Light Pollution Officer

The British Astronomical Association has appointed Ken Staples as the Light Pollution Officer for the Bailiwick of Guernsey. He joins a team of 44 other officers that are responsible, in their various regions, for campaigning against ***skyglow*** *throughout Great Britain. Ken can be contacted on tel. 54759. He writes:*

Like other land or sea environmental pollution issues, **skyglow** has become a major problem, and has been left unchecked for far too long. Random light spill, glare from traffic, bright shop windows and advertisements, over-conspicuous sports floodlighting, and security lighting are some of the examples of urban light which offend. Seldom is a balance achieved between over-lighting and under-lighting, so we lose the "romance of shadow". There is no evidence that light that is shone above the horizontal is of any use to anybody; it merely becomes another wastage on the state's resources.

There is a considerable amount that can be done to reduce **skyglow** so that we can ensure that our children will be able, not only to enjoy the awesome beauty of a **dark sky**, but will also keep the best possible learning aid for them to use in their studies, as **astronomy** is now part of the National Curriculum in schools.

The Campaign for Dark Skies, commissioned by the BAA, is now underway in Guernsey, and I look forward to hearing any suggestions that Section members think may help.

Ken Staples

Astronomy Section Officers

Section Secretary:	Geoff Falla	724101
Honorary Treasurer:	Peter Langford	720649
Education Officer:	David Williams	725088
Light Pollution Officer:	Ken Staples	54759

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

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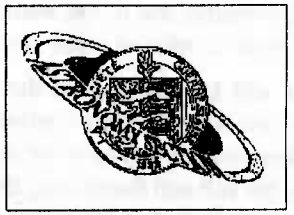
Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise



May/June 1994

Special Eclipse Issue

Forthcoming events

Partial Solar Eclipse
Tuesday, 10th May
6.36 - 8.40 pm
at the Observatory

Scintillate, Scintillate, Global Flavilic
by David Williams
Tuesday 24th May
8.00 pm at the Observatory

Partial Lunar Eclipse
Wednesday, 25th May
2.38 - 4.25 am
at the Observatory

Book Sale and The Sun
by Lawrence Guilbert
Tuesday, 26st June
8.00 pm at the Observatory

Inside

Major articles in **bold**

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Centre inserts

Double Stars
May/June star chart

Scintillate, Scintillate, Global Flavilic

At 8.00 pm on Tuesday, 24th May at the Observatory, David Williams will give a talk with the above title. No prizes for interpretation, but if you want to hear how the rhyme continues come along.

This will be a talk about the stars - what they are, what they are composed of, what makes them shine, how we classify them. And the full and fascinating details of their lives and deaths. A hot topic!

Two for the price of one

Two events, that is. At 8.00 pm on Tuesday, 26st June at the Observatory there will be a:

Book Sale

This will be a fund-raising event. The idea is for members to bring along any books (preferably astronomical or other scientific books) that they don't want, so that other members can choose them for a small donation to Section funds. Search out your old books, ask your friends, and come along and make this event a success. Books can be left at the Observatory any time between now and then, if you wish.

The Book Sale will be followed by a talk by **Lawrence Guilbert** on his favourite subject:

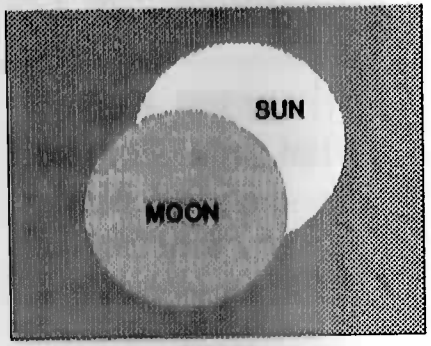
The Sun

Lawrence has spent many years observing, drawing and studying the Sun, using his 3-inch refractor. The timing of his talk is opportune, as we prepare to have our very own solar telescope. He will, no doubt, give good coverage to the practical aspects of observing the Sun, as well as the theory.

Partial Solar Eclipse . . .

On **Tuesday, 10th May** there will be a partial eclipse of the Sun. At 6.30 pm the Moon will start to cover the Sun. Maximum eclipse will be at 7.35 pm, and the eclipse will end when the Sun and Moon set together at 8.40 pm.

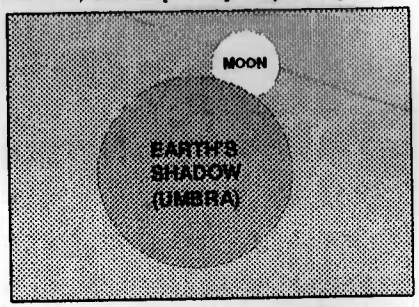
Observations will be made from the Observatory, but we will probably have to get on top of the bunker to see it, as it will be low in the west. See chart on page 3.



Solar eclipse of 10th May, at maximum

. . . and a partial lunar one

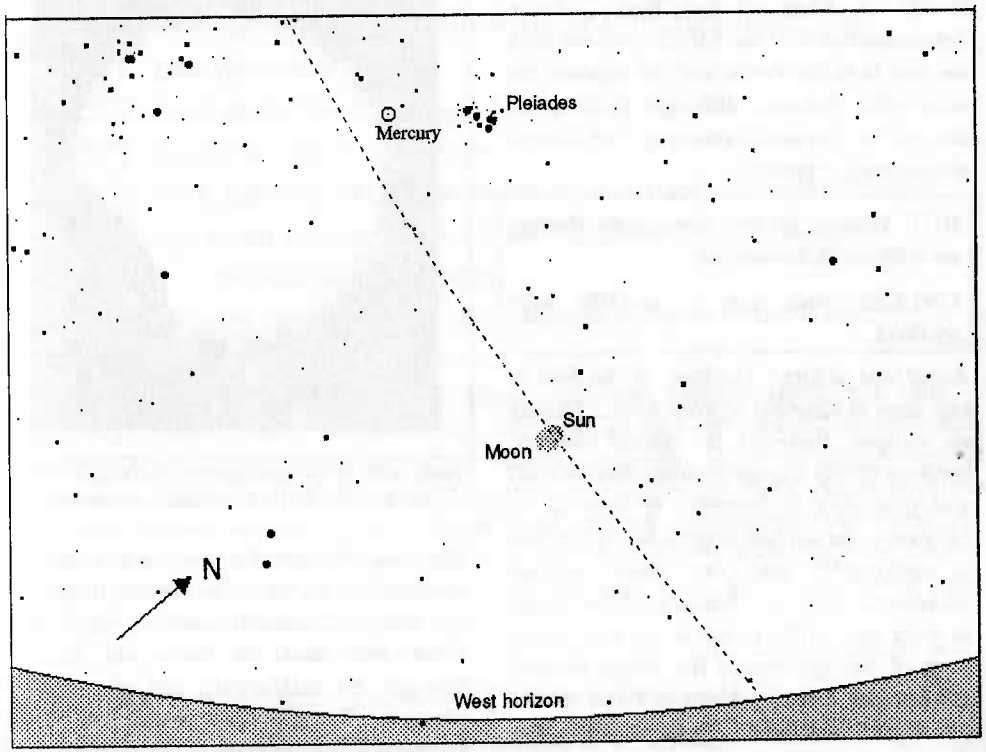
In the early morning hours of **Wednesday, 25th May** there will be a (slight) partial eclipse of the Moon. The Moon will start to enter the umbra of the Earth's shadow at 2.38 am. Mid-eclipse is at 3.30 am, and the eclipse ends at 4.25 am. It will be low in the west. Weather permitting, somebody may be at the Observatory to observe it, and hopefully to photograph it.



Lunar eclipse of 25th May, at maximum

Partial solar eclipse, 1994 May 10, 1835 UT (7.35 pm BST)

from the Observatory, Guernsey



Special Eclipse Issue

This issue of Sagittarius is being issued a few days early to enable members to have time to plan for the solar eclipse of 1994 May 10. It contains details, not only of that eclipse and the lunar eclipse of 1994 May 25, but also solar eclipses visible from Guernsey since 1940 and until 2040. There is also a review of a new book on eclipses in the current decade.

Because of the early publication of this issue it has not been possible to include an account of Antony Saunders's talk on the Microwave Background Radiation. This will be included in the next issue.

Public Star Nights

About 70 people came to our star nights in March, including 18 children from Notre Dame School. The weather was not very cooperative, but on the first two nights most people were able to see the Moon and the Orion Nebula through the telescopes, and some other objects such as double stars. It was, however, largely a matter of dodging the clouds!

A couple of small telescopes were brought in for our attention, and David Williams was able to point out to one manufacturer that the "reflecting" telescope described in the instructions was in fact a refractor!

Observing the solar eclipse safely

Solar eclipses are exciting and interesting. There is a sense of awe as the Moon passes slowly in front of the Sun. As a demonstration that the Moon is closer than the Sun is to the Earth, and yet appears the same size (because although it is much closer it is also much smaller), it is also an educational experience.

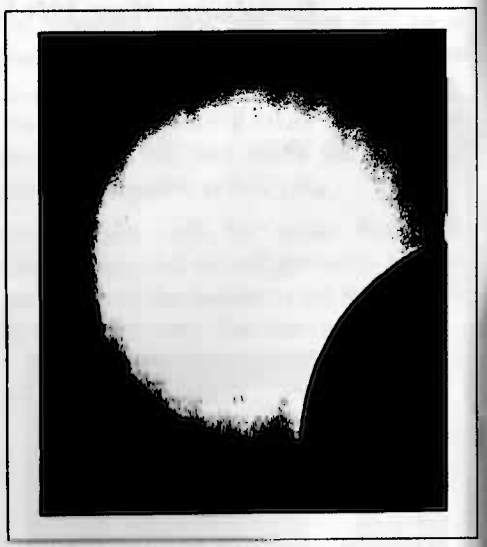
BUT looking at the Sun, even during an eclipse, is dangerous -

UNLESS you use a strictly safe method.

Avoid eye injury. Looking at the Sun at any time is harmful to your eyes. During an eclipse there is a special danger, because it may appear dimmer than normal and you may be tempted to look at it. However, the surface brightness of the Sun is undimmed, and can cause ***eclipse blindness***. This is a burning of the retina of your eye. (The retina is the part at the back of the eye, where the image forms.) It can cause a blurry image or blind spot at the centre of vision. In some cases the damage may be temporary and recover after a few days or weeks, but ***in many cases permanent damage is caused.***

The safest way to observe the eclipse is either to project the image of the Sun onto a white card, or to use a special solar filter. Sunglasses and other types of filters are no good for the purpose.

The Astronomy Section has obtained special solar filter glasses which may be used to see the eclipse in safety. They cost just £1.00, and may be obtained from Geoff Falla or David Le Conte, or at the Observatory. Get yours now!



Partial solar eclipse photographed by David Le Conte, October 1977 at Kitt Peak National Observatory

The projection method uses a telescope or one half of a pair of binoculars to project the image of the Sun onto a white card. Great care must be taken not to look through the instrument, and not to sight along it. To project the image line up the instrument by looking at its shadow cast on a white card or piece of white paper placed a foot or so from the eyepiece. The image of the Sun will be clearly seen, including large sunspots if any happen to be on the disc of the Sun. This image is quite safe to look at. Keep a cap on the other half of the binocular, or on the finder 'scope if the telescope has one, to prevent anyone looking through it.

An alternative, although not giving such a large image, is to use a small hole (about one mm wide) pierced in a piece of card as the projection device, instead of an optical instrument. Do not look through the hole, but project the image onto another card about 20 cm (8 inches) away.

Some Do's and Don't's for observing solar eclipses

DON'T look directly at the Sun without a special solar filter.
DON'T use sunglasses.
DON'T look at the Sun through binoculars.
DON'T look through a telescope.
DON'T look through the viewfinder of a camera or video camera.
DON'T use even a solar filter at the eyepiece of a telescope, binoculars or camera.
DON'T use any type of filter other than a special solar filter.

For example, do not use photographic filters, polarisers, smoked glass, dark film, or coloured or shaded plastic. These can pass damaging amounts of infra-red or ultra-violet light, which you cannot see but which can damage your eyes. It is even more dangerous to use such devices because the apparent dimming of the of the Sun's visible light can make you feel you are safe. You may therefore be tempted to look at the Sun for too long a time - even a few seconds! But the pupils of your eyes will be wide, since the level of visible light is low, and as a result the retina of your eyes will receive even more damaging amounts of invisible light.

DO take advantage of this eclipse to view it safely.
DO show it to children, and explain it to them.
BUT . . .
DO take care of their eyesight and your own by taking full precautions.

Why not spend just £1.00 on a pair of our solar eclipse filter glasses to safeguard your eyes?

We have made special arrangements with Specsavers to acquire from America 2000 patented solar filter glasses, made of Solar Skreen® material,which are guaranteed by the manufacturers to be safe for viewing the Sun, filtering out all harmful rays to safe standards. Specsavers is providing these free to Island school-children, and making a substantial contribution to Section funds. We are providing schools with full information on the eclipse and how to view it safely.

The next partial solar eclipse visible from Guernsey will be in 1996, and in 1999 there will be an almost total eclipse of the Sun. ¤

101 years of solar eclipses

The partial solar eclipse on the 10th May 1994 caused me to wonder what recent solar eclipses had been visible from Guernsey. I recall seeing one when I was a child, my father providing me with smoked glass. But when was it? And were there others? And what solar eclipses can we look forward to in the future?

I therefore set my computer to work, finding possible solar eclipses since 1940, and predicting ones to occur in the years up to 2040. 101 years in all!

First I used a program developed by Peter Duffet-Smith to list possible eclipse dates, times and magnitudes (the percentage of the Sun's disc covered by the Moon). I then checked these against the Archimedes computer program NightSky, which is much more accurate. I was able to plot the eclipse against the star (and planet) background, and to check whether it was in fact visible from Guernsey, or whether the Sun was below the horizon.

The results show a surprising 36 solar eclipses in the 101 year period, an average of more than one every three years. None, however, is quite total, although a couple come very close to totality. The average magnitude is 47%, with actual magnitudes in the range 6% to 99%.

There are several interesting eclipses, and I have provided pictorial representations of some of them. I suspect the one I remember is the one of June 1954. It occurred at midday and 70% of the Sun's disc was obscured. The one of May 1966 was close to the Pleiades, although I doubt whether anything of the star cluster could be observed. »»

Solar eclipses visible from Guernsey, 1940 - 2040

Date	UT of mid-eclipse	Mag (%)	
1942 Sep 10	1620	28	
1944 Jan 25	1647	6	Sun setting
1945 Jul 09	1357	55	
1949 Apr 28	0709	41	
1951 Sep 01	1206	21	
1952 Feb 25	0910	13	
1954 Jun 30	1233	70	
1959 Oct 02	1156	38	
1961 Feb 15	0738	97	Sun rising
1966 May 20	0919	42	
1968 Sep 22	1021	21	Uranus
1971 Feb 25	0936	64	
1982 Jul 20	1941	18	Sun setting
1982 Dec 15	0820	31	Sun rising
1983 Dec 04	1202	7	
1984 May 30	1814	54	
1994 May 10	1844	59	
1996 Dec 12	1418	56	
1999 Aug 11	1017	99	
2005 Oct 03	0857	74	
2006 Mar 29	1030	28	
2008 Aug 01	0918	15	
2011 Jan 04	0807	72	Sun rising
2017 Aug 21	1907	14	Sun setting
2021 Aug 10	1008	29	
2022 Oct 25	0958	19	
2025 Mar 29	1100	40	
2026 Aug 12	1816	95	Good one!
2027 Aug 02	0857	58	
2028 Jan 26	1656	72	Sun setting
2030 June 01	0528	60	
2036 Aug 21	1810	64	Regulus
2037 Jan 16	0903	53	
2038 Jan 05	1433	14	
2038 Jul 02	1404	20	
2039 Jun 21	1840	68	»»

The eclipse of September 1968 was very close to the autumnal equinox; hence the appearance of the ecliptic (the Sun's path) crossing the celestial equator so close to the eclipse. And note how close Uranus was to the Moon - just a few minutes of arc!

The eclipse of the 10th May 1994 will be quite good, with nearly 60% of the Sun's disk obscured. The eclipse of October 1996 occurs at a better time of day, with the Sun high in the sky, and quite close to the bright star Spica. The magnitude of the eclipse will be almost as much as in 1994 - over half.

The best eclipse is, of course, the one in August 1999. It appears that Guernsey will be just off the track of total eclipse, and it will be necessary to go to Alderney or France (or in a boat just of Guernsey's north coast) to see totality. In Guernsey a tiny sliver of the Sun will still be visible at maximum eclipse, so it is unlikely that the corona will be seen.

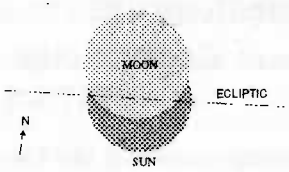
We will just miss an excellent eclipse in April 2024. Although the magnitude is a whopping 89%, the Sun will have set just before the start of the eclipse! However, there will be an even better one in August 2026 (if you can wait that long), when the Moon will cover 95% of the Sun's disc.

Finally, in August 2036 Regulus will be within half a degree of the eclipsed Sun. Is there a chance that it will be visible? Wait and see! As I shall be approaching my century by then I suspect my eyesight might not be too good. ¤

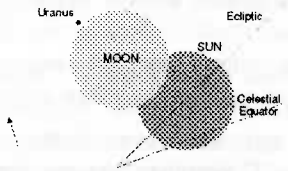
David le Conte

In the next issue: 101 years of lunar eclipses.

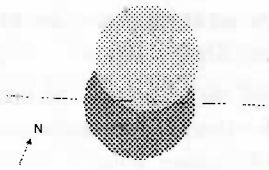
Solar eclipses in the past and the future



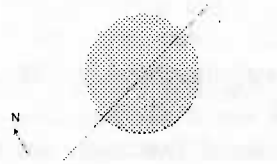
30th June 1954



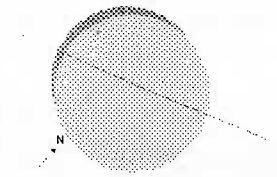
22th September 1968



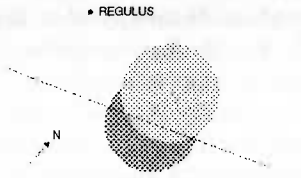
12th October 1996



11th August 1999



12th August 2026



21st August 2036

Famous lives - 2
Nicolaus Copernicus (1473-1543)

The first thing to realise is that Copernicus was not his real name. His actual name was (and here you may take your pick) Nicolas Koppernigk or, in Polish, Mikolaj Kopernik.

He was born in the town of Thom in the border region between Germany and Poland, and has come down through history as Copernicus because his name was latinised while a student at the University of Bologna. In those days scholars used only latin.

Copernicus was to attempt by mathematics and crude observational technique to prove that the Ptolemaic geocentric system was unsound and incorrect. To arrive at a true understanding of the Earth's place in the Universe, it had to be replaced with a heliocentric system, with the Earth and planets revolving around the Sun.

His work was to take him many years of study, years of frustration, and in many ways danger, as the established Church orthodoxy at this time was in agreement with the teachings of Ptolemy. To propose such revolutionary ideas as those held by Copernicus was indeed a dangerous business - especially if you worked for your uncle, who happened to be a Bishop!

Eventually, his work was published with the help of another, younger scholar named Joachim Rheticus, and so it was in May 1543 that *De Revolutionibus Orbium Coelestium* or 'On the Revolutions of the Celestial Bodies' was published. Copernicus saw his work in print, but only just, as he died on 24 May 1543.

It was in this work that he stated that the Earth was not at the centre of the universe, and that all other heavenly bodies did not revolve around us. Instead, in his system the Earth rotated on its axis once a day in a west-east direction, and while it was spinning at a tremendous speed, like a top, it was also hurtling through space in its orbit about the Sun.

He also stated that the same applied to the other planets, that they too were orbiting about the Sun. The Earth was far from being the centre of the universe - it was simply a sphere orbiting another larger and more powerful one.

He also called into question the nature of the stars themselves. No longer were they to be friendly twinkling lights in heaven; instead they became vast celestial furnaces at unimaginable distances from the Earth.

At this point it is interesting to note that, like Ptolemy, Copernicus's work was not his own. It was based upon the work of much earlier Greek philosophers, in particular the ideas of the 3rd century BC philospher Aristarchus of Samos, although the works of other philosophers also influenced him. Of course, his genius lay in his ability to take these ideas, refine them, and establish a whole new school of thought.

Although Copernicus lived long enough to see his work published, he did not live long enough to see the effects his work was to have upon scholars, priests and laity at the time. He had destroyed the order and certainty of 1300 years of teaching. His new system was to destroy not only the Ptolemaic system, but was to establish a new era in astronomical thought, especially in the field of cosmology. »»

However, his work was also to cause learned people to question their belief and faith in God - in many cases their very philosophy of life and the divine order of creation, as the security of Ptolemy's universe came crashing down about them. Such was the controversy that ensued publication, that his work was declared false and unsound by the Church, and as a result became prohibited reading.

Luckily, the damage had already been done. Copernicus had freed people's minds from the constraints of the teachings of Ptolemy. In so doing he established a new era in scientific thinking, one in which minds would be open and receptive to new ideas. And of course it allowed those who followed him to undertake their great works, and so, in their turn, advanced our understanding of the universe in which we live and in which we are still energetically engaged in attempting to understand and appreciate fully. ¤

David Williams

References:-

The Space Encylopædia, M.T. Bizony

Penguin Dictionary of Astronomy

Pioneers in Astronomy

Members will be sorry to hear that David will be leaving Guernsey in July in order to take up a post as Head of a school in Ipswich. David has been a member since 1986, and has always played a keen role in the Section's activities, especially where young people are concerned. For over a year he has been the Section's Education Officer. He has been a regular contributor to Sagittarius, and has promised to complete his series of *Famous Lives.*

An embarrassing moment

I was standing at the 14-inch telescope, surounded by a dozen eager faces of schoolchildren, all waiting for their first glimpse through the giant instrument. As I was setting it up I described it to them, emphasising how important it was to have an electric drive to counteract the spinning of the Earth on its axis. Otherwise, the object being observed would move out of the field of view within a minute or two.

The first child looked through the telescope at the Moon, and said "WOW" - she could see craters and mountains - fabulous! The second child looked and said "Very nice". The third child seemed puzzled and said there was nothing there.

I'd forgotten to switch on the drive!

DLC

Would you like to share an embarrassing moment with our readers?

Full moon-less Februaries

A few months ago we noted that sometimes there are two full moons in a month, and we asked whether there were any months which had no full moon at all. It would have to be a February.

Well, Daniel Cave has come up with the answer. He modified a computer programme from *Sky and Telescope* magazine to search through Ferbuaries in the past and in the future. He found that the last time this happened was in 1969, and the next time will be in 1999. February 2018 and February 2037 also have no full moons. In these years the January and/or March can be expected to have two full moons.

Images from Hubble

December 1993 saw the spectacular shuttle mission to repair and service the Hubble Space Telescope. While this mission made headline news all over the world, what has not been so widely publicised are the fabulous images the telescope is now able to produce. Presented here are a few of the Early Release Observations from the telesecope.

The new Wide Field and Planetary Camera, WFPC II, now performs better than WF/PC I would have done - even if the telescope's mirror had been perfect. This increase in performance was made by including small corective mirrors into the camera and by making use of more advanced detector technology. The other instruments are corrected by the Corrective Optics Space Telescope Axial Replacment (COSTAR). This device swings pairs of corrective mirrors in front of each instrument enabling them to cancel the effects of the mis-shapen mirror and almost fully restore the instruments' designed performance.

HST will now be able to see objects 10 to 12 billion light years away easily. That's about 8 billion light years further than it could see before the service mission and about 10 billion light years better than any ground based telescopes. The improvements mean that the search for extra-solar planets will now be possible. The rate of expansion of the universe can now also be found with higher accuracy than ever before - enabling the age of the universe to be determined.

Later this year HST will spend a day observing Jupiter as comet Shoemaker-Levy 9 collides with it.

Keep your eyes open for the results.

The spiral galaxy M100 as seen with Hubble's improved vision

On the next page is an image of the grand design spiral galaxy M100 obtained with the second generation Wide Field and Planetary Camera (WFPC-2), newly installed in the Hubble Space Telescope (HST). Though the galaxy lies several tens of millions of light years away, modified optics incorporated in the WFPC-2 allow Hubble to view M100 with a level of clarity and sensitivity previously possible only for nearby galaxies.

One of the greatest gains of the high resolution provided by Hubble is the ability to resolve individual stars in other galaxies. The new camera not only allows astronomers to separate stars which would-have been blurred together in the best ground-based images, but also allows astronomers to measure accurately the light from very faint stars. The quantitative study of the composition, age, temperature, and other properties of stars and gas in other galaxies will provide important clues about how galaxies form and evolve.

In addition, the WFPC-2 will allow the HST to attack one of the most fundamental questions in science: the age and scale of the universe. Astronomers have many yardsticks for measuring the scale of the universe, but lack a good knowledge of how long these yardsticks really are. M100 is a member of the Virgo Cluster of galaxies. By allowing astronomers to resolve and measure individual stars in the Virgo Cluster (in particular "Cepheid Variable" stars, sought out because their brightness is well known) HST observations are expected to provide a crucial measurement of this much needed scale. Only Hubble can make these »»

types of observations. Cepheids are too faint and the resolution from ground-based telescopes too poor to separate the images in such a crowded region of a distant galaxy.

The WFPC-2 image is chevron-shaped because it is a mosaic of the instrument's three wide-field cameras and one planetary camera. The three wide-field detectors in the camera reveal individual stars and filamentary dust lanes in the outer arms of the majestic spiral galaxy. The instrument's planetary camera image (smaller square, upper right) resolves complex structure in the core of the galaxy, which is the site of vigorous star formation.

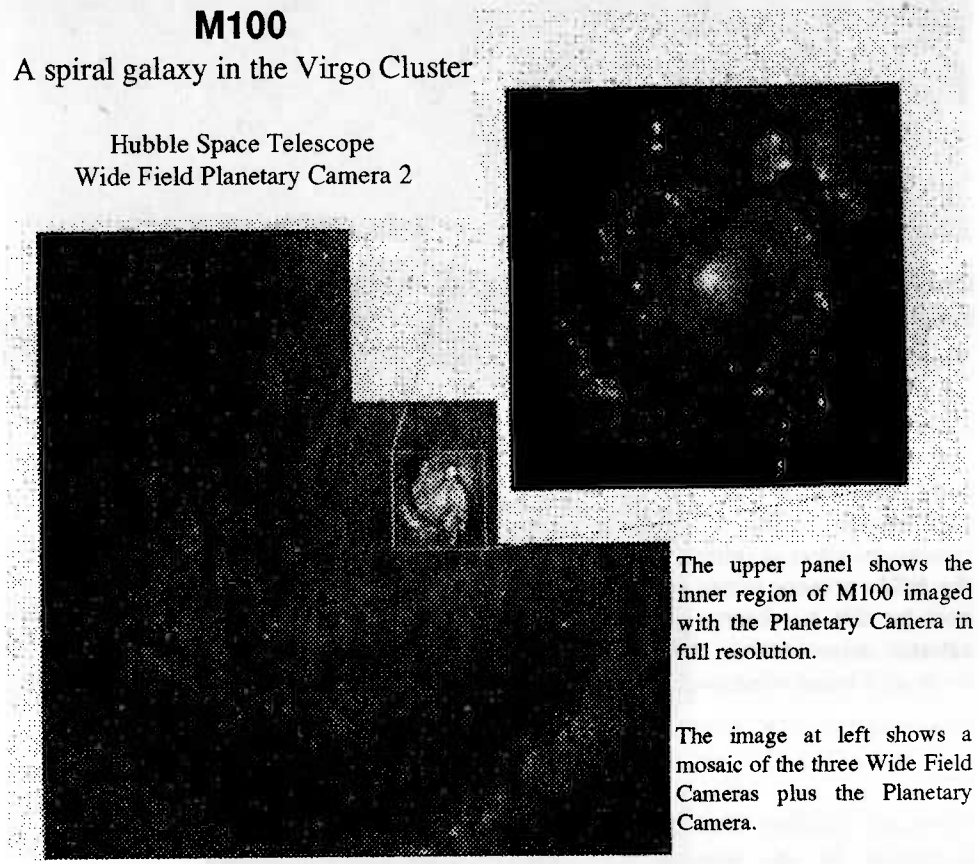
The image was taken on December 31, 1993, through red, green, and blue filters to create a true color picture. Blue (not evident in this black and white copy) corresponds to the light from young and massive stars that have recently formed along the spiral arms. The bright blobs (which appear pinkish in the colour version) are huge clouds of glowing hydrogen gas. They identify sites of new star formation. The field of view is about two and a half arc minutes across.

The Wide Field and Planetary Camera-2 was developed by the Jet Propulsion Laboratory and managed by the Goddard Space Flight Center for NASA's Office of Space Science. »»

M100

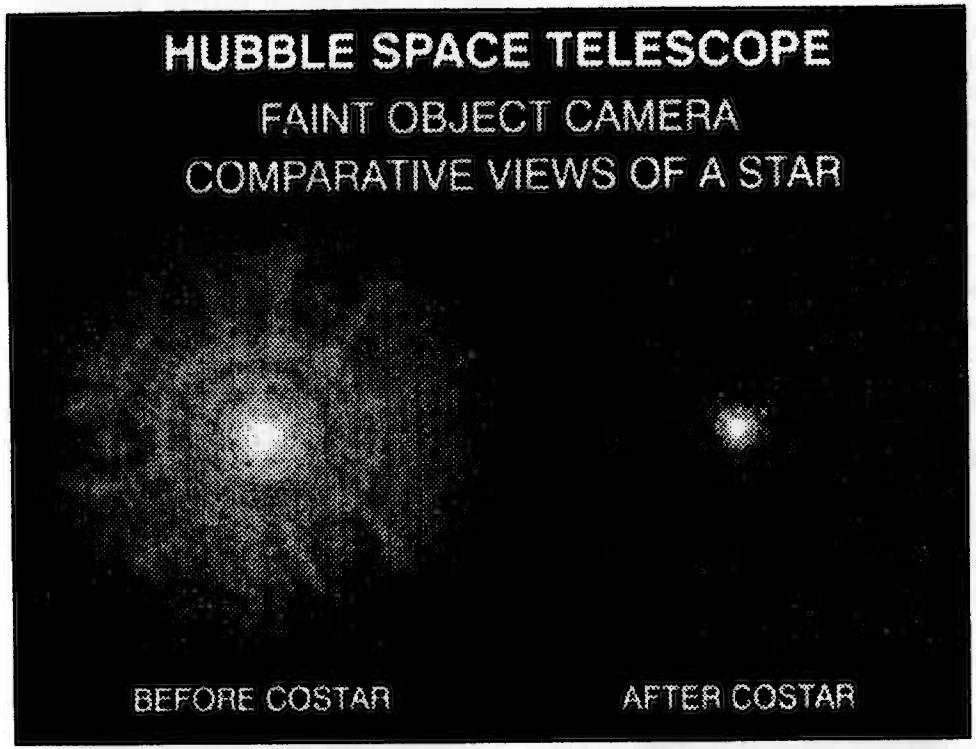
A spiral galaxy in the Virgo Cluster

Hubble Space Telescope
Wide Field Planetary Camera 2



The upper panel shows the inner region of M100 imaged with the Planetary Camera in full resolution.

The image at left shows a mosaic of the three Wide Field Cameras plus the Planetary Camera.



Comparative views of a star before and after the installation of the Corrective Optics Space Telescope Axial Replacement (COSTAR)

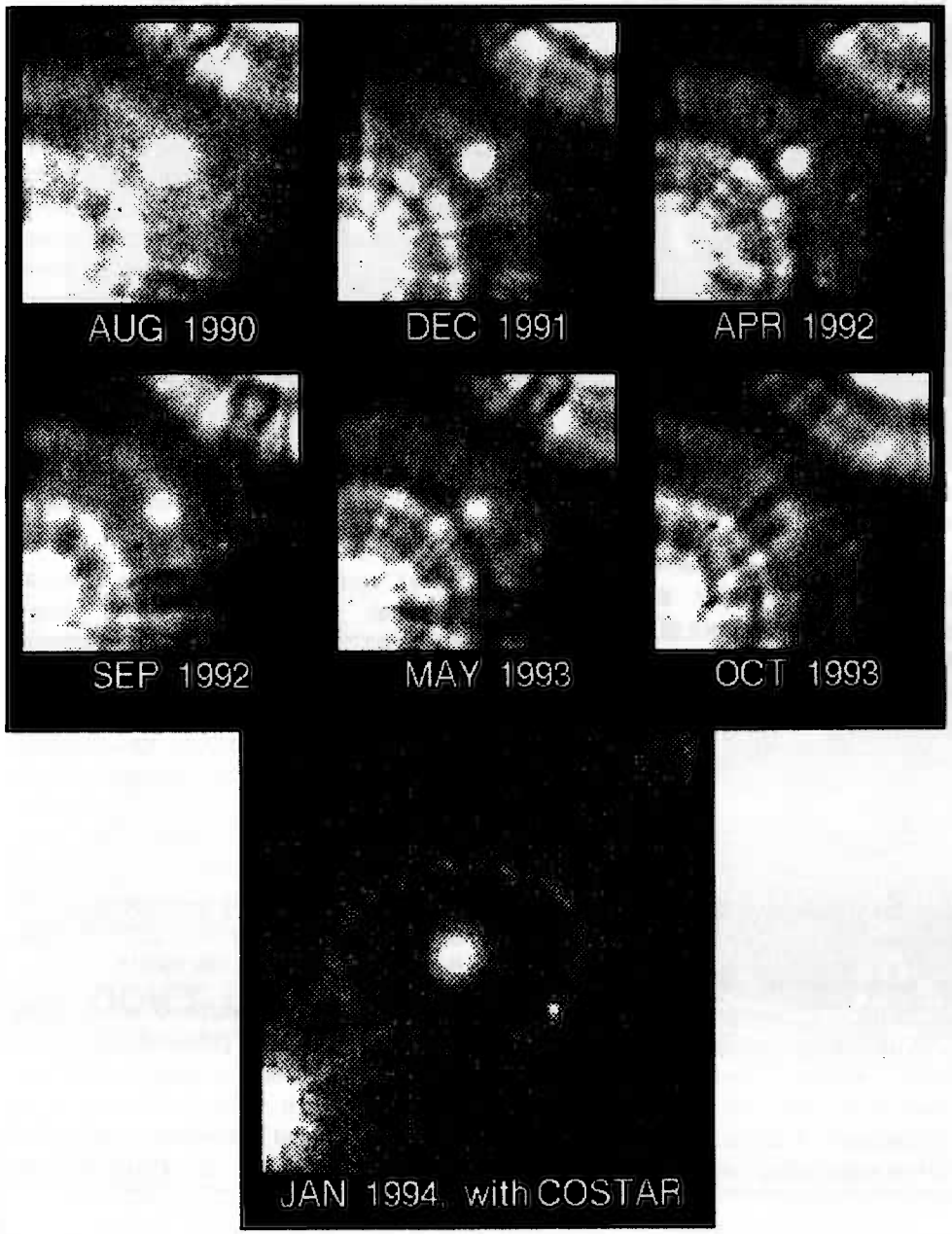
This pair of images of a single star, taken with the European Space Agency's Faint Object Camera (FOC), demonstrates that NASA's Hubble Space Telescope has been fully restored to its planned optical performance. The COSTAR mirrors remove the effect of spherical aberration in the HST's primary mirror. The FOC will now be able to observe extremely faint celestial objects with a clarity unmatched by ground-based telescopes.

Above left: An FOC image of a star taken prior to the STS-61 Space Shuttle mission to service the HST during which astronauts installed COSTAR. Spherical aberration in the telescope's primary mirror causes the broad halo (four arc-seconds in diameter) around the star. Because of this aberration, only a small fraction of the light is concentrated in the central core (inner 0.1 arc second radius) of the star's image.

Above right: Following the installation, deployment and alignment of COSTAR, the FOC now fully meets its pre-launch expectations. Most of the starlight is concentrated into a 0.1 arc second radius circle (85% at wavelength 486 nanometers), and the blurry "skirt" of light is completely gone. This demonstrates that HST now has 10 times better resolution than large ground-based telescopes. »»

The 1987 supernova

Six Hubble images taken before the corrective optics, compared with an image taken after correction.



Hubble sees changes in gas shell around Nova Cygni 1992

The European Space Agency's (ESA) Faint Object Camera (FOC), using the corrective optics provided by NASA's COSTAR (Corrective Optics Space Telescope Axial Replacement), has given astronomers their best look yet at a rapidly ballooning bubble of gas blasted off a star. (See pictures on next page.)

The shell surrounds Nova Cygni 1992, which erupted on February 19, 1992. A nova is a thermonuclear explosion that occurs on the surface of a white dwarf star in a double star system.

Right: The new HST image reveals an elliptical and slightly lumpy ring-like structure. The ring is the edge of a bubble of hot gas blasted into space by the nova. The shell is so thin that the FOC does not resolve its true thickness, even with HST's restored vision.

Left: An HST image taken on May 31 1993, 467 days after the explosion, provided the first glimpse of the ring and a mysterious bar-like structure. But the image interpretation was severely hampered by HST's optical aberration that scattered light from the central star contaminating the ring's image. However, an image of the nova's ring made using a ground-based telescope under the best seeing conditions on Earth would show up as a fuzzy dot, completely filling a single picture element or "pixel".

A comparison of the pre- and post-COSTAR/FOC images reveals that the ring has evolved in the seven months that have elapsed between the two observations. The ring has expanded from a diameter of approximately 74 to 96 billion miles (image angular diameters of 0.26 arc seconds and 0.34 arc seconds, respectively). The bar-like structure seen in the earlier HST image has disappeared. These changes might confirm theories that the bar was produced by a dense layer of gas thrown off in the orbital plane of the double star system. The gas has subsequently grown more tenuous and so the bar has faded.

The ring has also grown noticeably more oblong since the earlier image. This suggests the hot gas is escaping more rapidly above and below the system's orbital plane. As the gas continues escaping, the ring should grow increasingly egg-shaped in the coming years.

HST's newly improved sensitivity and high resolution provides a unique opportunity to understand novae by resolving the effects of the explosion long before they can be resolved in ground-based telescopes.

Nova Cygni is 10,430 light years away (as measured directly from the ring's diameter), and located in the summer constellation Cygnus the Swan.

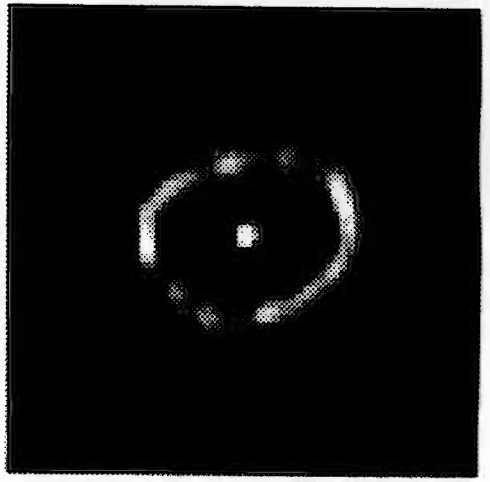
The images and captions shown here were all downloaded from NASA SPACELINK which is located at Marshall Space Flight Centre in Alabama, USA. SPACELINK is designed primarily to be used in education, but can be freely accessed by anyone with the correct setup - just watch those 'phone bills! (modem number 0101 205 895 0028, ftp/telnet number 192.149.89.61).

The pictures have suffered from being reproduced, but the colour originals are quite amazing (see, for example, *Sky and Telescope*, April 1994; *Astronomy Now*, March 1994; and *Astronomy*, April 1994 for colour versions). ¤ ***Daniel Cave***

Nova Cygni 1992

Hubble Space Telescope
Faint Object Camera

Pre-COSTAR
Raw image

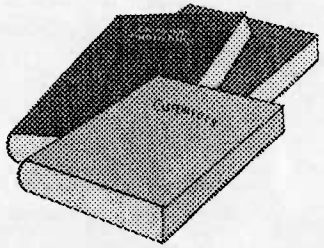


With COSTAR
Raw image

Book Review

The Cambridge Eclipse Photography Guide

by Jay M. Pasachoff and Michael A. Covington



This thin paperback seems to have been largely a family affair, with the Pasachoff and Covington wives and daughters (two each) mentioned in the acknowledgements and credited with some of the photographs. The aim of the book is to describe "everything you need to know to observe and photograph the forthcoming solar and lunar eclipses in the decade of the 1990s." (Well, the remainder of the decade, as it was published in 1993.)

After a general introduction to eclipses, the first chapter deals with eclipses of the Moon, listing details for 11 events from 1993 to 2000, and giving guidance on photographic exposures. Eclipses of the Sun are dealt with in Chapter 2, which describes methods of viewing solar eclipses safely, and taking photographs through filters.

Chapter 3 discusses cameras, lenses and telescopes, with tables of the size of the solar or lunar image on the film, methods of determining exposures, and how to couple a camera to a telescope and to focus it. Chapter 4 is a detailed description of the forthcoming annular solar eclipse of 1994 May 10 in North America (which will be seen as a partial eclipse here). Chapter 5 gives briefer descriptions of the remaining 5 total solar eclipses and 3 annular eclipses from 1994 to 1999, including the total eclipse of 1999 August 11, the track of which passes close to Guernsey.

Chapter 6 presents maps and tables showing the path of the August 1999 eclipse, which will be useful for local observers. Chapter 7 describes how to video solar eclipses, and the final chapter is an account of the Pasachoffs' expedition to the 1991 eclipse in Hawaii.

Finally, there are two appendices listing sources of further information and exposure tables. The book also contains a number of actual photographs, many in colour, showing the results possible and various effects obtainable with different photographic techniques.

Despite the amount of useful and highly specific data, I found the book somewhat unsatisfactory. It seemed rather anecdotal in character, and appeared to have been cobbled together from a variety of previously published material (much of it from Covington's *Astrophotography for the Amateur*, which is in the Section Library) and personal reminiscences, perhaps with a view to exploiting the current interest in solar eclipses.

Although it is an inexpensive book, I think members will find it of limited interest. I propose to place my copy in the Section Library, so you can consult it there. ¤

David Le Conte

The Cambridge Eclipse Photography Guide is published by Cambridge University Press (ISBN 0-521-45651-7), and costs £10.95.

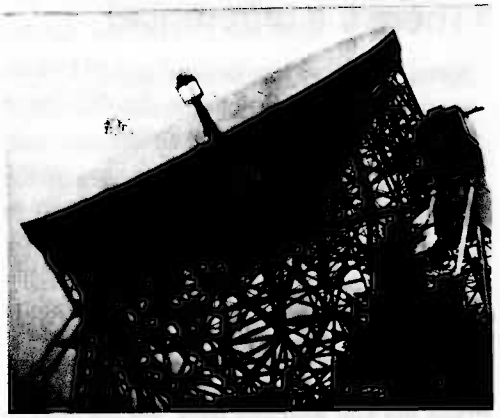
Another visit to . . . Jodrell Bank

The site at Macclesfield in Cheshire is the Nuffield Radio Astronomy Laboratory of the University of Macclesfield. The main instrument is the 76.2 metre fully steerable Mark I telescope, which has a computer guided altazimuth mounting. There is also a smaller 38 metre Mark II elliptical telescope.

I last visited Jodrell Bank about four years ago, and was very impressed with the Visitors Centre. when I first arrived I could not help being overwhelmed by the sheer size of the Lovell Telescope, as it is called. There is a planetarium, with shows every ¾ of an hour. The 35 acre arboretum has a model of the solar system, showing the distance scale of the planets from the Sun. The Visitors Centre has a mock-up of the control room, a gift shop, and many other interesting demonstrations.

During my visit I got talking to a caretaker; a nice gentleman who let me take photographs from a viewpoint where the public are not permitted. We talked for about thirty minutes. He told me of celebrities who have visited Jodrell Bank, like Patrick Moore, who has made it the subject of the Sky at Night programme.

The Mark I has been in operation since 1957, and was mainly due to Sir Bernard Lovell who overcame one difficulty after another, mainly financial. Radio astronomers have an advantage over optical astronomers, as they can work in daylight, and when it is overcast cloud cover does not matter. But they also have problems with interference from other radio sources.



Jodrell Bank is part of a network with other radio telescopes in the country, which are linked to the Jodrell Bank computer.

A visit to Jodrell Bank is a rewarding and educational experience for anyone, even if they are not scientifically minded. I will certainly be visiting Jodrell Bank again in the future, and hope to learn a lot more about it.

Radio astronomy has come a long way since it really began at the end of World War II. Although Jodrell Bank is no longer the largest radio telescope in the world, we hope it will continue to be at the forefront of modern research. ¤

Roger Chandler

Jodrell Bank Science Centre and Arboretum are open from Easter to the 31st October from 10.30 am to 5.30 pm, and the rest of the year on weekends and Christmas holidays only, from 12 noon to 5.00 pm. There are modest admission charges. The address is: Macclesfield, Cheshire SK11 9DL, tel. 0477 71339.

There's a difference!

Even in this modern day and age of hi-tech some people do not know the difference between astronomy and astrology.

Where astronomy is the true study of the celestial bodies, astrology is supposed to predict events in a person's life by reference to the positions of the Sun, Moon and planets on the zodiac at the time of birth.

It is true that the Moon gives us the tides, and the Sun heat and light, but the stars in fact so far away and at all different distances from us that they cannot possibly affect our lives.

Astronomy is the real science of celestial bodies, where astrology is really no more than superstition and fortune telling by the stars.

Roger Chandler

Who are you?

In the next issue of Sagittarius we will be starting a new series of brief articles about Astronomy Section members.

We need **you** to write in with details about how you became interested in astronomy, what your favourite area of astronomy is (and why), something about yourself and your family, where you work, where you have lived, what your other hobbies are, whether you have a telescope, etc.

Literally anything you can think of that may interest other members. (Giving your age is optional.) In this way it is hoped that members will get to know a little more about each other, and perhaps identify further mutual interests. We may also be able to make use of unfathomed skills!

Did you know?

There are over 40,000 square degrees in the sky.

The surface area of a sphere is $4\pi r^2$, where r is the radius. So a sphere with unit radius has a surface area of 4π square radians. This does not sound like a lot (about 12½). However, a radian equals 57.2958 degrees, and a square radian is therefore 3,282.8 square degrees. The surface area of the celestial sphere is then given by $4\pi \times 3{,}282.8$, or 41,253 square degrees.

What does this mean? Well, suppose the field of view of your telescope is 1° wide, that is an area of just 0.785 square degrees (given by πr^2). So you would have to point your telescope some 52,550 times (= 41,253 / 0.785) to cover the whole sky. In fact, because of overlapping fields, that figure should be approximately doubled, so about 100,000 separate observations would be needed.

Even binoculars or finder 'scopes with a field of, say, 7° cover less than one thousandth of the sky.

No wonder it's so easy to miss things! ¤

David Le Conte

More sundials

I knew I'd missed one sundial. The one on the front of the Forest School is dated 1829. It has also been suggested that there used to be one in the centre of the rose garden at Saumarez Park, but it is no longer there.

Anyone know of any others?

David Le Conte

Kepler's harmony

The mention in the last issue about the "music of the spheres" reminded me of Kepler's keen interest in the concept. Indeed, his third law was contained in the work entitled *Harmonice Mundi* (Harmony of the World) in 1619.

He spent much effort in trying to find correlations between the motions of the planets and the harmonic series. He eventually established that the ratios in angular velocity of the planets, as seen from the Sun, accorded with the musical intervals.

For example, the ratio of Saturn's motion at aphelion to that at perihelion is close to 4:5, the major third. For Jupiter the ratio is a minor third. He found that he could arrive at the intervals of the complete scale by taking various ratios, and, if several planets were simultaneously at the extreme points of their orbits, a motet would result! Saturn and Jupiter, he said constituted the base, Mars the tenor, Earth and Venus the contralto, and Mercury the soprano.

He published the results in *Harmonice Mundi* (see below), and said:-

"It is, therefore, no longer surprising that man, in imitation of his Creator, has at last discovered the art of figured song, which was unknown to the ancients. Man wanted to reproduce the continuity of cosmic time within a short hour, by an artful symphony for several voices, to obtain a sample test of the delight of the Divine Creator in his works and to partake of his joy by making music in the imitation of God."

It is somewhat strange that the motivation for Kepler's superb work in analysing Tycho Brahe's observations of the motions of the planets, and producing his three laws describing those motions, was to find a cosmic and truly heavenly harmony, a concept long since discredited.

David Le Conte

Reference: *The Watershed* by Arthur Koestler, Heinemann, 1961