Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise

October – December 2010

Forthcoming Events

Public Open Evenings

12th October: 8.00 pm

Public Lectures:

Professor Nicholas Day: "What's the point of the Royal Society? A modern perspective"

Wednesday 20th October
8.00 pm at the Frossard Centre, Candie Gardens

Dr David Falla: "Energy from Nuclear Fusion?"

Monday 25th October
8.00 pm at the Frossard Centre, Candie Gardens

Astronomy Section Christmas Meal

Tuesday, 7th December: 8.00 pm
(venue to be confirmed)

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

Perseids 2010

The night of Thursday 12th August, our planned BBQ and Perseid meteor watch night, turned out to be overcast and we all went home having seen nothing more than a cloudy sky. Just before going to bed I decided to have one last look at the sky, just in case, and was delighted to see it was clear and cloudless. I went out in to the garden at 11.30pm and faced east. There was little activity for the first 15 minutes but around 11.45 I saw the first Perseid.

Over the next half hour I saw another eight, all fairly bright and mostly close to the radiant. There was a couple that appeared as a rapid flash of light, and must have been right in the line of sight, they were so quick and as I saw them out of the corner of my eye, I did not include them in the total. I was determined not to go in until I had seen ten for sure and had to wait until just after 12.30 am before I spotting the last of my ten.

So between 11.30 pm and 12.30 am, I counted ten in total plus two right in the line of sight. Not a memorable total for such a clear sky, but I was glad I made the effort (and my neck ache had worn off by the next day!)
I had watched some earlier Perseids on the night/morning of 2nd / 3rd August. Starting just before midnight, I saw 8 in about 45 minutes, though three of them were from other showers, probably Aquarids since they came the opposite part of the sky. The five Perseids I saw were reasonably bright, a couple being at least magnitude 0 and further away from the radiant when first seen.

Whilst we did have terrible weather for most of our summer open nights, there were some clear skies in between. On the night of Thursday 29th July, I drove to Richmond to see Saturn, Mars and Venus in the west. Venus was easy to spot of course, with Mars and Saturn being fainter against the almost dark sky and a little harder to find. Mercury was expected to be visible in the evening sky but on the night I looked there was low cloud and I was unable to see it, despite scouring the sky. As I went to get in the car to return home, I was saw the 17 day old Moon rising in the east, and the contrast of it so low down against the houses on the horizon, made a spectacular sight.

Approaching winter there will be the Leonid's meteor shower 17th/18th November, the Geminids 13th/14th December and the Quadrantids on the 3rd/4th January 2011. The Leonids are the fastest shower with the Geminids about half speed and Quadrantids nearer two thirds speed in comparison.

May I suggest to those who get the opportunity watch these showers and that they record times and observations which can be combined with others records. Close to the dates, it is wise to check sites on the internet for the time that the predicted maximum is likely to be and to watch

that night and also just before and after. It will be interesting to compare notes as both the Geminids and Quadrantids do produce respectable peaks, up to 75 per hour for Geminids and 40 per hour for Quadrantids.

The Quadrantids appear from a now abandoned constellation called Quadrans Muralis, which was located in the sky between Ursa Major, Bootes, Hercules and Draco.

Happy viewing!

Debby Quertier

The Foucault pendulum, 2010

The proposal

Jean Bernard Léon Foucault (1819-1868) was a French physicist. Among a number of achievements, he was the first to demonstrate the rotation of the Earth by setting up a pendulum in the Panthéon in Paris, in 1851. The pendulum was 67 metres high and had a bob weighing 28 kg. As it swung freely in space, maintaining its plane of swing, the Earth rotated beneath it, making it appear to rotate slowly.

Early in the year an idea came to me to set up a Foucault pendulum in the Island for a few days, as part of the Astronomy Section's contribution to the International Year of Astronomy, 2009. The Astronomy Section had installed such a pendulum before, during a Société open day in 1989, at the church hall of the Church of St Pierre du Bois (now the Styx Club). It was a success, but was in place just for the day. The new idea was to run one for a whole week.

It would need a building with sufficient height. The longer the pendulum, the greater the period of swing, and the larger the displacement between each swing. The Town Church appeared to be the ideal location. It has a central location, is easily accessed by anyone in Town, and is visited by many people. It also has the benefit of access to the belfry above the crossing, with an aperture from which a chandelier had previously been hung. A pendulum there would provide an educational experience for the public, and give publicity to the Church, the Astronomy Section and La Société.

The Astronomy Section readily agreed to the idea, and the Dean and Rector, the Very Reverend Paul Mellor, and the Churchwardens were equally enthusiastic. Encouraged, I proceeded to develop a detailed proposal.

The Church was to be closed during the spring of 2009, while major re-wiring and other works were taking place, but it was due to re-open in the summer. Unfortunately, the works in the Church took much longer than planned, and it was not re-opened until shortly before Christmas. I therefore deferred the project until the summer of 2010.

The calculations

The architects provided an accurate measure of the height of the crossing as 8.75 metres. This enabled me to carry out some calculations:

L = Length of pendulum (8.75 metres)
T = Period of swing
θ = Angle of swing
R = Radius of swing (I assumed one metre)
h = Height which the pendulum reaches above its lowest point (ie at its maximum swing)
g = Acceleration due to gravity (9.80665 m/s²)
lat = latitude of the Town Church (49.452°)

$T = 2\pi\sqrt{(L/g)} = 5.9$ seconds
$\theta = \sin^{-1}(R/L) = 6.6°$
$h = L(1 - \cos\theta) = 0.05$ metres = 5.7 cm

The Earth rotates 360° in one sidereal day of 23h 56m 04s (= 23.9344 hours).
So in 24 hours the Earth rotates: 360 x 24/23.9344 = 360.99°.
Therefore, in 24 hours the pendulum rotates: 360.99 sin(lat) = 274.3°.
It takes 31h 35m to rotate 360°.
*In 5.9 seconds (*T*) the pendulum rotates* 5.9 x 274.3 / (24 x 60 x60) = 0.01873° = 0.000327 radians.
This produces a lateral movement per swing of 1000 x 0.000327 = 0.33 mm.

In order to demonstrate the apparent rotation of the pendulum upright pegs can be placed so that it knocks one down every, say, ten minutes. This would require a separation between adjacent pegs of some 3 cm, or 6 cm if the pegs are alternated between sides of the swing.

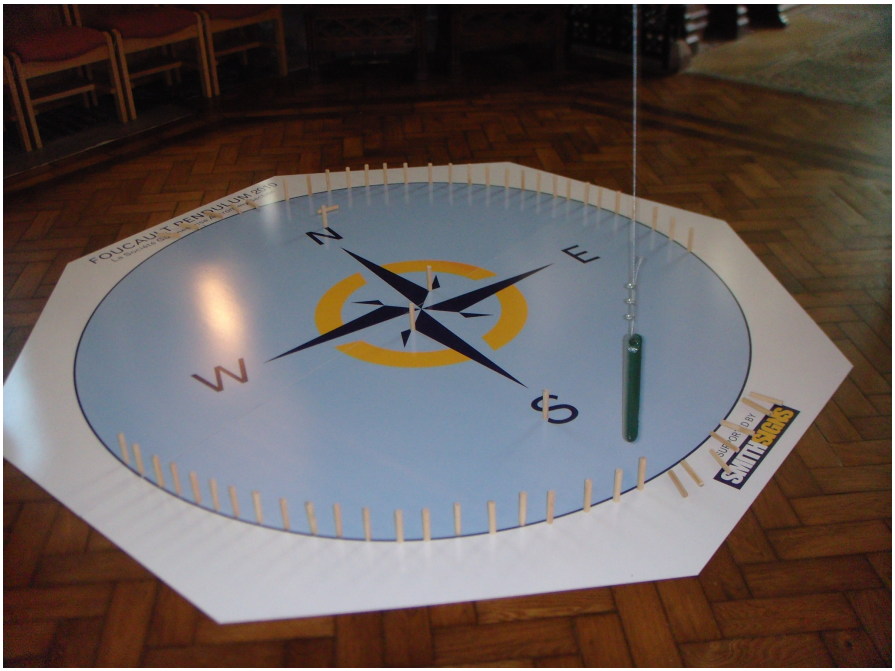
The installation

On the morning of Monday 12 July Frank Dowding and I set up the pendulum. Access to the belfry required entering a door in the church garden to the south-west, climbing up a spiral staircase, negotiating an external passageway across the roof, through another door, then down a few steps and into the bell tower. There was a warning not to touch the bell ropes as the bells were in an upright position.

Over the aperture in the floor there was a large box, screwed down, with louvers on each side. I am advised by a bell-ringer that this was for ventilation from the church in the days of gas lighting. The gas ventilated into the bell-chamber. (What happened to the bell-ringers does not seem to have been recorded!) The box was easy to remove by two people. A Perspex cover also needed removing, finally revealing the grating over the large central aperture. We had been warned not to put any weight on it, because, despite appearances, it was made of wood, not metal, and one could plummet to the floor of the Church some 9 metres below.

I had anticipated that a hook on which the chandelier had been suspended would still be present. In fact, it was apparent that the chandelier had been hung from a chain, which itself was wrapped around a joist and shackled. The chain had simply been cut off, leaving several inches. We had no alternative but to hang the pendulum from the chain.

I had selected a swivel as the suspension point, and had a ten-metre long 5mm cable, which proved quite adequate. We lowered this carefully to the floor, replaced the Perspex and ventilation box, and descended. There



we hung a 2 kg sash weight on the bottom of the cable as a bob, securing it with three metal grips. The next task was to put in place the baseboard which had kindly been produced by Smith Signs Limited. This was a large octagonal design, with a compass rose showing the true north direction (the church being 17° off from an east-west alignment), and really enhanced the presentation of the pendulum, as well as providing protection for the church floor.

Our final act was to set the pendulum in motion, and to place wooden pegs (9 cm pieces of dowel) at intervals for it to knock them over, demonstrating its apparent rotation. An explanatory poster was displayed, and a demonstration model and earth globe were placed nearby.

The operation

I had hoped that the pendulum would continue swinging for a reasonable amount of time, so that it would not need constant attendance. However, there was considerable damping in the suspension system, probably caused by the chain, as it needed re-starting every ten minutes or so. A heavier weight might have helped. (I was later informed that we could have used a bell bob weighing about 13 kg, which was in the belfry.) It was, therefore, necessary to establish a rota of members to 'nurse' it. This had the

advantage that there was always someone on hand to explain the pendulum, and to answer the many questions and comments from visitors. It was also useful in that the pegs could be positioned where they were soon knocked over, so that observers did not have to wait a long time to see the effect. I am grateful to Frank Dowding, Geoff Falla, Colin Spicer and Peter Langford for their assistance in manning the pendulum over the week.

I had been concerned that the cable might stretch, and require adjustment of the height of the bob, but this proved not to be necessary. During the whole week there was no evidence of stretching.

What was apparent was that the pendulum, not only damped down quickly, but also developed an elliptical motion. This was generally slight, and took several minutes to appear, but occasionally it was quite severe. Very gentle release of the pendulum helped to reduce this motion, although we found that releasing it by burning a string made little difference. We developed a technique of placing the pegs along radii, so that the pendulum knocked over each in turn. The elliptical motion meant that the pegs could be placed so they were knocked over by that motion as much as the earth rotation effect. People seemed to accept this, and understood that they were watching the earth rotate.

There was certainly a lot of interest in the pendulum. I estimate that around a thousand people saw it during the week. The Dean has advised that it broke all records for visitors to the Church. Many, of course, were casual visitors, such as cruise ship passengers, and had no idea that they were going to see the pendulum, but a lot did come specially to see it. It

generated much interest and discussion. Parents explained it to their children, and one boy had a lovely time playing skittles with the pendulum and pegs.

There was also considerable media interest in the pendulum, with good coverage by the Guernsey Press, BBC Radio Guernsey, Island FM and Channel Television.

The Dean had asked me to give a talk at the Church during the week, as one of the *Meeting Point* series of Friday lunchtime events. This was well attended, with an estimated 100 people present. As speaker, I was given the choice of nominating a charity to receive donations, and, following discussion with other Astronomy Section members, I nominated the Town Church, in view of its cooperation with the project. The talk, entitled *The Earth Moves: The Story of the Foucault Pendulum*, was accompanied with a PowerPoint presentation and demonstration. It is covered in a separate article.

Colin Spicer and I dismantled the pendulum on the afternoon of Saturday 17 July.

Issues

Two recurring issues arose during the many discussions with visitors to the pendulum.

The first was the explanation of the pendulum's apparent clockwise motion. Generally, this is simply explained by saying that the pendulum swings freely in space, maintaining a steady plane, while the Earth rotates beneath it. The model pendulum was useful for demonstrating that the plane of the pendulum's swing is constant, and it is possible, as I demonstrated during my talk, to show the effect by simply holding a pendulum, set it swinging, and then turn one's body.

At the poles the rotation is evident, and the globe could be used to demonstrate the concept. One can rotate the Earth, while showing that the pendulum stays swinging in one direction, and it is clear that the pendulum's apparent rotation period is 24 hours, in a clockwise direction at the north pole, and anticlockwise at the south pole. Similarly, the lack of rotation at the equator is readily demonstrated with the globe.

When it comes to the motion at an intermediate latitude, however, things get much more complicated. This exercised the best minds in the 19th century, and many attempts have since been made to explain it in simple terms, as well as through mathematics, especially the fact that the period of rotation relates to the sine of the latitude. But it is not simple, because the location of the pendulum, in this case the island of Guernsey, is moving along the arc of a small circle, the point of suspension itself describes a circle, and the floor of the Church makes a complex motion. This is dealt with in some detail in Tobin's book (see reference), in published papers, and on a number of websites. In the event, we found it generally unnecessary (thankfully) to go into lengthy discussion on the matter.

Several people, incidentally, asked whether the direction in which the pendulum was initially set swinging made a difference. It does not, of course.

The other point which arose time and again was the suggestion that the pendulum's apparent motion was related to the direction of bath water circulation as it goes down the plughole – that there is a common cause for both phenomena. The latter invokes the concept of coriolis forces (which affect trade winds, for example), and, indeed, the pendulum's motion can be explained in those terms. However, I had time and again to disabuse people of their belief that water goes down the plughole in different directions in different hemispheres. Many were adamant that this was so, and some had seen it demonstrated at the Equator, where a man had two bowls a few feet apart, with water clearly circulating one way on the north side, and the other way on the south side of the equatorial line. It was evident that some had paid for the demonstration, and were upset when I advised them that they had been conned.

While coriolis forces do apply to water currents, the effect, especially on the scale of a bath, is minute, and is vastly dominated by other factors, such as the shape of the bath, existing eddies in the water, and the way the plug is pulled out. Many experiments have been done which show conclusively that the hemisphere makes not the slightest difference to the direction of bath water. I have myself experimented with water in a large bath with a flat base and central plughole, and found it was easy to change the direction of circulation by simply swishing my hand in the water.

Conclusion

Did it work? Not as well as it should. If it is repeated sometime in the future great care needs to be given to the design of the suspension, and a much heavier bob should be used.

But was it a success? From a public point of view, and in terms of an activity which provided an educational experience and brought credit to the Astronomy Section, the answer must be a resounding "Yes!"

David Le Conte

References:

The Life and Science of Léon Foucault, by William Tobin (Cambridge University Press, 2003).

The Pendulum: Scientific, Historical, Philosophical and Educational Perspectives, by Michael R Matthews, Colin F Gauld and Arthur Stinner (Springer 2005).

http://www.animations.physics.unsw.edu.au//jw/foucault_pendulum.html.

http://www.phys.unsw.edu.au/~jw/pendulumdetails.html.

The real Moon landing

I used to think that superstition and far-out beliefs were ancient tenets with no place in our modern and more enlightened age. However, it seems that they are as prevalent as rational thought. Lots of people believe that aliens have visited the Earth, that crop circles are made by spacecraft, and in all sorts of incredible conspiracies.

This was brought home recently by a letter from a Richard Abbey in Jersey, published in the Guernsey Evening Press on 31 August. Starting with a UFO sighting, he went on to include just about every bizarre phenomenon imaginable, including a statement that the pyramids were built using anti-gravity and point towards the sky to show that they were constructed with help from elsewhere in the universe!

Most of his statements were too ridiculous to warrant answering, although a Martin Bishop of Guernsey did a good job of rebutting them in a letter in the Press on 3 September. One, however, really caught my attention: that the Moon landing never happened.

Despite the fact that all the claims by the cover-up conspiracy theorists have been soundly refuted by NASA and many others, the claims persist, a tendency common with most conspiracy claims. Some time ago I contributed to a NASA educational website, which listed reasons to believe that man had been to the Moon. They included the Moon rocks brought back to the Earth, the fact that some 360,000 people worked on the Moon landings, the myriad of contemporary documentation, and the many items which the astronauts left behind on the Moon. To that can be added the photographs of the Apollo landing sites taken by the Lunar Reconnaissance Orbiter in 2009.

My contribution, which was published on the NASA site, was that tens of thousands of people saw in person the Apollo spacecraft go out into space. At the time I was Station Manager of tracking stations in Hawaii and Arizona. Our teams took many photographs of the trans-lunar burn of Apollo 8, clearly showing the spacecraft turning and heading out of Earth's orbit. On subsequent nights (and for the later Apollo flights, including Apollo 11) we photographed the receding spacecraft and their waste dumps far out in space, well on their way to the Moon. I can personally vouch for the fact that there was no conspiracy.

I can only think that the conspiracy theorists are relatively young. Nobody who experienced the Apollo programme first hand could ever doubt its achievements.

David Le Conte

The Earth Moves: The Story of the Foucault pendulum

[Talk given at the Town Church on 16 July.]

First, I want to try a little experiment...

I want everyone to keep perfectly still...

You can't do it, can you?

Everyone of us is moving – moving at high speed, just because of the Earth's spinning motion. The Earth is turning completely on its axis once every 24 hours. A point on the equator moves at over a thousand miles per hour. Here in Guernsey, at a latitude of just under 50 degrees north we are moving 675 miles per hour towards the east.

Not only that, but the Earth is also revolving around the Sun once a year, at an orbital speed of over 60,000 miles per hour. And the whole solar system participates in the rotation of our galaxy, the Milky Way, at over half a million miles per hour. But we feel nothing of these high-speed motions. To us the Earth is a steadfast rock, unmoving. So how do we know, for example, that the Earth is spinning on its axis?

Lord Martin Rees, Astronomer Royal and President of the Royal Society, recently presented the Reith Lectures on Radio 4. One of the many astute things he said was: " *Science is indeed a global culture, and its universality is specially compelling in my own subject of astronomy. The dark night sky is an inheritance we've shared with all humanity, throughout history. All have gazed up in wonder at the same 'vault of heaven', but interpreted it in diverse ways*."

When we look up at the night sky we see a daily westward movement of the stars. During the daytime we see a similar movement of the Sun. The Moon accompanies the daily westward motion of the stars, but day by day has an additional motion eastwards amongst them. What we do not see is any evidence that the Earth is moving. We appear to be fixed, while celestial objects revolve around us.

The ancient Greeks had problems envisaging any different explanation, although some, such as the 3rd century BC Aristarchus of Samos, did suggest that the Earth both rotated on its axis daily and revolved annually around the Sun. They certainly knew that the Earth was spherical; there was ample evidence for that.

For example, the curvature of the Earth means that sailors see mountain peaks before the shore. The shape of the Earth's shadow on the Moon during a lunar eclipse, is circular. The elevation of stars and the Sun changes with latitude. Indeed, Eratosthenes in the 3rd century BC used this effect to measure the circumference of the spherical Earth. Noting that sunlight penetrated to the bottom of a well in

Syene (modern day Aswan), meaning that the Sun was directly overhead, he measured the Sun's altitude in Alexandria, further north, and arrived at a figure very close to the one now accepted for the circumference of the Earth.

However, it was the 4th century BC thinker, Aristotle, whose arguments held sway. He held that a moving Earth would violate common perceptions. For example, we sense no constant wind, projectiles do not deviate from their true paths, an arrow shot straight upwards falls back on the archer, although the archer would have moved if the Earth was spinning. A moving Earth would, in any case, require a force to keep it moving. It seems evident that the Earth is fixed, and is at the centre of the universe. Here we are, surrounded by stars and planets, and we can see the Sun and the Moon going around us.

This concept was developed by Ptolemy in the 2nd century AD, who also came up with an explanation for the complex motions of the planets. Mars, for example, sometimes makes a regressive loop amongst the stars, and Ptolemy proposed a system of deferents and epicycles – circles turning upon circles – to explain this. We had to wait until the 16th century for a better system – that of Copernicus. His heliocentric theory held that the Sun, not the Earth, is at the centre of the solar system of planets, the Earth being merely the third planet from the Sun. Far from being stationary the Earth revolves in an orbit around the Sun, and moreover spins on its axis.

So while we perceive the Sun moving around the Earth in a clockwise direction as seen from the north, what is actually happening is that the Sun is fixed, and it is the Earth which is spinning once a day in an anti-clockwise direction.

It was Galileo who, in the 17th century first used the newly-invented telescope to make detailed observations of the planets. He saw that Jupiter had four separate bodies orbiting around it, indicating that not everything went around the Earth. We now know these to be the four brightest moons of Jupiter, which we call the Galilean moons. He further observed that the planet Venus shows phases like our Moon, and appeared sometimes larger and sometimes smaller, effects which we can clearly see in our modern telescopes. He correctly deduced that this was proof that Venus orbited the Sun.

Galileo was, of course, not thanked for his revelations. On the contrary, he was threatened and placed under house arrest, because his deductions contradicted the prevailing dogma of the time. This continued to adopt the Aristotelian view, which appeared to be supported by some biblical texts, that the Earth remained fixed, immovable and central. The Tribunal examining Galileo stated: "*The proposition that the sun is the centre of the world and does not move from its place is absurd and false philosophically and formally heretical, because it is expressly*

contrary to the Holy Scripture. The proposition that the earth is not the centre of the world and immovable, but that it moves, and also with a diurnal motion, is equally absurd and false philosophically, and theologically considered, at least erroneous in faith."

Nevertheless, the evidence for the true situation mounted, and men like Johannes Kepler and Sir Isaac Newton gave us a mathematical and physical description of what was happening, and an explanation for it. So by the mid-nineteenth century it was well understood that the Earth spun on its axis once a day, and revolved around the Sun once a year, sharing its motion with the other planets.

We can, however, have some understanding of the different view accepted in Galileo's time. The leading Cambridge astronomical historian, Michael Hoskin has said: "*It is important to recognize that … Aristotelian cosmology drew strength from being an intellectual formulation that reinforced common sense, in contrast to modern science, which contradicts what seems self-evident.*"

Sitting in the Town Church, we have no evidence that the Earth is moving at all, let alone at hundreds or thousands of miles an hour. The effects of the Earth's motion are rather subtle. We can see the result of the spinning Earth in star trails apparent in long-exposure photographs of the night sky. In the north region, for example, the stars appear to describe circles in an anticlockwise direction.

The spinning Earth produces what are known as coriolis forces, which cause winds to veer from a true north-south direction, affects ocean currents, and makes long-distance rockets deviate from a direct course. It does not, however, cause water to go down the plughole in different directions in the hemispheres!

So where does Foucault's pendulum fit in? And who was Foucault anyway?

Jean Bernard Léon Foucault, born in 1819, was a frail child, whose father died when Léon was just 10 years old, and he was brought up by his mother in Paris. He was not a good student at school, being described as lazy and slow, and he had to be tutored at home. He had one short-sighted eye, and one long-sighted, which gave him an awkward appearance. He became self-conscious and a loner.

What he was good at was making complex contraptions, such as a steam engine and a telegraph, and his mother decided that he should be a surgeon. Although he did well in his medical studies, the first time he went into a hospital he saw blood and fainted, and that was the end of his medical career. He became interest in daguerreotype photography, taking the first photograph of the Sun in 1845, and he became expert at taking photographs through microscopes. He then devised a method of measuring the speed of light in water, using a mirror spun with one of his steam engines, showing in 1850 that light travels slower in water than in air.

It was in 1851 that he had the idea for a pendulum to demonstrate the rotation of the Earth. He said that he got the idea from observing a vibrating rod held in a slowly rotating lathe. Although the rod turns, the plane of vibration remains fixed. Clearly a lateral thinker of the first order, he cleverly translated this concept to a pendulum. Indeed, an image of the first table-top version appears in an article by Foucault in 1851.

Now, of course he knew, as did everyone else, that the Earth is turning. So he reckoned that if he set up a pendulum which continued swinging for a long time, the effect would accumulate, and would become evident. He first tried it out in January 1851 in the basement of his house, using a 5 kilogram weight and a 2 metre wire. When he told others of his achievement it was suggested that he demonstrate it at the Paris Observatory, and this he did, in February of that year, in the Observatory's Meridian Room, using an 11 metre wire. Every scientist in Paris, as well as journalists, were invited to see it.

One of the reporters suggested that "*An experiment of this quality deserves to be made publicly, at a more grandiose scale, and with some pomp. It is under the dome of the Panthéon that it would be appropriate to suspend a wire some sixty metres long; those noble walls are worthy of serving as the setting of one of the most beautiful experiments which has ever come out of the mind of a physicist*."

So a Foucault pendulum was set up at the Panthéon. It had a 67-metre wire, and a 17cm bob weighing 28 kilograms. It would have had a period of swing of 16½ seconds, compared with our 9-metre pendulum with a period of just under 6 seconds. The period of swing of a pendulum, incidentally, depends entirely on the length of the suspension, and not at all on the weight of the pendulum bob, or the size of the swing. This relationship was shown by Galileo some 400 years ago.

The experiment has been replicated numerous times, including in the Panthéon itself. In recent years there has been a permanent pendulum at the Musée des Arts et Sciences, using Foucault's original bob, but in May of this year it suffered an accident when the cable snapped, the bob fell, and was seriously damaged.

Immediately after the first demonstrations in Paris word spread like wildfire, and Foucault pendulums were set up all over Europe and the United States. They are still to be found in museums and other institutions all over the world. The Science Museum in London has one, whose swing is slower than ours – about 9½ seconds, because it is 22½ metres long. It is also kept in motion by a sophisticated system, whereas ours had to be re-started every few seconds because of friction in the suspension and air resistance. A longer wire, and therefore a longer period, of course, enables the turning

effect to be more noticeable between swings.
So, what of Foucault himself? Well, he went on to invent the gyroscope, and to use it to show that it too rotates in a fixed plane, and therefore demonstrates the rotation of the Earth. This feature of gyroscopes makes them useful in all sorts of applications, especially in stabilising systems and, as gyrocompasses, for navigational purposes.

He was appointed physicist at the Paris Observatory, with the task of developing telescopes, and the application of photography to astronomy. While he was quite successful in introducing innovation to telescope design, he was less successful in astronomical photography, especially photography of the Sun. In 1860 he was sent to Spain to photograph an eclipse of the Sun, but unlike our own Warren De La Rue, did not make such a good job of it.

This talk has been about one man and his extraordinarily simple idea for demonstrating something fundamental. I can leave you with his own thoughts on his pendulum: "*Every man, whether converted or not to prevailing ideas remains thoughtful and silent for a few moments, and generally leaves carrying with him a more insistent and lively appreciation of our unceasing motion in space.*"

David Le Conte

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

Plans for Pluto Rendezvous. The New Horizons spacecraft is now half wayon its long journey to Pluto after a fastest ever launch to counter the effects of gravity. Details of the journey so far, and plans for the observation of Pluto and its three moons when the spacecraft arrives there in 2015. (Astronomy, July 2010)

Hubble's Top 5 Discoveries. During the twenty years since the launch of the first major optical observatory in space, there have been breakthroughs in learning more about the universe, with a dramatic increase in the depth of observations. Discoveries by the Hubble Space Telescope include the findings that galaxies evolved from smaller structures, and that black holes seem to be common in the centre of galaxies; that a mysterious 'dark energy' exists, increasing the expansion rate of the universe, with that expansion rate now measured, and the identification of planets orbiting other stars. (Astronomy, July 2010)

Sir Patrick Moore's Career as a Writer. With a life-long interest in astronomy and writing, Sir Patrick Moore published his first paper about the Moon when he was 13 years old, and with his first scientific book, *Guide to the Moon*, published in 1953. Sir Patrick's own summary of his writing career which has produced

well over 100 books – including several unusual science fiction works and non-astronomy books too. (Astronomy Now, July 2010)

Solar Power. A set of articles focusing on the Sun, including some of the more recent spacecraft observations, following ground based observations and studies from Earth orbit before the first solar-orbit spacecraft SOHO was launched in 1995. British scientists are foremost in this research, operating from Europe's largest space science department at the Rutherford Appleton Laboratory in Didcot, Oxfordshire, where scientists are now understanding more about magnetic fields and how the Sun's power is produced. (Astronomy Now, July 2010)

Finding Planets hidden by Dust. Many other stars are surrounded by thick rings of dust which can hide the existence of orbiting planets, but the shape and gaps in such dust rings can provide clues in the search for these planets. (Astronomy, August 2010)

Ring Systems of the Gas Giants. Each of the solar system's four gas giant planets are now known to have ring systems. A detailed look at the more familiar ring system of Saturn, as well as the more recently found thin ring systems of Jupiter, Uranus, and Neptune. (Astronomy, August 2010)

The Largest Telescopes in the World. A progress report on plans to complete a new generation of giant te1escopes.These will include several large optical telescopes - the largest being a 42 metre mirror telescope at the European Southern Observatory site in Chile. A new Space Telescope is also being built, and a huge array of radio telescope dishes is also being planned by the University of Manchester. (Astronomy Now, August 2010)

The Case for Dark Energy. In 1998 evidence was found that the expansion of the universe is accelerating rather than being at a steady rate or slowing down, but the reason for this has remained uncertain. The 'dark' unknown energy could be caused in more than one way, with one theory suggesting that variations in gravity could also provide an answer. (Astronomy Now, August 2010)

The Blue Universe. Our own blue planet may be far from unique in having a plentiful supply of water on its surface. Recent studies using the Spitzer Space Telescope and its infrared spectrograph have identified the signature of water vapour in a large percentage of newly formed stars, strongly indicating that water is present during the formation of planetary systems. (Astronomy Now, August 2010)

The Next Great Space Telescope. Steady progress is being made on development of the new James Webb Space Telescope, due for launch in 2014. A detailed look at the project, which will have a telescope mirror area six times larger than the mirror of the Hubble telescope and with an infrared capability designed to obtain

images of stars and galaxies back to the earliest age of the universe. (Astronomy, September 2010)

Jupiter at its Best. Jupiter is now larger and brighter in the sky than it has been for more than ten years, a good opportunity to examine the planet's cloud belts in more detail, (and to keep watch for the expected reappearance of the South Equatorial Belt.) A summary of advice for observing Jupiter and its main surface features. (Astronomy, September 2010)

The Galaxy Zoo Project. In three years since its beginning, the Galaxy Zoo Project has gathered more than 300,000 participants, viewing computerized images of galaxies and classifying these into different types. Apart from the more usual spiral and elliptical galaxies, the project has discovered many more irregular galaxies, also small green star-forming ones which have been named 'pea' galaxies, and examples of ringed galaxies. (Astronomy Now, September 2010)

Surveying the Gould Belt. The Gould Belt of stars - a ring around our solar system and including many of the most massive and luminous nearby stars, was first observed in its entirety by Benjamin Gould in 1874. The reason for the ring, tilted at an angle to the galactic plane, has been a mystery, but recent evidence suggests that the ring was caused by a collision with dark matter. (Astronomy Now, September 2010)

What's the point of the Royal Society? A modern perspective

Lecture by Professor Nicholas Day, CBE, FRS

Wednesday 20th October
8.00 pm at the Frossard Centre, Candie Gardens

The third and final lecture in the *Guernsey Heroes of the Royal Society* programme, will be given by Guernsey's only living Fellow of the Royal Society. Professor Day will describe the structure, function, and work of Britain's national academy of science in supporting scientific disciplines, applying scientific knowledge to business, promoting informed debate, and influencing public policy with evidence-based advice. Through a series of publications and workshops, often in conjunction with its international counterparts, the Society provides authoritative syntheses of the current state of knowledge for many of the pressing issues of the day, ranging from climate change to the storage of radioactive waste. These make an important contribution to the scientific basis for government action.

Professor Day is distinguished for his wide-ranging and influential work in quantitative epidemiology, especially of cancer. He was for many years Professor of Epidemiology at Cambridge, Director of the Institute of Public Health, and Director of the Medical Research Council Unit of Biostatistics. He has authored or edited eleven books, and published

some 500 papers in the scientific literature. He was elected as a Fellow of the Royal Society in 2004, and is a Council Member of La Société Guernesiaise.

Energy from Nuclear Fusion?

Lecture by Dr David Falla,
Department of Physics, Aberystwyth University

Monday 25th October
8.00 pm at the Frossard Centre,
Candie Gardens

It is generally believed that nuclear fusion occurs in the central region of the Sun, and is the primary source of the Sun's light and heat radiation.

What progress has been made so far in thermonuclear research; and what are the prospects of building a nuclear fusion reactor that would provide a plentiful and controllable supply of energy for the future?

Dr David Falla is one of the founding members of La Societe Guernesiaise Astronomy Section. Dr Falla obtained his PhD at the University of Bristol and then held research posts at Manchester and London (Queen Mary College). He has now retired from a lectureship at the University of Wales (Aberystwyth), where he is currently an honorary lecturer in the Institute of Mathematical and Physical Sciences.

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