is well written with excellent colour images but falls between an armchair/coffee table guide and a useful guide to the user new-observer. After spending £295 at BCF and not seeing M81 as depicted in all its orange-blue false colour glory will you be wanting your money back? I appreciate that this is a difficult area but a section on observing which links itself to real instruments ought to focus more on the sort of observations which the beginner will relate to. For me the excellent pages on "hints for practical astronomy" lead to a cul-de-sac. Some photographs of planets, double stars, clusters, Jovian Moons, Lunar craters etc. as seen through a small instrument together with suggestions on projects and recordings would have been welcome and might have tempted the GCSE astronomy student to invest in a copy.

The final section, "Probing Space and Time", introduces the wonders of modern, technical astronomy. Radio telescopes, black holes, quasars and cosmological theories are made accessible through clear graphics and good photographs. There is a strange, perhaps misplaced, appendix page discoursing on atomic physics and a handy glossary of terms.

The Amateur Astronomer's Pathfinder will have to compete in what has become an increasingly competitive market. Its strength is the quality of its presentation. At £14.95 it will find favour as a gift at Christmas and birthdays and as a reference in school libraries.

Bob Kibble

Astronomy for Every Kid, by Janice Van Cleave, published by John Wiley, ISBN 0-471-53573 (paperback, £6.95), 1991.

As secretary of an astronomical society I am periodically asked to be a guest speaker at local schools. Inevitably, this means that the pupils expect something out of the ordinary, and so I am always on the lookout for fresh ideas for getting the message across in a brief but bright presentation. As these are one-off affairs (yes, I am occasionally asked to come back, but by then there is a new set of pupils), they have to be stimulating, hopefully memorable, and impart just a few key points.

Demonstrations and simple projects are useful in these circumstances, and so it was with considerable interest that I found this book, subtitled "101 Easy Experiments that Really Work", with children aged 8 to 12 in mind. I recently tried out a few of the experiments during a prep school's project week in which 35 boys spent two hours on the subject of Motion in Space.

One of the most effective experiments required four boys to swing small weights in circles on strings cut to the relative lengths of the orbital radii of the inner planets, as slowly as possible while keeping the strings taut. The onlookers immediately spotted that the shorter the string the faster it had to be swung to keep the weight in "orbit".

One project I could not get to work satisfactorily (a two-stage rocket using balloons and a paper cup), and one I modified (escape velocity using a magnet and small metal balls - I found blowing through straws more convincing than rolling the balls down a ramp). But the others worked well, and seemed to help the boys grasp the concepts involved.

A simple spinning disc suspended by a string gave an effective demonstration of

the stabilising gyroscopic effect of spinning planets and the reason for setting a satellite spinning.

The boys' favourite experiment, however, involved throwing small bead "spacecraft" at a swinging pendulum Moon, while judging the direction and timing of the spacecraft launch.

Experiments on aspects of the Sun, Moon, stars and space are provided, each one covering two well-illustrated pages. The descriptions are clearly presented, in a uniform format: purpose, materials (mostly household items), procedure (step by step instructions), expected results, and a reasonably scientific explanation. Most would only take a few minutes to set up and carry out, and many could easily be done from start to finish by older children.

As the author says, the introductory purpose for each experiment gives the reader a clue to the concept without giving away the mystery of the results. I found the mostly single-word titles of each experiment did not give much away either - they could have been more descriptive - it was difficult to find again ones which I had noticed while skimming through the book.

This is only a minor comment on a well-organised, inexpensive little book, brimming with ideas, and I would heartily recommend it.

David Le Conte
La Société Guernesiaise,
Guernsey.

"Space", by Roy Gibson, published by the Oxford University Press, ISBN 0-19-858343-5 (price £15.95).

This book is part of the Science, Technology and Society Series. It gives an authoritative account for the non-specialist of the great variety of human activities in space.

Written by the former Director General of the European Space Agency (ESA) and also of the British National Space Council (BNSC), he first surveys the history of the subject and describes the various systems available for putting payloads into space. He then considers manned space flights, space science, and the other uses of space such as telecommunications and Earth observation. He surveys what is being done by the various countries that are engaged in space activities of one kind or another and discusses the commercialisation of space. In a postscript he considers what activities in space may have to offer for the future.

Essentially this book is a personal quick look review of all aspects of spaceflight activity. Having been in the thick of decision making of many space programmes, he is well versed in space technology. "Space" must surely be a book that can be called upon for the very basic information required to explore the vast areas of space. Being written in everyday terms, it is a must for any library and is also an asset to any instructor on space technology.

Nik Steggall

Guide to the Sun, by Kenneth J. H. Phillips, Cambridge University Press, 1992, ISBN 0-521-39483-X, (hardback, pp 386, £1.95).

What a delightful book! Even the four pages of the dust-cover provide useful information, and the book certainly lives up to the few words of introduction: a brief overview of sun worship and mythology, the Copernicus controversy and the introduction of the telescope, the complexity of the Sun and our present understanding of it - its surface and interior and its interaction with the bodies of the Solar System, including the Earth. The book discusses the latest developments in helioseismology and the search for neutrinos, how the Sun was born and how it will die. There is a section on utilizing solar energy and how this presents a serious alternative to the burning of fossil fuels. Finally, the book includes a description of the equipment used for solar investigation, not forgetting methods of observation by amateur astronomers with small telescopes.

The intended level of the book is that of the *Scientific American* or *Sky and Telescope*, and therefore it uses the bare minimum of mathematics. The diagrams and photographs are of high quality and there is a comprehensive bibliography. The book may either be read from cover to cover - it is very readable - or used as a work of reference. It is interesting to note that even a book of this standard carries a "health warning" about the dangers of solar observation.

The author works at the Space Science Department of the Rutherford Appleton Laboratory. I thoroughly recommend the book to all those who would like to know more about our nearest star.

Eric Zucker

HALYARD COMMUNITY OBSERVATORY

Halyard High School Community Observatory at Luton, Bedfordshire, was formally opened by the Astronomer Royal (Professor Arnold Wolfendale) on the 9th November 1992. A two-day astronomy event subsequently took place on the 10th and 11th November, attended by primary school children from local schools.

Work on the Observatory is now virtually complete, and all that is left to do is the installation of a 300mm Cassegrain telescope with two IBM PC computer systems.

Halyard School has produced (as a press release) a 16-page booklet giving details of the project, and readers are wholeheartedly recommended to acquire copies. They may be obtained, on receipt of a remittance of £1.00 (which covers postage and packing), from: Mr. Nigel Rumble, Halyard High School, Emerald Road, Luton LU4 0NE (Tel: 0582 601221).

Sky Diary Winter 1992-93

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

Solstice :	Dec	21^d	14^h	43^m
Equinox :	Mar	20^d	14^h	41^m

MOON

New Moon	First Quarter	Full Moon	Last Quarter
Dec 24^d 00^h 43^m	Jan 01^d 03^h 38^m	Jan 08^d 12^h 37^m	Jan 15^d 04^h 01^m
Jan 22^d 18^h 27^m	Jan 30^d 23^h 20^m	Feb 06^d 23^h 55^m	Feb 13^d 14^h 57^m
Feb 21^d 13^h 05^m	Mar 01^d 15^h 46^m	Mar 08^d 09^h 46^m	Mar 15^d 04^h 17^m
Mar 23^d 07^h 15^m			

MERCURY Cannot be seen in January, but it is an evening object around February 20th when it will be seen a few degrees south of the crescent Moon.

VENUS A brilliant evening object setting about 4 hours after the Sun. The crescent Moon will be a few degrees north of Venus on 26th January. It starts to fade in March.

MARS Visible most of the night from January to March.

JUPITER Rising about midnight at the beginning of the period, visible all night by the end of this period.

SATURN Too close to the Sun to be observed.