

Journal of the  
ORWELL ASTRONOMICAL SOCIETY (IPSWICH)

JULY, 1976.

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[REDACTED],  
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WHAT'S UP? The Solar System as seen from Ipswich, July, 1976.

SOLAR SECTION.

The Sun, will be in the constellations of Gemini and Cancer this month. Sunrise will be at 03hrs 40m U.T. and sunset 20hrs 10m U.T. at the beginning of the month.

Heliographic Co-ordinates as at noon U.T.

	<u>P.</u>	<u>Bo.</u>	<u>Lo</u>		<u>P.</u>	<u>Bo.</u>	<u>Lo.</u>
1st July	-2.6°	+2.9°	266.7°	16th July	+4.1°	4.5°	68.1°
6th "	-0.4°	+3.5°	200.5°	21st "	+6.3°	4.9°	2.0°
11th "	+1.9°	+4.0°	134.3°	26th "	+8.4°	+5.4°	295.2°
				31st "	+10.5°	+5.7°	229.7°

Synodic Rotation No 1643 commenced June 23.95d  
" " No. 1644 commences July 21.15d.

MERCURY will be in superior conjunction on the 15th at 15hrs U.T. so it will not be observable this month.

VENUS is an evening star in the constellation of Gemini too near the Sun for observation this month.

EARTH will be at aphelion on July 3rd at 04hrs U.T.

MARS is now at mag. 1.9 setting at 22hrs 40m U.T. and is not very impressive at the moment.

JUPITER now rises at 01hrs U.T. in Tauris not far from the Pleiades. The Moon will be near Jupiter on the night of the 21st/22nd.

SATURN Will be in conjunction on the 29th and is unlikely to be seen this month.

LUNAR SECTION.

Moon phases Lunation 662/663

First Quarter	July 4th	17hrs 28m U.T.
Full Moon	" 11th	13hrs 09m U.T.
Last Quarter	" 19th	06hrs 29m U.T.
New Moon	" 27th	01hrs 39m U.T.

Perigee July 7th 02hrs U.T. - Apogee July 19th 11hrs U.T.

OCCULTATIONS.

July 3rd ZC 1727 Mag 7.1 D 21hrs 05m U.T.

### Report on the June Lyrids Meteor Watch.

The Meteor Watch on Saturday 12th June to observe this stream was attended by a grand total of seven (7) members. A total of sixteen meteors were seen during the watch which lasted for about one and a half hours. Of the sixteen meteors seen eleven were from the June Lyrids shower and five meteors were sporadic ones. This was the third clear sky watch in a row!

### FIREBALL.

On June 6th (Sunday) about 2130hrs U.T. a fireball of magnitude -10 was seen across southern England. The Meteor Section of the B.A.A. is undertaking a thorough investigation and anyone who saw this object is urged to contact me, or the B.A.A. Meteor Section Director. It now seems that the fireball commenced around Gloucestershire and probably ended in the East Anglian Region. The object was seen by a couple of our members. The fireball was accompanied by a loud bang, probably due to the outer fragmenting. The 'Evening Star' gave a column to it in the June 7th issue. Meteorites could well be lying in our area from this object!

### JULY PROGRAMME.

This month sees the culmination of two very favourable meteor showers, 1. The Capricornids and 2. The Delta Aquarids, maxima occurring on July 25th and July 27th respectively.

### THE CAPRICORNIDS.

Bright Meteors, normal limits July 10th to August 15th. No Moon at time of maximum. Radiant Dec.  $-15^{\circ}$  R.A. 2100. ZHR of about six

### THE DELTA AQUARIDS.

This shower has a double radiant, normal limits July 15th to August 15th. Radiant Dec. 00 and  $-17^{\circ}$ , R.A. 2236. ZHR of about thirty-five.

### OTHER SHOWERS.

Also occurring this month is the ~~the~~ Capricornids shower, not to be confused with the Capricornids. This is a shower which produces yellow fireballs. Although maxima does not occur until August 2nd, there will be a watch to observe this shower on Saturday 31st July.

Also active this month is the Iota Aquarids of which I will give more fuller descriptions in next month's Journal.

To summarise, Meteor Watch 1. On Saturday 24th July observing the Delta Aquarids and Capricornid Showers, depending on attendance. Meteor watch 2 on Saturday 31st July, observing the ~~the~~ Capricornids shower.

### MINOR SHOWERS THIS MONTH.

There is only one minor shower this month, the  $\Theta$  Aquarids, Max on 26th July. This is a very weak shower, with perhaps only one or two meteors every hour or so, but well worth watching as these showers of this type badly needs observations.

### DATES TO REMEMBER.

SATURDAY 24th July Delta Aquarids, Capricornids (Combined Watch)

SATURDAY 31st July ~~the~~ Capricornids.

Meet at 10p.m. OUTSIDE the Golf Hotel, Foxhall Road, Ipswich, irrespective of weather conditions.

PLEASE DO COME to these meetings, even if it is only for an hour or so, all you have to bring is yourself (and your friends if possible) and a chair to sit on. As the nights are now quite warm there will be no need to bring your electric fires this month to keep warm.

D. Barnard, Director Meteor Section,  
[redacted], Ipswich, Tel [redacted]

### OPEN DAY.

This year we will be holding our OPEN DAY on Saturday 18th September 1976, but before this event can take place we have a tremendous amount of work to be done at the observatory.

We require as many members (and friends) as possible to attend on the Wednesday and Thursday nights as advertised in the Journal to help in redecorating the club room and observatory. Every year we redecorate the observatory and there is only a handful of members helping and it would be nice to see more members helping so that we can make a really good job of it.

Please come along on these nights and help as the OPEN DAY provides us with the bulk of our money to run the Society.

### DRAW TICKETS.

This year our first prize in the draw will be an electronic digital watch which will be quite expensive to purchase. To cover this prize, other prizes and the cost of printing the draw tickets we have had 3,000 draw tickets printed. We would like as many members as possible to sell these tickets and to this end we will send five books to the total of £1 to as many members as possible. If you do not receive any or would like to have more tickets to sell please contact the promoter, Mr. R.M. Cheesman, 3 Tasmania Road, Ipswich who will supply them.

Please send the counterfoil tickets together with the money back to Mr. Cheesman by Saturday 11th September.

### NEW REFLECTOR:

On Friday 18th June six of our members went to pick up the reflector donated to the Society by Mr. N.C.C. Barrell, F.R.A.S.

This instrument has been hand built by Mr. Barrell right down to the small nuts and bolts over the last thirty years and is indeed a superb instrument which has been made with great care. Some of the wooden parts are made from black oak which is over 1,000 years old!

The instrument is basically a test bench for mirrors from 6" to 12", although it can quite satisfactorily be used as a permanent set up. The mirrors currently being used on the instrument is an 8" mirror of f9 (i.e. a focal length of 6'). This mirror is quite a good one and has been parabolized to 80% of a true parabola for evening observing. There is also an 8" mirror unsilvered at f9 which has not been fully corrected but very satisfactory for use on the Sun for direct vision. The legs of the stand are made from concrete. The mirror flat has a 6v light built in which when switched on in the winter prevents the flat from dewing up. Also there are many eyepieces which are brand new which not only can be used with this instrument but also can be used with the 10" O.G. Orwell Park Telescope.

We will be erecting the telescope in its own portable observatory within the next couple of months in the Orwell Park School Grounds on the top of the hill which leads down to the River Orwell. This site, although at ground level, offers a good skyline for observing.

Our thanks again go to Mr. Barrell for donating not only this instrument but also all the equipment for making reflector mirrors.

This telescope will be known as 'The N.C.C. Barrell Reflector' and will be suitably plated to this effect.

### MIRROR MAKING SECTION.

We still have a few mirror blanks available to members who are interested in building their own reflectors.

Mr. David Miles, [REDACTED], Ipswich will be looking after this section and will be holding another meeting of this section to discuss mirror making and reflectors on WEDNESDAY 7th JULY at 8.p.m. in the Observatory Club Room.

If you are interested in making your own reflector then please come along to this meeting and if you have already made a telescope please come to this meeting as you may be able to help other members. If you cannot make this date please contact Mr. D. Miles.

The method used by astronomers to calculate the mass of the Sun is an example of the many applications of Newton's Law of Universal Gravitation. With a few basic premises one can calculate various physical quantities without ever stepping outside one's study or performing a single experiment. This principle is used in astronomy more than any other science simply because of the astronomer's inability to experiment directly with the object he is studying.

Newton's Law says that the force of gravity between two objects is proportional to the product of their masses and inversely proportional to the square of the distance between them i.e.

$$F = \frac{Gmm'}{r^2} \dots\dots\dots (1)$$

where m,m' are the masses concerned, r is the distance between them, and G is the Universal Constant of Gravitation, whose value in SI units is  $6,67 \times 10^{-11}$ . Thus the force that the Sun exerts on the Earth is  $\frac{GMm}{r^2}$ , where M is the mass of the

Sun and m that of the Earth. An inward force is required to keep the Earth from escaping the Sun's gravitational pull. From empirical observations,

$$F = \frac{mv^2}{r} \dots\dots\dots (2)$$

where v is the velocity of the Earth. The velocity of a moving object is defined as the distance it covers in one unit of time; therefore the velocity of the Earth is  $\frac{2\pi r}{T}$ , where T is the time for one revolution of the Earth about the Sun.

Substituting this value of v in (2) we find  $F = \frac{4m\pi^2 r}{T^2} \dots\dots\dots (3)$

But this force must exactly equal the force of gravitation between the Earth and the Sun to prevent the Earth from either flying off it's orbit at a tangent to it or spiralling in towards the Sun. So we can write

$$\frac{4m\pi^2 r}{T^2} = \frac{GMm}{r^2}$$

rearranging,  $M = \frac{4\pi^2}{G} \times \frac{r^3}{T^2} \dots\dots\dots (4)$

Thus, once the Earth-Sun distance and the length of the year are known, the Sun's mass is easily calculated,

We could also rewrite equation (4) as  $\frac{r^3}{T^2} = \frac{GM}{4\pi^2}$

Since all the values on the right-hand side are constant \*  $r^3$  must be proportional to  $T^2$ , which is exactly what Kepler's Third Law says. So we have not only found the mass of the Sun, we have also verified one of Kepler's Laws of Planetary motion.

Because we can use the mass of any planet as m and still get the same value for the Sun's mass,  $\frac{r^3}{T^2}$  must be a constant for our solar system.

The same argument would follow for any other star with planets, or a double star; in other words we could find the mass of such a star by finding out the distance between the components and the time taken for them to go round each other. A simple sum would give us the answer once we had acquired the relevant data.

ESCAPE VELOCITY.

Using calculus and the Law of Gravitation it can be shown that the work done (kinetic energy employed) in lifting a mass m to a distance H from the earth's centre is equal to

$$\text{Kinetic Energy} = GMm \left( \frac{1}{R} - \frac{1}{H} \right) \dots\dots\dots (1)$$

where G is the gravitational constant, M and R are the mass and radius of the Earth respectively.

If we wish the object to break completely free from the Earth's gravitational pull, H will be infinity and its reciprocal will be 0. We can therefore rewrite equation (1) as

$$\text{K.E.} = \frac{GMm}{R} \dots\dots\dots (2)$$

From fundamental physics we know that the K.E. of a body is given by

$$\text{K.E.} = \frac{mv^2}{2} \dots\dots\dots(3)$$

where v is its velocity. This has to be greater than or equal to the amount of energy required to transport the object an infinite distance from the Earth, so we combine (2) and (3)

$$\frac{mv^2}{2} \quad // \quad \frac{GMm}{R}$$

Rearranging for v we obtain  $v \quad // \quad \frac{2GM}{R} \dots\dots\dots(4)$

v is known as the escape velocity.

\* The mass of the Sun does vary, but by an amount which is negligible except over a long period of time.

NEW PLANETS

Discovery of Pluto

After the discovery of Neptune, the discrepancies in Uranus' orbit were still not fully explained by the presence of Neptune. This led to the idea that a further planet existed at a greater distance than Neptune. Percival Lowell, an American astronomer, began around the beginning of this century to compute the probable position of the predicted new object which was not discovered during his life-time - he died on 21st March 1915.

Clyde Tombaugh was born in Illinois on 4th February, 1906. He was interested in astronomy from an early age, and in 1929 he became an assistant at Lowell Observatory. The tradition of Percival Lowell was still present even though he had died some thirteen years previously. The search for Lowell's unknown planet was still continuing and Tombaugh was given the task of looking for it. The new planet would be very dim, due to its great distance from the sun. Tombaugh used a technique of photographing an area of sky on two different nights. The two pictures would be compared. If an area of each picture was focused alternately on to a screen the star back-ground would remain the same. An object that had moved would appear to flicker.

After about a year of searching, Tombaugh found a 'star' that flickered. The object was observed for another month before the discovery of a new planet was announced. The announcement was made on 13th March, 1930 the seventy-fifth anniversary of Lowell's birth. The new planet was named Pluto.

\* \* \*

In recent years it has been proposed that a tenth planet might exist at a much greater distance than Pluto. This was proposed by observations of anomalous perturbations of Halley's Comet. It has yet to be proved if a tenth planet does exist.

CHRONOLOGICAL LIST OF IMPORTANT ASTRONOMICAL DISCOVERIES AND EVENTS

- ca. 3000 B.C. Earliest recorded Babylonian observations of eclipses, planets and stars.
- ca. 2500 B.C. Egyptian pyramids constructed, oriented north-south by the stars.
- ca. 2000 B.C. Babylonian story of creation. Enuma Elish. Stonehenge built in southern England with stones lined up by the stars.
- ca. 1000 B.C. Beginnings of Chinese and Hindu astronomical observations.
- ca. 700-400 B.C. Greek story of creation. Hesiod's Theogony: Hebrew story of creation. Genesis: Greek philosophers Thales, Pythagoras and Anaximander note regularity of celestial motions.
- 400-300 B.C. Greek philosophers Plato, Eudoxus and Calippus develop the concept of celestial motions on spheres. Aristotle develops the idea of four elements and the concept that heavy things fall, light ones rise.
- 300-100 B.C. Aristarchus proposes that the earth moves. Eratosthenes measures the size of the earth. Hipparchus makes accurate observations of star positions.
- ca. A.D. 150 Ptolemy's Almagest summarizes the geocentric theory: the planets' motions are explained by epicycles and other motions in circles.
- ca. 1400 Ulugh-Beg in Samarkand, reobserves star positions.
- 1530 Copernicus, in Poland, postulates that the earth and planets move around the sun because this involves fewer circular motions. This revolutionary idea later rouses strong opposition.
- ca. 1600 Tycho Brahe measures the motions of the planets accurately; Kepler uses these measurements to show that the orbits of the planets are ellipses rather than combinations of circles. Galileo uses the first telescope to observe the moons of Jupiter and the crescent shape of Venus, supplying strong support for the Copernicus idea. Galileo also establishes that falling weights would all be accelerated in the same way if there were no air to hold the lighter ones back.

ORWELL ASTRONOMICAL SOCIETY (IPSWICH)

PROGRAMME FOR JULY 1976.

at  
ORWELL PARK OBSERVATORY

WEDNESDAYS: from 7p.m. Solar, Lunar & Planetary Section.  
Director Mr. R.M. Cheesman, [REDACTED], Ipswich.

7th July  
14th "  
21st "  
28th "

THURSDAYS from 8.30p.m. Double Stars Section.  
Director Mr. D. Bearcroft, [REDACTED]. Ipswich, Tel. [REDACTED]

1st July  
15th "  
29th "

METEOR SECTION. Director Mr. D. Barnard, [REDACTED], Ipswich, Tel. [REDACTED]

SATURDAY 24th JULY Delta Aquarids, and Capricornids Combined Meteor Watch

SATURDAY 31st JULY Capricornids Meteor Watch.

For these two meetings please meet outside the Golf Hotel, Foxhall Road, Ipswich  
at 10p.m. irrespective of weather conditions.

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ORWELL ASTRONOMICAL SOCIETY (IPSWICH)

WINTER PROGRAMME,  
1976 - 77 SEASON.

1. 18th September, 1976. OPEN DAY at Orwell Park Observatory.
2. 15th October, 1976, LECTURE 'The Century of the Great Refractors'  
by Dr. D.W. Dewhirst of the Institute of Astronomy, Cambridge.
3. 19th November, 1976. LECTURE: 'Observations of Galaxies and Binary Stars  
using the Issac Newton Telescope' by Dr. B. Morgan of Imperial  
College, London.
4. 10th December, 1976. LECTURE 'The Galaxy' by Mr. G. Curtis, B.Sc.
5. 7th January, 1977. A.G.M. of the Society, to be held at Orwell Park School.
6. 18th February, 1977. LECTURE 'The Mythology of Quasar Redshifts'  
by Dr. S. Mitton, of the Institute of Astronomy, Cambridge.
7. 25th March, 1977. LECTURE 'The Geology of the Solar System'  
by Mr. R. Markham, B.Sc. of the Ipswich Museum.  
(this Lecture will be held in conjunction with the Ipswich Geological  
group)

All the Lectures will be held at The Friends Meeting House, Fonnereau Road,  
Ipswich on Friday evenings. Fuller details will be published nearer the dates  
of the Lectures.