# Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise

January – March 2005

## Forthcoming Events

Comet Macholz (C/2004 Q2) – Visible in January

Business Meeting Tuesday 25th January

'Hands on' viewing with smaller telescopes Tuesday 15th February

WEA Course 10th February

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

## Inside


| | |
|---|---|
| Astronomical Events in 2005 | 2 |
| An Appreciation of Warren De La Rue – Part 2 | 4 |
| Abstracts from Astronomy periodicals | 7 |
| Supernovae | 9 |
| Footnote on the Transit of Venus | 12 |


## Inserts

Star chart

Sunset, sunrise, moonset and moonrise times

# Astronomical Events In 2005

While we are not expecting any spectacular event in 2005, there is a good partial eclipse of the Sun to look forward to, on 03 October.

**PLANETS**
The dates of maximum elongations of **Mercury** are as follows. It can usually be seen about ten days before and after these dates.

| | |
|---|---|
| 29 December (2004) | Morning |
| 12 March | Evening |
| 26 April | Morning |
| 09 July | Evening |
| 23 August | Morning |
| 03 November | Evening |
| 12 December | Morning |

**Venus**, which has been a spectacular morning object for the last few months, will disappear from our morning skies in January (but note its close conjunction with Mercury; see below). It will reappear as the 'Evening Star' from May until the end of the year, although remaining low in the west due to its southerly declination. Its maximum eastern elongation occurs on 03 November.

**Mars** reaches opposition on 07 November, when it will be at a distance of just under one astronomical unit, and have an angular diameter of 20 seconds of arc. It can be seen in the evenings from September until the end of the year.

**Jupiter** starts to become visible in the late evening from February, and will increasingly dominate the eastern evening sky, reaching opposition on 03 April. By September it will get too low in the west for observation. There will be many transit and occultation events involving Jupiter's moons.

**Saturn**, at opposition on 13 January, will be an excellent evening object for the first few months of the year, until June.

**Uranus** is at opposition on 01 September, **Neptune** on 08 August, and **Pluto** on 14 June.

**OCCULTATIONS**
When the Moon rises on 26 April it will be occulting the first-magnitude star *Antares*. The star will reappear at 23h 55m, when it is just 1º above the horizon!

**CONJUNCTIONS**

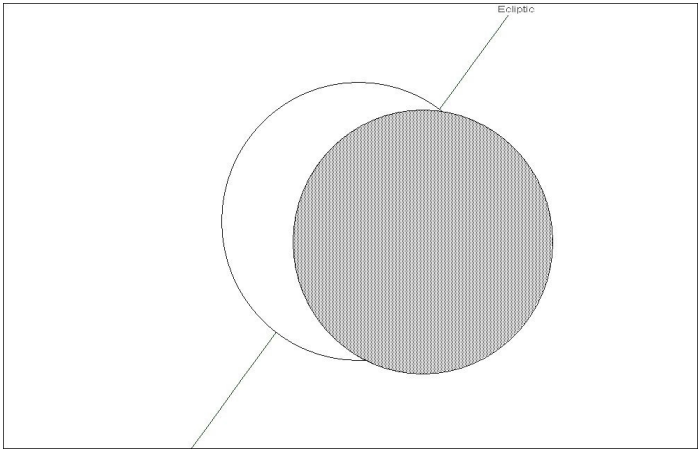
| *Date* | *Planets* | *Separation* | *Direction and time* |
|---|---|---|---|
| 13 January: | Mercury and Venus | < 0.5º | Low in south-east before sunrise |
| 01 September: | Venus and Jupiter | ~ 1º | Low in west after sunset |

Mercury, Venus and Saturn make a close grouping from 21 to 28 June, low in the west after sunset.

**METEORS**
The waxing crescent Moon on 11 August will set at 10.40 pm, and so should interfere little with observations of the Perseid meteors. The 16-day-old Moon on 17 November, however, will hamper observation of the Leonids. Similarly, the almost Full Moon on 12 December will affect the Geminids.

**COMETS AND ASTEROIDS**
Comet Macholz (C/2004 Q2) may reach 5$^{th}$ magnitude in January, well-placed in the south-east evening sky. Several other, faint comets and asteroids should, as usual, be visible in telescopes, and, of course, one never knows when a comet or asteroid may make an unexpected appearance.

**ECLIPSES**
A good partial solar eclipse will be seen from Guernsey on Monday, 03 October, starting at 8.45 am BST and ending at 11.18 pm, with maximum eclipse of 74% at 9.58 am. From Madrid it will be seen as an annular eclipse (ie not total, but with a ring of Sun left around the Moon), its central path passing through North and East Africa. The graphic below shows the eclipse as seen from Guernsey at its maximum extent.




On 08 April there is a hybrid solar eclipse (part annular and part total) in the Pacific, touching Central America, Colombia and Venezuela. It is not visible at all from Guernsey.

A penumbral lunar eclipse on 24 April and a total lunar eclipse on 17 October will not be visible from Guernsey.

**EQUINOXES AND SOLSTICES**
The following are the dates and times (UT) of the equinoxes and solstices in 2005.

| | | |
|---|---|---|
| Vernal Equinox | 20 March | 12.41 |
| Summer Solstice | 21 June | 06.46 |
| Autumnal Equinox | 22 September | 22:23 |
| Winter Solstice | 21 December | 18:34 |

**SATELLITES**
The International Space Station is regularly visible from Guernsey. Also of interest are flashes from the Iridium satellites. Many other, fainter, satellites appear every night. Details of the times and directions of visibility can be obtained from the Heavens-Above web site, accessible by a direct link from the web site of La Société Guernesiaise Astronomy Section, at www.astronomy.org.gg.

**WEA COURSE**
The Astronomy Section is running its annual six-week "Star Gazing" course at the Observatory in February and March. Enrolment is through the Workers Education Association.

***David Le Conte***

***References***
*SkyMap Pro software.*
*Starry Night Pro software.*
*http://www.theman.themoon.co.uk/Alignments.htm*
*Astrocalendar 2004/2005, The Federation of Astronomical Societies*

# An Appreciation of Warren De La Rue – Part 2

Mystery man might be a good description of Warren. In common with all who've set out to research him, I discovered very rapidly that his scientific and engineering work is extremely well documented and recorded, but when personal details are needed, almost nothing has survived.

The family records are almost minimal and company data suffered from the ravages of time and two World Wars' devastation. Nor is it just in astronomy. Not much is known via the Chemical Society, today's Royal Society of Chemistry. Records in Victorian times are largely a record of meetings, not of the persons concerned.

What I have discovered reveals him to have been someone we'd all like to know, and a good family man. Apart from that I leave further research to others with better access. We must all know about the family business and how it thrives today. Many aspects of it are not widely known and only as recently as this Year's Honours List, the inventor of the cash machines at banks (finally) got recognition for the invention. He worked in one of the De La Rue branches of industry. When we delve into the less well-known subjects like photography, the total lack of recognition is a terrible shame, and some measure of his modesty. It also throws some light onto the character, which seems to be more one of a highly skilled artisan, than academic seeker after fame. Seem familiar today? Get your hands dirty and that's not going to make you famous. Never mind that it was his skill that made the machinery run to print the bank notes the so-called professionals regard so highly. Without that skill the astronomical measuring machine would not have come about when it did.

Warren's attitude seems to have been one of "Problem solved-next!" A partial explanation why he never gets credit for making the photographic process so reliable as a scientific tool in the 1850s. Others make the claims and one gradually loses by default one's true reputation to history.

Let's see what Warren got up to in this crucial bit of enabling technology we all take for granted today. With Health and Safety Commissars breathing down your neck, and with 'Team Leaders' itching to claim the credit would you consider working in 1850's photography?

The main tool he used at first was the Daguerreotype because it did give accurate physical measurements and a positive to work from. Copying them was never solved in a practical way at the time. Think on this.

The basic working medium is a sheet of silver which is highly polished. For reasons of economy it was quickly replaced after the invention in the 1830s by a copper sheet which had a very thin layer or film of silver deposited on it. Today we'd vapour deposit silver metal directly in the way it's done for the Gemini telescopes, but back then even the silvering of glass for mirrors was way into the future. Electroplating was an option, if you didn't have rolling facilities to meld two sheets together.

Take your polished bit of copper and electroplate with silver cyanide solution. Snag 1 today...then repolish using powders with respiratory complications. Now for the really nice step. Expose the polished sheet to a mixture of halogens, the exact ratio being a trade or private recipe. Iodine had to be the major component but with bromine and chlorine also present. Visions of the trenches in WW1 spring to mind! The exact time of exposure had to be closely scrutinised as this was the whole key to the process and skill of the worker. When the silver had the desired yellow to brownish hue, the vapouring was stopped. Quite how the workers avoided horrible eye damage is a mystery. Maybe nobody noticed, nor cared.

When the plate was ready it could be exposed and that had to be within a reasonable time, otherwise the sensitivity died pretty quickly, meaning that the sheet had to be repolished and resubmitted to vapour treatment. This was quite a common experience, apparently.
After camera exposure with (by our standards impossibly long) times of several minutes, the plate had to be developed. If any of the previous steps give you nightmares, this will finish the job. In a large box, boil up some mercury until the space is well filled with vapour, evenly, then place the exposed plate in it, close the lid, then inspect regularly until a good image appears. Many workers accepted the photograph as it came out of the box, but many completed the process by fixing out the unexposed/undeveloped silver halides. Potassium cyanide solution was often preferred to plain hypo because silver iodides are poorly soluble in thiosulphates, still a problem today with modern high speed films.

That Daguerreotype process rapidly fell into disuse around this time, not just because of the hazards and complexity, but for the simple reason of not being able to copy. An original one-off was it.

It was possible to avoid the mercury vapour and the answer lay in huge exposures of the exposed plate to red light. The process became known as the Becquerel process, the same chap who gives his name to radiation standards. However, some other research of mine in press indicates that Becquerel gets the credit from the true inventor, who also loses his credit to history in the same way as Warren. The effect is properly known as the Herschel Effect. A spin off from his infra red studies, which he noted then failed to claim from the roof tops.

The exciting aspect of this is that colour photography can be put down to Herschel.

These red light developed Daguerreotypes are not only positives but in full, natural colour. True. I've seen it work. All from 1839.

Warren is considerably up in my estimation if he'd only been doing Daguerreotypes. But he did these on astronomical exposures, and many of these in stereo, through telescopes of huge focal ratios designed for planetary studies, not photography.

The problem of making good quality copies and so on was solved when Scott Archer described the wet collodion process in 1851. He was not the first to try that medium but made it work. He seems to have had a similar attitude to Warren in giving his technology on a plate to the world. The difference was that he really did need the money, never Patented and died destitute, as did his widow. Same result- another lost name to history until modern historians righted that wrong.

Warren as a gifted chemist rapidly got to grips with the wet collodion process and as I mentioned last time, improved both the sensitivity and reliability, to make it the main-stream process for the next 30 or more years. Why do I have more appreciation for the man? Here's the process.

Take guncotton, just discovered and dissolve it in ether and alcohol, both highly inflammable liquids. This could be kept for long periods and some from that time in Birr is still viable! When ready and in the dark, not passing out from the anaesthetic effects of ether, coming into practical use around that time, coat onto glass plates nice, neat and even. Try it sometime and see how you get on. A highly skilled operation.

That is impregnated with a concoction of halides, normally a high proportion of cadmium, lead and other "interesting" materials. When ready recoat with silver nitrate (the process could be other way round), again in the dark. Silver nitrate is not known as 'Lunar Caustic' for nothing, a good wart remover. It stains everything black, indelibly. Whilst still wet the plate is camera exposed. If not wet then the sensitivity drops to insignificance, and has to be stripped or discarded.

Development is one of Warren's main introductions and the brew is an improvement on pyrogallol (another nasty stainer) in strong caustic alkali.

If you've got so far, still living, in other words, without safe lighting, by and large, you then fixed the plate in potassium cyanide. Now you can see why I'm so full of appreciation for Warren. I've handled all these chemicals in my time and hundreds of litres of cyanide but I'd not be too happy doing that in total darkness, and under pressure of time. He'd never get a look in today, even if allowed to buy the chemicals. More likely someone, or a neighbour would complain and have his 'collar felt'. Even with his success he'd be way down the pecking order in 'acceptable' occupations, certainly not as a Professional, although a total professional in his conduct.

Without people of his ilk, we'd never have progressed out of the oil painting stage and never reaped the full benefits of the engineering kits he devised. All the modern astronomy we know has to be down to geniuses like him. That at least is the summary in his obituary. Be proud of him.

***Michael Maunder***

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

**Is Anyone Out There?** So far, there has been no confirmed signal found in the search for extraterrestrial intelligence in deep space. There seems to be plenty of evidence of planets around other stars, and researchers are pinning their hopes on a rapid advance in technology which is already improving the search. (Astronomy, September 2004)

**A Ring of Stars around the Sun.** About 30 million years ago, there was a significant period of star-making in the Sun's galactic neighbourhood. First noted by American astronomer Benjamin Gould in 1874, many of our brightest stars can be found in this ring plane known as Gould's Belt. (Astronomy, September 2004)

**Star's End.** It is exactly 400 years since a supernova bright enough to be seen with the naked eye was observed in our own galaxy. The events involved in a supernova explosion, the frequency of these observed
telescopically in our galaxy, and seen occurring also in other galaxies, is examined in a set of articles. (Astronomy Now, October 2004)

**How Britain Divided the World.** The Royal Greenwich Observatory was established in 1675 so that observations could produce tables for the use of navigators in finding their position at sea. A summary of how latitude, and later a more accurate determination of longitude was made, with Greenwich also being accepted in 1884 as the site of the Prime Meridian dividing the eastern and western hemispheres. (Astronomy Now, October 2004)

**Southern Superstar.** The brightest known star in our galaxy, Eta Carina, is a giant star which has undergone periodic eruptions, with evidence that the nebula is hiding a second massive star. There is much about the star and its likely evolution which remains a mystery. (Sky and Telescope, October 2004)

**Tracing the Milky Way's History.** Some of the history of the Milky Way can be deduced by studying the chemical composition of stars. Further data is now being gathered relating to star formation, which will help in understanding the evolution of this and other galaxies. (Sky and Telescope, October 2004)

**Cassini reaches Saturn.** The Cassini spacecraft is in orbit around Saturn after a seven year journey. Further information is being obtained about Saturn's ring system, with first pictures of some surface details on its major moon Titan. (Astronomy, October 2004)

**The Caldwell Catalogue.** Astronomer Sir Patrick Moore devised his own list of 109 notable celestial objects in 1995. Whereas the long established Messier catalogue includes objects noted by French astronomer Charles Messier from the latitude of Paris, this alternative catalogue includes objects visible from both hemispheres. Sir Patrick's full surname is Caldwell-Moore. (Astronomy, October 2004)

**Jodrell Bank.** The story of the famous radio telescope in Cheshire. Resulting from the vision of Sir Bernard Lovell more than 50 years ago, the telescope has been involved in many achievements, including the discovery of pulsars, quasars, microwave background radiation, and the tracking of spacecraft. (Astronomy Now, November 2004)

**New Views of Saturn's Rings.** The Cassini spacecraft's images of Saturn's ring system have a high resolution - much better than those obtained by the Voyager spacecraft more than twenty years ago. (Sky and Telescope, November 2004)

**First Planet seen outside Solar System?** What may turn out to be the first image of, an 'exoplanet' has been obtained by the European Southern Observatory in Chile. Confirmation that the red object is not a companion star is expected to take a year or so. (Astronomy and Space, November2004)

**Binocular Astronomy.** Choosing and using binoculars for astronomy. The combination of wide field of view and low magnification provides good viewing of faint objects such as galaxies and star clusters, more easily seen using binoculars than is sometimes the case using a telescope. (Astronomy and Space, November 2004)

**CERN's Golden Jubilee.** CERN is the world's largest laboratory for research on fundamental physics. This year the giant accelerator complex near Geneva celebrates fifty years of particle physics research. (Frontiers Journal of UK Particle Physics, Astronomy and Space Science, Autumn 2004)

**The Trouble with Hubble.** The limited future of the Hubble Space Telescope. It is still uncertain if NASA will go ahead with a robotic mission to extend the life of the telescope beyond the next three or four years.
(Astronomy, November 2004)

**Weighing the Universe - Galaxy Clusters.** Clusters of galaxies can provide evidence about the structure of the universe and its content. Discovering the mass of the clusters from gravitational lensing effects and by other means can also help to reveal the properties of dark matter and dark energy. (Sky and Telescope, December 2004)

**Mapping the Moon's Shadow.** A historical look at solar eclipses, and the shadow tracks as portrayed on antique maps, including five solar eclipse events over the British Isles in the years 1715 to 1764. (Sky and Telescope, December 2004)

**Seeing Red.** A set of articles. Some of the early work in infrared astronomy, and new facilities to improve the study of infrared sources, including the Spitzer satellite, and the SOFIA project, a 2.5 metre telescope housed in a jumbo jet, are about to become operational. (Astronomy Now, December 2004)

# Supernovae

A Supernova is an exploding star. Only the super giants explode and only after a logical sequence of events. Our nearest Star, the Sun will not explode, it would need to be at least twenty times its mass making it around three to four hundred times its diameter.

Supernovae are extremely important. All Stars start off as Hydrogen with perhaps a little helium. If they were to glow very brightly and then go out, we would not exist, because we and all that is around us are made from heavier chemical elements. Fortunately, the super giants, during their lifetime, and during their explosion, can develop these heavier chemical elements and explode them out into space as a huge cloud. From one of these large clouds our Solar System evolved and we are able to breathe oxygen and use iron to make things.

Betelgeuse, the top left hand Star in the Orion constellation is a potentially explosive star. If we compare the Sun with Betelgeuse perhaps we can see why one will explode and the other will not.

Our Sun, like all Stars in the main sequence is converting hydrogen to helium in its core. When the Sun was young and the core area reached 10 million degrees Centigrade, it became hot enough for the nuclear reactions to take place. This extreme temperature increased the speed of the hydrogen atoms to such an extent, that they could overcome the electrostatic repulsion of each positively charged proton, so that the protons in each atom could get so close that a stronger nuclear attractive force could take over, bonding the two protons together thus making a new helium atom. This has been happening in the Sun's core for the past 500,000 million years and will continue to do so for the next 500,000 million years. The core temperature has been increased to 15 million degrees due to the fusion reactions. In the core's centre, the intense heat will drive the electrons away from their atoms, leaving them in a state of ionized plasma.

Eventually, all the hydrogen, in the Sun's core will become helium and nuclear reactions will cease. Up until now the sun has been in balance. The core has been pushing outwards at the same pressure as the rest of the Star has been pushing inwards under gravity. But once that comes to an end, the core will shrink and the outer areas will push inwards with new vigour with nothing to hold it back. This has the effect of increasing the core temperature once again, this time to 100 million degrees Centigrade. Nuclear reactions start again, as before, but the higher temperature this time forces the helium atoms together to form beryllium with four protons from helium's nuclei of two protons and with the help of neutrons (which only attract), can bring a helium nuclei (two protons) with a beryllium nuclei (four protons) to make a carbon atom of six protons.

This will continue for around 10 million years and with such a force going on in the core, it pushes the surrounding Sun's hydrogen further and further out, The Sun will become a Red Giant. It will glow with an orange colour and extend to somewhere between Mercury and Venus. But the Sun will be coming to the end of its life, because it will have become so large that the outer areas will disperse and what is left will go with a solar wind. The Sun will be left as a shrinking dense core and over the next 10 million years or so will

become a dense, mainly carbon dark sphere.
Betelgeuse, on the other hand, because of its huge size when it was formed, around 350 times the Sun's diameter, started its life with a 600 million degree core, compared with the Sun's 10 million. This meant that Betelgeuse was able to convert all the hydrogen to helium in just two million years, compared to the Sun's 1,000 million years. Again due to its huge size and temperature, it went on to produce beryllium and carbon very quickly. Betelgeuse is only 15 million years old but because larger Stars process these nuclear reactions so quickly, their lives are shorter.

The difference between the Sun and Betelgeuse at this stage, is that Betelgeuse has held on to the outer areas, because of its massive size. As with the Sun, each time reactions stop, the outer area pushes in again under gravity and boosts the temperature. It went on to produce silicon from the carbon and other elements in between such as oxygen, nitrogen and sodium. The core of Betelgeuse is like an onion, with the hottest part in the centre where silicon is being produced, around that helium is producing carbon and outside that again it is eating into the hydrogen to produce helium.

In around one million years time iron will be produced in the core and when that is complete, Betelgeuse will not be able to go any further, because to produce iron requires 7 thousand million degrees and this is the upper limit physics dictates for any Star.

So this time when nuclear reactions stop, the pressure from the surrounding material of mainly hydrogen and some heavier elements that have migrated from the core, will not revive the core.

Betelgeuse is a type 11 supernova Star. It grew on its own and will explode on its own. There is a type 1 supernova Star, an example of which is a double interacting star, where one is much bigger than the other. As the bigger one gets bigger and gets closer to the smaller star, the smaller one starts to take material from it. Once this starts, it does not stop until all the material has been transferred. If the smaller star was actually quite big in the first place, it could now become a Super Giant in its own right and could eventually explode.

The difference between this and a Star like Betelgeuse is that if one of the pair of double stars is older and because it drew off material last from near the core of the once bigger star, there will be some heavier elements in it. So the now bigger star may not consist of as much hydrogen.

Meanwhile, all the material surrounding Betelgeuse's core is starting to fall inwards. Partly because there is now no resistance from the core and partly because the core is rapidly shrinking. As the core shrinks it compacts and the gravitational pull becomes even greater. The outer material is coming in so fast that speeds of over 100 million mph are reached. As everything gets closer together, the temperature rises and nuclear reactions start again. This time with temperatures reaching three to four thousand million degrees Centigrade, elements are formed heavier than iron. Clouds of photons and neutrinos leave the area at light speeds, although in the photons case they have to clear the Star first.

With continuing pressure and higher temperatures, the electrons in the iron core become degenerate and their negative charge so great that they neutralize the iron protons to become neutrons, which only attract themselves together. The electrons are then ejected and the core becomes so small that it would be like the Earth contracting to just 180 metres. A thimble

full would weigh on Earth 4 million tons.

Everything has closed in at enormous speeds and has to explode outward. Just at this moment, the neutrons in the iron core having virtually come together, rebounds slightly sending shock waves through everything as everything explodes. During the explosion, 500 thousand million degrees Centigrade are reached and it is during this time that all remaining elements are produced, silver, gold, uranium, everything up to the heaviest atom of 105 protons.

All these elements are exploded out into space, forming a huge cloud. It would appear as a very bright light for about a month, by which time it has become around twice the size of Pluto's orbit, but will now be transparent. It will keep expanding for perhaps a thousand years. During this time we no longer see the actual remnants, but instead, pockets of gas that the still hot remnants come across and interact with.

When it does eventually come to a stop, it may get triggered by shock waves from a Supernova somewhere else to start contracting into another Star or Solar System - just as ours was formed.

***Frank Dowding.***

*This article is a result of the talk Frank gave to the section in October.*

## Footnote on the Transit of Venus

On the morning of Tuesday 8 June, the planet Venus passed across the lower part of the sun. No living person had seen this rare astronomical phenomenon as the last transit had occurred in 1882. I was determined to see it and luckily the sky was clear. Using my large sextant, I found that a combination of the red and green filters showed the sun as a pale green disc, but no Venus. I therefore took the binoculars and held one of the apertures against the red and green filters. And there it was! - an unmistakable black dot at '7 o'clock' of the sun's 'clockface'. Over the next four hours I saw it crawl across the sun, emerging from the '4 o'clock' position at around noon. This was the sight that Captain Cook had sailed across the Pacific to see in 1769.

It was not, however, the first time I had seen Venus in daylight. During the Battle of Britain, with other boys, I was watching a dog-fight, fought very high up. Suddenly one of us said, 'Look! A parachute!' And there, in the blue of that cloudless sky, was a small white dot, apparently at a great altitude. We were ready to cycle to wherever the pilot came down and eagerly speculated whether he was one of ours or one of theirs. But half an-hour later the 'parachute' still seemed to be in the same place. It was, in fact, Venus, its great brightness giving it visibility, even at around midday.

A third daylight sighting was on 12 August 1999. It was a few minutes before the evermemorable total eclipse of the sun. Only a narrow crescent of the sun's disc was left, when suddenly Venus was glimpsed in a brief gap in the clouds.

***Dr Brian Porter of Seasalter, Kent***

**Astronomy Section Officers**

| | | |
|---|---|---|
| Joint Secretaries | Jessica Harris | 247193 |
| | Debby Quertier | 725760 |
| Hon Treasurer | Peter Langford | 263066 |
| Editor | Colin Spicer | 721997 |
| Facilities | Geoff Falla | 724101 |
| Public Relations | David Le Conte | 264847 |
| Library | Geoff Falla | 724101 |
| Research | Frank Dowding | 255215 |
| Light Pollution | Vacant | |

## Observatory

Rue du Lorier, St Peters,
Guernsey
Tel: 264252

## Web page

www.astronomy.org.gg

Material for, and enquiries about Sagittarius should be sent to the Editor

Colin Spicer
60 Mount Durand, St Peter Port
Guernsey GY1 1DX
Tel: 01481 721997
colin.spicer@cwgsy.net



**Copy deadline for next issue is 1st April 2005**

La Société Guernesiaise, Candie Gardens, St Peter Port, Guernsey GY1 1UG.
Tel: 725093