Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise

April – June 2009

Forthcoming Events

Public Lectures:

Dr Michael Hoskin: "The Megalithic Tombs of Brittany in their European Context"

Friday 3rd April
8.00 pm at the Frossard Centre, Candie Gardens

Dr David Falla: "Light, Gravity and Black Holes in Space"

Thursday 16th April
8.00 pm at the Frossard Centre, Candie Gardens

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

Minutes of the Astronomy Section Annual Business Meeting

(held at the Observatory, Rue Lorier, St Peters on 10th February 2009 at 8pm)

Present: Frank Sealy, Paul Gavey, Geoff Falla, Frank Dowding, Peter Langford, Colin Spicer, Roger Chandler, David Le Conte, Debby Quertier

1. Election of Officers

Debby Quertier was re-elected as Secretary, Peter Langford as Treasurer, Geoff Falla as Facilities Officer (assisted by Frank Sealy), David Le Conte as Public Relations Officer (including website) and Colin Spicer as Editor.

Frank Dowding stood down as Research Officer and all expressed their thanks for the contribution he had made. The position of light pollution officer remained vacant.

2. Treasurers Report

Peter Langford presented the treasurers report for 2008, noting that the subscription numbers had been dropping over the last few years. Donations were also down, though the weather had not helped with some of the open nights. Despite this, the section was in an overall healthy position with total funds at £3,224.

Those present thanked Peter for his work in presenting the accounts.

3. Roof

David Le Conte had taken photographs and the roof condition looked serious. He advised that patching had been done but over the bunker rather than actually on our roof section.

David proposed that there were two options for repair:

- Take ceiling down. Support and raise roof using accro props and boards. Install new wall plate, scarfing any rotten timbers. Thought to cost about £1,000 labour plus materials.
- Strip the old roof and replace with a fibre glass roof. This was the longer term option and would be considerably more expensive perhaps £10,000 or more.

Whilst a lease had been signed many years ago, it had not been formally renewed and the landlord, Hugh Lenfestey had not pressed for its renewal, nor had he charged for the last few years. The problem would arise that if we or the Societe were to contribute to the cost of repairs then without a proper lease there was no continued security of tenure for that investment. Discussion followed as to the type of lease and length of term. It was agreed we require a long term lease with 21 years suggested as the minimum term. Agreed rent and clarity as to who was responsible for maintenance of the building would need to be stipulated. No firm decision would be made until the ceiling was taken down at the end of March when the damage could be assessed and the repair options further considered. Debby Quertier would arrange to meet

with Pat Costen and Peter Budwin to discuss the costs and who would negotiate the lease.

4. Building Maintenance

The leaks in the Meade building roof were discussed. The cost of the repairs was expected to be about £80.

There were several painting and maintenance jobs that needed attention. Debby Quertier had already enquired about using the community service scheme as we would qualify being a non profit making charity. Debby Quertier would go back to the probation service and find out how much notice was required. The Meade building runoff framework needed another coat of preservative, as did the main building doors, facia and toilet door.

It was decided we should revert to having a cleanup day for maintenance in order to tackle these jobs rather than informally on a summer Tuesday evening.

5. Open Nights

No dates had been advertised for the summer and it was agreed to see how the roof work progressed before confirming. The observatory would be open during the summer school holidays as normal and the dates could be advertised nearer the time and included in the EDC diary supplement which is available to teachers. Group visits postponed from this winter because of the leaking roof would be rearranged and circulated to those volunteering to support.

6. Year of Astronomy 2009

Year of Astronomy coincides with 400th anniversary of the first use of a telescope by Galileo.

Michael Hoskin was giving a lecture at Candie on the 3rd April about the orientation of the Brittany dolmens. As this date coincided with the weekend of 100 hours of astronomy, it was agreed to take a telescope to view the moon after the lecture.

David Le Conte had given presentations at both St Sampson and Ladies College where he showed Galileo's drawings and related them to what we see today.

David Falla will be giving a talk about Black Holes on 16th April at Candie which will need to be advertised. A telescope will also be taken to this lecture.

7. Any Other Business

WEA Providing the weather remained dry it was preferred to start the WEA course at the observatory although a school room was available at La Houguette School as a backup. David Le Conte had one or two new presentations, though the format was pretty much the same as previous years.

Trees Geoff Falla suggested that we write and thank Mr Whittaker, Pat Costen and Jamie Hooper for their agreement and assistance in getting the trees pollarded, thus enhancing our view of the skyline. Debby Quertier agreed to send these letters.

Duke of Edinburgh Award scheme. We had been approached by two students who wished to study astronomy as part of this scheme. This had now become one student. However since it was a commitment for 12 weeks for just one student it was agreed that we would decline.

There being no other business the meeting closed at 10.20pm.

Debby Quertier

Telescopes Past and Present

Astronomers in ancient times knew from studying the night sky that some of what looked like stars were quite different. There were five of these star-like objects which, unlike normal stars, were not fixed but were continually changing their relative positions - sometimes coming much closer together.

The Greek astronomers recognized this by calling these objects 'planetes' meaning wanderers, but it was not until much more recent times - with the invention of the telescope, that the true nature of these objects was revealed. We now know these wandering objects as Mercury, Venus, Mars, Jupiter and Saturn - the five planets visible to the naked eye, and which like our own planet all have their different orbits around the Sun.

The astronomer Copernicus, now accepted as being a founder of modern astronomy through careful scientific observation, declared in 1543 that Earth was just one wanderer of many, and that our planet was part of a Sun-centred system, also explaining that the reason for night and day was because the Earth must be rotating on its axis.

At that time, and until the 17th century, the widely held belief was that the Earth stood still at the centre of the Universe, with everything rotating around it - because there was not enough good observational evidence to prove otherwise. Astronomers who suggested that Earth was part of a different kind of system were persecuted by the Church for their beliefs.

It seems that the telescope was invented in 1608, although there is unproven evidence that the idea may have been developed at an earlier date. The official inventor, however, was Hans Lippershey, a Dutch spectacle maker born in Germany, who built the first small telescopes after it was found that two different lenses, when held one in front of the other, produced an enlarged view of distant objects. The image was upright, and it was thought that these telescopes would be valuable for land use, particularly in times of warfare.

The telescope was at first simply called a 'looker', and was not given the actual name of telescope - from the Greek words tele (meaning far) and skopos (watcher) until several years later in 1611, after Galileo's first

observations of Jupiter's moons.

After learning of the invention in Holland, the Italian astronomer Galileo Galilei obtained one of the newly invented devices, and made one of these for himself. This, like the Dutch invention, had just a one inch diameter aperture - the size of a spectacle lens, and a three times magnification. Galileo then developed improvements to the design, and towards the end of 1609 he made higher power telescopes of eight and twenty times magnification, also presenting one of these to the Venetian senate in August of that year.

It has been thought that Galileo was the first astronomer to make observations through a telescope, because of his major discovery of Jupiter's four largest moons in orbit just like our own moon, and his realization that the wandering points of light also seen from the earliest times were indeed planetary spheres. Galileo also observed Mars, the phases of Venus and features on the Moon, with the results of his observations published in March 1610.

Although Ga1ileo was first with his published observations, it seems that it was the relatively unknown English astronomer Thomas Harriot who deserves more rightful recognition, having used a telescope to observe the Moon on July 26th, 1609, drawing up the first Moon map and showing many of its detailed features. He also studied sunspots, but unlike Galileo he did not publish his observations at the time, and his achievements remained unknown until 1832.

In 1611, Johannes Kepler made further improvements to Galileo's refractor design by replacing the concave eyepiece lens with a convex one, improving the field of view and producing the first astronomical type refractor - with an inverted image.

Improvements to refractor telescopes continued, allowing Christian Huygens to identify a bright satellite in orbit around Saturn, in 1655. This large moon was at first named Saturni Luna before being given the present name Titan in 1847. Huygens also discovered, in 1659, the true shape of Saturn's rings - which Galileo with his original type of telescope had only been able to see as a strangely changing shape of Saturn, not knowing the cause of this as being the different view of the rings as the planet moves around in its orbit.

A considerable problem found with the early refracting telescopes, bending light through the main lens, was that light passing through the lens is dispersed into colours, with light of different wavelengths not coming to a focus in the same place - an effect known as chromatic aberration.

In 1666 Isaac Newton concluded that this problem could not be solved, and decided to develop his own different kind of telescope, using a mirror instead of a lens. The Newtonian type reflector was made in 1668, with a main mirror set at the base and a small diagonal mirror near the top end of the telescope so that light could be

reflected to an eyepiece set at the side for convenient viewing.

A variation of this design was invented in 1673, with the Cassegrain system using the secondary mirror to reflect light back through a hole in the centre of the main mirror to the eyepiece. The problem of precise focusing, however, had not been fully solved. A spherical flat mirror does not reflect light to quite the same focal point, causing a slight blurring of images. This problem of spherical aberration was solved in 1721 by English mathematician John Hadley, by producing the first bowl shaped, parabolic mirror to bring the light rays to the same precise point.

In the case of refractor telescopes, and the chromatic aberration of light through a lens, as seen in a rainbow effect, it was found that this could also be solved by producing compound lenses - cementing two different kinds of glass together to give a distortion free image. The first refractor using one of these achromatic lenses was produced in 1729.

With these focusing problems solved, the development of larger telescopes of both types, refractors and reflectors, could be continued.

One of the most famous British astronomers was William Herschel, who began his professional life as a talented musician, and was employed as an organist at the Octagon Chapel in Bath, but gave up this career to concentrate on his growing interest in astronomy. In 1774, at the age of 35, he saw the stars through a telescope which he had built himself, and he continued making mirrors and new telescopes. On March 13th, 1781, he discovered the planet Uranus - the first of the outer planets beyond Saturn not visible to the naked eye, and in 1789 he went on to build the first of the giant reflectors - a Newtonian based telescope with a 49 inch mirror and a focal length of 40 feet.

In 1845 an even larger reflector, with a 72 inch mirror, was built at Birr Castle in Ireland by William Parsons, the third Earl of Rosse. This telescope was mounted on a structure more than 50 feet high, and was named The Leviathan. It was used to discover the shape of galaxies, and one of its first observations was of the Whirlpool Galaxy, which was drawn showing its spiral arm structure. This telescope remained the largest in the world until 1917, and although it was later dismantled it was reconstructed in 1998 because of its historic interest.

The original reflector telescopes, including the one at Birr Castle, had mirrors of speculum metal, a copper-tin alloy which tarnished easily. An improvement was found in 1857, with a method of depositing silver on glass, not tarnishing to the same extent but with the mirror still requiring periodic re-silvering.

Refractor type telescopes were also being developed further. In 1897 a refractor with a 40 inch lens, developed by George Hale, was installed at the Yerkes Observatory in Wisconsin. This telescope was found

to be the largest practical size for a refractor, because the lens has to be supported around its edge, and a lens of more than 40 inches was found to bend slightly under its own weight. Since that time all larger aperture telescopes have been reflectors.

The great size of reflectors, with length of tube and support structure, was solved by the wider use of the Cassegrain system – having a more folded light path to the eyepiece at the base of the telescope. In 1930 a variation of this, the Schmidt-Cassegrain design, was introduced, enclosing the top of the telescope with a corrector plate lens to alter the light path, reducing the focal length and providing a wider field of view. The secondary mirror, attached to the back of the corrector lens, produced a very satisfactory and compact design, limited only by the size of the lens. However, with the main mirror resting at the base of the telescope there was less of a limit to growth in size of the reflector mirrors.

Having built the world's largest refractor telescope at the Yerkes Observatory, astrophysicist and astronomer George Hale turned his attention to developing reflectors. He founded the Mount Wilson Observatory in California, where he installed a 60 inch reflector in 1908, becoming also the first telescope to be fitted with an aluminized mirror. A 100 inch reflector was added in 1917, and in 1928 he began developing the massive 200 inch telescope which was finally completed and installed at Mount Palomar in 1947. An even larger, 236 inch single mirror telescope was installed at Mount Semirodriki in the USSR, in 1976.

The discussion so far has been of optical telescopes but there are other kinds including radio telescopes which identify and map radio wave emissions often from very deep space sources far beyond our own galaxy. The first radio telescope, with a 31ft dish, was built at Wheaton, Illinois, in 1937, and further developments of these has led to the largest dish antenna, of more than 300 metres diameter, being built into the landscape at Arecibo - on the island of Puerto Rico, in 1963. In the UK there is the well known steerable dish at the Jodrell Bank Observatory in Cheshire. This 250ft dish was completed in 1955, and achieved early fame by picking up radio signals from the first artificial satellite - the Russian Sputnik 1, after it was launched into orbit on October 4th, 1957.

With the beginning of the Space Age, and the launch of larger satellites and spacecraft, it was inevitable that a plan would be developed to put a telescope into space, to overcome the effects of observing through the varying visibility of Earth's atmosphere.

In 1990 the Hubble Space Telescope, with a 94 inch mirror comparable with many Earth-bound observatories at that time, was launched by NASA into a 350 mile high orbit. After an initial disappointing problem with the optics - caused by inaccurate focusing which was corrected during a manned Shuttle mission, the Hubble Telescope proved

to be a success, more so than expected, returning a huge number of unrivalled deep space images, and obtaining images also from ultraviolet and infrared radiation sources.

With the limit of giant single mirror telescopes having apparently been reached, there were still several innovations allowing observatory telescopes to become even larger and to remain very effective when compared with the capabilities of the space telescope.

The first telescope with a multiple mirror, made up from six military surplus mirrors, was installed at Mount Hopkins Observatory, Arizona, in 1979, and became a standard way of increasing the size of giant telescopes. The major observatory site at Mauna Kea, Hawaii, was established with its first large reflector in 1970, and a giant twin reflector system was installed in 1993 - with each telescope having a 10 metre mirror of 36 hexagonal segments. In 2001, the twin Keck telescopes were combined to function for the first time as one telescope, with computers providing another innovation - adjusting the shape of each mirror segment to maintain the best possible curvature of the surface, correcting for any distortions which may be caused by changes in temperature or wind effects, a system known as active optics.

There was still one other problem, that light is affected as it travels down through varying conditions in the atmosphere, and an ingenious solution was also found. To remove the effects of atmospheric turbulence, a laser beam guide system was developed to produce a spot of light in the upper atmosphere. The variation of the light is then measured, and adjustments made to the telescope mirror to produce a final sharp image. This system, of adaptive optics, was first used at the Lick Observatory, California, in 1996, and has also helped to make plans for much larger Earth bound telescopes a practical reality.

The European Southern Observatory established a site at Mount Paranal, Chile, with four 8.2 metre telescopes able to work in combination completed in 2003. Larger telescopes are planned to be built in Hawaii and in Chile, and these are expected to produce images much better than is achievable with the Hubble Space Telescope.

With evidence being obtained of planets in other solar systems, from the observed gravitational and transit effects, the first actual images of planets in orbit around other stars were obtained in 2008, with plans also being developed for larger space telescopes.

So, after 400 years since telescopes were invented, there is still much to look forward to in the future development of observational astronomy and in anticipation of further discoveries.

Geoff Falla

Slingshot to Spring

February, Februar, Février, my Favourite.

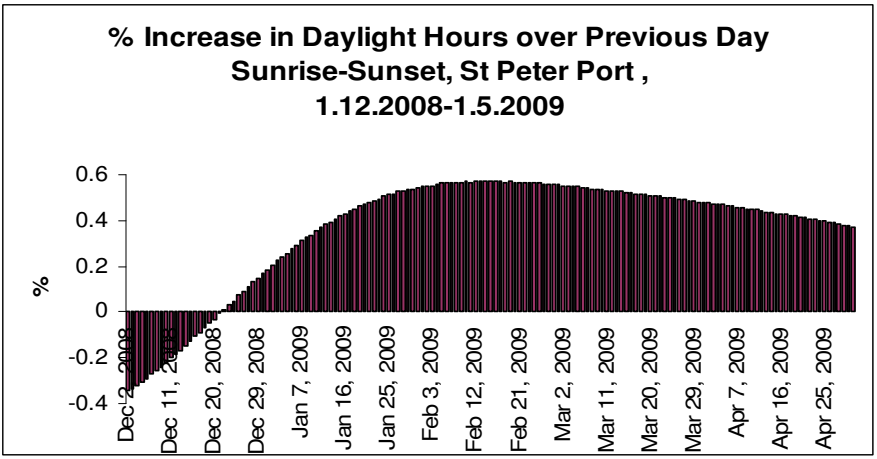
At first acquaintance, February is the runt of the litter, passed-over in the promotion stakes when the thirteenth lunar month was being shared out across the solar year.

This view may be coloured by February's awkwardness in the classroom - its quirky leap-years and eccentric spelling - that first "r". Other distorting childhood memories can include: the papery pleasures of pancakes on Shrove Tuesday; the unreasonableness of rugby in the rain; and vacuous Valentine's Day.

In northern Europe, cold dark February is no month for a carnival. Out-caroled by Christmas, eclipsed by Easter, it is closer to the longueur of Lent than the madness of Mardi Gras.

So, wherein then lies February's redemption?

Call it planetary pull. The shifts of the seasons are not straight lines. To understand what I mean, start with the winter and summer solstices. At Christmas or Midsummer, little happens on the daylight front. One day- or night-length is much like the next. For three weeks around the winter solstice and again in the summer, the length of day moves in a band just six minutes wide.



Even around the equinox at Easter we will feel a second-order stability. Day-length may be accelerating fastest, at its peak almost 4 light minutes is added each day. But the changes themselves are much like each other. For eight continuous weeks at this station of the year, daylight gains exceed 3½ minutes per day.

To locate the greatest sensation, we must find the third-order effect, the acceleration of acceleration. Like the jetplane on the runway, it is the shove-in-the-back, not the absolute speed or even the build up of speed, which impresses. And like the jetplane, it is not the first half of the shove which surprises, so much as the last.

At the start of February, sunrise is still not far short of 8 am. By the end of the month, the top rim of the sun clambers over the Guernsey horizon at 06:55. On 28th February we are blessed with 92 minutes and 25 seconds more day than on February 1st. That is 26% more sun-time, compared with an increase of 17% in the 31 days of March and 14% in January. As the graph shows, 17th February is the best day of the year.

Just as the quickening onset of night is August's secret undoing - summer slipping from our grasp - so the quickening approach of Spring is February's all-conquering quality.

Fergus Dunlop

Editor:
This article was first published in Ship to Shore, the parish magazine of St Saviour's and Forest. If anyone has come across or knows the name for this type of analysis please let me know.

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

Binary Star Systems. It seems that most stars are part of binary systems of two or more stars, and much can be learned from their interactions. A set of articles focusing on binaries, first named as such by William Herschel in 1802. Details of the different kinds of binary stars and their characteristics, a look at some of the best known ones, including Mizar and Alcor, Castor, and the double-double Epsilon Lyrae. (Astronomy Now, January 2009)

Looking for Other Earths. Of the rapidly rising total of planets now detected in orbit around other stars, most of these are gas giants like Jupiter or larger. Recent discoveries now include several planets more like Earth in mass. NASA's Kepler mission, which is to identify transiting planets, will expand the search, and it is expected that the first potentially habitable planet outside our solar system may be found within the next three years. (Sky and Telescope, January 2009, and Astronomy Now, March 2009)

Alien Worlds Pictured. For the first time, images were obtained in 2008 showing planets in orbit around other stars - with a planet shown orbiting the bright star Fomalhaut, and a family of three large planets in orbit around the star HR 8799 in Pegasus. (Astronomy Now, January 2009)

The Brightest Burst. On March 19th, 2008, the NASA Swift satellite saw an exploding star in the constellation

Bootes. This produced the brightest gamma ray burst ever seen - briefly at naked eye visibility, from an immense distance of more than seven billion light years - half way across the universe. (Sky and Telescope, January 2009)

Is our Galaxy running out of Gas? Our Milky Way Galaxy is still forming new stars. Results from the Spitzer Space Telescope suggest that the absorption of available gas in this process will lead to the galaxy gradually running out of gas, with new stars forming at a faster rate than previously thought. (Astronomy, January 2009)

How Kepler revolutionized Astronomy. Johannes Kepler, born in 1571, was a major figure in the history of astronomy. He wrote the first modern book of optics, and his discoveries included the inverse square law of light, and celestial mechanics - that the movement of the planets is due to unseen forces, leading to the development of his three laws of planetary motion. (Astronomy, January 2009)

Impact Craters. Craters caused mostly by impacts on planetary surfaces, if not subject to erosion or other processes, are the most commonly occurring feature on planets, moons, and even on comets. A set of articles focusing on how craters must have been formed during the early history of the solar system, what controls the size and shape of craters, and the risk from impacts at the present time. (Astronomy Now, February 2009)

Nicolaus Copernicus - 'The Founder of Modern Astronomy'. The life of Copernicus, born in Poland in 1473, and recognized as having played a major part in establishing the scientific method in astronomy based on observations. Part of a series on great astronomers. (Astronomy and Space, March 2009.)

The Galactic Centre - Hubble's Extraordinary View. The Hubble Space Telescope has obtained a highly detailed view of the remarkable features found at the very centre of our galaxy. (Astronomy Now, February 2009)

What is making Methane on Mars? Three regions on Mars are found to be producing methane plumes. This could be caused by geological or biological activity. As there is no evidence of volcanic activity on Mars at present and there is found to be seasonal variation in the methane amount, the possible reality of a biological cause becomes more plausible. (Astronomy Now, March 2009)

The Story of Comets. A detailed look at comets - from appearances in historical times to more recent events, including the mystery of comet Holmes - with its remarkable outburst of light in October 2007. What comets are, where they are mostly located in our solar system, and why they are sometimes seen in its inner regions. (Astronomy Now, March 2009)

Light, Gravity and Black Holes in Space

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

Thursday 16th April
8.00 pm at the Frossard Centre, Candie Gardens

The nature of light is first considered: particles or waves? One important property of light is that it has mass, just as material bodies have. It follows from this that light is affected by gravity: light rays are bent in passing through a gravitational field, and light loses energy in the process of emission from a massive stellar source. In the extreme case where a large stellar mass is concentrated in a sufficiently small volume, light cannot escape and a 'black hole' is formed. How can its presence be detected when it is invisible? Astronomers have now made observations which provide indirect but quite convincing evidence for the existence of black holes, in several different types of location amongst the stars and galaxies.

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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