Gnomon

Newsletter of the Association of Astronomy Education

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New Science Centre and Planetarium in Ghana

We had dreamed of creating a Science Centre and Planetarium for many years, but did not have a site or funds. About three years ago Dave Weinrich from Minnesota came to Ghana at the time of the solar eclipse and we were then renting a building with a large space at the back. Despite a lack of funds, Dave committed to helping us create a planetarium if we committed to building it.

Following these commitments, through Dave's contacts and efforts initiating, coordinating and organising, we received some major donations: in particular we received a refurbished Mediaglobe projector from an American planetarium, and Uniview software from Sweden. Jon Elvert and Carol Gikas of Irene W. Pennington Planetarium, Louisiana, donated the projector. Ken Yager and Elumenati donated a laptop and we were supported by Joel Halvorson of Minnesota Planetarium Society and Dave Burgess who organised an Astronomy Club donation.

Digging of the foundations began on Ghana's Independence Day March 6th 2008. The floor was concreted and the wall was constructed with concrete blocks. The dome

☞ *(cont. on p2)*

Double Hubble bean and bubble

A new NASA/ESA Hubble Space Telescope image is one of the largest ever released of a star-forming region. It highlights N11, part of a complex network of gas clouds and star clusters within our neighbouring galaxy, the Large Magellanic Cloud. This region of energetic star formation is one of the most active in the nearby Universe. The Large Magellanic Cloud contains many bright bubbles of glowing gas. One of the largest and most spectacular is LHA 120-N11, from its listing in a catalogue compiled by the American astronomer and astronaut Karl Henize in 1956, and is informally known as N11. Close up, the billowing pink clouds of glowing gas make N11 resemble a puffy swirl of candy floss. From further away, its distinctive overall shape led some observers to nickname it the "Bean Nebula". The dramatic and colourful features show the telltale signs of star formation. N11 is a well-studied region that extends over 1000 light-years. It is the second largest star-forming region within the Large Magellanic Cloud and has produced some of the most massive stars known. It is the process of star formation that gives N11 its distinctive look. Three successive generations of stars, each of which formed further away from the centre of the nebula than the last, have created shells of gas and dust. These shells were blown away from the newborn stars in the turmoil of their energetic birth and early life, creating the ring shapes so prominent in this image.

Beans are not the only terrestrial shapes to be found in this image. In the upper left is the red bloom of nebula LHA 120-N11A. Its rose-like petals of gas and dust are illuminated from within, thanks to the radiation from the massive hot stars at its centre. N11A is relatively compact and dense and is the site of the most recent burst of star development in the region. Other star clusters abound in N11, including NGC1761 at the bottom of the image, which is a group of massive hot young stars busily pouring intense ultraviolet radiation out into space.

Photo: NASA, ESA; and Jesús Maíz Apellániz Instituto de Astrofísica de Andalucía

☞ (cont. from p1) eventually took shape with metal pipes forming the half-sphere like the segments of an orange. Dave Weinrich arrived in May as the domed roof was being constructed. Dave showed us how to use the Mediaglobe Projector and the Uniview Software and organised a domecast with international participants.

The metal segments were lined with wooden supports to hold sections of hardboard for the interior surface. We raced to create a watertight cover for the dome before the rainy season and before Dave returned to America. The first cover failed and was later replaced. The basic structure was completed by June. Interior finishing included creating a smooth surface on the interior of the dome, securing the Mediaglobe to the floor, fixing metal gates to the outside of the two wooden doors, supplying electrical power, installing ventilators, fans and air-conditioning, creating dimmable interior lighting, a sound system, and lining the lower walls with matting. Later, reclining foldable chairs were obtained to replace plastic chairs and wooden benches.

In October 2008 we had our first children's group visit.

Children coming out of the planetarium 2010

Laura and children going into the dome

Soon afterwards our first volunteer, Laura, arrived from the UK and stayed for six weeks. Dave came back for the official opening on 22nd Jan 2009 by The British High Commissioner to Ghana, Dr Nicholas Westcott. Others present were the French Ambassador, the Chief of Nungua, Accra, and the Director of the British Council in Ghana. Volunteers Fran and Pete were with us for six weeks in January and February when we started having regular visits by classes of school children, ranging from age 4 upwards. Groups from a Special School enjoyed the shows greatly and other groups have been students, teachers, club members, families and work groups. On some days we have had groups of 70 or more and have divided them into two groups to take turns, one group doing activities in the summer hut where we have poster displays, with tasks and worksheets to complete, while the other group watches the digital planetarium show.

For their fantastic encouragement long before this building project started, we would like to thank Ray Worthy and Peter Bassett. For making everything possible we are forever indebted to Dave Weinrich We are particularly grateful to Jan Warnstam of SCISS for Uniview software, and to Joanne Young and Mark Zellers of Audiovisual Imagineering for refurbishing the Media-globe projector and to Jon Elvert for securing the donation of the projector. Thanks are also due to Ken Yager, Carol Gikas, Joel Halvorson, Carter Emmet, Dave Burgess, Nick Barton, Stuart Gold, Laura Youngson, Frances Ling, Peter Sitch, William Tackie, Mike Puplampu, The staff of Quality Distance Learning (QDL) and family members.

Dave Weinrich and Jacob Ashong

Jacob and Jane Ashong
Ghana Planetarium

Go to 💻**www.ghanascienceproject.net** for more info.

(There are more pictures of this project on page 7)

☞ (cont. on p7)

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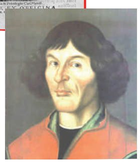
1492, 1609, 2009 and beyond…

Celebrating the International Year of Astronomy at a school as old as modern astronomy itself..!

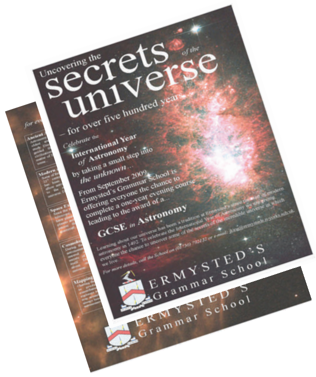
As part of its celebration of the International Year of Astronomy in 2009, Ermysted's Grammar School in Skipton, North Yorkshire launched a GCSE Astronomy course for its Year 9 students, taught in lunch-hours and completed over one year. This obviously involves students in a fair amount of work in their own time. The course has been very successful, resulting in Ermysted's becoming one of the largest centres for GCSE Astronomy in the country.

The school also launched its Primary Astronomy Roadshow which has now toured almost all the local primary schools in the area. This first roadshow has focused on Galileo's pioneering work with early telescopes and its impact on our view of the universe. This has been a particularly appropriate topic for the school, which was founded in 1492 – the year that Copernicus published his important book '*De revolutionibus orbium coelestium*'. In other words, the school is the same age as modern astronomy!



As well as a presentation about Galileo and the first telescopes, the roadshow allows students to use simple telescopes, similar to those of Galileo, and to see a working replica of an eighteenth-century orrery. We intend to continue the Primary School Roadshow every other year, with a new topic each time.

As part of the school's work with local primary schools, 2009 also saw the first publication of 'EGS Astro News', produced by students, which covers topical astronomical items, in a form which younger students and the general public can enjoy. This is now regularly distributed to schools in the area.



Following the success of GCSE Astronomy for students, the school also launched it as an evening class for adults from September 2009. This has again worked well, resulting in four Year 9 students suiting the examination this summer *alongside their parents!*

'GCSE Astronomy Evening Class students of all ages hard at work at Ermysted's Grammar School in Skipton.'

And the future…?

Julien King

ERMYSTED'S

"Our Space" – Digital Adventures in Space

Richard Garriott - computer games guru, adventurer and astronaut - visited the International Space Station in 2008. Now Richard is sharing some of his amazing experiences with you through the videos on his website. I regularly use his videos to start a lesson and they really capture the class's attention. And don't just think these videos can be used in a "space" lesson. He shows us magnets, food and much more in zero gravity. All materials are downloadable.

Visit: www.our-space.org

James O'Neill

Letter from Down Under

Astronomy, like all fields of science, is fast-evolving, so making predictions about the future direction of research is always risky. Nevertheless it is worth taking stock every 10 years or so of where the action is, and assessing priorities for the coming decade in terms of research facilities. Many countries including the USA and Australia (though notably not the UK) carry out such reviews, and the latest Decadal Survey report from the US National Research Council has just been released. The report entitled “New Worlds, New Horizons in Astronomy and Astrophysics” is the culmination of nearly two years’ work by a panel of 23 eminent astronomers, assisted by 180 astronomers on 11 sub-panels. Their task was to assess the areas of space and ground-based astronomy; to recommend priorities for the most important scientific and technical activities of the decade 2010 – 2020; to prepare a concise report addressed to the funding agencies,, to government, to the scientific community and to the public. To ensure wide consultation within the US community, the panel held a series of “town hall” meetings and received over 500 submissions on the state of nearly every field of research and technology and the state of the profession in general.

The panel based their priorities on the scientific objectives, together with careful cost and risk analysis for each project under consideration. They also sought a balance between large and small-to-medium scale projects, between existing and new facilities, between ground and space-based facilities,, and between short-term return or investing for the longer-term future. Clearly this was not going to be a simple process and not everyone would be happy with the outcome. However previous Decadal Plans have been remarkably successful at convincing funding agencies and politicians that the astronomy community is for the most part united in knowing where it wants to go and they have, in large part, met the goals set out.

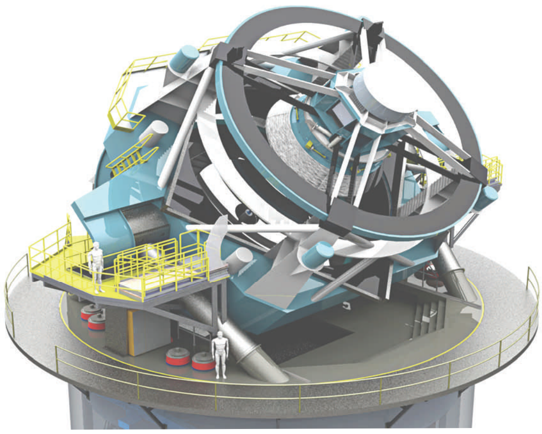
In the area of large-scale space programs the top 4 priorities are:

1. WFIRST, a wide-field infrared satellite costing US$1.6 billion with a 1.5m mirror, to be launched in 2020, which can address not only the nature of the dark energy which dominates our Universe, but will also be capable of detecting extrasolar planets by gravitational microlensing.
2. Augmentation of the Explorer class of small satellite missions, following on from the highly successful series which includes WMAP, Swift, GALEX, and WISE.
3. The Laser Interferometer Space Antenna (LISA) mission, a set of 3 spacecraft whose separations of up to 5 million km can be measured so precisely that it could detect the passage of gravitational waves due to merging black holes, as well as test general relativity.
4. The International X-ray Observatory (IXO), the next generation of X-ray observatory after Chandra and XMM-Newton, probably as a joint mission with ESA and the Japanese space agency.

In addition, a set of medium-scale space programs focuses on new technologies that will help us characterise the nature of planetary systems around other stars and to refine our measurements of the cosmic microwave background which carries a fossil imprint of the formation of the first galaxies.

For large-scale ground-based programs, the top 4 priorities are:

1. The Large Synoptic Survey Telescope (LSST, see photo), an 8m-class telescope planned for Cerro Pachon in Chile with a 9.6 square degree field of view, which will be able to image the entire southern sky every 4 days, revealing millions of new transient sources (supernovae, variable stars, etc.) and minor planets.
2. A mid-scale Innovations Program, akin to the Explorer class of satellite missions, to facilitate the rapid development and deployment of innovative new instruments and survey facilities on existing ground-based telescopes.
3. Acquiring a major share in one of the two US-led extremely large telescope (ELT) projects, either the Thirty Metre Telescope (TMT), or the Giant Magellan Telescope (GMT).
4. The Atmospheric Cerenkov Telescope Array (ACTA), which will enable the study of the highest energy phenomena in the Universe (black holes, supernova remnants, and possibly the annihilation of dark matter) from air showers produced by their gamma rays.



Computer visualisation of how the LSST will appear when completed. Note the human figure on the platform for scale, and the unusually fast focal ratio. (Image credit: LSST Corporation / NOAO)

One medium-scale ground-based program singled out is the Cerro Chajnantor Atacama Telescope (CCAT), a 25m diameter sub-millimetre telescope which will nicely complement the Atacama Large Millimetre Array (ALMA) currently being commissioned in Chile.

There is as yet no new funding source clearly identified for any of these projects, and many of them will require joint investment with other international partners. But being identified as a high priority project by an independent panel such as this provides powerful ammunition to the project teams as they lobby for construction and operations funding. Other countries naturally have different priorities but take great interest in the US rankings. Probably the one of most interest to us here in Australia is the recommendation to invest in just one of the extremely large telescope projects. Australia has already committed funding to be a 10% partner in the GMT so has a lot riding on which of the two projects the US does ultimately decide upon. While neither ELT project is reliant on having the US National Science Foundation involved, such a vote of confidence and long-term commitment to operations funding would go a long way towards guaranteeing the project’s success.

Australia’s last Decadal Plan was drawn up in 2005, and we are currently in the process of a Mid-Term Review. In the area of optical and infrared astronomy, two of the three key recommendations from that report have already been met, namely securing the long-term future of the AAO and establishing a significant stake in an ELT. The third recommendation, that Australia increase its access to 8m-class telescopes, will be met in part by the UK’s withdrawal from the Gemini partnership in 2012, taking our share to 8%. Nevertheless, we must be constantly vigilant in maintaining these hard-won gains, and not being afraid to change priorities when exciting new avenues of research open up.

Stuart Ryder
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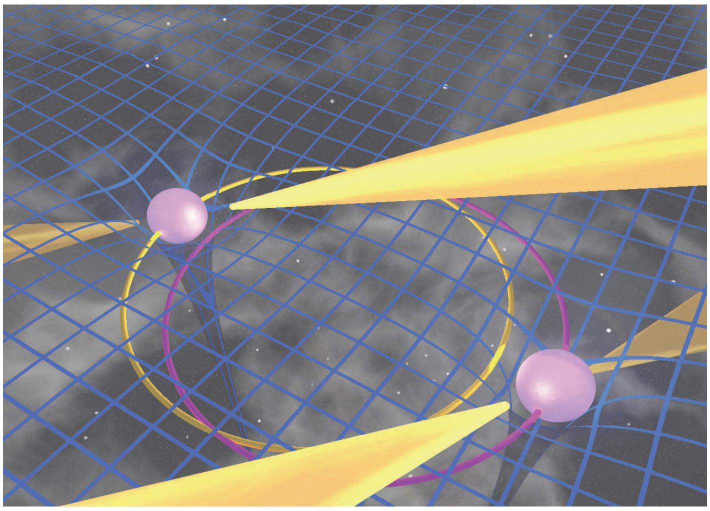
Proving Einstein Right (Part 3)

The most stringent test of General Relativity to date has been produced by another pulsar system, this time where both objects in the system are pulsars, called the "Double Pulsar". It was discovered in a survey carried out at the Parkes Telescope in Australia using receivers and data acquisition equipment built at the University of Manchester's Jodrell Bank Observatory. In the analysis of the resulting data, using a super-computer at Jodrell Bank, the double pulsar was discovered in 2003. It comprises two pulsars of masses 1.25 and 1.34 solar masses spinning with rotation rates of 2.8 seconds and 23 milliseconds respectively. They orbit each other every 2.4 hours with an orbital major axis just less than the diameter of the Sun. The neutron stars are moving at speeds of 0.01% that of light and it is thus a system in which the effects of general relativity are more apparent than any other known system. At this moment in time, General Relativity predicts that the two neutron stars should be spiralling in towards each other at a rate of 7mm per day. Observations made across the world since then, including those using the Lovell Telescope at Jodrell Bank, have show this to be exactly as predicted.



In fact, five predictions of General Relativity can be tested in this unique system. The one that has provided the highest precision is a measurement of the Shapiro delay. By great good fortune, the orbital plane of the two pulsars is almost edge on to us. Thus, when one of the two pulsars is furthest away from us its pulses have to pass close to the nearer one on their way to our radio telescopes. They will thus have to travel a longer path through the curved space surrounding the nearer one and suffer a delay that is close to 92 microseconds. The timing measurements agree with theory to an accuracy of 0.05%. Einstein must be at least 99.95% right!

As the two neutron stars are gradually getting closer, at some point in the future they will coalesce to form what may well be a black hole. As they finally merge into one, what I can only call a gravitational wave "tsunami" is produced. The predicted strength of this gravitational wave is sufficient for it to be detected by the gravitational wave detectors now in operation on the Earth; two in North America, two in Europe and one in Japan.

The way that they could detect such a gravitational wave can perhaps be understood by a "possible" way to detect a tsunami wave crossing an ocean. Suppose, in a "thought experiment", two boats are spaced one kilometre apart and an accurate laser system measures the distance between them. Should a tsunami wave first reach one of them, the boat will carry out a circular motion as the wave passes beneath thus making a small momentary change in the two boats' separation which will be detected by the laser system. Some time later the wave will reach the second boat and the separation will again show a deviation. Note, however, that a tsunami wave which comes side-on and reaches both boats simultaneously would not be detected as the boats' motion would be at right angles to the distance being measured. To overcome this one might well have three boats to make a right angled triangle and so waves reaching the boats from any angle could be detected.

This is similar to the gravitational wave detectors such as "LIGO" - the Laser Interferometer Gravitational Wave Observatory in North America. LIGO uses a device called a laser interferometer, which measures the time it takes light to travel between suspended mirrors to very high precision using laser light. Two mirrors, 4 kilometres apart, form one "arm" of the interferometer, and two further mirrors make a second arm perpendicular to the first forming an L shape. Laser light enters the system at the corner of the L and a beam splitter divides the light between the arms. The laser light reflects back and forth between the mirrors repeatedly before it returns to the beam splitter. Any deviations in the path lengths can be measured with extreme precision. Movements as small as one thousandth the diameter of a proton can be measured! To achieve this, the mirrors and the light paths between them are housed in one of the world's largest vacuum systems, with a volume of nearly 300,000 cubic feet, evacuated to a pressure of only one-trillionth of an atmosphere. High-precision, vibration-isolation systems are needed to shield the suspended mirrors from natural vibrations such as those produced by earth tremors.

To date, no gravitational waves have been detected. Gravitational wave detectors will not detect the merging of the two neutron stars in the double pulsar for they are predicted to merge in 84 million years time! However we believe that such binary systems are common and that such an event should happen on time scales of a few years within this galaxy - so watch this space! By 2015 the sensitivity of the LIGO systems will be greatly enhanced and then events happening over much of our local universe could be detected - the direct detection of gravitational wave cannot be far off!

However, though we are now showing that Einstein's theory holds true to high precision, this cannot be the whole story. One of the most perplexing problems in theoretical physics at the present time is the attempt to harmonize the theory of general relativity, which describes gravitation and applies to the large-scale structure of the universe (including stars, planets and galaxies) with quantum mechanics, which describes the fundamental forces acting at the atomic scale of matter. It is commonly thought that quantum mechanics and general relativity are irreconcilable, but general relativity can be linked to massless particles called gravitons. There is no proof of their existence, but quantized theories of matter necessitate their existence and they would act as "messenger particles" carrying information about changes in mass distribution in the same way that the other fundamental forces have messenger particles - for example photons are the messengers of the electromagnetic force and gluons are the messengers of the strong force (which keeps groups of three quarks bound together to form protons and neutrons).

The graviton is an essential element of much modern theoretical physics and one major effort of the Large Hadron Collider, the world's largest particle accelerator, is to provide evidence for their existence though it will not be able to detect them as such.

One problem is that the force of gravity is ~10^{39} times weaker than the other electrical forces that control the universe. One idea is that is that gravity may in fact have an intrinsic strength similar to that of the other forces, but appears weaker because it operates in a higher-dimensional space. This provided a link with string theories where there may, in fact, be 11 dimensions in all. Six of these are tightly curled and form the fundamental particles - called strings. The way in which these vibrate defines the type of particle. Four further dimensions are those of space and time which thus leaves one further dimension. Some think that gravitons can "leak out" into this hidden dimension so that gravity appears to be far weaker than it actually is.

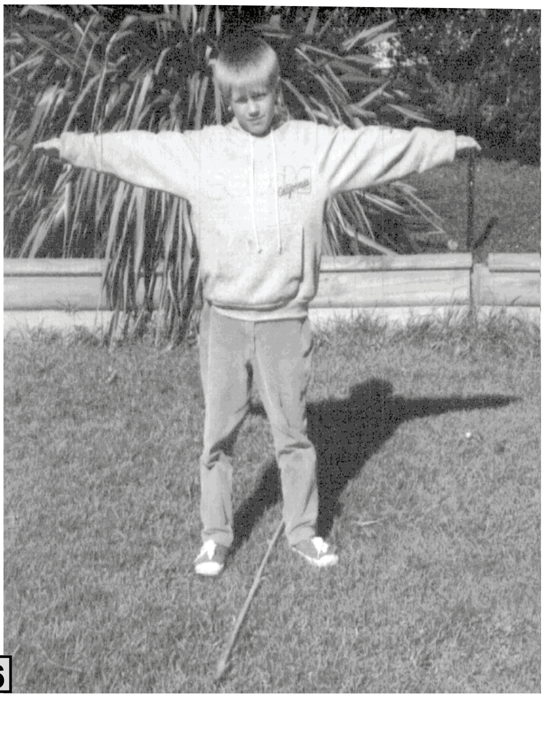
We have a lot to learn!

Ian Morison

Curriculum Corner

Plotting the Sun's Path

Repeat last issue's "I'm a Compass" activity at solar noon time with the students raising their hands out sideways to point to the western and the eastern horizons. By bringing their outstretched left hand above their face to touch their outstretched right hand they will make the path that the Sun appears to take across the sky.



Do this at home:

When this activity is done at solar noon at home over the weekend, the students are able to set up a north-south line at their place. They should mark it somehow (with a string or stick). Standing astride this line just after dusk, facing south, raising their hands out sideways and bringing their outstretched left hand above their face to touch their outstretched right hand they will make the path of the moon, planets and constellations of the zodiac, in other words the path of the ecliptic. Bright objects anywhere along this path, besides the Moon, could be planets.

Vocabulary: horizon, solar noon, British summer Time, zodiac, ecliptic

NB Solar noon is when the sun is half way in time between sunrise and set at the place where you live. The time of solar noon changes slowly from week to week and varies throughout the year depending on the season and time changes, such as daylight saving, and is usually after "clock" noon. You could discuss with the students how "British Summer Time" works.

Eric Jackson

(This activity is developed in next issue's "Curriculum Corner" so students can use their north-south line at home to find the Plough, Polaris and the circumpolar stars).

The Pink Icing

Any experienced teacher or planetarium operator will tell you that one of the most important aspects of programme preparation is getting the intellectual level of the programme matched with the mental development of the class. I have seen several instances where the matching was either poor or non-existent and there was no rapport between the operator and the class.

Whenever I found myself in the dome with an unknown class, I started off with a quick and simple quiz, so that the pupils could show off with their knowledge. I gradually made the questions more searching. Sometimes I ended up by saying "You know it all. Why am I here?" This often relaxed the class and a brilliant session ensued.

All this preparation, of course, pre-supposed that the class was homogeneous and that the general development level was similar. Now, consider this situation: a primary school situated in the Vale of York. The area was rural and the village was small, so small that the local education authority and the village council were constantly warring about the proposed school closure. One consequence of this small size was that the class was a " Family Unit" and instead of all being roughly the same age, the pupils were of mixed ages and had reached different stages of development. I decided to aim at the level of the youngest and invited the older ones to chip in from time to time and try to keep everyone on board.

The teacher wanted a programme which included a show about the planets. I went through how the stars were formed from their nebulae and explained that probably most stars would have a family of planets. Then, in some detail, I went through the planets with a quick addendum about their moons. The intelligence level of the pupils was quite high and they paid close attention to everything I said.

Towards the end of the planet series, we came to the amazing picture of one of Neptune's Moons, Triton. I explained that the temperature was so low that if it went much lower it would reach a point where it could no lower. The kids had never heard of the concept

☞ (cont. on p7)

☞ *(cont. from p6)* of Absolute Zero.

The slide showed the frozen surface and the pole covered with a frozen pinkish ice and black smoke coming away from various points on the ice cap.

"Where are the clouds " asked one, and I had to explain that the temperature was so low that all the material which could make clouds was frozen into solid matter.

There was an eight year old girl on the floor next to me. She had taken an avid interest all the way through, constantly asking pertinent questions.

"What is that stuff?" she asked.

"What particular stuff do you mean?"

"That icing stuff"

"Well", said I, "It is a stuff which on Earth would be a gas; a gas which you could burn so that you fry your sausages on it."

"Yes, but what is it?" She had four years before she would go to the big school and do chemistry.

"It is a gas we call methane."

"Yes, but what IS it?" she insisted. "What is methane?"

I was stumped. How do you explain what methane is so that she could understand and be satisfied. "Well," I said again, deep in thought. "It is sometimes called Natural Gas." Was she satisfied? No she was not.

"What's natural gas?" she persisted.

Now, I am stuck. Where do I go from here? In for a penny, in for a pound, so I waded in.

"You know how little Johnny at the back of the class makes a rude noise with his bottom", I asked. The class was by now sitting up and paying very close attention.

"Yes", She said, "We have a boy called Benjy and he is always making rude noises."

"Well then, that's natural gas. It comes from animals and plants."

She was truly puzzled but the class was buzzing.

"But what's that got to do with that icing on that moon?" she demanded.

"What am I getting into here?" I asked myself. "Where are we going?"

So bravely I answered, "If little Johnny was sitting on that moon, it would be so cold that the gas which comes out would freeze and make that pink icing." That should do it I thought, but I was sadly mistaken. The class dissolved into hilarious laughter, but the poor girl burst into a genuine flood of tears that I and her teacher became very concerned.

"What is the matter, love?" I asked,. "What have I said to upset you?"

No answer came for quite some time whilst the class was rolling around the floor in merriment. "What is it?" Why are you crying?"

The answer came through, punctuated by her sobs,

"It's my birthday tomorrow and I am having pink icing on my cake!"

Ray Worthy

World Space Week, 4-10 October 2010

UN-declared World Space Week, October 4-10 annually, is the largest space event in the world and the ideal time for teachers to use space in the classroom to excite students about learning. The World Space Week Teacher Activity Guide provides quality space-related maths and science activities for this purpose. It requires little or no teacher preparation and can be found at:

💻www.worldspaceweek.org/education.html

James O'Neill

☞ *(cont. from p2)*

The Ghana Planetarium also has a work/teaching/activity area called the "Summer Hut" where one group can work while another is in the planetarium.

Some of the youngest visitors, working in the Summer Hut.

Lincoln School children walking to the dome

Most of these photographs were taken by Jane Ashong, but the construction of the dome shot was taken by William Tackie. There is a useful list of worldwide planetariums on the French website APLF. The entry for Ghana Planetarium has a picture showing the inside of the dome when a show was on. (This photo is credited to Dave Weinrich).

💻www.aplf-planetariums.org

(NB This site provides an English translation!)

Jane Ashong

UK-ESERO

The European Space Education Resource Office has a UK centre at last. UK-ESERO, also known as the UK Space Education Office, aims to promote the use of space to enhance and support the teaching and learning of Science, Technology, Engineering and Mathematics (STEM) in schools and colleges throughout the UK. Funded by the European Space Agency (ESA) and the Department for Education UK-ESERO aims to:

- share good practice and teaching and learning resources globally with teachers and college lecturers.
- be the first point of contact for the education and space communities when seeking information about space education and careers.
- raise the profile of ESA, the UK Space Agency and the wider UK Space community with schools and colleges.

I recommend contacting your area space ambassador and asking for some resources. Ask for the "International Space Station Education Kit" which is a folder full of brilliant resources.

James O'Neill

Sky Diary Autumn 2010

Welcome to the last quarter of 2010 and the sky notes. I'll start with the planets and discuss what is, and what is not, visible in the night sky. Mercury is always a tough object to spot. It would be better to wait until the new year but if you want to try and if you have a very low horizon, look south-west just after sunset. Venus, on the other hand, is a very favourable sight in the morning sky from November onwards. Venus will be prominent in the south-east before sunset, a beacon of light marking each new day. The old crescent Moon will be close to Venus on 2nd December.

Moon phases for the fourth quarter of 2010

	New Moon	First Quarter	Full Moon	Last Quarter
October	7	14	23	1 & 30
November	6	13	21	28
December	5	13	21	28

Heading further through the Solar System we reach Mars. This is yet another planet too near the position of the Sun in the sky to be seen clearly. However Jupiter is available in all its glory for the last part of 2010 and this is the best object to observe this Autumn. Sitting right near Uranus the planet can be seen southwards each night. By the end of the year it will be visible early in the evening. If you are confident with a telescope or mounted binoculars you can make observations of Jupiter at a reasonable hour. So if you are running an astronomy club at school it might be worth trying to get the pupils to see the planet and they would not have to stay behind at school too long.

Saturn reappears from its conjunction with the Sun in December. You can find it upwards and towards the right of Venus. Use a telescope or binoculars and if you see that the "star" you are looking at is not perfectly round then you have found it.

After the fantastic Perseid meteor shower this year let us hope for some further meteor action. The most favourable showers are the Taurids on the 3rd and 13th of November, the Leonids on the 17th/18th and in December the Geminids peak on the 12th. The Leonids have a variable rate so you are not always sure what you are going to see. Also the night of maximum will see a fat gibbous Moon. But as the evening goes on the Moon will become lower down. The Geminids however are a better prospect as they have a predicted rate of 100 per hour and the quarter Moon will set earlier in the evening. Furthermore this shower is also at a time of year when we might get some clear skies!

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

	October 15		November 15		December 15	
	Rise	Set	Rise	Set	Rise	Set
Sun	06:36 ♍	17:18	07:31 ♎	16:21	08:13 ⛎	16:00
Mercury	06:27 ♍	17:21	09:17 ⛎	16:50	08:58 ♐	16:44
Venus	09:09 ♎	17:01	05:18 ♍	15:13	04:05 ♎	14:08
Mars	09:26 ♎	18:12	09:28 ⛎	17:13	09:16 ♐	16:45
Jupiter	16:34 ♒	04:10	14:28 ♒	01:57	12:31 ♒	00:06
Saturn	05:21 ♍	17:08	03:39 ♍	15:12	01:55 ♍	13:20
Uranus	16:33 ♓	04:25	14:29 ♓	02:19	12:31 ♓	00:20
Neptune	15:36 ♑	01:25	13:33 ♑	23:19	11:36 ♑	21:23
Moon	14:22 ♐	23:28	13:36 ♒	00:39	12:27 ♓	01:46

Data for other venues and dates can be estimated from this (and Moon phase) table. Symbols after rise times show constellations where body is, at rising.
⛎ is a symbol "borrowed" for Ophiuchus, the "13th" zodiacal constellation.

On the 21st of December we have a lunar eclipse. But this time there is a catch: it is very low down in the north-west. Still, it is a treat during the Christmas holiday so give it a go. The Moon enters the Umbra starting at 06:32 and will be fully eclipsed at 07:40. Mid totality is at 08:16 but get snapping with the camera quickly as the Sun rises about 10 minutes later.

James O'Neill

And Some "Snippets" from James:

IYA 2009 Reached Hundreds of Millions of People: Final Report Released

A 1300-page final report for the International Year of Astronomy 2009 was released early September at the European Week of Astronomy and Space Science in Lisbon, Portugal. The report shows that at least 815 million people in 148 countries participated in the world's largest science event in decades.

For more information visit:

www.astronomy2009.org/news/pressreleases/detail/iya1006/

Launch of SKA website for schools:

An interactive educational website dedicated to the Australian Square Kilometre Array (SKA) radio telescope will encourage school students to reach for the stars. Launching the SKA website developed by Questacon, the Australian Parliamentary Secretary for Innovation and Industry, Richard Marles, said while the website is aimed at school children, especially those who are considering further studies in astronomy, it is really designed for the world. For more information on the SKA radio telescope visit the new interactive website www.ska.edu.au