

# ORWELL ASTRONOMICAL SOCIETY IPSWICH

## SOCIETY NEWS

### 1 SOCIETY EXPENDITURE BUDGET'S

At the last committee meeting it was decided to allocate a fixed amount of money for spending on various items.

£50 was allocated for the new library books. If any one needs to buy any items for the library, could they please check with Pete Richards first.

Expenditure on other items should firstly be checked with Mike Nicholls before purchasing.

### 2 OPEN WEEKEND


The OPEN WEEKEND this year is to be held on April 2nd, 3rd & 4th. The observatory will be open from 8 to 10 pm each evening, as usual as much help as possible is needed from members to look after the visitors. Even if you can only help for an hour or so please come along.

## NIGHT SKY

### SUN

All times GMT

Rises approximately between 05.40 to 04.30  
Sets approximately between 18.30 to 19.30

**M O O N**   
6th

  
13th

  
22nd

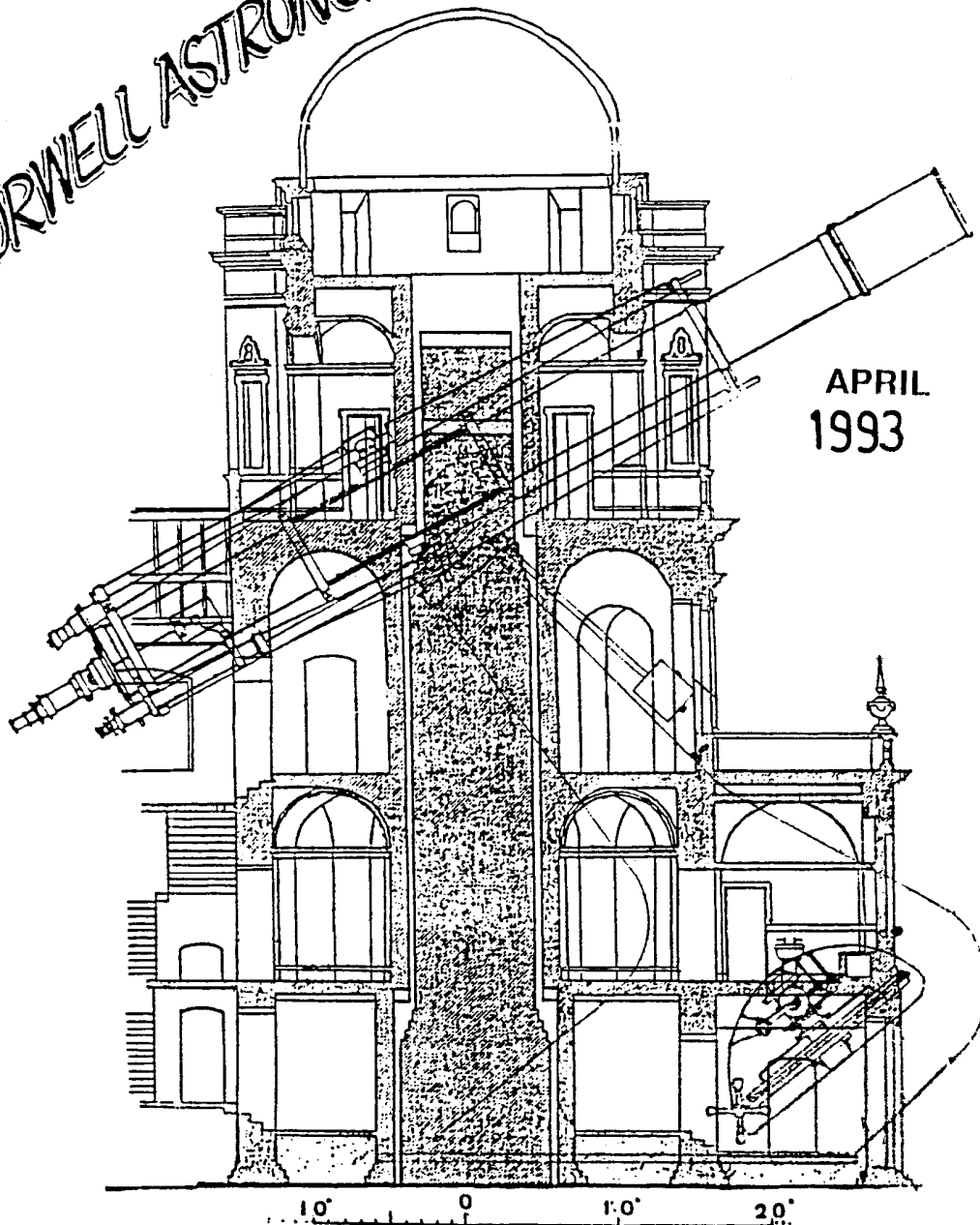
  
29th

### MERCURY

Mercury will be visible this month in the morning sky. It will be low down and in a bright sky, making it difficult to see. Mercury will be greatest western elongation on 5th (28°). Maximum brightest will be Mag. -0.2

### VENUS

Venus is at inferior conjunction on the 1st. After which it will reappear in the morning sky, where it will remain for the rest of the year. Venus will be in bright sky until July.



MARS Mars will be travelling eastwards this month, moving from Gemini into Cancer. Mars's distance from the earth is still increasing, and its brightness will decrease from Mag. 0.6 to 1.1.

JUPITER Jupiter is visible all night. Mag. -2.4.

SATURN Saturn will be rising before 03.00 at the end of the month. Mag. 0.9.

URANUS & NEPTUNE Uranus will be rising at about 02.00 in mid month. Neptune will be rising about 10 minutes before Uranus.

R. Gooding

## HOW LIGHT BEHAVES IN THE EXPANDING UNIVERSE

By Ian Swann

What follows are just some thoughts I have had regarding how light may behave in an expanding universe. I am left puzzled because my ideas are logical, but they do not seem to fit with current knowledge. I happily invite anyone to shoot my ideas down in flames, and will be delighted if someone can tell me the "truth" of the situation.

You are probably all familiar with the BIG BANG theory, that is the universe started by being infinitely small and through some singular event began to rapidly expand. This expansion is still going on today, and there is overwhelming evidence to support this theory, such as the observed red shifts from distant objects and the cosmic background radiation.

I must make one important point before I go on. The universe is not expanding into empty space. That is to say there is no space-time out there waiting for the stars and galaxies to spread out into it. Space-time and every thing in it is expanding as a whole.

The BIG BANG theory says that the "fabric" of the universe is expanding and that we see red shifts from distant objects because the wave like properties of light leaving a distant object, are stretched out as the expansion takes place. This stretching is the reason for the increase in the wave length, i.e. red shifts. From this we can imply that in some very intimate way, light is interacting with the "fabric" of free space! Of course we know that free space does have a permeability factor which governs the propagation speed of all electromagnetic radiation.

If the expansion of the universe stretches out the wave like properties of light, then it must be reasonable to suggest that the particle like properties of light are also stretched, that is to say the space between photons is stretched. We measure light intensity as the number of photons per second arriving at our detectors. Therefore, if the distance between photons from distant objects is stretched, they will arrive less frequently than photons from nearby objects, provided that both objects have the same absolute intensity. This would mean that the observed intensities of distant objects are underestimated, unless the speed of light has gradually increased to maintain the frequency of arrival.

### STRETCHING OF PHOTONS CAN BE VISUALIZED LIKE THIS.

(This must not be taken too literally.)



One of the cornerstones of modern physics is the principal of conservation of energy. This is a universal principal applying equally to such things as internal combustion engines as it does to particle physics and quantum phenomena. This principal is well proven, but it seems to me to fail with respect to light in an expanding universe.

We can do a thought experiment to see how the conservation of energy applies to light in an expanding universe. Let's say we have photons coming toward us from a distant object, and for the sake of simplicity all this light is of the same wave length. If a being millions of years ago, in the vicinity of our source object, had a spectrometer to capture some of this light and measure its wave length, what would he see? The detector on his spectrometer would register each photon as it arrived and the deflection within his spectrometer would tell him the wave length. Some of this light now travels across space and time, and is stretched out as the universe expands. It arrives at my spectrometer and I measure its wave length in the same way as our distant friend, but now the wave length is longer because the expansion has stretched it. Okay, now let's work out what happens to the energy of these photons. The equation for the energy of a photon is :-

$$E=h*f$$

where h is Plancks constant and f is the frequency of the light. Another equation we need is the one for the speed of light and this is:-

$$C=f*w$$

where C is the speed of light, f is frequency and w is wave length. It is obvious from this last equation that if we increase the wave length (w) and if C stays the same, the frequency (f) must get smaller. In being stretched our photons now have a lower frequency. If we now apply the first formula  $E=h*f$  we can see that if Plancks constant also stays the same then the photons have lost energy and this contravenes the conservation of energy principal. If we assume this principal is sound, then either the speed of light or Plancks constant must have changed as a consequence of the universe expanding.

One last interesting point. If we have the speed of light increasing with time through some mechanism other than the expansion of the universe, then what we get is wave length increasing just the same, i.e. red shifts without the need for the universe to be expanding at all!

## Messier Objects in Canes Venatici

David Payne

Canes Venatici is a fairly faint constellation lying south of Ursa Major 'The Great Bear' It contains four Messier objects within its boundaries all of which are worth searching for and observing with small or moderate telescopes. These Messier objects are M3 - a lovely globular cluster, M51 - the famous 'Whirlpool' spiral galaxy, M63 - a bright oval spiral galaxy and M94 - another spiral galaxy bright and very compact.

The globular cluster M3 was discovered by Messier in 1764. It lies on the southern border of the constellation in a fairly faint area of sky and is probably most easily found using binoculars. First locate Beta Coma Berenices then move east at the same declination about 6 degrees onto a line connecting Arcturus and Alpha Canes Venatici. M3 should be close to the centre of the field appearing as a fuzzy star about magnitude 6. Having located the object with binoculars it should be easy to find with a telescope. In a three inch telescope it appears as a bright central region fading away to a faint glow at the edges. No real resolution can be discerned with a three inch and at least a four inch is required to show some resolution at the outer edges. With every increase in aperture more stars can be discerned against the bright background of unresolved stars. With a ten inch, good dark skies and fairly high magnifications stars can be resolved against the bright background right to the centre of the cluster.

The cluster is about 35,000 light years away and contains at least 45,000 stars in a diameter of about 220 light years. It shines with a luminosity of about 160,000 times that of the Sun. At the distance of the cluster the Sun would be a shining at a feeble 20.4 magnitude! So that all the stars visible in telescopes are giant stars in comparison.

Moving almost due north from M3 to the northern edge of the constellation the 'Whirlpool' spiral galaxy M51 can be found below the handle of the 'Big Dipper'. It can be found with binoculars as a faint small misty spot. This galaxy is a face on spiral galaxy first discovered by Messier in 1773. It was also the first galaxy to be observed to have a spiral structure. This was seen by Lord Rosse

with his 6 foot diameter reflector in 1845. A striking feature of this galaxy is the presence of a bright irregular companion galaxy which by chance visual alignment appears to hang on the end of one of the spiral arms of the main galaxy.

A three inch telescope will show the nuclei of both the main and companion galaxies under good dark sky conditions larger instruments will show a faint glow surrounding the main galaxy. The spiral structure can be glimpsed with an 8 inch telescope under the best conditions. A ten inch or larger instrument will show the spiral structure including the arm linking the main galaxy and the companion galaxy.

M51 is estimated to lie at a distance of 35 million light years (from Burnhams, other sources quote a much shorter distance of only 15 million light years but I believe these are older estimates!). Using the larger figure the total mass of the galaxy is estimated to be about 160 billion suns with a diameter of 100,000 light years making the galaxy comparable with that of the Andromeda galaxy M31.

The third Messier object in Canes Venatici is another spiral galaxy M63. Lying near the centre of the constellation on a line between the end star of the handle of the 'Dipper' and Alpha Canes Venatici, it can again be located with binoculars (see chart below). Faint stars either side of the galaxy confuse the image with binoculars giving the impression that the galaxy is larger and more conspicuous than it really is. A three inch telescope clearly separates the galaxy from the nearby stars revealing the fainter nucleus. In a ten inch telescope the nucleus is seen as small and bright with a surrounding rather featureless fainter region.

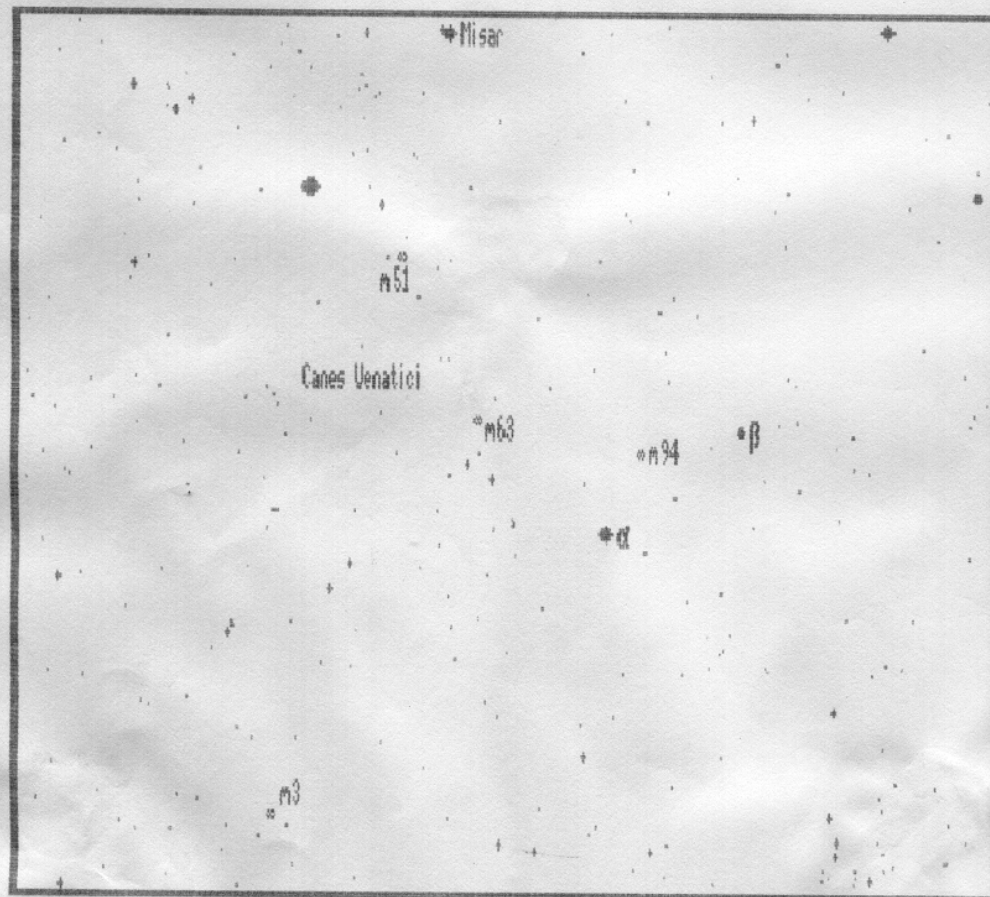
The distance of the galaxy is estimated to be about 35 million light years with a diameter of about 90,000 light years and a total mass of about 115 billion solar masses.

The final Messier object is M94 easily found about 1.5 degrees north of a line connecting Alpha and Beta Canes Venatici and about midway between. This is a compact nearly circular spiral galaxy again easily found in binoculars but appearing almost stellar. In a three inch it appears as a fairly bright fuzzy star while a ten inch reveals a very small bright central nucleus surrounded by a much larger faint outer

region.

The galaxy is estimated to be about 20 million light years away (Burnhams) with a diameter of only 33,000 light years much smaller than M51 and M63.

All four Messier objects are fairly easy to find with binoculars if good dark skies are present. Unfortunately light pollution from street lights etc. will have a significant impact on the discernability of features but if clear dark skies are available then these objects are worth searching for and observing even with small telescopes.



-8-

Stretching across the evening sky soon after dark are the planets Venus and Mars, and our own satellite The Moon. I train the telescope on to Mars, just past opposition now, about 40,000,000 Miles (64,360,000 KM) from us. A definite red disc and if you are careful not to look at the planet directly you can see the south polar cap and some obscure surface features. How red it looks! Mars gets its red colour from minute dust particles from the planets surface floating about in its tenuous Carbon Dioxide atmosphere. Mars is only 4,219 miles (6,788 KM) in diameter, so its atmosphere is very thin, only about 6 millibars which is approximately 1/200 of that on the Earths surface. The surface of Mars is totally without water, there may have been water millions of years ago, as various probes have photographed what looks like old river beds scarred into the surface rock.

Next I train the telescope onto The Moon, our companion in space. what else can we say about it, the only other world the Human Race has walked on. No atmosphere, no water, geologically dead, searing hot on the day side and freezing cold on the night side. At 2,160 miles (3,475 KM) in diameter only a little over 1/4 off the size of the Earth. More and more people are thinking now that instead of The Moon orbiting the Earth, both bodies are revolving around a common centre of gravity in more of a double planet form of relationship. The Moon is at the time of writing half phase, what astronomers call Dichotomy. Looking along the Terminator (the boundary between night and day) you can see the detail, shadows of craters and mountains interacting with those of the Terminaor. The view gets more exciting every time I see it. Next I look along the Limb (the circular edge of the daylit side) of The Moon, again some good views, but not to such good effect due to the glare. I look at my watch, it's getting late, reluctantly I leave The Moon and turn the telescope to Venus, not much time left to look at her.

Venus is about as close to us as she can get, about 25,000,000 miles (40,225,000 KM), through the telescope she looks like a small crescent moon, the brightest object in the sky apart from the Sun and The Moon. The magnitude can be as high as 4.4 if well placed. Although called The Evening Star or The Morning Star depending on which side of the Sun she is on in relation to the Earth. Venus is well and truly a planet, and an odd one at that. First of all Venus's year is 225 Earth Days, but has a Day of her own that lasts 243 Earth Days, bad news for shift workers!!! a day thats longer

than its year. Then there's the fact that Venus is inclined at her orbit to  $178^{\circ}$ , which puts her Orbital Rotation in retrograde (i.e. the Sun rises in the West and Sets in the East.). Apart from a choking atmosphere of Carbon Dioxide and rainclouds of Sulphuric Acid, the atmospheric pressure is 90 times that of Earth, so intense that on the planets surface, if you stood on the level, the surrounding terrain would appear to be uphill all around you. Not that you would see much either, so thick is the cloud cover that only 2% of light from the Sun ever reaches the surface. And finally there is the heat. Venus is a victim of a runaway Greenhouse effect and any water in liquid form has long since evaporated. Surface temperatures can reach as high as  $900^{\circ}\text{F}$ . The only way to map the surface of Venus is by radar due to the cloud cover. And this has revealed that Venus has two main land masses, Ishtar Terra in the northern hemisphere, about the size of Australia, and Aphrodite Terra in the southern hemisphere, about the size of Africa. More recently radar mapping has uncovered a huge volcano in a range of mountains called Maxwell Montes.

I take a look at my watch again, time to put the telescope away for another night. Venus has nearly disappeared behind the rooftops. As I go indoors with my telescope, I turn to take one last look at our closest neighbours in space.

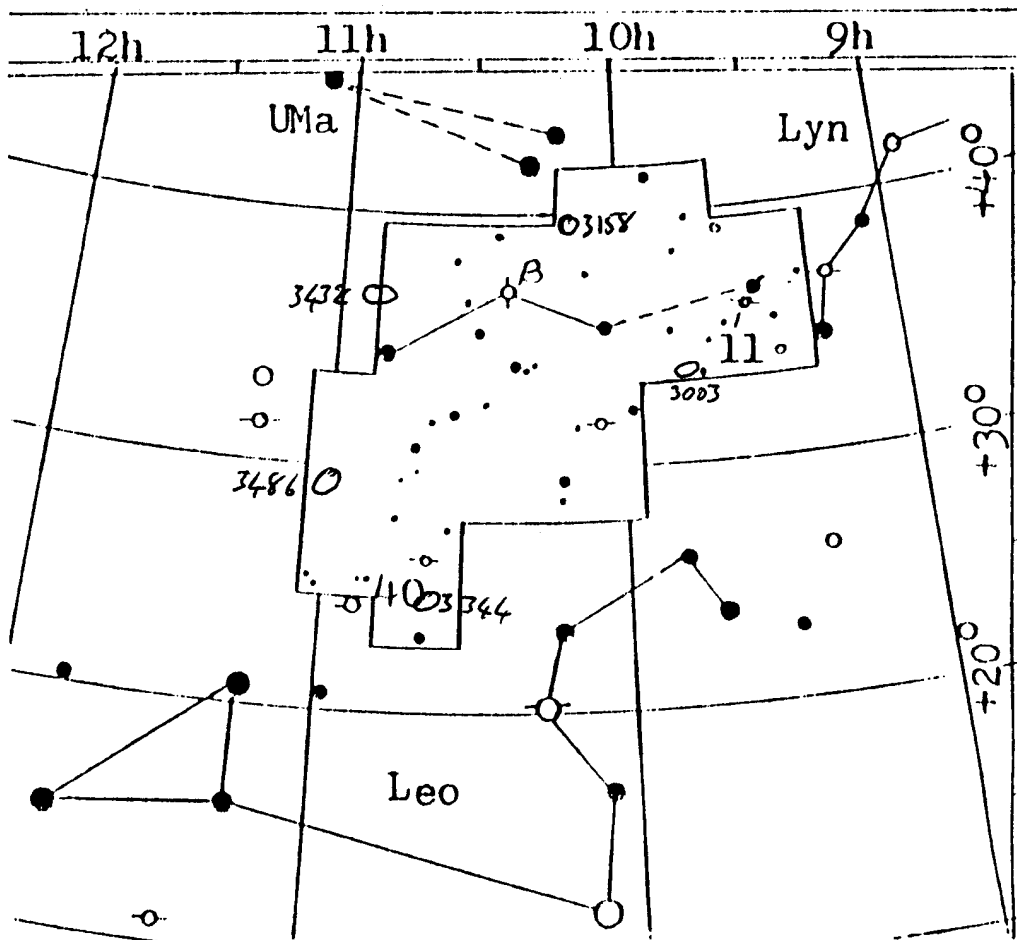
## LEO MINOR

Leo Minor is a faint and rather obscure constellation in the northern skies between Ursa Major and Leo.

Leo Minor contains many small and faint galaxies within its borders of which several are edge on examples. N.G.C.3003 is 5 arcminutes long and N.G.C.3432 6 arcminutes.

There are also two face on spirals which are large but of low surface brightness. N.G.C.3344 and N.G.C. 3486. There is also a small cluster of galaxies around N.G.C. 3158.

# LEO MINOR



## Double Stars

Pos.	1	2	D	d"	P	A	No.
093236	5.4-14.0	o	4.1	33	11		
100531	6.1-13.5	c	26.7	173	h475		
2536	4.6-6.3	b	0.6	224	B		
4026	5.5-13.0	o	17.8	112	40		

## PROGRAMME FOR APRIL

DAYS & DATES	DIRECTORS	SECTION & ADDRESSES	PHONE INC. STD CODE
Mondays	from 7.30pm	GENERAL OBSERVATION SECTION	
	Mr R Newman	[redacted], Felixstowe, IP11 9DY	[redacted]
5-12-19-26	Mr J King	[redacted], Felixstowe, IP11 9LQ	[redacted]
Tuesdays	form 7.30pm	GENERAL OBSERVATION SECTION	
	Mr R Newman	(Address above.)	(Number above)
6-13-20-27	Mr J King	(Address above.)	(Number above)
Wednesdays	from 8.00pm	NEBULA & FAINT OBJECTS SECTION	
	Mr M Cook	[redacted], Ipswich, IP4 5PZ	[redacted]
7-14-21-28	Mr D Payne	[redacted], Wickham Market, IP13 OSD	[redacted]
Thursdays	from 7.30pm	OBSERVATORY VISITS FROM OUTSIDE GROUPS	
	Mr P Richards	[redacted], Nacton, Ipswich, IP10 0HS	[redacted]
1-8-15-22-29	Mr G Marriott	[redacted], Ipswich, IP4 4JB	[redacted]
Fridays	from 7.30pm (may be postponed to Saturday)	PLANETARY & LUNAR SECTION	
	Mr P Richards	(Address above.)	(Number above)
2-9-16-23-30	Mr R A Lobbett	[redacted], Felixstowe, IP11 8UJ	[redacted]
	Mr G Marriott	(Address above.)	(Number above)

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:

## 1993 COMMITTEE

		Home Phone:	Work Phone:
CHAIRMAN	D Payne	(Address above)	[redacted]
VICE CHAIRMAN & MEMBERSHIP SECRETARY	D Barnard	[redacted], Ipswich, IP3 8RN	[redacted]
SECRETARY	R Gooding	[redacted], Ipswich, IP1 6AE	[redacted]
TREASURER	M Nicholls	[redacted], Capel St Mary, Ipswich, IP9 2EX	[redacted]
MAINTENANCE CO-ORD	M Cook	(Address above)	[redacted]
JOURNAL CO-ORDINATOR	E Sims	[redacted], Ipswich, IP1 4HA	[redacted]
PUBLICITY & VISIT CO-ORD	P Richards	(Address above)	[redacted]
EQUIPMENT CURATOR	J King	(Address above)	[redacted]
SPECIAL EVENTS CO-ORD	A Smith	[redacted], Ipswich, IP4 5RZ	[redacted]

ORWELL ASTRONOMICAL SOCIETY  
IPSWICH

OPEN WEEKEND

ORWELL PARK OBSERVATORY  
NACTON  
near Ipswich

FRIDAY    APRIL 2nd    8.00 to 10.00 pm  
SATURDAY    APRIL 3rd    8.00 to 10.00 pm  
SUNDAY    APRIL 4th    8.00 to 10.00 pm

The observatory will be open to observe the night sky.  
Binoculars may be useful.  
Weather permitting,

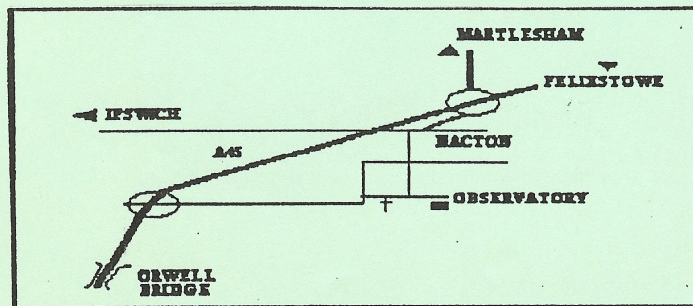
The **MOON, JUPITER** and **MARS**

Will be observed using the observatory's 10" refractor and other telescopes

Slide shows and talks if cloudy.

ENTRANCE DONATION

Child & OAP    35p  
Adult            75p



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