



January 2010

ARMAGH PLANETARIUM

ASTRONOTES

Incorporating **FRIENDS' NEWSLETTER**

Our place in space

2010's Odysseys too

The sky this month

The discovery of Vulcan

Irish language shows launched

Our (Future) Place in Space

By Tom Mason, Director

When I was a boy, I devoured my nearest library's science fiction books as they were an optimistic antidote to the Cold War paranoia which was endemic at that time. I also read lots of military history. My book learning suggested to me then that if there was going to be a Third World War with the Warsaw pact armies then we would either all end up as crispy radioactive casualties or we would exist under Soviet rule. Neither prospect was very appealing, so the science fiction escapism, principally of my favourite author Isaac Asimov, showed that humanity would need to raise its game to populate the cosmos.

Most of the stuff I enjoyed then comprised stories of Galactic Empires which existed, flourished and waned far into the future, a sort of early Star Wars concept. The primary difference was that the fictional worlds where I roamed were populated by an important part of me: my imagination. This was given free rein, as there were no sci-fi animations to see, and no PCs. In fact, computers were not really on the landscape, or



Image Credit: NASA

IBM 7094 a typical mainframe computer of the 1960's

rather those that did exist then dominated their landscape as they were enormous. The first ones I worked on inhabited entire special buildings, serviced by a priestly caste of computer scientists: my iPhone is more powerful than those 1960's IBMs.

“My iPhone is more powerful than those 1960's IBM's”

Science fiction provided space for my imagination to roam, with space-adapted humans, vast empires, asteroid mines, and wonderful gadgets. Needless to say the humans were still afflicted with all of the things that make us imperfect on Earth. In space there seemed to be even greater rein for wickedness, with insurrections on a much vaster scale than our puny Earth revolutions.

“science fiction provided space for my imagination to roam”

I was struck then, as I still am today, but with better reason, that the sheer scale of the Universe is such that we humans are less than motes in a sunbeam. Therefore it seems reasonable that our rather puny biology, and our limited understanding of science does not fill me with optimism about our ability to make the essential colonising leap from our home planet to others in the Solar System. Things were just too difficult, and as a species we seem to have mostly lost the urge to spread our cosmic wings. However, things have changed recently, and my natural optimism has reasserted itself. I am referring to some new discoveries which have altered forever the possibilities for our future. My hopeful landmarks for a better future are: the confirma-

tion of the discovery of significant water on Mars and also on the Moon; and the re-assessment of the Allen Hills Martian meteorite with its organic artefacts.

The Martian water was almost a foregone conclusion. The stunning images that have been sent back by the orbiting cameras that are mapping the Martian geography (HiRISE: http://marsoweb.nas.nasa.gov/HiRISE/hirise_images/ and <http://HiRISE.lpl.arizona.edu/hiflyers.php>) clearly show landforms which were shaped by flowing water. Mars has a myriad of well-documented features created by flowing water, as well as spectacular wind sculpted desert landscapes. In addition, its giant volcanoes show that this “dead” world will conceal plenty of secrets. The methane levels are still a mystery and could be organic, as the amount appears to wax and wane with Martian seasons. Exciting research targets for the curious young people we seek to nurture.

“The sheer scale of the Universe is such that we humans are less than motes in a sunbeam”

I have written before about the tenacity of Earth’s living things, and their amazing adaptability to extreme conditions. Our concepts of what are viable environments for living things have undergone a major shift, for our understanding of life has become less restrictive, and surface-of-the-Earth centred. Mars is likely to provide further extreme environments when we eventually get there. Water on any Solar System object means a lot: it can be rocket fuel, breathable oxygen, and provide the biological water needs for humans and the transported seeds that will be grown for food, so we now have Mars as a possible colony.

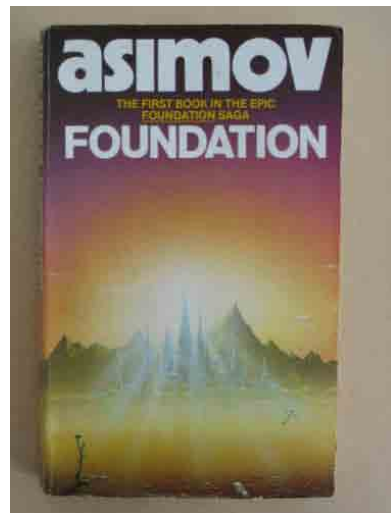
The water ice on the Moon is also a startling new development. For years we have told our visitors that the Moon is airless and waterless. Well, that’s still true but we now need to qualify the degree of “waterlessness” and point out that there is ice, and once again if this can be better quantified, a future Moon base looks more likely.

Further developments in the newest discoveries of extra-solar planets orbiting distant suns suggest that the latest ones may have liquid water.

“These scientific discoveries offer a great opportunity to talk to our young people”

So we return to NASA’s so far successful strategy of following the signals for water. If we have any hope of expanding our colonisation of space we will need water in large volumes, and if we can find this water on other planets and moons, given the ubiquity of life on Earth maybe we will find further evidence of living things that did not originate on our fertile blue water world.

A careful re-assessment of the ALH meteorite which was discussed in 1996 as showing signs of fossils has now concluded that they may indeed be related to biogenic precursors. Truly we live in exciting times, and these scientific discoveries and controversies offer a great opportunity to talk to our young visitors, to inspire them to start a scientific career, and to have the ambition that will keep our curiosity fed by new advances in understanding that they can make



Foundation (actually a collection of five short stories) was followed by *Foundation and Empire* and *Second Foundation*. More sequels and prequels appeared in the 1980s and '90s.

in the future.

“Our understanding of life has become less restrictive.”

So noting that some of the scientific gadgets used in the Star Trek series have become reality, is it not worth thinking the unthinkable? Maybe our slow progress in unravelling dark matter and dark energy, and working out how a multi-universe may work could lead to astonishing new progress. Given our abilities to make occasional leaps of inspiration, I am very optimistic. I would commend some of the classic sci-fi books of the 1960s: check out Asimov’s Foundation series

and see what I mean.



Image Credit: NASA / Johnson Space Center

Allan Hills 84001 (commonly abbreviated ALH 84001) is a meteorite that was found in Allan Hills, Antarctica on December 27, 1984.

2010’s Odysseys too

By Colin Johnston, Science Communicator

Well, Christmas is over, 2009 is tottering off into history and 2010 stands bright-eyed before us. What has this new year in store for astronomy and space exploration?

Almost certainly this year will see the final mission in the Space Shuttle programme with the surviving space-worthy orbiters Atlantis, Discovery and Endeavour retired to museums. Discovery is to make the last flight in late September (subject to change). Since 1981 (yes, really) NASA’s shuttle fleet has been the only

US piloted orbital spacecraft and its retirement will mean a hiatus of several years when NASA astronauts will travel into space as passengers on board Russian Soyuz vehicles.

3 January Planet Earth is at perihelion (its closest point to the Sun)

6 January: 400 years today Galileo discovered the four satellites of Jupiter now known as Io, Europa, Callisto and Ganymede (which featured prominently in Clarke’s 1982 novel “2010: Odyssey 2”). Others may have seen them first, but Galileo wrote down his results. He cunningly

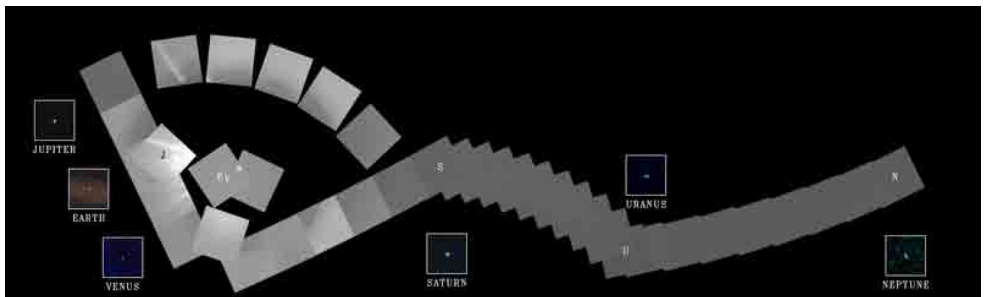


Image Credit: NASA

Sol Family Portrait The individual images making up this famous image were taken with varying exposures and through a variety of filters to bring out as much detail as possible.



X-37B This is a project that has been quietly rumbling away in the background for years receiving minimal attention but may lead to significant advances in cheap access to space. The craft is 27.5 ft (8.4m) long and has a small Shuttle-style payload bay.

named the new worlds the Medican satellites after the powerful and wealthy Medici family. They later employed him, but the name didn't stick.

15 January: an annular solar eclipse will be visible across central Africa, the Indian Ocean and eastern Asia. Observers in eastern Europe, most of Africa, Asia and Indonesia will witness a partial solar eclipse.

14 February-6 June: This period will mark 20 years since Voyager 1 photographed the planets of the Solar System from a distance of about 40 AU from the Sun. These images were combined into one, the justly celebrated family portrait often known as the "Pale Blue Dot" image. The Dot is of course our own tiny world.

April: Sometime this month an Atlas V booster will launch the USAF's X-37B spaceplane on a test flight. The X-37 will become only the third winged vehicle to operate in orbit. The unmanned vehicle will perform a test mission (most details of which are classified) to validate the concept of a small winged and reusable spacecraft.

1 April: This is the fiftieth anniversary of the launch of TIROS-1, the first successful weather satellite.

11 April: This is the fortieth anniversary of the launch one of spaceflight's most dramatic missions. On this day, Apollo 13's set off on a 'routine' mission to the Moon. On 14 April 1970 an internal explosion crippled the Apollo CSM.

By the heroic efforts of astronauts Lovell, Haise and Swigert and an army of NASA and contractor technicians, the crew survived their ordeal to return safely home.

24 April: The Hubble Space Telescope was launched into space on the Space Shuttle Discovery twenty years ago today. Of course, no one at the time suspected that errors during its manufacture meant the instrument was nearly useless. After a repair in December 1993, the HST finally became the ground-breaking mission it always should have been

May: Japan's PLANET-C probe, also known as Venus Climate Orbiter (VCO) is planned to be launched this month. If the fickle gods of space-flight smile on the probe it will arrive at Venus in December 2010. Japan's last deep space mission has been more than usually unlucky (see next entry) so this mission deserves a break.

June: This month Japan's Hayabusa probe should deliver surface samples from asteroid 25143 Itokawa in a re-entry capsule which is expected to land in the Australian outback. Launched in 2003, this mission has encoun-



Astronomers gathering to view July's Eclipse on Easter Island. In the 1970s Erich von Däniken claimed that the Moai were self-portraits of alien space travellers. Like many 1970s products such as bell-bottoms, pet rocks and Austin Allegros, this theory hasn't aged well.

Image Credit: NASA



Shuttle Sunset An era in human spaceflight will come to an end in 2010. Atlantis sits on launch pad 39A awaiting launch in November 2009.

tered severe difficulties from technical failures to damage from a solar flare. Its Japan Aerospace Exploration Agency (JAXA) controllers deserve huge credit for their perseverance in gaining a useful scientific return from the mission.

26 June: On this date there will be a partial lunar eclipse best seen in New Zealand, Australia and mid-Pacific Ocean

6 July: Today Earth is at aphelion, its furthest point from the Sun.

10 July: ESA's Rosetta probe flies by asteroid 21 Lutetia on its way to comet 67P/Churyumov-Gerasimenko, approaching to within 3000 km of the 100 km diameter minor planet. It will arrive at the comet in 2014.

11 July: a total solar eclipse (visible only in the South Pacific (especially Easter Island) and southern South America).

30 October marks an unusual anniversary. All being well this will be the twentieth anniversary of the last day when there was no one in space. The Soviet/Russian Mir space station was crewed throughout the 1990s, and the ISS (which overlapped Mir's career) should hopefully been continuously occupied since. Perhaps we are slowly becoming an interplanetary civilisation.

November will mark 30 years since Voyager 2 visited Saturn vastly expanding our knowledge of the giant planet.

21 December: a lunar eclipse will be visible from Ireland.

January Night Sky

By Tracy McConnell, Education Support Officer

The Sun sets between 5.30pm and 6.00pm giving you plenty of opportunity to study our night sky at this time of year. Although it does get frosty and cold on clear nights, make sure to wrap up warm and have a hot drink handy. As the Sun sets you should clearly see the planet Jupiter low in the SW sky appearing as a very bright star. As the night progresses, other planets become visible.

At 6.00pm, Mars rises as a beautiful red jewel over the ENE sky, nestled between the constellations of Leo the Lion and Cancer the Crab. Mars will be the closest to Earth for the whole year on 27 January 2010 and at opposition (the

planet will be on the opposite side of the Earth to the Sun) on 29 January 2010. This will be the brightest Mars will be for several years. At about 7.30, Jupiter will set in the west, after which 11.30pm, Saturn rises in the east, to join Mars which is high in the SE sky. The Sun rises again at approximately 7.30am, obscuring the view of the rising planet Mercury in the east.

The rest of the sky guide covered here is based on the stellar positions at 11.00pm, 15 January 2010. The position of the stars will appear to move across the sky during the night, due to the Earth's rotation, however their positions will not vary much from night to night.

One of the brightest patterns visible at this time



This image was taken over the Alborz Mountains in northern Iran under the light of the Moon on 25 January 2007. This stunning image clearly shows the bright stars of the constellation Orion and Canis Major, including the famous Dog Star, Sirius, which is hard to miss.

of year is Leo the Lion. It is in the Eastern sky and is one of the signs of the Zodiac, “the signs of the Zodiac” being the collective name for the band of star patterns that encompass the Sun and the orbital paths of the Moon and planets. There are 12 of these patterns in total, (13 if you include Ophiuchus the Healer, which the Sun passes through but which is not included in the signs of the Zodiac) but only six are visible right now. Leo the Lion, Cancer the Crab, Gemini the Twins, Taurus the Bull, Aries the Ram and Pisces the Fish stretch in a belt across the sky from east to west.

There are many other bright patterns visible at this time as well including Orion the Hunter. It’s currently in the southern sky, and contains seven very bright stars, three in a row marking

his belt, two for his knees and another two for his shoulders (the stars of which were described in great detail in November 2009 sky guide by Colin Johnston).

Orion was considered to be a great hunter in Greek mythology. It was said that his father, Poseidon, the God of the sea, gave Orion the gift of being able to walk on water. He was also said to be very strong and very handsome. Many of the stories about Orion include his love of beautiful women, (he was what would be termed a “skirt chaser” today), including the Seven Sisters (the Pleiades) and the goddess Artemis, just to name a few.

“The Zodiac star patterns encompass the orbital path of the Sun”

There are two famous celestial objects in the constellation Orion. One can be seen with the unaided eye on a very dark night, as bright patch just below his belt. This is M42 the Great Orion Nebula, a brilliant glowing cloud of gas and dust, the celestial home of newborn stars, and planets. Another nebula is below the left star in Orion’s belt. This however is a dark nebula. The gases in this cloud actually absorb the surrounding light. Astronomers have to use long exposure photographs and special filters to see the details. The Horsehead nebula is probably the most famous of such dark clouds.

“Sirius B was the first white dwarf star discovered”

Orion is followed across the sky by his loyal hunting dogs, Canis Major, the Great Dog and Canis Minor, the Little Dog, each containing one of the brightest stars in the sky. Following Orion’s belt down towards the horizon you come to Sirius, the Dog Star. This is the brightest star in the sky and its part of the constellation Canis Major. It is a binary system, Sirius A and Sirius B. Sirius B was the first white dwarf star discovered. Sirius A is the star we see brightly dominating our night sky. It is approximately 20 times brighter than our



The Pleiades star Cluster, also known as the Seven Sisters, contains over 3000 stars, up to 7 of which can be seen clearly in the night sky without binoculars or telescopes. It is located only 400 light years (122.6 Parsecs) away and is only 13 light years (4 Parsecs) across.

star, the Sun, and twice as massive.

The system is also only 8.7 light years away (2.7 parsecs), which also contributes to its brightness in our sky. Tracing Orion's shoulders across from right to left and on across the sky until you come to another bright star. This is Procyon, meaning "before the dog". It rises in the sky before the Dog Star. It's part of the Canis Minor constellation, which contains only two easily seen stars.

Another bright pattern sits above Orion, directly overhead. This is Auriga the charioteer. It is named for Erichthonius, the king of Athens who

developed the four-horse chariot. The lead star in this pattern is called Capella, the goat star, which is the 6th brightest star in the sky. There is no Greek or Roman legend to explain why Auriga is carrying the little goat, which was said to have helped to feed the infant god Zeus.

Above the sword of Orion and up into the constellation Auriga there are four Messier objects, M38, M37, M36 and M35. These objects are open/galactic clusters (like the Pleiades). They tend to be what is left after a stellar nursery has formed new infant stars, and "burnt" away the surrounding gases.

As well as these patterns some of the circumpolar constellations in the northern sky are very bright. Such as Ursa Major, high in the NE sky, Ursa Minor high in the northern sky, and Cassiopeia high in the western sky. These patterns are visible all year round from our position on the Earth so they should be familiar to you.

I hope you have found this guide to be useful. Happy stargazing.

Moon Phases, Jan 2010

Thursday 7 January	Last Quarter
Friday 15 January	NEW MOON
Saturday 23 January	First Quarter
Saturday 30 January	FULL MOON

The discovery of Vulcan

By Colin Johnston, Science Communicator

As this International Year of Astronomy draws to a close we could have also been celebrating the 150th anniversary of the discovery of planet Vulcan. Once thought to be a certainty to exist, our Solar System's Vulcan is now known to be as much a fantasy as the Star Trek one (which is said to orbit 40 Eridani A). Here is the cautionary tale of Vulcan's discovery.

The discovery of the seventh planet Uranus in 1781 thrilled astronomers. Observing this distant orb and plotting its course around the Sun were on the cutting edge of science two hundred years ago. Uranus was found to take about 84 years to plod through an orbit. As the decades passed, astronomers found that the planet was exhibiting some unexpected behaviour, deviating slightly from where it ought to be. This was utterly mysterious as by the early nineteenth century gravity and orbits were well understood



Image Credit: NASA

Urbain Le Verrier Director of Paris Observatory

(or were they?). There was a possible answer to this puzzle. Perhaps Uranus was being tugged by the gravitational field of some unseen body. There could be an eighth planet to discover!

In the early 1840s the brilliant young mathematician Urbain Le Verrier (1811-71) spent months carrying out painstaking calculations (by hand with ink and paper), analysing the position of Uranus to pinpoint where the hypothetical planet's effect on Uranus began. (At the same time as he investigated Uranus in the distant outer darkness, he was also studying the innermost Solar System which had a mystery of its own.)

By 1846, Le Verrier completed his calculations, which showed that planet ought to lie between Aquarius and Capricorn, and posted them to the Berlin Observatory (no French observers were interested, such was the novelty of Le Verrier's reasoning). Within a day of receiving Le Verrier's missive German astronomers led by Johann Galle (1912-1910) used his calculations to discover the no longer theoretical planet on 23 September 1846. It was within 1° of the calculated position. The planet was duly named Neptune and Galle and Le Verrier were lauded as the planet's co-discoverers. At the time and ever since, some have manufactured a controversy around this: in 1843, John Couch Adams (1818-92) also calculated that Uranus was being influenced by an undiscovered eighth planet. Should Adams receive some of the credit? From recent research

it seems his work was less complete than Le Verrier's.

Le Verrier's fame was assured, especially in his native France, and he was regarded as "the man who discovered a planet with the point of his pen." Buoyed by this triumph, he further investigated the inner Solar System anomaly alluded to earlier. Sometimes Mercury wasn't where it should be! The orbits of the planets could be predicted perfectly- apart from Mercury's.

Planetary orbits are not circles, but ellipses and Mercury's orbit was the least circular (or most eccentric) known. Mercury varies from as close as 46 million km from the Sun ("perihelion") before climbing as far as 70 million km from the Sun when it is at the opposite side of its orbit ("aphelion"). This was all in accordance with the laws of planetary motion discovered by Kepler and explained by Newton. The problem was that Mercury kept reaching the low point of its orbit early and the high point late. The discrepancy was tiny (so tiny as to invoke awe for the observational skills of the astronomers of the period who measured it) but disconcerting. Could Newton have been wrong?

"Vulcan was discovered transiting the Sun in March 1859"

Le Verrier said not, but after thoroughly studying observations of Mercury going back to the 1600s, he also proved that Mercury's odd shifting orbit was not due to the gravitational pulls of Venus, Earth and Mars. Instead a previously unseen planet between Mercury and the Sun was to blame. He began the task of predicting its location so that it could be found in a telescope. Even once its position was known, observing it would be difficult. This planet would be smaller than Mercury and close to the Sun, so it would be hard to see. The best chances to see it would be during a total eclipse of the Sun or whenever the tiny planet passed across ("transited") the Sun's face as seen from Earth.

In 1859 Le Verrier published his calculations and proposed the planet once found (a mere detail he

was willing to leave to others) be called Vulcan. Vulcan was the Roman god of fire and it seemed appropriate for a world that would be roasted by its proximity to the great furnace of the Sun. History seemed set to repeat itself with Le Verrier successfully predicting another planet's position. At the great observatories, astronomers set to work to find the new world.



Image Credit: NASA/ESA

Mercury from MESSENGER, orbiting a mere 0.14 AU from the Sun, the hypothetical planet Vulcan would be even more hostile thanks to the solar radiation and heat.

Vulcan was discovered transiting the Sun in March 1859 by a physician and amateur astronomer named Edmond Modeste Lescarbault (1814 -94). Le Verrier had some misgivings about Lescarbault's non-professional status but after visiting him at his little home-built observatory, satisfied himself that the observation was legitimate. Le Verrier formally announced Vulcan's discovery in March 1860. In France Le Verrier and Lescarbault were hailed as heroes (Lescarbault was awarded France's highest medal, the Legion d'honneur). The Solar System was complete! Vive la France!

Sadly this was too good to be true. Within weeks astronomers were pointing out that the body 'seen' by Lescarbault would actually be quite prominent. It was difficult to see how it could have been missed by other observers with superior equipment. Then there was the annoying

fact that most astronomers who used Le Verrier's orbital parameters for Vulcan could not see it at all. Those who did report it claimed positions irreconcilable with the supposed orbit. Vulcan was quickly recognised as being much less substantial than Neptune. Vulcan was spotted occasionally over the next 40 years, sometimes by very reliable observers (but so were the Martian canals, and so too are some UFOs today) but by 1900 its existence seemed unlikely. Photography has revolutionised astronomy and no photographic plate had captured the planet. The problem of Mercury's orbit was unsolved.

“Mercury was moving through space bent by the Sun's gravity”

It took an even greater giant of science than Le Verrier to solve the mystery. In 1915 Albert Einstein (1879-1955) published his ground-breaking General Theory of Relativity. This postulated that space and time were linked and that the mass of very large objects could bend both. Einstein was not overthrowing Newtonian physics but was showing that there was more going on in extreme gravitational fields than previously thought. Applying his reasoning to Mercury's orbit, Einstein showed that at its perihelion Mercury was moving through space that was being 'bent' by the Sun's gravity, effectively lengthening the distance Mercury was travelling (by a minuscule amount). The predicted discrepancy was a good match to the measured value. This theory neatly solved the mystery of Mercury's strange orbit- and Vulcan, sadly for its discoverers retreated into myth.

Were he to be aware of Vulcan's fate from some celestial Valhalla, I expect Le Verrier would be disappointed to lose one of his planets but then intrigued and delighted by the Universe's unexpected wonders.

Further reading

Asimov, Isaac, *The Planet That Wasn't*, *The Magazine of Fantasy and Science Fiction*, May 1975

Our Irish Language Shows

By Neil Cullen, Administrative Officer

Armagh Planetarium, in collaboration with BBC NI's Irish language unit has developed Irish translations of two of our popular shows.

"The Secret of the Cardboard Rocket" is a children's show, made by Aaron McEuen and Mike Murray of the Clarke Planetarium in Salt Lake City. It is every kid's fantasy, as the young heroes use a large cardboard box to make their own rocket and explore the Solar System.

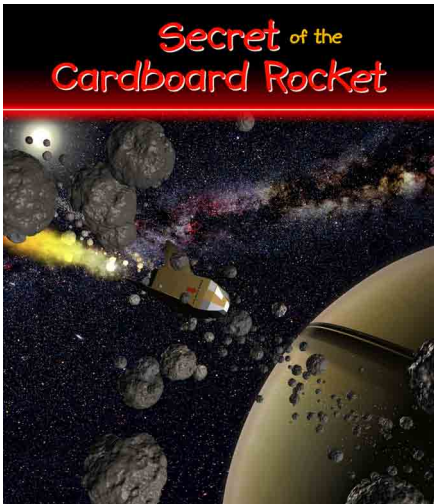


Image Credit: Evans and Sutherland

The Secret of the Cardboard Rocket, a highly educational show that takes young people on an animated tour through all the planets of our Solar System, investigating their wonders and escaping their dangers.

"The Mystery of the Christmas Star" is from Utah based Evans and Sutherland (manufacturers of the Digistar 3 projector equipment used by the Planetarium to show the stars in the Digital Theatre). This is an extremely popular show for the festive season and it seeks to explain what drew the Wise Men across the deserts of the Middle East to Bethlehem to find the baby Jesus. Supported by funding from the Ultach Trust and

the Awards for All Big Lottery Fund, a small local committee, Antaine Ó Donnaille, Tom Mason, Gareth Mackle, Réamonn Ó Ciaráin, Dermot McElmeel and Neil Cullen, the BBC, the two Salt Lake-based companies and the Planetarium worked to develop the Irish language version of these popular shows. Local actors and pupils from the local Irish language schools were used to provide the voices, and it proved to be quite a challenge to lip synch the animated character in the "Cardboard Rocket" with the Irish language script.

"Its every kid's fantasy as they use a large cardboard box to make a rocket"

The object of this work is to provide an opportunity for the ever-expanding Irish medium schools to bring their pupils to the Planetarium. It is one of the Planetarium's aims that every school child should visit the facility at least once during their primary school career. The two shows were formally launched at the Planetarium on 11 December 2009. On the morning of the launch local Irish language schools were invited to attend a special screening of "The Secret of the Cardboard Rocket". Afterwards the feedback from the pupils and teachers alike was very positive. The local Irish language teachers were extremely pleased that there are now other options available to them when it comes to taking their pupils on educational field trips.

On the afternoon of the launch local Irish-speakers and local dignitaries were invited to a special screening of both the new shows. A great afternoon was had by all and the feedback was extremely positive. At the moment two of the Planetarium's shows have been translated into Irish but we intend to translate at least another two of our shows in the near future.

For further information on these shows, please contact Neil on 028 3752 3689 or neil@armagh-planet.com

Image of the Month



Image Credit: NASA/JPL-Caltech

As Mars happens to be at opposition this month I thought these images would be appropriate. The images were taken by HST's Wide Field Planetary Camera-2 on 10 March 1997, just before Mars opposition, when the red planet made one of its closest approaches to the Earth (within about 60 million miles or 100 million km).

The images were taken at precise intervals so that most of the martian surface would be exposed. Mars was observed in nine different colours ranging from the infrared to the ultraviolet. The specific colours were chosen to clearly discriminate between airborne dust, ice clouds, and prominent Martian surface

features. The coloured images shown here are composites of the red, green and blue observations.

These images show the planet on the last day of Martian spring in the northern hemisphere (just before summer solstice). The annual north polar carbon dioxide frost (dry ice) cap is rapidly sublimating, revealing the much smaller permanent water ice cap. There are many other interesting features seen here but there isn't room to mention them all. For more information see www.nasaimages.org

(Caption by Tracy McConnell, Education Support Officer)



www.armaghplanet.com

Astronotes, Incorporating Friends' Newsletter is published monthly by Armagh Planetarium, College Hill, Armagh, Co. Armagh BT61 9DB
Tel: 02837 523689 Email: cj@armaghplanet.com

Editor: Colin Johnston
Assistant Editor:
T McConnell
©2010 Armagh Planetarium
All rights reserved