Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise

October – December 2009

Forthcoming Events

Observatory

Observatory is closed because of ongoing building work.

Astronomy Section Christmas Meal

8th December: 8.00 pm

(venue to be arranged)

Foucault Pendulum

Postponed to 2010
(see page 12 for details)

In addition, the Section meets at the Observatory every Tuesday evening, and Friday if clear for observing.

Inside

Inserts

Star chart

Sunset, sunrise, moonset and moonrise times

The Shuttle's Successor

NASA's Space Shuttle is to be retired in the near future, so my research this month has been to look at its successor.

In fact the Space Shuttle has actually been very successful. The first Shuttle flight was Columbia on April 12th 1981. Columbia was followed by Shuttles: Challenger, Discovery, Atlantis and Endeavour. There were, of course, two major tragedies. Challenger, which on 28th January 1986, exploded, just 73 seconds after launch, killing all seven crew members. Columbia broke up during re-entry on 1st February 2003, again claiming seven lives.

There have been one hundred and twenty eight Shuttle flights and there remain just six more planned. The remaining missions are all to the International Space Station (ISS) with the very last mission scheduled just under a year hence on 16th September 2010.

Of the 128 flights, the missions range from satellite launching and retrieval, launching probes to distant planets, scientific studies, launch and later maintenances of the Hubble Space Telescope, missions to MIR and ISS space stations with men and materials. These flights have carried a total of 942 men and women into space.

Replacing the Shuttle is not a straight forward project. The Space Shuttle is a reusable launch system that is composed of three main assemblies: the reusable orbital vehicle, the external tank, and the two reusable solid rocket boosters. The tank and boosters are jettisoned during ascent; only the orbiter enters orbit. The Shuttle is launched vertically like a conventional rocket, and the orbital vehicle glides to a horizontal landing, after which it is refurbished for reuse. The solid rocket boosters parachute back to earth, where they are collected from the ocean and refilled for another use. Reusability will be part of the design of the replacement space vehicle but otherwise there will be little other similarity.

Assuming that NASA will get funding then this ambitious programme will be the next stage of space exploration. Called 'The Constellation Programme', its goals are to return to the moon and set up a long term human presence there and then for man to travel to Mars and possibly beyond. At the same time the ISS has to be maintained and serviced. In order to achieve this, new types of space vehicles will be required and NASA wants them to be all of similar design but with some being larger and more powerful than others. Those that service the ISS will be smaller than those servicing the moon base. The first of the new vehicles are not planned to be available until 2015 which means that for at least 4 years the ISS will be served by the Russian Soyuz vehicles.

So what will the mode of transport that future ISS personnel will enjoy from 2015 be like? When I started this research, I imagined the vehicle approaching the ISS as a sleek futuristic version of the Shuttle perhaps designed like a Lamborghini. But no, it looks just like the bell shaped capsule from the Apollo programme. Rather than landing at an airfield, like the Apollo capsule it will splash down in the ocean. NASA say that this configuration worked well before and with new technology, experience and reusability factored into the design then this is the way to go.

Let us follow a crew of six astronauts going to the ISS in 2015 - six will be the maximum number of crew. They are taken to Kennedy Space Centre, where there is a very high, very thin looking rocket, about twice the height of the Space Shuttle waiting on pad 39B. Its height is close to that of the old Saturn V rockets. It is called 'Ares 1' – 'one' being the smaller of the Ares rockets. Like the Saturn V the crew capsule is right at the top below the launch abort system. The bell shaped capsule they will travel in is called 'Orion'.

Ares 1 is in two parts. There are two long narrow cylinders, attached one above the other. The lower cylinder stands 154 feet high, but is only ten feet in diameter. This is the first stage rocket containing solid fuel called polybutadiene acrylonitrile. Above this, the next cylinder is 120 feet high and slightly wider, at fourteen feet in diameter. This is the second stage and is a liquid fuel rocket motor containing liquid hydrogen and liquid oxygen which will have been fuelled by ground staff shortly before the astronauts board. The six crew members are taken up by lift and climb aboard Orion three hours before launch. The Space Shuttle can only launch in winds up to 22 mph but side thrusters will allow Ares 1/Orion to launch in winds up to 40mph. The solid fuel first stage is ignited and Ares with its six man cargo inside Orion will lift off heading over the Atlantic. After 120 seconds, the first stage will shut down, propellant expended and will be jettisoned with a controlled fall using parachutes into the sea to be later recovered for re-use. The second stage liquid fuel is ignited and continues upwards burning for a further 330 seconds, during which time the launch abort system covering Orion is jettisoned. The crew are in the same orbit as the space station and are now able to see out. Forty five minutes later, the second stage will burn again to improve the shape of the orbit and having completed its job will be jettisoned and burn up in the atmosphere. Just the crew module Orion remains which the crew must navigate to and dock with the ISS using rear rocket motor and side thrusters. They will deploy two large solar panels en route.

Mission completed, the crew will return to Orion and undock from the ISS. They gently move away from the station and turn Orion around, so that it is facing backwards. In this way, when they fire the rear rocket motor, Orion will slow down leaving the ISS

in orbit. Once Orion has slowed to a lower orbit around 17,000 mph, the rear rocket motor is jettisoned, left to burn up in the atmosphere. Orion re-enters the Earth's atmosphere with heat shielding deflecting the heat of re-entry. The space vehicle's speed is reduced from 17,000 mph to 300 mph. Parachutes are deployed and Orion splashes down in the ocean. Orion and crew are recovered by ship and Orion is transported for refurbishment, ready for the next flight.

Like most governmental organizations, NASA has funding difficulties and Project Constellation may slip with a possibility that the Space Shuttle may stay in service for a little longer.

Frank Dowding

Editor: For more information consult the NASA/Constellation web pages:
http://www.nasa.gov/mission_pages/constellation/main/index.html
The following link is an overview of the Constellation programme
http://www.nasa.gov/pdf/163092main_constellation_program_overview.pdf

Stars at Sea

In July I sailed across the Atlantic to New York on Queen Mary 2, which boasts the only planetarium at sea. Knowing that Cunard had recently appointed several Fellows of the Royal Astronomical Society as resident astronomers on board their vessels, I rather assumed that the planetarium would be operated in the traditional fashion of an illustrated lecture about the stars. I knew that it doubled as a cinema, and indeed, when I first glanced into it a film was being shown on an ordinary cinema screen, although I could see a dome in the centre of the theatre ceiling. It was with some interest, therefore, that I went with my family, including all four grandchildren, to a planetarium show called *Cosmic Collisions*.

This turned out to be a quite spectacular film projected onto the interior of the dome, a two-metre skirt of which had been swivelled down at an angle to create a planetarium theatre. With a bit of difficulty the seats, which all faced in the same direction, could be reclined backwards. The film, which utilised the full extent of the planetarium's facilities, showed a number of collisions in the universe: a comet, meteors, the creation of the Moon by a huge asteroid striking the Earth (stating that it took only a month for the resulting debris to coalesce into the Moon), the extinction of the dinosaurs 65 million years ago by a similar impact of a seven-mile wide asteroid, methods of diverting future asteroids from a similar fate (eg using the gravitational attraction of an accompanying spacecraft to change the asteroid's orbit), the role played by charged solar particles in producing aurorae in the Earth's polar regions, and finally the future collision of the Andromeda Galaxy with the Milky Way galaxy.

The film, which lasted 23 minutes, and was narrated by actor Robert Redford, was produced by the famed Hayden planetarium of the American Museum of Natural History in New York. It was, therefore, scientifically accurate and authoritative, and I have to say that I was changed from being a slight sceptic (having seen some very poor planetarium shows in the past) to being very impressed by the presentation and effects. My family were equally impressed, including the children, aged 3 to 7, who had seen nothing like it before. (The youngest was, however, a bit concerned when space debris appeared realistically to come raining down on us.) We all expressed an eagerness to see the remaining three planetarium films to be shown during the voyage.

I was pleased that a programme which was clearly meant to be entertainment, could nevertheless impart much scientific knowledge in a short period of time, and in a way which was accessible to an otherwise unenlightened public. This could only be achieved by professionals in film and science, who thoroughly understood the subject and how to get it across.

I spoke to the theatre operator afterwards, and he confirmed that there was no resident astronomer on this voyage. His role was simply to switch on the projectors, of which there were six around the periphery of the theatre, coordinated by computer, unlike traditional planetarium with their massive central projectors. According to the operator, however,

this DigitalSky system created by Sky-Skan is now obsolete, modern planetaria now using two Sony projectors.

The next film was *Infinity Express*. Unfortunately, the planetarium shows are so popular that we could get into none of the three English presentations of this film, and had to settle for a French one. The third was *The Search for Life* narrated by Harrison Ford, and the fourth was *Passport to the Universe*, a journey to the edge of the universe, narrated by Tom Hanks.

The technology was certainly impressive, using a database of over three billion stars. This was most evident when, a couple of days later, we visited the Museum of Natural History in New York, and witnessed a show in the massive Hayden Planetarium. This was called *Journey to the Stars*. It started with a journey outside of the Milky Way Galaxy, and then jumped back to a time shortly after the beginning of the universe 13 billion years ago, when stars started forming, a rapid flux of supernovas providing the elements from which new stars formed. It then jumped to the formation of the solar system 4.5 billion years ago. It used the Sun as an example to discuss how stars worked, and then jumped another 5 billion years into the future to show the death of the Sun. Finally, the show returned to the present time, and looked at nearby objects, such as the Orion Nebula, the Pleiades and the Helix Nebula, as examples of these stellar processes.

This was certainly the most spectacular show of the five which we saw. Much of the material was, probably necessarily, duplicated in the shows. I imagine that it was beyond the comprehension of most of the audience, a huge swathe of information being rapidly presented. All of us agreed that Whoopi Goldberg was a strange choice as narrator, being not very believable as a science presenter.

The Hayden Planetarium is contained within a huge ball in the Rose Center for Earth and Space. This is a three-storey centre containing exhibits on the scale of the universe, cosmic evolution, the development of the solar system and the formation of the Earth. Unfortunately, time, and the accompanying four grandchildren, who really wanted to see the excellent life-size dioramas of mammals and visit the museum shop, prevented us from exploring these exhibitions in depth. I can, however, recommend them to anyone visiting New York, and a look at the Museum's website http://www.amnh.org/.

This article started as a description of star shows at sea, but we have found ourselves beyond the Atlantic. As a footnote, we can venture even further, to Boulder, Colorado, where I visited the Mesa Laboratory of NCAR, the National Center for Atmospheric Research, one of the world's major centres for climate studies. This outstanding building has an exhibition on the centre's work, including exhibits about the Sun-Earth relationship. I felt, however, that the excellent website (http://www.eo.ucar.edu/visit/) was rather more satisfactory than the exhibition, which, although the content was excellent, was clearly in need of some physical upgrading.

I was nevertheless pleased to revisit Boulder. I had last been there over 40 years ago, when I spent a few days at the Time and Frequency Division of the National Institute of Standards and Technology (NIST). The Division has the responsibility for the dissemination of precise time and frequency in the United States, which it does through radio, internet, and telephone, as well as providing scientific and commercial services. At that time I was responsible for running precision clocks for satellite-tracking purposes, and then for the Smithsonian Astrophysical Observatory's master clock and coordinating clocks at tracking stations around the world, ensuring that they were all accurate to within a few milliseconds.
Nowadays that would be a fairly easy task, but in the 1960s it was at the forefront of timing technology, and no trivial matter. My work involved regular checks against the master clock at the US Naval Observatory (USNO) in Washington DC. I once found an anomaly which could only be explained if the United States master clock was in error by 5 milliseconds. I presented my evidence to the USNO, which, on further investigation, confirmed that I was correct. They had to adjust US time by the appropriate amount, and notify users to correct their records. These

days anyone can get extremely accurate time through internet and radio services, and I am sure that now NIST and USNO, and the UK equivalent, the National Physical Laboratory, have no such errors.

David Le Conte

Photographs: David Le Conte
1. Queen Mary II Planetarium
2. Hayden Planetarium, New York

A Neolithic Curiosity

Recent archaeological excavations in Herm by Professor Chris Scarre of Durham University have revealed an unexplained structure, first excavated by F C Lukis in 1841. It is a circle of stones in two layers, about one metre diameter. The base was covered with beach pebbles, and there was no sign of any burning, as might be expected if it was a fireplace. On the south side is an external arc of stones extending about a quarter of a circle. It is supposed that this arc may originally have formed a complete ring.

The archaeologists have no explanation for this feature, as there is nothing else resembling it. During a recent Société visit I suggested, my tongue firmly in my cheek, that if the secondary arc did not extend all around the circle, it could be a graphical representation of a solar eclipse. As expected, it raised a laugh.

This may be far-fetched, but any ideas would, I am sure, be welcomed. The site is on the left of the path towards the common (about half way from the main Shell Beach path to the obelisk on the north coast). It is described at http://www.dur.ac.uk/herm.project/trench_c.html.

David Le Conte

Photograph: David Le Conte

Geoff Falla's regular roundup of articles from popular Astronomy and Space Journals

Last Hubble Upgrade mission completed. On May 19th, the last mission to replace and repair instruments on the Hubble Space Telescope was completed successfully. The 13 day mission tasks included the installation of a new wide field camera, spectrograph, and guidance sensor, with the upgrade expected to extend the telescope's operating life until at least 2014. (Astronomy and Space, July 2009)

Albert Einstein - Founder of Modern Physics and Cosmology. An overview of Einstein's life and work, which culminated in 1905 with the publication of his two greatest theories - special relativity, and general relativity, the second of which - with its famous equation $E = mc^2$, was to make possible the development of the atomic bomb. (Astronomy and Space, July 2009)

Apollo 11 - The first men on the Moon. 20th July 2009 marked the 40th anniversary of the Apollo 11 mission. The story of the first manned landing on the Moon in 1969, with the development of the Saturn V rocket and landing module, and the problems of the mission before being successfully accomplished. (Astronomy Now, July 2009)

Celebrating England's 'Galileo' - Thomas Harriot. 26th July 2009 was the 400 year anniversary of the first telescope used for astronomy, by the English astronomer Thomas Harriot. Using the telescope to observe the Moon, Harriot completed the first moon map, showing details of the lunar 'seas' and some of the large craters. (Astronomy Now, July 2009)

Unlocking the History of Mars. Orbital images of Mars have already shown clear indications of past major water flows on the surface of the planet. Rover vehicles and orbiters are now mapping the planet's minerals, giving further clues to the watery history of Mars. (Sky and Telescope, July 2009)

Who Invented the Telescope? The early development of telescopes made from optical lenses at the beginning of the 17th century, and as used by Hans Lipperhey in 1608, Thomas Harriot in 1609, and more famously by Galileo, developing these in the beginnings of telescope astronomy. (Sky and Telescope, July 2009)

Apollo 11 Anniversary. A good pictorial summary of the historic manned mission to the Moon 40 years ago, from launch to photos obtained on the lunar surface. (Astronomy and Space, August 2009)

What's wrong with the Sun? The recent minimum period of solar activity has been longer than expected, with hardly any sunspots. Astronomers still do not really know when the Sun will become more active, and how much sunspot activity there will be in the coming years, in

comparison with previous solar cycles. (Sky and Telescope, August 2009)

Catch a Fallen Star. Astronomers have for many years been tracking asteroids which could strike Earth. On 7th October 2008, the arrival of a very small asteroid and the location of its fall was accurately predicted, also allowing pieces to be retrieved from Sudan's Nubian Desert. (Sky and Telescope, August 2009)

Ice Age Impact. During the last Ice Age, around 13,000 years ago, there was a mass extinction of animals, in particular the North American mammoths. There is now increasing evidence that this extinction of species may have been caused by a large comet explosion over Canada. (Sky and Telescope, September 2009)

The Cosmologist Left Behind. Edwin Hubble is usually credited for establishing the fact that the universe is expanding. The work of Vesto Slipher, however, is now recognized. Slipher was hired by astronomer Percival Lowell, and served as director of the Lowell Observatory at Flagstaff, Arizona from 1916 to 1954, developing spectrographic work at the observatory and detecting the first signs of universe expansion. (Sky and Telescope, September 2009)

Jupiter - Another Cosmic Impact. The first effects of another comet or asteroid impact on Jupiter was observed on 19th July, from Australia. When the fragments of Comet Shoemaker-Levy 9 impacted Jupiter in 1994, it was thought to be a very rare kind of event. This time nothing was seen beforehand, and the dark spot marking the impact site was discovered in Jupiter's south polar region. (Astronomy and Space, September 2009)

Supernova Superstars. An early supernova, seen in daylight by Chinese astronomers in 1054, has expanded to what is now known as the Crab Nebula, and supernovae create many of the heavy elements or metals. A set of articles focusing on different types of supernova involving the destruction of massive stars, white dwarf stars, and in another galaxy where recorded supernova events have been rather more frequent than elsewhere. (Astronomy Now, September 2009)

The Oriental Total Solar Eclipse of July 2009. The total solar eclipse of 22nd July 2009, with a track from northern India to the Pacific Ocean, had a maximum duration of more than six minutes, and was reported to be just about the longest observable period of totality this century. An account of the eclipse as experienced by an astronomer in Hangzhou, China. (Astronomy Now, September 2009)

The Greek Pleiades

While reading *Reflections on a marine Venus: a companion to the landscape of Rhodes*, by Lawrence Durrell (Faber & Faber, London, 1960), I came across the following passage (page 103):

"*The first autumn rains came belatedly; this warm green rain does not belong to the beginnings of winter. The Pleiades have gone below ground, daughters of Atlas and Pleione. Hoyle tells me that they are seven in number, but that we only see six because one, Sterope, hides her face on account of a misfortune that befell her; others say that her name was Electra, and she hides because of her grief at the fall of Troy. Gideon rejects their etymology from the verb 'plein' meaning 'to sail'. They were obviously called πελειαδες in ancient times, he says, which means a flock of pigeons; and to do him justice they are known as 'the birds' (τα πουλια) in demotic Greek even today. A New Year festival connected with and determined by the rising of the seven seems to have been a wide-spread custom in ancient times.*"

Wikipedia says: "*The nine brightest stars of the Pleiades are named for the Seven Sisters of Greek mythology: Sterope, Merope, Electra, Maia, Taygete, Celaeno and Alcyone, along with their parents Atlas and Pleione. As daughters of Atlas, the Hyades were sisters of the Pleiades. The English name of the cluster itself is of Greek origin, though of uncertain etymology. Suggested derivations include: from πλεîν plein, to sail, making the Pleiades the "sailing ones"; from pleos, full or many; or from peleiades, flock of doves.*"

David Le Conte

Poem: Comet Donati

The following poem appeared in *Punch*, 30 October 1858, as the spectacular Comet Donati left the inner solar system.

What, off so soon, for whom so long we waited,
Have we displeased you, Wanderer of the Sky,
By flippant jests have you been aggravated,
Or felt insulted that we dared to pry?

Accept apologies, we didn't mean it,
Stars must permit the tribute of a stare;
Come, shake your tail, and from that star-dust clean it,
Nor look as sulky as your friend the Bear.

Still savage with our earth, and turning from it?
Well, *enfant trouvé*, of Donati, go:
"Welcome the coming, speed the parting" Comet,
Is, perhaps, polite above as here below.

One hardly knows, though, why you can't endure us,
For you we've taxed our eulogistic powers,
That night you stuck your tail before Arcturus
We screamed and shouted "Beautiful!" for hours.

Nor only have we hymned your matchless splendour,
But given you that with which you've nought to do:
Our fruits so plentiful, our game so tender,
Our glorious summer, all ascribed to you.

Will nothing move you to delay your moving,
And charm us longer with that radiant face,
No, the Grand Orrery, of Newton's grooving,
Twists your head round – Away! through endless space.

From the old grandsire, wondering "if that *be* you,"
With his white hair dishevelled in the breeze,
To the quick, bright-eyed babe held up to see you,
While the fond mother fancies that it sees:

Queen on her terrace, Sage with ardour mounting
Tower whence his Galileo-glass is thrust,
Will be, in time by you not worth the counting,
Scattered and undistinguishable dust.

Dares a bold atom ask, with brain half dizzy,
What you will see two thousand years to come:
This planet still an ant's nest, black and busy,
Or an extinct volcano, white and dumb?

Will you behold, if keeping that appointment,
(Made for you, Sir, by Airy and by Hind)
Men still anointing Kings with holy ointment,
And Priests still leading, as the blind the blind.

Will that day's Patriot be a mouthing truckler,
Setting proud Freedom's hymn to Freedom's dirge;
Will Law be still the rich man's shield and buckler,
The good man's terror, and the poor man's scourge?

Will you find Life a hot and blindfold scrimmage,
Men straining, struggling, scrambling, for red gold:
And Faith still worshipping the Golden Image
Reared by King Beelzebub in days of old?

Will all that world, with coronet and plaudit
Reward Success, while Merit's scorned and passed;
Will man ignore that great and dreadful Audit,
When Lies shall fail – the first time, and the last?

Who knows? Off, glorious Star-horse, clothed with thunder –
Thou hast no right to make a light strain sad;
Yet, he wrote well, who wrote, thou parting Wonder –
"An undevout Astronomer is mad."

David Le Conte

Foucault Pendulum

The installation of the Foucault pendulum in the Town Church, which was planned for the summer, has had to be postponed because building works in the Church have taken much longer than expected. The Church is still closed, and will not be open until Advent. It has, therefore, been decided to put the project off until next year, at a date to be decided.

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