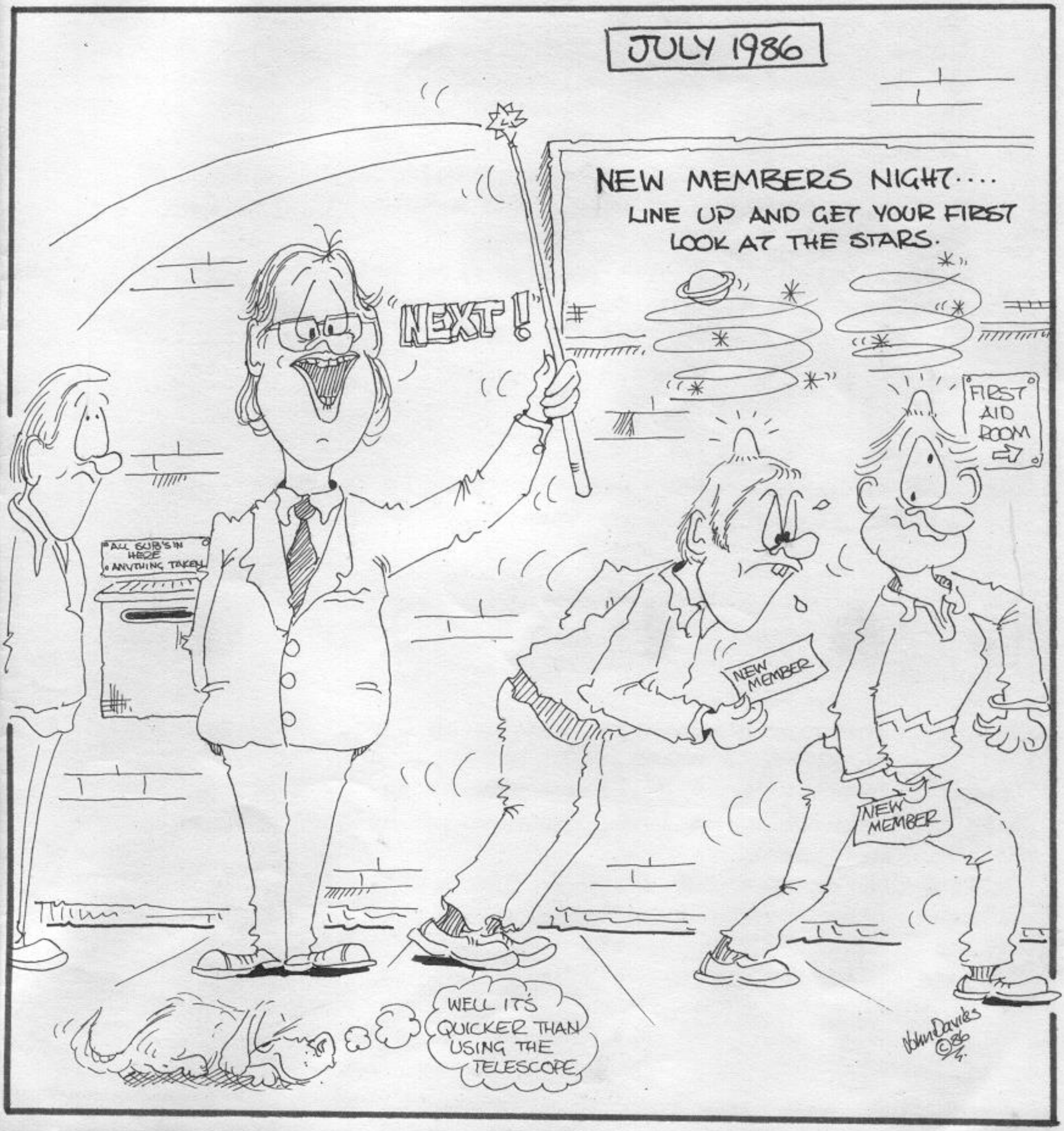
ORWELL ASTRONOMICAL SOCIETY (IPSWICH)

O.A.S.I.



SOCIETY NEWS

1. <u>Lens Cleaning</u>
   The 10" O.G. was removed for cleaning on Wednesday 11th June in a completely cloudless sky. It had not been removed for cleaning since 1977 and was long overdue for attention. Concerned members may be relieved to know that the services of an electric saw were not required (nobody remembered to bring one). The lens and lens cell were clamped between 1" planks of plywood for transporting. The cleaning was undertaken by Dave Payne. By the time you read this newsletter the lens should have been reinstated back into the telescope. The rack and pinion draw tube was also removed for cleaning.
2. <u>Committee Meeting</u>
   The next meeting will be held on Saturday, 5th July at 7.30 p.m. in the club room. All welcome to attend.
3. <u>Church Fete at Highfield Approach</u>
   A small exhibition will be staged on Saturday, 12th July together with the hopeful observation of Venus.
   Please contact Eric Sims for further details.

NIGHT SKY

(all times G.M.T.)

Sun	Rises approximately between 03.40 to 04.20 Sets approximately between 20.20 to 20.00
Moon	● 7th ◐ 14th ○ 21st ◑ 28th
Mercury	Inferior conjunction occurs on 23rd. Will be difficult to see this month.
Venus	Sets at about 21.50 in mid month Mag. - 4.1
Mars	Opposition on 10th. Mag. -2.6. Sets at about 02.20 in mid month.
Jupiter	Rises at about 22.00 in mid month. Mag. -2.7
Saturn	Rises before sunset. Mag. 0.3.
Uranus	Rises before sunset. Mag. 5.8.
Neptune	Rises before sunset. Mag. 7.7.

R. Gooding.

Report From the Outback!

WHERE WERE YOU ALL? On Friday 20th June at the 'The Friends Meeting House' there was a presentation and slide show given by our intrepid explorers Roy Cheesman and Alan Smith relating their experiences in the Australian Outback.

They made those present green with envy as they retold their exploits during the 3000 mile journey across the Australian continent. Many of the stories were hilarious such as the encounter with an Australian-German Opal Miner at Coober Pedy opal mine. Alan and Roy had left the main party, during the evening of their visit to the mines, to find an isolated, pitch dark area from which to photograph Halley's Comet without disturbance from roaming bodies with torches. Having found a suitably dark and deserted spot a good distance from any sign of "civilisation" they proceded to set up their equipment and start photographing. Within minutes of getting thoroughly dark adapted there came a blinding light from an aperture that mysteriously appeared in the ground a few feet from where they were observing. This all began to sound like Close Encounters of the Fourth Kind and sure enough from this hole in the ground emerged a small spindly creature who oblivious to the two astronomers proceeded to relieve himself. Upon turning round to re-enter his hole the creature saw Alan and Roy and challenged them in a strange language that turned out to be Australian with a German accent! Having explained to him who they were and what they were trying to do the Australian - German miner said words to the effect "Oh! Good on yer mate. I'll leave the light on so's yer can see what yer doing".

The story didn't finish there but you should have been there for the rest and the many other gems accompanied by nearly 200 excellent quality slides. It was a memorable evening and certainly was a journey of a lifetime for Roy and Alan.

David Payne

A HISTORY OF ASTRONOMY PART 5

N. Taylor.

GALILEO

Meanwhile in Italy a certain Galilei Galileo (1546-1642) was making a name for himself. Galileo initially studied medicine at Pisa, but undoubtably his greatest contributions to science were in the fields of Mathematics, Physics, and Astronomy. He was first to observe that the time for a swing of a pendulum, of a given fixed length, is independent of the amplitude the pendulum is first given. Perhaps his most celebrated experiment was that on the tower of Pisa, where by dropping two different objects from the tower he showed that the time taken for an object to fall did not depend on its' weight.

In 1589 he was appointed proffessor of Mathematics at Pisa, but in 1592 moved to Padua, where most of his Astronomical discoveries were made. By 1609 Galileo had heard of, and built himself, a new instrument called the telescope, immediately realising its' potential military application by suggesting that distinct advantages could be gained by its use within the Italian Navy. However, Galileo was probably one of the first people to apply the telescope to Astronomy, and consequently made many discoveries.

He observed the phase of Venus, the craters and mountains on the Moon, the four largest and brightest moons of Jupiter (now known as the Galilean satellites) and observed that the sun has a variable number dark 'sunspots'. Probably through his observations ofthe Jovian satellites Galileo became convinced that the Copernican viewpoint was basically correct.

In 1610 he was appointed Mathematician to the grand duke of Florence, during which time he worked upon his book "Dialogue concerning the two chief world systems - Ptolemaic and Copernican" which was published in Florence in 1632. The book was immediately banned and Galileo was brought to trial before the Inquisition He was forced to recant his belief in the Copernican s system and for the rest of his life lived under virtual house arrest at Arcetri, a small town on the outskirts of Florence. Galileo undoubtably progressed Astronomy through his many discoveries, although paid for his naked eye observations of the Sun by blindness in his later life.

A HISTORY OF ASTRONOMY PART 5

N. Taylor.

KEPLER

Johannes Kepler (1571 - 1630) was a German Mathematician who laid down the foundations of celestial mechanics and gravitation. His first appointment was as a teacher of Mathematics at Gruz, during which time he accepted the novel theories of Copernicus and reseatched into trying to fit regular geopmetric shapes between the spheres of the planets. He published this work in 1596 as "Mysterium Cosmographicum", the cosmographic mystery, a work which came to the attention of Tycho Brahe who in 1600, asked Kepler to join him in research to prove that the Solar system was arranged as Tycho had proposed. When Tycho died in 1601 Kepler succeeded him as the Imperial Mathematiciam of Denmark. From Tychos's observations Kepler deduced thAt the planet Mars was moving in a heliocentric, elliptical orbit, with speed depending upon its' distance from the Sun, and in 1609 he presented his 3 famous laws in the book Astronomia Nova", the new Astronomy. Briefly:

i) The planets move in ellipses with the Sun at one focus.
ii) The radius vector of a planet sweeps out equal areas' in equal time.
iii) The sidereal period of any planet squared is proportional to the planets semi-major axis cubed.

THE MUSIC OF THE SPHERES

Kepler had a strong belief that God had created the Universe according to some divine plan. He discovered a relationship between the orbital speed of the planets and the notes in a musical scale and suggested a scheme of divine musical harmony which he published in 1619 as "Harmonices Mundi", the Harmonies of the World.

<u>MR. SCHMIDT AND HIS CAMERA</u> by Mike Harlow.

<u>Part 2: The Design of the Schmidt Camera.</u>

Last months journal presented a short biography of Bernhard Schmidt, the man who invented the Schmidt camera; but what is so special about this type of telescope? Probably it is best to start by describing the limitations of conventional telescopes to see why there was a need for a new design.

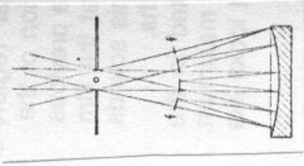
Basically there are two types of optical telescope, the refractor and the reflector. The refractor, in it's simplest form, was invented around 1608 in Holland but was really developed as an astronomical tool by Galileo beginning in 1609. The early refractors had a single lens to form the image which was examined by a simple eyepiece. There were two main disadvantages with this design, firstly, the glass of the lens focused light of different colours at different distances from it giving indistinct, coloured images; the effect known as *chromatic aberration*. The second problem was *spherical aberration*; rays of light which pass through the edge and the centre of the lens come to a different focus. Efforts to overcome spherical aberration went to extreme lengths, literally! By making the focal length very long spherical aberration becomes very small; in the mid 1600's telescopes 100ft long were sometimes used.

This desperate situation was remedied by John Dollond in about 1757 who realised that by making the main lens in two parts of different types of glass it would be possible to almost cancel out both chromatic and spherical aberrations, such lenses being *achromatic*. As a result of this advance refracting telescopes could be made with much larger lenses but with much shorter focal lengths. The state of the art was reached in the late 1800's with the completion of the 40 inch telescope at Yerkes observatory near Chicago which is still the worlds largest. This upper limit is imposed on telescope makers because the lens becomes very thick above 40 inches diameter and absorbs a lot of light. It is also extremely heavy and sags under it's own weight distorting the images.

Turning now to the reflector, which was invented around 1660 by Isaac Newton, one immediate advantage is the absence of chromatic aberration; all colours of light are reflected to the same extent. However, spherical aberration remains unless the spherical mirror is *figured* , that is, has it's shape changed slightly, to a parabolic curve. This however is not an ideal solution because although spherical aberration is elliminated another type is introduced called *comatic aberration or coma* . If a mirror is parabolic, parallel rays of light hiting the edge or centre are focused at the same point. However, if parallel rays come in at an angle those from the edge and the centre are focused at different points so that the image of a star is not a point but is fan or comet shaped, which gives this type of aberration it's name. As the angle of the incoming light increases the distortion becomes worse so that the area of sky in sharp focus is very limited.

Bernhard Schmidt knew of all these limitations of existing telescopes and wanted to design a new type which would have a very large field of view and yet be free of the major aberrations and have a large diameter compared to focal length, that is, a high photographic speed. His design incorporates elements from both refractors and reflectors but also has completely new features.

Schmidt realised that the new design would have to have a mirror to elliminate chromatic aberration and that it would have to be spherical to elliminate coma. This was a good start, no colour errors or coma but of course a great deal of spherical aberration. Remembering the trick used by the 17th century astronomers of using a very small aperture, one possibility was to use a small aperture stop some distance in front of the large spherical mirror. This is illustrated below and shows that a large field of view is allowed, in principle, on a curved focal surface; if the diameter of the stop is less than 1/10 the focal length spherical aberration will be small.

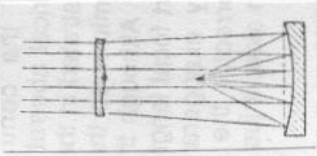


One way to overcome spherical aberration---- a small aperture stop in front of the large mirror.

O.K., so now we have no spherical, chromatic or comatic aberrations but only a small aperture. Schmidt's stroke of genius was to make the aperture very much larger but to put in it a weak lens with a special curve on it. Weak in this sense has a special meaning in that light passing through it is on slightly effected by it. This weak lens or *corrector plate* has some interesting properties. Firstly, because the curves on it are very shallow, light of different colours is effected essentially the same, that is, introducing the corrector does not introduce chromatic aberration; it's just like looking through a window. Secondly, by putting a special curve onto it's surface it is possible to cancel out the spherical aberration of the mirror.

So now we have no spherical, chromatic or comatic aberration but have gained a large diameter or aperture giving bright images of stars, nebulae, galaxies etc. A third and important advantage of the weak corrector is that light passing through it at large angles is effected essentially the same as light going straight through so that the camera has a large field of view. For this reason the mirror is always larger than the corrector; the 48 inch camera of mount Palomar has a 48 inch corrector but a 72 inch mirror and can photograph an area of the sky with a diameter about 12 times the diameter of the moon, about 6 degrees.

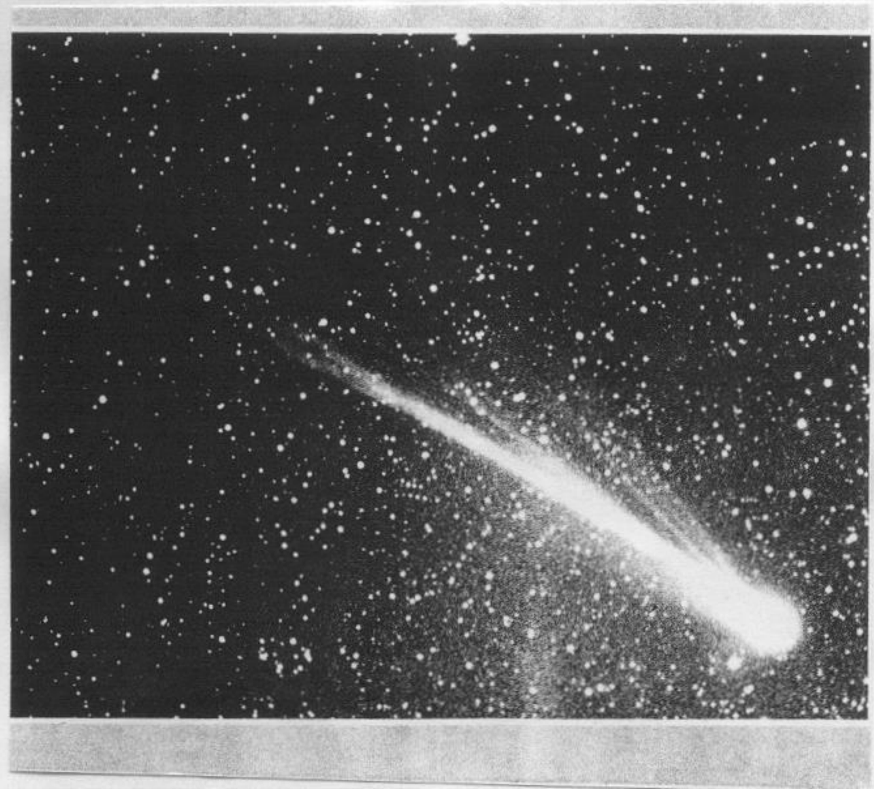
The diagram below shows the basic design of the Schmidt seen in cross-section. Light enters from the left and passes through the corrector. It can be seen from it's shape that light passing through the edge diverges whereas light passing through the central region



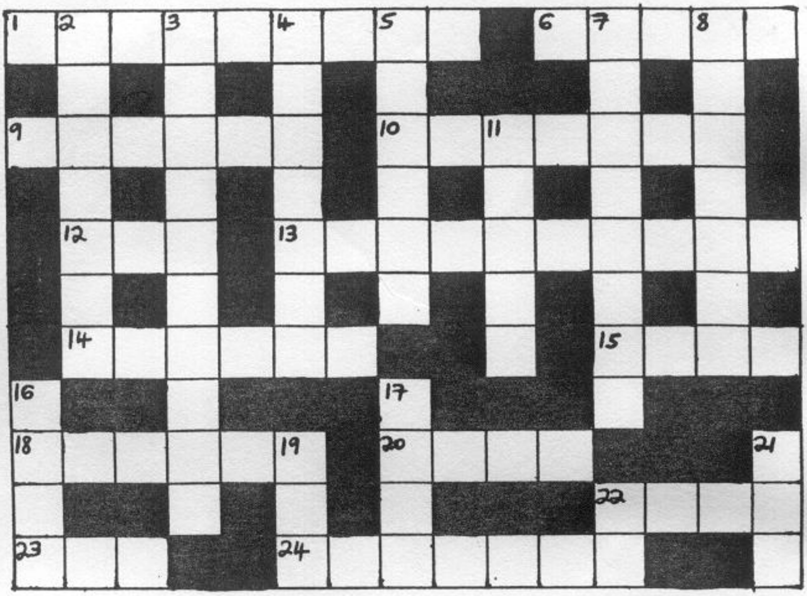
Schmidt's solution----light passes through a corrector plate before it gets to the large mirror.

converges--this exactly cancels the effect of spherical aberration of the mirror. Because of the symmetry of the system, illustrated in the previous diagram, the focal surface is curved towards the mirror so that the film has to be sprung loaded to conform to this curve. Although this sounds rather difficult it only becomes a problem with short focal lengths. The curves on the corrector have been grossly exaggerated in the diagram--in my camera which has a 6 inch corrector the maximum deviation from flat is only .004 millimeters on each side; it just looks like a flat, clear disc of glass!

Next month--Part 3: How to Build a Schmidt Camera. The mathematical equations for calculating the exact shape of the correctors curves plus details of how to grind and polish the glass and the essential mechanical considerations.



XWORD



ACROSS

1 One of the oldest of the exact sciences.
6 The final frontier.
9 Unit of distance.
10 Passage of a celestial body across the meridian.
12 Planetary nebula in Ursa Major.
13 Angle between sun & planet as seen in the sky.
14 Slowest moving of the naked eye planets.
15 Type of star cluster.
18 Emission nebula in Sagittarius.
20 Imaginary line about which rotation takes place.
22 Planets have two.
23 Nearest dwarf star of spectral type G2.
24 Division between A & B rings of Saturn.

DOWN

2 Four a year.
3 Ability of telescope to separate close objects.
4 Fision on Earth, fusion in the sun.
5 Shooting star.
7 Location of a body on the celestial sphere.
8 Part of a valve.
11 Demon star in Perseus.
16 A Lunar highland region.
17 At it's closest this year on July 16th.
19 Catalogue published in 1888.
21 Colour of a giant star.
22 It may have an infinite number of decimal places.

LAST MONTH'S SOLUTIONS

Across – 1 Jupiter, 7 Time, 8 Noon, 11 Orbit, 12 Guide, 13 Ion, 15 Rosette, 16 Io, 20 Scorpio, 21 Arm, 22 Procyon, 24 Helium, 25 Seas.

Down – 1 Juno, 2 Phobos, 3 Et, 4 Ring, 5 Gemini, 6 Comet, 9 Orion, 10 Nine, 14 Star, 17 Pisces, 18 Cygnus, 19 Earth, 20 Small, 23 Ram.

R. A. LOBBETT

ASTRONOMICAL TERMS. E. Sims.

ECLIPTIC.

Eclipric is the name given to the great circle on the Celestial Sphere which represents the apparent annual path of the Sun in its motion relative to the back-ground stars. Due to the motion of the Earth round the Sun, the Sun appears to move across the celestial sphere, completing one full circuit in a year.
The ecliptic intersects the celestial equator at two points, the vernal equinox and the autumnal equinox. The reason this only happens twice a year is because the Equator of the Earth is inclined at An angle of approximately $23\frac{1}{2}^{\circ}$ to the orbital plane.

CELESTIAL SPHERE

The Celestial Sphere is an imaginary sphere of very large radius central on the Earth to which the Stars are considered to be fixed for the purpose of position measurement.
As the Earth rotates on the axis, the Celestial Sphere appears to rotate round the Earth once a day.
The Celestial Sphere is considered to rotate round an axis joining north and south Celestial Poles in an east to west direction at a rate of 15 degrees an hour. At any instant an observer on the earths surface can only see one half or the sphere. If he is at one of the poles one hemisphere is always above the horizon but if he is located at the equator then each part of the sphere is visible at some time.

CELESTIAL POLES.

The Celestial Poles are the points on the Celetial Sphere at which the projected axis of the Earth intersects the sphere. The north celestial pole is vertically above the Terrestrial North Pole and the South Clestial Pole is vertically above the South Terrestrial Pole.
There is a star close to the North Celestial Pole, this is Polaris or the Pole Star, It is possible for an observer in the Northern Hemisphere to obtain a rough estimate of his latitude by measuring the altitude of the Pole Star. Due to the rotation of the Earth stars appear to move in circles around the Celestial Poles.

LONG PERIOD VARIABLES by Mike Nicholls

The class of long period variables gets its name because the periods of these stars are between 80 and 1000 days, the average being around 300 days. They are quite numerous and several are quite bright, which, together with the large magnitude range, probably accounts for the fact that the first variable stars discovered were of this type. The magnitude range of the variations is 7 or 8 on average but can be higher; 11 magnitudes in the case of χ Cygni. The cycles are not absolutely constant either in time or magnitude change, the maximum being the most likely to differ. o Ceti (Mira) for example produces maxima between the 2nd and 5th magnitude, and the time of maximum light may vary in time by up to a week from the predicted value. Several examples of the light curves may be seen in past journals where it will be observed that in most cases, the rise from minimum to maximum is more rapid than the fall. In some cases the rise and fall times are equal and there often humps in the rising portion.

The majority of long period variables are old red giants. The light variations are the result of pulsations in the distended and rarefied atmosphere, varying the size of the stars. Ironically they are brightest when smallest because they are hottest (2400°C), and faintest when largest and cooler (1500°C). The large change in magnitude is rather deceiving, however, because the radiation emmision at 'minimum light' shifts into the infra red where it cannot be seen visually. The change in total radiation emmision is much less. There is also more absorption of light due to the increased formation of metal oxides at the lower temperature.

The cause of the pulsations is still virtually unknown. The mathematical models which describe theories of pulsation do not seem to fit very well.

The large light variations over a long period make this type of variable the easiest for beginners to tackle. o Ceti and R Leonis are the beginners favourites and may be followed with binoculars for most of the period. There are many others which may be followed using a small telescope. Because of its narrow field of view, the Orwell Park is more suited to these stars when they are at minimum.

PROGRAMME FOR JULY

MONDAYS from 8pm	DOUBLE STAR & PLANETS SECTION		
7, 14, 21, 28	Mr N Taylor	[redacted], Farmlands Trimley	Tel:Fel. [redacted]
	Mr T Gillan	[redacted], Felixstowe	Tel:Fel. [redacted]
	Miss M Edwards	[redacted], Felixstowe	Tel:Fel. [redacted]
TUESDAYS from 7pm	GENERAL OBSERVATION SECTION		
1, 8, 15, 22, 29	Mr N Gage,	[redacted], Trimley	Tel: Fel. [redacted]
	Mr R Newman	[redacted], Felixstowe	Tel: Fel. [redacted]
	Mr J King,	[redacted], Felixstowe	Tel: Fel. [redacted]
WEDNESDAYS from 8pm	NEBULEA & FAINT OBJECTS SECTION		
2, 9, 16, 23, 30	Mr M Cook,	[redacted], Ipswich	Tel: Ips. [redacted]
	Mr D Payne,	[redacted], Wickham Market.	Tel:W.Mkt [redacted]
FRIDAYS from 8pm	GENERAL OBSERVATION SECTION		
11, 25	Mr R A Lobbett,	[redacted], Felixstowe.	Tel:Fel. [redacted]
	Mr J Hood,	[redacted], Ipswich.	Tel:Ips. [redacted]
	Mr M Harlow,	[redacted], Felixstowe	Tel:Fel. [redacted]

On nights other than Wednesday please contact directors to confirm dates.

1986 COMMITTEE

CHAIRMAN	D Payne	[redacted], Wickham Market, IP13 0SD	Work: [redacted] Home: [redacted]
VICE CHAIRMAN	R Cheesman	[redacted], Corringham, Essex SS17 9BU	Work: [redacted] Extn [redacted]
SECRETARY	R Gooding	[redacted], Ipswich IP1 6AE	Work: [redacted] Home: [redacted]
TREASURER	M Nicholls	[redacted], Capel St. Mary, Ipswich, IP9 2EX	Work: [redacted] Home: [redacted]
MEMBERSHIP SEC. /P.R.O	D Barnard	[redacted], Ipswich, IP4 5PP	Home: [redacted] Work: [redacted]
MAINTENANCE	M Cook	[redacted], Ipswich, IP4 5QA	Home: [redacted] Work: [redacted]
LIBRARIAN	E Sims	[redacted], Ipswich, IP1 4HA	Home: [redacted]
SOCIETY EVENTS	R Lobbett	[redacted], Felixstowe	WORK: [redacted] Home: [redacted]
F.A.S. ARTICLES	M Harlow	[redacted], Felixstowe	Home: [redacted]