

ORWELL ASTRONOMICAL SOCIETY IPSWICH.....

NEW YEAR ISSUE



NIGHT SKY

All times GMT

SUN

Rises approximately at 08.00 to 07.50
Sets approximately at 16.00 to 16.40

MOON



5th



13th



20th



27th

MERCURY Mercury will be at greatest eastern elongation on the 2nd, and at inferior conjunction on the 18th.

VENUS Venus will be very prominent in the evening sky this month. Setting about 20.00 in mid month. Mag. -3.9

MARS Mars remains very low down in the evening sky, setting about an hour after sunset, and will be very difficult to see this month.

JUPITER Jupiter is back in the morning sky this month, rising at about 6.30 in mid month. Mag. -1.8

SATURN Saturn is visible in the earlier part of the evening this month, and will be setting at about 21.00 in mid month. Mag. 1.2

URANUS & Neptune Both planets are close to the sun, in the sky this month and will be difficult to see.

MONTHLY PHENOMENA

Day	Event
2	Greatest eastern elongation of Mercury.
4	Quadrantid meteor shower.
13	Mars 3° north of Mercury.
18	Jupiter 5° south of the moon.
18	Inferior conjunction of Mercury.
20	Mercury 2° south of the moon.
21	Mars 6° south of the moon.
23	Venus 5° south of the moon.
24	Saturn 5° south of the moon.

OCCULTATIONS DURING JANUARY 1996

The table lists stellar occultation disappearance events which occur during the month under favourable circumstances. The data relates to Orwell Park Observatory, but will be similar at nearby locations. (Note: two events are listed for the night of 29th January.)

Date	Time (UT)	Lunar Phase	Sun Alt (°)	Star Alt (°)	Min Dist (radii)	PA (°)	Star (D = double)	Mag
Tue 02 Jan	21:09:52	.92+	-47	55	.94N	13	ZC684 (D)	6.3
Thu 04 Jan	02:51:05	.97+	-46	31	.85N	37	120 Tau	5.4
Sat 06 Jan	05:11:58	1.00-	-25	22	.28N	87	Lambda Gem	3.6
Mon 22 Jan	17:35:58	.07+	-11	15	.94S	137	SAO145938 (D)	7.4
Fri 26 Jan	17:40:56	.42+	-11	47	.03S	70	SAO110099 (D)	7.1
Mon 29 Jan	23:11:07	.73+	-54	37	.94N	18	Delta Tau	3.8
Mon 29 Jan	23:32:03	.73+	-55	34	.51N	58	64 Tau (D)	5.0
Tue 30 Jan	02:23:12	.74+	-47	9	.85N	32	SAO93962	7.2

James Appleton

2 1996 Subscriptions

Subscriptions for 1996 will be due from 1st of January
The rates for the new year will be:-

Junior	£8.00
Adult	£12.00
Family	£14.00

A renewal form will be included with the January newsletter. It would be appreciated if you could return this so that the society

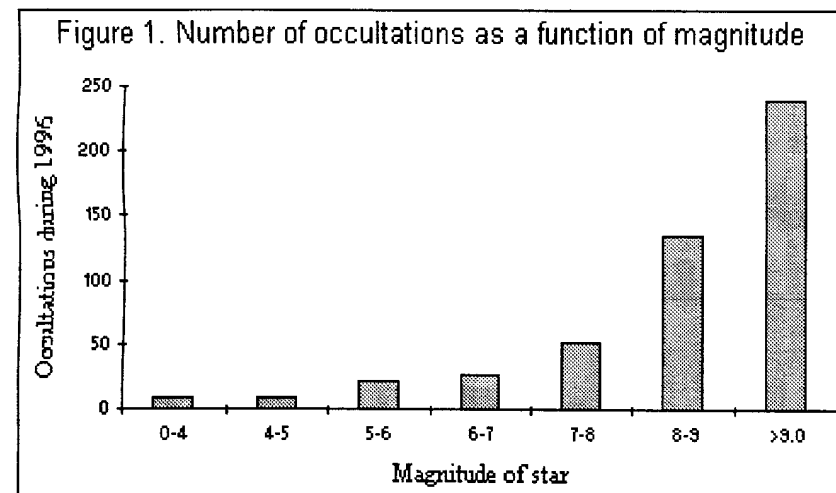
membership records can kept up to date.

OCCULTATION PREDICTIONS FOR 1996

by James Appleton

This article summarises the occultations visible from Ipswich and surroundings during 1996. (A full list is available in the Orwell Park Observatory.) Altogether, there are 490 potentially observable stellar occultations throughout the year (including two grazing occultations) and an occultation of Venus.

Figure 1 illustrates the number of occultations visible as a function of magnitude. The numbers are considerably down on last year.



Below, circumstances of the most spectacular events are listed for the location of Orwell Park Observatory. Differences should be negligible in practice for locations within easy travelling distance of Ipswich.

CALCULATION OF PREDICTIONS

The software used to predict occultations is based on the program *Occult* in *Astronomy On The Personal Computer* by O.Montenbruck and T.Pfleger. Several enhancements have been made to improve accuracy, and to filter out predictions occurring under unfavourable circumstances.

The lunar ephemeris used by the program is the NASA JPL (Jet Propulsion Laboratories) ephemeris DE-200. This is a high-accuracy reference ephemeris, and the software is structured so as to employ its full accuracy for every prediction.

The star catalog used is a special occultation catalog compiled by the International Occultation Timing Association (IOTA) in 1994. It is an enhancement of NASA's Position And Proper Motion catalog (also compiled in 1994).

Predicted timings incorporate corrections due to the local lunar limb profile. (This makes a difference of several seconds in typical cases.) Limb profile data is based on electronic Watts charts obtained from IOTA.

TOTAL OCCULTATIONS

Of the 490 stellar occultations predicted for 1996, nine are of magnitude 4.0 or brighter. The details of these occultations are summarised in table 1 below for the location of Orwell Park Observatory.

The first two columns of table 1 give the date and time (UT) of the occultation. 'D' denotes a disappearance event and 'R' a reappearance event. (Both D and R times are listed for all occultations except that of Rho Sagittarii on 16th February, when the reappearance event occurs under a bright sky, and is not readily observable, so is omitted.) The third to seventh columns of the table contain the detailed circumstances of the event. The lunar phase is expressed as a fraction of unity ('+' denoting waxing and '-' denoting waning). The altitude of the Sun below the horizon and the star's altitude above the horizon are given in degrees. The column labelled 'Min Dist' gives the minimum distance, in lunar radii, of the star from the centre of the Moon, at the time of closest approach (midway between D and R events). Here 'N' indicates a North passage of the star and 'S' a South passage. The PA (position angle) specifies the angle in degrees, anti-clockwise from North, of the star at the time of contact with the lunar limb. The final two columns provide the star's name and magnitude.

Unfortunately, with one exception (*viz.* Delta Tau on 29th Jan), all the occultations in table 1 involve bright limb disappearances, which are notoriously difficult to time accurately. However, for sophisticated observers who have mastered such events, there are several repeated bright occultations during the year, offering the prospect of repeating occultation timings under different lunar limb profiles (different libration angles). α Tauri (Regulus) and ρ Sagittarii are occulted twice, while λ Geminorum is occulted three times. Note that the second occultation of α Tauri occurs with the sun above the horizon, but should be visible telescopically.

Date	Time UT	Lunar Phase	Sun Alt (°)	Star Alt (°)	Min Dist (radii)	PA (°)	Star	Mag
Sat 06 Jan	D- 05:11:58	1.00-	-25	22	.28N	87	Lambda Gem	3.6
	R- 06:10:44	1.00-	-16	13		299		
Mon 29 Jan	D- 23:11:07	.73+	-54	37	.94N	18	Delta Tau	3.8
	R- 23:36:11	.73+	-55	33		337		
Fri 16 Feb	D- 05:55:29	.11-	-12	6	.21N	73	Rho Sgr	4.0
Wed 08 May	D- 01:00:10	.74-	-19	9	.17S	94	Rho Sgr	4.0
	R- 02:07:57	.73-	-15	15		254		
Tue 01 Oct	D- 20:53:49	.74-	-30	5	.10S	86	Alpha Tau (Regulus)	0.8
	R- 21:48:59	.74-	-36	13		254		
Sat 05 Oct	D- 00:48:14	.44-	-41	18	.56N	58	Lambda Gem	3.6
	R- 01:42:02	.44-	-37	26		306		
Tue 29 Oct	D- 08:29:35	.92-	13	8	.70S	133	Alpha Tau (Regulus)	0.8
	R- 09:08:32	.91-	17	3		225		
Thu 26 Dec	D- 03:08:12	.98-	-44	46	.94S	172	Lambda Gem	3.6
	R- 03:34:08	.98-	-40	42		212		
Sun 29 Dec	D- 00:24:52	.84-	-61	37	.46S	135	Omicron Leo	3.5
	R- 01:35:58	.84-	-56	44		261		

Table 1. Occultations of stars of magnitude 4.0 or brighter.

Occultations of double stars are interesting to observe because the disappearance can occur in two "steps", with a brief intermediate period of reduced intensity. During 1996, there are forty-eight disappearance events involving double stars. Table 2 lists the disappearance circumstances for all double stars of magnitude 6.0 or brighter throughout the year. (The columns have the same interpretation as in table 1.) Note that 115 Tauri is occulted twice during the year.

Date	Time UT	Lunar Phase	Sun Alt (°)	Star Alt (°)	Min Dist (radii)	PA (°)	Double Star	Mag
Mon 29 Jan	23:32:03	.73+	-55	34	.51N	58	64 Tau	5.0
Mon 25 Mar	20:51:20	.38+	-23	35	.48N	65	115 Tau	5.4
Thu 28 Mar	00:14:39	.59+	-35	17	.58S	138	51 Gem	5.0
Mon 01 Apr	19:28:18	.95+	-10	29	.83S	169	65 Leo	5.5
Mon 26 Aug	22:41:47	.95+	-26	23	.97S	149	Tau Cap	5.2
Wed 23 Oct	01:22:42	.84+	-44	8	.47N	42	ZC3362	5.7
Thu 21 Nov	00:00:54	.80+	-58	22	.80S	122	44 Psc	5.8
Mon 23 Dec	22:36:58	.99+	-58	55	.61N	49	115 Tau	5.4

Table 2. Disappearance circumstances of bright double stars.

Disappearance events of faint stars with a very young Moon traditionally represent a challenge for observers with large telescopes. During 1996, there are three such disappearance events for which the following criteria hold: sun 10° or more below horizon; star 10° or more above horizon; lunar phase at most 10%. Table 3 summarises the circumstances.

The columns of table 3 are the same as those of table 1, except that all the stars are too faint to be given Bayer letters, and are therefore identified by their PPM Catalog numbers.

Date	Time UT	Lunar Phase	Sun Alt (°)	Star Alt (°)	Min Dist (radii)	PA (°)	Star (D = double)	Mag
Mon 22 Jan	17:35:58	.07+	-11	15	.94S	137	PPM 206095 (D)	7.4
Mon 22 Jan	18:00:53	.07+	-15	12	.63S	107	PPM 206114 (D)	9.2
Thu 21 Mar	19:27:42	.06+	-13	12	.71S	122	PPM 45158	10.8

Table 3. Disappearance events with young Moon.

When the Moon traverses a rich star field, several occultations can occur in a single evening. Table 4 lists the days of 1996 during which more than five occultations occur.

Date	No. occs	Date	No. occs	Date	No. occs	Date	No. occs	Date	No. occs
22 Jan	6	23 Jan	11	24 Jan	7	26 Jan	6	22 Feb	11
23 Feb	6	24 Mar	7	26 Mar	6	27 Mar	7	21 Apr	7
22 Apr	8	23 Apr	6	20 Sep	6	17 Oct	6	19 Oct	7
20 Oct	7	15 Nov	9	13 Dec	9	14 Dec	9	17 Dec	7

Table 4. Dates during 1996 with more than five occultations.

GRAZING OCCULTATIONS

The paths of two bright grazing occultations pass within relatively easy travelling distance of Ipswich during 1996. Table 5 summarises the circumstances, while figure 2 shows the graze tracks in outline.

The track of WW Piscium cuts across Norfolk almost due west → east, passing through Downham Market, Wymondham, Mulbarton and out to sea half way between Lowestoft and Great Yarmouth. The track of 25 Virginis traverses north-west to south-east, passing through King's Lynn, narrowly south of Swaffham, narrowly north of Diss, through the centre of Stradbroke, south of Saxmundham, and out to sea approximately 2½ km South of the centre of Aldeburgh.

Date	Time (UT)	Lunar Phase	Sun Alt (°)	Star Alt (°)	Star Azi (°)	Limb	Star	Mag
Thu 25 Jan	22:04	0.34+	-48	11	267	N	WW Psc ZC136	6.0
Fri 9 Feb	03:09	0.82-	-38	32	177	S	25 Vir ZC1807	5.9

Table 5. Grazing occultations.

The Sun

"Like a mother she tends to the needs of her children, sustaining them, giving them life and light."

So wrote one of the ancient philosophers, and perhaps more perceptively:

"The creator and destroyer of all life."

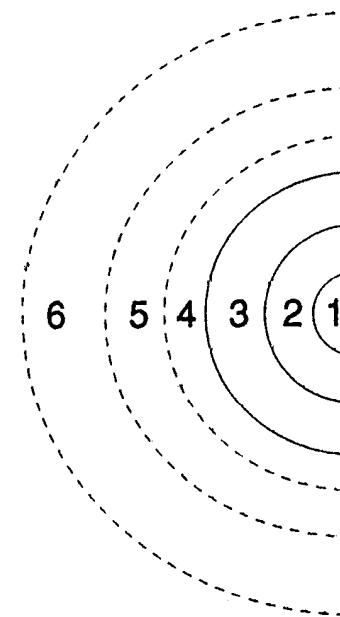
The Sun, as we know, provides us with all the light and heat necessary to sustain life on Earth. It is the centre of the solar system of nine planets, of which we are the third.

Although it appears huge to us, in excess of 1,000,000 km (the Earth, by comparison, is 12,750 km in diameter), it is, on the cosmic scale a medium sized and fairly ordinary star. Thankfully for us, it is also a very stable star. The spectral type based upon the Harvard classification is G2.

Approximately 1,000,000 Earths would fit inside it. It has an apparent magnitude of minus 26.9, and an equatorial rotation period of 25 days. Its velocity is 19 km/sec towards the constellation of Hercules, and of course it shares in the velocity of the Galaxy, which is 272 km/sec.

The Sun is approximately 5,000,000,000 years old, which makes it a middle aged star, and astronomers believe it is approximately at the mid stage of its life. It is a giant nuclear reactor, converting the gas hydrogen into helium at the rate of 4,000,000 tonnes/sec. In so doing it gives out radiation in the form of light, heat and various radio emissions. All the elements found on Earth can be found in the Sun.

Let us delve inside the Sun, using a sectional diagram. »»



Key

- 1 - Core
- 2 - Radiation zone
- 3 - Convection zone
- 4 - Photosphere
- 5 - Chromosphere
- 6 - Corona

A cross-sectional diagram of the Sun

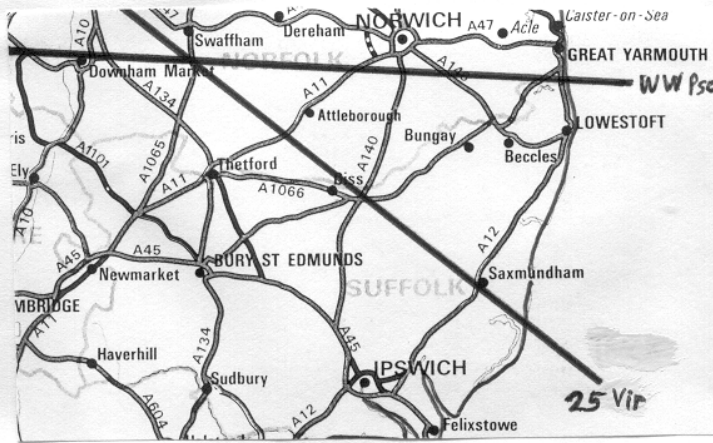


Figure 2. Tracks of grazing occultations.

Detailed plots of each graze will be produced if it is decided to mount observing trips.

PLANETARY OCCULTATION

Venus is the only planet subject to a lunar occultation during 1996. At the time of the occultation, it is of magnitude -4.5 and should be visible telescopically in the morning sunlight. The lunar phase will be 10%, waning. Circumstances for Orwell Park Observatory are given in table 6. The event will be seen as a grazing occultation from Southern Shetland.

Date	Time UT	Sun Alt (°)	Venus Alt (°)	PA (°)
Thu 12 Jul	D- 07:50:26	34	51	45
	R- 08:57:20	44	55	299

Table 6. Venus occultation.

The core temperature is 14,000,000 °C, at a pressure of 2.2 x 10¹¹ atmospheres, and, moving out towards the surface, the photosphere temperature is 6,000 °C, the chromosphere is 35,000 °C, and the corona, which is visible so spectacularly at solar eclipses, is 1,000,000 °C.

Of course, other features are visible: the darker (cooler) areas known as sunspots, at 4,000 °C, and from time to time vast solar flares or prominences which erupt from the surface into space outwards to a distance of 625,000 km.

The light generated by the Sun travels through space at 300,000 km/sec, and covers the distance to Earth, 150,000,000 km, in approximately 8½ minutes.

The Sun is indeed the source of all life on Earth, and it continues to sustain our lives. It has been regarded as a god, and worshipped throughout history by many

different cultures. This is understandable as, if the Sun shone the crops would grow; if the god was angry then it could destroy the crops, and stop the rain from coming, thereby punishing the people. No wonder they sacrificed their own to appease this great god.

Well, all this is the stuff of myth, legend and ignorance. Our understanding of the Sun continues to improve, but like the ancient sun worshippers, the one factor we share in common is to respect, give thanks and appreciate the importance of the Sun in the continuing story of life on Earth.

David Williams

References:

- Sectional drawing of the Sun
- The Penguin Book of the Physical World, 1976
- The Penguin Book of Astronomy, 1966

SOCIETY NEWS

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*          1996 AGM
*
*   SATURDAY   13th   JANUARY   8.00 pm
*
*   ALL MEMBERS ARE INVITED TO ATTEND
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*   The meeting will be held in the usual venue, the class
*   room behind the school library. If you are not sure
*   where this is please meet in the club room. The meeting
*   will include a review of the society's activities
*   during 1995 and proposed events for 1996.
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PROGRAMME FOR JANUARY

<i>Mondays from 7.30pm</i> <i>No Directors available for this night</i>	GENERAL OBSERVATION SECTION
<i>Tuesdays from 7.30pm</i> <i>Mr D Barnard</i>	GENERAL OBSERVATION SECTION daytime only
<i>Wednesdays from 7.45pm</i> <i>Mr M Cook</i>	NEBULA & FAINT OBJECTS SECTION <i>Mr D Payne</i>
<i>Thursdays from 7.30pm</i> <i>Mr P Richards</i>	OBSERVATORY VISITS FROM OUTSIDE GROUPS
<i>Fridays from 7.30pm</i> <i>5th 19th</i> <i>Mr J Hood</i>	DOUBLE STARS <i>Mr M Barritt</i>

All members are welcome to come but, on nights other than Wednesdays please check with the director of the night that the observatory will be open.

Lectures and other events: A.G.M.
The Annual General Meeting is provisionally booked for Saturday January 14th and is usually held in the school library, all members are invited to attend but please check with one of the committee members to confirm the date and location.

e-mail enquires to oasieng@btbcs.bt.co.uk
WWW url <http://www.ast.cam.ac.uk:80/~ipswich/>

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TREASURER	M Nicholls		
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