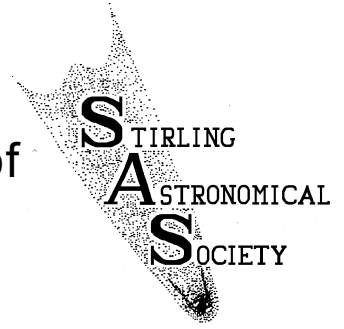
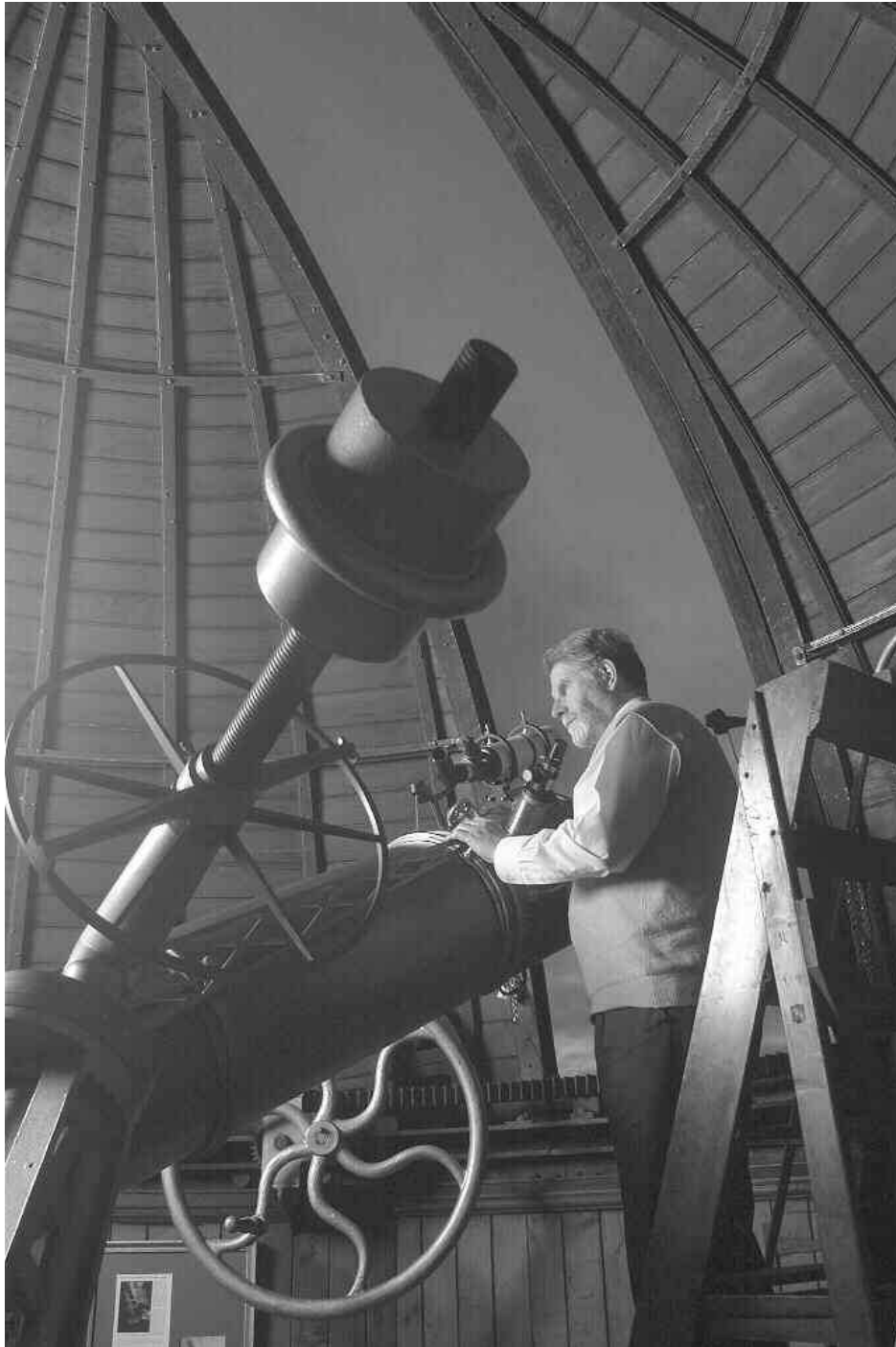


Newsletter of



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[www.stirlingastronomicalsociety.org.uk](http://www.stirlingastronomicalsociety.org.uk)



*Ken Mackay in action with our Highland Hotel Telescope*

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## ONE ATTEMPT TO VIEW THE RARE VENUS TRANSIT

With the high prevalence of cloud this year it seemed that the chances of seeing all the stages of the transit would be poor, and the chance of seeing nothing at all was on the cards. At the preceding Mayfield meeting it was suggested that having members dispersed on the day would increase the probability of SAS recording the transit. The main SAS group was to be at the David Stirling monument. Douglas Cooper volunteered to go to Egypt! I finally decided to take up station in my own garden where I could run a mains equatorial drive. Then, about a week before the event, high pressure moved over the country, cloud thinned and regular bursts of sunshine encouraged me to construct and test a Sun-tracking solar projector.

Since this transit is such a rare event, I thought it would be worth to be ready with the best possible technology available - that is, the best that could be made from cardboard, bits of wood and old equipment I had lying around. By great good fortune I happened to have three cardboard boxes which, with only a little modification and reinforcement, nested together to make a nice rigid projection box. It was so rigid in fact that it could hold in alignment a pair of astronomical 20 x 80 binoculars and a heavy video camera. One objective lens of the binoculars was removed and the other was used to project a solar image (about 8 cm diameter) onto an ordinary sheet of A4 paper. This simple screen was mounted on a flat sheet of perspex at the far end of the two foot long box. Three access doors were cut into the box; one to eyeball the screen and the other two to enable manual focusing of the camera and the binoculars. The video camera was inset and mounted alongside the remaining binocular objective and looked back down the box at the screen.

The third shorter inner box, as well as acting as an internal support for the binoculars and camera, also provided two intervening light baffles to keep any chinks of sunlight off the screen. The idea was to make the interior of the box so dark that the Sun might be detected behind quite thick cloud. A lot of effort went into lining all the surfaces inside with black card and making light traps at all openings. Eventually the black-out was so effective that the video camera at highest night vision sensitivity could not make out the white screen at the end of the box. Indeed during testing the faintest hint of a solar disc behind cloud showed up in the camera.

The other strategy employed to deal with anticipated cloud was to mount the whole assembly on the mains equatorial drive, so that once the projector was correctly aimed it would follow the Sun, even behind cloud. This was where the bits of wood came in, to make an adjustable cradle on the equatorial for balancing the big solar projector box.

All this preparation was rewarded on the big day, 8 June, with total cloud cover. From 5 am onwards the dawn seemed to get darker instead of lighter and there was no hint of the Sun's position behind the grey - in fact it looked as if it was going to rain. The only thing for me to do was to scan the TV channels and hope to see live broadcasts of the first and second contacts. Frustratingly the Egyptian TV camera was close up on the left of the Sun for first contact where we would expect to see it, but looking east. Egypt is tilted right relative to us, putting the expected Egyptian first contact at the bottom of the Sun. Then, with the whole of England bathed in sunshine, nobody seemed to be actually broadcasting pictures at the second contact black drop moment.

Disgusted, I persuaded myself that perhaps our sky was looking less like rain and I started setting up the solar projector in the front garden. Before I had finished, I thought I saw a bit of solar disc in the grey. I rushed the final setup and fortunately nearly everything worked, probably thanks to the rehearsal the morning before. The exception was that without direct sunlight there was no shadow round the objective to align the projector with. I had to resort to scanning the sky with the projector, with my head nearly inside the box to keep the light off the screen, while looking

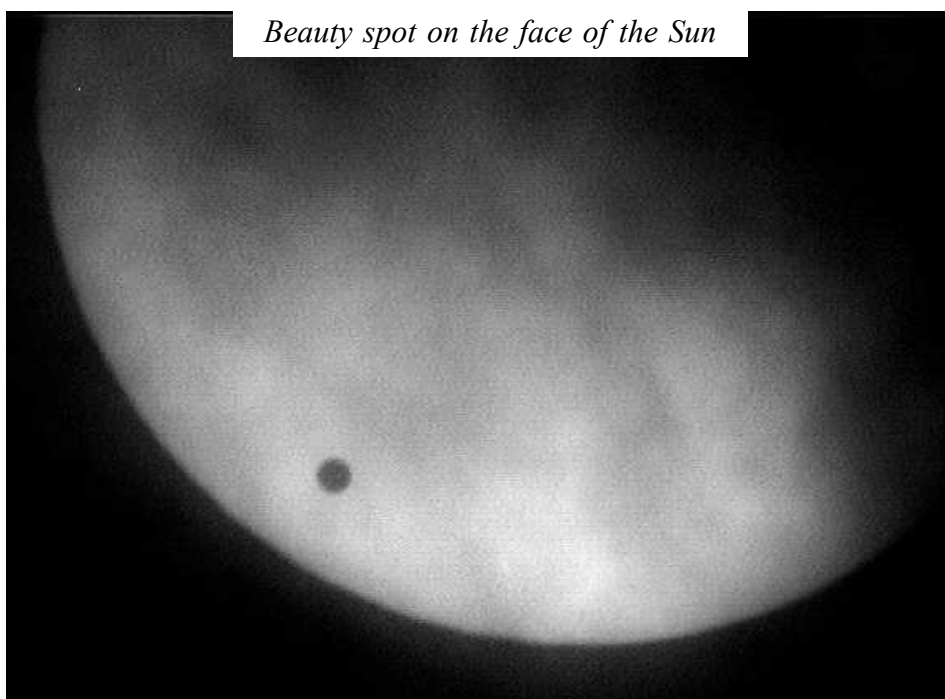
for a hint of solar disc to flash into view. If this was the only glimpse of the transit we were likely to get today I was busy missing it. Indeed when I emerged from the box and looked up, the solar disc had gone.

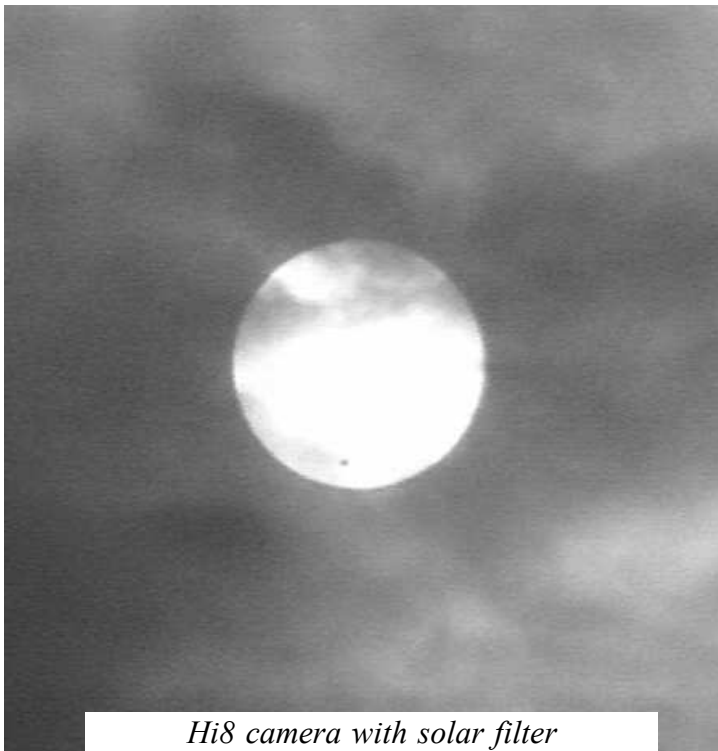
Then great excitement! It appeared again, brighter this time, but still not enough to cast a shadow and I still could not get the projector locked onto it. In desperation I picked up the old Hi8 emergency camera with a solar filter fitted to it. The filter blocked out all the meagre sunlight available, leaving just blackness in the view finder. However, the Sun was persisting. I went back to scanning with the solar projector and at last a solar disc flashed past the screen. Now if only the sun would stay out long enough for me to acquire a tracking lock and get the camera started.

When I got the solar image back on screen and centred it, Eureka! - it had a beauty spot on the lower left of its face. But before I could reach out to start the camera the phone rang in the living room. I thought, even if it is the Astronomer Royal, he will have to use the answering machine right now. It turned out to be someone almost as astronomically eminent - it was Douglas, transit watching in Egypt.

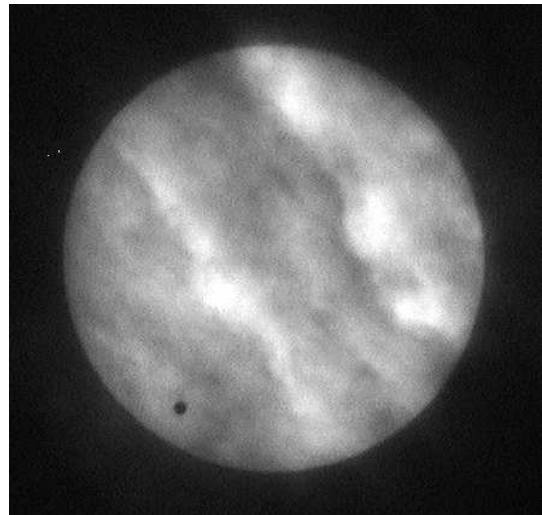
I got my first footage of the hundred and twenty two year rare event as the phone stopped ringing. Later the answering machine played Douglas's glad tidings of clear Egyptian skies for the first and second contacts, and he had heard there was some sun in Britain. Happily the Sun did peer through the gloom several times in the next sixty minutes or so, providing opportunities for me to get video footage. The scurrying cloud created quite a dramatic foreground for the spectacle of Venus silhouetted against the mighty Sun. On one occasion banded cloud made the Sun look a bit like Jupiter and it could be imagined that the Venus silhouette was a Galilean moon shadow.

After about 8 am the Sun was not seen again for about thirty six hours, so I obtained no footage of the last contacts, as well as having already missed the first contacts. But at least there were some pictures of the transit to add to the SAS collection. Also during the window of opportunity several neighbours and passers-by got a chance to glimpse the spectacle in the magic box. So making a solar projector specially for the event turned out to be worthwhile.





*Hi8 camera with solar filter*



*Shadow of a Galilean moon?*

*Chris Davis*

## ***Women in Astronomy - Part 1***

### **CAROLINE LUCRETIA HERSCHEL (1750 – 1848)**

Caroline Herschel (Lina) was born in Hanover, Germany on 16 March 1750, the fifth of six children of oboist and gardener Isaac Herschel and his wife Anna Ilse Moritzen. Caroline was left facially scarred and with a disfigured eye by smallpox at the age of three. She was 4 feet 3 inches in height, a legacy of typhus contracted at the age of ten. She had received a rudimentary education at the insistence of her father, although her mother treated her as a servant. Caroline's interest in science probably began at an early age – she recalled overhearing conversations between her father and elder brothers in which the names of Newton, Leibnitz, and Euler were often mentioned. In 1772 at the age of 22, Caroline's favourite brother, Freidrich Wilhelm (William, born at Hanover in 1738), then an organist in England, brought her back with him to his home in Bath.

William taught Caroline music and voice development and she became well known as an operatic singer in England. However, as her brother's interest in astronomy developed, he trained his sister to assist him, and taught her English and mathematics - algebra, geometry and trigonometry. It was she who carried out the tedious and complicated astronomical calculations from William's observations. When William discovered Uranus in 1781 and astronomy became his livelihood (he was given a £200 per year salary by King George III), Caroline was enabled to make her own observations with a small Newtonian telescope that William had given her (but only when William was away from home!). The Herschels moved to Datchet in August 1782 and in 1783 Caroline discovered three nebulae. In June 1785 they moved to Clay Hall, near Windsor, and in April 1786 to a new home they called Observatory House in Slough. It was there that Caroline discovered her first comet. Caroline also became, from 1787, a paid astronomer. Her astronomy assistant's salary of £50 annually was paid by King George III, who had appointed William as court astronomer.

On 1 August 1786 Caroline discovered her first comet, Comet Herschel (C/1786 P1), which was of magnitude around 7.5. Comet Herschel became a naked eye object on 17 August; a day later



Charles Messier telescopically observed a tail 1.5 degrees long. The comet had reached perihelion on 8 July at only 0.41 AU. Caroline therefore was the first woman in recorded history to discover a comet, a feat that secured her place in astronomical history. More comets were to follow. They were :

- 21 December 1788 - Comet Herschel-Rigollet (35P), found about one degree south of Beta Lyrae, at brightness around magnitude 7.5; it was followed until 5 February, 1789 and its orbit was believed to be parabolic, with perihelion on 21 November at 0.75 AU. This periodic comet returned in 1939-40.
- 7 January 1790 - Comet Herschel (C/1790 A1), reported as having a brightness of 7th magnitude, with perihelion believed to occur on 15 January at 0.76 AU.
- 18 April 1790 - Comet Herschel (C/1790 H1), also having a brightness of 7th magnitude. The comet brightened to 5th magnitude by early May and was developing a visible tail. Perihelion occurred on 21 May at 0.8 AU, by which time the tail was four degrees. The closest approach to Earth in early June was at 0.7 AU, when the comet brightened to 4th magnitude and had a one degree tail.
- 15 December 1791 - Comet Herschel (C/1791 X1), of 6th magnitude. Perihelion occurred on 14 January 1792 at 1.29 AU.
- 14 August 1797 - Comet Bouvard-Herschel (C/1797 P1), of 3rd magnitude and discovered independently by Eugene Bouvard and Caroline. At discovery, Bouvard-Herschel was only 0.17 AU from Earth; it moved even closer, passing by at 0.0879 AU on 16th August 1797.

Subsequently to 1797, Caroline embarked on a new project of cross-referencing and correcting Flamsteed's star catalogue. In 1798 she submitted to the Royal Society an Index to Flamsteed's Observations of the Fixed Stars, together with a list of 560 stars which had been omitted. These catalogues were published by the Royal Society in 1799. The publication marked the temporary end of her own research; she would not begin again until 25 years later after William's death in 1822.

However, Caroline had involved herself with the education of John Herschel (born 1792), the son of William and Mary Herschel. She saw to his education at Cambridge, where he was to become a mathematician of note, be elected to the Royal Society, join his father in astronomical research and be awarded the Copley Medal of the Royal Society for his achievements. Caroline continued to assist William but her status independently was great: she was the guest of Maskelyne at the Royal Observatory in 1799 and a guest of Royalty at various times in 1816, 1817 and 1818. After William's death in 1822, Caroline returned to Hanover. She completed her catalogue of the 2500 nebulae and stars observed by her brother and in 1828 the Royal Astronomical Society awarded her its gold medal for this work. This was followed by honorary membership (along with Mary

Somerville) of the Society in 1835. In recognition of her service to astronomy, Caroline also received a medal in 1832 from the King of Denmark, and in 1846 the Large Gold Medal for science from the King of Prussia.

*"However long we live, life is short, so I work. And however important man becomes, he is nothing compared to the stars. There are secrets, dear sister, and it is for us to reveal them."*  
Caroline Herschel.

Caroline Lucretia Herschel died in Hanover on 9 January 1848 at the age of 97. Her record for comet discoveries by women was to be held until the 1980s, when another female astronomer improved on her record and also established herself in comet history - Carolyn Shoemaker.

In 1889, a minor planet was named Lucretia in honour of Caroline Lucretia Herschel, a fitting tribute to a fine astronomer.

*Sandie Cayless*

◆ This is the first of three articles on *Women in Astronomy* by Sandie.

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## **HOW BIG CAN A STAR BE ? - MUCH BIGGER THAN WE THOUGHT !**

For many years the accepted wisdom has been that there is an upper limit to the possible size of any star, of about 120 times the mass of the Sun. This is based on the theory of how stars are formed by the gravitational collapse of gas clouds and the nuclear reactions which start as the temperature and pressure rise inside the resulting growing proto-star. The effect of the nuclear reactions, initially the conversion of hydrogen to helium, is to halt the collapse and form a stable star, as the outward pressure generated balances the inward gravitational force. In a proto-star growing from the collapse of a very massive gas cloud, the outward pressure from the increasing internal generation of energy eventually exceeds the effect of gravity and it starts to push away additional excess mass from its surface. It has been reliably calculated that this happens when such a proto-star has grown to about 120 solar masses, and so this is the maximum possible mass for a stable star.

Now enter star LBV 1806-20, about 45,000 light-years away on the far side of the Milky Way. This bright blue star has been known for several years and was identified as a "luminous blue variable" (LBV), which are fairly rare, massive and short-lived stars which display light and colour variability. LBV 1806-20's light is largely blocked from our view by intervening gas and dust clouds, and only about ten percent of its infrared light in our direction actually reaches us. The star's apparent magnitude is 8.4. LBV 1806-20 has been further investigated more recently using the 200 inch Hale Telescope at the Palomar Observatory in California. The telescope's camera was equipped with new "speckle imaging" technology to mitigate the interfering effect of the Earth's atmosphere on star observations, and this considerably improved the resulting image resolution. Observations from the four-metre telescope at the Cerro Tololo Observatory in Chile were also used.

LBV 1806-20 turns out to be an incredible body of unimaginable proportions. It is a hypergiant with a total luminosity that varies between 5 and 40 *million* times that of our Sun. Its mass is at least 150 solar masses, way above the previously thought limit, and its diameter has swelled to at least 200 times that of the Sun. Its surface temperature is estimated to vary between 18,000 and 60,000 °K. The previously most massive and luminous star known was the Pistol Star (named from the pistol-shaped nebula surrounding it), of about 100 solar masses and six million times brighter than the Sun. The possibility of LBV 1806-20 being an unresolved dense cluster of lower-mass stars has been ruled out by the high resolution of the observations, although there is a small

chance that it could be a binary star system. Theoretically this would present other problems, first because the variable light from it is characteristic of a single star, and secondly it is not known how two massive bodies could have formed and coexist so close to one another.

So - is it back to the drawing board for the theory of stellar formation ? Probably not, as LBV 1806-20 seems not to have been formed in the conventional way. It is situated at the edge of a small cluster of massive stars contained within a volume less than 6.5 light-years across, and which includes a number of other peculiar stars - two blue hypergiants, two carbon-rich stars, a rare magnetic neutron star known as a soft gamma-ray repeater, and a massive proto-star - a star still being born. LBV 1806-20 also lies at the core of a radio nebula which is powered by the tremendous stellar wind generated by LBV 1806-20 itself, and it is located close to a molecular cloud from which the whole cluster could have originated.

LBV 1806-20 is most likely to have been formed as a special case of shock-induced star formation. The nearby magnetic neutron star is the remnant of an earlier massive star which reached the end of its life span and exploded in an intense supernova between one and two million years ago. This also fits the age of LBV 1806-20. The shock wave from the exploding supernova could have quickly - over only 100,000 years or so - compressed nearby gas and dust from the molecular cloud which was already collapsing under gravity into a proto-star. The combined gravitational force and the extra shock force of compression would then have resulted in the growing proto-star growing far beyond the usual size limit described earlier, before the increasing outward pressure exceeded these combined opposing forces and excess mass started to be shed.

In general, the more massive a star, the quicker it burns its nuclear fuel and the shorter is its life. LBV 1806-20 is only about a million years old but is already middle aged. It is losing vast amounts of gas from its outer layers in an intense stellar wind and in enormous eruptions. The ejected gas, mostly hydrogen, is moving away from it at speeds of 50 to 500 km per second and this has formed the nebula, bright at radio wavelengths, seen around it. In only another million years or so it will have burned all its nuclear fuel and will explode as a Type-II supernova, or as a hypernova with an intense burst of gamma radiation. For comparison, stars like our Sun, which is five billion years old, live for about ten billion years. It is perhaps fortunate for us and our descendants that LBV 1806-20 is the other side of the Galaxy to us !

*Derek Allen*

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## **FORTHCOMING EVENTS**

**Scottish Astronomy Weekend**, 27-29 August 2004 at the Dundee West Park Centre. The theme will be "Deep Sky Objects". Two of the speakers will be Guy Hurst, the BAA President, and Martin Lunn from York. Further details from Douglas Cooper.

The third **Scottish Astro-Fest** is being organised by Wigtonshire Astronomical Society for 12-13 November 2004. They are asking for assistance with ideas and speakers. Any suggestions please to Martin Thomson, tel. 01988 402242 or e-mail [martin@thomson40.freemove.co.uk](mailto:martin@thomson40.freemove.co.uk)

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## SAG MEETING, FEBRUARY 2004

### Report by Douglas Cooper

The Spring Meeting of the Scottish Astronomers' Group was held on Saturday 21 February in the Mitchell Library, Glasgow. This is a spacious and well appointed venue, and the Astronomical Society of Glasgow made us very welcome.

The main speaker for the day was Dr Martin Hendry from the Department of Physics and Astronomy at Glasgow University. His talk was based on the forthcoming transit of Venus on 8 June this year, and he began by detailing the significance of the historical background to the understanding of such events. As the last observable crossing of the Sun's disc by the planet Venus was in 1882, Martin pointed out that there is unlikely to be any person alive who had witnessed this event! People should therefore make every opportunity to view the forthcoming transit, with appropriate safety measures of course.

Captain Cook's famous expedition to Tahiti in 1769 was to observe the transit of Venus in June of that year, thereby allowing calculation of the distance from the Earth to the Sun - the Astronomical Unit. But the story started long before that. Martin detailed the historical development of the concepts of the solar system and the motions of the planets, starting with the geocentric circular models of Plato and Aristotle, where all major objects in the universe are perfect spheres and are deemed to move in perfect circles around planet Earth. In the third century BC, Aristarchus used geometrical arguments to conclude that the Sun, not the Earth, is at the centre of the Universe. At the same time, Eratosthenes made an accurate measurement of the size of the Earth, by comparing the directions toward the Sun from two widely separated points on the Earth's surface. Hipparchus, in the second century BC, made precise observations, applied new mathematical techniques to astronomy, discovered precession, and developed the epicyclical theory of planetary motion, where planets follow smaller circular orbits superimposed on their believed main motion around the Earth. In the second century AD Ptolemy used the epicyclical theory to construct tables of planetary motion that were used throughout the Dark Ages.

Enter Copernicus, Tycho Brahe, Johannes Kepler, and Galileo. In the 16 Century, Copernicus rejected the geocentric model in favour of the Sun centred (heliocentric) theory because it provided a more unifying picture of the Universe. With this model he was able to calculate the relative distances of the planets from the Sun, and was able to explain the seasons of our year and the lack of detectable parallax, that is the predicted displacement of nearby stars against distant background stars at different times of the year. The colourful Danish astronomer Tycho Brahe made vast improvements in the quantity and quality of astronomical observations of the stars, and more especially the planets, using a variety of instruments at his well equipped observatories, supported by the Danish royal family. Tycho was unable to detect stellar parallax, and for this and philosophical reasons, he rejected the heliocentric hypothesis. Tycho's legacy was a wealth of data for those following him to unravel, particularly a young astronomer named Johannes Kepler who had been his assistant in Prague for a short time before his unfortunate death.

Through painstaking analysis of the data, Kepler sought the underlying harmony among the planets and its physical basis, and he discovered three fundamental laws of planetary motion:-

1. Each planet orbits the Sun in an ellipse, with the Sun at one focus.
2. A planet moves fastest when it is closest to the Sun and slowest when farthest away, in such a manner that the area swept out in space by a line connecting the planet to the Sun is equal in equal intervals of time.

3. The square of the orbit period of a planet is proportional to the cube of the semi-major axis of the elliptical orbit.

Thus Kepler was able to make very precise predictions about the motion of the planets, even to the extent of predicting transits of the planets Mercury and Venus across the face of the Sun, these being the two planets closer in orbit to the Sun than Earth. This was a major achievement.

Contemporary with Kepler, Galileo Galilei carried out observations and experiments in Italy, by which he defined several important concepts of physics, including the ideas of inertia and acceleration. Following Hans Lippershey's development of the telescope in 1608, Galileo's observations of the heavens led to several discoveries that he used to refute the geocentric hypothesis. These were :

1. The discovery of many faint stars was difficult to reconcile with the idea of stars as points on an interconnected sphere.
2. Craters on the Moon proved that the Moon was not a perfect body.
3. Moons circulating Jupiter indicated a body other than the Earth as a centre of motion.
4. Phases of Venus could only be explained if Venus orbits the Sun, and shines by reflected light.
5. Spots on the Sun indicated that the Sun is not perfect.
6. The variation in angular planetary sizes was explained by the motion of the planets around the Sun, rather than around the Earth.

Galileo's publications included the *Sidereus Nuncius* and a treatise called in translation: 'The Dialogue on the Two Chief World Systems'. As is well documented, Galileo's assertions got him into a lot of trouble with the doctrine of the Church. He was effectively confined by house arrest, but science won out in the end.

Although Kepler had died, his predicted transit of Mercury was observed by Gassendi, and a rarer transit of Venus was recorded by the young Englishman Jeremiah Horrocks in 1639. It was realised that by using simple trigonometry, and by simultaneously observing the transit of Venus from different locations on the Earth's surface, it was possible to determine the Astronomical Unit - the distance from Earth to the Sun. The radius of the Earth was already known to a reasonable accuracy.

The 1761 transit of Venus yielded the AU to an accuracy of 20% - or between 77 and 97 million miles. The Astronomer Royal, Nevil Maskelyne, sailed with Captain James Cook to the South Seas in 1769 to observe and record the six hour transit of Venus. From this event, calculations by Thomas Hornby yielded the AU as lying between 90 and 94 million miles. Unfortunately the 'Black Drop Effect' at second and third contacts with the outer edge of the Sun, caused by refraction effects of the atmosphere of Venus, renders exact measurements difficult. This method of determining the AU was therefore abandoned in favour of a different method involving observations of Mars. In 1877 David Gill observed the parallax 'motion' of Mars from Ascension Island, and determined the AU to within an accuracy of better than 1%. Nowadays, techniques such as radar echoes from Venus are used.

So, when you are making your observations of the Transit of Venus on 8 June this year, just remember the build up to the prediction and understanding of this event, and give a thought to all those who have gone before you.

*Douglas Cooper*

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## SALT - A NEW BIG TELESCOPE FOR THE SOUTHERN HEMISPHERE

Construction of the southern hemisphere's largest single optical telescope is due for completion at the end of this year in South Africa. It is at the South African Astronomical Observatory in the Karoo desert near the small town of Sutherland in the remote Northern Cape. The site provides very favourable conditions for viewing, as it is 1759 m above sea level and free from effects of light pollution. It has the mundane name of the "South African Large Telescope", or SALT.

SALT is similar to the Hobby-Eberly Telescope at the McDonald Observatory in Texas. It has a ten metre wide segmented mirror array consisting of 91 panels. The optical system is an improvement on the Hobby-Eberly telescope, with a field of view four times greater and also in the way the series of mirrors in the array more accurately correct distortions and aberrations in the light collected by the telescope. SALT will enable astronomers to view objects a billion times fainter than can be seen with the naked eye - the equivalent to seeing the light of a candle on the Moon from Earth. The European Southern Observatory in Chile is more powerful than SALT when its four slightly smaller telescopes are integrated to operate as one, but SALT has other advantages. It is on a different longitude and can cover 70% of the southern hemisphere sky, and it can take exposures of seconds or tenths of a second, much shorter than other comparable telescopes.

The telescope weighs 82 tonnes and is housed in an observatory with a rotating dome having an eleven metre hexagonal opening panel. Most nights it will be manned by only two people, an astronomer and an operator, and it will run up to a dozen separate viewing projects each night. The following morning the data gathered will be sent via the internet to researchers around the world.

The SALT project started five years ago after it received the approval of the South African government. It is jointly funded by research institutes in South Africa itself and in the USA, Poland, Germany and the UK. Canada and Japan may join later. As well as funding for its construction, funding has so far also been secured for seven and a half years of its operation. It is, however, expected to continue to operate for several decades. Economically, it is hoped by the government that SALT will also bring benefits to what is a depressed area, including tourism. SALT may be the forerunner of even bigger things. Northern Cape is in the running as the site for what will be the world's most powerful radio telescope. This is the Square Kilometre Array (SKA), a billion dollar project to construct a radio telescope a hundred times more powerful than any existing one. Other possible sites for this being considered by the international scientific committee in charge are the USA, Mexico, Brazil and Argentina. A decision will be made next year.

*Derek Allen*

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### THE SKY AT NIGHT : July, August, September 2004

SUN	July		August		September	
	11	25	8	22	5	19
(approx) Rises	04.47	05.09	05.35	06.02	06.30	06.57
(approx) Sets	21.57	21.36	21.08	20.36	20.00	19.23

MOON	July				August				September				
Phase	FM	LQ	NM	FQ	FM	LQ	NM	FQ	FM	LQ	NM	FQ	FM
Date	2	9	17	25	31	7	16	23	30	6	14	21	28
Rises	22.52	06.54	03.42	14.39	21.51	22.55	05.25	15.33	20.33	21.49	05.53	16.18	18.55
Sets	03.17	13.43	22.24	23.43	03.35	14.06	21.14	22.20	05.56	15.48	19.38	21.35	06.28

**PLANETS****Magnitude**

<b>MERCURY</b>	<i>July</i>	Unsuitable for observation	
	<i>August</i>	Unsuitable for observation	
	<i>September</i>	Visible morning first week of month, low E sky near Regulus. Unsuitable for observation last few days of month	+1.2 to -1.2
<b>VENUS</b>	<i>July</i>	Very bright Morning object E sky	-4.0
	<i>August</i>	Bright Morning object E sky before sunrise	-4.3
	<i>September</i>	Bright Morning object E sky before sunrise, at beginning of month passing south of Castor & Pollux	-4.2
<b>MARS</b>	<i>July</i>	Unsuitable for observation	
	<i>August</i>	Unsuitable for observation	
	<i>September</i>	Unsuitable for observation	
<b>JUPITER</b>	<i>July</i>	Evening object in W sky	-1.8
	<i>August</i>	Evening object in W sky after sunset for first few days of month	-1.7
	<i>September</i>	Unsuitable for observation	
<b>SATURN</b>	<i>July</i>	Unsuitable for observation	
	<i>August</i>	Visible morning SE sky, moving eastwards in Gemini	+0.2
	<i>September</i>	Visible morning E sky before midnight by end of month	+0.1
<b>NEPTUNE</b>	<i>August</i>	At opposition on 6th in Capricornus, not visible to naked eye	+7.8
<b>URANUS</b>	<i>August</i>	In Aquarius	+5.7

**CONSTELLATIONS** (near meridian at 22.00)*16 July* Ursa Minor, Draco, Hercules, Ophiuchus.*16 August* Draco, Lyra, Cygnus, Sagitta, Aquila, Ophiuchus, Serpens*15 September* Draco, Cepheus, Cygnus, Delphinus, Sagitta, Capricornus.**METEORS***August* Perseid shower morning of 12th, little interference from old crescent moon**ZODIACAL LIGHT***September* Morning cone can be seen reaching up from eastern horizon along the ecliptic before the beginning of the morning twilight from the 12 to 26**CONJUNCTIONS** (with the Moon unless otherwise stated, and based on observing at 51°N)**July**

<i>Day</i>	<i>Time</i>		<i>Day</i>	<i>Time</i>	
5	11.00	Earth at aphelion (152 million km)	16	22.00	Saturn 5°S
			18	05.00	Mars 4°S
8	18.00	Saturn in conjunction	19	20.00	Mercury 5°S
11	01.00	Mars 0.2°S of Mercury	21	17.00	Jupiter 3°S
13	23.00	Venus 8°S	27	04.00	Mercury at greatest elongation E 27°

<b>August</b>			<b>September</b>		
<i>Day</i>	<i>Time</i>		<i>Day</i>	<i>Time</i>	
6	04.00	Neptune at opposition	2	14.0	Mercury at stationary point
10	02.00	Mercury at stationary point	9	15.00	Mercury at greatest elongation W 18°
11	00.00	Venus 8°S			
13	11.00	Saturn 5°S	10	01.00	Saturn 5°S
16	23.00	Mars 3°S	10	20.00	Venus 6°S
17	03.00	Mercury 9°S	13	05.00	Mercury 3°S
17	20.00	Venus at greatest elongation W 46°	14	16.00	Mars 2°S
18	08.00	Jupiter 2°S	15	02.00	Jupiter 2°S
18	21.00	Mars 6°N of Mercury	15	14.00	Mars in conjunction
23	22.00	Mercury in inferior conjunction	22	01.00	Jupiter in conjunction
27	20.00	Uranus at opposition	27	01.00	Jupiter 0.2°N of Mars
30	20.00	Pluto at stationary point	29	02.00	Jupiter 0.6°S of Mercury
31	17.00	Saturn 2°N of Venus	29	20.00	Mars 0.8°S of Mercury

*Compiled by Hamish MacPhee*

## **SATURN ACQUIRES A NEW SATELLITE**

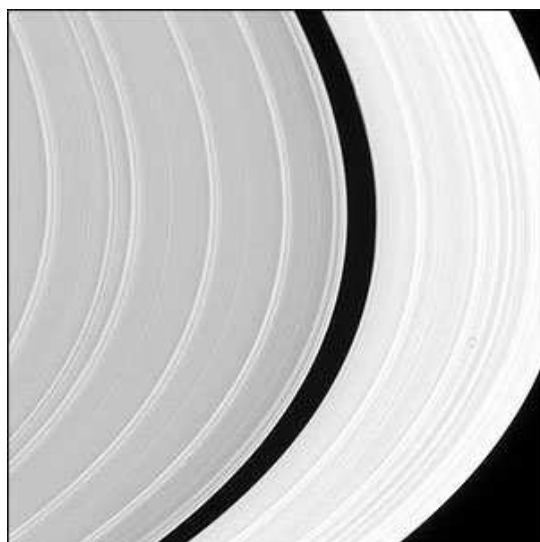
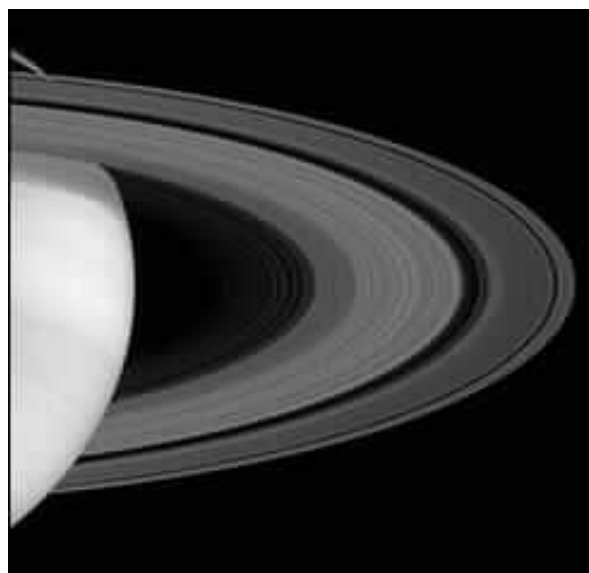
Saturn now has a new satellite - the spacecraft Cassini-Huygens which went into orbit around it on the 1st of this month. The Cassini-Huygens mission is a co-operative venture between NASA, the European Space Agency (ESA) and the Italian Space Agency (ISA). It is being managed by the Jet Propulsion Laboratory (JPL) in Pasadena. The spacecraft was launched from Cape Canaveral on 15 October 1997. To reach Saturn it had to perform a series of gravity assist manoeuvres around Venus (April 1998 and June 1999), Earth (August 1999) and Jupiter (December 2000). The direct distance between Earth and Saturn at present is 1.5 billion km, but Cassini-Huygens has travelled 2.2 billion miles to get there.

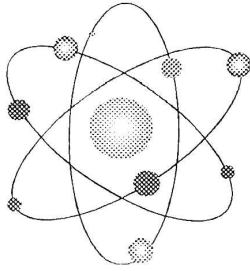
The Cassini orbiter is the largest and most complex deep-space vehicle ever launched and carries twelve science instruments to conduct a four year in-depth study of Saturn, Titan, the icy moons, the ring system and the magnetospheric environment. It will measure magnetic fields, radio waves, charged particles, cosmic dust, infrared and ultraviolet light. It will make at least 76 orbits around Saturn and have 52 close encounters with seven of its 31 known moons. This tour actually began before it went into orbit, with a close fly-by of an eighth moon, Phoebe, on 11 June. The primary target for Cassini-Huygens is the largest of Saturn's moons, Titan. Its first fly-by of Titan, at an altitude of 1200 kilometres will be on 26 October. The Huygens probe will be released from the orbiter on Christmas Day and will enter the atmosphere of Titan on 14 January 2005. Huygens carries six science instruments to enable it to analyse and characterise Titan's atmosphere and its dynamics during the descent. If the probe survives the impact on reaching the surface, it will also analyse the physical properties of its environment after landing. Titan is actually bigger than Mercury and has a hazy nitrogen-rich atmosphere containing carbon-based compounds. The chemical environment on Titan is thought to be similar to that of Earth before life started, although it is colder (-180°C) and lacking liquid water. The in situ results from Huygens, combined with global observations from repeated fly-bys of Titan by the Cassini orbiter, are expected to help us understand the evolution of the early Earth's atmosphere and to provide clues about the mechanisms that led to the dawn of life on Earth.

The mission takes its name from two 17th Century astronomers. Jean-Dominique Cassini from Italy identified and named four of Saturn's moon while Christiaan Huygens, a Dutchman, discovered Saturn's rings and first saw its moon Titan.

Cassini-Huygens has already sent back some fascinating new pictures of Saturn and its rings. Some of these are reproduced below.

*Derek Allen*





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## STIRLING ASTRONOMICAL SOCIETY

For information about Stirling Astronomical Society, membership and activities, please contact the Secretary, Hamish MacPhee :

Tel : 01786 462310

E-mail : [hamish@hmacphee.freeserve.co.uk](mailto:hamish@hmacphee.freeserve.co.uk)

Or visit the website : [www.stirlingastronomicalsociety.org.uk](http://www.stirlingastronomicalsociety.org.uk)

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### STIRLING ASTRONOMICAL SOCIETY MEETINGS

Regular Society Meetings are held from September through to May. Lecture Meetings take place on the second Friday of the month in the Smith Museum Lecture Room, Dumbarton Road, Stirling from 7.30 pm to 9.30 pm. Details of the lecture programme are available from the Secretary. They are also published in *Mercury* and are announced immediately beforehand in the *Stirling Observer*. These Meetings are free and anyone with an interest in astronomy is welcome to attend, whether a member of the Society or not.

Members' Evenings are informal discussion meetings which are held on the last Friday of the month at the Mayfield Community Centre, St. Ninians, Stirling, from 7.30 pm to 9.30 p.m.

Exceptions to this timetable are the meetings on 17 December 2004 and 18 March 2005.

At suitable times and weather conditions, arrangements are also made for groups of members to meet for observation sessions.

The outline 2004-2005 programme of Meetings is as follows. More details will become available in due course.

#### 2004

10 September	Douglas Cooper	The 2004 transit of Venus from Egypt
24 September	Members' evening	
8 October	<i>Speaker and title to be confirmed</i>	
29 October	Members' Evening	
12 November	AGM and two short talks	
26 November	Members' Evening	
10 December	Mark Butterworth	<i>Title to be confirmed</i>
17 December	Christmas Meeting	

#### 2005

14 January	<i>Speaker and title to be confirmed</i>
28 January	Members' Evening
11 February	<i>Speaker and title to be confirmed</i>
25 February	Members' Evening
11 March	<i>Speaker and title to be confirmed</i>
18 March	Members' Evening
8 April 8	<i>Speaker and title to be confirmed</i>
29 April 29	Members' Evening
13 May	<i>Speaker and title to be confirmed</i>
27 May	Last Members' evening until September

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## **EDITORIAL**

Thanks to all contributors. Please think about pieces or articles for the next issue. Items describing events or the activities of the Society, or of individual members or groups of members, are especially welcome.

Please send your contribution to (or first discuss it with) the Editor :

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Copy can be in clear handwriting, typescript, image for scanning, e-mail attachment, or on floppy disk, in that ascending order of preference for editing. Contributions should usually be not more than about 750 words in length, or 1000 at the most. Please try to have material ready by the end of August for the next issue of *Mercury* due out the beginning of October 2004.


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#### **Stirling Astronomical Society OFFICERS AND COMMITTEE FOR 2004**

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<i>Secretary</i>	Hamish MacPhee
<i>Treasurer</i>	Dr Iain Smith
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