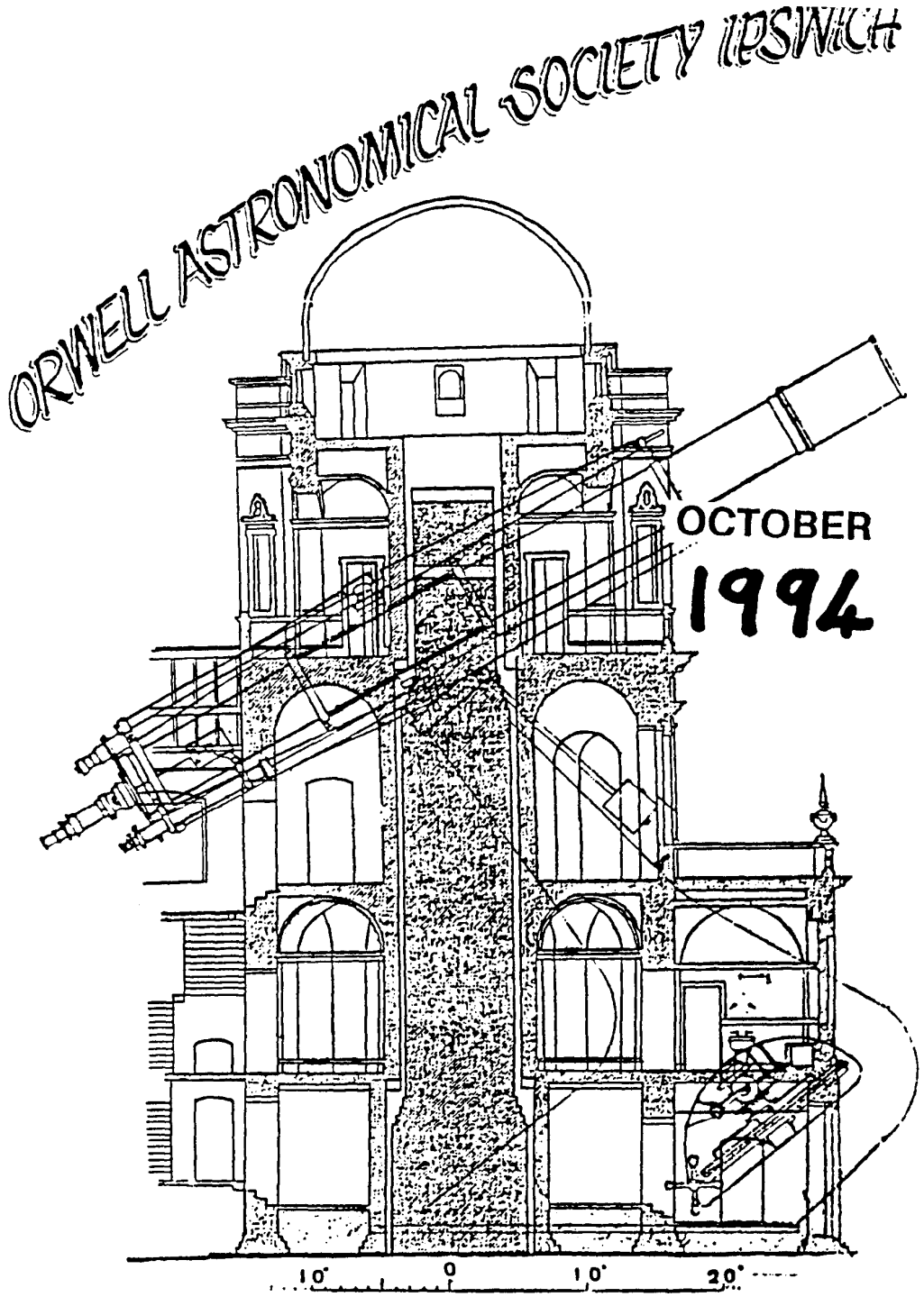


SOCIETY NEWS

1 Committee Meeting

The next committee meeting will be on Saturday 1st October from 7.30. As usual this is an open meeting and any member is welcome to attend.

2 List of Events For 1994

OPEN WEEKEND

New dates for this years Open Weekend:-

Friday	14th	October	8.00	to	10.00	pm	
Saturday	15th	October	8.00	to	10.00	pm	
Sunday	16th	October	8.00	to	10.00	pm	

As usual as much help as possible will be required, even if it is for only an hour or so.

ii) CHRISTMAS MEAL

THE CHRISTMAS MEAL THIS YEAR WILL BE THE BlACK TILES PUBLIC HOUSE MARTLESHAM. ON WEDNESDAY THE 7th DECEMBER

Twenty places have been booked. If you wish to attend there is a £3.00 none returnable deposit required, on a first come first served basis.

All monies to Roy Gooding ASAP

iii) Norwich AS will be approached, with the aim to arrange an evening visit to their new observatory site.

NIGHT SKY

All times GMT

SUN

Rises approximately at 06.00 to 07.00
Sets approximately at 17.40 to 16.40

MERCURY Mercury is at inferior conjunction on the 21st, after which it will become visible in the morning sky. Mercury will be rising about 2 hours before the sun by the end of the month.

VENUS Venus will not be visible this month as it will be setting very near to sun set all month.

MARS Mars will be rising at about 23.00 in mid month. Mag. 0.7.

JUPITER Jupiter will be setting at about 18.00 in mid month. Mag. -1.7

SATURN Saturn will be visible for most of the night, it will be setting at about 02.00 in mid month. Mag. 0.8

URANUS & Neptune Both planets are in Sagittarius, and will be visible in the evening sky only. They will be setting at about 22.00 in mid month.

R.Gooding

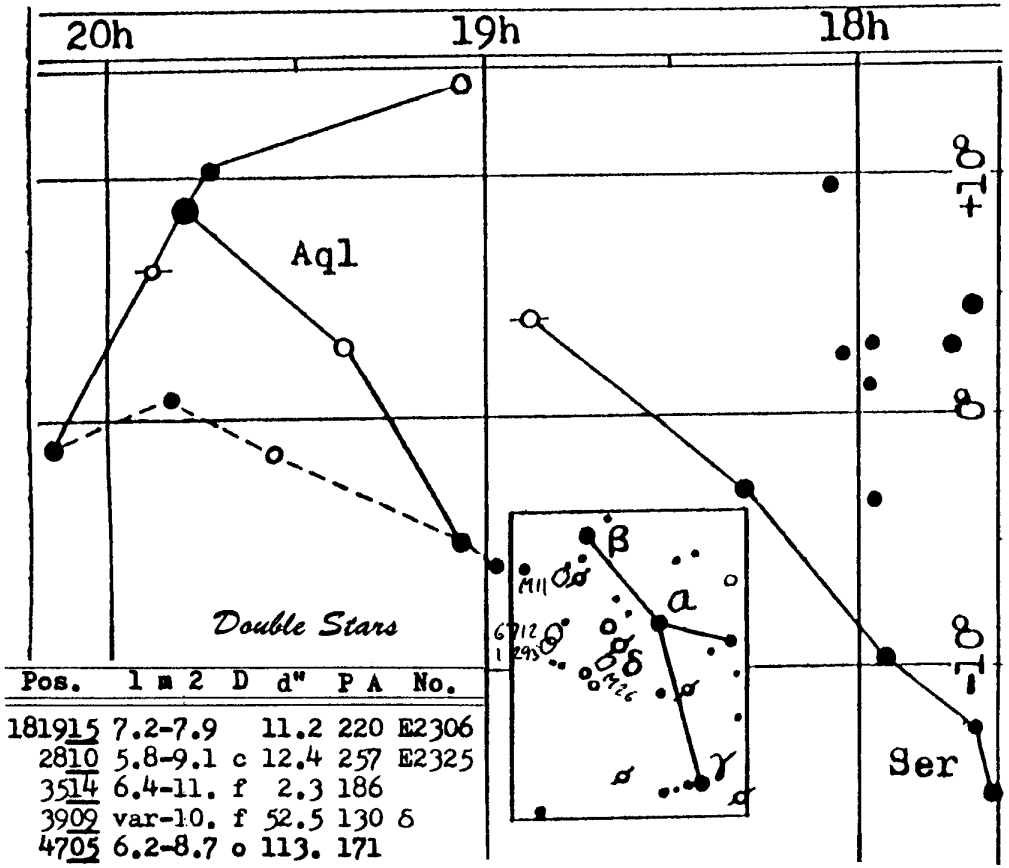
Scutum

Scutum is a small constellation through which the summer Milky Way runs. Scutum is a shield but its stars do not form a recognizable figure. It is most easily picked out by the presence of a star cloud within it, a bright patch of Milky Way (roughly circular in shape) with three bright stars at the top. This area is on the meridian at 10pm on August 1st.

Scutum is worth exploring as it contains several very interesting telescopic objects. The star cloud itself is best seen with 7 + 50 binoculars. It has quite defined boundaries to the north and west and blends into the Milky Way to the south and east.

The open cluster M11 is embeded in the north east shoulder of the cloud. It is one of the most concentrated open clusters. The stars are of a similar brightness except for an orange star which is about a magnitude brighter at about Mag 8.

Another field of interest is that of the globular cluster N.G.C. 6712 and planetary nebular I.C. 1295. This pair of objects can be seen together in a half-degree field as they are only 24 arcminuets apart. The cluster is fairly large but needs a 10 inch telescope or better to resolve it. Just east is the fairly large planetary nebular which appears as a grey round disk with little detail. The open cluster M 26 is nearby to the west, but is not a strong object for the smaller telescopes but contains about 40 stars gathered into a 15 arcminute of field.



A REVIEW OF THE JUPITER COLLISION

by James Appleton

The last half of July witnessed much interest among the astronomical community, and the wider public, in the collision of comet Shoemaker-Levy 9 with Jupiter.

The comet was discovered on 25 March 1993 by Eugene and Carolyn Shoemaker and David Levy, using an 18" Schmidt camera at the Mount Palomar observatory. The discovery was based on a photographic plate exposed two days earlier.

The Shoemakers are particularly experienced comet hunters with 61 discoveries to their credit. Their technique relies on the proper motion of a comet to identify itself as a non-stellar body. They photograph large areas of the sky, typically with an eight minute exposure, and repeat the photograph 45 minutes later. Comparison of the two photographs with a stereo-microscope reveals any bodies which have moved against the background of fixed stars.

As so often in science, serendipity played a large part in the discovery of Shoemaker-Levy 9! The weather on the night of 23 March was so poor that the observers would not normally have bothered putting film into their camera. However, they had a box of old film to hand, which had been partially exposed by accident some days previously, so decided to insert it into the camera, and avoid wasting good film. Fortunately, two of the film plates, despite being fogged round the edges, captured the first image of a very strange, bar-shaped object. This object, which Carolyn Shoemaker first described as a "squashed comet", later became known as comet Shoemaker-Levy 9.

Other, more powerful, telescopes, revealed that the comet was in fact composed of 21 cometary fragments, strung out in a line, which accounted for the unusual shape. The term *string of pearls* was soon coined. Figure 1* is a mosaic taken by

* The images of the comet and Jupiter shown here may be accessed via the Internet at URL http://newproducts.jpl.nasa.gov/sl9/news.html. There is now a vast wealth of images available from this source.

the Hubble Space Telescope (HST) during 24-27 January 1994. It shows the main fragments, which at that time spanned a linear distance of approximately 600,000 km. Initially, the fragments were surrounded by extensive dust clouds in the line of nucleii, but these later disappeared. Some of the nucleii also faded out (presumably due to disintegration), while others split into multiple fragments.

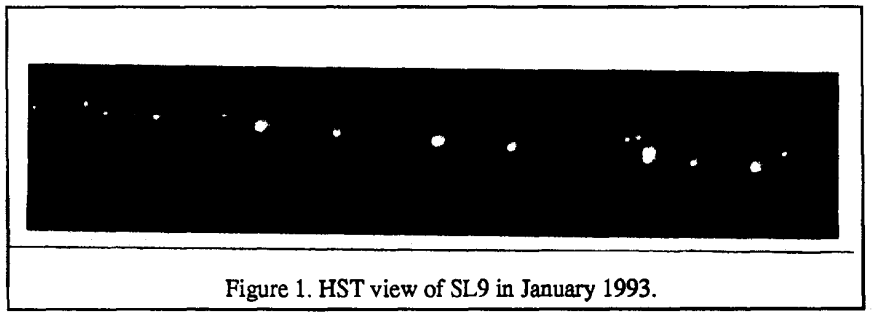


Figure 1. HST view of SL9 in January 1993.

The use of large telescopes enabled the precise positions and velocities of the cometary fragments to be obtained, and this facilitated calculation of their orbits. At the time of their discovery, the fragments were located approximately 50,000,000km from Jupiter, all co-orbital, in a highly elliptical orbit. Calculations revealed that prior to its disintegration, the comet had originally been in a periodic orbit around the Sun. It was captured by Jupiter at some unknown date, and on 7 July 1992, passed approximately 21,000km above the Jovian cloud tops. The gravitational forces associated with such a close approach caused the comet to disintegrate, resulting in the 21 fragments visible at the time of its discovery.

The size of the original comet and each of the fragments was, and still is, something of a mystery. The first analysis of the orbital dynamics of the fragments suggested that the comet was originally some 2.5km in diameter, with an average fragment diameter of 0.75km. Later work gave corresponding diameters of approximately 10km and 2km, and these values are considered more likely now. There was considerable variation in the diameters of different fragments.

Further calculations revealed that the cometary fragments were on course to collide with Jupiter during July 1992, and that each fragment could deliver an energy equivalent to approximately 500,000 million tons of TNT. The prospect

of celestial fireworks on such a grand scale immediately captured the attention of astronomers world-wide!

Each fragment was assigned an identity letter A-W (letters "I" and "O" were not used to avoid confusion with numbers "1" and "0"), and a co-ordinated program of observations was put in place world-wide to track their progress towards impact with Jupiter.

As the cometary fragments reached the cloud tops of Jupiter, they were travelling at approximately 60km/sec, and the chain of fragments had spread out to cover approximately 30,000,000 km. The impacts occurred during 16-22 July. All took place at a latitude of approximately 48°S, which nominally placed them in the SSS Temperate Region; however, visually they appeared close to the Jovian polar region. The impacts all occurred some 10-15° round the limb on the far side of the planet as seen from Earth. However the rapid rotation of the planet (a Jovian day is only some 10 hours long) soon carried the impact sites into the view of Earth-based telescopes. The collisions lived up to all but the wildest expectations, and provided a truly impressive spectacle.

Jupiter is composed of a relatively small core of iron and silicates, surrounded by hydrogen. In the depths of the planet (approximately 1000km and more below the visible cloud tops), the hydrogen is so compressed that it is metallic in form; further from the centre, the pressure is lower and the hydrogen is in its normal molecular form. The Jovian clouds visible from Earth consist primarily of methane and ammonia. There are other elements and compounds lurking in the cloud tops and below, which are thought to be responsible for the colours seen in the atmosphere.

The smaller comet fragments plunged into Jupiter, rapidly disintegrated and left little trace; three of the smallest fragments, namely T, U and V, left no discernible traces whatsoever. However, many of the comet fragments were sufficiently large to result in a spectacular display. Each large fragment punched through the cloud tops, heating the surrounding gases to some 20,000K on the way, and caused a massive plume or fireball, up to 2000km in diameter, to rise above the cloud tops. Before encountering thicker layers of the atmosphere and disintegrating in a mammoth shock wave, the large fragments raised dark dust particles and ultra-violet (UV) absorbing gases high into the Jovian cloud tops. The dark particles and UV absorbing gases manifested themselves as a dark scar surrounding the impact site in visible light.

The HST took many fine pictures of the collisions using its Wide Field Planetary Camera. Figure 2 is a view from the HST of the impact sites of fragments C, A

and E (in that order from left to right across the disk). The satellite Io may also be seen, passing above the equator of the disc. The photograph was taken on 17 July. The impact sites, all near the planet's South polar region, are considerably more prominent in UV light than visible light (this is because of the presence of UV-absorbing gases). Some idea of the scale of the impact sites may be gained from comparison with the Great red Spot, visible on the Eastern limb of the planet, which has a major axis approximately equal to the diameter of the Earth.

Fragment G was one of the larger fragments of the comet, and had a particularly impressive collision with Jupiter. (Collision occurred at approximately 07:30 UT on 18th July.) Figure 3 shows the impact plume associated with the fragment G collision as seen by the HST, with views given in several wavelengths. The plume is analogous to the mushroom cloud associated with a nuclear explosion. The collision site is still on the far side of the planet, but the plume has reached sufficient altitude that it is visible round the limb of the planet. As explained above, the plume is most prominent in blue light. Figure 4 gives an Earth-based view of the plume, taken by the Keck telescope on Mauna Kea (Hawaii). Figure 5 shows HST photographs taken once the impact site of fragment G was carried by the planet's rotation into visibility from the Earth. The impact site bears a certain resemblance to a sunspot, with a dark central region surrounded by lighter shading.

The impact sites of the collisions are now beginning to evolve and fade as they become subject to the dynamics of Jupiter's atmosphere. No-one knows how long they will remain visible from Earth, but it is thought that the larger scars may persist for a year or more.

The interest of professional astronomers in Jupiter is now waning and valuable work can therefore be performed by amateurs in tracking the evolution of the collision scars. The scars are easily visible in a modest telescope, and a large reflector will show them in some detail. There is scope for valuable observing work from now until Jupiter reaches conjunction with the Sun.

Astronomers and archivists are now searching old records for possible previously unrecognised impacts on Jupiter. Several spots were reported from 1690 to 1872 by observers including William Herschel and Giovanni Cassini. The records of the BAA in 1927 and 1948 contain drawings of Jupiter with black dots or spots visible. It may be possible that comet impacts have been observed before, without their identity being realised, but no-one can be sure.

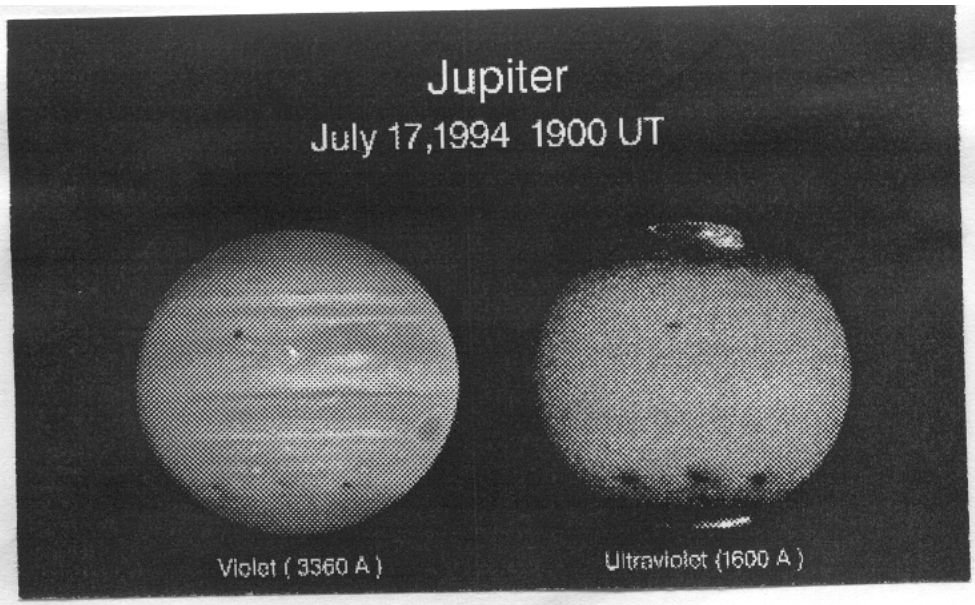


Figure 2. Hubble Space Telescope view of impact sites C, A and E.

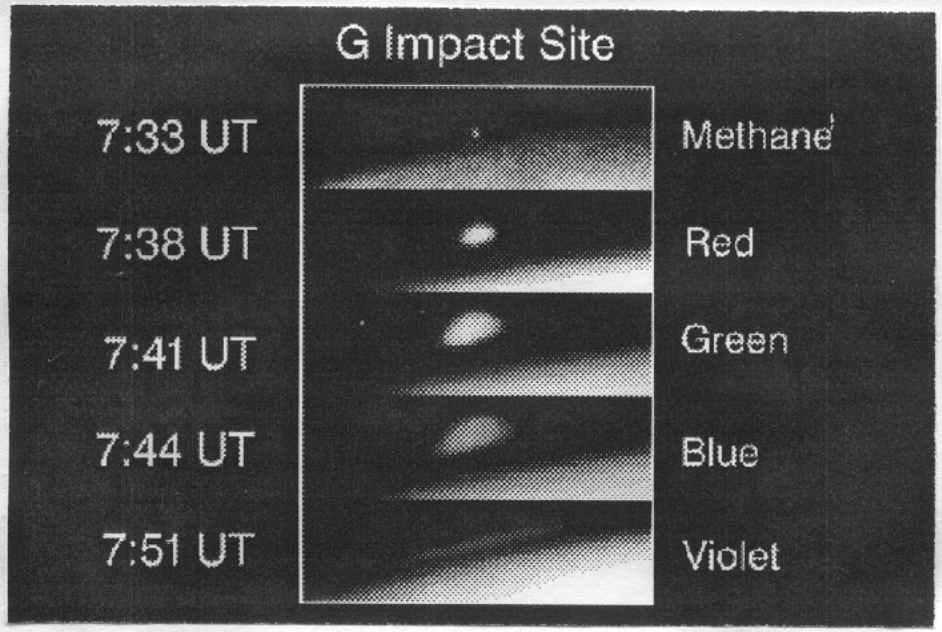


Figure 3. HST view of impact G plume appearing around Jovian limb.

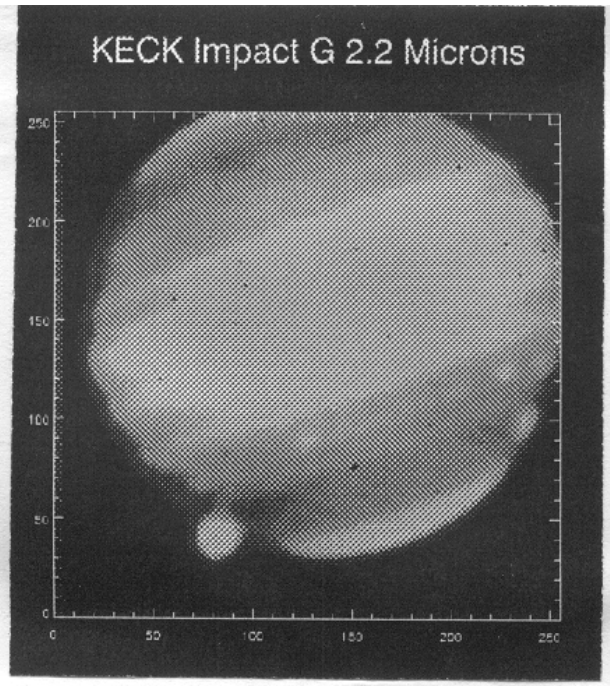


Figure 4. Keck image of fragment G impact plume.

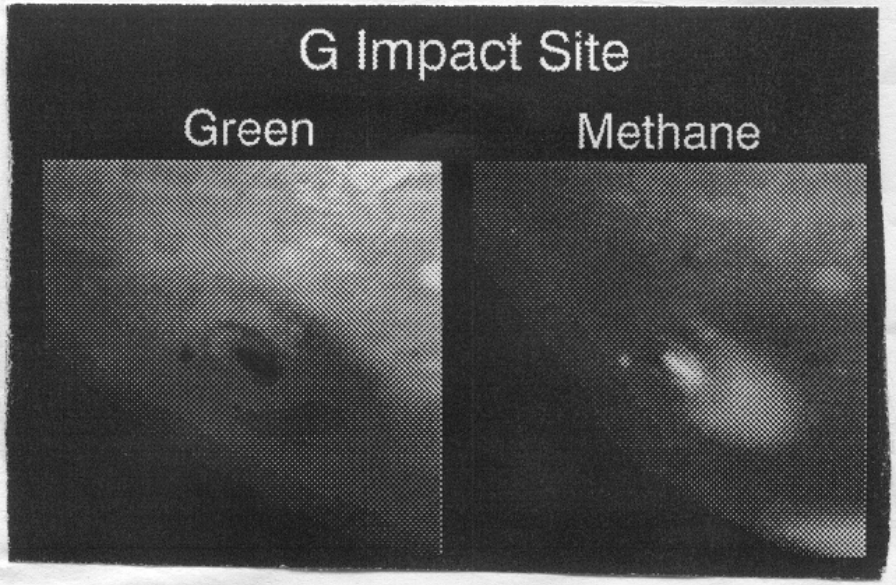


Figure 5. HST view of fragment G impact site.

THE HUBBLE CONSTANT(LY CHANGING!) By Roy Adams.

As a regular reader of New Scientist, I thought members and friends would like to know about the latest goalpost position in the seemingly everlasting game of 'guess the age of the Universe'.

The August 20th edition of the weekly scientific magazine suggests in an article entitled, 'One giant leap for cosmology...' that the game has at last ended!

Cepheid variables, pulsating yellow stars, have been discovered in the Virgo cluster of galaxies. This is said to be extremely important, Cepheid variables being good distance indicators, and Virgo also being a valuable post along the way.

George Jacoby at Kitt Peak Observatory in Tucson said the quest for accurate definition of the Virgo distance had begun in the late 1920s, with Edwin Hubble. This had been a primary goal in deriving the Hubble constant, the current expansion rate of the Universe, and key to the age of the Universe.

The larger the figure for the constant, the younger the firmament would be, as the faster the expansion, the smaller the time taken to get to its present size.

Measuring the distance to a remote galaxy, then comparing that with its red shift, is notoriously hard. A previous New Scientist article (1993 February 13) put the Hubble constant uncertainty factor at no less than two!

The longer the Cepheid's period, the brighter it is. The period shows the star's true brightness, which can be compared with its apparent brightness to yield the distance. (This was in yet another N. S. article, 1992 June 6.) But until recently, Cepheids had not been seen far enough away - only in fairly near galaxies under the influence of Milky Way forces.

Now a group of astronomers has found Cepheids in NGC 4571 in Virgo, with the Canada-France-Hawaii Telescope on Mauna Kea. They arrive at a distance of 49 million light years, +/- 15 per cent, for that galaxy. Past estimates varied between about 40 and 70 million light years.

The rather low latest estimate makes the Hubble constant large and the Universe fast-expanding. And only 10 billion years old, or less. Michael Pierce of the group puts the Hubble constant at about 90 kilometres per second per megaparsec (one megaparsec being 3,26 million light years).

Research has since proceeded apace: another large group of astronomers have verified Cepheids in M100, also in Virgo, using NASA's refurbished Hubble Space Telescope. Distance determination for M100 is expected in a few weeks. The task is, one might say, 'of course', complicated by the fact that galaxies in the Virgo cluster are NOT at the same distance from Earth! The elliptical galaxies at Virgo cluster core are old, and have no young, Cepheid-type stars.

But Pierce and others argue there may be a gravitational link between M87, 2o away from NGC 4571, and NGC 4571 is losing some gas to the Virgo cluster's dense core. This would prove it as a stepping-stone to even better measurement of the constant using Cepheids much further away.

PROGRAMME FOR OCTOBER

DAYS &DATES	DIRECTORS	SECTION & ADDRESSES	PHONE INC. STD CODE
Mondays	from 7.30pm	GENERAL OBSERVATION SECTION	
3-10-17-24-31	Mr J King	[redacted], Felixstowe, IP11 9LQ	[redacted]
Tuesdays	form 7.30pm	GENERAL OBSERVATION SECTION	
4-11-18 25	Mr D Barnard	[redacted] IP3 BRN	
	Mr J King	(Address above.)	(Number above)
Wednesdays	from 8.00pm	NEBULA & FAINT OBJECTS SECTION	
5-12-19 26	Mr M Cook	[redacted], Ipswich, IP4 5PZ	[redacted]
	Mr D Payne	[redacted], Wickham Market, IP13 0SD	
Thursdays	from 7.30pm	OBSERVATORY VISITS FROM OUTSIDE GROUPS	
6-13-20 27	Mr P Richards	[redacted], Nacton, Ipswich, IP10 0HS	[redacted]
Fridays	from 7.30pm (may be postponed to Saturday)	PLANETARY & LUNAR SECTION	
7-14-21 28	Mr P Richards	(Address above.)	(Number above)
	Mr G Marriott	[redacted] Ipswich IP4 4JB	

All members are welcome to come but, on nights other than Wednesdays please check with directors that the observatory will be open. Directors will also be able to tell you if a group visit is taking place. All of the sections observe anything of interest but the title of each section suggests a popular subject.

Lectures and other events: **COMMITTEE MEETING**

The next committee meeting will be on Saturday 1st October at 7.30. As usual this is an open meeting and any member is welcome to attend.

At the time of printing there are four visits by outside groups arranged so if any one can help on the 3rd 13th 20th or the 27th please contact P Richards.

1994 COMMITTEE

			Home Phone:	Work Phone:
CHAIRMAN	D Payne	(Address above)	[redacted]	
MEMBERSHIP RENEWALS	M.Cook	(Address above)		
MEMBERSHIP SECRETARY	R.Gooding			
SECRETARY	R Gooding	[redacted], Ipswich, IP1 6AE		
TREASURER	M Nicholls	[redacted], Capel St Mary, Ipswich, IP9 2EX		
MAINTENANCE CO-ORD	M Cook	(Address above)		
JOURNAL CO-ORDINATOR	E Sims	[redacted], Ipswich, IP1 4HA		
PUBLICITY & VISIT CO-ORD	P Richards	(Address above)		
EQUIPMENT CURATOR	M.Harlow	[redacted] Trimley	[redacted]	
SPECIAL EVENTS CO-ORD	P.Richards			
LIBRARIAN &COMP SOFTWARE	J.Appleton	[redacted] Ipswich IP3 0QJ	[redacted]	

ORWELL ASTRONOMICAL SOCIETY
IPSWICH

OPEN WEEKEND

ORWELL PARK OBSERVATORY
NACTON

near Ipswich

FRIDAY	*OCTOBER*	*14 th*	*8.OO*	*to*	*10.OO*	*pm*
SATURDAY	*OCTOBER*	*15 th*	*8.OO*	*to*	*10.OO*	*pm*
SUNDAY	*OCTOBER*	*16 th*	*8.OO*	*to*	*10.OO*	*pm*

The observatory will be open to observe the night sky
Weather permitting.

Binoculars may be useful.

The MOON and SATURN

Will be observed using the observatory's 10" refractor and other telescopes
Slide shows and talks if cloudy.

OBSERVATORY
ENTRANCE DONATION

Child & OAP 35p
Adult 75p

Honorary Secretary
Mr. R Gooding
168 Ashcroft Road
Ipswich
IP1 6AE

Helen Sharman, Britains women astronaut will be giving a talk at Orwell Park School on 14th October at 7.30 pm. Details about tickets can be obtained from Orwell Park School.