



Gnomon

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Astronomy society target new junior members

The Society for Popular Astronomy, is launching in October a major new initiative to help new young members take up an interest in the stars. The Young Stargazers section will encourage and help members who are under 16 via special pages in *Popular Astronomy*, the Society's quarterly magazine, and a special "Young Stargazer" file containing loads of useful observing information that all junior members will receive on joining. Young Stargazer's membership is at a special rate of only £10 a year.

Chief Stargazer is Emily Baldwin, who also edits the Society's *Prime Space* publication that is available at some science centres and planetaria. She said: "The Society exists to promote an interest in astronomy among beginners of all ages. We have a long tradition of showing that science can

be fun and putting over the excitement of astronomy in plain English without the jargon. However, we feel it is important to recognise that younger members may feel put off if a society appears dominated by adults, and we want to give them their own space to develop their interest and to communicate with other young enthusiasts."

Young Stargazers Files will contain lots of useful information about choosing your first pair of binoculars or telescope, observing - including sheets for you to fill in to help you focus your observing sessions, and facts about the world's greatest telescopes. Members will also be pointed towards the best websites, places of interest and astronomy stores in the UK (The Society's Membership Card allows some great discounts!).

Young Stargazer members of the Society will receive *Popular Astronomy*

(including *Prime Space*) quarterly, and regular newsletters to keep up to date with the latest news. There will be special Young Stargazer pages in *Popular Astronomy* too, including competitions and quizzes, to fun facts and things to make. Other information will include tips on starting astronomy clubs at school, and even careers advice. The Young Stargazers' pages will also feature photos and drawings of members' observations.

The Society's Vice President, Robin Scagell, said: "Although *Popular Astronomy* is already easy to understand by all beginners, young or old, we feel that young people need something extra. We want to give our young members the sort of help that they just can't get from the internet.

For more information visit the Society's website www.popastro.com

Ring of dark matter

An international team of astronomers has discovered with the Hubble Space Telescope a ghostly ring of dark matter that was formed long ago during a titanic collision between two massive galaxy clusters. It is the first time that a dark matter distribution has been found that differs substantially from the distribution of ordinary matter. Astronomers have long suspected the existence of the invisible substance of dark matter as the source of additional gravity that holds together galaxy clusters. Otherwise, astronomers say, the clusters would fly apart if they relied only on the gravity from their visible stars. The discovery of this ring is among the strongest evidence yet



that dark matter exists. The ring measures 2.6 million light-years across, was found in a galaxy cluster 5 billion light-years from Earth while mapping the distribution of dark matter within the cluster. During the dark-matter analysis, a ripple somewhat like the ripples created when a stone drops into water was spotted.

The discovery, by a team from John Hopkins University, raised the questions of why the ring was in the cluster and how it had formed. Research was found that suggested the cluster had collided with another cluster 1 to 2 billion years ago. The research, published in 2002 had revealed two distinct groupings of galaxies clusters, indicating a collision between both clusters. The collision occurred, fortuitously, along Earth's line of sight, from which perspective, the dark-matter structure looks like a ring.

The John Hopkins team created computer simulations to show what happens when galaxy clusters collide. As two clusters smash together, the dark matter falls to the centre of the combined cluster and "sloshes back" outwards. As the dark matter moves outward, it begins to slow down under the pull of gravity and "piles up", like cars form platoons on a highway.

UK Schmidt Telescope material for disposal

The UK Schmidt Telescope (at Siding Spring Observatory, Australia) photographed the southern sky from 1973 to 2003, taking over 19,000 original plates.

Many plates were taken for the various southern sky surveys and these have been scanned by different measuring machines, including the SuperCOSMOS machine in Edinburgh (www.wfau.roe.ac.uk/ssss) The original 14 inches square glass plates (each covering 6.5 X 6.5°) have all been archived in a specially designed archive at the Royal Observatory Edinburgh and can be accessed on request.

The sky surveys were reproduced as sky atlases on both film and glass and much of the copying was done in the photographic laboratories in Edinburgh. These labs have now been closed and dismantled and therefore no further copies can be made from either the original (negative plates or the intermediate positive plates. Most duplicate material will be disposed of very shortly; this includes both positive and negative plates (of random areas of sky) and negative film copies. Some film copies have been made into teaching packages which are also useful as demonstration material.

Details of some of the material can be found at the web site listed below. Much of the material can be provided free the recipient having to pay only postage and packing costs. For some (the most popular) there will be a small charge (probably less than that quoted on the website).

If anyone is interested in acquiring any of this material please contact Sue Tritton as follows:

Sue Tritton, Royal Observatory Edinburgh, Blackford Hill, Edinburgh EH9 3HJ. ☎ 0131 668 8326; ✉ sbt#roe.ac.uk
🌐 www.roe.ac.uk/ifa/wfau/ukstu/

Newcastle planetaria going and coming

Many *Gnomon* readers will have been distressed to hear of the closure of the Planetarium at what I still think of as the South Shields School of Navigation. As a teacher, both my classes and I benefited from Eva's knowledge and enthusiasm. Its closure and Eva's departure are both losses to the region.

But, as in the heavens, there is a continual cycle of birth, death and rebirth, and there is now a new digital planetarium at the Centre for LIFE, conveniently situated next to the Central Station in the middle of Newcastle.

Our 10m dome seats 68 people and we have two projection systems. One is de Pinxie unit which projects a custom-built show which explores life in extreme environments on Earth then takes off to other parts of the Solar System to search for places where life could be possible. However, teachers will probably be more interested in the D3 system which projects a conventional star field and allows exciting animation of plants, nebulae and other astral images.

We currently have a seasonal astronomy show which can be enhanced for school, audiences with information about the factors giving rise to days, years, months and seasons. We are actively writing an interactive show aimed at KS1 which will make more use of the showmanship which is possible with the D3 system. We also intend to write a show to support higher level astronomy based on the theme of star birth and star death. We have a novel idea for its delivery – so watch the space for news of its world premiere!

In addition to the conventional astronomy shows we have curriculum linked workshops which we deliver in our education suite.

KS1: Alive in space. The children are told that they are going on a space journey and they are asked to pick things from a basket that they will need to stay alive. The objects include cuddly toys and sunglasses as well as replica food, canisters labelled air and bottles of water. The children then sit on mats in a "spaceship" and are briefed on the procedures they must follow in an emergency. They then follow an animated PowerPoint to fly through the Solar System. Beyond Eris, they encounter a strange planet populated by strange life forms. The children have been divided into groups before the flight and given a secret thing which they have to mime as a group. The rest of the children have to guess what the object is and say whether or not it is alive. At the end of the last mime, the emergency alarm sounds and the children have to jump on board for a speedy return to Earth.

KS2/3: How do we know that the Earth is rotating? We start off by asking the students this challenging question. They come up with a variety of ideas but soon realise that they do not really *know* that it is true. We then set up a giant pendulum and return to the tables to work with little pendulums on turntables. We quickly establish that pendulums keep swinging in the same direction, regardless of whether the mounting base is turned. We then repeat the experiment with a little model man on the turntable and we get the students to recognise that the apparent direction of motion changes, not because of the motion of the pendulum changes but because the surface on which the model is standing has been moved.

We then go back to the big pendulum which has, of course, precessed. We make a big fuss about "Did any one touch the pendulum?" We get them to recognise that the apparent direction of motion has shifted and this is the point where one can see the light bulbs beginning to come on. We persist with the chain of logic. Did the building move? Was there an earthquake? Of course, Foucault's pendulum is nothing new but with out the small scale work with pendulums, turntables and models, it is too big a leap for young minds to make. At the end of this session the students will *know* that the Earth is rotating. We contrast the position between the start and end of the workshop and

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There will generally be a 10% discount to AAE members on all publications and advertising rates.
Practising teachers may claim their subscriptions as an allowance against income tax, effectively reducing their contributions.

All communications (except those to the Editor) should be addressed to:

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A 25% reduction is made for advertising in all four issues.

Publication Dates:

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

point to the difference between scientific proof and mere belief.

KS3/4: What do satellites do for us? Students use satellite images to plot the decline of the Aral Sea and use on-line resources to find aerial images of their own house and track polar bears. They use handheld GPS to monitor the satellites visible from the Centre for LIFE and compare this with the satellite orbits we have shown in the planetarium.

KS4/5: How old is the Universe? It took me a little while to realise that astronomers do not spend a lot of time looking at stars. They conduct their real work on photographs of astronomical objects. In a programme devised in conjunction with Durham University, students measure the red shift and apparent size of selected galaxies. From size they can estimate distance, make a Hubble plot, derive a value for the Hubble constant and hence a value for the age of the visible universe.

Most students get the right order of magnitude and generally estimates are within 10% of the currently accepted value. The transition from astronomical pornography (nice pictures but all you do is look at them) to research tool is a valuable illustration of how science works.

KS5: What evidence is there for dark matter? In another programme devised by astrophysicists from Durham University, students measure the rotational speed and apparent magnitude of distant galaxies in Hubble Deep Field images. They then compare real mass and visible mass and find that the former is much greater than the latter.

Next they look at the arcs caused by gravitational lensing of very high red shift objects. From the size of the arcs and the distance calculated from red shift they can calculate the mass of the object which is focusing the light. This is always very massive and located in deep space between galaxies. So students have evidence which can be explained by large amounts of unseen material both within galaxies and between galaxies – evidence for dark matter.

For more information visit www.life.org.uk

If you are interested in visiting the Centre for LIFE or finding out more about its astronomy programme, please contact me at noel@life.org.uk or **0191 243 8211**

Noel Jackson

New role for Herstmonceux

In the heart of the Sussex countryside, Herstmonceux was once the home of the world's busiest and most famous astronomical observatory. The six green domes are very distinctive and contain some of the largest telescopes in the country. It is now a leading Science Centre not just in the South-East but throughout the UK and is open to the public seven days a week for ten months of the year.

With the help of the National Heritage Lottery Fund, this unique Grade II listed building has been refurbished allowing four of the historic telescopes to be restored to working order. Open evenings and special evening events afford the opportunity to look through these telescopes at the Moon, planets and other astronomical phenomena. The Centre's mission is to try and help you identify the constellations and understand the mysteries of the Universe including our own Solar System.

One of the exciting new developments that have occurred on the strength of the telescope refurbishment is the Herstmonceux Astronomy Festival. This has been running for two years and our third year promises to be even bigger. As an educational charity it would be almost impossible to find the money to maintain the telescopes in the condition they deserve without raising funds somehow. The aim of the festival is to generate some money to help us do

this. This year the festival was over the first weekend of September. Visitors could camp under the backdrop of the domes and enjoy a full programme of events including guest speakers, trade stalls, family activities (including rocket launching), raffles, telescope tours, quizzes and of course viewing through the telescopes.

There were over 100 hands-on exhibits, indoors and out, offering spectacular science and visitors were challenged to discover what they could make these devices do.

If you were unable to make the festival but would like to come along some other time, we cater for everyone. School visits are a speciality, motivating children and stimulating their minds. The wealth of hands-on experience gained, helps to reinforce previous knowledge or complements work carried out in school at a later date. A pre-booked guided tour of the telescopes can also be incorporated into the visit. The tour guides always aim their talk at the level of ability and knowledge of your group and actively encourage interaction through questions and answers.

The tour usually lasts for approximately 40 minutes, is highly recommended and leaves students and teachers alike with a sense of awe and wonderment about astronomy, astronomers and what giant telescopes can do! We



also offer twilight visits to schools with or without an active interest in astronomy. On a clear evening there is nothing quite like looking through a large telescope and seeing for yourself the wonders of the night sky. If viewing is not possible we aim to fill your evening with stimulating facts about astronomy.

We are all very proud of the Centre and we want everyone to gain as much out of their visit as they can. It is not possible to describe in detail the tremendous range of activities The Observatory Science Centre has to offer. You will just have to come and see for yourself!

Check out the website for full details which are being updated all the time www.the-observatory.org

Sandra Voss 

This year's Royal Astronomical Society Newspaper and Feature Article competition for schools invited students to imagine what space exploration would be like by the year 2057, the 100th anniversary of the beginning of space exploration with the Sputnik probe.

The competition once again attracted a wide range of entries from across the UK and beyond, with a high standard in all age categories. Many entries imagined how the newspapers of 2057 would be celebrating the 100th anniversary of Sputnik, by which time, travel around the Solar System would apparently be commonplace with hotels and holiday resorts available on a number of planets.

Some entrants imagined that the significant technical problems of manned space travel beyond our Solar System would have been overcome by 2057, allowing the exploration of other planetary systems within our galaxy. A number of entrants felt that this would almost inevitably have meant that we would have made our first encounter with intelligent life - a popular topic for illustrations!

As in previous years, the Newspaper and Feature Article formats of the competition allowed students of both primary and secondary school age groups to enjoy working together to produce some very professional results.

This year's winners and runners-up were:

7-11 NEWSPAPER COMPETITION

Winner: "Parillis Earth found" by: Josiane Segar & Angeli Bhowse of South Hampstead High School, London NW3.

Runners-Up: "Nodehill Star II" by: Year 5 Class of Nodehill Middle School, Newport, Isle of Wight.

"Super Seven Safe on Mars" by: Becky Black, Emma Cowdray, Claudia Evans, Beatrice Fabris, Ana Hallgarten, Sophia Murdock & Shriya Sethia of South Hampstead High School, London NW3.

11-14 NEWSPAPER COMPETITION

Winner: "The SpaceTimes" by: Danya Zeng & Alice Zaparova of Rugby High School, Rugby.

Runners-Up: "The Shooting Star" by: Baytree Science Club, The Baytree Centre, Brixton, London SW9. "The Shooting Star" by: Dominic Ingram, Jake McBride & Hannah Holah. Pate's Grammar School, Cheltenham.

14-16 FEATURE ARTICLE COMPETITION

Winner: "What will this be like in 50 years?" by: Timothy Robinson, Jack Titley & Richard Nicholson. Mary Webb School & Science College, Shrewsbury.

Runners-Up: "A century among the stars" by: William Warner. Haberdashers' Monmouth School for Boys, Monmouth. "The Titan Project" by: Jenny Shrimpton. Stroud High School. "Space - 2057" by: Abigail Beall. St. Columba's School, Kilmacollm, Scotland.

The winning entries can be viewed by following the Education links on the Royal Astronomical Society's website www.ras.org.uk

All winning schools will receive a telescope, along with individual astronomical prizes for each student.

The competition for the academic year 2007/8 will be based around the Sun and its influence on the Earth, to help celebrate International Heliophysical Year. A leaflet giving full details of the 2008 competition can also be downloaded from the Education pages of the RAS website or by e-mailing newspaper@ras.org.uk

Julien King
Education Committee Chair
Royal Astronomical Society.

4 (Illustrations of winners and runners up show front page only - Ed.)

Space 2057- the RAS 2007 S



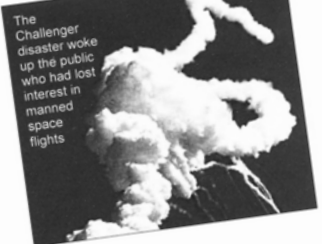
Winner 7-11 Newspaper competition: Josiane Segar & Angeli Bhowse of South Hampstead High School



When the space shuttle Challenger exploded within a minute of take-off on 28 January 1986, it marked the end of an era in manned exploration of space. The excitement of the six moon landings, from 1969 to 1972, had long since given way to public boredom with the routine shuttle launches. What the shuttle disaster did was demonstrate that an under-funded NASA space programme was cutting corners and taking risks.

Disasters like Challenger, and later Columbia have therefore resulted in the public losing confidence in space exploration technologies, and generally losing interest in space travel altogether. Although it is quite remarkable that it is 50 years since the tiny Russian satellite Sputnik 1 was launched into space, it is even more surprising that it is more than 35 years since Eugene Cernan left mankind's last footprint on the moon in December 1972. Throughout the period these missions to the moon and space shuttles, the rockets used by NASA have remained very similar, with massive single-use booster rockets needed to escape Earth's gravity.

For many years rocket technology has been in need of a major overhaul. Computers have massively advanced - there is more power in many modern pocket calculators than in the lunar landing craft - and huge advances in navigation systems such as GPS have been developed, based on military technology, but rocket design has undergone few changes.



Winner 14-16 Feature Article competition: Timothy Robinson, Jack Titley & Richard Nicholson. Mary Webb School & Science College

Schools' newspaper Competition

ROYAL ASTRONOMICAL SOCIETY

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THE SPACETIMES

THE END OF AN ERA?

Solar sails have been in use for about 20 years now, using the sun as its source of power and energy. They have taken numerous people all over space and beyond, on long distance and short distance missions, having an endless and reliable fuel. It is so far the fastest form of space travel, taking less than a third of the time it takes for a normal space shuttle to reach space. However, recently the Sun, the vessel's trusty power source let them down. Three people on board The Sail 2, including a fourteen year old girl, were tragically killed when the vessel got so close to the sun, it simply exploded. This was because the steering vanes at each corner of the vessel were malfunctioning, causing the whole vessel to be pulled towards the sun. Therefore, instead of being pushed away by the sun's light and heat, the vessel was pulled towards the sun at what must have been an alarming speed. The passengers were on a mission to discover more of interstellar space. Nobody onboard survived. NASA is currently being sued for issuing unstable vessels that should've been tested before take off. However, the last 150 vessels that have been launched have all carried out successful missions. Was it sabotage or just plain complacency from NASA? There is no evidence that it was sabotage or just an accident, as the solar sails exploded and the passengers burnt. However enough damage was done as the value of solar sails have gone down considerably, due to the trust and strong reliability lost from future buyers of travellers. We could probably say that the era of solar sailing is almost over.

By Danya Zeng

WE ARE NOT ALONE

BY DANYA ZENG

Yesterday a ten year old boy from New Zealand was looking through his new telescope, bought from a NASA shop. He was observing the planet Venus, when a movement on the surface came to his attention. He zoomed in finding that he was looking at a moving shape. The boy immediately contacted NASA, who launched an investigation, sending a probe up to Venus. The probe is yet to transmit the information back to Earth. However scientists are almost certain that this life form does not belong to any kind of community, therefore earth is probably not threatened by it. Nevertheless, when the information returns, it will be priceless. Scientists are kicking themselves, that they didn't find out before this little boy did. Hopefully, Earth can finally start making important connections with Venus and its inhabitant.

Space - 2057

Einstein's theory of special relativity shows that it is physically impossible to travel through space faster than the speed of light. Space is thought to be expanding and objects which are further away move with greater speeds due to the larger distances between themselves and earth. Because the universe is spatially infinite, there must be objects which are far enough away to travel with the expansion of space at a rate faster than the speed of light. Therefore, there is a distance which is physically impossible to reach, because it moves away faster than even light can reach, no matter what year it is.

In 2057 it is possible that all the mysteries will be uncovered all the questions of the universe will be answered, especially the discovery of what caused the Big Bang and if time exists. Even these revelations, however, may not change space travel itself...

The start of a phenomenon
In October 1957, the satellite Sputnik 1 was launched into a 293 km orbit of the Earth, being the first man-made satellite to do so. Since then many advances in space travel have been made, from the first human in space - a man named Yuri Gagarin who, in 1961 in the shuttle 'Vostok 1', orbited the world once - to the famous moon landing of Apollo 11 in 1969. However I believe the progression of our space exploration is very restricted and in 2057 we will not have travelled further than the edge our solar system.

Unreachable horizons?
Our nearest star is called Proxima Centauri and is a distance of 4 light years away, it would take 4 years to travel there at the speed of light. When Apollo 11 travelled to the moon its speed was roughly 40,000 km/h which is 2700000 times smaller than the speed of light, so travelling at that speed would take 216,000 years to reach and return to Earth. It is therefore an impossible goal, even with rapid advancements in technology, to reach within 50 years. This then has implications as to the limits of scientific discoveries which can be made using space exploration, no information will be gained about the rest of the universe.

Life on Mars
Of course, people imagine huge numbers of us being shipped off to Mars in the future to escape an increasingly hot sun but it is not an impossible dream. The book 'Mars Direct' by Robert Zubrin describes how humans may be able

NODEHILL STAR II

NODEHILL MIDDLE SCHOOL
100 credits (Space course optional)
Thursday 12th July 2057!

TWO YEARS OF SPACETIMES

AMAZING ALIENS

Runners-Up 7-11 Newspaper Competition: Year 5 Class of Nodehill Middle School

18 September 2057

PUBLISHER: BAYTREE SCIENCE CLUB

The Shooting Star

SPUTNIK- Russian word for traveller

TIME TO CELEBRATE

A hundred years ago Russian scientists launched Sputnik 1. This was the start of a long challenge bringing together science fiction and science fact. The race to conquer space started over 100 years ago and in 1957 placed a man on the moon. Then came the age of collaboration, when countries came together to build a laboratory in space, the International Space Station, which is still going around the Earth and can be seen at night glowing overhead every twenty minutes.

These appear to be much more intelligent than we are and we know that they will reach us to learn our planet. They are arriving at our planet in great numbers, in the thousands. They also appear to be much more advanced than we are. They will be able to travel through space and in the future we will see them at the very gates of our planet. We are almost certain that they will be able to reach our planet.

By Angela Farnes & Fuduna Daud

Independence Day: For Real

These appear to be much more intelligent than we are and we know that they will reach us to learn our planet. They are arriving at our planet in great numbers, in the thousands. They also appear to be much more advanced than we are. They will be able to travel through space and in the future we will see them at the very gates of our planet. We are almost certain that they will be able to reach our planet.

By Angela Farnes & Fuduna Daud

The Titan Project

On the 13th of July 2057, a spaceship will set off on a course to Titan, Saturn's largest moon. This expedition is a research mission, trying to conclude if Titan is a suitable place to set up a colony for humankind. In November 2049, the first colonists landed on the moon, and since then, over 5000 inhabitants have settled successfully and the first moon baby was born two months ago (on the 3/12/56). Unfortunately, due to the over-population on Earth, we need more space. Titan seems to be the best option, seeing as the American weapon testing destroyed Mars in 2052. The researchers will determine any faults with the planet, whether they can be overcome or not, and whether the human race will be able to survive in this new environment. The mission will set off at 11:00 am (Earth - London time) on the 13th and travel for 9 months to Titan. The crew will stay there for 2 1/2 years, collecting and analysing samples, carrying out tests for the life they intend to lead and so on. The return journey will commence on October 11th 1060, making their time of arrival at 11:00 am on the 12th of July 2061.

While they are there, they intend to research such factors as the daily life requirements of people living there (for example, the times of the day where space suits may not work), the potential plant life, the raw materials available and any procedures that could make life easier for any settlers. For example, the excrement of the crew will be recycled and used as fertilizer for the plants and also as an experimental energy source. This has work on Earth in labs, but these researchers will be using this in daily life for 4 years.

A century among the stars

With mankind standing on the edge of the solar system, looks back at the achievements of the past hundred years...

"One hundred years have passed since the first man-made object was sent into space in 1957. It is an impressive statement, however, it seems unimpressive that this line was spoken by an American president, when it was the Russians who, a century ago, in 1957, launched their famous 'machine that goes boom', also known as Sputnik 1. From those early, primitive, beginnings mankind has launched itself into the depths of space; for many, the defining moment was when men first took our satellite, the Moon. In 1969, three American astronauts flew to the Moon and two of them stepped onto the Moon's surface. The flag they placed there remains today - not only does it mark the area where humans first trod on the Moon, it remains the heart of a thriving colony, in the centre of the first lunar heritage site.

The Moon landings came the space stations: Skylab, Mir and, finally, the International Space Station, which was a great success until the shuttles were decommissioned in 2009. It is strange that this success in the case still is not celebrated. This success in the case still is not celebrated. This success in the case still is not celebrated.

Runners-Up 11-14 Newspaper Competition: Baytree Science Club, The Baytree Centre

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Runners-Up 14-16 Feature Article Competition: William Warner, Haberdashers' Monmouth School for Boys

The Shooting Star

Space travel: 2057

Special points of interest:

- The first man-made satellite
- The first human in space
- The first moon landing
- The first space station
- The first space shuttle
- The first space hotel

Europa: the water of life?

Water on Europa? It could be the key to life. Europa is a moon of Jupiter, and it is thought to have a large ocean of water under its icy surface. This could be the perfect environment for life as we know it.

Super Seven Safe on Mars

The seven young heroes who came from South Hampstead have successfully landed on Mars. All of these brilliant girls passed their Physics A-levels with flying colours; in 2012, they later moved on to graduate in very good colleges such as the Imperial college and Lancaster university. They later joined up after their PhD's and since that time have embarked on 29 epic journeys through our solar system.

They have had an amazing time on Mars, where they have made various discoveries including how Mars' subterranean liquids can be used to fuel our daily lives. It even has enough energy to power SOL™ (see Pg 3 for more information). The subterranean supplies are abundant in hydrogen, the fuel of our time. This hopefully will power all the spaceships into nearby galaxies and solar systems.

They have all enjoyed their "space adventure" enormously, here are a few of their comments which were heard straight after they returned to earth:

"It has been one of the most thrilling experiences I have ever encountered."

"I have never been so excited in my life!"

"On this epic journey we have found valid information which we hope will fuel the future." They ended with a final thanks to all the assistants who helped their journey become the success that it was.

By Ana Hallgarten

Letter from Japan UMOG

One of the great things about being an astronomer is the opportunity to travel to some rather exotic and out-of-the-way places. Not just when visiting observatories, but also on those occasions once or twice a year when we gather with our colleagues for a conference to swap recent results, argue over their interpretation, and build new collaborations.

Usually astronomy conferences have a specific scientific theme, such as the recent one on "Galaxies in the Local Volume" held here in Sydney, which was focused on only those galaxies within 10Mpc (32.6 million light years) of the Milky Way.

Sometimes however, conferences are intended to bring together astronomers working with a common facility. Every three years, the eight partners in the Gemini Observatory (USA, UK, Canada, Australia, Argentina, Brazil, Chile, and the University of Hawaii) hold a meeting to highlight recent groundbreaking science conducted with the twin Gemini 8-metre telescopes (Gemini North on Mauna Kea in Hawaii, and Gemini South on Cerro Pachon in Chile).

The first of these meetings took place in 2004 in Vancouver; the 2007 meeting was held last June, at Iguazu Falls near the Brazil/Argentina border. While getting there



Having to take in the awesome view from the "Devil's Throat" area atop Iguazu Falls on the Argentinian side of the border is just one of the many crosses astronomers have to bear.

was quite an undertaking (in my own case, it involved a 3-hour flight to Auckland, a 12-hour flight to Santiago, a 4-hour flight to Sao Paulo, and another 1-hour flight to Iguazu!), both the astonishing science presented there, not to mention the breathtaking Falls themselves, made it all worthwhile.

More than 100 astronomers from each of the partner countries gathered over 3 days to show off the diverse range of science enabled by the Gemini telescopes and their powerful complement of instruments. I will briefly describe just some of the highlights.

Karl Glazebrook (Swinburne University) and Bob Abraham (University of Toronto) presented the latest findings from the "Gemini Deep Deep Survey", which is the deepest-ever survey for galaxies with redshifts of between 1 and 2 (i.e. when the Universe was between 3 and 6 billion years old).

In a throwback to the pioneering efforts of Hubble and Humason, the GDDS team spent several nights observing the same target field on one of the world's largest telescopes to im-

prove their signal. One particular cluster of galaxies they found looks as if it may be about to merge into one very massive galaxy of the sort we see around us today.

Using a technique known as angular differential imaging, René Doyon (Université de Montréal) and collaborators have been able to suppress the "speckle" pattern around bright stars, increasing the potential to make direct images of planets around these stars.

By obtaining follow-up spectroscopy at Gemini of sources found in a new survey with the United Kingdom Infrared Telescope (UKIRT, where I used to work), Nicolas Lodieu (University of Leicester) and David Pinfield (University of Hertfordshire) have found eight new T dwarfs. T dwarfs are the coolest, least massive stars known, with temperatures between 700 and 1400°.

Taking advantage of the low thermal emission for which the Gemini telescopes were designed, Pat Roche (Oxford University) has been able to peer inside the heavily dust-obscured region around some active galactic nuclei, inside which supermassive black holes are thought to be feeding.

Douglas Welch (McMaster University) showed that in addition to the well-known light echoes from Supernova 1987A in the Large Magellanic Cloud, there are numerous other light echo features throughout the Cloud. Amazingly, the spectrum of a light echo is a fossil record of the original supernova which can be accessed long after the supernova itself has faded into obscurity.

Nathan Smith (University of California at Berkeley) presented some stunning 3D visualisations of the numerous "hour-glass" features around the luminous blue variable star Eta Carinae, based on his high-resolution near-infrared spectroscopy with Gemini.

Bob Blum (National Optical Astronomy Observatory) and Tracy Beck (Gemini Observatory) presented some of the first science results to come out of Australia's own near-infrared integral field spectrograph instrument, built to replace the original instrument destroyed in the Canberra bushfires of 2003. This slices up a small (3 arcsec) square patch of sky and produces a spectrum for each point within that patch, making it ideal for studying disks around young stars where planets may form.


Heidi Hammel (Space Science Institute) showed incredible images of Neptune taken at mid-infrared wavelengths (20 times longer than optical wavelengths) from Gemini, together with adaptive optics images from the Keck telescope, which rival the *Hubble Space Telescope* for detail. By seeing where the heat is escaping from Neptune's atmosphere, it is possible to learn about its atmospheric chemistry and cloud properties.

I presented my recent work with Gemini, which revealed a surviving companion to Supernova 2001ig in NGC 7424, as described in the May 2006 issue of *Gnomon*.

Following the Science meeting, opportunity was given for the Gemini users to share with Gemini staff some of their likes and dislikes about the way the observatory operates. Like the Anglo-Australian Observatory, Gemini aims to provide a wide range of instruments and observing modes to suit the broad interests of the user community. Unlike the AAO however, most users never get anywhere near the Gemini telescopes, relying instead on the queue mode of operation which attempts to match observing conditions against need, and have the data delivered to them. This new way of working has taken some getting used to by both Gemini and its users.

However, it is clear that the Gemini Observatory has matured a lot in the past 3 years, and is set to deliver even more spectacular discoveries in the years ahead.

Stuart Ryder

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The things people ask!

The life of *Query*, dealing with any questions that people from, all over the world want to throw at him, is scarcely dull, to say the least. The title of this column, coined many years ago now, was not intended to imply the outlandish nature of some of the problems thrown at him. So just for a change, here is a small sample of questions that are obviously meant in good faith, but which must tempt *Query* to groan quietly when he first reads them.

Astronomy educators of all kinds must have been asked time and time again what they think about UFO's, aliens, and invasions from Mars and so on, but it is more often than not a genuine interest from someone whose study of astronomy goes only as far as "Star Wars" and other sci-fi movies.

But what do you say when the question obviously originates from some experience quite removed from fiction. Here are some that I have selected from the file of our valiant *Query*, Francisco Diego.

★ *Andrew had a puzzling experience: On a recent trip to north Norfolk, I observed three bright lights streaking across the sky from west to east. Their speed did not seem to be extremely fast but this was difficult to judge. The sighting occurred in daylight and clear conditions (blue sky). The altitude of the objects appeared to be relatively low. I could judge this by observing an aeroplane flying at apparent cruising altitude (approx. 30,000ft). The objects flew below this aircraft. The objects had the appearance of flares but emitted no clear sound. The event took place at approx. 6.30pm on Monday 2nd April about 1 mile east of Holt, Norfolk. I was just wondering if: a) you could offer an explanation of what this phenomenon may have been (ie. meteors)? b) is there any record of these objects appearing at the given time? Thanks in advance. Andrew*

Dear Andrew, perhaps you say the planet Venus, perhaps some lights from an aircraft, or perhaps weather balloons reflecting sunlight, etc. It is not possible to judge the altitude of anything, including aircraft in clear blue sky, so I don't know how can you be so sure that the airplane was at 30,000ft and how do you know the altitude of these objects with respect to the aircraft. Altitudes and distances of objects in the sky are very misleading.

★ *Ron from Florida wrote: I know someone who emphatically believes that the Earth is stationary and that the Universe revolves around it. But if this were true, wouldn't that directly affect the calculations required to send space probes to Mars and other planets? Wouldn't the geometry*

of a spaceflight in a geocentric universe be completely different from one in a heliocentric universe, and thus if the former were true a flight-plan based on the latter would cause the vehicle to fly hopelessly off-course?

Dear Ron, Absolutely. Some people may still believe this because it agrees with common "sense" that is with what we see and feel around us. The way the Universe works goes against this. The fact that we are stuck to the surface of a huge spherical rock that spins and travels through space at incredible speed has been difficult to accept even today.

Now, beware: the Universe is not heliocentric either; only our Solar System is. The Universe has no centre at all. Once again, a difficult concept for our limited common sense - but this is another story.

★ *John wrote [much more than this, but it is drastically cut]: I am writing to you to try and begin a correspondence with an astronomer on the subject of astrophysics. I am an artist at Central St. Martins and am very interested in the concepts of astrophysics. I have always been interested in astronomy in an amateur sense, but it has been only recently that I have begun to develop an interest in astrophysics. Any advice, websites, contacts or events that are on at the moment would be very helpful indeed.*

Dear John. Astrophysics is a great subject that started around 140 years ago. You can find plenty of information on the web and I can recommend *The Universe* by Freedman and Kaufmann as a general book at a reasonable level. I feel that you need to go into this first to bring you to a better understanding of what you really want to know. I also suggest you to get in touch with the Open University, they have excellent courses on astrophysics.

★ *Dave wrote: I am a member of Jersey Astronomical Society and last night we held an 'Eclipse Party' [lunar] that was blessed with clear skies. With the naked eye, general opinion described the colour of the Moon at totality as "copper". However, through any optical instrument (ranging from a 14-inch reflector and various members' telescopes to binoculars) this colouration could not be observed and it appeared only as shades of grey. Can you offer any explanation as why this should be?*

Dear Dave, I agree, very strange. Sometimes the Moon appeared a bit orange, sometimes grey. It is really orange in the pictures though. With my 6-inch f/4 rich field Newtonian it was definitely orange, and so it was with 15X70 binoculars. Colour perception under dark conditions is always a problem. Best regards.

Francisco Diego
AAE Query line

Sky Diary Autumn 2007

The autumn evenings allow observation of the night sky at a reasonable hour for those who must get their beauty sleep or need to catch the ten o'clock news on the telly. The Sun makes its way south of the celestial equator at about the time that this issue is due to reach you, dear reader. "The days are drawing in" you hear people cry, and it is not much use explaining to them that a day is 24 hours if you are afraid of being called pedantic. The stars and constellations in the south are not among the most famous or easily recognised, but there is a large expanse of sky with which you should familiarise yourself.

High overhead from British latitudes is probably the most familiar grouping in this part of the celestial sphere, the W (or M, since overhead offers a choice of viewing angle!) of Cassiopeia. The leading star (and the brightest, β Cas, at

the western end of the W, as it appears at this time of year) is almost on the meridian marking zero in celestial longitude. This meridian passes through the celestial poles and in the north almost through β Cas and then southwards almost along the eastern side of the Great Square of Pegasus (shown on the map overleaf). Roughly south of the Great Square, by about the same angle as the length of the eastern side of the Square, this zero line passes through the position of the Vernal Equinox, and it is here, by definition, that the celestial longitude is zero hours of right ascension.

The constellations that dominate the lower part of the southern evening sky at this time are, in general, large, sprawling and lacking easily recognised patterns or individual stars. The western edge of the Great Square provides a useful set of "Pointers" due south to the bright star Fomalhaut (α Piscis Austrini - in the "Southern Fish") one of the most southerly stars easily visible from Britain. It ☞ **7**

☾ can never reach an altitude of more than 11° from mainland Britain (from the Lizard Point).

The constellations of the region of sky about 30° north and south of the celestial equator include such familiar

Moon phases for the fourth quarter of 2007				
	New Moon	First Quarter	Full Moon	Last Quarter
October	11	19	26	3
November	9	17	24	1
December	9	17	24	1/31

names, but less familiar appearances, as Capricornus, Aquarius, Pisces, Cetus, and Eridanus. Fortunately, more easily found are Pegasus and the so-called "Great Square", Andromeda, and Aries.

Many of these groups are linked in mythology, most especially the Perseus and Andromeda story as in the movie "Clash of the Titans" (which had nothing to do with Titans as it happened!). The sea monster that was supposed to devour Andromeda was Cetus, variously translated as the "whale" (Latin) or "sea monster" (as depicted in many ancient star atlases. The brightest star in Cetus, misleadingly catalogued as β Ceti, can be found by following the line of zero right ascension described above south from the Great Square's eastern side, and veering a little eastwards (away from Fomalhaut). The latter and β Ceti are the only stars easily visible in this area.

Cetus has a number of interesting objects within its boundaries, but possibly pride of place must go to the amazing variable star \omicron Ceti, known as "Mira".

Discovered before telescopes were in use on the sky, Mira was first thought to be a nova, since it had apparently appeared from nowhere and then faded from view. Actually Mira had been previously been noted by many astronomers in different countries, but its variability had not been recognised. It was later catalogued by Bayer as \omicron Ceti. Its periodic variability was not discovered till 1638 and its peculiar character no doubt inspired Hevelius to name it Mira, "the Wonderful".

Mira has a mean period of about 331.96 days, with a range of magnitudes of from 2 to 10. The star soon gave its name to a class of variables described as long period pulsating stars. It is the dominant partner of a double system. Mira's maximum brightness varies considerably and

unpredictably: only the period is reliable. Its absolute magnitude shows that it ranges from a star dimmer than our Sun to as much as 1500 times the Sun's brightness. The Hubble Space Telescope has allowed Mira's angular diameter to be measured, showing that it is about 700 times the diameter of the Sun, but this size also probably varies considerably as with most red giant stars.

In 2007, Mira was photographed from space by the Galaxy Evolution Explorer (GALEX) in ultraviolet light. The photographs revealed surprisingly that Mira possesses a comet-like tail about 13 light years long. The tail may be composed of material ejected by Mira over the past 30,000 years. The tail shape may be due to Mira's comparatively high velocity, about 130 km/s, with respect to the surrounding stars in this part of the galaxy.

To find Mira, it is best to first identify the head of the Sea Monster. As shown in the map, this can be found by

Rising and setting times (UT): lat.52°N; long.3°W						
	October 15		November 15		December 15	
	Rise	Set	Rise	Set	Rise	Set
Sun	07h 34m	18h 21m	08h 29m	17h 22m	09h 12m	17h 00m
Mercury	09h 34m	18h 30m	06h 41m	16h 55m	09h 13m	16h 43m
Venus	03h 20m	16h 53m	04h 04m	16h 01m	05h 18m	15h 12m
Mars	21h 46m	14h 29m	20h 05m	13h 01m	17h 27m	10h 52m
Jupiter	12h 45m	20h 38m	11h 12m	18h 58m	09h 45m	17h 27m
Saturn	03h 10m	17h 11m	01h 22m	15h 14m	23h 27m	13h 19m
Uranus	17h 17m	04h 20m	15h 14m	02h 15m	13h 17m	00h 14m
Neptune	16h 26m	01h 52m	14h 24m	23h 46m	12h 27m	21h 51m

following a line of stars from the point of the V of the head of the Bull, Taurus. The enlarged inset section identifies the stars grouped into the Whale's "head", and shows the position of Mira which will be brightening at the end of the year.

Mars will be prominent throughout the quarter as it moves through Gemini, reaching opposition on Christmas Eve. Through the remains of September through to opposition it will brighten from magnitude 0.0 to -1.6.

Mid December (the Moon is pretty thin on the 14th) marking a favourable occasion for watching the Geminid meteor shower. I hope no tips off the so-called science correspondents of the popular press as must have been done with the Perseids so that people expect another firework display to rival November 5th (also this quarter: groan!)

Richard Knox

The evening sky, looking south at 22:00hr UT on November 15. Uranus is still detectable (arrowed below the "circling" in Pisces, which in turn is south of the Great Square of Pegasus). From the Great Square, the three main stars of Andromeda (α , β and γ) point north-east towards Perseus (not shown), and the galaxy M31 is indicated. Mira (\omicron Ceti) is shown inset below, an area of sky at the end of a trail of stars from the V of Taurus (near top left). The numbered stars are 1 α Cet; 2 γ Cet; 3 δ Cet; and 4 α Psc; with Mira shown as a circle.

