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A classroom of the future on Mars

A remote corner of England will soon start building a classroom designed to act as a Martian mining operation. Combining a futuristic architectural design with the latest computing and communications technology, the aim is to create a space age setting for British school children.

Camborne is a medium-sized Cornish town, in an area of social and economic challenges. The area has a strong mining tradition, but most of the local industry has closed down in recent decades. Educationally, the area will benefit from raising achievement and aspirations amongst school students, and a tendency for young people to leave the region for work elsewhere in the UK.

Camborne Science and Community College (a school catering for 11-18 year olds, recently awarded science specialist status) is part of an "Education Action Zone" called the Camborne Pool Redruth Success Zone. Following a call for proposals from the Department for Education and Skills in 2000, a bid was submitted for an architectural scheme to develop revolutionary new classroom designs. The Camborne bid was one of the twelve selected, and was awarded £1.2 million, which, with additional input from Cornwall County Council, means that the baseline project is fully funded. Further funds to supplement the baseline project are still being sought from a range of sources, including the European Union (ESF funding for community-based projects), the UK science community (grants for public understanding of science from the Particle Physics & Astronomy Research Council, the Royal Society and several other charitable bodies) and industry.

An artist's impression of the finished Martian mining complex at the Camborne Science and Community College

The "Education through Space Centre" will open in the Spring of 2004, and will combine the futuristic setting of a Martian mining colony and mission control centre, with the latest in computer and communications technology. The building design is exciting, with novel materials and futuristic theming to allow users to "suspend disbelief" during their lessons. It will contain two electronically linked classrooms; a heavily themed science lab based around robotic mining of Mars (complete with robots and physics, chemistry, biology and geology experiments) and a "Mars mission control centre" full of computers and communications technology. These mirror the Cornish mining tradition and current links with global communications through the Goonhilly Earth Station, the countries' largest satellite ground-station a short distance away.

The design for the building envisages a unique structure based around the "elements", with water, fire, earth and air featured in the construction and power sources. As with several proposed Mars habitats, the building will be powered by a combination of natural sources (solar, wind, and geo-thermal), will feature hydroponics and recycling, and as with space missions, children will be closely monitoring all aspects of the building using sensors, cameras etc. Architects' drawings of the building design can be seen at 💻 **www.askesc.org.uk** The classrooms will link with weather and communications satellites, NASA and ESA TV, and make use of robotics, video-conferencing and virtual reality. Direct links with the Faulkes robotic telescopes in Hawaii and Australia will ensure that the facility has a truly global, space age feel to it. Children will perform ☞

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The Association for Astronomy Education,
The Royal Astronomical Society,
Burlington House, Piccadilly,
LONDON W1J 0BQ.

💻 Web site: www.aae.org.uk

For all enquiries concerning the newsletter, contact the
Editor: Richard Knox,
3 Alexandra Terrace, Penzance
Cornwall, TR18 4NX.
e.mail: gnomon-editor@beeb.net
Telephone/Fax: 01736 362947

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

☞ real-time astronomical observing through the Internet, and space science and astronomy will be integral to the centre's educational programmes.

The ESC is a highly themed classroom, drawing on the mining tradition of the local region and blending this with the high-tech facility at Goonhilly Earth Station and the biomes at the Eden Project. To generate the futuristic theming, the interior of the building is modelled on a Martian mining community in 2040. It draws on the experience of using themed classrooms that has been successful in the USA, such as the Challenger Learning Centres and the NASA "Classroom of the Future" at Wheeling Jesuit University, Virginia.

By taking the classroom theme from a near-future Martian community, it is hoped to encourage users to participate in the global community. As an area of social and economic disadvantage, it is vital that young people should be retained within the region. The ESC aims to show them that the historical roots of Cornwall (mining) can be combined with modern engineering and design (e.g. Eden Project, Goonhilly Earth Centre) to ensure that they can be active participants in the future development of the UK and beyond.

The ESC is a regional project, serving the 32 schools within the Camborne and Redruth Regional Success Zone, and the wider community of Cornwall and Devon. It will be working with groups around the UK and abroad via video-conferencing, radio communications, and will serve as the Cornish "community user centre" for the Faulkes Telescopes project. Links with astronomers at the Rutherford Appleton Labs will provide information on current astronomical and space science topics.

The ESC will contain an area of about 5m square of "Martian landscape". A variety of remotely controlled robotic vehicles will operate within that area, equipped with basic sensors (black and white cameras, magnetometers) and some manipulative equipment (robotic arms). The Martian landscape will be constructed on a hardboard base covered with a durable surface coating (concrete and SandTex), moulded to create a "realistic" Martian surface with craters, mountains, valleys etc. The camera systems are a vital component of the "robotic operation" of the Martian mining community. Remote camera systems monitor all aspects of activities on the surface. There will be a number of fixed pan and zoom only cameras, with others mounted on mobile units that can move around the landscape.

Other equipment will include Mars Rovers, which are wire-free, remotely controlled vehicles made from model army tanks, heavily modified with new bodywork to look like mars surface exploration vehicles, with a robotic arm and magnetometer. There will beplenty of "theme" materials to create a Martian colony feel to the classroom areas, using posters, Mars globes and maps, satellite images, and so on.

The Mars-theme should maintain topicality over a long timescale, as the robotic exploration of Mars will continue for the foreseeable future. The ESC will open at an exciting time for UK involvement in Martian exploration. It will be linked with other groups working on similar projects (e.g. participants in the Planetary Society/JPL "Red Rover" project in the USA), and video-conference connections to astronomers from around the UK and abroad. This could include talking to NASA astronauts.

For more information contact Dr. Paul Roche, Centre for Astronomy & Science Education, Univ. of Glamorgan, ESC Technical Adviser, or Malcolm Woolcock, Camborne Science and Community College, ESC Project Team.

Paul Roche

COMMENT

As an editor working in two contrasting disciplines, energy and astronomy, it is rare for a common "burning issue" to arise in both areas of this work. The local weekly paper in my town is far from impressive. It is typically filled with court proceedings, petty crime and the like. But this week it included (albeit tucked away at the back) a well written news item showing how Penzance lets Cornwall down as far as its contribution to light pollution is concerned. This has been highlighted in its poor rating in a national survey based on satellite data, which forms the backbone of a new campaign of the CPRE called "Night Blight!" (see the item following this.) I am impressed at the success of such an initiative when it is even getting through to that paper's collective editorial consciousness. The tireless efforts of Bob Mizon in his role as the co-ordinator of the BAA campaign for dark skies , and this new CPRE initiative, deserve all our thanks on behalf of the growing proportion of the UK population, particularly its young people, being deprived of one of nature's most inspiring free spectacles.

Wearing both my editorial hats, I am (naively!) astonished at the apparent incapability of local and national politicians to grasp the simplest concepts. Solar energy reaches the surface of our planet at a low density. If it were not so, life could not exist here. So it is axiomatic that efforts to collect solar energy, in whatever form, always demands covering the surface with collectors, be they wind generators, solar cells, or even coppice grown especially to burn in a power station. Renewable energy is vitally important, but it is only a contribution to dealing with the potentially life-threatening problems of changing this planet's environment. Efforts into developing more renewables may already be too little and too late to solve the potential problems of fossil fuel combustion.

Some time ago, the Cornwall Highways Department relamped the road along the sea-shore in Penzance They used high efficiency, sharp cut-off luminaires that considerably improved the road illumination, and put the stars back in the sky at the same time. Public money well spent! A short while later, the local authority provided a skate board area opposite a small store's carpark in the same road. Before long, the same authority.installed floodlights to illuminate the now usually empty skateboard park (public money again!), and the store opposite decided to floodlight its carpark. Guess what the result of all that was!

So missing any obvious chance to stop trivial energy usage, and especially totally wasted energy, is nothing short of criminal. It alone justifies the objection to the attempts of so many of our institutions to illuminate outer space, without even considering the educational, social and aesthetic case for letting people enjoy the stars.

Richard Knox

One by one, the stars were going out

The CPRE (the Campaign to Protect Rural England, once the Council for the Protection of Rural England) launched on May 9 its major initiative for the year, publicising and deprecating the spread of light pollution and the disappearance of starry skies over England's countryside. Bob Mizon, Co-ordinator for the British Astronomical Association Campaign for Dark Skies writes that your local CPRE branch (see the phone book or the website) will have details of how you can help with this initiative. Material available☞

☞ includes a full-colour 31-page booklet, posters and isophotic satellite-based maps showing the spread of waste light in English regions since the early 1990s.

The BAA Campaign for Dark Skies has been instrumental in providing CPRE with information, images and opinions, and urges all those concerned about the loss of our heritage above to support both organisations in their endeavours. In the words of Matt Dugas, one of CfDS' 121 local officers: "Ours is an argument

What might have been a good view of comet Hale Bopp in 1998, ruined by light pollution from street lighting (Photo: Graham Stocks)

The "constellation" of the City of Leicester, seen from the high ground of Bradgate Park. Notice the lovely constellations high overhead. This photograph was by CPRE member Graham Stocks

which can be won only if we can persuade enough people that it is important and worthwhile".

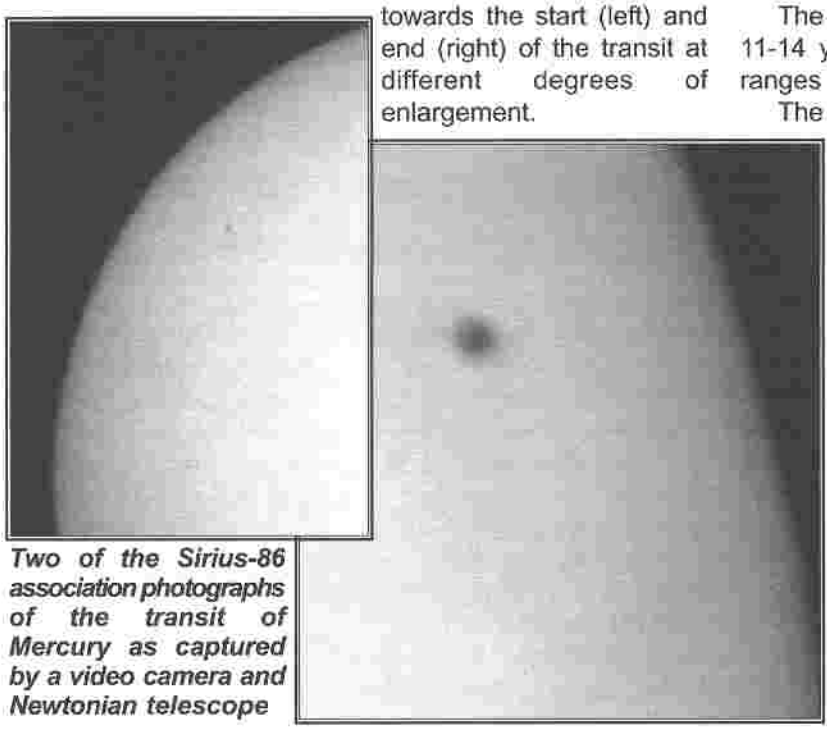
Writing to *Gnomon* from the Leicestershire branch of the CPRE, Graham Stocks wrote:

I do voluntary work for the CPRE. You could fill two A4 pages (of *Gnomon*) at least with information from the "Night Blight" campaign. This has heavily involved Bob Mizon of the BAA and data from a US military/NOAA satellite, which has compared UK light emissions in 1993 and 2000 - amazing pictures! Terrible stuff! It shows graphically why so much of our UK astro-photography gets continually trickier. I have one or two pictures of my own if you wish to use them. (*You bet! Here they are! The headline is a modified quote from Arthur C. Clarke's short story "The nine billion names of God" and is totally out of context, but is none the less evocative! -Ed.*)

So write to your local MP, and MEP, your local council and you county council, and send them the contacts details. Contacts for further information: the British Astronomical Association Campaign for Dark Skies 💻 **www.dark-skies.org**; CPRE 💻 **www.cpre.org.uk** or 📻 **info@cpre.org.uk**

Mercury transit from Russia

Vladimir Golendukhin of the Sirius-86 association in Russia has sent us these images showing the May 7 transit of Mercury, taken through the 15 and 25mm eyepieces of a 110mm Newtonian reflector telescope using a video camera. The photographs show theplanet near the Sun's limb towards the start (left) and end (right) of the transit at different degrees of enlargement.



Two of the Sirius-86 association photographs of the transit of Mercury as captured by a video camera and Newtonian telescope

Mars newspaper competition - a reminder

This is to remind all schools readers that the RAS Education committee has invited school pupils to create a newspaper or a feature article to mark the day in 2040 the first pictures of humans walking on the surface of Mars are being broadcast live!

The Newspaper Competition is for age ranges 7-11 and 11-14 years and the Feature Article Competition for age ranges 14-16 and 16-19 years.

The closing date is 2003 September 1. Full competition rules are obtainable from 💻 **www.ras.org.uk** - follow the Education Committee links. **Alan Pickwick**

Another space experience

Jean Collins reminds everyone that Leicester University's National Space Centre's short residential courses at the Space School UK will be piloting a Silver Crest award in astronomy for students on August 3 to 14, at a cost of £450.

Other dates for the short residential courses are 3-7 and 10-14 August 3 to 7 and 10 to 14, at a cost of £240. Details of all these courses are available on the website (💻 **www.spaceschooluk.org**) or from Jean Collins, National Space Centre, Exploration Drive, Leicester, LE4 5NS. ☎ 0116 258 2136

CURRICULUM CORNER

Dark matter, the Universe and everything

The search for dark matter in the universe has recently been in the news a great deal following the recent upgrade of the dark matter facility in Boulby postash mine in North Yorkshire (which cost a not inconsiderable £3 million).

So how do we know that dark matter exists if we still haven't found any? Studies of how galaxies are moving within clusters of galaxies show that there is about 30 times more mass in the cluster (and hence the universe as a whole) than there is in the visible matter (stars/galaxies) that we can see in the cluster. We call this extra mass "dark" matter. We know that it is there, because it acts gravitationally and affects the movement of galaxies. The speed of the galaxies in a cluster can be measured by using a spectroscope to measure the Doppler shifts in their spectral lines. They are essentially found to be moving too fast so that, if the extra mass were not present then the clusters of galaxies would fly apart. The extra mass is required to bind the galaxies together into vast clusters, such as the Virgo Cluster, which contains over one thousand galaxies as large as our Milky Way galaxy.

The nature of dark matter has engaged cosmologists for several decades now. There are basically three possibilities being considered. Normal matter consists of all the elements in the periodic table, in other words the same stuff that you and I are made of, plus a small amount of other naturally occurring particles that consist of quarks. Not all normal matter is expected to be in stars that emit light so at least some dark matter can be normal e.g. dust and gas clouds between the stars. If you add up the mass of all the gas and dust astronomers have detected (by studying how it absorbs the light of more distant objects for example) we still find only about one sixth of that required to exist in clusters of galaxies. This amount of normal matter is also required by observations of the relative abundance of the light elements in the universe (hydrogen, helium, lithium). Comparing this with the predictions from the standard model of the Big-Bang it looks as though this is as much normal matter as we can possibly have.

The next type of matter is classified as "exotic". It consists particles that interact very weakly with normal matter and so is not noticed in everyday life. The fact that there is a discrepancy between normal matter and the mass of galaxy clusters means that some of this must exist. Physicists have many candidate particles that come from modern unification theories of the fundamental forces. The neutrino was an interesting possibility, however following the recent measurements of a very small mass for the neutrino, even though there are many of them in the universe, they may contribute less to the total than normal matter. Other candidates come under the general heading of "weakly interacting massive particles" (wimps).

Some normal dark matter may be in the form compact halo objects, or machos (who said cosmologists have no sense of humour!). wimps are from very low mass stars or large planets etc. in the halo of our galaxy. So-called "massive" wimps are the type of particles that physicists are searching for in Boulby mine. The experiments are down a deep mine to shield the exquisitely sensitive equipment from cosmic rays and natural radiation, not just because it is dark!

Identifying how much matter there is and what it is made of is important since it is the mass/density of the universe which ultimately determines its fate. Even the total amount of normal and exotic matter implied by the galaxy cluster studies is not enough to make the universe re-collapse into a Big Crunch, recent studies of the all pervading microwave background radiation suggest that the actual density of the universe is much higher.

Which brings us to a third possible candidate, "vacuum energy". The vacuum of space itself has an inherent energy density, with mass density equivalent via e = mc2, with very peculiar properties - such as exerting a negative pressure. This energy does not affect the galaxies in clusters because it is "smooth", effectively pulling the galaxies equally in all directions. However it does have an effect on the patterns of temperature fluctuations observed in the microwave background radiation. But this would need another article to explain properly.

Some observations suggest that there may be at least twice as much vacuum energy/mass as there is in the combined normal/exotic matter total! Even though the total density of the universe is now high (just high enough to "close" the universe in models pre vacuum energy) the strange effect of negative pressure is to cause the universe to expand forever and even accelerate in its expansion rate! As weird as this may sound, some recent observations of distant supernovae have been explained by suggesting that the universe is accelerating! Vacuum energy is by no means fully understood by physicists. This may leave us in the interesting position of not knowing what 90% of the universe is made of!

I was recently re-reading the now classic Hitch Hiker's Guide to the Galaxy series by Douglas Adams and in Mostly Harmless he suggests an interesting alternative theory as to the nature of the dark matter.

'For a long period of time there was much speculation and controversy about where the so-called "missing matter" of the Universe had got to. All over the Galaxy the science departments of all the major universities were acquiring more and more elaborate equipment to probe and search the hearts of distant galaxies, and then the very centre and the very edges of the whole Universe, but when eventually it was tracked down it turned out in fact to be all the stuff which the equipment had been packed in.'

I will leave it up to the reader to decide which theory seems more far-fetched! Of course we know that the universe has no centre and can have no edges - I can feel another article coming on.

Fred Stevenson

SPA's 50th celebrations

The golden anniversary meeting of the UK's Society for Popular Astronomy attracted a record number of people. As well as the AGM, there were talks by astronomer Iain Nicolson, the SPA/BAA Comet Section Director Jonathan Shanklin and the BAA President Guy Hurst.

A special presentation was made to amateur astronomer Stephen Laurie, discoverer of the SPA's own asteroid, named Popastro to mark the society's 50th anniversary. The Society has also heard that their member and well-known astronomical artist David Hardy has also had an asteroid named after him.

At an informal get together later, ten former SPA presidents and dozens of past and present society officers, ☞

The SPA Patron, ten former society Presidents and the current President line up for a unique portrait. Left to right: Patrick Moore, Ian Morison, Barrie Jones, Iain Nicolson, Margaret Penston, Michael Maunder, Iwan Williams, Jack Meadows, Heather Couper, Arnold Wolfendale (Patron), Ian Roxburgh and Derek McNally. (Photograph: Ian Morison)

☞ advisers and Section Directors met members and continued the celebration. The society's former presidents present were Sir Patrick Moore, Ian Morison, Barrie Jones, Iain Nicholson, Michael Maunder, Iwan Williams, Jack Meadows, Heather Couper, Ian Roxburgh and Derek McNally. Congratulations and some fascinating reminiscences were given by current SPA Patron, Professor Sir Arnold Wolfendale (14th Astronomer Royal).

THE THINGS PEOPLE ASK!

Victoria Truesdale asked **Could you provide reasons that Mars could never have supported life**

There is no conclusive evidence of currently existing life on Mars, and some suggestive evidence against it. However, nearly every expert source consulted thinks that, in the very distant past, around the time when life on Earth began (3.8 billion years ago?) Mars had liquid water and very possibly life of some sort. Very few if any experts would say that they rule out life at some time in the distant past. It is at least a possibility that some form of life survives today on Mars deep underground. A good web site with many links to various resources on this subject may be found at:

www.fas.org/mars/marslife.htm

Carla Chase, from Rockville, Maryland, USA wrote: **It would seem that, when matter was first createdit would be plasma. I did a search on "fifth state of matter", and that appears to be something that is extremely cold, whereas plasma is extremely hot.**

Cosmologists are fairly sure that the conditions during the first few seconds of the Big Bang permitted the formation of a certain amount of hydrogen, helium, and a few other very light elements. The amount that formed then was only about 4% of the amount needed to "close the Universe".This is called "baryonic" matter because it has to be made up of heavy particles like protons and neutrons. So if this is all there was, the Universe would continue to fly apart and never slow down. But it is now evident that most of the mass (defined as something that exerts a gravitational attraction) in the Universe is not baryonic.

We have no idea what it is. All we know is that it cannot be seen. We are just beginning to detect most of the baryonic matter in the form of very hot thin gas between galaxies. Only about 20% of the baryonic matter is in the form of stars and dust. The non-baryonic matter is truly dark and cannot be seen except for its gravitational influence, and adds up to about five times the matter seen. The rest of the Universe (the other two thirds!) appears to be some sort of "dark energy", with mass equivalence according to the Theory of Relativity, about which we know even less.

Johnny asked some questions about the Apollo Moon landings, then followed them up by asking: **How come the flag was waving, where were the stars, and where was the blast crater from the landing module?**

These three points are the ones most frequently raised by those who say the lunar landings must have been faked. Those who make any of these three points betray their serious lack of knowledge about the nature of the lunar soil, photography, and rocket engines. If these three common and popular claims of a fake can be immediately debunked by any 15-year-old kid who knows about space and astronomy, what does that tell you about all the other so-called evidences, and the (complete lack of) expertise of those who claim that they are evidence of a hoax?

Firstly, the only time the flag appeared to "wave" was while it was being set up by the astronauts. There was a wire through the top edge of the flag to hold it up (any breeze strong enough to make a flag stand straight out like this would have ripped it to shreds in a very short time!). When the astronauts planted the flagpole, one of them took a film of the event while the other had to push and twist it to get it to go into the lunar regolith top layers so it would stand up. Any pictures taken after this event showed the flag standing perfectly still.

Secondly, the stars are there, but the photographs were set for short daylight exposures to record the lunar surface, astronauts, and spacecraft. Don't forget that it was full daylight on the Moon's surface. No stars could be recorded in such short exposures. To test this, on a clear starry night, go outside with a camera loaded with very slow film (similar to what the astronauts used in the 1960s, say slower than ISO 100), and set the exposure time to 1/60s similar to the astronauts' settings. There will be no stars on your photographs.

Thirdly, why would you expect a "blast crater" if there was only a thin layer of dust on the surface? The pressure in the rocket jet was only about 1.5 lb/in^2, about the same as when you blow on a dandelion to set the seeds in motion. The rocket blew away the fine dust particles (you can see this outward streaming in the well-known landing films) but the heavier pebbles remained in place directly under the rocket exhaust. The unmanned Surveyor lander program that preceded Apollo showed clearly that there was very little dust on the surface, usually no more than a few millimetres.

Ask an Astronomer

"The Things People Ask!" is selected, and edited, from the many questions received, and answers given by the Association of Astronomy Education's "Ask and Astronomer" Service conducted by Dr. Mike Dworetsky, University College, London. *Query* reminds senders of e.mail that plain text format is preferred, not Microsoft Word documents which can transmit computer viruses. The service is available to members of the AAE by e.mail:

query@ulo.ucl.ac.uk, or via the AAE home page:

www.aae.org.uk

FOR YOUR LIBRARY

The Caldwell Objects *Stephen James O'Meara. Foreword by Patrick Moore. Cambridge University Press. 484pp. Illustrations (B&W). ISBN 0 – 521 82796-5 (hardback). £25.00*
Just recently Cambridge University Press has produced a number of excellent books under the series title of "Deep-Sky Companions". Most recently reviewed in Gnomon (the last issue) was Don Macholz' guide to a Messier observation marathon, and the present author's earlier companion to this new volume was his guide to the Messier Objects (Vol 18, No. 4). So Messier has done rather well, but what about the objects that Messier missed? Not all of them faint and difficult by any means, although by far the greatest number visible from the northern latitudes would certainly not often be as obvious as one of the most famous that he did miss - the Double Cluster in Perseus! Well Caldwell has made up the deficiency.

There *may* be some *Gnomon* readers who are not familiar with Caldwell himself, although really I doubt it! But perhaps some may not have heard of Caldwell's own marathon task of listing another 109 deep space clusters, galaxies and nebulae (to match Messier's number) and so not appreciated the fact that the foreword to this book was written by the man himself, Sir Patrick Alfred Caldwell-Moore. Sir Patrick explains in his foreword that, largely through laziness, he has long since not used his double-barreled family name, but if he had used his familiar sobriquet for his new catalog, they would be M numbers as well! Hence his catalog consists of C for Caldwell objects (Sir Patrick may be many things to different people, but I suggest that "lazy" would be at the bottom of most lists!).

His target was to match Messier in the number of objects that he would collect and the first criterion was to include only such objects as he had observed personally. Stephen O'Meara points out that there are still more objects to join both catalogs, and they too are sometimes quite easy objects to observe. He lists 20 of his own, just for starters. Will we have the third book in this series in about three years time called the O'M objects? Only 89 to go!

As in the Messier book, Stephen O'Meara has excelled in the amount of detail produced for each object. The majority of pages (410 of them) are devoted to the objects themselves, what they are, how to find them, what else is in the vicinity in the sky. Each one is photographed, and has many detailed maps together with the author's impressive sketches of the telescopic appearance of the object.

Deep space observation, with the attendant difficulties of finding faint objects, let alone examining them, is not every amateur astronomer's main interest (and that includes Patrick Moore himself!) but there are excellent reasons for taking at least some interest. These objects fill the celestial sphere from pole to pole, and there is never a time when there are less than a night's-worth of objects to observe and enjoy.

Another reason is because some of the most beautiful objects that can be seen in the sky are deep space objects. In encouraging young people to use binoculars and telescopes, it is vital to be able to put them on the track of the Messier, Caldwell, O'Meara and any other deep space objects that are there to be seen. The Moon and planets are not so obliging (see for example, the "Sky Diary" in this issue commenting on the forthcoming perihelic opposition of Mars.)

It is all too common for an aspiring young observer to set out with a treasured new present of a telescope but often without having had the proper encouragement and background of good advice on what sort of telescope or instrument to use, and what to do with it once you have it. Nothing can stop the inevitable loss of enthusiasm that results from aimless scanning of the stars, or the repeated failures to find the object that is being sought.

Books such as this series will be invaluable in putting such a situation right, and giving enormous pleasure to the celestial explorer. The author, and Caldwell, of course, have done a good job. **Richard Knox**

Solar System voyage. *Serge Brunier. Translated by Storm Dunlop. Cambridge University Press. 248pp. Full-colour illustrations. ISBN 0 521 80724 7 (hardback) £30.00*
This is a large coffee table book to go with the author's Majestic Universe, Glorious eclipses, and Space Odyssey, and in much the same style.

There is not a lot of text, compared with the total area of the many beautiful illustrations (although in this case some of the best and most recent ones surprisingly are missing). But there are careless mistakes or some poor science, and a rather florid style of wrting to cope with. **RK**

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Thanks to Carl and Francisco

Our President Francisco Diego may be pleased to know that the text he selected by the late Carl Sagan as part of his "Comment" in the last issue had an impact beyond the readership of *Gnomon*. Sagan's description of the one-pixel blue dot that was Earth, seen from the distance of Saturn, had a threefold message touching upon our humanity, our environment, and our view of our place in the cosmos.

On 2003 April 5-6 I attended the 5th European Congress of Amateur Astronomical Societies, at Nantes in France. It was an extremely well organised event, staged by the Société Astronomique de Nantes. Delegates came from several countries, and the high standard of talks, exhibits and workshops matched the quality of the hospitality.

However, a certain amount of anti-British feeling surfaced occasionally among one or two French delegates, who allowed their views on the political schism between France and the UK governments to intrude into the astronomical context. Sunday morning was devoted to light pollution, and I gave a lecture in French on the progress of the BAA Campaign for Dark Skies, and the need for international co-operation in our approaches to legislative bodies. I finished my talk by announcing that my final quotation touched not only upon astronomy and the environment, but also on our common humanity: Sagan's text, which I had translated into French, was received with a few moments of contemplative silence, and then loud applause, which I am sure was not all for me!

Truly a powerful piece of writing. Thanks to Francisco for highlighting at just the right time.

Bob Mizon

News from Down Under

This *Letter* is unusual for a couple of reasons. First, it is being hand-delivered to the *Gnomon* editor from Australia. I am finishing the writing on the train down to Penzance after a 22-hour flight from "Down Under". *(Now that's what I call dedication! All you tardy potential contributors please take note for the next issue. Ed.)*

Secondly, I thought I might share with you some of my own recent experiences in on-line astronomy education. For the past two semesters, I have worked part-time as a course instructor for Swinburne Astronomy Online (SAO), one of the largest providers of on-line astronomy courses in the world. Operated by the Centre for Astrophysics and Supercomputing from the Swinburne University of Technology campus in Melbourne, Australia, SAO offers a variety of accredited courses, leading to a Graduate Certificate, Graduate Diploma, or even Master of Science in Astronomy.

The Centre has four research astronomers/lecturers, eight administrative staff, nine postdoctoral researchers, and ten PhD students. Yet for a department with an undergraduate enrolment of 260, the corridors are eerily quiet. All lectures, tutorials, projects, and assignments are conducted on-line, and the only time most SAO students will ever attend the campus is for their graduation ceremonies!

The units offered range from "Exploring the Solar System", through the "History of Astronomy", to "Tools of Modern Astronomy" and "Great Debates in Astronomy". A teaching semester of 14 weeks is broken up into 7 fortnights. Each fortnight, the students are expected to work their way through a set of modules and textbook readings. Instead of formal lectures, the course material is provided as a set of Microsoft Powerpoint slides on CD-ROM, prepared under contract by various contributors from around the world. Since it is virtually impossible for the students to assemble in one place at one time, tutorials are conducted via a question and answer format, through Internet news groups. Each fortnight, students are expected to post at least one question concerning the current set of Modules to the news group. They are also expected to post at least one reply to other student's questions. This way, the students effectively teach themselves. The role of the course instructor is to moderate these news groups (by keeping the discussions flowing in the right direction, and quelling any flame-wars if they occur!), as well as tidy up any queries that remain unresolved by the end of the fortnight.

Course assessment varies slightly for each unit, but generally consists of: quality and consistency of news group postings; a 1500-2000 word essay; a research project; and two Computer-Managed Tests (CMTs). The CMTs consist of 20 multi-choice questions, which the students are free to preview and spend up to a week thinking about before submitting answers via the Web.

Although the marking is done automatically, the "open book" format of the CMTs makes it difficult for the course instructors to set questions for which the answers cannot be obtained simply by typing the question directly into a search engine such as Google. In general, I try to find questions which require the students to assemble multiple facts from the course material and/or textbook. Even then, I have learnt that the questions (and answers) have to be worded extremely carefully to avoid any chance that more than one answer could be construed as correct.

Because our students tend to be very Internet-savvy, and have access to a diverse range of resources on-line, plagiarism in essays is a constant worry. In this respect however, the Internet search engines can be our ally. You would be surprised the number of times that SAO instructors have typed suspicious sections of text from essays into Google, and got back an exact match from some little-known Web site! Regrettably, students must be penalised severely for such actions, but they are all warned in advance that while citing sources is encouraged, sheer plagiarism is not acceptable. Not only that, but they must also learn that just because something is published on the Internet does not make it fact!

So who are our students? In my own course (History of Astronomy), I have had retired military officers with home observatories that would put some professional observatories to shame; home-makers with a life-long interest in astronomy, who like the fact they can study at times that suit them; planetarium staff looking to upgrade their credentials; and university undergraduates who cannot access comparable astronomy courses at their home institution. I have had students living on Pacific islands who have Internet access (or power even) available for only a few hours a day, and yet in that time they can feel like part of a community.

Though on-line teaching is still very much in its infancy, SAO has already demonstrated the efficacy and commercial viability of such courses.

Stuart Ryder

If you wish to know more, you can check out **www.astronomy.swin.edu.au** *or contact Stuart at*

sdr@aaoepp.aao.gov.au

Mullach Dubh, Islay © Clive Ruggles

A small sample of a page taken from a module on the history of astronomy dealing with standing stones and their possible astronomical significance, such as in alignments as proposed by Professor Alexander Thom.

Sky Diary Summer 2003

The quarter will be marked by a growing anticipation of the important opposition of Mars that takes place on August 28. This, someone has stated, will be the closest opposition of Mars since the invention of the telescope. This is because the Earth and Mars orbit the Sun at different distances and speeds. As a result, when Mars reaches opposition, at which point the Earth is about to overtake Mars on the inside track, the two planets are at their shortest separation for that particular year. They also line up with the Sun, which is exactly opposite Mars in the sky (hence *opposition*). Whether Mars is also near perihelion or aphelion is another matter. Because Mars has one of the highest eccentricity's of all the planets (all except Mercury and Pluto, and Pluto hardly counts as a planet anyway) if an opposition happens near Mars' perihelion, the planet is nearly half the distance from Earth that it would be at an opposition near aphelion.

Due to the orbital motions of both planets, each successive opposition of Mars happens at a different point in its orbit. The exact interval between oppositions (the *synodic* period) varies due to several variables, but the average value is about 2 years and 50 days (Earth time). So if we measure Mars' position from some date in the past when it was at opposition almost at perihelion, two years and 50 days later it will reach opposition again, but will be some 50 days' motion past perihelion. This will repeat in the next synodic period when Mars will arrive at a position some 100 days' motion past perihelion, and so on. After more than 30 years it will reach another opposition near perihelion, but not as close as this year. Now I leave it to you to work it out! If you put Leonard Digges' invention of the telescope as 1571, there are only 14 such 30-year cycles in which the difference can be made up! At this year's opposition, Mars will be within 1° of its present ecliptic longitude of perihelion, which is almost spot on! The not-so-good news is that all oppositions of Mars near perihelion take place when Mars is relatively low in the northern skies, in Aquarius. But it will reach a magnitude of -2.9, a splendid brightness, and will have an angular diameter of 25", which may not seem much, but it is over half the maximum apparent diameter of Jupiter (45.5" this year) and bigger than the disc of Saturn.

Moon phases for the third quarter of 2003

Month	New Moon	First Quarter	Full Moon	Last Quarter
July	29	7	13	21
August	27	5	12	20
September	26	3	10	18

The planet Uranus is also in Aquarius, and a fairly barren part of the sky, so although it is still 11° south of the equator and magnitude 5.7, it is getting to be a potential binocular object that may be more easily spotted now.

Mercury is just 1° short of its maximum possible angular distance from the Sun on August 14, when it is at 27° maximum eastern elongation, so it may seem that it should look good in the evening sky. It is, however, a good demonstration of how the elongation of Mercury (or any other elusive Solar System object such as the very young, or very old, crescent Moon) is not the important point, because this will not be a good time for northern observers. (Southern observer's will find it well placed, however.)

What matters is the difference between rising or setting times of the object and the Sun and that depends upon the inclination of the ecliptic to the observer's *horizon* which in turn depends upon the date and time of day. You can demonstrate this quite well with a planisphere (as long as it has the ecliptic marked on it), an astrolabe, or (best of all) a celestial globe. But if you have none of these (shame on you) you can make a fair effort at a visual simulation of this situation, (which many people find difficult to visualise) as follows. Open your *Norton's Star Atlas* at Map 3 and 4, or any star atlas at the page showing 00.00hr of right ascension, or the Spring Equinox, which is just below the Great Square of Pegasus. Now place a plane sheet of paper over the lower half of the atlas page to represent the horizon so that the equator crosses the horizon at an angle equal to your co-latitude (90° - lat.). If the equator slopes upwards from east to west (i.e. you can see the equator and ecliptic on the right of the point where they "rise" so you are "looking east"), you are simulating a morning sky. You will see the ecliptic also rising, but at a much smaller inclination. The actual value at 00.00h right ascension is your co-latitude minus 23½°. So if you were on the Arctic Circle, latitude 66½°N, co-latitude 23½°, the ecliptic lies round the horizon in all directions. At British latitudes, say 53½°, the ecliptic is crossing the horizon at only 13°. So when the Sun is near the Spring Equinoctial position, say early March to mid-April, Mercury, or any other body that happens to be close and to the west of the Sun at that time, will rise before the Sun, but not by much. Slide your paper horizon along the equator, keeping it at the angle of your co-latitude, and see for yourself!

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

	July 15		August 15		September 15	
	Rise	Set	Rise	Set	Rise	Set
Sun	04h 08m	20h 26m	04h 53m	19h 38m	05h 44m	18h 30m
Mercury	04h 55m	21h 09m	07h 38m	20h 14m	18h 20m	18h 01m
Venus	03h 17m	19h 54m	04h 42m	19h 43m	06h 22m	18h 48m
Mars	22h 37m	08h 28m	20h 44m	06h 20m	18h 24m	03h 37m
Jupiter	06h 51m	21h 42m	05h 27m	19h 53m	04h 04m	18h 04m
Saturn	02h 54m	19h 19m	01h 10m	17h 31m	23h 18m	15h 40m
Uranus	21h 56m	08h 07m	19h 52m	05h 59m	17h 48m	03h 50m
Neptune	21h 10m	06h 15m	19h 06m	04h 09m	17h 03m	02h 03m

Now repeat all that for maps 9 and 10 in Norton's, or the Autumn Equinox in Virgo (roughly beneath the tail of Leo, Denebola), and you will see that the ecliptic is now steeply inclined to your horizon (60° in the case of the British latitude of 53½°N). This time, bodies rising before the Sun around early September to mid-October, will have reached a much higher position in the sky by sunrise.

The reverse applies to the evening sky at the same times of the year. Try it with your paper horizon, this time with the equator sloping downwards, east to west. The reverse conditions for seeing objects near the Sun apply to observations from the southern hemisphere. This is because the equator at the eastern horizon slopes in the opposite senses to the equivalent points and dates in the northern hemisphere,

Mercury will be well placed for Northern observers in the morning skies near the Autumn equinox, even though the elongation at that time will reach a maximum of only 18°.

The Perseid meteors, which are reliable displays, are due to peak on August 13. One of the best fireballs I have ever seen was in the evening twilight many years ago during a Perseid period, and they are well known for that type of meteor. Alas, look at the table of Moon phases! The almost full Moon will be around all night! Spode strikes again!

Richard Knox