



December 2009

ARMAGH PLANETARIUM

ASTRONOTES

Incorporating **FRIENDS' NEWSLETTER**

Centaurian planets?

Top 10 astronomy moments of 2009

Apollo on screen

Ares: the future of space exploration?

The sky this month and much more!

Merry Christmas

By Tracy McConnell, Education Support Officer

The Armagh Planetarium adds the “Mystery of the Christmas Star” show to our line up at this festive time of year. The star of Bethlehem is an iconic astronomical event whose true origin remains unknown even today, in spite of years of speculation and investigation. This show guides the viewer through some of these investigations and the most likely identities of this interesting cosmological object. For further details on this show, please see the website, www.armagh-planet.com or contact our reception desk, 028 3752 3689. Please also remember that pre booking is essential for all shows. The “Mystery of the Christmas Star” show is only available until Wednesday 23 December 2009.

From everyone here at the Planetarium I would just like to wish you all, a very Merry Christmas

and a happy New Year. I hope you have enjoyed reading the articles in Astronotes every month. As a special celebration of the season we have our traditional bumper edition this month. 16 pages of interesting articles to keep you rivited and entertained until next year.



Image Credit: Evans & Sutherland

Three Magi priests follow a mysterious cosmological object across the sky in search of a new born king.

Far Centaurus?

By Colin Johnston, Science Communicator

James Cameron (b.1954) is that rarest of birds, a director of big-budget action movies who has both a heart and a brain (to see what I mean you just have to compare and contrast ‘Aliens’ and ‘The Terminator’, both directed by Cameron with, ‘Aliens vs Predator: Requiem’ and ‘Terminator Salvation’ directed by Hollywood hacks for hire).

“Alpha Centauri is the obvious first target when we come to explore the stars”

Cameron’s latest epic is ‘Avatar’, a story of a crippled human who gets a chance to live a new life as a 3m tall blue-skinned humanoid alien from a world called Pandora. In the movie Pandora is a lush jungle-covered moon of a gas giant planet called Polythemis in the Alpha Centauri system just 4.36 light years (1.3 parsecs)

from our own Solar System. The Centauri system is of course, real and comprises our Sun’s nearest stellar neighbours, while Polythemis and Pandora are fiction. How plausible are these fantasies?

The constellation of Centaurus the centaur lies too far south on the celestial sphere to be visible from the UK and Ireland. In ancient Babylon this constellation was seen as a great bull, but in classical times it was associated with Chiron, the wise centaur who tutored Achilles and Hercules. Later, Hercules shot Chiron with a poisoned arrow while in the midst of one of his drunken binges. The god, Zeus, in an atypically kindly act placed the agonized centaur into the sky where his suffering would cease. Sometimes called Rigil Kentaurus (Foot of the Centaur), Alpha Centauri appears as the brightest star in the constellation, and at magnitude -0.01 is the fifth brightest star seen from Earth. Alpha Centauri is in fact not a single star but a system of three stars. The primary, Alpha Centauri A, is a yellow

G2V star amazingly similar to our Sun. Centauri A is about 10% larger than the Sun and half as bright again. Its secondary, Alpha Centauri B, is a slightly smaller and cooler K1 star. Both stars are calculated to be somewhat older than the Sun, having existed for 4.85 billion years (some sources quote figures as high as 8 billion years) compared to the Sun's 4.6 billion. The last and definitely least of the trio is the tiny M5 red dwarf Proxima Centauri.

“Proxima is spending its nuclear fuel slowly, so it will outlive its sister stars”

Could there be planets orbiting the stars of Alpha Centauri? Astronomers have long debated whether planets can exist in stable orbits around multiple star systems. Some doubt that planets can exist at all in such systems. The argument goes that the gravitational tug of additional stars will prevent planets from maintaining relatively circular orbits around their parent star, or even in the distant past have prevented material from accreting together to form worlds. If this is correct, multiple star systems would have no planets, but presumably possess awesome belts of asteroids.

“Alpha Centauri A is... amazingly similar to our Sun”

While the jury is still out, some astronomers have carried out elaborate simulations suggesting planets ought to be able to exist in such star systems. In 1997 one of these simulations of the Centauri system, showed that there was a stable zone some 3 AU from Centauri A and Centauri B. If correct, what does this mean? Our planet, Earth, orbits 1 AU (astronomical unit, about 150 million km or 93 million miles) from the Sun. To enjoy an Earth-like climate a planet orbiting Centauri A, which is a little brighter and hotter than the Sun, would need to orbit about 20% further out, this would mean its year would be longer, 470 of our days or more. This would be inside the zone of stability. However if this hypothesis is correct, the Centauri system will have no equivalents of Jupiter and the other giant

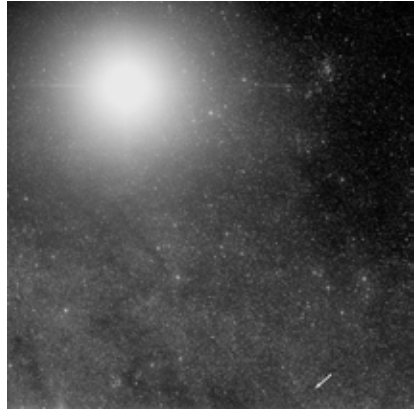


Image Credit: ESO

Meet the Neighbours Alpha Centauri A and B are strongly overexposed in this image, with the outlying member, Proxima lying to the lower right (arrow).

planets. In fact, a search by astronomers at the European Southern Observatory in 2006 failed to find any super-jovian planets (that is planets larger than Jupiter) in wide (100-300 AU) orbits of Alpha Centauri.

A terrestrial visitor to an inhabitable planet in the Alpha Centauri system would soon realize this was an alien world when the second sun rose in the sky. Centauri B takes almost 80 years to complete its eccentric orbit around its primary. This orbit takes it from as close as 11.2 AU to Centauri A to a distant 36 AU. Having two suns may suggest any hypothetical habitable planet would experience an arid climate but its distance and relative dimness means in fact that Centauri B's warmth would be imperceptible on our hypothetical Earth-like world. However its light would dominate the night sky. The star would appear as a dazzling disc which would fluctuate in brightness and move across the sky as the star and planet moved in their orbits around Centauri A. At its dimmest, when furthest from the planet, Centauri B would be more than 100 times as bright as the full Moon, at maximum it would be a stunning 14 000 times as bright as the full Moon. The planet would, as the years went by, at times see days with two suns and nights illuminated by a tiny distant sun, both utterly outside terrestrial experience.

You may have noticed that the third member of the trio has not been mentioned much. Proxima,

like most of the stars in the Universe, is a small and dim M class red dwarf. It contains about an eighth of the amount of matter making up our Sun and its diameter is about 15% that of the Sun (so Proxima is just about 50% wider than Jupiter). This little star is so faint from Earth that it was only discovered in 1915. It is the closest member of the Centauri system to us, and is separated from its sisters by a distance, huge in human terms, of about 12 000 AU (about 0.2 light years). Its orbital period about the other two must be about half a million years! So unimpressive is Proxima, that it would be relatively hard to see from our hypothetical planet orbiting Centauri A; appearing as a fourth magnitude object in the night sky. As it is so feeble, Proxima is spending its nuclear fuel slowly, so it will outlive its sister stars. A few billion years from now, Centauri A and B will have expanded into red giants before collapsing into tiny white dwarfs, yet Proxima will look virtually the same as it does now.

“The planet would see days
with two suns and nights
illuminated by a tiny
distant sun”

Alpha Centauri is often thought of as the obvious first target when we come to explore the stars. Could we send a spacecraft there? Well we could, but we would need to be patient. The New Horizon probe, currently speeding across the Solar System to rendezvous with Pluto in 2015 before flying into the interstellar void is humanity's fastest space vehicle to date. Its course will not take it in the direction of Alpha Centauri, but if it had been aimed there it would take about 63 000 years to span the gulf of four light years. In future centuries we may develop new advanced techniques such as nuclear pulse propulsion or beam powered lightsails which could cut this journey time down to decades.

However, long before travel to Alpha Centauri is feasible, perhaps even in the next decade, we will know if there are planets there to visit. New telescopes and observatories currently on the drawing board could potentially detect large ter-

restrial worlds orbiting our neighbouring stars. Only slightly more advanced technology will make feasible instruments which could detect the atmospheres of such worlds. Were such an observation to detect an atmosphere on a Centaurian planet containing oxygen (a gas so reactive that it must be continuously regenerated by living organisms on Earth) it be almost certain that life exists there. We would know that we have neighbours, whether they are blue humanoids or blue-green algae, just 4.3 light years away.

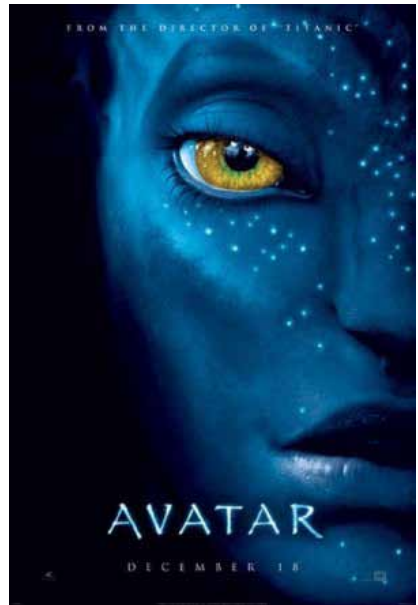


Image Credit: 20th Century Fox

Blue Lady In the movie Avatar, Alpha Centauri's natives are blue-skinned and slightly feline, but disappointingly human-like.

(Avatar opens on 18 December 2009)

Further reading

Gilster, Paul, Centauri Dreams, Copernicus Books, New York, 2004
Kaler, James, The Hundred Greatest Stars, Springer, 2002

<http://www.surrealaward.com/avatar/plotv.shtml>
[http:// www.Centauri-dreams.org](http://www.Centauri-dreams.org)
<http://www2.avatar-movie.com/>

Ares I-X test flight success

By Nigel Farrell, Education Support Officer

On 28 October 2009 at 15.30 GMT the United States space agency (NASA) successfully launched a prototype rocket, which it hopes will eventually replace the veteran Space Shuttle. Wednesday's successful launch came after an aborted attempt on Tuesday which was scrubbed, due primarily to adverse weather conditions. The unmanned 100 metre tall (327 feet) Ares I-X test rocket lifted off from the recently modified Launch Complex 39B, which is located just north of Cape Canaveral on Merritt Island. Originally constructed to launch the huge Saturn V rockets, pads A and B have witnessed some of the most momentous American journeys into Space including, among others, the Apollo missions and the Space Shuttle.



Image Credit: NASA

Ready for Blast Off! Ares I-X sits atop Launch Pad 39-B at the Kennedy Space Centre preparing for the launch designed to test several key features of the craft and its viability as a replacement for the Space Shuttle.

Doug Cooke, an associate administrator for the Exploration Systems Mission Directorate at NASA's headquarters in Washington called the mission a huge step forward for NASA's exploration goals, and said. "Ares I-X provides NASA with an enormous amount of data that will be used to improve the design and safety of the next generation of American spaceflight vehicles – vehicles that could again take humans beyond low Earth orbit."

The test flight was designed to provide NASA with an early opportunity to test important facilities, ground operations and hardware for the Ares I crew launch vehicle. During the flight a huge range of performance data was relayed to the ground and also stored onboard via the flight data recorder. The slender rocket, referred to by some as syringe-like, produced some 2.6 million pounds of thrust, (11.5 million newtons) accelerating the rocket at approximately 3g's to Mach 4.76, almost reaching hypersonic speed. The flight achieved a sub-orbital altitude of 150 000 feet (45 720 metres) before the booster stage and solid rocket motor splashed down nearly 150 miles (241 kilometres) downrange.

"The most valuable learning is through experience and observation"

These were the only parts of the rocket to be recovered for later inspection. The upper stage of Ares was a dummy containing simulators of the Orion crew module and launch abort system made to the correct size and shape. This was not designed to be recovered for investigation. Ares carried some 700 sensors aimed at relaying telemetry back to the ground, they relayed data relating to, assembly and launch operations, separation of the vehicle's first and second stages, controllability and aerodynamics, re-entry and recovery of the first stage and new launch vehicle design techniques.



Image Credits: NASA

The Prandtl-Glauert singularity also known as a shock egg, the beautiful cone of vapor that forms around a craft moving very fast through the atmosphere.

Ares I-X mission manager, Bob Ess said of the mission, “The most valuable learning is through experience and observation..... Tests such as this-from paper to flight-are vital in gaining a deeper understanding of the vehicle from design to development.” The Ares mission, part of NASA’s Constellation programme, has not been without its issues however. Following the recovery of the craft’s booster stage from waters east of the Kennedy Space Centre, the salvage team sent to retrieve it found a large dent in the side of the booster. NASA was reported to have said that the dent was caused by failures in the parachute system and it appears that upon inspection two of the three chutes used malfunctioned. This would have led to the booster hitting the water much harder than expected which most likely caused the dent discovered by recovery divers.

Though the parachute system was set to be studied to establish why it failed to deploy correctly, Ares managers remained unconcerned as the rocket had not been designed for repeat use. However, this was just a minor glitch compared to a recent report by the Augustine Panel. Tasked with reviewing the US human spaceflight programme they cast considerable doubt on the future of the programme as a whole. Although the panel supported the Ares I-X test flight which cost a phenomenal \$445 million, it queried the need to develop the Ares I. The panel questioned the cost and design of the craft as well as its development time.

“The slender rocket, produced some 2.6 million pounds of thrust”

The panel also found that although NASA should be allowed to shape its organization and infrastructure, while maintaining facilities deemed to be of national importance, the current structure of the budget, is such that NASA essentially has the resources either to build a major new system or to operate one, but not to do both. The panel stated that: “This was the root cause of the gap, incapability of launching crew to low-Earth orbit under the current budget and will likely be the source of other gaps in the future.”

Of NASA, the panel concluded by saying, “Its human spaceflight activities are nonetheless at a tipping point, primarily due to a mismatch of goals and resources. Either additional funds need to be made available or a far more modest program involving little or no exploration needs to be adopted.”

However, the future of Ares, while still remaining in the balance, can yet be resolved. With appropriate funding and changes in the ways in which NASA conducts its affairs, Ares can surely achieve its goal of becoming the future of the US spaceflight programme.

(Editor’s note: This will be the last Article Nigel writes for us as he is moving on to continue his education. We wish him the best of luck!)

Apollo on Screen!

By Colin Johnston, Science Communicator

Unlike previous voyages of exploration, humanity's first steps on the Moon did not inspire great works of art and literature. In fact Apollo has rarely even intruded into popular culture. However in the past forty years there has been a smattering of movies featuring project Apollo. Here are some worth looking at. Opinions are my own and are based on my remembered viewings.



Image Credit: Photo copyright © 2005 IMAX Corporation and Playtone

Re-creation of Neil Armstrong, Apollo 11, surveying the landscape with a Hasselblad still camera in the IMAX® 3D film “Magnificent Desolation: Walking on the Moon 3D”.

The Apollo movie everyone knows is of course Ron Howard’s “Apollo 13” starring Tom Hanks (a noted enthusiast for space exploration in general, and Apollo in particular, see later). In fact it is so well known that there is little more to say. In every department, acting, direction, script and the technical department, this is a great movie. Released in 1995 it was based on the book “Lost moon” by Jim Lovell and Jeffrey Klugman and probably did more to establish the “can do, failure is not an option” ethos attributed to Apollo-era NASA than the actual events did. To see how effective this fine movie was in changing public attitudes, look at pre-1995 histories of space exploration and see how little space they devote to this mission. Jim Lovell (the real one) makes a brief appearance as the captain of the recovery ship.

Hanks and Howard came together a few years later to help produce “From the Earth to the

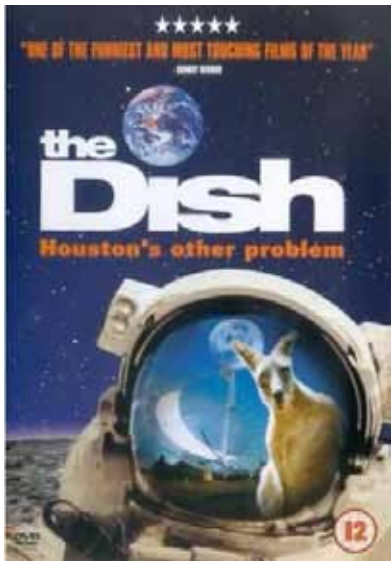
Moon”, a 12 part mini-series first shown in 1998. Loosely based on Andrew Chaikin’s superb book “A man on the Moon”, this tells the story of the Apollo project from the early 1960s to 1972. The first few episodes are pretty standard dramatised documentaries, but as the series continues each episode tells its story in a different and often original way; for example the Apollo 12 mission is presented as a comedy, Apollo 13 is told virtually entirely from an Earth-bound perspective as rival reporters cover the story, the final episode intercuts the Apollo 17 mission with the story of film maker Georges Méliès (played by Tom Hanks) struggling to make “Le Voyage dans la Lune” in 1902.

As a historical recreation this series is wonderful. The producers strove to find actors who resembled the astronauts they were to portray, so the series gives numerous fine character actors a chance to take starring roles. It’s fun to spot all the familiar but hard to name faces (“Wasn’t he a bad guy in Robocop?”, “Look there’s the dad from Malcolm in the Middle!”, “Is he the one from the Princess Bride?”). As you may have realised I love this series, my only misgiving being the rather stiff and pompous introduction Tom Hanks gives to each episode. Popular in the US, the series has only been shown once on terrestrial TV in the UK, hilariously but sadly, ITV showed it with no advance publicity in the Saturday morning kids’ cartoon slot. The schedulers allegedly believed it was a sci-fi show!

“Tom Hanks is a noted enthusiast for space exploration”

The Apollo mission and astronaut in my next movie are entirely fictitious but are intended to be authentic. “Beyond the stars” directed by Richard Saperstein is an interesting oddity. Christian Slater plays Eric, a space-mad teenage boy who tries to befriend a gruff

and uncommunicative retired Apollo astronaut played by Martin Sheen. Sheen's character initially spurns the hero-worshipping Eric, but is gradually won over, and we discover why his lunar experiences have left him so sour (the flashbacks are very well-done, the spacesuit and lunar landscapes are very convincing for a relatively low-budget production). I like this 1989 movie and I think it deserves to be better-known, the leads show what splendid actors they are, while the rest of the cast, which also includes F. Murray Abraham and a pre-fame Sharon Stone (before she didn't lose her pants in "Basic Instinct" until the following year), is excellent. It has a surprising plot development in the final five minutes which does have you wondering what happened next. The following movie might be the answer...



A charming comedy, "The Dish" should not be thought of as a documentary.

"Moontrap" which was also made in 1989 is a low-budget science fiction B movie in which NASA discovers evidence of alien activity on the Moon. In response an investigative mission is assembled using surplus Apollo hardware, and I remember being impressed by the attempts to make this look realistic. The film starred Walter Koenig (of "Star Trek" and "Babylon 5" fame) and Bruce Campbell (who seems to have appeared in every trashy horror movie in the past

thirty years). I have seen it once and remember thinking it wasn't too bad, but I would not be surprised to discover it is actually terrible.

"UK TV schedulers believed From the Earth to the Moon was a sci-fi show!"

"The Dish", the only comedy on this list, tells the (heavily fictionalised) story of the Australian staff of the Parkes radio telescope fighting technical problems to receive the TV footage of Armstrong and Aldrin's first steps. Made in 2000, it is a nice, gentle movie which has a lot of fun with the culture clash between the Australians (led by Sam Neill), at Parkes and the local small-town eccentrics and the NASA representative.

Aside from fiction however closely based on fact, Apollo has been treated in several cinema documentaries. "The Space Movie" is a film made by Tony Palmer in 1979 to celebrate the tenth anniversary of the Apollo 11 moon landing. It is essentially movie clips from many NASA missions, including Gemini and Skylab flights, edited together to create a lunar mission, set to music by Mike Oldfield. As such it is interesting to watch but would not be my first choice for anyone wanting to learn about the Apollo project, as far as I remember there is no narration. The obvious inconsistency of the footage from various missions brought together for this production (the lunar landscapes suddenly change from flat to hilly for example) has been used by Moon hoax proponents as 'evidence' for their case.

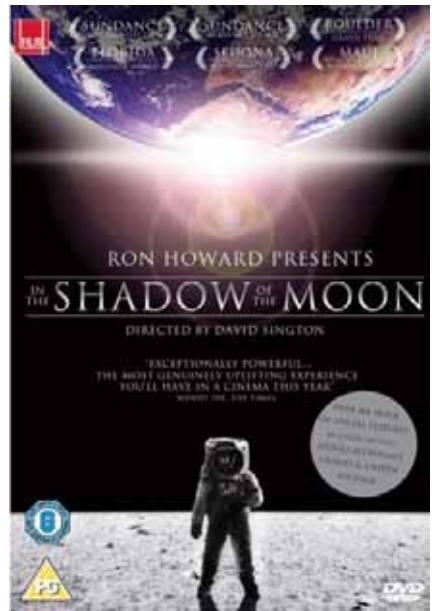
"Look there's the dad from Malcolm in the Middle!"

Ten years later Al Reinert directed "For All Mankind" to retell the Apollo story. Again the film edits together NASA footage taken by the Apollo astronauts on many different missions into a fascinating collage but does feature narration from interviews with astronauts including Michael Collins, Jim Lovell and "Pete" Conrad. Brian Eno was to have provided the soundtrack but many composers contributed to the final version. Despite my misgiving on the film's editing.

I think this is a pretty good documentary. It was nominated for an Academy Award in 1990.

Magnificent Desolation is a 40 minute documentary made in 3D for IMAX cinemas. First shown in 2005, this is an excellent experience, depicting recreations of events from the Moon missions tied together with extracts from interviews about the Moon from children. It also features some fictional scenes of an hypothetical crisis faced by astronauts when their rover crashes and a look at a possible future with a glimpse of a grandiose lunar base. The movie was produced, co-written and narrated by (you've guessed it) Tom Hanks.

The most recent Apollo movie is 2006's "In the Shadow of the Moon". Once again this used NASA archival images, including some rarely seen footage and interviews with ten surviving Apollo astronauts, including Aldrin, Al Bean, Collins, Gene Cernan and Harrison Schmitt. In my opinion, this is the best of the Apollo documentaries, and was very well received by the critics. On the DVD release there are some very interesting deleted scenes, such as the astronauts talking about the "Dark Side", the accidental deaths and personal sacrifices caused by the Apollo project and Gene Cernan describing just why the first 15 seconds of each flight were so important. If TV is a little boring this Christmas holiday,



In the shadow of the Moon received favorable reviews

why not find one of these on DVD and finish off the fortieth anniversary of Apollo 11 by seeing how this great achievement has been treated on screen?

Top 10 Astronomy moments of 2009

Orla O'Donnell, Education Support Officer

Yet another year draws to a close and what a year it has been! 2009 has been a memorable year seeing events from elections in America to recession in Europe. The year has been full of highs and lows but thankfully some of the highlights of the year have come thanks to astronomy and space science. In the month of December it therefore seems appropriate to highlight the top ten astronomy moments of 2009 as selected by the members of staff and myself at Armagh Planetarium.

10) Leonid Meteor shower

Due on 17 November (before our deadline) a highlight of the astronomy year is predicted as the annual Leonid Meteor shower is foreseen to be the most spectacular it has ever been. Unfortunately for those of us living in Europe the best place to view this beautiful show is in Asia. So fingers crossed that this shower is as spectacular predicted.

9) Solar Eclipse 22 July 2009

For some lucky nations the highlight from their astronomy year was viewing a total eclipse of

the Sun. The moon completely blocked out the light of the sun for a whopping 6 minutes and 39 seconds leaving people living in parts of Asia and the South Pacific in complete darkness. We may not have been able to witness it in Europe but the longest solar eclipse of the 21st century deserves to be recognized.

8) Saturn's Rings Vanish!

This is a bit of an odd selection for a top astronomy moment as you could not see anything really. In January of this year Saturn's rings were at their minimal angle, this means that Saturn's rings would look razor thin. You will not be able to see the rings this thin again for another thirty years so it's worth while including.



Image Credit: STScl and NASA

Hubble Space Telescope gets a new lease on life thanks to a new camera.

7) Hubble's longer life

The Hubble Space Telescope is the gift to humanity that keeps on giving, and thanks to the to refit it received in May of this year it will continue to send back mind blowing and beautiful images for a further decade. In May 2009 the space shuttle Atlantis mission STS - 125 repaired some of Hubble's equipment and replaced WFPC2 (Wide Field and Planetary Camera 2) with WFPC3. The images that were sent back from WFPC3 did not disappoint and for the sake of their scientific importance and splendor let's hope there are many more to come.

6) Testing of the Ares I-X Rocket

The Space Shuttle has been the stalwart of the American space program for twenty-seven years, it will have some way to go to out do the Russian workhorse that is the Soyuz running

for over thirty years. This year, NASA decided it was time to test the Shuttle's successor. In October NASA tested the Ares I-X and at 100 metres tall it is reminiscent of the rockets of the 1960 Apollo missions. The jury is still out as to whether the Ares program will be the future of space travel. In these financially challenging times expensive programs like Ares may be curtailed for some time. There was no denying the excitement and spectacle of the launch in October.

5) NASA's new Administrator

July 2009 saw the appointment of Charles Bolden as the 12th Administrator of NASA, a highlight of 2009 for our director Dr Tom Mason. Bolden is a self made man. Born in Columbia, South Carolina, he joined the Air Force after high school where he earned a degree in Electrical Science in 1968. Bolden spent the 1970's rising up the ranks of the Air Force and continued his education gaining his masters in Systems Management in 1977. In the 1980's Bolden was selected as a candidate for astronaut training and in the fourteen years he spent at NASA he fulfilled many roles including flying in orbit four times and commanding two of those missions. Bolden returned to active service with US military in 1998 and rose to the rank of major general and he finally retired from the armed forces in 2003. Charles Bolden returned to NASA this year to take on the role of the highest-ranked official and we wish this amiable gentleman best of luck in his role.



Image Credit: NASA/Emmett Given, UNITEs

Administrator Charles Bolden (or Charlie as he likes to be called) and Deputy Administrator Lori Garver the top ranking official of NASA look comfortable as they sit on the floor surrounded by children.



US President Barack Obama hosts Apollo 11 astronauts, left to right, Edwin 'Buzz' Aldrin, Michael Collins and Neil Armstrong in the Oval Office of the White House.

4) LRO's Apollo images

NASA left the moon thirty seven years ago and although they have made a foothold in space with the creation of the International Space Station they have yet to return a human to the Moon. The Lunar Reconnaissance Orbiter is NASA's way of preparing the path back to the Moon and was launched in June 2009. The LRO's primary mission is to collect data to pave the way for longer human missions on the Moon. Images the LRO sent back from the original Apollo landing site in September were a bonus and were viewed with great excitement. The lunar module's footpads were clearly visible as was some of the experimental equipment that Armstrong and Aldrin left behind. These images are Astronotes Editor and Apollo enthusiast, Colin Johnston's highlight of his astronomy year.

3) Exoplanet research

Although originally discovered in 1995 one of the highlights of the year has to be the continuing work carried out on exoplanet research. In February 2009 the smallest terrestrial exoplanet was discovered by the European satellite COROT (COncvection ROtation and planetary Transits). The discovery of this rocky planet with a diameter less than twice that of Earth's is an important one, as rocky planets have a greater possibility of life. Most of the over 300 exoplanets discovered so far are gas giants like Jupiter. In April 2009 it was released that further discoveries suggested that there was another terrestrial planet that was in the heart of a star's habitable zone and therefore there is a pos-

sibility that water could exist in a liquid state. In the past fourteen years there have been many encouraging discoveries made by the various teams that are conducting research into exoplanets and 2009 was no exception.

2) The 40th Anniversary of Apollo 11

The 40th anniversary of a man called Neil taking a walk on a summer's day has to be considered one of the highlights of the year. The celebrations of the successes of Apollo 11 highlighted the enormous team effort that it took to safely carry two men to the surface of the Moon. The anniversary allows some of us for the first time to witness the awesome power of the Saturn V rockets and others to relive much cherished childhood memories of one of the most momentous events in human history.



IYA09 was an international event with every county having their own logo

1) IYA09

2009 was selected as the year to celebrate astronomy as it marked the 400th anniversary of Galileo's "invention" of the telescope. The 'International year of Astronomy' commenced in January at the UNESCO headquarters in Paris and events were then rolled out world wide. In conversations with all the staff in the Planetarium IYA09 came up over and over again as the highlight of the year. The global nature of the event saw celebrations of the impact of astronomy from Italy to India which were designed to be informative and inspiring.

Here in the Planetarium we got involved in the celebration partaking in the global event '100 Hours of Astronomy' and 'She is an Astronomer' which brought NASA scientist Caroline Porco to Armagh in July. The event will conclude in December with a closing ceremony which will be held in Italy and let's hope that IYA09 has encouraged some budding astronomers to pursue their interests in 2010. So

there you have it, some of my highlights of the astronomy year 2009 that I have complied with help from the Planetarium staff. These are just some of my highlights and I'm sure every reader has a list of their own.

It would be remiss of me though not to mention some of the lowest moments in astronomy in 2009. The failure the large Hadron Collider which was an attempt to recreate the big bang in CERN was a great disappointment to the scientific community but not to the few who believed its success could be the end of the world. Then of course there was the non-event that was NASA's attempt to look for water ice on the

Moon. They crashed a rocket into the Moon in October with hope that water would be released but alas there were no plumes of debris and the mission entitled: "The Lunar Crater Observation and Sensing Satellite" cost \$79 million (£47.5 million). Yikes! In the spirit of Christmas lets forget about the bad times and remember 2009 as the International year of Astronomy and let's hope that there are many more great moments in 2010.

(Editor's Note: This is also going to be the last scintillating article from Orla as she is leaving us to travel to far and exotic places. Good Luck Orla on your adventures.)

December Sky

By Tracy McConnell, Education Support Officer

Welcome everyone to the December guide of the night sky, where I will outline some interesting constellations and sights in the sky over Ireland at this time of year. Remember to wrap up warm, it will be cold out at this time of year. The majority of this guide will refer to star positions at 11.00pm on 15 December 2009.



Image Credit: NASA

M45, the Pleiades star cluster, perhaps the most famous star cluster on the sky, found in the constellation of Taurus.

There are three planets visible clearly at this time of year. Jupiter is visible in the early evening just after sunset, and can be seen in a SSW direction, it sets in the west just after 9.00pm, just after Mars rises in the ENE. Mars progresses

across the southern sky during the night and is directly east at 11.00pm. Saturn rises in the sky at approximately 1.30am and follows Mars across the sky.

The two most well-recognised patterns in the sky are both visible at this time of year. One of these is Ursa Major, the great bear. Clearly visible mid way up the sky at this time, the most familiar stars in this pattern make up the well-known asterism the "plough" (an asterism is a pattern of stars seen in Earth's sky which is not an official constellation). The blade of the plough representing the bear's rear end and the handle his long tail. Moving east from edge of the blade is a hook-shaped pattern of stars which mark the bears head and front paw.

"Three planets are clearly visible at this time of year"

Ursa Major is one of the circumpolar constellations. These are visible all year round and appear to circle the Pole Star. To find the Pole Star, trace a line up through the two stars on the edge of the blade, Merak and Dubhe, continue upwards for about five times that distance between Merak and Dubhe, the star found there is Polaris, commonly known as the North Star or the Pole Star, it's the only star in the sky which will not appear to move through the sky as the Earth rotates,

this is due to its relative position above the rotational axis of the Earth (the North Pole).

Polaris marks the tail tip of Ursa Minor, the little bear, this pattern is made up of a curved handle shape attached to a small box shape similar to the plough. These two bears are based on a Greek myth. One of Zeus' many paramours, Callisto, was turned into a bear by Zeus' wife Hera in a jealous rage. Later, Callisto's son who was now a hunter found the bear and before he could unknowingly kill his own mother, Zeus turned the boy into a bear also. Then to keep them both safe from other hunters Zeus grasped both bears little tails and swung them around over his head and threw them up into the stars where they could be safe.

The other circumpolar constellations are Draco the dragon, who threads between the two bears. Queen Cassiopeia, appears as a "W" in the west, and King Cepheus, in the high NW sky. There is also the very faint pattern Camelopardis the giraffe, directly overhead.

The other most visible and recognised pattern is SSE at this point, it's the great hunter Orion. This pattern and its stars were covered in great detail last month by Colin Johnston in the November sky guide article last month.

“Sirius, the brightest star in the sky, is also known as the Dog Star”

Orion has several companion constellations, two loyal hunting dogs are just to the east. If you follow Orion's belt downwards towards the horizon, you will come to Sirius, the brightest star in the sky also known as the “Dog Star”. It's part of the Canis Major big dog pattern. Following the two stars of Orion's shoulders upwards and east you will encounter another bright star called Procyon. This is part of a two star constellation imaginatively representing Canis Minor, the little dog. To the west of Orion is a vicious “V” shape pattern, which marks the face of Taurus the bull, Orion's arch-rival and one of the signs of the zodiac. It contains a very bright red star marking the fiery eye of the bull. This star is called Aldebaran. Extend the V

upwards and you should find bright stars marking the tips of the bulls horns.

Further west again is a small cloudy cluster of stars called the Pleiades, Doves, or Seven Sisters. On a very clear night you may see as many as seven bright stars here. These sisters are also based on Greek mythology; they were turned into doves to allow them to escape the amorous advances of Orion. As well as Taurus there are five more zodiac signs visible at this time. Leo the lion, Cancer the crab, Gemini the twins, Taurus the bull, Aries the ram, and Pisces the fish. They stretch across the middle of the sky from east to west.



Image Credit: NASA

M42 the Orion Nebula offers one of the best opportunities to study how stars are born.

At this time of year we can also see the most distant object visible to the naked eye. If you have good clear dark skies the Andromeda Galaxy is located 2.5 million light years (765 979 parsecs) away and is visible half way up the sky directly west, in the constellation of Andromeda, mid-way up the sky facing west at this time. Good luck and happy star gazing!

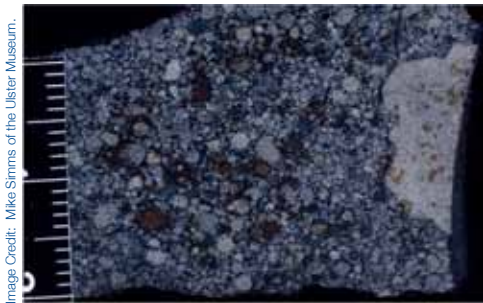
Moon Phases, Dec 2009

Wednesday 2 December	FULL MOON
Wednesday 9 December	Last Quarter
Wednesday 16 December	NEW MOON
Thursday 24 December	First Quarter
Thursday 31 December	FULL MOON

The Sprucefield Meteorite rediscovered

By Tom Mason, Director

In 1969 I was a second year student of Geology at Queen's University and one of our lecturers was Dr Ian Meighan, a specialist in igneous rocks. He taught us how to interpret the mysteries of igneous rock classification and formation by examining them under the microscope. Igneous rocks are born in fire and extreme temperatures, they spew out as lavas from volcanoes or violently invade and intrude pre-existing rocks, often converting them by the baking process known as metamorphism.



A polished surface of the Sprucefield Meteorite showing chondrules: smallest scale divisions 1 mm

To better understand their formation very thin slices of rock can be mounted on glass slides. The slices are cut so thinly that light is able to pass through the minerals. As all minerals are different, the light is bent and twisted in its passage through the thin section. By carefully measuring the optical properties of the different rock forming minerals, geologists can tell much about their genesis and chemistry, and hence their origin.

So in April 1969 my class had heard and read the reports about the fireball from outer space that had been widely observed all over Ireland. We were consumed with curiosity when we heard also that Dr Meighan had managed to obtain the fragment that had fallen through the roof

of a police training establishment at Sprucefield. What's more, he had also cut a slice from the sample to make a precious thin section to study under the microscope. The thin section clearly showed one of the diagnostic features of stony meteorites. Small spherical objects called chondrules, plus shiny metallic streaks of nickel iron which made the sample magnetic. As I recall it also had some bits of asbestos from the roof preserved on the sample. We also had the opportunity to see the hand specimen of the meteorite which he brought into the lab.

You need to remember that early 1969 was an extremely exciting time in space exploration. The Space Race was in full swing, Apollo 8 had flown from the Earth to the Moon in December 1968, Apollo 9 had flown the month before in March to test the Lunar module in Earth orbit as a dry run for the eventual Apollo programme manned landing. The geological community around the world was excited by the prospect of fresh specimens of Moon rock scheduled to be collected by the first manned mission to the Moon. A number of organisations had been chosen to perform the detailed geochemical studies which would revolutionise our understanding of the history of our Earth and its Moon. It was not so long since astronomer Patrick Moore had been stating that he still thought that most of the craters on the Moon were volcanic rather than having been made by an impact storm early in the history of the Solar System.

“Reports about a fireball from outer space ”

Dress rehearsals for the inevitable attempt to land on the Moon were coming thick and fast. NASA was on a roll, and we all expected that the first men would soon land on the Moon. So the Sprucefield Meteorite was a poor man's sample from outer space, and it was awesome to know that we were holding and studying a 4.6 billion

year old object: one of the oldest objects that could be studied from the origin of the Solar System.

Image Credit: Mike Simms of the Ulster Museum.



This is the hole punched through the roof of the old RUC training building at Sprucefield.

The last time I saw the Sprucefield Meteorite was in 1969, the year that it fell. When I took over as Director at the Planetarium in 1996, I thought that the Sprucefield Meteorite was at the Ulster Museum. I later learned that in fact there was a fragment housed at the Planetarium, but I could not find it. Just a few weeks ago I was reviewing some of the meteoritic samples which we have on display and which we use to demonstrate their properties to visitors and take out to schools. Wrapped up in a tissue at the bottom of a box which had not been opened for a long time I found a small fragment which I immediately recognised as resembling the Bovedy Meteorite in our collection. This was clearly the “lost” fragment. I had already found a box which was labelled as containing the Sprucefield specimen and it is on display. We will be putting our historic sample on display in the near future. For a small sample it tells a big story. Beneath the fusion crust, the fresh broken rocky surface is grey and characterised by many small round objects a few millimetres in diameter which are called chondrules.

These are unique structures in stony meteorites. They formed during the chaotic birth pangs of the Solar System. As the dust, gas and fragments which orbited the young Sun started to stick together (technically known as accretion), so the newly accreted objects started to collide, and when they did, the energy of collision generated heat which melted the rock and the result was a lot of spherical chondrules. Meteorites

made of chondrules are very common and are known as chondrites.

I recall handling the Sprucefield sample in 1969 and it had a very distinctive dark brown fusion crust, but it also showed natural fracture surfaces which revealed that the actual rocky material was grey and contrasted well with the fusion crust. The surprise for me was that the reports had all mentioned the bright colours of the fireball and I think that I had expected the melted fusion crust to be thick, but it actually is no more than a veneer. The thermal shock of the passage through our planet’s relatively thick atmosphere after the cold thin medium of space had not only ablated the substance of the meteorite, but had also caused it to break into many fragments of which only two were eventually recovered: from Sprucefield and Bovedy.



Image Credit: Mike Simms of the Ulster Museum.

This is a table showing the Sprucefield Meteorite resting on it. I wonder where it is now? The only table on Earth showing a scar of a meteorite impact?

The bulk of the body probably fell as many fragments into the ocean off the north coast of Ireland, where they likely lie still. I imagine that they are now colonised by algae, sponges and bryozoans, soft moss-like creatures bonding this lost primaevial fragment from the Solar System’s birth pangs into the watery oozes of our planet’s oceans. In a way this last resting place of the lost meteorite fragments is like a homecoming, and a closing of the circle, as this leftover from the Solar System’s planetary accretion phase disintegrated in our life giving atmosphere and returned to the soft ocean sea bed where all of us vertebrates started our journey.

Image of the Month

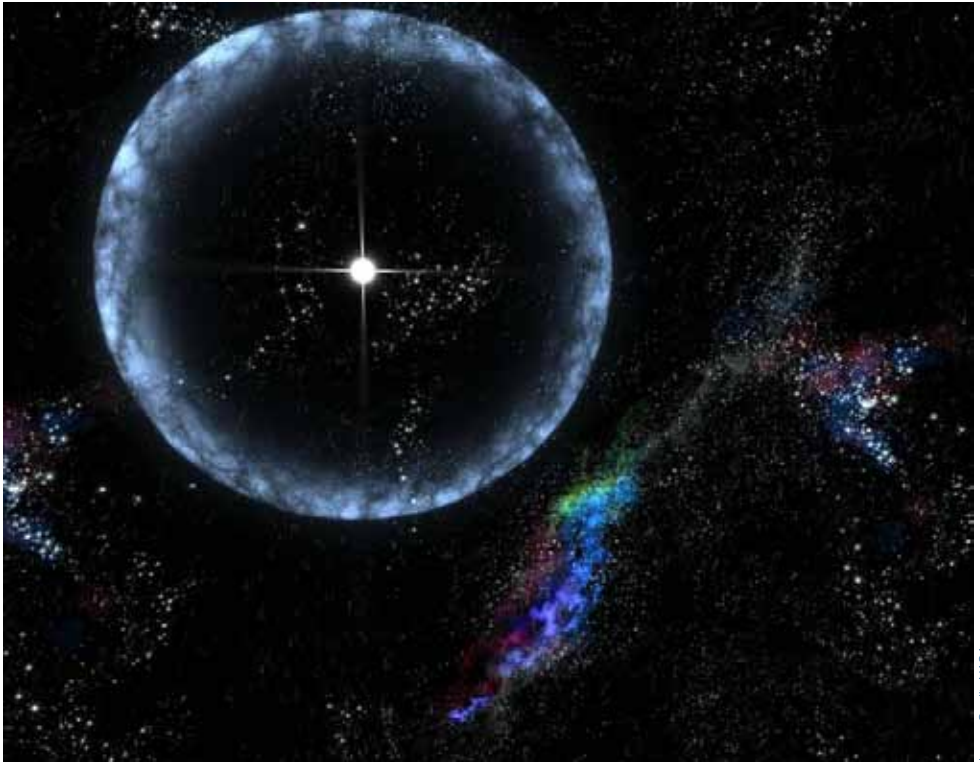


Image Credit: NASA

SGR-1806 is an ultra-magnetic neutron star, called a magnetar, located about 50,000 light years away from Earth in the constellation Sagittarius. On 27 December 2004 this star flared up so brightly that its light bounced off the Moon and lit up the Earth's upper atmosphere.

The flash lasted a tenth of a second and was brighter than anything NASA had ever detected from outside our Solar System.

Above is a NASA artist impression of what this gamma ray flare may have looked like. This image is part of a short animation illustrating the spectacular stellar explosion. The animation can be found at this link. http://www.nasa.gov/mpg/108531main_flashcam0001_NASA%20WebV_1.mpg

(Caption by Tracy McConnell, Education Support Officer)



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