GNOMON

Newsletter of the Association for Astronomy Education

Vol. 22 No. 1 | ISSN 0952-326X | AUTUMN 2002

UK steps up role in the Global Hands-on Universe

The 2002 conference of the Global Hands-on Universe was held at the Université Pierre et Marie Curie, Paris, July 24 - 29. This was the largest international gathering organised by the Hands-on Universe groups, with about 80 representatives of branches from across the USA, Europe, Japan, Russia and Africa. The latter was represented by representatives of the group in Senegal, established by Suzanne and Michel Faye, two of the leading lights of HOU-France who were hosting this gathering.

The Hands-on Universe project was established in the early-1990's by Professor Carl Pennypacker, a supernova hunter based at the Lawrence Livermore Labs of the University of California, Berkeley. The HOU website (💻 www.hou.lbl.gov) outlines the project goals. It is an educational programme that enables students to investigate the Universe while applying tools and concepts from science, math, and technology. Using the Internet, HOU participants around the world request observations from an automated telescope, download images from a large image archive, and analyse them with the aid of user-friendly image-processing software.

The successes of the HOU programme include the first-light observations of SN1994I discovered in images of M51 taken by high school students, and several asteroid discoveries made by schools, including the Kuiper Belt object 1998 FS144. (☛ page 2)

Brian Ellis

The Association is very sad to report that member Mr Brian Ellis, Head of Physics, Ilfracombe College, died in a climbing accident in the Massif de la Belledonne this summer.

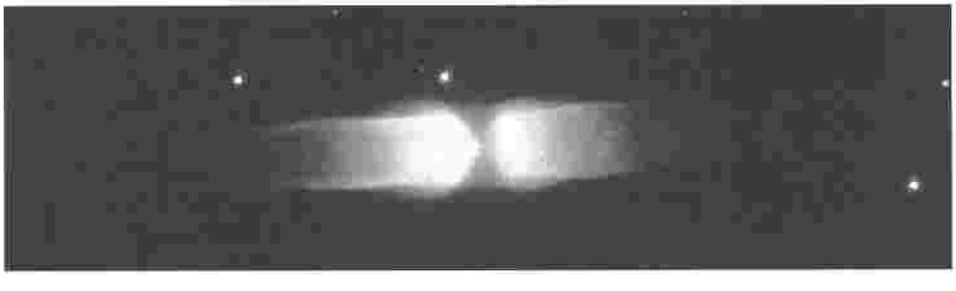
Recycling in progress

An incredibly elongated planetary nebula, showing the heart of a cosmic recycling region powered by a dying star, is one of the latest of the images to be released from the Hubble Space Telescope.

The discovery has raised some intriguing questions as to how a star sheds heavy elements into space in the final stages of its active existence can take up such an elongated shape. When a dying star sheds outer parts of its atmosphere into space it exists as a planetary nebula only as long as the star still has fuel to burn, which is a very short time on the cosmic scale.

Listed as Henize 3-401, the nebula appears to be composed of two almost cylindrical outflows with threadlike intricate structures throughout, and ragged ends. The central star responsible for the nebula can also be seen. The bi-polar form of some planetary nebulae has frequently been observed, but the extreme elongation seen here may be due to the nearby effects of a neighbouring star, or to magnetic fields associated with the central body. The object was found in Carina and is at an estimated distance of 10,000 light years.

(Photo: European Space Agency and Pedro Garcia-Lario (ESA ISO Data Centre)



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Advertising Charges:

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Publication Dates:
These are at the equinoxes and the solstices, that is four times a year. Copy deadlines are six weeks before these dates.

(☛ from page 1) Supported by 22 trained classroom educators in the USA, and several dozen professionals and amateurs worldwide, HOU programmes are thought to be used in around 500 classrooms globally, with a total of about 700 teachers and 250,000 students involved.

Whilst supported by a number of professional astronomers and observatories, most notably Yerkes Observatory and the Adler Planetarium, the lack of access to professional-standard astronomical data and support has been a problem for the project in the past. However, at the Paris meeting a number of new projects were discussed which should greatly increase the Global HOU access to astronomical data.

A variety of telescopes

The largest aperture instruments that will regularly "donate" data to the HOU archive will be the two 1.2m Monet telescopes, located at the McDonald Observatory of the University of Texas, and at the Sutherland Observatory in South Africa. With the capital costs funded by the giant Krupps steel corporation, and an educational programme focussing on the Ruhr Valley region of Germany, these (primarily research) telescopes will greatly increase the HOU access to fresh data.

In addition, several projects were described where small (0.4-0.6m) robotic telescopes (typically off-the-shelf Meade and Celestron set-ups, with Paramounts and computer controls) would be accessible via the Internet, in a manner similar to the plans for the Liverpool Telescope and National Schools Observatory.

The most advanced of these seem to be in Japan, where the Univ. of Toyko is collaborating with HOU in providing access to a number of small instruments. These include KIT, a robotic Meade LX200 12-inch telescope equipped with the CATS-i remote control software and an SBIG ST8E CCD camera, located on the rooftop of the science museum in Tokyo, and operational since summer 2001). There are also collaborative projects where limited numbers of images are available from the giant 8-metre Subaru telescope on Hawaii.

Radio astronomy is also featured strongly in the HOU portfolio, with both Spanish (X-ray binary monitoring in collaboration with the University of Barcelona, using spare time on a NASA facility in Robledo) and Japanese (using the giant 45-metre Nobeyama radio/mm dish) involvement.

The UK currently has no formal links with HOU, a situation which, it is hoped, will change in the near future. Several UK astronomers and educators have attended recent meetings, including representatives of the Liverpool Telescope/NSO project (Mike Simcoe), the Faulkes Telescopes (Richard Beare, Paul Roche), the European OPTICON network (John Davies, ROE), and Highgate School's David Smith, Europe's leading light in the Mount Wilson "Telescopes in Education" programme. Clearly, the Liverpool and Faulkes Telescope projects have much in common with HOU, with an emphasis on the excitement of discovery from scientific investigations of real astronomical data.

The conference highlighted a number of key issues. The group as a whole has a great deal of expertise and experience in education, astronomy and software areas, but lacks a clear goal and a unifying focus (and funds!). The clear message from this meeting was that whilst individual members were doing great things at a local level, and occasionally on a larger, regional, scale, there was little communication and collaboration taking place between individual countries. The leading players seem to be the USA, Japan and France, with smaller scale but equally impressive programmes running in other countries. The representative of HOU-Poland was particularly keen that all international HOU resources be translated into English, so that he and his collaborators could eventually translate them into Polish! He spoke "only" four languages, but none of them was French, in which many of the new on-line Global HOU resources are available!.

I was very impressed by the range of activities being carried on under the HOU banner, and by the recognition at this meeting that things had to change, and quickly, if the vision of a global HOU community was to be realised. To this end, HOU-France is co-ordinating a bid to the EU Framework 6 programme for 2003, and I hope that the UK can eventually become a part of the network. The Faulkes Telescopes Project is hoping to be able to work with Global HOU and provide access to data from the Hawaiian and Australian telescopes, and the NSO's International Schools Observatory programme would seem another obvious area for collaboration.

All in all, Global HOU has come a long way, but in a very fragmented (if dynamic!) fashion. It has a lot of potential, especially if it can gain access to more archival telescope data and establish stronger communications between member states. I hope that a HOU-UK section will be operational within a year, and will be acting as the main HOU contact within the UK to try and set things up. Anyone interested in participating please contact me at the Faulkes Telescope Project, University of Glamorgan.

Paul.roche@faulkes-telescope.com

Dr. Paul Roche

Jean lays down her notepad

The AAE owes many thanks to Jean Collins who has been a member of the AAE Council for five years. She has stepped down as Secretary to concentrate on her educational projects in Leicester and with the British Association.

Jean dealt effectively with many inquires from members and the general public as well as dealing with the Council business. This last January she looked after the stand that the AAE set up at the ASE Annual Meeting in Liverpool.

We welcome Anne Urquhart-Potts (Cohen), a previous President of AAE, who takes over from Jean.

AAE President, Francisco Diego, writes: Having Jean Collins on board has been a great experience. She is a very resourceful and organised person, always ready to help and to come immediately with practical solutions. I specially remember our first experience as exhibitors at the ASE in Liverpool, when she organised our stand, including a beautiful vase with flowers that made all the difference. The AAE also had quite a few new members recruited by Jean.

No doubt she will still be around and come with many activities for us to participate in. Thank you Jean for all your hard and professional work!

Apologies for lateness in advance

The Editor will be in Australia in search of a sunset eclipse of the Sun (see the *Sky Diary*, page 8). The usual early press date for *Gnomon* (because of the Christmas holidays) will be impossible to meet. So the next issue will be late, a New Year edition! So may I take this opportunity to be one of the first to wish everyone a happy and peaceful Christmas, and all the very best for 2003.

Special Events for World Space Week

The United Nations has declared October 4 to 10 of every year to be "World Space Week". More information is available at: http://www.spaceweek.org

World Space Week will be an international celebration of the contribution that space science and technology makes to the betterment of the human condition.

Events at Odyssey, Belfast, have been announced that include the Schools' Lecture, *Death of the Dinosaurs* by Dr Alan Fitzsimmons on October 4 at 10.30 am and 12.00 noon at Queens University.

The Special Evening Lecture is *The Century of Space Science* by Martin Huber, October 4 at 5.00 pm. Contact W5 (WhoWhatWhereWhenWhy) on 02890 467790 or 467710, or by e.mail to suemcgrath@w5online.co.uk

Hot web sites by ESA

The European Space Agency (ESA) has started a new web site for teachers and schools at

www.eduspace.esa.int.

It is going to offer material not normally available to the general public, so schools have to register. ESA is very keen to improve its out-reach, so this site should be very good value as it develops.

ESA has also launched a site for teachers to show indispensable applications of basic science:

info.web.cern.ch/info/scitech

Open weekend at Orwell

The Orwell Astronomical Society is holding an open weekend and exhibition at the Orwell Park Observatory, Nacton. Near Ipswich, November 9 and 10, to which all are welcome.

Visitors can see the full range of the Society's instruments, with a chance to use them if conditions allow. The instruments include an 1872 10-inch Troughton & Simms refractor. There is also an exhibition and trade stands. Entrance costs £1, or 50p concessions.

Full details of the Society can be found at www.ast.cam.ac.uk:/~ipswich, and information about the Open Days is available from Ken Goward, 01473 785802, KandL.Goward@btinternet.com

Small increase in subs

At the AGM is was agreed that the subscriptions be raised to: members £12 (£10); retired members £10 (£7); Corporate £24 (£20). The previous figures are in parentheses.

Treasurer, Alan Pickwick explains that the increases were necessary due to a continuing shortfall in finances, mainly related to the publication and distribution costs of *Gnomon*. The increases in subs will not completely cover this shortfall but they will help substantially.

Comet Ikeya-Zhang well seen from Russia.

The comet, which received the designation C/2002C1, immediately attracted special attention by astronomers. It was soon found that it has a large period, and the elements of its orbit were reminiscent of Comet C/1532R1, which had attracted similar attention.

However, as more astrometric data were obtained, it more closely resembled comet C/1661R1. The latest information gave an estimated orbital period of 367.17 years, which rules out the possibility that it marked the return of any of the historical comets mentioned.

Comet Ikeya-Zhang - March 24

Amateur observers in our area of Russia were immediately excited by the news that the comet would soon be visible with the unaided eyes, having already reached magnitude 4.5 - 4. The comet rapidly "inflamed", and we were soon reassured that forecasts of comet magnitudes are not *always* mistaken when its magnitude reached 3,5. At the ☞*(Cont. on page 5)*

FOR YOUR LIBRARY

3D Atlas of Mars: *CD ROM 0-9541600-0-2. Price £19.99. Xamba Software, 56a Nightingale Lane, London, SW12 8NY*

www.xamba.com

With the increased interest in the exploration of Mars, this CD-ROM is perhaps a timely addition to the information available. It is a mine of information on Mars and has some spectacular maps.

In its "3D Map" section it has good looking maps with the latitude and longitude of the cursor being continuously updated. Double clicking on a feature gives detailed information. I could navigate around the maps easily but could not get the images to auto-rotate. There are nice images of Phobos and Deimos and good historical maps showing the 'canals'.

I found the "3D Flights" slightly disappointing. I had some difficulty making them work until I realised that the specification on the box for 800 x 600 and 16-bit graphics was not a recommendation but a required setting! Finding out how to navigate around the maps also proved a problem. There was no help on the screen so I used the help menu to find the way to use the mouse. At last I could use all the features but I am not sure how interesting it is to fly over the surface.

The "Missions to Mars" section has good historical notes on past space missions and a useful section on proposed missions. The survival guide has good detail on dust and terrain dangers but only a few line on radiation dangers. At least there could have been links to the ESA and NASA sites that deal with such matters. The "Information" section gives detail about the Viking mission, Mars meteorites, the prospects for life on Mars, surface geology and has a good fact file. The online option just takes you to Xamba's web site which disappointingly has almost no links.

"Weird Mars" deals with the 'canals' that were proposed before space exploration and the 'face' that was seen in Viking photographs of the surface – an optical illusion. "Mars in Space" has a star map showing the location of the planet in the sky for the next few years. "Future for Mars" deals with terraforming and has a speculative map of a terraformed surface.

The sound effects that accompany parts certain parts seem interesting to start with, but soon annoy. I could not find an option to turn them off so I switched off my speakers at the Windows control panel.

The CD-ROM is not too expensive and could be a useful resource for school projects, particularly for those without convenient internet access.

Alan C Pickwick

The wonderful planisphere (part 2)

In the first part of this article in the last issue of Gnomon *the basic principles of operation, and some of the varieties in the design of the device were described.*

How do you apply this amazing instrument? Suppose that you are going to observe the sky on February 6 at 20h local time.

Holding the baseplate, the dial is rotated until the 8pm or 20h mark on the dial is aligned with the date, February 6 on the base. The planisphere is now fully set and the stars seen in the oval window are the same stars seen in the sky on this date and time, but not as seen exactly from where you are. If you set the dial time according to your watch, the dial setting will correspond to the view of the sky from the longitude of the base meridian of your particular time zone. To set the dial to your local view of the sky you must correct for your longitude, adding 4 minutes per degree east of the base longitude, or subtracting 4 minutes per degree west. To set the time in the summer you will also have to remember to subtract one hour from the clock time if daylight saving is in force.

Sit (or lie) down facing north and raise the planisphere in front of, and above, your head so that the Pole Star is roughly aligned with the central hole. If one is unable to locate north, then a pocket magnetic compass could be used to show the general direction. The general idea is for the observer to face North and to raise the planisphere above the horizontal level by an amount equivalent to one's latitude. The higher one's latitude the higher must the planisphere be held above one's head. (To be able to see the planisphere and still allow the eyes to become dark-adapted, a red flashlight is a useful accessory.)

With north ahead and South behind, West is to the left and East to the right. The planisphere orientation should now correspond to these positions - the western and eastern horizon positions are printed on the edges of the oval window. The greater part of the window beyond the central rivet faces upwards while the smaller part points down to the ground. The "line" (actually a great circle on the celestial sphere) passing through both celestial poles and the zenith is called the prime meridian (or simply "meridian") and any object that lies on the meridian is said to culminate, i.e. reach highest altitude at that particular location. On the planisphere, the local meridian would be denoted by a line passing through the centre of the rivet (representing the north celestial pole), and the noon (12 h) and midnight (24or 00h) points found on the dial. While the midnight (south) point is found at the lowest part of the planisphere as made, the noon point would be highest when the device is held in this particular position.

With the February 6, 20h setting, it can be seen that Capella, in Auriga, is very close to culmination. Turning the dial clockwise shows stars rising from the eastern horizon and setting on the western horizon. It also shows why the circumpolar stars always remain visible. The planisphere can show which particular stars and constellations are circumpolar as seen from any particular latitude. With a planisphere for 51° N, the latitude of London, which is suitable for use in northern Europe, northern USA, Canada etc. it can be seen that Deneb in Cygnus is just circumpolar while Vega in Lyra is not quite. The limiting declination for circumpolar stars can also be seen. At the 51° latitude and this can be read off as about 40°, so stars having declination greater than this will always be seen. Stars are circumpolar if their declination is greater than the observer's colatitude, i.e. +39° in this case. The planisphere gave us a fantastic estimate indeed! One can try to identify some circumpolar stars and constellations in this manner, which is always a good start to finding your way around the night sky.

Once the circumpolar and nearby region of the sky is mastered, you can then proceed to look at the equatorial and southern parts of the sky. For example, staying at the same settings of the planisphere used above, the observer now needs to face south. Now east will be to the left and west to the right of the observer.

The planisphere is placed in front with north at the top. Most of the oval window (the horizon) now lies below the central rivet and the eastern and western horizons again are on the left and right sides, respectively, corresponding with the observer's horizon. The midnight point on the rotating dial lies above while the midday (noon) point lies below.

In this position, one can identify some equatorial and southern stars/ constellations that are in the sky at this particular date, time and location. The planisphere is a convenient tool to help us identify stars and constellation groups. Having identified some stars, they can then be quickly found in a star atlas for added detail.

The Earth rotates anticlockwise on its axis as seen from the North Ecliptic Pole. So celestial objects appear to rise in the East and set in the West. But the Earth also orbits the Sun, also in an anticlockwise direction, once each year. This gives the Sun an apparent motion eastwards against the background stars of just under 1° each day (actually 360/365.25 degrees). So during the apparent 360° westward daily motion of the whole sky, the stars that were exactly behind the Sun one day, arrive at the local meridian about 4 minutes earlier than the Sun the next day.

The planisphere shows that the same stars are in the oval window at, say, the beginning and middle of the month, provided the dial is moved anticlockwise by 1 hour. By the end of the month, the time for the same sky to appear in the window is two hours earlier, and so on till a year has passed and the clock has "lost" 24 hours. This demonstrates the reason for the relationship between sidereal and mean solar time.

The planisphere can show the appearance of the sky at any day and time of the year, and in comfort on a cold, overcast night! It will, of course, also tell us which stars are above the horizon during the daylight hours, as well as the approximate position of the Sun relative to these stars. A curve should be provided, sometimes with a broken line or a different colour, denoting the ecliptic, the Sun's apparent path through the year through the zodiacal constellations. The Sun can be assumed to be on the meridian at local noon for the date in question (the time of true local noon must be corrected to allow for longitude and daylight saving, and indeed the Equation of Time, to be really precise). The Sun can then be fixed on the ecliptic at the point due south. Sunrise and sunset times can then be computed for any day of the year.

Sometimes the positions of the planets within the zodiac can also be determined if planetary data is included on the reverse of the planisphere's base plate.

For example, on February 6 the planisphere is set for this date at noon by setting the noon point on the dial against February 6 on the base plate. An imaginary line

from the north point on the horizon, through the north celestial pole (centre of the rivet) to the south point (where you have set February 6) intersects the ecliptic in the constellation of Capricornus (just to the east of two fourth magnitude stars, ψ and ωCap.). Setting the dial so that this position is on the eastern or western horizon, the times of sunrise and sunset are found as about 7h 30m and 16h 30m. The larger a planisphere is, the more accurate any estimated times and positions will be, or course.

For observers in the southern hemisphere, the appearance of the constellations, and their positions relative to one another, are changed because of the Earth-based observer's orientation. While Lepus is found beneath Orion seen from the northern hemisphere, it lies above it seen from the southern hemisphere. From the north, Eridanus lies to the right of Orion and Monoceros to the left, whereas south of the equator Eridanus is found to Orion's left and Monoceros to the right - so east and west now seem to be switched round too! The appearance of Orion also changes, and can be quite upsetting, with Rigel being "up" for observers in the southern hemisphere.

A planisphere for use in the southern hemisphere shows all these effects. Residents of the northern hemisphere can be astonished, even uneasy to see the all too familiar pattern of the mighty hunter turned upside down and laterally inverted while on a visit to Australia! Did Scorpius finally get him in the end?

For those with a creative imagination, a planisphere can be made at home or in the classroom where only the simplest of materials are required. But the undertaking will be most enjoyable and instructive. A planisphere can be made as large as or as small as one wishes. A purchased, commercial planisphere can also be used as a model to create another, more simple or complex to suit your requirements and fancy.

You might wish to include fainter stars, positions of Messier objects, variable stars etc. all obtainable from an atlas. The bigger a planisphere is designed, the more accurate it will be and the more detail that can be included. Why not two planispheres instead of one? One planisphere can be made to show only northern stars and another dedicated to equatorial and southern stars.

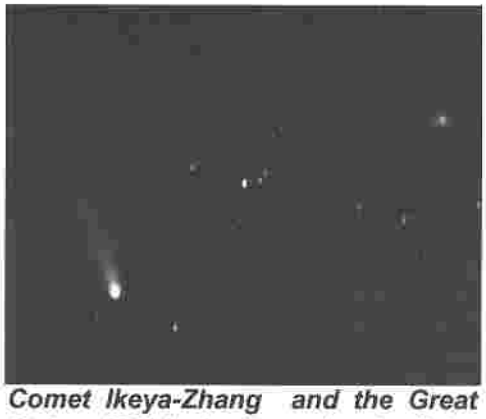
Only the sky is the limit....literally! on what one can do. Once an observer learns how to use a planisphere well, it will forever remain a trusted companion.

Dr. Alex Gatt

☞ **Comet Ikeya-Zhang** *(cont. from page 3)*

beginning of March it had got a small tail, and though not far from the Sun, about 30-40°, the plane of a tail was almost perpendicular to the line of sight, so it could be seen at its maximum angular extent.

The first magnitude estimate of the comet was approximately 8.1. In two weeks it had grown in size, and by February 20 - 24 had passed the naked eye visibility threshold (mag. 6.5 - 6). At the beginning of March it was already perfectly visible with the unaided eye, and the gas tail was also well seen. It had an angular width at the head with the coma of about 3arcmin, but poorly extended from the head. In binoculars it could be observed across 3 - 5°. By the end of March the comet has reached the maximum magnitude.

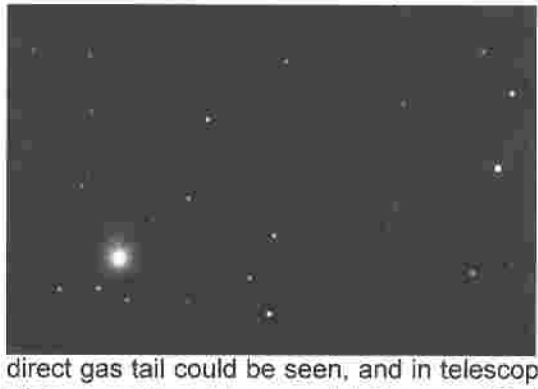


Comet Ikeya-Zhang and the Great Galaxy M31 in Andromeda - April 4

Visibility improved as it gradually passed from the evening sky to morning. In especially dark places and with good sky transparency, the length of tail exceeded 10°. At the same time the tail appeared dusty and bent. Even though very weak, the tail could be distinguished in large binoculars and wide angle telescopes. In large instruments it was possible to make out detail of the nucleus. The coma had the normal greenish colour, marked by many observers. The gas tail had a light-blue shade. The colours of both the head and tail were well shown on colour film. Even in small instruments observers could make out the jets, frequently wavy, almost of a sinusoidal form, in the tail due to the rotation of the nucleus, and they could study the most active areas of jets.

Comet Ikeya-Zhang passed through the constellation of Cetus, into Pisces. On March 25, it passed by M33, only 3° away in Triangulum. At the end of March it was in Andromeda, and during April 4 and 5 passed near to the Great Galaxy in Andromeda (M31), presenting lucky observers with a fine sight. It continued in a western direction, through Cassiopeia, Cepheus and Draco, when the visible length of the tail of the comet gradually decreased as its longitudinal axis (the radius - vector of a comet) gradually came nearer to the line of sight, and the magnitude decreased insignificantly.

At the beginning of May, the comet was passing through the head of Draco. At dawn, it appeared almost at the zenith and was easily visible to the unaided eye at a magnitude about 5. In binoculars, a small (about 10 - 20arcmin) thin direct gas tail could be seen, and in telescopes it was possible to make out a second tail, more diffusive and dusty. The angle between the tails at this time was between 60° and 70°, giving photographs taken at that time a distinctive appearance. During May 16 and 17 the comet passed as close as 2.5° to the globular cluster M13 in Hercules. Observers at this time noted that, outwardly, the comet and M13 appeared very similar. It moved on through the constellations of Corona Borealis and Serpens. Finally, the comet dimmed to end the period of unaided visibility. From the end of May it was quickly dropping in magnitude, and by middle of June was difficult to spot even in binoculars.



Comet Ikeya-Zhang - April 19

Now comet Ikeya-Zhang is moving far from the Sun and the Earth, and will soon disappear once more in the depths of the Solar System.

Vladimir Golendukhin

Astrocosmic association, Sirius-86

CURRICULUM CORNER

Following the Moon in the Sky

The orbital plane of the Moon around the Earth is inclined by just 5° to the plane of the ecliptic, so it passes through all of the zodiacal constellations during each orbit of the Earth.

The Moon moves eastwards through the Zodiac, covering an angular distance of a little more than its own angular diameter, about ½° each hour. The Moon covers a distance of just over 13° each day - about the width of your outstretched hand. The Moon goes through a complete cycle of phases from new moon, through full moon and back again to new moon in 29.5 days. This period is called a synodic month, or lunation. Because the Moon's orbital plane is fairly close to the ecliptic, its monthly path among the zodiacal constellations is similar to the apparent path of the Sun during a whole year.

A little careful thought is required when considering the Moon's visibility and its height above the horizon at various times of the year. The full moon must always be on the opposite side of the sky to the Sun, occupying the same region of sky where the Sun will be six months later. From northern temperate latitudes, the Sun of the winter solstice reaches its lowest point above the southern horizon; because it is on the opposite side of the sky, the mid-winter full Moon rides high in the midnight skies. At summer solstice the Sun reaches its highest point above the southern horizon, which means that the mid-summer full Moon is low. If the Moon's orbit has also taken it south of the ecliptic at this time - especially if it is near its maximum of five degrees beneath the ecliptic - then it appears barely able to pull itself clear of the southern horizon, and for a few hours only.

Intervals between the times of successive Moon rises each night are called retardations, and they average less than an hour, the Moon rising around 50 minutes later each day. If the Moon's orbit was circular and the plane happened to coincide with the celestial equator, then all retardations would be around the same length. However, retardations vary in length throughout the lunar month, and for a given phase they vary according to the time of the year at which the Moon is observed. The observer's latitude also plays an important part in how greatly lunar retardation is seen to differ from the average.

In equatorial regions of the Earth, where the angle at which the ecliptic (and the Moon's orbital plane nearby) intersects the eastern horizon varies the least, the interval between successive Moon rises ranges from around 30 minutes to an hour. For observers in temperate latitudes the range of lunar retardation is far greater, from a few minutes up to as much an hour and a half. This is because the angle at which the ecliptic intersects the local horizon from temperate latitudes varies greatly.

Close to full moon in the northern autumn, the evening ecliptic makes a very shallow angle with the eastern horizon, causing the Moon to rise just 15 to 20 minutes later each evening. The Harvest Moon is the full moon nearest to the date of the northern autumn equinox about September 23. It was called this because farmers can bring in the harvest till well after sunset for many nights, assisted by a bright Moon that appears only slightly later each evening. Near the northern spring equinox, the evening ecliptic makes a steep angle with the eastern horizon, meaning that around the time of full Moon its retardation is greatest and consecutive evening rising times are most widely separated.

Peter Grego
Editor, *Popular Astronomy*
Director, SPA Lunar Section

CD ROM for teachers of astronomy

The Auckland Stardome (New Zealand) has produced a CD crammed with goodies aimed at teachers taking astronomy. The UK price is £15, including postage. The contents include:

- Stardome teacher planning guides and pupil worksheets (mostly PDF documents).
- New Zealand curriculum documents from NZQA, NCEA, MOE, and Learning Media (mostly PDF files)
- Stardome website archive from February 2001.
- Space Science movies: NASA spaceflight, galaxy simulations, comets, impacts, etc. Movies of night sky and daytime events (short Quicktime movie clips for all level use).
- The Universe in Pictures from the Hubble Space Telescope, Galileo, Cassini etc. Most images are 800 pixels wide.
- Life of Stars: 26MB Powerpoint file for years 10 -13.
- Solar physics book: about the Sun. Teacher references plus activities for senior classes (American).
- Sunspin: use images of the Sun (supplied or use your own) collected over several days to work out the rotation rate of the Sun from sunspot positions.
- Mars Orbit: a worksheet revisiting the original method Kepler used to plot the orbit of Mars using a protractor, a compass and a ruler. Data from Tycho Brahe.
- Telescope mirror-making: Powerpoint show.
- Skyglobe 3.6 - classic 500kB shareware planetarium program for DOS /Windows.
- Skymap Pro: a powerful planetarium program for Windows.
- Additional software: Astronomy Lab, Astronomy clock and Star Clock (PC only).
- Starry Night planetarium software: teacher and student manuals, plus exercises (before trying the exercises, you need to download free trial software that lasts two weeks, or buy the full product - preferably from the Stardome)
- Project CLEA for senior science/physics. Simulated astronomy observations. Drive a telescope, analyse spectra, monitor Jupiter's moons and more. Complex but valuable.
- USA Curriculum Quilt - 2.5MB Flash-powered matrix of topics including hundreds of PDF activity sheets plus weblinks.
- Destination Mars - 2MB 50-page PDF book plus activity packet from NASA for mid primary to junior high.
- Astronomy, Maths and Science links: 4th form astronomy unit - planning documents, unit outline, worksheets, etc.
- Astronomy Quiz: Powerpoint from Science Works in Ontario.
- "The Eagle Has Landed" and "One Small Step" - the original Apollo 11 soundbites.

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Eric Jackson

News from Down Under

The Anglo-Australian Observatory recently delivered to the European Southern Observatory's Paranal site a major new facility for their Very Large Telescope.

Building on the experience gained in developing the 400-fibre 2dF instrument for the AAT, (*OzPoz* as it is called) is a state-of-the-art robotic fibre-positioner for the FLAMES spectrograph, which resides at the Nasmyth focus of "Kueyen", one of the four 8-metre Unit Telescopes of the VLT. Though similar to 2dF in its operation, OzPoz differs in many ways.

First, instead of riding on the top end of the telescope like 2dF does, OzPoz has a relatively stable orientation, moving with the telescope in azimuth, but not having to tilt or rotate. As a result, the spectra it produces are easier to clean of bright emission lines from the night sky. Whereas 2dF has two plates with up to 400 fibres each (one of which is observing the sky, while the other is being reconfigured by the robot), OzPoz has four plates, with up to 150 fibres each. The major difference however is that while the 2dF plates are flat, the OzPoz plates are concave, to match the curved focal plane of the (fast focal ratio) VLT design.

For this reason, it made sense to abandon the "x-y" design of the 2dF robot (i.e. independent movement along two orthogonal axes) in favour of an "R-theta" design, in which the positioner moves in and out radially along a rotating arm, which is curved to match the shape of the OzPoz plates.

To test this new approach, a scaled-down prototype of OzPoz was constructed first. So successful was this prototype that, once the engineers had finished with it, the AAO astronomers pressed it into service as a new robotic fibre positioner for the UK Schmidt Telescope at the Siding Spring Observatory.

In honour of its big brother next door, this instrument was christened "6dF", on account of the telescope's 6° field of view. Before 6dF, preparing a multi-fibre plate for the Schmidt involved spending up to three hours standing in a fume cupboard attaching the fibres with a UV-curing cement! So despite an early tendency to turn fibres into spaghetti, 6dF has made a big improvement and effectively extended the Schmidt's operating lifetime by another 3 - 5 years

Already underway is an all-(southern)-sky galaxy redshift survey, targeting galaxies selected from the 2MASS infrared survey (and therefore less biased by dust in our Galaxy).

Meanwhile, work continues apace at the AAO on yet another fibre positioner concept, this time for the Japanese 8-metre Subaru telescope on Mauna Kea. Because the focal plane of Subaru is rather more compact than the VLT, the traditional "pick and place" approach was not suitable. Instead, the idea of packing the focal plane with fibres attached to rigid spines, which are then individually pivoted to intercept light from the targets, is being pursued. Because of its resemblance to the Australian cousin of the hedgehog, this instrument is known as "Echidna".

So successful has been the Echnidna concept that plans are now being drawn up for a super-sized version for a possible future wide-field upgrade of the Gemini 8-metre telescopes.

Once again, a prototype with 2250 fibres to go on the UK Schmidt is under consideration, but so far we haven't managed to come up with a good name for it yet (suggestions include "Spinifex", "Puggle", and "Spiny Norman"!).

Such an instrument could be used to acquire almost 10 million stellar spectra in just 5 years, and help open up the field of "Galactic Archaeology", in which chemical "fingerprints" might allow us to retrace the origins of groups of stars (and perhaps even locate the siblings of our Sun). More information about each of these projects is available from the "New Instruments" section of the AAO's Instrumentation web page :

www.aao.gov.au/astro/instrum.html.

Certainly, the AAO is building quite a reputation as the Fibres R Us of the booming business of 21st century astronomical instrumentation.

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Sky Diary Autumn 2002

The last three months of the year give night skies that are possibly the best for students unfamiliar with the patterns of stars. The evenings are mostly dark, and there is still a little heat left over from summer to hold temperatures at above freezing, even on clear evenings.

Daylight saving time ends at the end of October, which results in an apparent sudden darkening of the evening skies, and it also allows the Sun to behave itself normally by culminating vaguely around 12 noon instead of well into the afternoon. (The Sun reaching due south in the afternoon is common anyway, since most of the UK is west of the Greenwich Meridian. This is offset to some extent in November when the Sun gets ahead of the "Mean Sun" position as the Earth speeds up towards its January perihelion.)

For those who can just about recognise the Plough only, there are some easy-to-identify star patterns that become prominent in the sky. Cassiopeia, looking more like an M now that it is moving towards the overhead position from British latitudes, and the "Great Square of Pegasus" both lead on to the other, more difficult members of the group linked in mythology, namely Andromeda, Perseus, Cepheus, and even Cetus. Towards the end of the quarter the magnificent patterns of the northern winter sky appear progressively earlier.

This Autumn offers the additional bonus of two of the most fascinating planets for amateur observers, Saturn and Jupiter. They have now moved apart to around 50°. Saturn is nearly 90° east of the Vernal Equinoctial position (indicated roughly by projecting southwards the eastern side of the Great Square). So they will not found high in the evening sky until later in the quarter (see the table of rising and setting times), and they no longer form the close pair slowly dancing their way together around the ecliptic as in the previous two years or so. But they will form long line along the ecliptic with Mercury and Mars across a 90° arc of the predawn sky in October. While not as spectacular as this Spring's line up of the five naked eye planets (see the last two issues of *Gnomon*) this will still be a most pleasing sight. Best times will be October 6, when they will be closest together overall (see diagram overleaf), but they will form interesting patterns for most of the month.

The most important event of the quarter will be the ☞

☛ December 4 total eclipse of the Sun. It is a southern hemisphere event, however, with no part of the eclipse visible from the UK. It will be seen across Southern Africa, not too far from where the last (2001 June) eclipse was seen, but this time the Moon's shadow will continue over the Indian Ocean until it comes ashore not far from Adelaide, South Australia, and finishes at sunset in the southern Australian desert. It is notable for giving totality of only about 40 seconds. Unusually, it should continue to be fascinating to watch after totality as the still partially eclipsed Sun sets. The next issue of Gnomon will be a week or two late (*see news item page 2*) because its Editor will not be returning from Down Under until press times are getting delayed by the Christmas period. Watch this space for the exclusive photographs!

The associated partial (88%) penumbral lunar eclipse will take place on November 20, with mid eclipse at 1h 02min, but as always with penumbral lunar eclipses, the effects will hardly be noticeable.

The (Northern) Winter Solstice falls on December 22 at 1h 14m when the Sun reaches its position in the sky furthest south, on the Tropic of Capricorn. The ancient names of the Sun's "milestone" positions in our skies still causes confusion among some students. Why are the constellations of Cancer, Capricorn, Aries and Libra not situated on the solstitial and equinoctial points bearing their names? Explaining the 25,000 year circuit of the Earth's poles around the ecliptic poles, which produces the precession of the equinoxes, scarcely satisfies many students.

Moon phases for the fourth quarter of 2002

Month	New Moon	First Quarter	Full Moon	Last Quarter
October	6	13	21	29
November	4	11	20	27
December	4	11	19	27

It is a wonderful demonstration in a planetarium, however, which clearly shows the ecliptic moving across the background stars. It amazes the audience to see the North Celestial Pole of AD 12000 close to Vega, the disappearance of Orion from the skies at British latitudes, and the appearance of the Scorpion, tail and all, high in our winter night skies.

There are five naked eye planets. *Mercury* reaches maximum western elongation on October 13 and may be found for much of the month with all except evening "star" Venus stretching round the ecliptic in the morning twilight. It reaches its maximum east elongation on Boxing Day, too low in the south west evening twilight to be found easily.

Venus is at inferior conjunction on October 31 (i.e. closest to the Earth as it passes to the west of the Sun, nearly 6° to the south of the Sun). As it moves into the morning sky, it brightens rapidly, reaching greatest brilliance on December 7 at magnitude –4.7. Mars will be about 1.6° to the west of Venus at that date.

Mars will still be long way off on its way back from the far side of its orbit relative to the Earth. In a good telescope it should be possible to make out a gibbous phase (of 0.949 by year's end). Mars is the only superior planet to show a significant phase, due to its proximity to the Earth. It reaches a magnitude of 1.6 by the end of year when it will be well south in the middle of Libra at a distance of about 2AU (twice the Earth-Sun distance). The Moon passes 1° north of Mars on December 30 at1h (and 2° south of Venus at 8h that same morning).

Rising and setting times (UT): lat. 52°N; long. 3°W

	October 15		November 15		December 15	
	Rise	Set	Rise	Set	Rise	Set
Sun	06h 38m	17h 18m	07h 31m	16h 21m	08h 13m	16h 00m
Mercury	04h 50m	16h 58m	07h 38m	16h 19m	09h 44m	16h 56m
Venus	09h 27m	17h 08m	05h 36m	15h 16m	04h 09m	14h 07m
Mars	04h 28m	16h 46m	04h 19m	15h 16m	04h 12m	13h 51m
Jupiter	00h 06m	15h 16m	22h 22m	13h 25m	20h 25m	11h 29m
Saturn	20h 17m	12h 38m	18h 14m	10h 35m	16h 07m	08h 28m
Uranus	15h 32m	01h 15m	13h 34m	23h 12m	11h 37m	21h 18m
Neptune	14h 49m	23h 38m	12h 52m	21h 41m	10h 55m	19h 46m

Jupiter will be prominent in Cancer at magnitude -2.4 by end of year, reaching opposition early in January next year.

Saturn reaches opposition in Taurus close to the border with Gemini on December 17, when it will be about 22° north of the Celestial Equator. Because of the tilt of Saturn's orbit relative the plane of the Earth's, it is still a little south of the maximum declination of the northern solstice. The planet is about as far north as it can be in the sky, and offers a maximum views of the south pole and the southern face of the rings as seen from Earth. It will be very nearly 30 years before we see it again (well, some of us may) in this prominent place in the northern sky.

Uranus is in still Capricornus (just) as it reaches the western stationary point in its retrograde loop and starts to move eastwards towards Aquarius again. At magnitude 5.7, it is a very difficult naked eye object, but is reaching a part of the sky where there is less to confuse it with. However, it is still 13½° south of the equator as the year ends and low down in the west after the sky becomes dark enough, so is unlikely to be seen from British latitudes without optical aid.

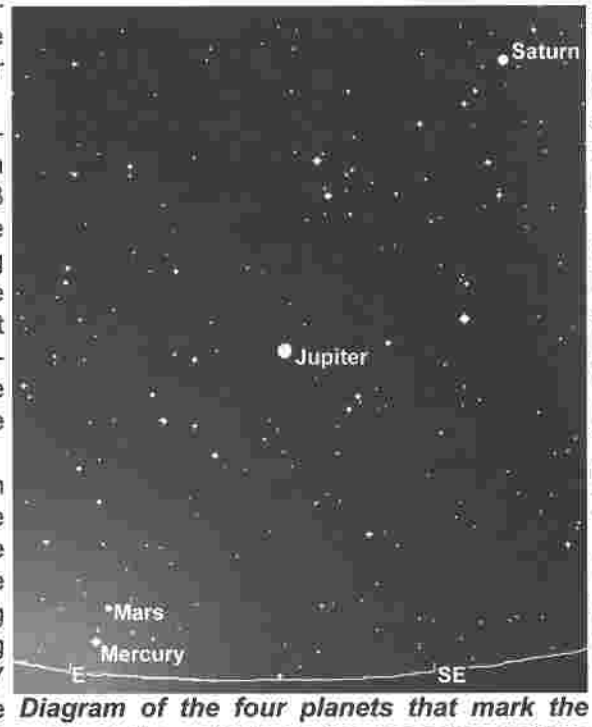

Diagram of the four planets that mark the path of the ecliptic in the morning twilight sky of 2002 October 6. Mars and Mercury are to the south of Leo, in the east.

Neptune is now left well behind in Capricornus to the west of Uranus and some 16° from it at the end of the year. At a magnitude of about 8 it is essential to use optical aid.

The best show for meteor watchers may be in November, when the Leonids should still be performing above average, peaking on about November 17 at 21h and well seen from the UK, with a possible second peak two days later but best seen from the Pacific. The almost full Moon will be high in the sky to spoil the view, alas.

The Geminids, early to mid-December, peaking at December 14 at about 4h may also be worth the loss of sleep on a cold night, and the Moon, although waxing gibbous, will be low or have set in the early hours on this occasion.

Richard Knox