. . ROUNDUP . . ROUNDUP . .

Advertisements

Do you have anything for sale, or do you want anything (preferably, but not necessarily astronomical)? Advertise here - no charge.

Radio interviews

Geoff Falla, Section Secretary was interviewed live on BBC Radio Guernsey News on the 11th August about the Perseid meteor shower.

Your Editor will appear on John Tyler's *After Six* programme on BBC Radio Guernsey on the 3rd October, from 6.10 pm to 7.00 pm.

Astronomy Section Officers

Section Secretary:	Geoff Falla	724101
Honorary Treasurer:	Peter Langford	720649
Light Pollution Officer:	Ken Staples	54759

The next newsletter will be published early in November. The deadline for publication materials is 15th October.

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Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise

September/October 1994

Forthcoming events

My Favourite Object
Tuesday, 13th September
8.00 pm at the Observatory

Video Evening and Star Night
Tuesday, 11th October
Starting at 7.30 pm
at La Houguette School,
then from about 8.30 pm
at the Observatory

Plus
regular meetings every Tuesday night from 7.30 pm,
and
observing meetings every Friday night after dark.

Starting in this issue:
a two-part series on
The Sun, by Lawrence Guilbert

Inside

Major articles in bold

Centre Inserts

Cassiopeian clusters
September/October star chart

Your favourite objects

On Tuesday, the 13th September, starting at 8.00 pm at the Observatory, the month's "formal" meeting will be an informal one. Members will invited to talk for a few minutes each on the subject of ***"My Favourite Object"*** - the celestial object which they most enjoy looking at (through telescopes or in books). It may be the Sun, the Moon, a planet, a Messier object, a comet, or anything else which gives you most pleasure. Or perhaps more than one object fits the bill. It may even be a class of objects.

If you can say something about the object, eg how far away it is, what it is, why it appears the way it does, and particularly why it interests you, so much the better. A picture of the object would also help. The idea of the meeting is that we should all learn something about objects which we as individuals may not necessarily find terribly exciting, but which nevertheless fascinates other members. We should also learn more about each other in the process (and perhaps more about ourselves!).

This will not be a "stand up and talk meeting", but rather an informal chat around the table, over a cup of coffee or tea. Even if you can't think of a favourite object, come along, listen and learn. ¤

Women's Institute visit

On Monday, the 26th September, about 14 members of the Mare de Carteret Women's Institute will be visiting **the Observatory, starting at 7.30 pm.** This will follow-up a talk on astronomy to be given to the WI by David Le Conte two weeks earlier. Any member able to assist on the 26th would be most welcome. ¤

Video evening and star night

Events when the public are made welcome at the Observatory are becoming a fixture on our calendar. Last year we held a very successful "Video Evening and Star Night", when about 70 members of the public turned up. A number of videos were shown, and people then had the opportunity of looking through the telescopes and learning something about the night sky. Because of the numbers of people the videos were shown in La Houguette School hall, just 50 yards down the road from the Observatory.

We will be repeating this event **on Tuesday the 11th October.** Last year we started at 6.30 pm, in the hope of attracting as many young children as possible. However, we found that this was too early, and many people came late. This year, therefore, we will be **starting at 7.30 pm at La Houguette School.** About 30 minutes of videos will be shown, and we then expect to be **at the Observatory soon after 8.00 pm**, by which time it should be good and dark.

Helpers are needed to make this event a success. Firstly, we need videos, so if you have something suitable please let Geoff Falla know. Short extracts (not more than 10 minutes) are preferable to long films, but we can always show just a piece of a video. We might also be able to show computer images received by the Hubble Space Telescope of the recent comet impacts on Jupiter, for example.

Secondly, helpers are needed, not only to man telescopes and help people, but especially to sell publications, get people to sign the visitors book, collect donations, etc. So please volunteer now to help. ¤

HST brought up-to-date

A packed, or rather overflowing, house heard Daniel Cave talk about the Hubble Space Telescope on the 19th July. No less than 29 people were counted, many having to stand (the last one to come did so through the window, as he could not get in the door!)

In a comprehensive talk well illustrated with colour slides, Daniel spoke of the achievements of the telescope worth seven times its weight in gold. He described the instruments, the launch on the Space Shuttle Discovery (showing spectacular pictures of the release of the spacecraft from the Shuttle), the subsequent imaging problems due to the deficiency in the main 2.4 metre mirror, the problems with the gyroscopes and solar arrays, and the successful repair mission last December.

He then showed a series of beautiful images taken by the telescope, including: Mars, Jupiter, Saturn, Pluto with Charon, the Einstein's Cross gravitational lens system, the NGC1275 galaxy in Perseus (probably the result of a collision of two galaxies), the Whirlpool Galaxy M51, the 1987 supernova in the Large Magellanic Cloud, the M100 galaxy, Nova Cygni 1992, and the star-forming region of the magnificent 30 Doradus Nebula.

Probably the most exciting images shown were the protoplanetary discs found in the Orion Nebula since the repair of the HST. However, undoubtedly the "star" turn of the evening was the series of bang up-to-date pictures of the impacts of the Comet SL9 fragments, which had been obtained by photographing television and computer screens. We were then able to go outside and actually see the impact marks for ourselves through the telescope. ¤

Perseid meteor watch

The annual Perseid meteor watch is always interesting, and usually provides a good display with several spectacular meteors. This year was no exception. Predictions were that the meteor shower would be as good as last year, although the timing of the shower peak seemed rather uncertain. No doubt this will be confirmed when all the results have been collated.

The planned watch following our barbecue on the evening of Thursday, 11th August, was unfortunately too cloudy for observations, but the following night proved much better. Four Section members gathered at the Observatory and kept watch in different directions of the sky, from 10.55 pm BST until 00.35 am on Saturday. Fifty meteors were observed, all but six recorded as Perseids, the remainder considered to be "sporadics". The most productive period was between midnight and five minutes past, during which time no less than ten meteors were counted, including, at five minutes past midnight, a spectacular meteor - estimated magnitude minus 4 - which left a luminous train remaining visible for at least 15 seconds.

After about 1½ hours of observation, and with increasing cloud cover, the watch was ended with some well-earned coffee in the Observatory. Altogether an enjoyable exercise, which always produces some celestial "fireworks". Recorded observations are to be forwarded to the Meteor Section of the Society for Popular Astronomy. ¤

Geoff Falla

About a dozen people - members and families - enjoyed an excellent meal on the 11th August. Many thanks to Hugh Lenfesty for providing the barbecues.

That was the week!

The week of the 18th July was a memorable one. Night after night, starting on Tuesday, the 19th, Section members watched through the 11-inch and 14-inches telescopes at the remarkable effects of the collision of Comet Shoemaker-Levy 9 with Jupiter. The events had considerable publicity, and about 100 members of the public visited the Observatory during the week.

The dark marks were clearly visible, rotating with the planet. It was fun to try to work out which mark matched with which fragment, and whether we were seeing the same marks on several successive rotations. Up-to-date predictions and information on observations around the world were obtained through modem links with the Royal Greenwich Observatory computer, which carries the latest bulletins issued by the International Astronomical Union. These bulletins inform the world's astronomical community of all events and observations of significance, usually within a few hours of their occurrence.

Later in the week the first images taken by the Hubble Space Telescope became available over computer links with NASA and the Space Telescope Institute, as well as on television and in newspapers. We could then see in greater detail the impact markings which we had observed through the telescopes (see page 5).

Some members also observed Jupiter with their own telescopes, and all reported easily seeing the impact markings. At the time of writing (end of August) some of the marks are still clearly visible, and in fact appear almost to have formed a ring around the planet.

Clean-up day

Several members spent most of Saturday, the 6th August working at the Observatory, and much was achieved. In addition, Bert Ozanne, who could not come on that day, spent a day and a half painting the C14 building, which now looks as good as new.

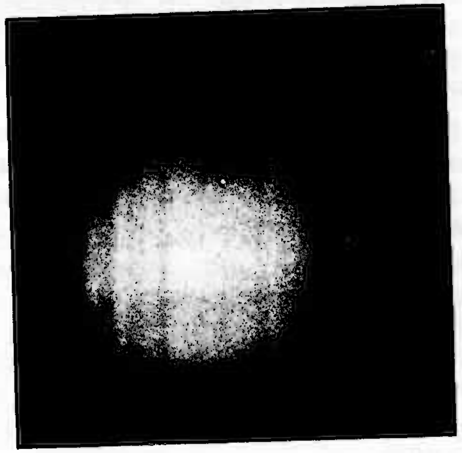
Geoff Falla painted the frame on which the roof rolls back. Roger Chandler completed the painting of the toilet, replaced broken glass in the shed, and did a number of other jobs. Ken Staples fitted the coving (yes, it is finally done!) and fixed the large magazine rack horizontally on the wall. This is a much better arrangement, and looks much neater than standing vertically on the floor with the magazines hanging out. Daniel Cave worked on the C14 telescope controls, organised the library and magazines, and worked with Ken. Lawrence Guilbert checked our holdings of magazines. David Le Conte was also seen on the site, doing mysterious things with rods, clocks, a sundial, an astrocompass, a solar compass, a tape measure, protractor, and bits of plywood.

Many thanks to all who turned up. ***DLC***

14-inch telescope work

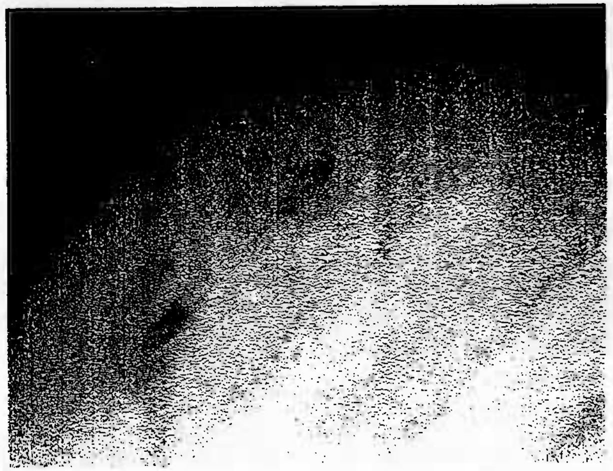
John Taylor, Daniel Cave and David Le Conte spent half a day in August working on the electronic controls of the 14-inch Celestron telescope. The controls had ceased working as designed, and investigation showed some corrosion of contacts. A thorough cleaning and rebuilding has resulted in the slewing motion now working properly. A new hand control box is to be built to provide a finer control of the motion, so that it can be more effectively used once the object is within the field of view.

Images of Comet Shoemaker-Levy 9's impacts with Jupiter



Above: The planet and comet impact marks photographed by David Le Conte with the 14-inch Celestron on 17 July 1994.

Above: A composite photograph, assembled from separate images of Jupiter and Comet Shoemaker-Levy 9, imaged by the Hubble Space Telescope's Wide Field and Planetary Camera-2 (WFPC-2). Jupiter was imaged on the 18th May 1994. The dark spot is the shadow of Jupiter's moon Io. The comet's fragments were imaged on the 17th May, as they headed for the July impact with the planet.



The comet impacts imaged by the Hubble Space Telescope

Famous lives - 4
Galileo Galiliei
(1564 - 1642)

We may well consider Galileo to be one of the giants of astronomy, but I have to tell you that he is also considered to be the founder of modern mechanics and experimental physics. His most important work, in all probability, was in the field of gravitation and motion, and in his ability to combine mathematical analysis with experimentation.

Galileo was born in Pisa on the 15th February 1564. In 1581 he attended the University of Pisa to study medicine. Sadly, he had to leave the University in 1585, before the end of his training, due to a lack of funds. However, in 1586, while lecturing at the Florentine Academy, he described the hydrostatic balance, and this established his name and reputation throughout Italy.

This was followed in 1589 by a paper on the centre of gravity in solids. As a direct result, he was appointed Lecturer in Mathematics at the University of Pisa, where he was to remain for just three years, until 1592 when he was appointed Professor of Mathematics at the University of Padua. It was here that he was to undertake his great work in motion, and his major astronomical discoveries. He was to remain in Padua for 18 years.

During this time his work on motion and gravitational attraction was to result in the law of uniformly accelerated motion, where an object speeds up or slows down uniformly with time. He also formulated the law of parabolic fall, where an object thrown into the air follows a parabolic path. Sadly, it seems that the lovely story of Galileo dropping different weights from the Leaning Tower of Pisa is pure fiction.

Let me turn now to Galileo the astronomer. Let me make one thing quite clear - he did not invent the telescope - but he did modify and improve the original design. His discoveries were to astound the scientific community and frighten the all-powerful Catholic Church and its vested interests.

Galileo had long believed the Copernican Theory, but, as some of his correspondence to Kepler shows, he was afraid to make his beliefs public. However, in 1609/10 he constructed his own telescope, and eventually produced an instrument with a 32x magnification. With this instrument he was to observe the Moon and establish that it was not a smooth object, but that it had vast mountain ranges and an irregular surface.

He also observed Jupiter, and eventually established that the points of light he saw around the planet moved in orbit about it, and that they must therefore be moons. He named them *Sidera Medicea* or Medican Stars in honour of his future employer and former pupil Cosimo II, Grand Duke of Tuscany. We know them as: *Io*, *Europa*, *Ganymede*, and *Callisto*.

He also turned his telescope upon the Milky Way, and found that it consisted of thousands of stars. He also saw spots upon the Sun's surface, which again caused disquiet as the Sun was considered perfect - how could it be blemished? Galileo was also the first person the observe the phases of Venus, the rings of Saturn and star clusters.

Can you imagine the excitement he must have felt? The whole of creation was being opened up to him. He was seeing things no human had ever seen before, »»

and in such detail. Perhaps his excitement can only be compared to that of modern day astronomers as they see the pictures beamed to Earth by the Hubble Space Telescope.

His discoveries were published in 1610 in his work *Sidereus Nuncius*, the Starry Messenger. Shortly afterwards he was to move again, this time to become the first "Mathematician and Philosopher" to the Grand Duke of Tuscany.

Events were now beginning to go against Galileo as his work supported the teachings of Copernicus and Kepler. It showed that the Earth did go around the Sun, and it was not the centre of the universe. As a result, in a decree published in 1616 Galileo was forbidden to "hold or defend" those teachings, although they could be discussed as a mathematical supposition.

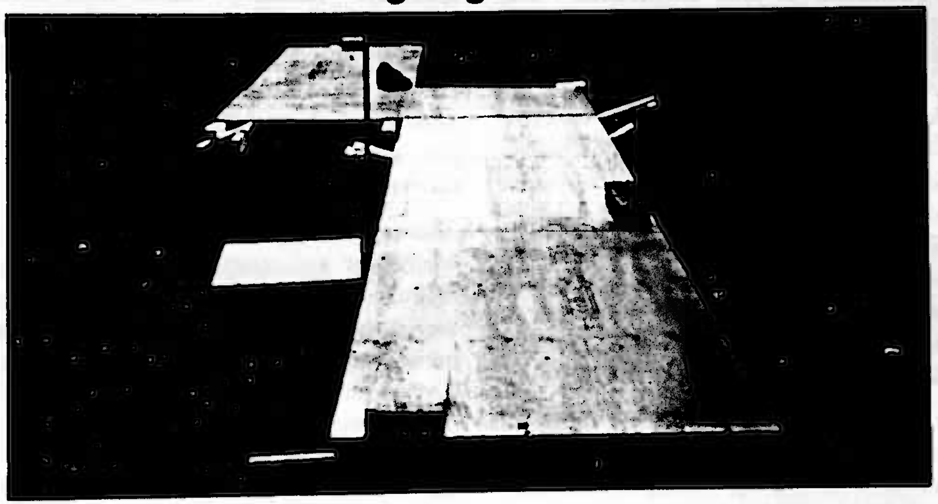
Over the next few years Galileo busied himself with his research work into mechanics, until in 1632 he published his work: *Dialogue Concerning the Two Chief World Systems - Ptolemaic and Copernican*, where he argued for and against the two great systems. But it was now clear to all who read the work where Galileo's beliefs lay. He was summoned to Rome in 1633 to stand trial for heresy. He was found guilty, but his sentence was commuted to house arrest and seclusion.

Galileo spent the last years of his life on his estate at Arcetri outside Florence. During these years he discovered the Moon's monthly libration, and continued his theoretical work to the end, having gone blind in 1637. His final work on the mechanics of pendulums was put to use by Huygens, and his other works on gravity were to be used to great effect by Newton.

The life of one of the world's greatest scientific minds came to an end in January 1642, his place as an astronomer. physicist, mathematician and philosopher assured for all time. ¤

David Williams

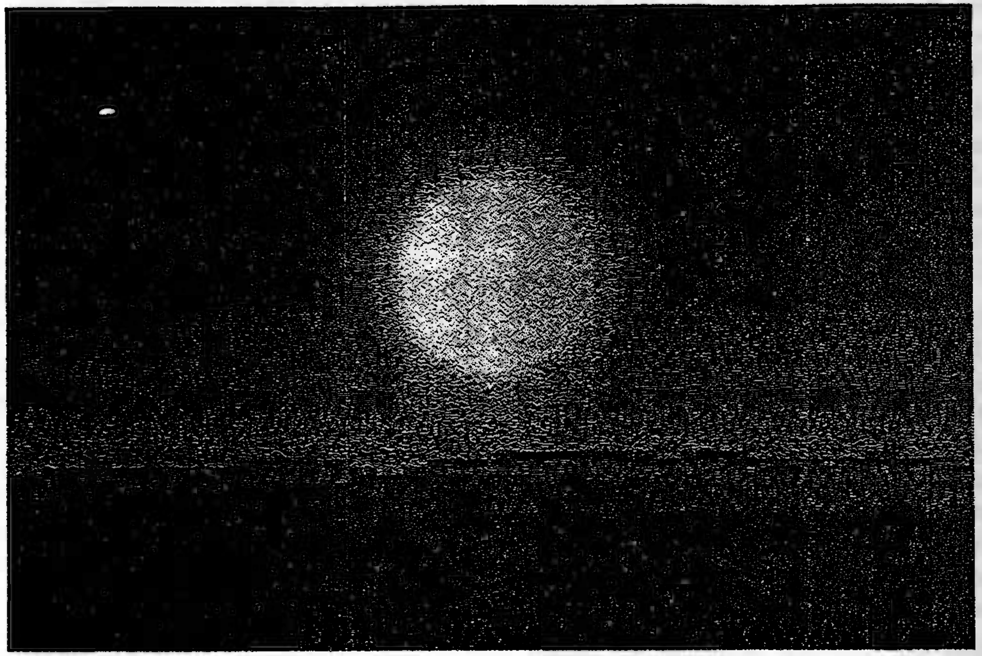
What's going on here?



This apparatus, recently set up at the Observatory, is a "monumental" experiment carried out by Section members. See public announcement on the 9th September, and full details in the next issue of Sagittarius

The Sun - Part 1 *by Lawrence Guilbert*

The first part of the paper presented by Lawrence at the meeting on the 21st June.



"Daylight Astronomy" - If one was to use this term to the average person, it would probably be met with looks of bewilderment or utter amazement. The word *Astronomy* immediately conjures up thoughts of studying the stars and their constellations, or perhaps the planets, or even the Moon. All require relative darkness. But very few would think of the Sun. This is, no doubt, because the word *Astronomy* comes from Greek, where "*astro*" means "*to do with the stars*", and people don't regard the Sun as a star. But the Sun is a star, and only a very average one at that, just one of an estimated 100 billion stars in our Galaxy, the Milky Way.

Before discussing the Sun, let us for a moment think of what it means to us. First and foremost it is the source of just about all natural heat and light, and is also indirectly responsible for all other kinds. Coal comes from prehistoric forests which depended upon the Sun to grow in times gone by. Similarly, timber from trees. Oils are reckoned to be of animal origin, and they too needed the Sun's warmth to grow. Wind power for pumping water, generating electricity, etc etc, relies upon the heat of the Sun which causes the movement of masses of air.

There is no doubt that solar energy will be used more and more in the future. Vast amounts of heat are continuously falling on the Earth, and the problem is collecting or harnessing it for commercial activities. Engineers have developed solar cells that produce electric current when sunlight hits them; these have been used to heat homes and swimming pools. Of particular interest to us is that such cells power »»

electronic gear on spacecraft, and also concentrated sunlight in a solar furnace at Mont Louis in France can melt any substance.

It is therefore in man's interest to learn as much about the Sun as possible, and it is not surprising that there is a very large number of "daylight astronomers", both amateur and professional, a substantial number of these being in the British Isles, taking daily recordings of the Sun's activities. This has been going on for many, many years, and a wealth of information has been gathered, the contribution of amateurs playing a very valuable part.

The BAA formed

In years gone by there was a time when wealthy amateurs led the world in astronomy, and the professionals were those who were engaged to assist, mainly in doing the recordings, etc. It was in October 1880, with the formation of the British Astronomical Association that the broad demarcation came between amateurs and professionals. It was the former who were looked upon as the collectors or gatherers of information, whilst the latter were regarded as the users or processors of these details.

The amateur's role

Inevitably, over the years, with the professionals able to use bigger, better and more sophisticated equipment, including radio, infra-red, ultra-violet, x-ray and gamma ray astronomy, not to mention the use of special instruments mounted on satellites, the work of amateurs has fallen behind. However, the serious amateur has still an important part to play, and the information he collects is greatly valued. The accumulation of this work enables graphs, etc to be produced which have revealed a great deal about the Sun's behaviour. These combined efforts of amateurs and professionals fully justify the theoretical deductions they make, and ensure that they have been based on sound judgement of vast experimental and observational knowledge.

The Sun's distance and movement

So, what do we know about the Sun? We have said that our Sun is an average star, and as such must be a seething mass of incandescent gas fuelled by violent nuclear reactions, and all the time emitting vast amounts of radiant energy, including heat and light, into space. It is relatively "close", being an mere 93,000,000 miles on average from Earth, whereas the next nearest star is in Alpha Centauri, more than 4 light-years away. To make these distances more apparent, a few simple calculations will tell us that travelling at a constant speed of 60 mph would take about 177 years to reach the Sun, but over 50,000,000 years to arrive at the nearest star.

Over the centuries, but more particularly the last one or two, a lot has been learned from the Sun that also applies to stars in general. Also, because there are stars in every stage of their life, astronomers are able to formulate or make predictions about the evolution of our Sun.

Man has never been able to observe the entire life of a single star because the time scale is too vast, but by combining knowledge gained from stars of varying ages, a reconstruction of their evolution can be made and applied to our Sun.

Scientists estimate that the Sun makes one circle of our galaxy in about 200 million years. This seems an awfully long time, »» but as the age of the Earth has been calculated to be in the order of 4,700 million years, it must have accompanied the Sun on quite a number of these circuits.

It has been determined scientifically that a star much smaller than the Sun would never become hot enough for nuclear burning to commence in its core, and a planet orbiting such a star would be in continual twilight and frost. Conversely, a star more massive than our Sun would burn its fuel far too fiercely to permit human existence.

The Sun is moving in space towards the constellation of Hercules at the rate of 12 miles per second. The Earth is, of course, carried along with it, and at the same time is revolving around it once a year at 18½ miles per second. The Earth also spins on its own axis once per day.

Although the universe contains millions of stars and vast quantities of interstellar gas, dust and debris, space is nevertheless very empty. Distances are great, and in an attempt to appreciate this emptiness we can imagine the Sun to be the size of a table tennis ball situated in the heart of London. In comparison, the Earth, averaging 93 million miles distant, would be a very tiny seed circling the ball at a distance of about 18 feet. The nearest star would be another table tennis ball as far away as Oslo or Barcelona.

As mentioned before, the Sun provides all the necessary heat and light without which our planet would be quite uninhabitable to life as we know it. But scientists also know that there is very little difference between these life-giving conditions and lethal radiation, realising that only minor changes in the Sun's performance would destroy all life in a very short time.

How solar events are related to happenings on the Earth

It is because of this, amongst a great many other things, notably the weather, climate, rainfall, tides and radio interference, etc that modern astronomers devote so much time to study the Sun very carefully. Claims, said to be beyond reasonable doubt, have been made that solar events are reflected in numerous terrestrial happenings. Some of these are, of course, inter-related and include: width of tree rings, layered ice, rock formations, agricultural yields, industrial production, even unemployment and frequency of wars, cyclones and a multitude of other things. But to link these things with the solar cycle needs conclusive evidence which only hundreds of years of recording can produce.

Creditability of correlations

However, in recent years a very great deal of strong correlation between solar activities and weather patterns has been claimed to have been found, so much so that scientists agree that the significance appears more than chance agreement. But at the moment a wait-and-see attitude must be adopted until sufficient data is accumulated, covering more sunspot cycles to really establish credability.

Sir Isaac Newton, 1665

In 1665, whilst in his early twenties, a young English physicist and mathematician, found that by using a prism it was possible to split the apparent white light of the sun into a spectrum of colours, ranging from red to violet.

This young man went on to discover the laws of gravity, and built the first reflecting telescope. He was, of course, »» Sir Isaac Newton. He made many other famous discoveries, and even in his own lifetime was internationally acclaimed as a man of unprecedented insight and genius.

William H. Wollaston, 1802

Over a century later, in 1802, a British chemist named William H. Wollaston found that very careful examination of this colour spectrum revealed about seven dark lines which crossed the bands in various positions.

Joseph von Fraunhofer, 1787-1826

Joseph von Fraunhofer, an outstanding German optical worker, took Wollaston's work a lot further, and was eventually able to see not just seven, but more than 500 dark lines, and they eventually became known as the *"Fraunhofer Lines"*. Fraunhofer discovered that any chemical suspended in a gas absorbs its own particular wavelength of light. The absorption, which appears as a dark line - a sort of shadow of the missing radiation - always showing up in the same position in the spectrum, can be used as an identifying finger-print. About 70 of the 92 elements naturally occurring on Earth have been identified in the Sun.

Fraunhofer's comparatively early death was a tragedy for astronomy. However, his work was continued by another German, a professor of physics, Gustav R. Kirchhoff, whose experiments marked the birth of the spectroscope. This instrument splits the light into a long horizontal band, varying from end to end in the colours of the spectrum, and crossing this band appear the Fraunhofer lines. The position of these lines and their character, ie whether they are dark, light or half shaded, sharp or fuzzy, all reveal information. The spectroscope also tells how the light source is moving relative to the Earth. If it is moving towards the red end of the spectrum, ie the *red shift*, it means that it is moving away, and if towards the blue/violet end, it is approaching. The astrophysicst can deduce the temperature and chemical element responsible, luminosity, composition, pressure, density, strength of gravity, electric force, magnetic field, degree of turbulence and convective movement in the region of the Sun where the spectrum line is produced. Many variations of this instrument have been developed since its invention, but it is probably true to say that the spectroscope has proved to be the most important piece of ancillary equipment in observational use. The principle of the spectroscope and its adaptations has revealed more about the composition of the Sun and the kind of physical processes taking place within it, and this, of course, includes sunspots.

Sunspots

Whilst this kind of equipment is very expensive and beyond the reach of most amateurs, they can still make interesting and important contributions by using very simple homemade apparatus, merely by observing and recording sunspots. It can happen that an isolated observation could well be like the missing piece of a jigsaw puzzle, the bit required to complete the picture, eg the missing day of a sequence.

Perhaps at this stage it would be beneficial to find out a little about the history of sunspots.

The earliest known reference to what must have been a sunspot has been attributed to one Theophrastus, a pupil of Aristotle the famous Greek philosopher of 384 BC, and over the centuries by many other individuals, most of whom had no idea »»

idea of what they were. Suggestions ranged from high flying birds, planets or other heavenly bodies in transit down to defects in telescopes. Chinese literature contains records of sunspots which date back to at least 28 BC. The Incas thought that sunspots were blemishes on the face of *Inti*, their sun-god, whilst Russian chronicles of the 14th century give vivid descriptions of sunspots as seen through the haze of forest fires. Johann Kepler saw one in 1607, but he thought it was a transit of the planet Mercury.

It was also thought that the spots were solid mountain tops protruding above an ocean of glowing lava, ie the photosphere. Folk in those days reasoned that the photosphere would have high and low tides, and as the tide ebbed the higher mountains would show as dark bodies. More recently it was thought that the Sun had a solid crust covered by cloud layers, the outer layer being brilliant and hot. Spots were thought to be partings in the clouds.

The coming of the telescope

With the advent of the telescope about 4 years later, at least four Europeans made independent observations of sunspots. Three of them were: Thomas Harriot at Oxford in England, Johann Fabricius at Wittenberg in Germany, and Father Christoph Schweiner, a Jesuit priest astronomer in Bavaria. It is said that one of Schweiner's assistants actually saw a sunspot before he did, but Schweiner is credited with making the first regular records of sunspots.

Galileo

The fourth was Galileo Galiliei, the Italian astronomer at Padua. Galileo's book "*Delle Macchii Solari*", published in 1613, contained the first known drawings of dark areas on the Sun's face, and stated that they were "substances" that were produced and dissolved by the Sun in varying periods of time. He also determined that, because the spots travelled across the Sun's disk in 13 to 14 days, and that some reappeared in a similar time, the Sun must rotate on its axis in about one lunar month.

The Maunder Minimum

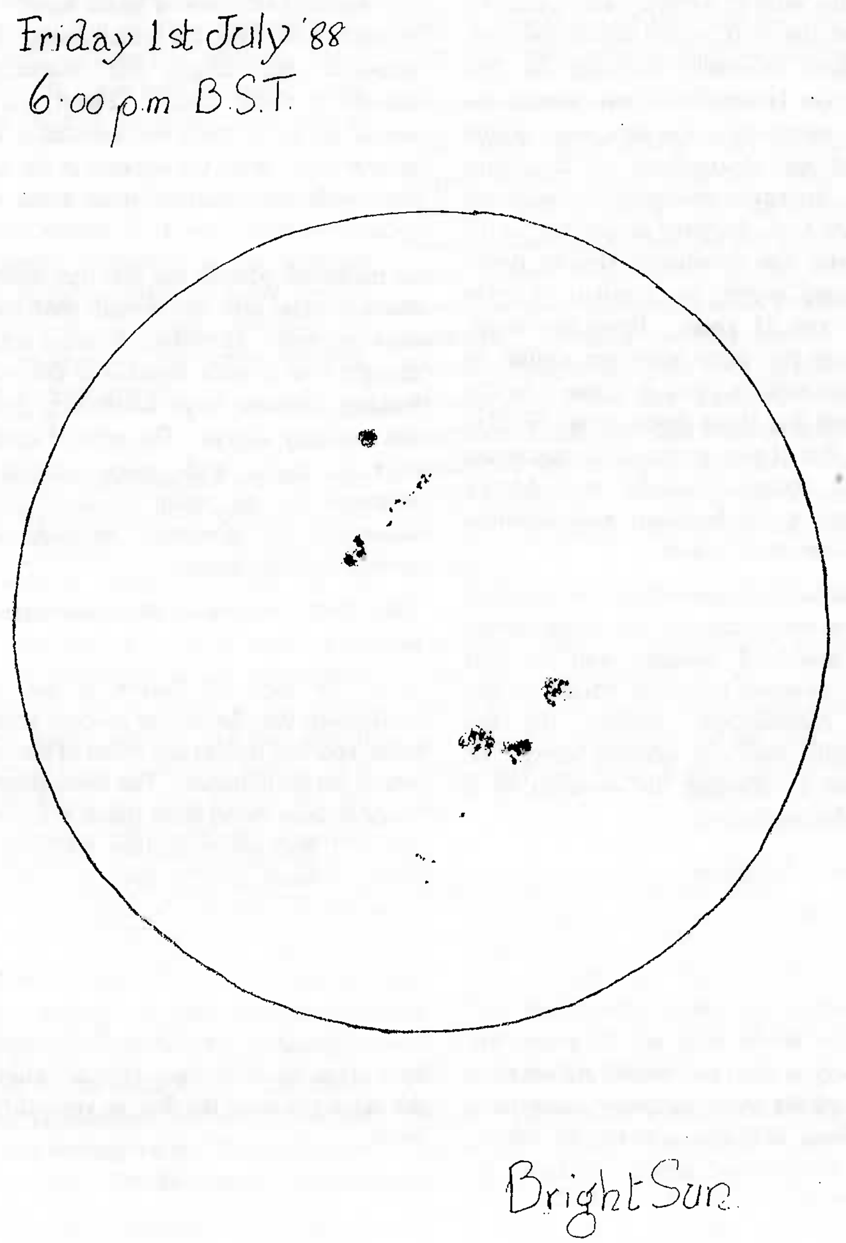
A few decades later records showed that there had been two maxima in a period of 30 years, but they were about 15 years apart. After that, activity declined to a very low level, and from 1645 to 1715 scarcely any sunspots were seen. In 1895, and again in 1922, E.W. Maunder published articles calling attention to the strange behaviour of the Sun in the 17th century, and this period is now referred to as the *Maunder Minimum.* The significance of the prolonged absence of sunspots could not be appreciated at that time because there had been 34 years with thousands of sunspots, followed by 70 years of inactivity with only an occasional sunspot to be seen. The problem was: what was normal? It is also interesting to note the scarcity of auroral displays during these 70 years inactivity.

Sir John Herschel

In 1833 Sir John Herschel made a very important discovery that sunspots were electromagnetic in nature, and was also the first to suggest that they had something to do with magnetic storms.

Heinrich Schwabe and the 11-year cycle

The next important step forward came 10 years later, when Heinrich Schwabe, a German pharmacist and amateur astronomer announced the 11-year cycle. His discovery was almost an accident »»



A good example of the work which an amateur "daylight astronomer" can usefully do.
One of Lawrence Guilbert's records of sunspot groups.

because he began studying the Sun in search of a planet that was thought to lie within the orbit of Mercury and which he hoped to see as it passed across the Sun. But whilst fruitlessly watching for this planet, now known to be non-existent, he became interested in the dark spots which appeared and disappeared on the Sun's surface. He began sketching the spots and continued to do so every sunny day for 17 years, and was eventually able to prove that sunspot activity has a pattern or cycle of just over 11 years. From minimum, when very few or no spots are visible, to maximum activity rises in from 3 to 4½ years, and then slows down again. He also proved that it was at times of maximum that the Aurora Borealis and Aurora Australis, ie the Northern and Southern Lights, were most visible.

It is interesting to note that it is recorded that Schwabe made all his observations with a hand-held telescope, and also that he was awarded the Gold Medal of the Royal Astronomical Society for the indomitable zeal and untiring energy he displayed in bringing his research to a successful conclusion.

Maxima and minima

The 11-year period is really a calculated average; no exact forecast can be made. Records now show that the interval between two successive maxima has been known to be as long as 13 years, but conversely as short as 9 years. All maxima are not of the same intensity; some have only about half the activity of others. Counts have varied greatly, and can be anything from 40 to 180. About 100 is considered the average. In 1947 a spectacular group appeared, the largest on record, which covered some 6,000 million square miles of the Sun's disk.

During the early part of each 11-year cycle a few rather small spots appear in northern and southern latitudes of about 40/46°. As the cycle wears on, the spots become more numerous and larger, and descend in latitude to about 10/15°. Finally, at the end of the cycle, spots are sometimes seen as near as 5° from the equator at the same time as the high latitude spots of the new cycle.

At minimum periods the Sun can show an absolute clear disk and remain spotless for days on end. However, it must not be thought that at such times it is not worth looking, because large interesting groups can suddenly appear. The ratio of spotless days to those with some activity is reckoned to be about 1 in 3 - the uncertainty of observing sunspots adds greatly to its fascination.

The Sun's rotation and the synodic period

Since the days of Galileo it has been established that the Sun is gaseous and not solid, and that it does not rotate at the same rate in all its latitudes. The areas near the Sun's equator travel most quickly, and take about 25 days per revolution, whilst at 45° North or South it is 28 days, and near the poles the time taken is 34 days. The time usually quoted these days is 25.38 days, and is that of latitude 15°. But because the Earth is also moving in its own orbit around the Sun throughout this period a spot takes an extra two days to return to the same place on the Sun as viewed from Earth.

June 7th and December 7th

Because the axis of rotation of the Sun is tilted with respect to the Earth's plane of orbit, at different times of the year the sunspots may not move directly east to »»

west, but at upward or downward curves. However, if after several days' observation and plotting of sunspots a line is drawn at right angles to that of their apparent path, then this will give very roughly the Sun's north and south. It is only on June 7th and December 7th that the spots move straight across.

To return to the sunspot cycle, it has been said that the period is 11 years, and whilst this is usually regarded as the average length, it would probably be more correct to double it to 22 years, because the magnetic polarity of the spots reverses after each 11-year period.

Statistics

To understand what sunspots are we must first of all learn a little more about the Sun. It is now known to be a vast gaseous sphere, and is often described as an immense thermonuclear furnace or atomic reactor. For the statistically minded its diameter is reckoned to be somewhere about 864,950 miles, which is 109 times that of the Earth, and we also find that it could contain some 1,300,000 Earths. It is about 750 times as massive as all the planets, satellites and asteroids together. To put it another way, it contains 99.87% of the Solar System, which leaves only 0.13% for all the remainder.

Granulated appearance

By using modern satellite telescopes to examine the Sun close up, scientists have discovered that its surface has a mottled or granulated appearance, and is in constant turmoil, like boiling water. These granules can be anything from 300 km to 1500 km in diameter. Considerable enlargement of the projected image is required to show this.

The granulated appearance is observed in very large telescopes. It is only when the "*seeing*" or observing conditions are perfect, which is very rare, that this can be seen with instruments as small as 3 inches.

Limb darkening and faculae

The areas approaching the periphery appear slightly fainter than those near the middle. This is called "*limb darkening*", and is caused by the fact that the gases are more intense when viewed as they curve away and more transparent when looked at centrally. Brighter patches known as "*faculae*" may possibly be seen against the darkening. These are areas of higher temperature than the main surface, and are usually in the vicinity of sunspots. They are reckoned to be caused almost certainly by the increased turbulence in these regions. ¤

Lawrence Guilbert

The story of the Sun concludes in the next issue, when Lawrence discusses the way in which the Sun's energy is transmitted from its core, the atmosphere of the Sun, and anticipates the final demise of our own star.

Periodicals received

The Summer 1994 issue of the Newsletter of the Federation of Astronomical Societies has been received, and copies are available for collection at the Observatory. We again have a mention.

We also receive the Vectis (Isle of Wight) astronomy society newsletter, and the Norman Lokyer Observatory (Sidmouth) newsletter.

We also receive many journals, magazines and other periodicals. ¤

Potted portraits - Roger Chandler

I have been interested in astronomy since I was at school and read library books on the subject, and realised that there was more to the universe than just the Earth. I am very interested in astrophotography, and hope to be a great help to the Section in that area. I am also interested in the origin and evolution of the universe and of life cycles of the stars.

I am married with two grown-up sons, who work in the motor trade. My wife, Sandra, comes from Uttoxeter in Staffordshire. I have lived in Guernsey all my life. I work as a carpenter for a local builder. I am a member of Prism photographic club, and now have my own darkroom at home. I am also a member of the voluntary St. John Ambulance, but my main interest is astronomy. Some day I hope to visit a major observatory in the USA. ◻

Roger Chandler

Roger describes how to take piggyback astrophotographs on page 18.

Eclipse photo first

Michael Maunder's spectacular photograph of May's annular eclipse being caught in the palm of his hand, which appeared in the last issue of [illegible], has had widespread publicity. Since we published it (I believe we were the first), it has, to our knowledge, appeared in the *BAA Journal*, *Astronomy Now*, and *Astronomy*.

But remember - you saw it here first!

Several other members photographed the partial eclipse as seen from Guernsey. Don't forget that magazines are always on the lookout for good photographs.

The 1995 Programme

Yes, that time is coming round again, when we are planning the Programme for next year. We need your ideas, suggestions, comments on this year's Programme, and your offers to speak at our monthly meetings. We already have some exciting ideas, but are looking for people willing to give a talk.

If you are bursting at the seams to tell other members about your favourite aspect of astronomy, do come forward. If you are merely interested, ask for suggestions about what you could speak about - we have plenty of ideas.

If you can think of a format for a meeting let us know. And tell us if there was a particular meeting this year which you didn't like, thought could be improved, or could bear repeating. Any legitimate activity will be duly considered.

One activity which we are considering for next year is to take a telescope out onto the streets, rather than expect the public to make the effort to come to the Observatory. This has been done in America, especially San Francisco, with considerable success. We are therefore making plans to set up a couple of telescopes on the evening of Liberation Day, the 9th May 1995, when the 50th Anniversary of the Liberation will be celebrated. The venue will probably be the upper walk of the Albert Pier, and the Moon and Mars will be the objects to be observed.

This will need considerable planning, so your help is needed. Your ideas will also be welcome on how to make the most of the event, both as a public education and experience, and not least as an opportunity to boost Section funds. ◻ *DLC*

An astronomical wordsearch

by Antony Saunders

B	R	E	T	S	U	L	C	R	E	P	U	S	K	B
S	N	O	R	T	U	E	N	R	L	L	T	O	P	S
C	I	T	E	N	G	A	M	M	U	J	I	A	L	Q
I	O	C	F	E	A	D	A	N	O	X	S	S	A	P
M	F	R	R	E	L	A	T	I	V	I	T	Y	N	R
A	O	G	E	T	A	H	T	U	T	L	A	S	E	R
N	M	O	I	V	X	W	E	X	E	R	Y	A	T	H
Y	A	B	N	N	Y	O	R	O	C	E	E	Z	T	Y
D	R	I	S	T	C	R	H	A	R	L	B	I	S	D
O	S	T	E	A	I	A	D	C	A	P	N	U	N	R
M	A	F	R	G	G	H	R	I	B	E	N	E	O	O
R	Q	D	E	C	A	I	D	O	Z	K	W	H	T	G
E	P	L	S	R	T	T	U	Y	R	V	A	A	O	E
H	U	B	B	L	E	T	O	X	B	U	Z	R	R	N
T	R	O	O	O	B	M	N	M	K	L	A	B	P	J

Find the following words in the above square. No prizes, just fun!

ATOM
AURORA
BETA
BRAHE
CORE
CRAB
CRUX
DRACO
GALAXY
HUBBLE
HYDROGEN
KEPLER
LASER
LEO
MAGNETIC
MARS
MATTER
MOON
NEUTRON
OORT
ORBIT
PLANET
PROTONS
RELATIVITY
RIGEL
SPOT
STAR
SUN
THERMODYNAMICS
ZENITH
ZODIAC

Piggyback astrophotography

What is "piggyback astrophotography"? Usually, astrophotographs are taken by attaching the camera, with an adapter in place of the lens, to the eyepiece of the telescope, or without an eyepiece, in the method known as "prime focus astrophotography". When using the "piggyback" method, however, the camera and lens are mounted either on top of, or on the side of the telescope, using a mount similar to that found on a tripod. The camera can then track the stars being carried along by the telescope's drive.

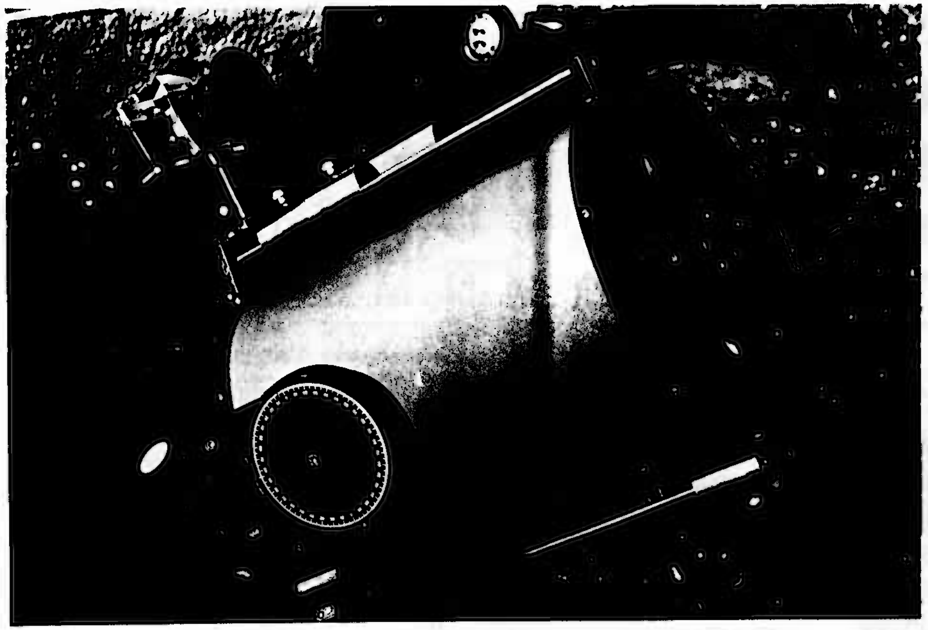
In this way, using the camera's standard lens (a 50 mm lens on a 35 mm camera), a wide field can be covered. A wide-angle lens (anything below 50 mm) can also be used.

Photographs of the Milky Way and whole constellations can be taken, and the movement of planets through the constellations can be followed photographically.

Astrophotography is very rewarding. I myself love doing it, although things do not always turn out as expected, as it is a matter of trial and error with exposures. But when things do go well it is very fulfilling.

I recommend any member to have a go. ¤

Roger Chandler



Roger Chandler's camera mounted piggyback on the 11-inch Celestron telescope.

What is light pollution?

In the first of a series of articles, Guernsey's Light Pollution Officer, Ken Staples describes the basic problem.

Light pollution, or *skyglow* as it is known, is caused by particles of water or dust in the atmosphere, that absorb or reflect either direct or indirect light from the surface of the Earth. The reflection produces a coloured semi-circular haze of light that removes the ability to see distant specks of light (the object you are looking for). Astronomers need the *darkness* to be able to see them. The nuisance value of *skyglow* is not just a nightmare for astronomers, but also it is very difficult to sleep in a bedroom that is totally illuminated by a badly designed street-light. Poorly directed light can also be potentially dangerous if glaring towards oncoming traffic.

It can now be deduced that some of the major causes of *skyglow* would be:-

- ★ *Sport floodlighting*
- ★ *Car park lighting*
- ★ *Traffic*
- ★ *Shop windows and advertisements*
- ★ *Greenhouses (local)*
- ★ *Mood or effect lighting (tourist attractions)*

There are many other causes, too numerous to mention, but all that it may need to remove the majority of this pollution is awareness. In the main, information and advice, rather than attack and blame, are potentially far more effective in getting both industry and the public to act sensibly and honestly toward a clearer understanding, and, ultimately, a *darker sky.*

We all need light, but are we using too much light for the job in hand? Bright light produces dark shadows; the elderly cannot see through dark shadows; criminals can hide in dark shadow. In this example alone, the effects of using only enough light as is necessary would be immediate and staggering. Just think how much we could improve the situation with a bit more effort in all the other areas of light pollution.

If we reduce the load on our power station we will also be helping in lowering the amount of toxic waste being poured into our atmosphere, co-existing with other *green* issues involved in environmental pollution.

Nobody is asking for a return to the dark ages, but for those of you old enough to remember the last war, darkness became very important then, and, gladly, for much more happy reasons now, it is still very important to have *darkness* where there was light in our skies. ¤

Ken Staples

Apollo 11's parachutes

My article in the last issue about the first manned Moon landing reminded Gillian Lenfesty that there is a link between our Observatory site and Apollo 11. The three parachutes which brought the spacecraft safely to a splash-down in the Pacific Ocean were made by a cousin of our landlord, Hugh Lenfesty. Florence Lenfestey Johnson, who had her own parachute company, was asked to design, make and check the parachutes. Apparently, after the safe return to Earth Neil Armstrong asked her for her autograph, saying that if it hadn't been for her they might not have got back safely! ¤

DLC