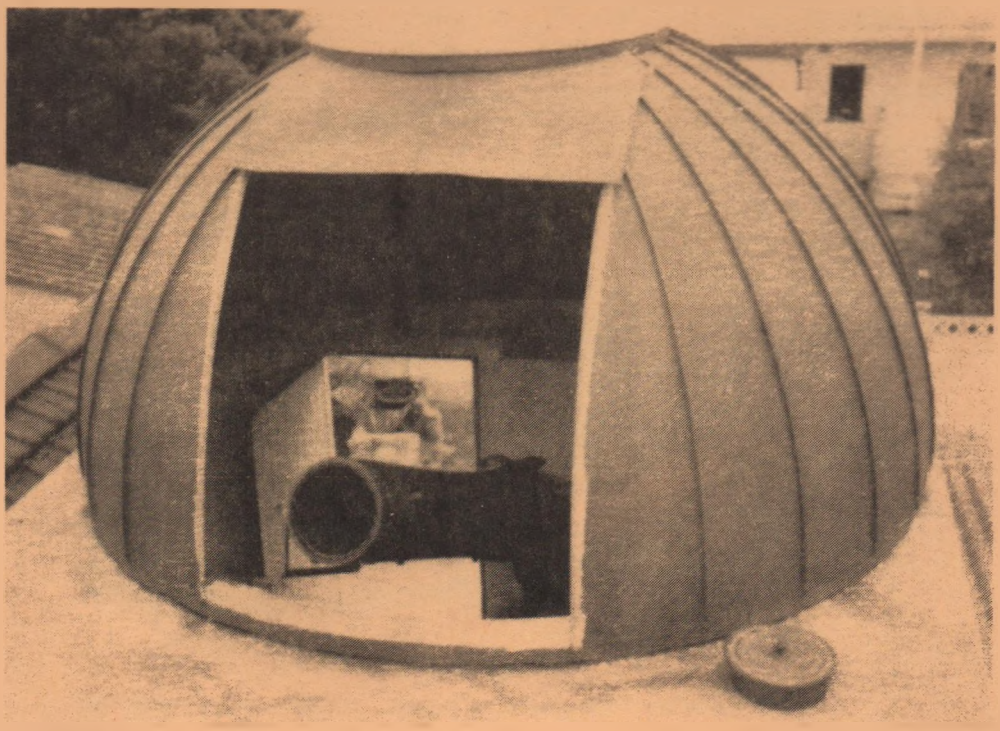
ASTRONOMICAL HANDBOOK FOR SOUTHERN AFRICA

1983



published by the Astronomical Society of Southern Africa.

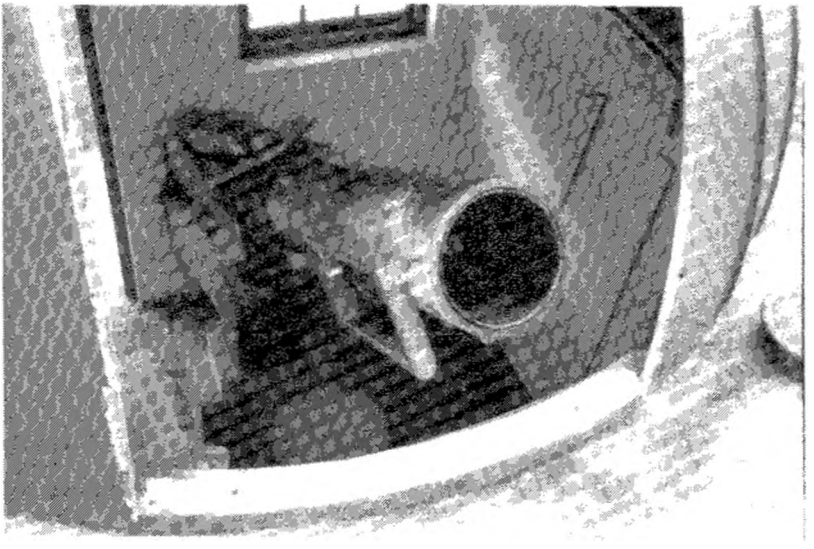
ISSN 0571—7191

PREDICTED PERIHELION PASSAGES OF COMETS 1983

Periodic comet	Perihelion Date	Revolution Period years	Perihelion Distance au
Pons-Winnecke	Apr. 7	6.4	1.25
Arend	May 22	8.0	1.86
Tempel 2	June 1	5.3	1.38
du Toit-Neujmin-Delporte	June 6	6.4	1.71
Oterma	June 18	19.4	5.47
Tempel 1	July 9	5.5	1.49
Kopff	Aug. 10	6.4	1.58
Harrington-Abell	Dec. 1	7.6	1.79
Johnson	Dec. 3	6.9	2.30

ASTRONOMICAL HANDBOOK FOR SOUTHERN AFRICA 1983

This booklet is intended both as an introduction to observational astronomy for the interested layman – even if his interest is only a passing one – and as a handbook for the established amateur or professional astronomer.



Front Cover

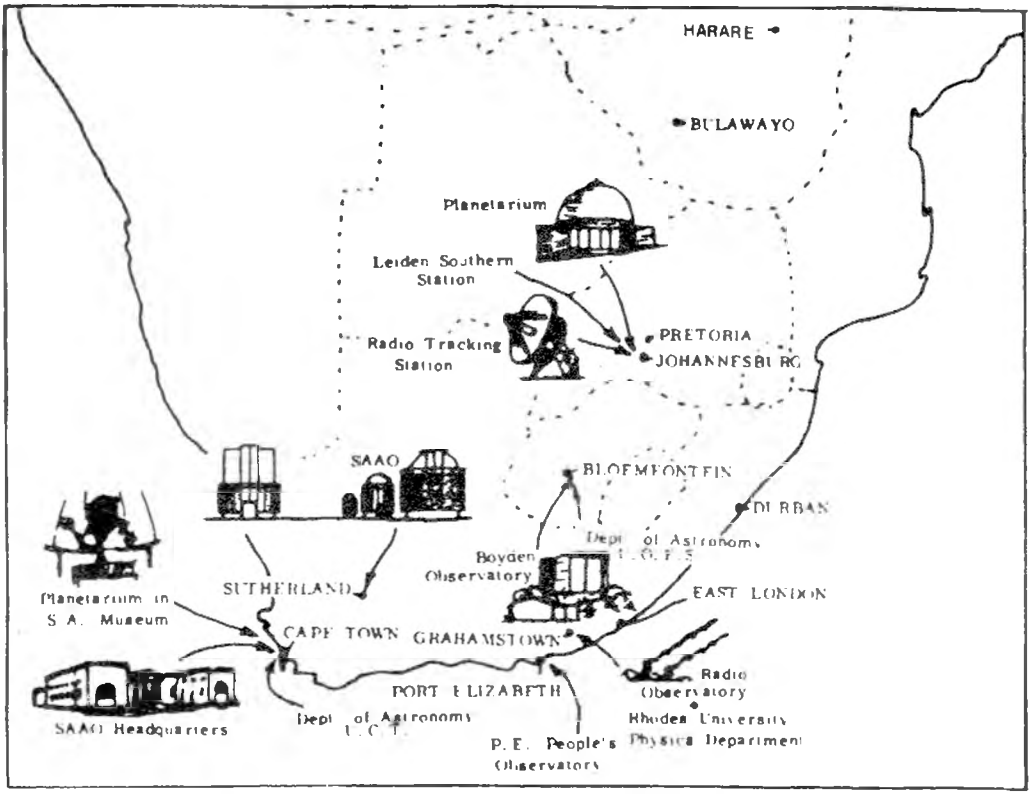
The Observatory of A.F.I. Forbes at Blairythan, Hermanus

Alexander Forbes (1871 - 1959) discovered comets in 1928, 1929 and 1930 from his observatory in Rosebank, Cape and on 15th December 1932 at Hermanus he discovered his fourth comet. These pictures were taken recently to commemorate the 50th Aniversary of the discovery of this 4th comet.

Astronomy in Southern Africa

Teaching Departments

Both the University of Cape Town and University of the Orange Free State have departments of astronomy. The chair of astronomy at U C T is occupies by Prof Brian Warner, whose department uses the S.A.A.O. observing facilities at Sutherland. Professor G F R Ellis of the Department of Applied Mathematics, U C T heads a group carrying out research in theoretical cosmology. The U O F S department, incorporated with the Boyden Observatory is headed by Prof A H Jarrett. The Physics Department of Rhodes University specialises in radio astronomy, and has its own observatory outside Grahamstown. The Department of Mathematics, Applied Mathematics and Astronomy at U N I S A offers a number of courses in astronomy and astrophysics.



THE ASTRONOMICAL SOCIETY OF SOUTHERN AFRICA

The Astronomical Society of Southern Africa is a body consisting of both amateur and professional astronomers. Membership is open to all interested persons, regardless of knowledge or experience. In addition to this handbook, the Society issues "The Monthly Notes of the Astronomical Society of Southern Africa" (MNASSA). Members also receive copies of "Sky and Telescope", an excellent and very popular monthly magazine published in the United States. It provides up to date information on both professional and amateur activities, together with news of space research and other related subjects. The Society's annual subscription is R25-00 and there is an entrance fee of R2-50. Information can be obtained from the Honorary Secretary, Astronomical Society of Southern Africa, c/o The South African Astronomical Observatory, P O Box 9, Observatory, 7935, Cape.

LOCAL CENTRE OF THE SOCIETY

Autonomous local Centres of the Society hold regular meetings in Cape Town, Durban, Johannesburg, Bloemfontein, Pietermaritzburg, Pretoria and Harare. Visitors are very welcome at meetings and may, if they wish, join a Centre, without becoming a full member of the Society. Centre members do not receive society publications nor Sky & Telescope.

CAPE CENTRE (Cape Town) - meetings on 2nd Wednesday of the month (except January and December) at the South African Astronomical Observatory at 8.00 pm. The Centre possesses a small observatory housing the 30 cm Ron Atkins Telescope. Secretarial address: c/o S.A.A.O., P O Box 9, Observatory, 7935. Information on meetings also available from telephone (day time) 69 8531 ext 256, 210 3814 evenings 61 4534.

TRANSVAAL CENTRE (Johannesburg) - general meetings are held on 2nd Wednesday of each month excluding December in the Sir Herbert Baker Building, Republic Observatory, Observatory at 20h00 when a formal lecture is delivered. On this site the Christos Papadopoulos dome houses a combined instrument, comprising of 30 cm cassegrain telescope arranged for photo-electric photometry, and two refracting telescopes of 18 and 15 cm aperture, which is available to members of the Centre. Public observing evenings are held on the first Monday of each month at 20h00, and there are sections catering for the observation of variable stars and grazing occultations. Secretarial address: 6 Hill Manor, Dukes Avenue, Windsor Park, Randburg, 2195. Telephone 678 5534.

NATAL CENTRE (Durban) - regular monthly meetings are held on the 3rd Wednesday of each month in St Paul's Church Hall, Church Street, Durban (opposite the GPO) at 7.45 pm. The Natal Centre publishes a monthly booklet "NDABA", which contains news and views and current information on astronomical and related topics. Secretarial address: c/o P O Box 840, Durban, 4000. Telephone 84 2321 (W) and 84 4751 (H).

NATAL MIDLANDS CENTRE (Pietermaritzburg) - meetings are held on the 2nd Wednesday of the month (except January) at the College for Further Education and Training, Havelock Road at 7.45 pm and occasionally at private homes. Information on meetings and membership is available from the Secretary, 23 Munro Avenue, Pietermaritzburg, Telephone 24 074 or 54 038.

BLOEMFONTEIN CENTRE - meetings are held every 3rd Wednesday of the month. For further information contact Mr F C Neser telephone 22 1142, 108 Japie Neser Street, Uitsig, Bloemfontein.

PRETORIA CENTRE - meetings are held on the 4th Wednesday of the months - January, March, May, July, September and November at 8.00 pm, the venue alternating between the Main Academic Building of the University of South Africa and the Christian Brothers' College, Silverton Road. The Centre's observatory containing a 32 cm reflector is situated on the latter site. For further information contact the Secretary, Mr J C Bennett, 90 Malan Street, Riviera, Pretoria, 0084.

HARARE CENTRE - the Centre holds fairly frequent meetings, usually at 8.00 pm at which talks on various subjects are given and/or films shown. In addition, social "star-gazing" sessions are arranged at intervals, at which telescopes are set up by those members who possess them and made available for observing by all members present. The address of the Harare Centre is P O Box UA 428, Union Avenue, Harare and the Hon. Secretary (to whom communications should be addressed) is Mr w l Stedman

OBSERVING SECTIONS OF THE SOCIETY

These sections exist to co-ordinate and encourage constructive observing programmes. Mention of the type of observations and equipment involved are made in the appropriate parts of this handbook together with the names and addresses of the directors.

Comets and Meteors	see page 28
Grazing Occultations	see page 38
Nova Search Section	see page 33
Ordinary Occultations	see page 35
Variable Stars	see page 34

DIARY OF PHENOMENA, 1983
CONFIGURATIONS OF SUN, MOON AND PLANETS

JANUARY

d	h	
2	18	Earth at perihelion
6	06	LAST QUARTER
6	14	Spica 8° S of Moon
6	20	Mercury stationary
7	12	Mercury 2° N of Venus
7	14	Saturn 2° S of Moon
10	00	Jupiter 2° S of Moon
10	09	Uranus 2° S of Moon
10	12	Antares 7° S of Moon
12	03	Neptune 0°.6 N of Moon Occ^{n}
14	07	NEW MOON
14	07	Moon at apogee
15	21	Venus 1°.8 N of Moon
16	05	Mercury in inferior conjunction
17	06	Mars 3° N of Moon
18	15	Vesta 0°.8 S of Moon Occ^{n}
22	08	FIRST QUARTER
27	12	Mercury stationary
28	13	Moon at perigee
29	00	FULL MOON

FEBRUARY

d	h	
3	02	Juno in conjunction with Sun
3	23	Saturn 2° S of Moon
4	00	Spica 3° S of Moon
4	21	LAST QUARTER
6	15	Jupiter 1°.5 S of Moon
6	18	Uranus 2° S of Moon
6	18	Antares 7° S of Moon
7	09	Pluto stationary
8	11	Neptune 0°.8 N of Moon Occ^{n}
8	22	Mercury greatest elong. W (26°)
10	10	Moon at apogee
10	17	Mercury 2° N of Moon
13	03	NEW MOON
13	10	Saturn stationary
15	04	Venus 4° N of Moon
15	08	Mars 5° N of Moon
15	17	Uranus 5° N of Antares
15	21	Vesta 0°.3 S of Moon Occ^{n}
17	07	Jupiter 5° N of Antares
17	16	Jupiter 0°.8 N of Uranus
19	00	Venus 0°.5 S of Mars
20	20	FIRST QUARTER
26	00	Moon at perigee
27	11	FULL MOON

MARCH

d	h	
3	08	Saturn 1°.7 S of Moon
3	10	Spica 2° S of Moon
6	02	Antares 7° S of Moon
6	02	Uranus 1°.8 S of Moon
6	05	Jupiter 1°.0 S of Moon Occ^{n}
6	15	LAST QUARTER
7	19	Neptune 1°.0 N of Moon Occ^{n}
10	01	Moon at apogee
14	15	Uranus stationary
14	20	NEW MOON
16	04	Vesta 0°.3 S of Moon Occ^{n}
16	08	Mars 5° N of Moon
17	08	Venus 5° N of Moon
21	07	Equinox
22	04	FIRST QUARTER
26	00	Moon at perigee
26	13	Mercury in superior conjunction
28	03	Jupiter stationary
28	21	FULL MOON
30	16	Saturn 1°.5 S of Moon
30	20	Spica 2° S of Moon

APRIL

d	h	
1	07	Neptune stationary
2	10	Antares 6° S of Moon
2	11	Uranus 1°.6 S of Moon
2	15	Jupiter 0°.6 S of Moon Occ^{n}
4	03	Neptune 1°.3 N of Moon
5	11	LAST QUARTER
6	20	Moon at apogee
9	14	Mercury 1°.4 N of Mars
10	21	Uranus 5° N of Antares
13	10	NEW MOON
14	17	Mercury 6° N of Moon
14	20	Vesta in conjunction with Sun
16	09	Venus 4° N of Moon
18	20	Pluto at opposition
20	11	FIRST QUARTER
21	10	Moon at perigee
21	10	Mercury greatest elong. E.(20°)
21	21	Saturn at opposition
22	15	Venus 7° N of Aldebaran
26	21	Saturn 1°.6 S of Moon
27	05	Spica 2° S of Moon
27	09	FULL MOON
29	19	Antares 6° S of Moon
29	19	Uranus 1°.5 S of Moon
29	21	Jupiter 0°.6 S of Moon Occ^{n}

MAY

d	h	
1	11	Neptune 1°.5 N of Moon
2	06	Mercury stationary
4	15	Moon at apogee
5	06	LAST QUARTER
6	08	Jupiter 6° N of Antares
7	23	Pallas stationary
12	19	Mercury in inferior conjunction
12	21	NEW MOON
16	03	Venus 1°.5 N of Moon
16	15	Jupiter 0°.8 N of Uranus
16	18	Moon at perigee
19	16	FIRST QUARTER
24	01	Saturn 1°.8 S of Moon
24	13	Spica 2° S of Moon
25	01	Mercury stationary
26	21	FULL MOON
26	23	Jupiter 0°.8 S of Moon Occ^{n}
27	01	Uranus 1°.6 S of Moon
27	04	Antares 6° S of Moon
28	00	Jupiter at opposition
28	18	Neptune 1°.6 N of Moon
29	03	Uranus at opposition
31	07	Venus 4° S of Pollux

JUNE

d	h	
1	10	Moon at apogee
3	13	Mars in conjunction with Sun
3	23	LAST QUARTER
8	08	Mercury greatest elong. W.(24°)
9	12	Mercury 0°.8 S of Moon Occ^{n}
11	07	NEW MOON Eclipse
13	08	Moon at perigee
14	13	Venus 1°.5 S of Moon
16	09	Venus greatest elong. E.(45°)
17	22	FIRST QUARTER
19	19	Neptune at opposition
20	05	Saturn 2° S of Moon
20	18	Spica 2° S of Moon
21	08	Mercury 4° N of Aldebaran
22	01	Solstice
22	23	Jupiter 1°.2 S of Moon Occ^{n}
23	05	Uranus 1°.7 S of Moon
23	10	Antares 6° S of Moon
25	00	Neptune 1°.5 N of Moon
25	11	FULL MOON Eclipse
28	08	Ceres stationary
29	01	Moon at apogee

JULY

d	h	
2	15	Saturn stationary
3	14	LAST QUARTER
6	12	Earth at aphelion
8	08	Pallas at opposition
9	18	Mercury in superior conjunction
10	01	Venus 0°.7 S of Regulus
10	14	NEW MOON
11	12	Moon at perigee
13	10	Venus 6° S of Moon
14	10	Pluto stationary
17	05	FIRST QUARTER
17	11	Saturn 2° S of Moon
18	00	Spica 2° S of Moon
19	17	Venus greatest brilliancy mag -4.2
20	01	Jupiter 1°.4 S of Moon
20	09	Uranus 1°.7 S of Moon
20	16	Antares 6° S of Moon
22	04	Neptune 1°.5 N of Moon
25	01	FULL MOON
26	09	Moon at apogee
29	15	Jupiter stationary

AUGUST

d	h	
1	04	Mercury 0°.4 N of Regulus
1	14	Venus stationary
2	03	LAST QUARTER
4	14	Mars 6° S of Pollux
6	08	Mercury 6° N of Venus
7	14	Mars 1°.8 S of Moon
8	21	NEW MOON
8	21	Moon at perigee
10	03	Venus 12° S of Moon
10	13	Mercury 6° S of Moon
13	20	Saturn 1°.9 S of Moon
14	07	Ceres at opposition
14	07	Spica 2° S of Moon
14	10	Uranus stationary
15	15	FIRST QUARTER
16	08	Jupiter 1°.3 S of Moon
16	15	Uranus 1°.6 S of Moon
16	21	Antares 6° S of Moon
18	09	Neptune 1°.5 N of Moon
19	18	Mercury greatest elong. E.(27°)
22	11	Moon at apogee
23	17	FULL MOON
25	07	Venus in inferior conjunction
29	22	Pallas stationary
31	13	LAST QUARTER

SEPTEMBER

d	h	
1	21	Mercury stationary
5	04	Mars 3° S of Moon
5	16	Venus 13° S of Moon
6	07	Moon at perigee
7	05	NEW MOON
7	22	Mercury 10° S of Moon
8	14	Neptune stationary
10	09	Saturn 1°.7 S of Moon
10	16	Spica 2° S of Moon
12	20	Jupiter 0°.9 S of Moon Occ^{n}
12	23	Uranus 1°.3 S of Moon
13	05	Antares 6° S of Moon
14	04	FIRST QUARTER
14	10	Venus stationary
14	16	Neptune 1°.7 N of Moon
14	21	Venus 9° S of Mars
15	18	Mercury in inferior conjunction
18	19	Moon at apogee
22	09	FULL MOON
23	17	Equinox
24	03	Mercury stationary
24	05	Juno stationary
25	00	Jupiter 0°.4 N of Uranus
28	23	Mars 0°.9 N of Regulus
29	22	LAST QUARTER

OCTOBER

d	h	
1	09	Venus greatest brilliancy mag -4.3
1	12	Mercury greatest elong. W(18°)
3	09	Venus 9° S of Moon
3	18	Mars 4° S of Moon
4	13	Moon at perigee
5	05	Mercury 4° S of Moon
6	13	NEW MOON
7	09	Venus 4° S of Regulus
7	15	Ceres stationary
8	01	Saturn 1°.4 S of Moon
8	02	Spica 1° S of Moon
10	10	Uranus 1°.0 S of Moon Occ^{n}
10	13	Jupiter 0°.4 S of Moon Occ^{n}
10	15	Antares 5° S of Moon
12	00	Neptune 2° N of Moon
13	03	Jupiter 5° N of Antares
13	22	FIRST QUARTER
16	10	Moon at apogee
22	00	FULL MOON
23	13	Pluto in conjunction with Sun
24	07	Juno at opposition
25	14	Vesta stationary
28	15	Venus 1°.7 S of Mars
29	06	LAST QUARTER
30	19	Mercury in superior conjunction
31	08	Saturn in conjunction with Sun

NOVEMBER

d	h	
1	05	Moon at perigee
1	06	Mars 4° S of Moon
1	08	Venus 5° S of Moon
4	12	Spica 1° S of Moon
6	22	Uranus 0°.7 S of Moon Occ^{n}
6	23	Antares 5° S of Moon
7	09	Jupiter 0°.2 N of Moon Occ^{n}
8	11	Neptune 2° N of Moon
12	18	FIRST QUARTER
13	05	Moon at apogee
20	06	Mercury 1°.8 S of Uranus
20	09	Mercury 3° N of Antares
20	14	FULL MOON
26	04	Moon at perigee
26	08	Mercury 3° S of Jupiter
27	13	LAST QUARTER
29	17	Venus 4° N of Spica
29	17	Mars 4° S of Moon
30	23	Venus 2° S of Moon

DECEMBER

d	h	
1	20	Spica 1° S of Moon
2	05	Uranus in conjunction with Sun
2	06	Saturn 0°.9 S of Moon Occ^{n}
3	01	Juno stationary
3	09	Mercury 4° S of Neptune
4	09	Antares 5° S of Moon
4	14	NEW MOON Eclipse
5	21	Neptune 2° N of Moon
6	05	Mercury 0°.9 S of Moon Occ^{n}
11	03	Moon at apogee
12	15	FIRST QUARTER
13	12	Vesta at opposition
13	23	Mercury greatest elong. E.(21°)
14	15	Jupiter in conjunction with Sun
17	13	Venus 0°.2 N of Saturn
20	04	FULL MOON Penumbral Eclipse
21	12	Neptune in conjunction with Sun
21	22	Mercury stationary
22	13	Solstice
22	20	Moon at perigee
26	21	LAST QUARTER
27	10	Mars 4° N of Spica
28	02	Mars 3° S of Moon
29	02	Spica 1° S of Moon
29	18	Saturn 0°.6 S of Moon Occ^{n}
30	21	Venus 0°.7 N of Moon Occ^{n}
31	10	Mercury in inferior conjunction
31	20	Uranus 0°.4 S of Moon Occ^{n}

THE SUN 1983

Basic Data

Diameter: 1 392 000 km (1 09 times Earth diameter)

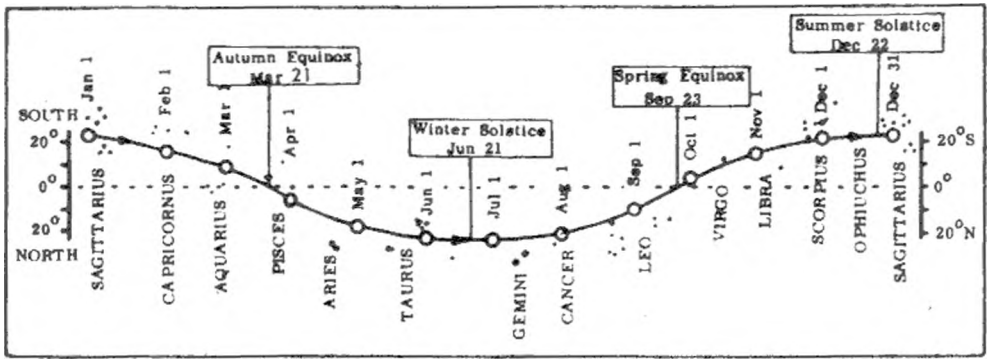
Mass: 1,99 x 10^{30}kg (330 000 times Earth mass)

Surface Temperature: Approx. 6000°C

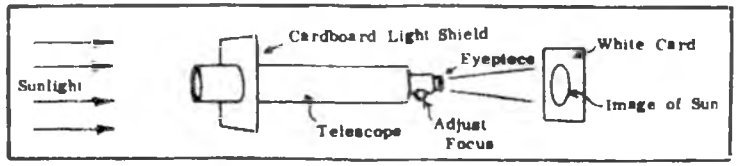
Temperature at centre: Apprx. 10 million°C

The Sun is our nearest star. It is composed chiefly of hydrogen and is in a gaseous state throughout. So hot and dense is its interior that nuclear reactions occur there - thus producing the energy that is eventually radiated from its surface. At times its surface is disturbed by sunspots (which may persist for some weeks) and flares (short lived).

The Earth's orbit round the Sun is not quite circular. In 1983 we will be closest to the Sun on January 2 (perihelion - approx. distance 147 million km) and furthest from the Sun on July 6 (aphelion - approx. 152 million km). During the year, the Sun appears to us to make a complete circuit of the sky (i.e. relative to the starry background) as indicated in the diagram.



Permanent damage to the eye can be caused by looking directly at the Sun. The diagram below shows how a small telescope (or half a binocular) may be used to project an image of the solar disk onto a piece of white card. It may also be advisable to stop down the telescope aperture so that the eyepiece is not damaged by the intense light passing through it. Tiny black sunspots are generally visible on the otherwise white solar disk - if monitored over a period of a week or so, the rotation of the Sun should be apparent.



SUN'S DECLINATION

Jan	1	23°04 S	Apr	1	4 14°N	July	10	22°20 N	Oct	8	5°35 S
	11	21 55 S		11	8 01 N		20	20 49 N		18	9 20 S
	21	20 04 S		21	11 35 N		30	18 42 N		28	12 51 S
	31	17 36 S	May	1	14 50 N	Aug	9	16 05 N	Nov	7	16 03 S
Feb	10	14 36 S		11	17 41 N		19	13 02 N		17	18 47 S
	20	11 12 S		21	20 01 N		29	9 39 N		27	20 59 S
Mar	2	7 30 S		31	21 48 N	Sep	8	6 00 N	Dec	7	22 31 S
	12	3 38 S	Jun	10	22 57 N		18	2 11 N		17	23 20 S
	22	0 19 N		20	23 26 N		28	1 43 S		21	23 26 S
				30	23 13 N					27	23 22 S
										31	23 09 S

TIMES OF SUNRISE AND SUNSET FOR THE MAIN CITIES OF SOUTHERN AFRICA

		CAPE TOWN		DURBAN		BLOEMFONTEIN		JOHANNESBURG		HARARE	
		sunrise	sunset	sunrise	sunset	sunrise	sunset	sunrise	sunset	sunrise	sunset
Jan	1	05h38m	20h01m	04h58m	19h01m	05h21m	19h18m	05h18m	19h04m	05h24m	18h35m
	11	05 46	20 02	05 06	19 02	05 29	19 18	05 25	19 05	05 29	18 37
	21	05 55	19 59	05 14	19 00	05 37	19 17	05 33	19 04	05 37	18 38
Feb	1	06 07	19 52	05 24	18 55	05 46	19 13	05 42	19 00	05 42	18 36
	11	06 17	19 44	05 32	18 48	05 54	19 06	05 49	18 55	05 47	18 32
	21	06 26	19 33	05 41	18 39	06 02	18 57	05 54	18 47	05 52	18 27
Mar	1	06 33	19 23	05 46	18 30	06 08	18 48	06 00	18 39	05 55	18 21
	11	06 41	19 11	05 53	18 19	06 13	18 38	06 04	18 29	05 57	18 15
	21	06 49	18 58	05 59	18 06	06 18	18 27	06 11	18 19	06 00	18 06
Apr	1	06 58	18 41	06 06	17 53	06 25	18 13	06 17	18 06	06 02	17 57
	11	07 04	18 30	06 11	17 43	06 30	18 03	06 21	17 56	06 04	17 50
	21	07 13	18 17	06 17	17 31	06 35	17 52	06 25	17 47	06 07	17 43
May	1	07 20	18 06	06 24	17 22	06 42	17 44	06 31	17 38	06 10	17 37
	11	07 28	17 57	06 31	17 14	06 49	17 36	06 37	17 31	06 13	17 32
	21	07 34	17 50	06 36	17 06	06 54	17 30	06 41	17 26	06 16	17 29
Jun	1	07 43	17 45	06 43	17 04	07 01	17 27	06 47	17 23	06 20	17 28
	11	07 48	17 44	06 48	17 03	07 05	17 26	06 52	17 22	06 23	17 27
	21	07 51	17 44	06 51	17 04	07 06	17 27	06 55	17 24	06 26	17 29
Jul	1	07 53	17 48	06 53	17 07	07 10	17 30	06 57	17 27	06 27	17 32
	11	07 51	17 52	06 51	17 11	07 06	17 34	06 55	17 30	06 27	17 35
	21	07 47	17 58	06 48	17 16	07 05	17 39	06 53	17 35	06 26	17 40
Aug	1	07 39	18 06	06 42	17 22	07 00	17 45	06 48	17 41	06 23	17 42
	11	07 30	18 13	06 34	17 29	06 53	17 51	06 41	17 46	06 18	17 46
	21	07 19	18 20	06 24	17 35	06 42	17 55	06 32	17 50	06 11	17 48
Sep	1	07 06	18 27	06 12	17 40	06 31	18 01	06 21	17 54	06 04	17 49
	11	06 52	18 34	06 00	17 46	06 19	18 06	06 11	17 59	05 55	17 51
	21	06 38	18 41	05 48	17 51	06 07	18 10	05 59	18 03	05 46	17 52
Oct	1	06 25	18 48	05 37	17 57	05 57	18 16	05 50	18 08	05 39	17 54
	11	06 12	18 55	05 25	18 03	05 45	18 22	05 39	18 12	05 30	17 57
	21	05 58	19 04	05 12	18 09	05 33	18 27	05 27	18 17	05 23	17 59
Nov	1	05 46	19 13	05 02	18 17	05 24	18 35	05 19	18 24	05 16	18 03
	11	05 38	19 23	04 55	18 26	05 17	18 44	05 13	18 32	05 14	18 08
	21	05 31	19 33	04 49	18 34	05 12	18 52	05 06	18 39	05 11	18 13
Dec	1	05 29	19 43	04 48	18 42	05 11	19 00	05 07	18 46	05 12	18 19
	11	05 28	19 50	04 48	18 50	05 11	19 07	05 08	18 53	05 14	18 25
	21	05 32	19 57	04 52	18 57	05 15	19 14	05 12	19 00	05 18	18 31

SOLAR ECLIPSES

There will be a Total Eclipse of the Sun on June 11 but this will start at 05.20 in Longitude 60° East and 36° South latitude and after passing over Indonesia and New Guinea will end at 08.10 at 153° East and 18° South. Madagascar, Australia, Ceylon, S E Asia, the Phillipines and New Zealand will see a partial eclipse.

The Annular eclipse on the 4th December will be seen over equatorial Africa in the early afternoon and will be seen as a partial eclipse over all but the southern coast of Africa, Cape Town, Port Elizabeth and East London will be just south of the partial eclipse belt.

THE MOON 1983

BASIC DATA

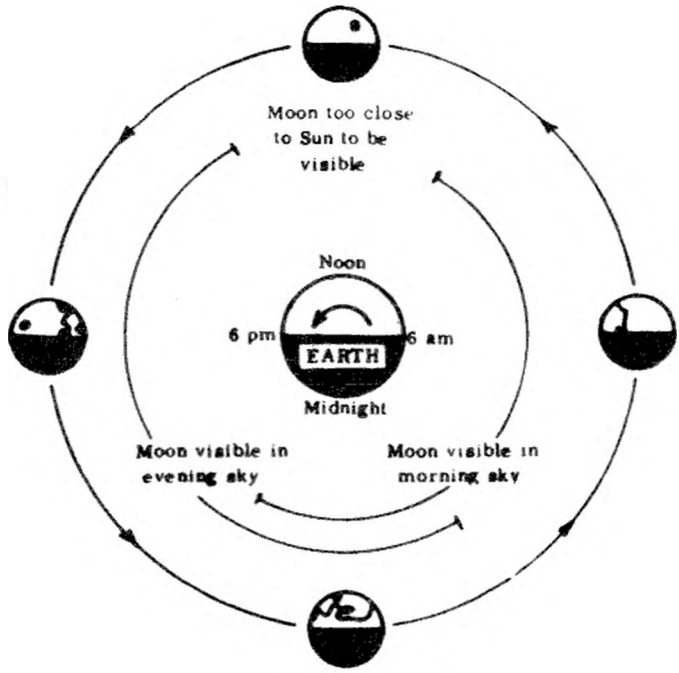
Diameter: 3 480 km (0,27 of Earth)
Mass: $7{,}35 \times 10^{22} \times$ kg (1/81 of Earth)
Surface Gravity: 0,16 of Earth
Average distance from Earth 384 000 km

PHASES AND VISIBILITY

New Moon

SUNLIGHT	Jan	$14^d07^h08^m$	May	$12^d21^h25^m$	Sept	$7^d04^h35^m$	
	Feb	13 02 32	June	11 06 37	Oct	6 13 16	
	Mar	14 19 43	July	10 14 18	Nov	5 00 21	
	Apr	13 09 58	Aug	8 21 18	Dec	4 14 26	SUNLIGHT

SCHEMATIC DIAGRAM OF MOON'S ORBIT



FIRST QUARTER

Jan	$22^d07^h33^m$
Feb	20 19 32
Mar	22 04 25
Apr	20 10 58
May	19 16 17
June	17 21 46
July	17 04 50
Aug	15 14 47
Sept	14 04 24
Oct	13 21 42
Nov	12 17 49
Dec	12 15 09

LAST QUARTER

Jan	$6^d06^h00^m$
Feb	4 21 17
Mar	6 15 16
Apr	5 10 38
May	5 05 43
June	3 23 07
July	3 14 12
Aug	2 02 52
Aug	31 13 22
Sept	29 22 05
Oct	29 05 37
Nov	27 12 50
Dec	26 20 52

Full Moon

Jan	$29^d00^h26^m$	May	$26^d20^h48^m$	Sept	$22^d08^h36^m$
Feb	27 10 58	June	25 10 32	Oct	21 23 53
Mar	28 21 27	July	25 01 27	Nov	20 14 29
Apr	27 08 31	Aug	23 16 59	Dec	20 04 00

THE MOON'S ORBIT

Dates of Apogee, when the Moon is furthest from the Earth (approx. 407000 km) and of Perigee, when the Moon is closest to the Earth (approx. 357000 km) are given below.

Moon at Perigee

	d	h		d	h		d	h
Jan	28	13	June	13	08	Nov	1	05
Feb	26	00	July	11	12	Nov	26	04
Mar	26	00	Aug	8	21	Dec	22	20
Apr	21	10	Sept	6	07			
May	16	18	Oct	4	13			

Moon at Apogee

	d	h		d	h		d	h
Jan	14	07	June	1	10	Oct	16	10
Feb	10	10	June	29	01	Nov	13	05
Mar	10	01	July	26	09	Dec	11	03
Apr	6	20	Aug	22	11			
May	4	15	Sept	18	19			

As a result of its motion around the Earth, the Moon appears to make a complete circuit pf the heavens in just under a month. It occasionally passes in front of bright stars (details given in Occultation section - page 35) and close to visible planets (details given in Diary pages 4 and 5).

TIMES OF MOONRISE AND MOONSET

Times for Bloemfontein, Cape Town, Durban, Johannesburg and Port Elizabeth can be obtained from the tables on pages 11 to 16.

THE SURFACE OF THE MOON

In common with the inner planets of our solar system, the Moon's surface suffered bombardment by numerous minor bodies during a period 4,5 to 3,0 billion years ago. This had produced the heavily cratered topgraphy now visible. Some particularly large impacts caused large circular depressions, which were flooded by molten lava from the Moon's interior. These are the maria basins which appear smoother and darker than the rest of the surface (the latin words mare and maria come from older times when they were mistaken for seas). The maria surfaces, being younger have fewer large craters, but the entire surface is peppered with tiny craters produced by tiny bodies which have also served to plough up the ground thus forming the regolith - a layer of loose material a metre or so deep.

LUNAR ECLIPSES

There will be a partial eclipse of the Moon on the morning of the 25th of June but this will only be seen from Australia and the Americas.

On the morning of the 20th December there will be a pen-umbral eclipse, centred on 04.00, visible from Africa.

MAP OF THE MOON'S NEAR SIDE

LIBRATIONS

Jan 5, Feb 2, Mar 1/28
Apr 24, May 22, Jun 18
Jul 15, Aug 11, Sept 8
Oct 5, Nov 1/28, Dec 25

Jan 6, Feb 4, Mar 4
Apr 1/28, May 25, Jun 20
Jul 18, Aug 15, Sept 12
Oct 10, Nov 7, Dec 4/30

Jan 20, Feb 16, Mar 15
Apr 11, May 9, Jun 5
Jul 2/29, Aug 25, Sept 22
Oct 19, Nov 15, Dec 12

Jan 22, Feb 19, Mar 18
Apr 13, May 10, Jun 7
Jul 6, Aug 3/31, Sep 28
Oct 24, Nov 20, Dec 17

TIMES OF MOONRISE AND

	JANUARY		FEBRUARY		MARCH	
	Rise	Set	Rise	Set	Rise	Set
1	21^h17^m	07^h13^m	21^h58^m	09^h17^m	20^h28^m	07^h58^m
2	22 05	08 22	22 34	10 17	21 04	09 00
3	22 48	09 28	23 09	11 16	21 41	09 59
4	23 26	10 31	23 45	12 13	22 19	10 58
5		11 31		13 09	22 59	11 55
6	00 01	12 29	00 23	14 04	23 41	12 50
7	00 36	13 25	01 03	14 58		13 44
8	01 10	14 20	01 46	15 50	00 27	14 36
9	01 46	15 15	02 32	16 41	01 16	15 24
10	02 23	16 09	03 22	17 28	02 07	16 09
11	03 04	17 03	04 13	18 11	03 00	16 50
12	03 48	17 55	05 07	18 52	03 53	17 28
13	04 36	18 44	06 00	19 29	04 48	18 04
14	05 26	19 30	06 54	20 03	05 42	18 38
15	06 19	20 13	07 48	20 37	06 36	19 11
16	07 12	20 52	08 41	21 09	07 31	19 44
17	08 05	21 28	09 36	21 42	08 27	20 18
18	08 58	22 02	10 31	22 17	09 24	20 55
19	09 52	22 35	11 29	22 55	10 24	21 36
20	10 45	23 07	12 29	23 31	11 25	22 22
21	11 40	23 41	13 32		12 28	23 14
22	12 37		14 36	00 26	13 31	
23	13 37	00 18	15 40	01 21	14 31	00 12
24	14 40	00 58	16 40	02 23	15 26	01 15
25	15 47	01 44	17 36	03 30	16 16	02 21
26	16 54	02 38	18 25	04 40	17 01	03 28
27	17 58	03 46	19 09	05 48	17 42	04 34
28	18 58	04 45	19 50	06 55	18 20	05 39
29	19 51	05 55			18 57	06 41
30	20 46	07 02			19 34	07 42
31	21 20	08 13			20 12	08 42

MOON SET - JOHANNESBURG

APRIL		MAY		JUNE	
Rise	Set	Rise	Set	Rise	Set
20^h52^m	09^h41^m	20^h58^m	10^h18^m	22^h19^m	11^h21^m
21 34	10 39	21 49	11 11	23 12	11 59
22 19	11 35	22 41	11 59		12 34
23 08	12 28	23 34	12 44	00 05	13 07
23 58	13 19		13 22	00 58	13 39
	14 05	00 28	14 01	01 52	14 12
00 51	14 48	01 22	14 35	02 48	14 45
01 44	15 27	02 15	15 08	03 46	15 22
02 38	16 03	03 10	15 41	04 47	16 03
03 32	16 37	04 05	16 15	05 52	16 50
04 27	17 10	05 03	16 50	06 59	17 45
05 22	17 43	06 03	17 29	08 05	18 46
06 18	18 17	07 06	18 13	09 08	19 52
07 16	18 54	08 11	19 02	10 06	21 00
08 16	19 34	09 16	19 58	10 56	22 07
09 19	20 19	10 20	21 00	11 40	23 11
10 22	21 10	11 19	22 05	12 20	
11 26	22 06	12 12	23 11	12 56	00 13
12 26	23 08	12 58		13 31	01 13
13 22		13 40	00 15	14 06	02 11
14 13	00 12	14 18	01 18	14 41	03 09
14 58	01 17	14 54	02 19	15 20	04 06
15 39	02 22	15 29	03 18	16 01	05 04
16 17	03 25	16 04	04 17	16 45	06 00
16 53	04 26	16 41	05 15	17 34	06 55
17 29	05 27	17 21	06 13	18 25	07 47
18 06	06 27	18 04	07 11	19 18	08 35
18 45	07 26	18 50	08 08	20 11	09 18
19 26	08 25	19 50	09 02	21 04	09 58
20 11	09 23	20 32	09 53	21 57	10 34
		21 25	10 39		

1 9 8 3

TIMES OF MOONRISE AND MOON SET - JOHANNESBURG

	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
1	22^h50^m	11^h07^m	h m	11^h15^m	01^h09^m	11^h56^m	02^h04^m	12^h46^m	03^h09^m	14^h58^m	02^h58^m	15^h53^m
2	23 42	11 39	00 26	11 50	02 13	12 52	02 59	13 53	03 47	16 01	03 35	16 54
3		12 10	01 16	12 30	03 15	13 54	03 48	15 00	04 24	17 03	04 14	17 55
4	00 36	12 42	02 18	13 15	04 14	15 02	04 32	16 08	05 01	18 06	04 56	18 56
5	01 31	13 17	03 23	14 08	05 09	16 12	05 13	17 14	05 39	19 08	05 42	19 55
6	02 30	13 55	04 36	15 08	05 57	17 22	05 52	18 18	06 20	20 10	06 32	20 50
7	03 32	14 38	05 32	16 15	06 41	18 29	06 29	19 22	07 04	21 10	07 25	21 41
8	04 37	15 28	06 30	17 26	07 21	19 35	07 07	20 24	07 52	22 08	08 19	22 26
9	05 44	16 26	07 23	18 37	07 59	20 39	07 47	21 26	08 43	23 01	09 14	23 06
10	06 50	17 31	08 09	19 45	08 37	21 41	08 29	22 27	09 36	23 48	10 08	23 42
11	07 51	18 40	08 51	20 51	09 15	22 42	09 14	23 25	10 30		11 01	
12	08 46	19 50	09 29	21 54	09 54	23 41	10 03		11 24	00 31	11 53	00 15
13	09 35	20 58	10 05	22 55	10 37		10 54	00 19	12 18	01 09	12 45	00 46
14	10 17	22 03	10 42	23 54	11 22	00 39	11 47	01 09	13 11	01 44	13 37	01 16
15	10 56	23 06	11 19		12 11	01 34	12 41	01 54	14 03	02 16	14 31	01 47
16	11 32		11 59	00 53	13 02	02 26	13 34	02 34	14 56	02 47	15 28	02 20
17	12 07	00 05	12 41	01 50	13 55	03 13	14 28	03 11	15 50	03 18	16 27	02 55
18	12 43	01 04	13 27	02 46	14 48	03 56	15 20	03 45	16 46	03 50	17 30	03 35
19	13 20	02 01	14 16	03 39	15 42	04 35	16 13	04 17	17 44	04 24	18 35	04 22
20	14 00	02 59	15 08	04 29	16 35	05 11	17 06	04 48	18 45	05 02	19 40	05 15
21	14 43	03 55	16 01	05 15	17 28	05 44	18 01	05 19	19 48	05 44	20 02	06 16
22	15 30	04 50	16 54	05 57	18 20	06 16	18 57	05 52	20 52	06 33	21 37	07 22
23	16 20	05 43	17 48	06 35	19 14	06 47	19 56	06 27	21 54	07 29	22 27	08 30
24	17 12	06 32	18 40	07 10	20 08	07 18	20 57	07 06	22 52	08 30	23 10	09 37
25	18 05	07 16	19 33	07 42	21 04	07 51	21 59	07 50	23 43	09 35	23 49	10 43
26	18 59	07 57	20 25	08 13	22 02	08 27	23 01	08 40		10 41		11 46
27	19 52	08 34	21 18	08 44	23 03	09 07		09 56	00 29	11 46	00 25	12 47
28	20 44	09 08	22 12	09 16		09 52	00 00	10 37	01 10	12 49	01 00	13 46
29	21 36	09 40	23 08	09 50	00 04	10 44	00 55	11 42	01 47	13 51	01 36	14 46
30	22 29	10 11		10 27	01 06	11 42	01 44	12 48	02 23	14 52	02 13	15 46
31	23 22	10 42	00 08	11 08			02 29	13 53			02 53	16 46

TIMES OF MOONRISE
FOR PORT ELIZABETH

	JANUARY		FEBRUARY		MARCH	
	Rise	Set	Rise	Set	Rise	Set
1	22h10m	07h34m	22h38m	09h51m	21h06m	08h35m
2	22 55	08 46	23 10	10 56	21 38	09 41
3	23 34	09 56	23 42	11 59	22 11	10 44
4		11 04		12 59	22 45	11 46
5	00 08	12 08	00 14	13 58	23 22	12 46
6	00 40	13 09	00 48	14 56		13 45
7	01 10	14 09	01 26	15 53	00 03	14 41
8	01 41	15 07	02 07	16 47	00 47	15 33
9	02 14	16 05	02 52	17 37	01 36	16 21
10	02 48	17 02	03 42	18 24	02 27	17 04
11	03 27	17 58	04 35	19 06	03 22	17 43
12	04 09	18 51	05 30	19 44	04 18	18 19
13	04 56	19 41	06 26	20 18	05 15	18 51
14	05 47	20 26	07 23	20 49	06 13	19 21
15	06 40	21 06	08 20	21 19	07 11	19 51
16	07 36	21 43	09 17	21 48	08 09	20 20
17	08 32	22 16	10 15	22 17	09 09	20 51
18	09 29	22 47	11 15	22 49	10 10	21 24
19	10 25	23 16	12 16	23 23	11 14	22 01
20	11 22	23 45	13 20		12 19	22 44
21	12 21		14 26	00 02	13 24	23 34
22	13 22	00 15	15 32	00 48	14 28	
23	14 26	00 48	16 37	01 41	15 27	00 31
24	15 32	01 25	17 36	02 43	16 21	01 35
25	16 41	02 08	18 29	03 52	17 08	02 44
26	17 50	02 58	19 15	05 04	17 49	03 54
27	18 55	03 58	19 56	06 16	18 26	05 04
28	19 53	05 06	20 32	07 27	19 00	06 13
29	20 43	06 18			19 33	07 20
30	21 26	07 31			20 06	08 25
31	22 04	08 43			20 40	09 29

AND MOON SET - CAPE TOWN

SUBTRACT 28 MINUTES

APRIL		MAY		JUNE	
Rise	Set	Rise	Set	Rise	Set
21^h17^m	10^h31^m	21^h18^m	11^h15^m	22^h42^m	12^h15^m
21 56	11 32	22 08	12 08	23 39	12 50
22 40	12 31	23 01	12 56		13 22
23 27	13 25	23 57	13 39	00 35	13 52
	14 16		14 17	01 32	14 20
00 18	15 01	00 53	14 51	02 30	14 49
01 12	15 42	01 50	15 22	03 29	15 19
02 08	16 18	02 47	15 52	04 31	15 52
03 05	16 51	03 45	16 20	05 37	16 29
04 02	17 22	04 45	16 50	06 45	17 13
05 00	17 52	05 46	17 22	07 55	18 04
05 59	18 21	06 50	17 57	09 03	19 04
06 59	18 51	07 57	18 37	10 06	20 11
08 01	19 24	09 05	19 23	11 01	21 22
09 05	20 00	10 13	20 17	11 48	22 32
10 11	20 42	11 17	21 19	12 29	23 41
11 18	21 30	12 15	22 25	13 04	
12 23	22 25	13 06	23 34	13 36	00 47
13 24	23 27	13 49		14 07	01 51
14 18		14 27	00 42	14 38	02 54
15 06	00 34	15 01	01 49	15 10	03 55
15 48	01 42	15 33	02 54	15 45	04 56
16 25	02 50	16 04	03 58	16 23	05 57
16 59	03 58	16 36	05 00	17 06	06 56
17 31	05 03	17 09	06 03	17 53	07 52
18 03	06 08	17 45	07 04	18 44	08 44
18 36	07 12	18 26	08 05	19 38	09 31
19 11	08 15	19 10	09 04	20 34	10 13
19 49	09 17	19 59	09 59	21 30	10 50
20 32	10 18	20 52	10 50	22 26	11 23
		21 46	11 35		

1983

TIMES OF MOONRISE AND MOON SET - CAPE TOWN

FOR PORT ELIZABETH SUBTRACT 28 MINUTES

	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
1	23^h22^m	11^h53^m	00^h05^m	11^h48^m	02^h05^m	12^h17^m	03^h02^m	13^h05^m	03^h55^m	15^h31^m	03^h33^m	16^h38^m
2		12 21	01 04	12 19	03 10	13 11	03 54	14 15	04 28	16 38	04 05	17 43
3	00 18	12 49	02 06	12 55	04 13	14 13	04 40	15 27	05 01	17 46	04 40	18 48
4	01 16	13 18	03 12	13 37	05 11	15 23	05 20	16 38	05 33	18 52	05 19	19 51
5	02 15	13 48	04 19	14 28	06 02	16 36	05 57	17 49	06 07	19 59	06 02	20 52
6	03 17	14 22	05 26	15 27	06 47	17 50	06 31	18 58	06 45	21 04	06 50	21 48
7	04 23	15 02	06 29	16 35	07 27	19 02	07 04	20 06	07 26	22 07	07 43	22 38
8	05 31	15 49	07 26	17 48	08 03	20 12	07 38	21 13	08 11	23 06	08 39	23 21
9	06 41	16 45	08 15	19 03	08 36	21 21	08 13	22 18	09 01	23 58	09 36	23 59
10	07 47	17 50	08 57	20 16	09 09	22 27	08 52	23 22	09 55		10 33	
11	08 48	19 01	09 34	21 26	09 44	23 32	09 35		10 51	00 45	11 29	00 32
12	09 40	20 14	10 08	22 33	10 20		10 22	00 22	11 48	01 25	12 25	01 02
13	10 25	21 27	10 41	23 39	10 59	00 35	11 13	01 17	12 44	02 01	13 20	01 29
14	11 03	22 36	11 13		11 42	01 35	12 06	02 06	13 40	02 32	14 16	01 56
15	11 38	23 42	11 47	00 42	12 30	02 31	13 02	02 49	14 37	03 01	15 14	02 23
16	12 10		12 23	01 44	13 21	03 23	13 59	03 27	15 33	03 29	16 15	02 52
17	12 41	00 47	13 03	02 44	14 15	04 10	14 55	04 01	16 31	03 56	17 18	03 23
18	13 13	01 49	13 47	03 42	15 11	04 51	15 52	04 32	17 30	04 24	18 25	04 00
19	13 46	02 50	14 35	04 37	16 08	05 27	16 48	05 00	18 33	04 54	19 32	04 43
20	14 23	03 51	15 27	05 26	17 04	06 00	17 45	05 28	19 38	05 28	20 39	05 34
21	15 04	04 50	16 22	06 11	18 00	06 30	18 44	05 55	20 44	06 07	21 39	06 34
22	15 50	05 47	17 18	06 51	18 57	06 58	19 44	06 24	21 50	06 53	22 33	07 41
23	16 39	06 40	18 14	07 26	19 54	07 25	20 46	06 55	22 53	07 47	23 19	08 52
24	17 32	07 28	19 11	07 58	20 52	07 53	21 50	07 31	23 49	08 48	23 58	10 03
25	18 28	08 12	20 06	08 27	21 52	08 22	22 55	08 11		09 55		11 13
26	19 24	08 50	21 02	08 54	22 54	08 54	23 59	08 59	00 38	11 04	00 33	12 20
27	20 20	09 24	21 59	09 22	23 57	09 31		09 54	01 20	12 13	01 05	13 26
28	21 16	09 55	22 57	09 50		10 13	00 58	10 56	01 57	13 21	01 36	14 30
29	22 11	10 24	23 57	10 20	01 01	11 03	01 51	12 03	02 30	14 27	02 07	15 34
30	23 07	10 51		10 53	02 04	12 00	02 38	13 12	03 02	15 33	02 40	16 37
31		11 19	01 00	11 32			03 18	14 22			03 17	17 40

1983

TIMES OF MOONRISE AND MOON SET - DURBAN

FOR BLOEMFONTEIN ADD 19 MINUTES

	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
1	21h09m	06h51m	21h46m	09h01m	20h14m	07h43m	20h33m	09h32m	20h37m	10h12m	21h59m	11h14m
2	21 57	08 01	22 20	10 03	20 49	08 47	21 14	10 31	21 27	11 05	22 53	11 51
3	22 38	09 09	22 54	11 04	21 24	09 48	21 58	11 28	22 20	11 54	23 48	12 25
4	23 14	10 15	23 28	12 02	22 00	10 48	22 46	12 22	23 14	12 37		12 57
5	23 48	11 16		13 00	22 39	11 46	23 37	13 13		13 17	00 42	13 27
6		12 16	00 04	13 56	23 21	12 43		13 59	00 08	13 53	01 38	13 58
7	00 21	13 13	00 43	14 51		13 38	00 30	14 41	01 03	14 26	02 35	14 30
8	00 54	14 10	01 25	15 44	00 06	14 30	01 24	15 19	01 59	14 57	03 35	15 05
9	01 28	15 06	02 11	16 35	00 54	15 18	02 19	15 54	02 54	15 29	04 38	15 44
10	02 04	16 02	03 00	17 22	01 45	16 03	03 15	16 27	03 52	16 00	05 44	16 30
11	02 44	16 56	03 52	18 05	02 39	16 43	04 11	16 58	04 51	16 34	06 52	17 23
12	03 27	17 49	04 46	18 44	03 34	17 20	05 07	17 30	05 52	17 11	07 59	18 23
13	04 14	18 38	05 41	19 20	04 29	17 55	06 05	18 02	06 57	17 53	09 02	19 29
14	05 05	19 24	06 36	19 54	05 25	18 27	07 05	18 37	08 03	18 41	09 59	20 38
15	05 58	20 06	07 31	20 25	06 20	18 58	08 06	19 15	09 10	19 36	10 48	21 47
16	06 52	20 44	08 26	20 56	07 17	19 30	09 10	19 59	10 14	20 37	11 31	22 53
17	07 46	21 19	09 22	21 28	08 14	20 03	10 15	20 48	11 13	21 43	12 09	23 57
18	08 41	21 52	10 19	22 01	09 13	20 38	11 19	21 44	12 05	22 50	12 44	
19	09 36	22 23	11 19	22 37	10 15	21 17	12 20	22 45	12 50	23 56	13 17	00 59
20	10 31	22 54	12 20	23 18	11 18	22 01	13 16	23 51	13 30		13 50	01 59
21	11 27	23 26	13 24		12 21	22 52	14 06		14 07	01 01	14 24	02 58
22	12 26		14 29	00 05	13 24	23 50	14 50	00 57	14 41	02 03	15 01	03 57
23	13 27	00 01	15 34	00 59	14 24		15 29	02 03	15 14	03 04	15 41	04 56
24	14 32	00 40	16 34	02 01	15 19	00 53	16 05	03 08	15 48	04 05	16 24	05 54
25	15 39	01 24	17 28	03 09	16 08	02 00	16 40	04 12	16 24	05 05	17 12	06 49
26	16 47	02 16	18 17	04 19	16 52	03 09	17 14	05 14	17 02	06 05	18 03	07 41
27	17 52	03 16	18 59	05 29	17 31	04 16	17 49	06 15	17 43	07 04	18 56	08 29
28	18 51	04 23	19 38	06 38	18 08	05 23	18 26	07 16	18 29	08 02	19 51	09 12
29	19 44	05 34			18 43	06 27	19 06	08 17	19 18	08 56	20 45	09 50
30	20 29	06 46			19 18	07 30	19 50	09 16	20 10	09 47	21 39	10 25
31	21 09	07 55			19 54	08 31			21 04	10 33		

TIMES OF MOONRISE
FOR BLOEMFONTEIN

	JULY		AUGUST		SEPTEMBER	
	Rise	Set	Rise	Set	Rise	Set
1	22^h33^m	10^h57^m		10^h59^m	01^h02^m	11^h35^m
2	23 27	11 28	00 07	11 33	02 06	12 30
3		11 57	01 07	12 11	03 09	13 32
4	00 22	12 28	02 10	12 54	04 08	14 40
5	01 19	13 01	03 16	13 46	05 01	15 51
6	02 19	13 37	04 22	14 46	05 49	17 03
7	03 23	14 18	05 26	15 53	06 31	18 13
8	04 29	15 07	06 24	17 05	07 09	19 20
9	05 37	16 04	07 15	18 17	07 46	20 26
10	06 44	17 08	08 00	19 28	08 21	21 30
11	07 45	18 18	08 40	20 35	08 57	22 32
12	08 39	19 30	09 16	21 40	09 36	23 33
13	09 26	20 40	09 51	22 43	10 17	
14	10 07	21 47	10 26	23 44	11 01	00 32
15	10 44	22 51	11 01		11 49	01 28
16	11 19	23 52	11 39	00 44	12 40	02 20
17	11 52		12 21	01 43	13 33	03 07
18	12 26	00 53	13 06	02 40	14 28	03 50
19	13 02	01 52	13 54	03 33	15 23	04 28
20	13 40	02 50	14 46	04 23	16 17	05 02
21	14 22	03 48	15 40	05 09	17 12	05 34
22	15 08	04 44	16 34	05 50	18 06	06 04
23	15 58	05 37	17 29	06 27	19 00	06 34
24	16 51	06 26	18 23	07 01	19 56	07 04
25	17 45	07 10	19 17	07 32	20 54	07 35
26	18 39	07 50	20 11	08 02	21 54	08 09
27	19 34	08 26	21 05	08 31	22 55	08 47
28	20 27	08 59	22 01	09 01	23 58	09 3
29	21 21	09 29	22 59	09 33		10 2
30	22 15	09 59	23 59	10 08	01 00	11 1
31	23 10	10 28		10 48		

1983

AND MOON SET - DURBAN

ADD 19 MINUTES

OCTOBER		NOVEMBER		DECEMBER	
Rise	Set	Rise	Set	Rise	Set
01^h58^m	12^h23^m	02^h59^m	14^h41^m	02^h44^m	15^h41^m
02 52	13 31	03 35	15 46	03 18	16 44
03 40	14 41	04 10	16 51	03 55	17 47
04 23	15 50	04 45	17 55	04 36	18 49
05 02	16 58	05 21	18 59	05 21	19 49
05 39	18 04	06 01	20 03	06 10	20 45
06 15	19 10	06 43	21 04	07 02	21 35
06 51	20 14	07 30	22 02	07 57	22 20
07 29	21 18	08 21	22 55	08 53	22 59
08 09	22 20	09 14	23 43	09 48	23 34
08 53	23 19	10 09		10 43	
09 41		11 04	00 24	11 36	00 06
10 32	00 13	11 59	01 02	12 30	00 35
11 25	01 03	12 53	01 35	13 24	01 04
12 20	01 48	13 47	02 06	14 19	01 33
13 14	02 27	14 42	02 36	15 17	02 04
14 09	03 03	15 37	03 05	16 18	02 38
15 04	03 35	16 34	03 35	17 23	03 16
15 58	04 06	17 34	04 07	18 29	04 01
16 53	04 35	18 37	04 43	19 34	04 53
17 49	05 05	19 42	05 24	20 36	05 53
18 47	05 36	20 46	06 12	21 31	06 59
19 47	06 09	21 49	07 06	22 19	08 09
20 49	06 47	22 46	08 07	23 01	09 18
21 52	07 29	23 36	09 13	23 38	10 25
22 55	08 18		10 20		11 30
23 54	09 13	00 21	11 27	00 13	12 33
	10 15	01 00	12 32	00 46	13 34
00 48	11 20	01 36	13 36	01 20	14 36
01 37	12 28	02 10	14 39	01 55	15 37
02 20	13 35			02 33	16 39

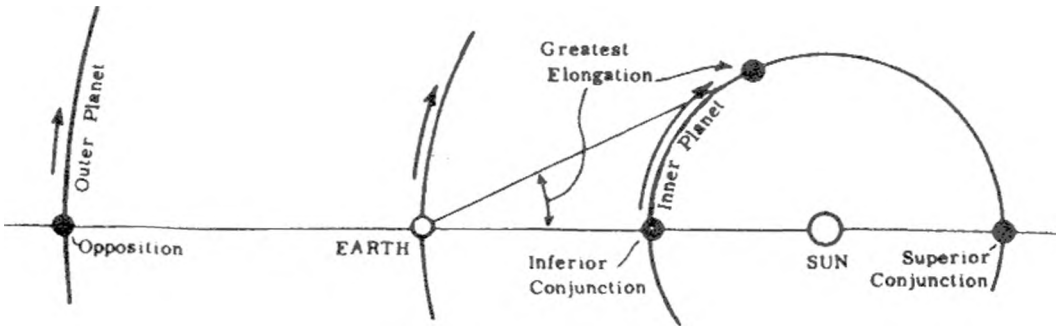
THE PLANETS 1983

BASIC DATA

	Dist from Sun 10^6 km	Period of Revolution years	Mass (Earth = 1)	Diameter 10^3 km	Rotation Period	Inclination of Equator to Orbit
Mercury	58	0,24	0,056	4,98	59d	?
Venus	108	0,62	0,817	12,4	244	?
Earth	150	1,00	1,000	12,8	$23^h 56^m$	$23^o 27'$
Mars	228	1.88	0,108	6,76	24 37	23 59
Jupiter	778	11,9	318,0	142,7	09 51	03 04
Saturn	1426	29,5	95,2	120,8	10 14	26 44
Uranus	2868	84,0	14,6	47,1	10 49	97 53
Neptune	4494	164,8	17,3	44,6	14 ?	28 48
Pluto	5896	247,6	0,9?	?	6d?	?

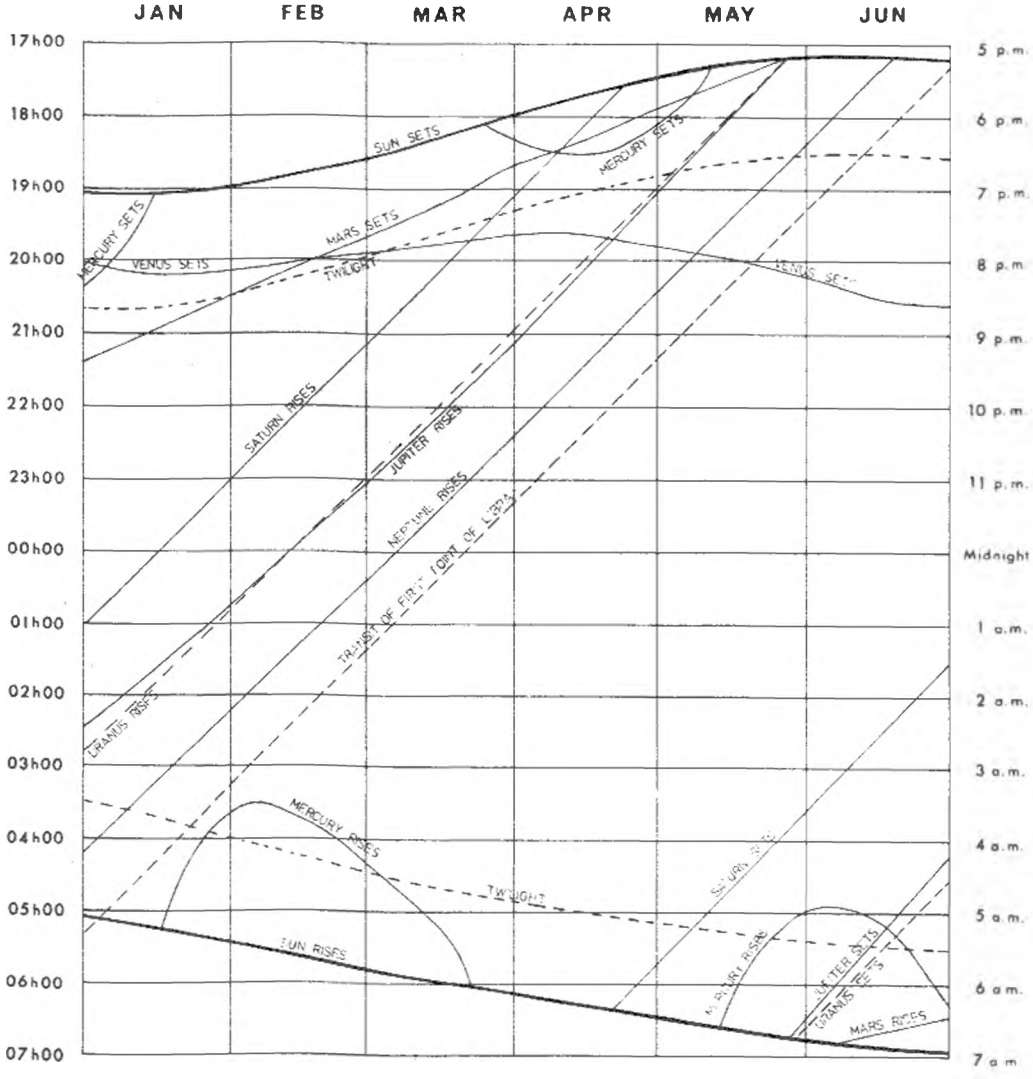
GENERAL

Apart from Uranus, Neptune and Pluto, the planets of our solar system are amongst the brightest objects in the night sky. Unlike the distant stars, their relative positions do not remain fixed, but continually change as, like the Earth, they orbit around the Sun. Their apparent movements against the starry background are complicated as they result from a combination of their own motion and the Earth's motion. Their brightnesses also vary considerably, as both their distances from the Earth and the visible portions of their sunlit hemispheres change. Since the period of a planet increases with increasing distance from the Sun, so we find that the inner planets - Mercury and Venus - appear to "overtake" the Earth in their orbits, while the Earth in turn "overtakes" the outer planets - Mars, Jupiter and Saturn. The terms given in astronomy to the various Sun-Earth-Planet configurations are illustrated in the accompanying diagram. Dates of such configurations occuring in 1982 are listed chronologically in the Diary (pages 4 and 5) and are also mentioned in the text below.

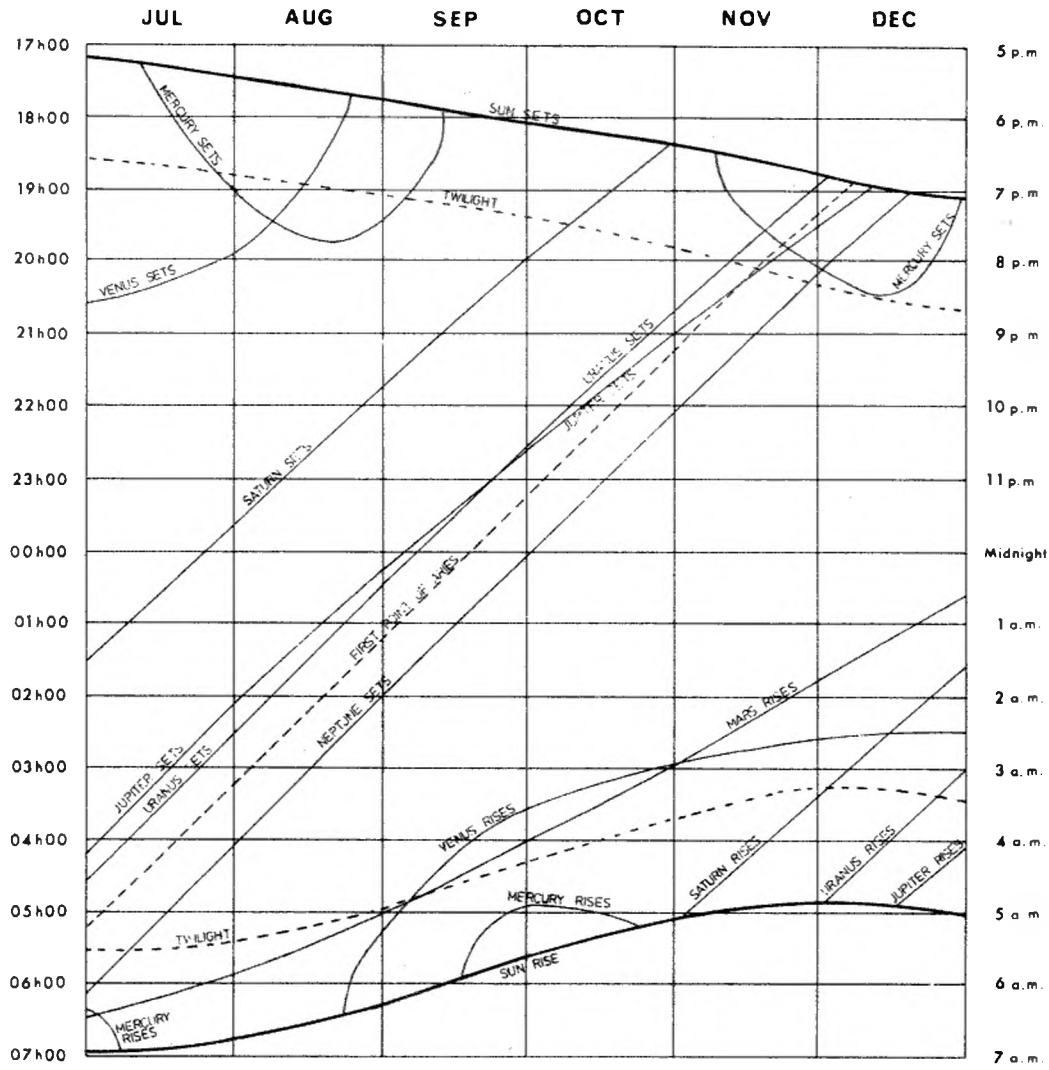


TIMES OF RISING AND SETTING

The times of rising and setting given by the diagram are accurate for position 30° East. 30° South, and approximately correct for other places in Southern Africa. Strictly speaking, corrections for latitude and longitude should be applied, but the latitude correction is, in general sufficiently small to be ignored and in no case will exceed 15 minutes.
Longitude corrections are given on page 44.



The Planets 1983



THE PLANETS 1983

OBSERVING THE PLANETS

To the naked eye, planets appear as virtually pinpoint sources of light. However, their disks can be readily resolved with the aid of a small telescope. Even so, their angular diameters are of the order of 10 seconds of arc - roughly 1/200 of the Moon's angular diameter - so it is not always possible to distinguish details on their disks. The disks of Mercury and Venus are only seen fully illuminated when they are furthest from us - as they draw closer, their disks grow larger but the phase changes to a crescent as we see more of their dark hemispheres. In contrast, the disks of the outer planets are always seen fully or near fully illuminated.

MERCURY

The innermost planet, Mercury, appears to move very rapidly among the stars either in the early evening or just before dawn. Its greatest angular distance from the Sun is 28° but at some elongations it is as little as 18°. Best times for viewing the planet are a few days on either side of the following dates. In the evening, April 21, Aug 19, Dec 13 and mornings Feb 8, June 8 and Oct 1.

Greatest Elongation East		Apr 21^d10^h (20°)	Aug 19^d18^h (27°) Dec 13^d23^h(21°)
Stationary	Jan 6^d20^h	May 2 06	Sep 1 21	Dec 21 22
Inferior Conjunction	Jan 16 05	May 12 19	Sep 15 18	Dec 31 10
Stationary	Jan 27 12	May 24 01	Sep 24 03	
Greatest Elongation West	Feb 8 22(26°)	Jun 8 08(24°)	Oct 1 12 (18°)	
Superior Conjunction	Mar 26 11	Jul 9 18	Oct 30 19	

VENUS

Venus will be in the evening sky from January until mid-August but will move rapidly into the twilight reaching inferior conjunction on August 25. From then on till the end of the year it will be in the morning sky reaching greatest elongation west of the Sun on Nov 4.

Its magnitude varies from -4.1 at the beginning of the year to -3.2 on August 24 and then brightens to -4.3 on Oct 3, fades to -3.6 at the end of the year.

Venus can be seen during the daytime with the unaided eye and if the Moon is near the planet, noting the relative positions in the pre-dawn sky will greatly help to locate the planet later in the day.

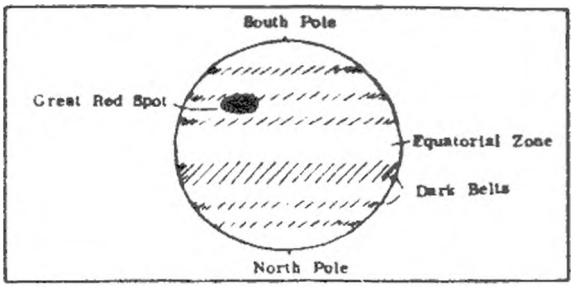
MARS

Mars is visible in the evening sky until early April. It passes from through Aquarius, Pisces and into Aries while its magnitude fades from +1.3 to +1.6.

Mars re-appears in the morning sky at the end of July at mag +2.0 but this brightens up to +1.4 at the end of the year having moved from Cancer through Leo into Virgo.

JUPITER

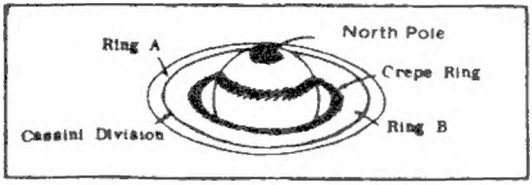
Jupiter (mag -1.3) is visible in the morning sky at the beginning of the year. It is at opposition on May 27, by which time it can be seen all through the hours of darkness. It has brightened to -2.1 at this time. It will move forward steadily until it disappears into the evening twilight in late November. On Dec 14, it will be in conjuction with the Sun and it will not be seen again this year.



SATURN

Saturn (mag 1.0) rises well after midnight at the beginning of the year in Virgo and remains in this constellation until late October when it moves into Libra.

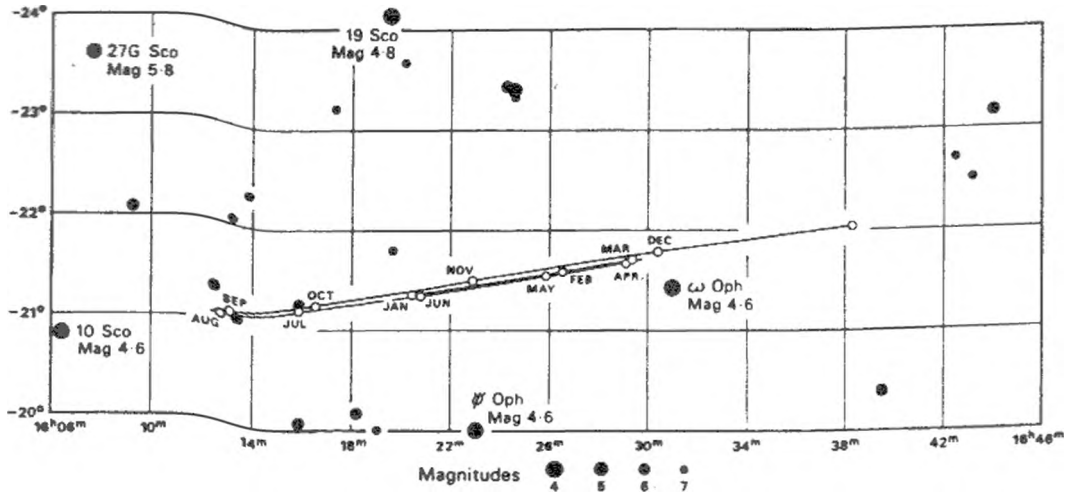
Saturn is at opposition on April 21 when it can be seen throughout the night, and from late July until the mid-October it is visible only in the evening sky. It then becomes too close to the Sun for observation until mid-November, after which it can be seen in the morning sky for the rest of the year. Saturn (mag 1.0) is in conjunction with Venus on Dec 17.



URANUS

Uranus (mag 5.8) rises well before sunrise at the beginning of the year in Ophiuchus and is at opposition on May 29. From early June until late October it is in Scorpius, and for the rest of the year it is in Ophiuchus. Uranus is in conjunction with the Sun on December 2.

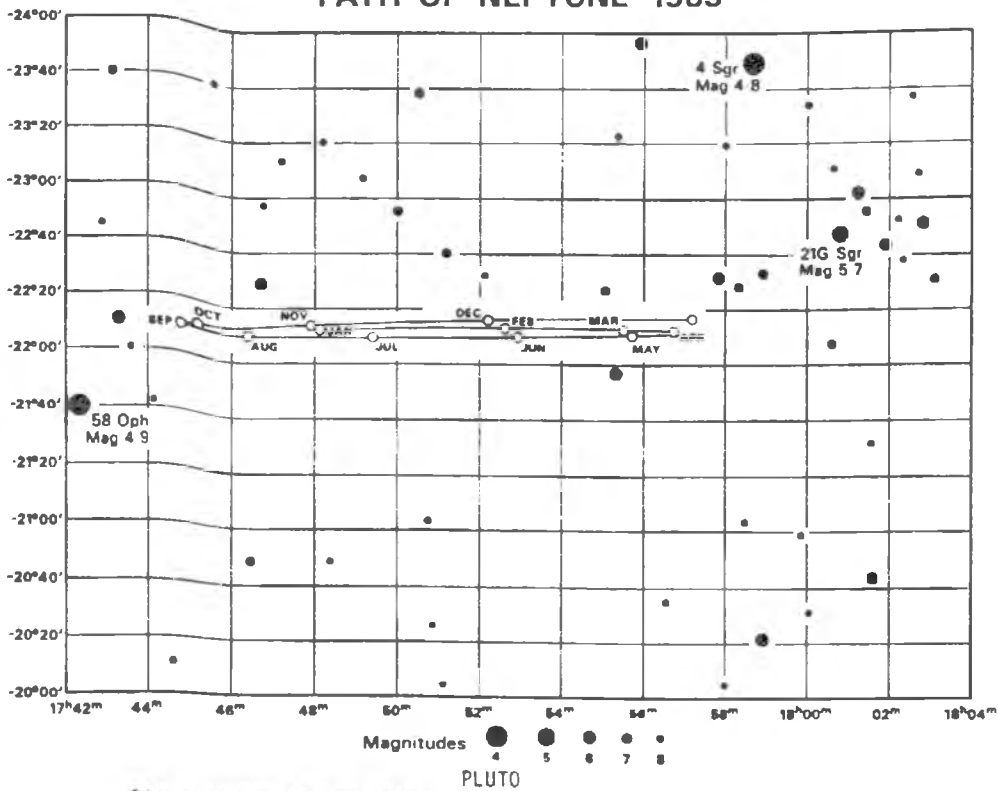
PATH OF URANUS 1983



NEPTUNE

Neptune at magnitude 7.7 can be detected using binoculars in the constellation of Sagittarius. Its diameter is 2.11 and its apparent size will help in identifying the planet. It is at opposition on June 19.

PATH OF NEPTUNE 1983



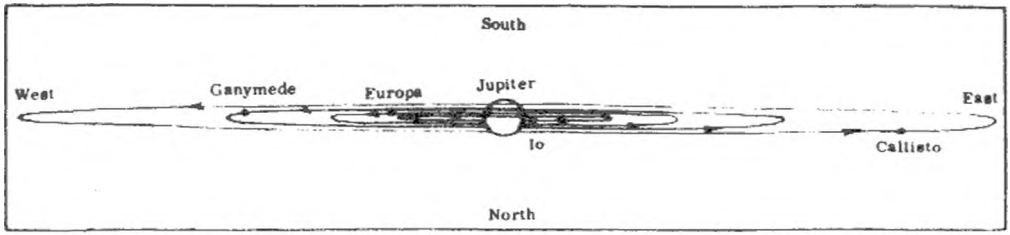
PLUTO

Pluto at mag 14 can only be detected with a large telescope. It varies from R A 14h11m dec. + 4°43' on Jan 1 to R A 14h 3m dec. +5°59' on June 1 to R A 14h 02m dec. +5°51' on July 1 and R A 14h20m dec. +3°45' on Dec 31. Its distances from Earth varies from 29.9 to 30.8 A U.

THE MOONS OF JUPITER AND SATURN 1983

MOONS OF JUPITER

One of the most popular sights for an observer with a small telescope is Jupiter and its Moons. Four of the fifteen - Io, Europa, Ganymede and Callisto - are generally clearly visible - they would just be visible to the naked eye were it not for the glare from the mother planet. As the diagram below indicates, the system



is seen almost edge-on so the moons always lie close to a straight line extending from the planet's equator. As they orbit, so they appear to oscillate from one side to the other, alternately passing in front and behind the planet. This motion is represented in the diagrams on pages 26 and 27 which cover the period when Jupiter is clearly visible in the evening sky. The horizontal lines show their relative configurations at 2 am each day.

When the moons pass in front and behind the planet, transits, occultations and eclipses occur. Details of such phenomena occuring between the end of astronomical twilight and just after midnight (and when the planet is above the horizon in Southern Africa) are given in the table below.

Explanation of Table.

Date and predicted times are given - these are for mid-phenomena and are not instantaneous.

The moons concerned are I - Io; II - Europa; III - Ganymede; IV - Callisto

Phenomena - the abbreviations used are:

Ec. - Eclipse: the satellite passes through the shadow of Jupiter
Oc. - Occultation: the satellite is obscured by the disk of Jupiter
D. - Disappearance
R. - Reappearance
Tr. - Transit: the satellite crosses the disk of Jupiter
Sh. - Shadow Transit: the shadow of the satellite transits the disk
I - Ingress
E - Egress

	d	h	m					d	h	m					d	h	m			
March	2	23	12	II	Sh.	I		20	1	51	I	Sh.	E	April	14	20	26	III	Tr.	E
	3	01	32	II	Sh.	E		20	2	03	I	Tr.	E		19	21	58	I	Ec.	D
	3	01	41	II	Tr.	I		20	22	13	II	Tr.	E		19	22	24	II	Ec.	D
	4	0	26	I	Sh.	I		20	23	18	I	Oc.	R		20	21	23	I	Sh.	E
	4	1	41	I	Tr.	I		27	21	51	I	Ec.	D		20	22	11	I	Tr.	E
	4	2	36	I	Sh.	E		27	22	23	II	Tr.	I		21	20	48	III	Sh.	E
	4	3	50	I	Tr.	E		27	22	27	II	Sh.	E		21	20	54	II	Tr.	E
	5	1	08	I	Oc.	R		27	23	24	III	Oc	R		21	21	54	III	Tr.	I
	9	23	52	III	Tr.	I		28	22	26	I	Tr	I		21	23	55	III	Tr.	E
	10	1	45	II	Sh.		April	3	22	40	II	Sh.	I		26	23	51	I	Ec.	D
	11	23	36	I	Ec.	D		3	22	50,	III	Ec.	R		27	21	07	I	Sh.	I
	12	1	00	II	Oc.	R		3	23	43	I	Ec	D		27	21	48	I	Tr.	I
	16	22	44	III	Sh.	I		4	22	00	I	Tr.	I		27	23	17	I	Sh.	E
	17	0	57	III	Sh.	E		4	23	07	I	Sh.	E		27	23	57	I	Tr.	E
	18	22	43	II	Ec.	D		5	21	23	I	Oc.	R		28	20	56	II	Tr.	I
	19	1	05	II	Ec.	R		5	21	40	II	Oc.	R		28	21	09	I	Oc.	R
	19	1	12	II	Oc.	D		11	22	51	I	Sh	I		28	21	56	II	Sh.	E
	19	1	29	I	Ec.	D		11	23	48	I	Tr	I		28	22	31	III	Sh.	I
	19	22	42	I	Sh.	I		12	23	11	I	Oc.	R		28	23	12	II	Tr.	E
	19	23	53	I	Tr.	I		13	20	25	I	Tr.	E							

The Moons of Jupiter and Saturn 1983

	d	h	m			
May	4	23	00	I	Sh.	I
	4	23	33	I	Tr.	I
	5	20	13	I	Ec.	D
	5	22	08	II	Sh.	I
	5	22	53	I	Oc.	R
	5	23	11	II	Tr.	I
	6	19	39	I	Sh.	E
	6	20	09	I	Tr.	E
	7	20	14	II	Oc.	R
	9	20	18	III	Oc.	R
	12	22	06	I	Ec.	D
	13	19	44	I	Tr.	I
	13	21	34	I	Sh.	E
	13	21	53	I	Tr.	E
	14	22	31	II	Oc.	R
	16	20	20	III	Ec.	D
	16	23	36	III	Oc.	R
	20	21	17	I	Sh.	I
	20	21	28	I	Tr.	I
	20	23	28	I	Sh.	E
	20	23	38	I	Tr.	E
	21	20	47	I	Oc.	R
	21	22	08	II	Ec.	D
	27	23	11	I	Sh.	I
	27	23	12	I	Tr.	I
	28	20	21	I	Oc.	D
	28	22	32	I	Ec.	R
	29	19	48	I	Tr.	E
	29	19	51	I	Sh.	E
	30	21	17	II	Tr.	E
	30	21	27	II	Sh.	E
June	3	18	22	III	Sh.	I
	3	19	55	III	Tr.	E
	3	20	41	III	Sh.	E
	4	22	05	I	Oc.	D
	5	19	22	I	Tr.	I
	5	19	35	I	Sh.	I
	5	21	32	I	Tr.	E
	5	21	45	I	Sh.	E
	6	18	55	I	Ec.	R
	6	21	13	II	Tr.	I
	6	21	40	II	Sh.	I
	6	23	31	II	Tr.	E
	8	19	02	II	Ec.	R
	10	21	06	III	Tr.	I
	10	22	21	III	Sh.	I
	10	23	13	III	Tr.	E
	11	23	49	I	Oc.	D
	12	21	07	I	Tr.	I
	12	21	29	I	Sh.	I
	12	23	17	I	Tr.	E
	12	23	40	I	Sh.	E
	13	18	15	I	Oc.	D
	13	20	49	I	Ec.	R
	13	23	28	II	Tr.	I
	14	18	09	I	Sh.	E
	15	18	22	II	Oc.	D
	15	21	38	II	Ec.	R
	19	22	52	I	Tr.	I
	19	23	24	I	Sh.	I
	20	20	00	I	Oc.	D
	20	22	43	I	Ec.	R
	21	18	33	III	Ec.	R
	21	19	28	I	Tr.	E
	21	20	03	I	Sh.	E
	22	20	40	II	Oc.	D
	24	18	28	II	Sh.	E
	27	21	46	I	Oc.	D
	28	19	04	I	Tr.	I
	28	19	34	III	Oc.	R
	28	19	47	I	Sh.	I
	28	20	10	III	Ec.	D
	28	21	14	I	Tr.	E
	28	21	58	I	Sh.	E
	28	22	33	III	Ec.	R
	29	19	07	I	Ec.	R
	29	22	59	II	Oc.	D

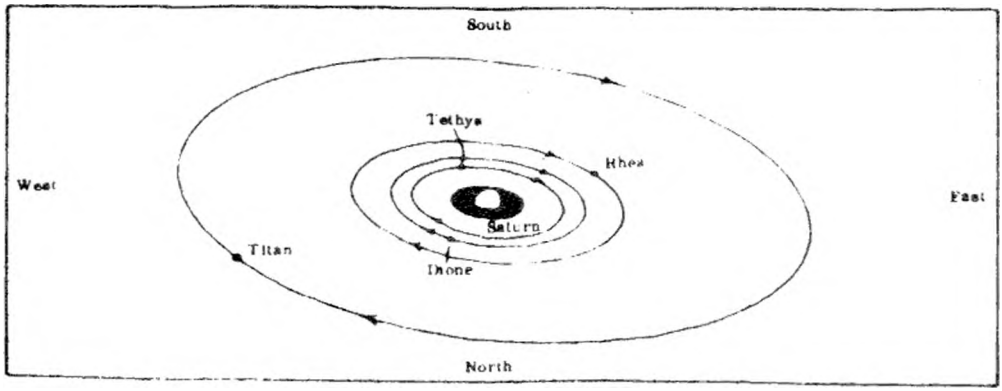
	d	h	m			
July	1	18	41	II	Sh.	I
	1	19	30	II	Tr.	E
	1	21	03	II	Sh.	E
	4	23	32	I	Oc.	D
	5	20	46	III	Oc.	D
	5	20	52	I	Tr.	I
	5	21	42	I	Sh.	I
	5	23	01	I	Tr.	E
	5	23	02	III	Oc.	R
	5	23	53	I	Sh.	E
	6	21	01	I	Ec.	R
	7	18	21	I	Sh.	E
	8	19	30	II	Tr.	I
	8	21	16	II	Sh.	I
	8	21	50	II	Tr.	E
	8	23	38	II	Sh.	E
	10	18	47	II	Ec.	R
		22	40	I	Tr.	I
	12	23	37	I	Sh.	I
	13	19	47	I	Oc.	D
	13	22	56	I	Ec.	R
	14	18	06	I	Sh.	I
	14	19	17	I	Tr.	E
	14	20	16	I	Sh.	E
	15	21	52	II	Tr.	I
	15	23	52	II	Sh.	I
	16	18	15	III	Sh.	I
	16	20	38	III	Sh.	E
	17	21	23	II	Ec.	R
	20	21	36	I	Oc.	D
	21	18	56	I	Tr.	I
	21	20	01	I	Sh.	I
	21	21	06	I	Tr.	E
	21	22	11	I	Sh.	E
	22	19	20	I	Ec.	R
	23	20	07	III	Tr.	E
	23	22	14	III	Sh.	I
	24	19	20	II	Oc.	D
	24	23	59	II	Ec.	R
	27	23	26	I	Oc.	D
	28	20	47	I	Tr.	I
	28	21	56	I	Sh.	I
	28	22	57	I	Tr.	E
	29	21	15	I	Ec.	R
	30	18	35	I	Sh.	E
	30	21	28	III	Tr.	I
	30	23	50	III	Tr.	E
	31	21	48	II	Oc.	D
Aug	2	18	20	II	Tr.	E
	2	18	21	II	Sh.	I
	2	20	44	II	Sh.	E
	3	18	31	III	Ec.	R
	4	22	39	I	Tr.	I
	4	23	51	I	Sh.	I
	5	19	45	I	Oc.	D
	5	23	10	I	Ec.	R
	6	18	20	I	Sh.	I
	6	19	16	I	Tr.	E
	6	20	30	I	Sh.	E
	9	18	27	II	Tr.	I
	9	20	50	II	Tr.	E
	9	20	57	II	Sh.	I
	9	23	20	II	Sh.	E
	10	20	04	III	Ec.	D
	10	22	31	III	Ec.	R
	11	18	30	II	Ec.	R
	12	21	38	I	Oc.	D
	13	19	00	I	Tr.	I
	13	20	15	I	Sh.	I
	13	21	09	I	Tr.	E
	13	22	25	I	Sh.	E
	14	19	34	I	Ec.	R
	16	21	00	II	Tr.	I
	16	23	23	II	Tr.	E
	16	23	34	II	Sh.	I
	17	18	52	III	Oc.	D
	17	21	20	III	Oc.	R

	d	h	m			
Aug	18	18	32	II	Oc.	R
	18	18	42	II	Ec.	D
	18	21	06	II	Ec.	R
	19	23	31	I	Oc.	D
	20	20	54	I	Tr.	I
	20	22	10	I	Sh.	I
	20	23	03	I	Tr.	E
	21	21	29	I	Ec.	R
	22	18	48	I	Sh.	E
	23	23	35	II	Tr.	I
	24	22	49	III	Oc.	D
	25	18	42	II	Oc.	D
	25	21	07	II	Oc.	R
	25	21	18	II	Ec.	D
	25	23	42	II	Ec.	R
	27	22	48	I	Tr.	I
	28	19	55	I	Oc.	D
	28	20	37	III	Sh.	E
	28	23	24	I	Ec.	R
	29	18	33	I	Sh.	I
	29	19	27	I	Tr.	E
	29	20	43	I	Sh.	E
Sep	1	21	19	I	Oc.	D
	1	23	45	II	Oc.	R
	1	23	53	II	Ec.	D
	3	20	29	II	Sh.	E
	4	19	30	III	Tr.	E
	4	21	51	I	Oc.	D
	4	22	10	III	Sh.	I
	5	19	13	I	Tr.	I
	5	20	28	I	Sh.	I
	5	21	23	I	Tr.	E
	5	22	38	I	Sh.	E
	6	19	48	I	Ec.	R
	8	23	58	II	Oc.	D
	10	20	36	II	Tr.	E
	10	20	42	II	Sh.	I
	10	23	06	II	Sh.	E
	11	2	41	I	Tr.	I
	11	23	37	III	Tr.	E
	11	23	48	I	Oc.	D
	12	21	10	I	Tr.	I
	12	22	23	I	Sh.	I
	12	23	20	I	Tr.	E
	13	21	44	I	Ec.	R
	14	19	02	I	Sh.	E
	17	20	53	II	Tr.	I
	17	23	18	II	Tr.	E
	17	23	20	II	Sh.	I
	19	20	47	II	Ec.	R
	19	23	08	I	Tr.	I
	20	2	28	I	Sh.	E
	20	20	15	I	Oc.	D
	20	23	39	I	Ec.	R
	21	18	47	I	Sh.	I
	21	19	47	I	Tr.	E
	21	20	57	I	Sh.	E
	22	19	59	III	Ec.	D
	22	22	31	III	Ec.	R
	23	5	19	II	Oc.	D
	24	23	36	II	Tr.	I
	24	23	57	II	Sh.	I
	26	18	41	II	Oc.	D
	26	23	22	II	Ec.	R
	27	22	14	I	Oc.	D
	28	19	35	I	Tr.	I
	28	20	42	I	Sh.	I
	28	21	46	I	Tr.	E
	28	22	52	I	Sh.	E
	29	19	27	III	Oc.	D
	29	20	03	I	Ec.	R
	29	22	03	III	Oc.	R

THE MOONS OF JUPITER AND SATURN 1983

SATURN'S MOONS

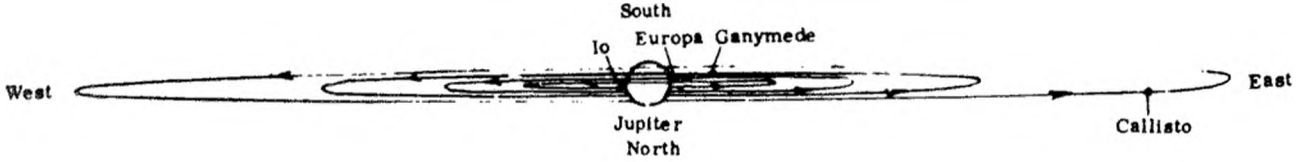
Saturn's moons are considerably fainter than the four Galilean moons of Jupiter. The diagram shows the orbits of four of Saturn's ten moons. The easiest to find is Titan (magnitude 8,5), according to the diagram and the information in the table below.

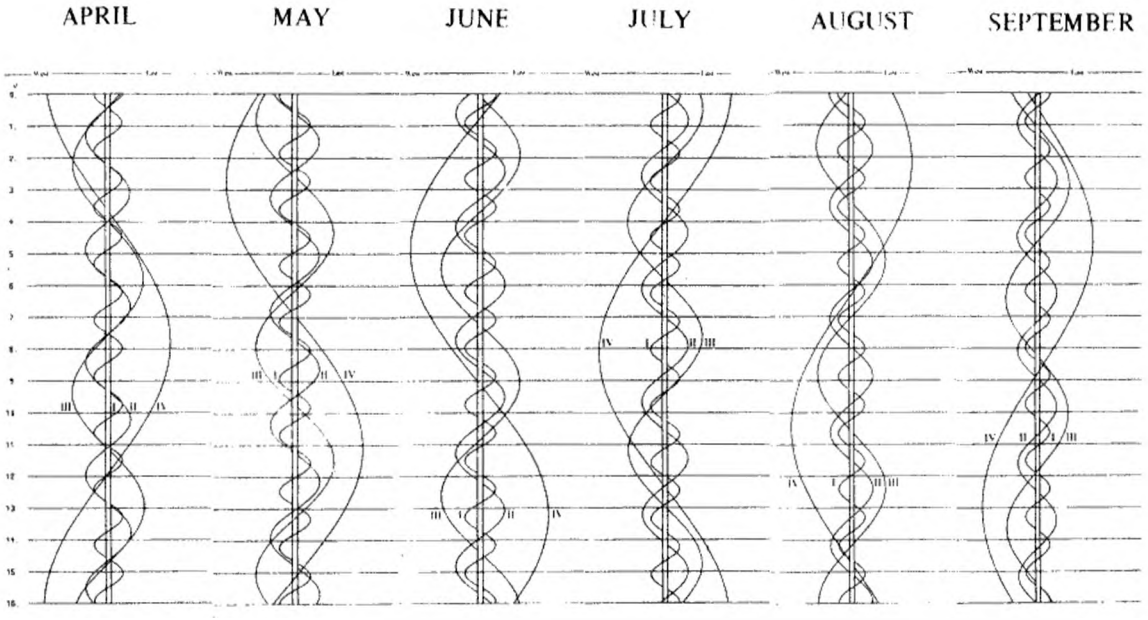


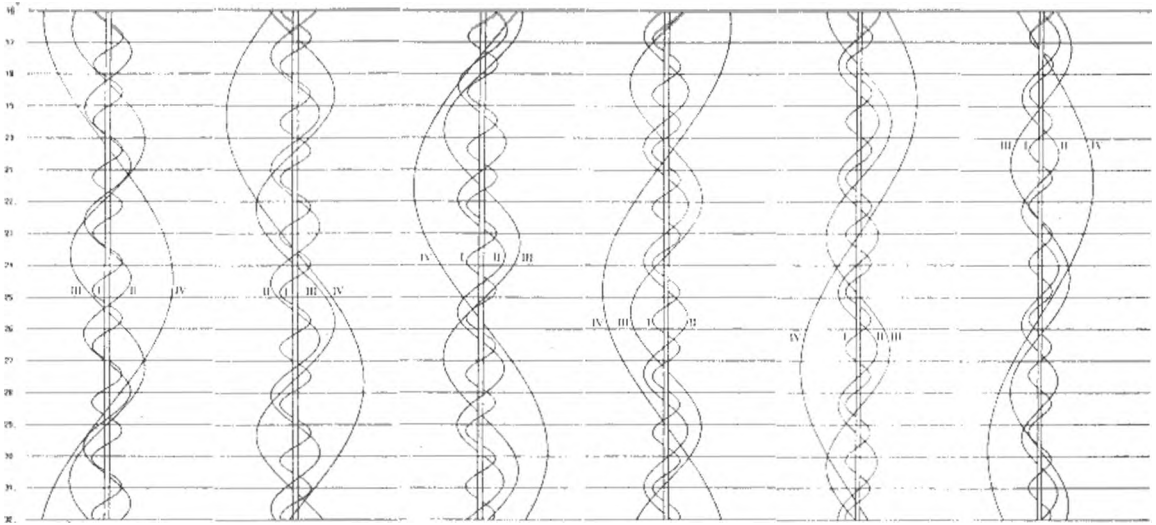
TITAN

Eastern Elongation			Inferior Conjunction			Western Elongation			Superior Conjunction		
	d	h		d	h		d	h		d	h
Jan	15	04.6	Jan	3	00.4	Jan	7	02.0	Jan	11	06.6
Jan	31	03.9	Jan	18	23.9	Jan	23	01.5	Jan	27	06.0
Feb	16	02.7	Feb	3	23.2	Feb	8	00.6	Feb	12	04.9
Mar	4	01.1	Feb	19	21.8	Feb	23	23.2	Feb	28	03.4
	19	23.0	Mar	7	20.1	Mar	11	21.3	Mar	16	01.4
Apr	4	20.7	Mar	23	18.0	Mar	27	19.0	Mar	31	23.1
	20	18.4	Apr	8	15.6	Apr	12	16.5	Apr	16	20.6
May	6	15.8	Apr	24	13.1	Apr	28	13.9	May	2	18.0
	22	13.4	May	10	10.6	May	14	11.4	May	18	15.5
June	7	11.4	May	26	08.3	May	30	09.1	June	3	13.3
	23	09.7	June	11	06.3	June	15	07.1	June	19	11.5
July	9	08.4	June	27	04.6	July	1	05.5	July	5	10.0
	25	07.5	July	13	03.4	July	17	04.4	July	21	09.1
Aug	10	07.0	July	29	02.6	Aug	2	03.8	Aug	6	08.5
	26	06.8	Aug	14	02.2	Aug	18	03.5	Aug	22	08.3
Sep	11	06.9	Aug	30	02.1	Sep	3	03.6	Sep	7	08.5
	27	07.2	Sep	15	02.3	Sep	19	04.0	Sep	23	08.9
Oct	13	07.8	Oct	1	02.8	Oct	5	04.7	Oct	9	09.5
	29	08.4	Oct	17	03.4	Oct	21	05.4	Oct	25	10.2
Nov	14	09.0	Nov	2	04.0	Nov	6	06.3	Nov	10	11.0
	30	09.5	Nov	18	04.7	Nov	22	07.1	Nov	26	11.7
Dec	16	09.9	Dec	4	05.3	Dec	8	07.8	Dec	12	12.3
			Dec	20	05.8	Dec	24	08.3	Dec	28	12.7

CHANGING CONFIGURATIONS OF JUPITER'S MOONS







The four bright moons of Jupiter always appear close to a straight line passing through the planet since, as shown in the drawing at the top, their orbits are seen nearby edge on. The main part of the diagram then shows how their positions along such a straight line change during the five months when Jupiter is prominent in the evening sky. For each month, time increases downward: the disk of Jupiter is stretched to make the central column and horizontal lines, representing 2 a.m. (0 hrs. Universal time), are shown for every day of the month. The wavy lines show how the Moons appear to oscillate from each side of the planet to the other.

COMETS AND METEORS

COMETS

Comets are essential bodies moving around the sun, mostly in very elongated orbits. The typical comet consists of a nucleus surrounded by a hazy aura of gas and dust called the coma, and in many cases there is a tail stretching away from the sun. Faint comets, several of which are discovered each year, usually appear only as fuzzy patches without nucleas or tail, though there may be a central condensation.

While they are believed to be true members of the solar system, comets differ radically from the planets in that their orbits, besides being highly eccentric, are inclined at all angles to the plane of the ecliptic, and their motion may be direct (like that of the planets) or retrograde. Compared with that of a planet, a comet's mass is almost negligible; nearly all this mass is concentrated in the nucleus which is believed to be not one solid piece but composed of many separate particles of various sizes.

Comets are the most mysterious and capricious of solar system objects and the nature of the physical changes which they exhibit is still not fully understood.

Observers with quite modest equipment, say a refracting telescope of not less than 7.5 cm, or in the case of bright comets, a good pair of binoculars, can do useful work by following known comets and reporting on their appearance. The ability to make accurate brightness estimates is especially useful and well worth cultivating. Sweeping the sky for new comets, though requiring considerable patience and perseverance, is also within the scope of the equipment mentioned.

Many of the fainter comets are undoubtedly escaping detection, particularly in the Southern skies which are not being as intensively searched as the Northern. There is a need for more amateurs to undertake this work.

Interested persons are asked to contact the Director of the Comet and Meteor Section at 90 Malan Street, Riviera, Pretoria, 0084.

METEORS

Meteors or "shooting stars" result from small bodies entering the Earth's upper atmosphere, and are generally seen in greater abundance after midnight (due to the direction of the Earth's motion) than in the early evening.

There are two categories of meteors - the sporadic ones and the showers. A meteor shower comes from a certain direction in space (the Radiant) and is thought to be associated with the remains of a comet. When the Earth passes close to the comet's original orbit, such a shower can be expected. A list of these predicted showers is given in the table opposite.

The term "shower" is perhaps misleading (as the table indicates); the most prolific of these showers normally yields an average of less than one meteor per minute. On rare occasions however, as in the case of Leonids, there is a phenomenal rise in the number of meteors observed.

There is always the possibility of new showers occuring, and any large-scale meteor activity observed on dates other than those mentioned should be reported without delay.

Reports by a reliable observer of the number of meteors seen coming from a particular radiant in a given period are always useful, but the best work is done by organised teams making a full sky coverage. In the latter case, care must be taken to avoid the overlapping of individual reports, i.e. where more than one observer reports the same meteor(s), giving a false total for the group.

"Fireballs" are meteors of a luminosity equalling or exceeding that of the brightest planets. Accurate reports of their path among the stars, or their altitude and azimutn, at specific times, are of great value, particularly if made by observers at different places along the trajectory. Details of brightness (compared with Venus, Moon etc) size and form, colours and any train or wake, are also important.

	Shower	Radiant R.A.	Radiant Dec.
Mar 14 - Mar 18	Corona Australids	16^h20^m	-48°
Apr 19 - Apr 24	April Lyrids	18 08	+32
May 1 - May 12	Eta Aquarids	22 24	00
Apr 20 - Jul 30	Sco-Sgr System	18 00	-30
Jun 10 - Jun 21	June Lyrids	18 32	+35
Jun 17 - Jun 26	Ophiuchids	17 20	-20
* Jun 26 - Jun 29	Cetids (new)	02 00	-15
Jul 10 - Aug 5	Capricornids	21 00	-15
Jul 15 - Aug 15	Delta Aquarids	22 36	(-17 (00
Jul 15 - Aug 20	Pisces Australids	22 40	-30
Jul 15 - Aug 25	Alpha Capricornids	20 36	-10
Jul 15 - Aug 24	Iota Aquarids	(22 04 (22 32	-6 -15
Oct 16 - Oct 27	Orionids	06 24	+15
Oct 10 - Dec 5	Taurids	(03 44 (03 44	+14 +21
Nov 14 - Nov 20	Leonids	10 08	+22
Dec 3 - Dec 5	Phoenicids	01 00	-55
Dec 7 - Dec 15	Geminids	07 28	+32
Dec 5 - Jan 7	Velaids	09 56	-51

* Uncertain

SHOWERS 1983

Date	Maximum Hourly Rate	Transit of Radiant (approx)	Recommended Time of watch	Conditions at Maximum
Mar 16	5	04^h45^m	02h - dawn	Favourable
Apr 22	15	04 15	03h30 - dawn	Favourable
May 5	18	07 30	-	Unfavourable
Jun 14	?	00 30	23h - 03h	Favourable
Jun 16	8	01 00	00h - 04h	Favourable
Jun 20	8	23 30	03h - 05h	Favourable
Jun 28	?	07 40	-	Unfavourable
Jul 25	8	00 50	-	Unfavourable
Jul 29	35	02 10	-	Unfavourable
Jul 31	11	02 10	20h30 - 24h	Favourable
Aug 2	10	00 00	00h - 02h	Favourable
Aug 6	12	(01 10 (01 40	23h - 03h	Favourable
Oct 21	35	04 30	-	Unfavourable
Nov 4	16	(00 50 (00 50	23h - 03h	Favourable
Nov 17	10	06 30	-	Unfavourable
Dec 4	?	20 10	18h - 23h	Favourable
Dec 14	55	02 00	02h - dawn	Favourable
Dec 29	?	03 00	23h - 03h	Favourable

THE STARS

CONSTELLATIONS

Apart from our Sun all the stars that we see are so incredibly distant that, despite their high speed velocities, their apparent positions change by only minute amounts each year. Consequently the patterns that they form appear unchanged. The Greeks and other ancient civilisations identified these patters, or constellations, with various mythological characters and creatures, and most of the names they gave are still used today.

In all there are 88 constellations, roughly one half of which would be above the horizon at any one time. Some contain distinctive patterns of bright stars and are relatively easy to find; others are difficult to locate, even with suitable maps. The Southern Cross and Centaurus, Orion and Taurus, Scorpius and Sagittarius, are featured later in this section. Detailed information on other constellations is beyond the scope of this handbook and interested observers are advised to obtain a suitable star atlas.

STAR NAMES

Within each constellation, the brightest star is generally labelled a(Alpha),the next B(Beta) and so on through the Greek alphabet. Most of the brightest stars also have their own names - usually of arabic origin. For example, α Canis Majoris, otherwise known as Sirius, is the brightest star in the constellation Canis Major.

STELLAR MAGNITUDES

The apparent brightness of a star - which depends both on its true luminosity and its distance - is indicated by its magnitude. Equal intervals of magnitude represent equal ratios in light intensity. A star of magnitude 1,0 (typical of the brightest stars in the night sky) would be exactly one hundred times more luminous than a star of magnitude 6,0 (about the limit of visibility to the naked eye). The maps in this section show stars down to magnitude 4,5.

STELLAR DISTANCES

Distances are often expressed in units of light years - the distance light would travel in a year (equal to $9,5 \times 10^{12}$km).

DOUBLE STARS

It now appears that single stars such as our Sun are the exception, the majority of stars being double or multiple - two or more suns in orbit around one another.

STAR CLUSTERS

These are of two completely different sorts. Galactic clusters, having of the order of 100 stars, are found close to the plane of the Milky Way. The ones we can see are relatively nearby. Globular clusters are much larger and far more distant. They contain of the order of 100 000 stars each and are seen above and below the Milky Way on that side of the sky towards the centre of our galaxy. So great is their distance that small telescopes fail to resolve individual stars - instead they appear as fuzzy balls.

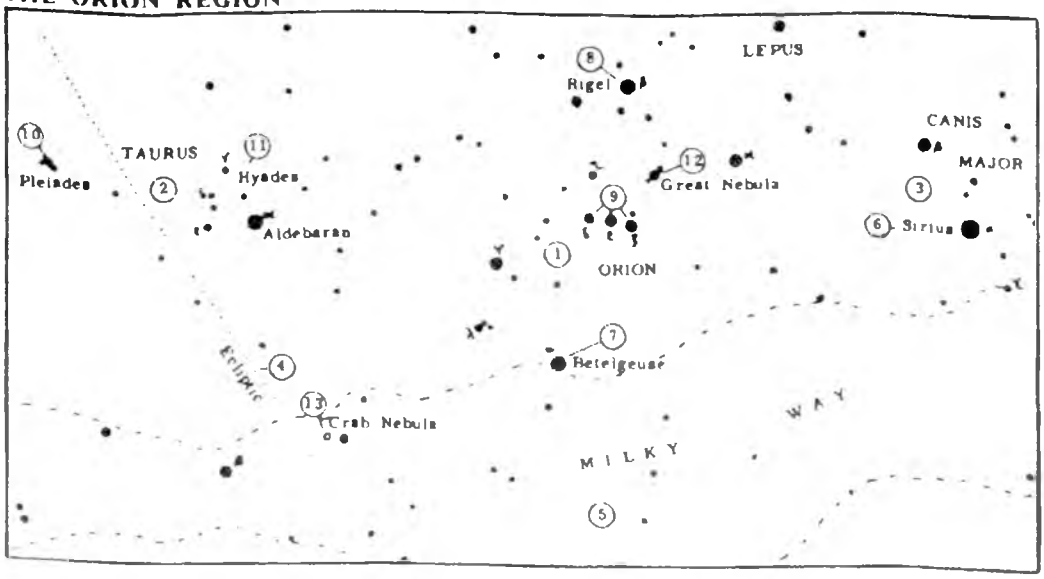
NEBULAE

Possibly one third of the matter in our region of the Galaxy is in the form of gas and dust (the remainder being contained in stars, plus a tiny amount in planets). Condensations of this material are called nebulae, some of which are illuminated by nearby stars while others are dark. They are usually referred to by their numbers in Messier's catalogue (M) or the New General Catalogue (NGC).

THREE POPULAR REGIONS

The dominating constellation of the summer skies is Orion, that of the winter skies is Scorpius, while the Southern Cross is conspicuous for most of the year. The regions around these constellations are also rich in interesting objects - visible either to the naked eye, or with the aid of binoculars or a small telescope - and are featured in the maps and text below. It may be necessary to rotate the maps to match the orientation of the constellations in the sky.

THE ORION REGION



1) The constellation of Orion. The figure of the legendary hunter of Greek mythology is unfortunately upside down when seen from Southern [illegible]. The faint stars by λ represent the head, α and γ the shoulders, δ ε ζ the belt, and β and κ the legs. Orion forms part of the "great hunting scene" in which he faces the onslaught of 2) Taurus, the bull. Only the forepart of the bull is depicted and, like Orion, it is upside down. α and ε are the eyes. γ the nose. Orion is accompanied by 3) Canis major, the large dog, and the small dog (off map) while Lepus, the hare, crouches at his feet.

4) A section of the Ecliptic - a line encircling the entire sky and representing the plane of the Earth's orbit. As the Earth revolves around the Sun, the Sun appears to move along the ecliptic through the constellations of the Zodiac, of which Taurus is one.

5) A portion of the Milky Way (looking out towards the edge of our Galaxy).

6) Sirius - the brightest star in the night sky. It is somewhat brighter than our Sun and relatively close by - at a distance of 9 light years. It is a double star but the companion is a white dwarf (only slightly larger than the Earth, and with a mass comparable to our Sun) and is only visible through a large telescope.

7) Betelgeuse - most famous of the red giant stars. Its diameter is of the order of the size of the Earth's orbit and its luminosity is nearly 10 000 times that of our Sun. Its red colour should be obvious to the eye. It is 520 light years distant.

8) Rigel, despite being physically smaller than Betelgeuse, is more luminous (higher surface temperature - bluish colour) and more distant.

9) The stars in Orion's belt are distant hot blue stars.

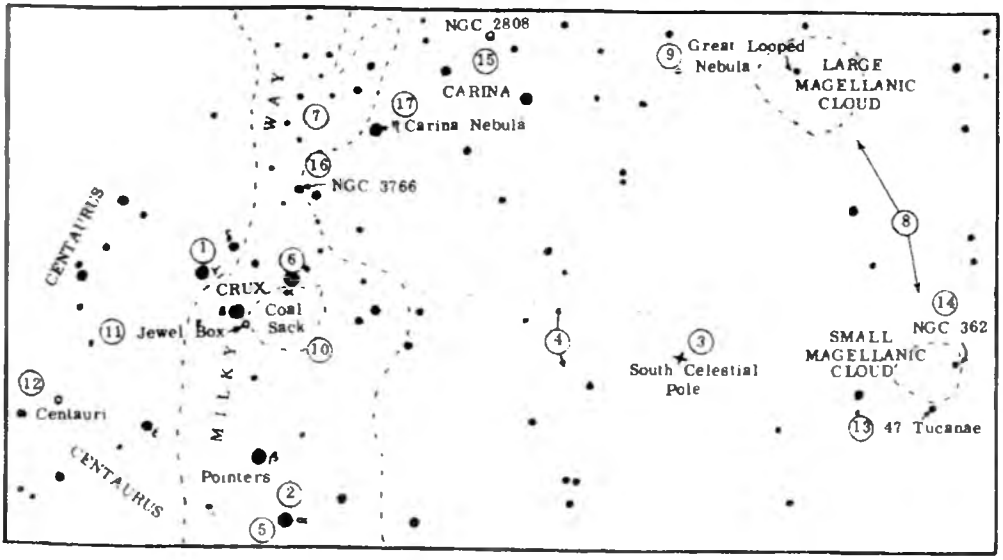
10) The Pleiades or Seven Sisters form the best known nearby star cluster. Six or seven stars are visible to the naked eye, binoculars or a small telescope show mo[illegible]

11) The Hyades is another nearby galactic cluster, but Aldebaran is not a member (it lies closer to us).

12) The Great Nebula in Orion, just visible to the naked eye, shows up as a fan shaped mass of luminous gas through binoculars or a telescope. A telescope will also show a tiny "Trapezium" of four stars in the centre.

13) The Crab Nebula, the remnant of a supernova recorded by the Chinese in 1054, requires a moderate sized telescope for observation. In its heart is located the extraordinary pulsar which emits a double flash of light 30 times every second. The current belief is that it is a rapidly rotating neutron star - a star with the mass of our sun but with a diameter of only 10 km.

THE SOUTHERN CROSS REGION



1) Crux, the Southern Cross, is one of the most compact patterns of bright stars to be found in the sky. It lies on the border of that region of the sky which never sets as seen from Southern Africa.

2) The two "Pointer" stars lie close to the Cross. (A similar pattern to the Southern Cross - called the False Cross - lies just outside and above the map, but has no accompanying pointer stars).

3) The South Celestial Pole: This is one of two opposite points in space towards which the Earth's axis of rotation is directed. As the Earth rotates so the sky appears to pivot about this point. It always lies above the south point on the horizon, elevated by an angle equal to the observer's southern latitude. (The north celestial pole lies below the northern horizon and can never be seen from the Earth's southern hemisphere).

4) The intersection of a line extended through the major axis of the Cross and the perpendicular bisector to the Pointers indicates the approximate position of the South Celestial Pole.

5) α Centauri has the distinction of being the closest star to our solar system - at a distance of approximately 40 X 10^{12} km or 4,3 light years. A small telescope readily shows that it is a double star - the two components take 80 years to resolve about one another. A much fainter third star also belongs to the system.

6) α Crucis can also be resolved as a double star by a small telescope (separation 5 sec of arc).

7) The region indicated is one of the brightest sections of the entire Milky Way.

8) The Large and Small Magellanic Clouds are the nearest of the external galaxies (see also next section). They can be seen with the naked eye provided the sky is reasonably dark.

9) The Great Looped Nebula - possibly the remnant of a supernova explosion - in the Large Magellanic Cloud. (Naked eye or binoculars).

10) The "Coal Sack" - a dark mass of gas and dust obscuring a part of the Milky Way. (Naked eye or binoculars).

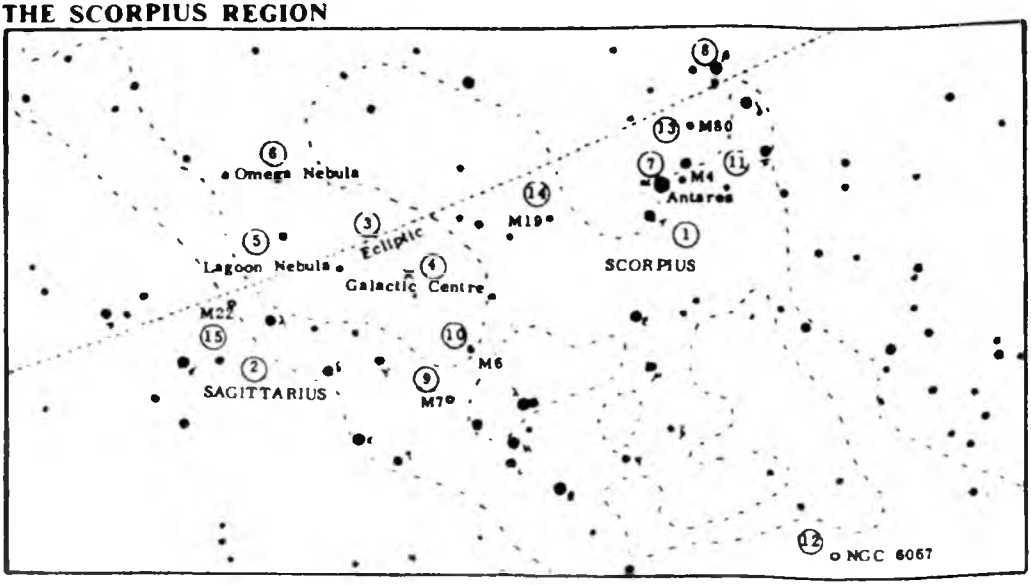
11) Herschel's "Jewel Box" - a galactic cluster containing stars of different colours. (Small telescope or binoculars).

12) ω Centauri and 13) 47 Tucanae are perhaps the best known globular clusters. Binoculars will show their fuzzy appearance. 14) NGC 362 and 15) NGC 2808 are fainter globular clusters.

16) NGC 3760 - a fine galactic cluster. (Binoculars or small telescope).

17) The η Carinae nebula - a site of a slow supernova that brightened to magnitude -0,8 in 1843 and is now of magnitude 6,4.

THE SCORPIUS REGION



1) The constellation of Scorpius. The creature is depicted with α in the centre of the body and β and π the claws. The distinctive tail $\varepsilon - \zeta - \theta$ curls round to the sting λ.

2) Sagittarius - the figure of the centaur archer is very difficult to make out.

3) A section of the Ecliptic. Like Taurus, Scorpius and Sagittarius are constellations of the Zodiac.

4) The direction of the centre of our Galaxy - the Milky Way is that part of our Galaxy visible to us. Unfortunately the central nucleus is obscured by foreground gaseous and dusty matter - both dark and luminous - hence the irregular shape of the Milky Way in this region. Luminous nebulae include 5) the Lagoon nebula and 6) the Omega nebula. These are best seen with the aid of binoculars.

7). Antares - a distant red giant, several hundred times the diameter of our Sun - is so named because its red colour rivals that of the planet Mars.

8) β Scorpii can be resolved as a double star (separation 16 sec of arc) with a small telescope. In fact the brighter component is in itself a triple star, and the fainter component a double star.

This region includes a number of galactic clusters including 9) M7, 10) M8, 11) M4 and 12) NGC 6067, (use binoculars or a small telescope).

Further from the plane of the Milky Way are some globular clusters: 13) M80, 14) M19 and 15) M22.

NOVA SEARCHING

On rare occasions a star may undergo a nova outburst, its light increasing tremendously. The result is that a "new" star appears where previously no star was visible to the naked eye, or even with a small telescope. The light of the nova may fluctuate for a time, then gradually fades over a period of days, weeks or months.

Even observers having no telescopes can perform a useful task in keeping a watch for such novae in an allocated area of the sky. A good knowledge of the constellations is a recommendation, since part of the procedure is to scan the whole sky for bright novae before the more detailed search in the allocated area is begun. However, anyone can be given training in star recognition.

Interested persons should contact the Director of the Nova Search Section, Mr J C Bennett, 90 Malan Street, Riviera, Pretoria, 0084.

VARIABLE STAR OBSERVING

The "General Catalogue of Variable Stars" by Kukarkin and Parenago lists some 20 000 stars. Professional observatories cannot possibly monitor all of these, and this makes the observation of variable stars a field in which amateurs can make a real contribution to astronomical knowledge.

Of the 20 000 stars, at least 2000 are suitable for visual monitoring in the southern hemisphere. However, the number of active observers in this part of the world remains woefully small, and scarcely 200 variables are at present being observed from South Africa.

The Variable Star Section of the A.S.S.A. exists for the purpose of encouraging observers and of acting as a medium of communication. The Section disseminates incoming information amongst observers, and will forward (on request) the observations of individuals to various variable star bodies. These include the American Association of the Variable Star Observers (AAVSO) and the Variable Star Section of the Royal Astronomical Society of New Zealand. These bodies combine the South African light estimates with those from other parts of the world. The resulting "light curves" and tables are made available to a large number of professional observatories where astronomers are interested in investigating certain of the stars more fully.

Visual estimates of magnitude are made by comparing the variable with two or more comparison stars, respectively brighter and fainter than the unknown variable. Suitable comparison stars are shown on special charts, which have been prepared for each variable, mainly by the two variable star organisations mentioned above. The use of these charts is essential for accurate, standardized observations, and intending new observers are therefore advised to obtain the necessary data by contacting the Director of the Variable Star Section, Mr J Hers, P O Box 48, Sedgefield 6573, Telephone (04455) 736. They will then be sent charts of a few easy objects, and data on stars which may be observed with the equipment at their disposal.

Prospective observers should, when writing, give brief details of their equipment. Larger, more powerful telescopes will naturally greatly increase the number of stars which may be measured, but many variables are bright enough to be observed through most of their cycles with quite modest equipment,e.g. binoculars. Some stars, such as 07104 L2 Puppis, are so bright that they may be observed without optical aid whatever.

Variable stars are designated in two ways. The first of these, the Harvard designation, consists of six figures which give the position for 1900; the first four figures give hours and minutes of R.A., the last two give the declination in degrees, underlined for southern declinations. The second name consists of one or two letters (or letter V plus a number) and the name of the constellation.

Variables can be divided into three main classes: pulsating, eruptive, and eclipsing binary stars.

Most suitable for beginners are the long period variables (or Mira variables, named after the typical representative Mira = o Ceti) which belongs to the class of pulsating stars. They are giant stars which vary through a range of brightness of 2,5 to 5 magnitudes or more, and which have well-defined periodicities, ranging from 80 to 1000 days. In most cases one observation per observer every 10 days will suffice.

Typical examples include:

		Approx. magnitude range
021403	o Ceti Mira	2.0-10.1
092962	R Carinae	3.9-10.0
100661	S Carinae	4.5-9.9

Among the eruptive variables, two groups are of special importance:

U Geminorum type. These are dwarf novae which have long periods of apparent quiescence at minimum, with sudden rises to maximum. A typical representative in the southern hemisphere is 040971 VW Hydri.

R Coronae Borealis type. These are high luminosity variables with slow, non-periodic drops in brightness. A typical representative is 191033 RY Sagittarii.

Eclipsing Binary Stars have orbital planes which lie close to the line of sight of the observer. The two components periodically eclipse each other, thus causing variations in the apparent brightness of the system. Periods are generally short, of the order of hours, so that observational programmes need very careful planning. Monitoring these interesting stars is therefore for experienced observers only.

ORDINARY OCCULTATIONS

This Section and that following concern a specialised branch of observational astronomy in which both professional and amateur participate. The tables of predictions must necessarily occupy a number of pages as this handbook is the sole published source for Southern Africa. They will undoubtedly appear complicated to the layman.

An occultation occurs when the disk of the Moon moves in front of a star. Timings of occultations, to a precision of one-tenth of a second if possible are very valuable for studies of the Moon's shape and motion. Since only very modest equipment is required, amateurs can make important contributions in this field. Persons interested in making and reporting occultation observations are urged to contact the Director of the Society's Occultation Section, Mr A G F Morrisby, (c/o Dept of Surveyor General, P O Box 1580, Bulawayo, Zimbabwe).

Predictions of occultations of all stars brighter than magnitude 7,5 supplied by Hydrographic Dept, Tokyo are given below. The main set of tables give predictions for three stations, namely,

	Longitude	Latitude
Cape Town	- 18°,475	- 33°,933
Johannesburg	- 28°,075	- 26°,182
Harare	- 31°,040	- 17°,788

This does not restrict its use to observers to those centres. The approximate time of an occultation at a place λ degrees west and ϕ degrees north of one of the standard stations given above may be found fr

$$\text{Approximate time} = \text{predicted time} + a.\Delta\lambda + b.\Delta\phi$$

where a and b, in minutes of time, are given in the tables. Alternatively, rough times for intermediate stations can usually be estimated direct from the tables.

Occulted stars have been identified by their Z.C. numbers, that is their numbers in the "Catalogue of 3539 Zodiacal Stars for the Equinox 1950.0" by James Robertson (U S Naval Observatory, 1939).

Note: That the times of these occultations are given in U.T.

Explanations of Abbreviations used in Tables

Z.C. - the number of the star in the Zodiacal Catalogue. An "m" following the number indicates the star is not single.

Mag. - the visual magnitude
Ph - the Phase: D = Disappearance, R = Reappearance
h.m. - the time of the occultation in U T
a,b - parameters in minutes for predicting times other than at standard stations (explained above in text)
P.A. - The Position Angle on the Moon's limb measured eastward from the north point

Lunar Occultations 1983

DATE	ZC	MAG.	PH.	ELG.	CAPE TOWN E 18.5 , S 33.9				JOHANNESBURG E 28.1 , S 26.2				HARARE E 31.0 , S 17.8			
M D				°	TIME H M	A °	B °	P °	TIME H M	A °	B °	P °	TIME H M	A °	B °	P °
JAN. 3	1514	6.1	R.D.	230	** **				0 13.2	-2.0	-1.1	304	** **			
JAN. 4	1751	5.7	R.D.	255	23 44.4	...	...	357	** **				** **			
JAN. 18	3446	7.2	D.D.	50	19 30.1	-0.0	2.2	36	** **				** **			
JAN. 21	249	6.7	D.D.	85	** **				19 16.0	...	...	344	** **			
JAN. 22	376	7.0	D.D.	98	20 20.3	-1.3	2.0	48	** **				** **			
JAN. 24	639	6.0	D.D.	122	** **				17 38.7	-2.8	-0.1	95	** **			
JAN. 24	654	6.0	D.D.	123	** **				20 41.4	-2.0	-2.3	116	** **			
JAN. 24	668	3.6	D.D.	124	** **				22 42.6	-0.5	-2.4	124	** **			
JAN. 25	817	6.8	D.D.	137	** **				21 16.4	-1.9	-2.4	122	** **			
JAN. 26	983	6.0	D.D.	149	** **				17 1.6	-1.2	1.3	74	** **			
JAN. 26	1015	6.4	R.D.	152	23 24.3	-2.5	2.9	96	** **				** **			
JAN. 31	1701	5.1	R.D.	222	21 51.3	-0.8	-2.5	335	** **				** **			
FEB. 1	1813	6.0	R.D.	235	** **				** **				22 28.5	...	...	230
FEB. 3	1950	5.8	R.D.	250	** **				3 55.6	-2.7	-0.7	278	** **			
FEB. 7	2425	5.9	R.D.	296	2 56.8	-1.1	-1.3	276	** **				2 29.1	0.4	-4.1	347
FEB. 21	755	6.3	D.D.	105	** **				21 1.4	-1.0	-1.1	97	** **			
FEB. 22	916	6.3	D.D.	117	** **				19 59.5	-2.2	-0.1	80	** **			
FEB. 22	923	6.9	D.D.	118	** **				** **				21 51.7	0.1	-1.9	147
FEB. 22	929	5.8	D.D.	119	** **				22 49.3	-0.5	-1.1	98	** **			
FEB. 22	931	6.7	D.D.	119	** **				23 12.8	-0.0	-1.7	120	** **			
FEB. 23	942	6.3	D.D.	119	** **				0 0.9	0.5	-2.0	133	** **			
FEB. 23	1080	6.9	D.D.	130	** **				** **				19 36.3	-2.3	-1.5	130
FEB. 23	1092	5.8	D.D.	132	22 20.0	...	...	172	** **				22 18.7	-1.3	0.4	96
FEB. 24	1239	6.4	D.D.	144	19 41.3	-2.1	-1.0	116	** **				20 8.7	-3.1	1.0	70
MAR. 10	2021	6.1	R.D.	308	** **				** **				1 13.8	-0.4	-0.1	255
MAR. 10	2028	6.5	R.D.	309	2 25.6	-1.1	0.8	222	** **				2 27.0	-0.6	-1.6	295
MAR. 17	298	7.2	D.D.	35	** **				16 45.6	-0.9	0.6	52	** **			
MAR. 21	A65	6.1	D.D.	86	** **				18 30.0	-2.4	2.2	39	** **			
MAR. 22	1050	5.8	D.D.	101	** **				21 45.8	-0.3	-1.3	109	** **			
MAR. 23	1178	6.2	D.D.	112	** **				18 22.6	-2.3	-1.2	111	** **			
MAR. 23	1195	6.7	D.D.	114	22 14.0	-0.7	0.3	115	** **				** **			
APR. 1	2193	6.1	R.D.	221	** **				** **				1 41.7	-4.0	2.3	247
APR. 1	2316	6.4	R.D.	232	22 44.6	-0.8	-1.9	299	** **				** **			
APR. 2	2322	6.3	R.D.	233	** **				0 13.3	-1.4	-1.3	320	** **			
APR. 3	2457	6.3	R.D.	244	1 9.8	-1.7	-1.6	291	** **				** **			
APR. 4	2589	6.8	R.D.	256	** **				** **				1 36.7	...	...	225
APR. 15	505	7.0	D.D.	29	NBM				** **				16 35.5	-0.8	1.1	74
APR. 17	828	6.5	D.D.	57	** **				19 28.9	0.8	-3.2	147	** **			
APR. 22	1544	5.7	D.D.	122	** **				18 51.1	-2.7	-0.3	94	** **			
APR. 23	1651	6.1	D.D.	134	16 47.9	...	...	45	** **				** **			
APR. 23	1659	6.8	D.D.	135	** **				19 1.4	-1.0	-2.9	161	** **			
APR. 24	1773	5.1	D.D.	149	** **				** **				20 46.5	0.8	-4.9	189
APR. 29	2394	6.5	R.D.	212	22 7.1	-1.1	-1.8	296	** **				** **			
MAY 2	2492	5.7	R.D.	236	2 4.6	-2.4	-1.2	287	** **				** **			
MAY 2	2496	6.4	R.D.	237	2 10.0	-2.7	1.4	245	...				1 5.1	-1.4	-2.0	104
MAY 3	2836	5.0	R.D.	267	** **				0 32.2	-0.9	-2.7	333	** **			
MAY 3	2836	5.6	R.D.	267	0 48.8	-2.1	0.3	264	** **				0 36.0	-2.1	-3.6	316
MAY 5	3089	5.3	R.D.	269	** **				1 15.4	-1.9	1.8	242	** **			
MAY 5	3092	6.2	R.D.	269	** **				** **				1 57.3	-2.5	1.2	238
MAY 16	1099	6.0	R.D.	5	17 22.1	-1.0	0.3	114	** **				18 1.0	...	...	34
MAY 16	1097	6.7	D.D.	5	17 37.3	...	...	164	** **				17 39.4	-1.0	0.6	88
MAY 19	1499	7.3	D.D.	92	** **				** **				17 18.7	0.4	-4.3	181
MAY 19	1514	6.1	D.D.	94	** **				21 10.8	...	...	48	** **			
MAY 20	1621	7.5	D.D.	105	17 48.6	...	...	190	** **				17 29.4	-2.4	-1.0	115
MAY 21	1739	6.5	D.D.	116	** **				** **				18 21.4	-2.0	-1.6	130
MAY 22	1854	6.9	D.D.	127	18 46.5	-1.8	-1.4	120	** **				** **			
MAY 22	1856	6.8	D.D.	13	** **				19 49.1	-4.0	0.8	73	** **			
MAY 23	1965	6.5	D.D.	141	18 7.3	-0.3	-3.0	168	** **				17 49.3	-2.4	-1.1	105
MAY 28	2430	5.1	R.D.	201	23 51.9	-1.6	-4.8	334	** **				** **			
MAY 29	2767	6.4	R.D.	231	** **				20 59.8	-1.2	0.8	274	** **			
MAY 29	2771	5.7	R.D.	231	** **				22 5.6	-1.2	-0.9	316	** **			
MAY 30	2790	6.2	R.D.	233	** **				** **				2 13.4	...	...	194
MAY 31	3031	5.9	R.D.	253	21 55.3	-0.8	-0.3	244	** **				21 40.5	-0.1	-3.4	318
JUN. 1	3164	6.7	R.D.	264	** **				22 51.4	-1.1	1.3	258	** **			
JUN. 3	3304	6.4	R.D.	26	2 30.1	-1.8	1.2	228	** **				3 13.6	-3.6	0.0	267
JUN. 4	3413	6.6	R.D.	27	** **				** **				1 8.6	-1.6	1.1	233
JUN. 4	3428	5.2	R.D.	27	4 37.6	-3.4	-1.2	282	** **				** **			
JUN. 5	3536	4.7	R.D.	28	** **				2 18.4	...	...	308	** **			
JUN. 16	1598	6.4	D.D.	7	** **				** **				20 14.3	...	...	190
JUN. 20	2056	7.4	D.D.	12	** **				18 50.7	-3.0	-0.3	94	** **			
JUN. 27	2991	6.2	R.D.	20	21 12.6	-1.8	1.3	221	** **				21 31.2	-2.1	-1.9	293
JULY 2	3506	6.3	R.D.	25	4 24.8	-3.3	-0.2	278	** **				NB2			
JULY 17	2022	5.5	D.D.	9	** **				18 8.4	-1.0	-3.0	163	** **			
JULY 19	2259	6.7	D.D.	12	** **				** **				19 54.4	-2.4	-1.1	120
JULY 21	2423	6.9	D.D.	14	** **				17 47.4	-0.1	-3.0	165	** **			
JULY 28	3458	6.5	R.D.	225	** **				** **				22 19.5	...	...	164
JULY 29	18	6.0	R.D.	236	** **				20 48.3	-0.5	1.7	243	** **			

Lunar Occultations 1983

DATE	ZC	MAG.	PH.	ELG.	CAPE TOWN E 18.5 , S 33.9 TIME	A	B	P	JOHANNESBURG E 28.1 , S 26.2 TIME	A	B	P	HARARE E 31.0 , S 17.8 TIME	A	B	P
D				°	H M	°	°	°	H M	°	°	°	H M	°	°	°
AUG. 5	792	5.1	R.A.	308	.. ..				0 51.2	0.6	1.8	225	.. ..			
AUG. 12	1856	6.6	D.D.	56	.. ..				.. ..				16 28.5	-1.1	-1.4	136
AUG. 13	1978	6.6	D.D.	67	.. ..				.. ..				16 46.3	-1.3	-2.1	140
AUG. 13	1985	7.1	D.D.	68	.. ..				18 7.7	-1.1	-1.9	129	.. ..			
AUG. 14	2097	7.1	D.D.	81	18 30.8	...	...	183	.. ..				18 22.2	-1.7	0.0	103
AUG. 15	2213	5.9	D.D.	92	.. ..				.. ..				16 32.4	-2.2	-2.2	136
AUG. 15	2218	5.6	D.D.	93	.. ..				.. ..				18 18.3	-2.1	-1.6	132
AUG. 16	2353	6.6	D.D.	104	16 57.2	-1.9	-2.0	128	.. ..				17 43.9	...	...	40
AUG. 17	2504	7.4	D.D.	117	21 40.5	-2.4	-3.0	152	.. ..				21 50.5	-1.1	0.3	99
AUG. 18	2641	7.6	D.D.	128	21 38.5	-1.1	4.0	38	.. ..				.. ..			
AUG. 19	2780	6.9	D.D.	138	.. ..				17 58.7	-2.5	-0.1	108	.. ..			
AUG. 19	2792	6.8	D.D.	139	.. ..				21 3.2	-2.5	-0.4	86	.. ..			
AUG. 19	2790	6.2	D.D.	139	.. ..				.. ..				21 3.4	-3.9	-2.8	131
AUG. 20	2811	6.2	D.D.	141	1 18.4	...	...	163	.. ..				GSI			
AUG. 25	3428	5.2	R.D.	196	0 46.8	-0.7	3.2	197	.. ..				1 44.7	-0.8	2.6	212
AUG. 25	3536	4.7	R.D.	206	.. ..				23 11.6	-0.6	3.4	189	.. ..			
AUG. 28	327	4.5	R.D.	238	.. ..				20 1.8	+0.2	0.2	292	.. ..			
AUG. 30	593	5.8	R.D.	264	.. ..				23 47.3	+0.1	2.6	208	.. ..			
SEP. 3	1070	5.2	R.D.	303	.. ..				1 24.1	-0.2	1.3	253	.. ..			
SEP. 10	2056	7.4	D.D.	50	17 41.7	-0.9	-1.3	148	.. ..				17 50.4	-0.6	0.8	85
SEP. 11	2170	6.8	D.D.	62	.. ..				16 52.7	-1.4	-3.5	164	.. ..			
SEP. 12	2302	2.9	D.D.	74	.. ..				16 53.7	-2.6	1.6	50	.. ..			
SEP. 12	2303	5.1	D.D.	74	.. ..				16 54.8	-2.6	1.7	48	.. ..			
SEP. 12	2302	2.9	R.A.	74	.. ..				17 41.3	-2.0	-4.0	343	.. ..			
SEP. 12	2322	4.3	D.D.	75	20 21.5	-0.6	0.8	100	.. ..				GBG			
SEP. 14	2577	6.1	D.D.	97	.. ..				17 55.4	-2.7	-0.9	102	.. ..			
SEP. 14	2584	6.9	D.D.	98	19 3.2	-2.0	1.6	74	.. ..				20 13.6	...	...	7
SEP. 14	2589	4.8	D.D.	99	20 54.2	-0.4	3.1	45	.. ..				.. ..			
SEP. 14	2593	6.7	D.D.	99	.. ..				.. ..				21 27.8	-1.1	-0.8	125
SEP. 16	2879	4.6	D.D.	119	.. ..				18 6.9	-3.1	-0.2	96	.. ..			
SEP. 17	3009	7.1	D.D.	132	.. ..				21 57.2	...	...	346	.. ..			
SEP. 23	192	5.3	R.D.	199	21 14.7	-0.2	2.8	187	.. ..				22 4.6	-1.5	2.1	215
SEP. 27	700	5.7	R.A.	246	.. ..				21 44.1	0.8	3.3	192	.. ..			
SEP. 29	1015	6.4	R.D.	271	.. ..				22 46.5	-0.5	0.3	289	.. ..			
SEP. 29	1023	6.5	R.D.	272	.. ..				23 42.5	-0.7	0.8	270	.. ..			
OCT. 8	2114	5.8	D.D.	30	.. ..				16 35.6	-0.7	-1.7	121	.. ..			
OCT. 10	JUPITER	-1.5	D.D.	51	.. ..				9 27.8	-0.9	0.3	106	.. ..			
OCT. 10	JUPITER	-1.5	R.A.	51	.. ..				10 40.0	-1.1	-0.6	308	.. ..			
OCT. 12	2672	2.9	D.D.	77	.. ..				16 39.2	-2.0	1.4	45	.. ..			
OCT. 12	2672	2.9	R.A.	78	.. ..				17 49.8	-2.6	-2.3	305	.. ..			
OCT. 13	2834	5.0	D.D.	89	18 6.6	-2.3	0.7	89	.. ..				18 54.1	-1.1	2.1	54
OCT. 13	2835	7.1	D.D.	89	18 14.2	-2.0	1.7	68	.. ..				19 10.8	-0.2	3.3	30
OCT. 15	3092	6.2	D.D.	111	18 47.7	-2.5	0.8	79	.. ..				19 40.1	-1.5	2.1	53
OCT. 15	3089	5.3	D.D.	111	.. ..				19 2.5	-0.7	2.4	20	.. ..			
OCT. 16	3214	6.6	D.D.	122	.. ..				18 46.0	-0.4	3.6	6	.. ..			
OCT. 18	3356	5.9	D.D.	136	1 22.8	0.2	2.2	36	.. ..				.. ..			
OCT. 18	3458	6.5	D.D.	144	.. ..				18 26.6	...	...	349	.. ..			
OCT. 24	517	6.4	R.D.	205	0 44.1	-1.0	2.5	196	.. ..				1 45.3	-2.0	2.2	224
OCT. 24	646	6.1	R.D.	216	GS2				.. ..				20 55.1	-0.5	1.3	218
OCT. 24	651	5.9	R.D.	216	21 14.4	0.6	2.1	190	.. ..				21 41.2	-0.9	1.3	221
OCT. 25	665	5.7	R.D.	217	0 24.7	-1.6	1.0	225	.. ..				1 11.2	-2.7	1.1	247
NOV. 2	1773	5.1	R.D.	323	.. ..				3 35.5	-0.6	-1.3	328	.. ..			
NOV. 9	2771	5.7	D.D.	58	NBM				.. ..				17 27.0	-0.1	3.0	34
NOV. 9	2790	6.2	D.D.	59	19 50.1	-0.4	1.1	89	.. ..				GBG			
NOV. 11	3037	7.3	D.D.	80	.. ..				16 48.0	-2.6	-0.0	79	.. ..			
NOV. 11	3050	7.3	D.D.	81	19 53.8	...	...	6	.. ..				.. ..			
NOV. 12	3175	4.8	D.D.	92	.. ..				20 39.7	0.1	1.3	29	.. ..			
NOV. 13	3304	6.4	D.D.	103	20 21.3	...	...	125	.. ..				20 52.0	-1.6	0.3	99
NOV. 14	3413	6.4	R.D.	114	.. ..				20 6.7	-0.6	2.0	23	.. ..			
NOV. 14	3428	5.2	D.D.	115	22 37.0	...	...	124	.. ..				22 55.7	-0.4	0.6	92
NOV. 15	3529	6.8	D.D.	125	.. ..				19 48.6	-1.7	1.4	46	.. ..			
NOV. 16	95	7.1	D.D.	136	19 42.5	-1.6	1.6	44	.. ..				20 37.4	-1.4	2.6	33
NOV. 18	327	6.5	D.D.	157	.. ..				15 32.9	-0.5	1.1	84	.. ..			
NOV. 22	898	6.0	R.D.	209	.. ..				18 33.0	-0.3	0.8	271	.. ..			
NOV. 24	1099	6.0	R.D.	226	.. ..				2 39.9	-2.6	0.6	250	.. ..			
NOV. 25	1373	6.1	R.D.	251	.. ..				.. ..				23 46.0	-1.5	0.4	245
NOV. 26	1484	3.6	R.A.	263	.. ..				21 53.7	-0.1	0.5	280	.. ..			
DEC. 7	2861	5.7	D.D.	37	.. ..				.. ..				17 8.8	...	...	134
DEC. 10	3243	7.4	D.D.	70	NBM				.. ..				17 17.0	-1.6	1.7	61
DEC. 10	3265	6.6	D.D.	72	20 56.7	-0.9	0.2	120	.. ..				GBG			
DEC. 11	3358	7.2	D.D.	81	NBM				.. ..				17 24.1	-0.1	3.9	8
DEC. 12	3490	7.1	D.D.	92	.. ..				18 34.5	-0.8	2.0	25	.. ..			
DEC. 13	49	4.1	D.D.	103	NBM				.. ..				18 17.9	-0.9	3.2	17
DEC. 14	165	6.7	D.D.	114	.. ..				16 39.8	-1.0	2.8	22	.. ..			
DEC. 14	170	6.2	D.D.	115	.. ..				18 53.9	-1.7	1.7	41	.. ..			
DEC. 14	178	6.8	R.D.	116	.. ..				20 25.7	...	...	117	.. ..			
DEC. 16	406	5.2	R.D.	138	.. ..				17 50.4	-2.8	0.6	89	.. ..			
DEC. 21	1170	3.7	R.D.	204	.. ..				20 8.1	-1.1	0.8	271	.. ..			
DEC. 25	1701	5.1	R.D.	259	GS2				.. ..				22 49.2	-0.7	-3.4	349
DEC. 27	1813	6.0	R.D.	273	0 13.6	-0.7	-0.5	246	.. ..				0 7.5	-0.9	-1.4	295

G R A Z I N G O C C U L T A T I O N S

When a star moves tangentially to the limb of the Moon, and is occulted for a very short period only - a few minutes, or even seconds - a grazing occultation is said to occur. Because the limb, as seen from the Earth, is in fact the outline of numerous mountains and valleys, there may be several disappearances and reappearances, which are not only fascinating, to observe, but which may be accurately timed to yield valuable data on the relative positions of star and Moon, in both right ascension and declination, as well as on the shape of the Moon. Some of these data cannot readily be obtained in any other way.

The maps on the following pages have been prepared by Hydrographic Dept, Tokyo to show the tracks of stars brighter than 7,5 magnitude which will graze the limb of the Moon when it is at a favourable elongation from the Sun and at least 10° above the observer's horizon (2° in the case of bright stars). Each track starts in the West at some arbitrary time given in the key and ends beyond the area of interest, except where the letters "A", "B" or "S" are given. "A" denotes that the Moon is at a low altitude, "B" that the bright limb interferes, and "S" that sunlight interferes. The tick marks along the tracks denote 5 minute intervals (at whole minutes), give the approximate time of the graze at places along the tracks.

The tracks as shown on the maps are approximate only. Since the observer's location is very critical, successful observations call for very accurate predictions. Such predictions, which include graphical representations of the probable profile of the Moon, are computed annually for a number of centres in Southern Africa. By plotting the predicted graze track on a reliable survey map (e.g. South African 1:50 000 series) it is usually possible to select a convenient site from where the graze may be observed. Ideally a team of observers would be stationed at intervals along a line running at right angles to the graze track - say, along a main road - each with his own telescope and timing equipment. Each observer will see a different sequence of events, the combined results forming an accurate picture of the limb of the Moon.

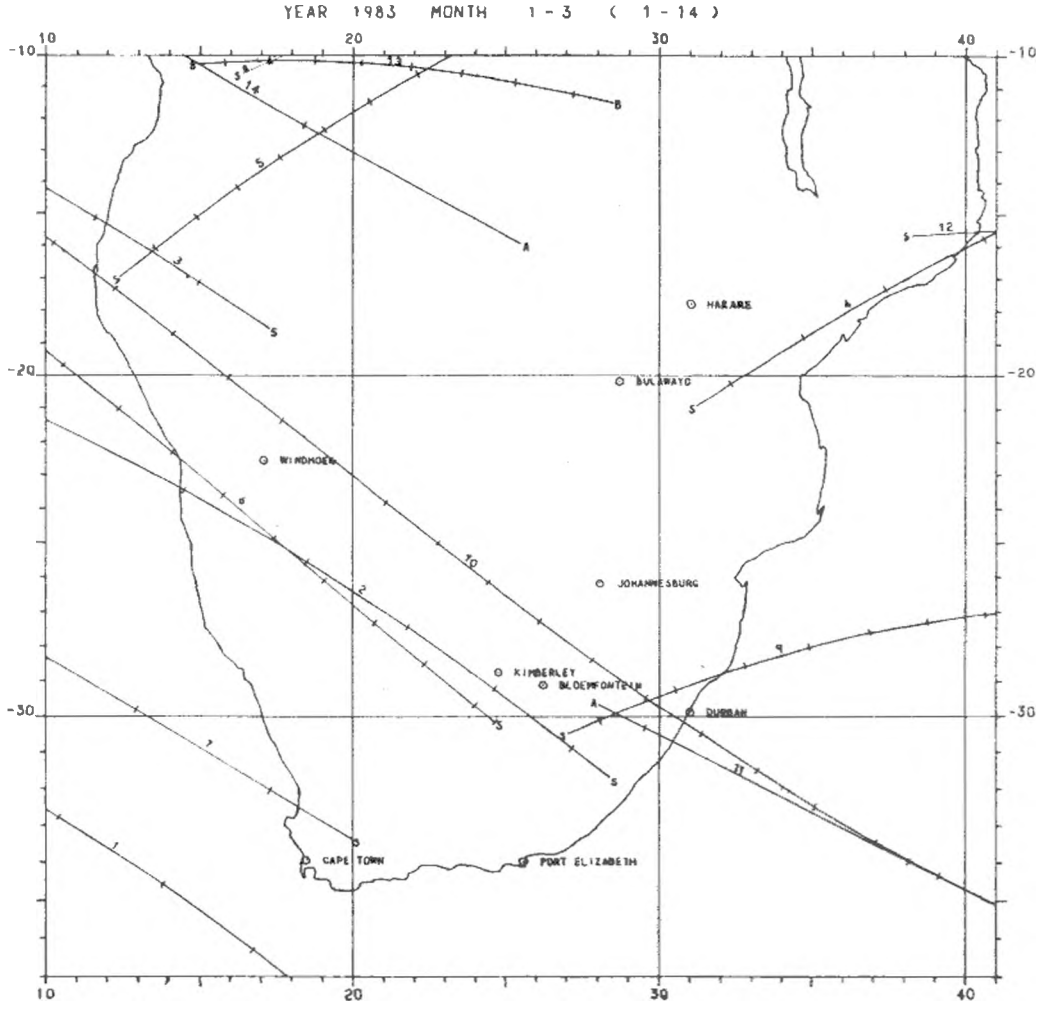
The equipment needed is similar to that used for ordinary (or "total") occultations, but must, of course, be portable. A 75 mm refractor is ideal for average events, but better instruments with a larger aperture have often shown their superiority under difficult conditions. Timing is best carried out with a portable tape recorder and radio receiver tuned to ZUO or other time signal station.

It will be seen from the maps that many grazing occultations occur in regions which are rather far removed from the main cities, and which cannot easily be reached by teams of observers from one of the ASSA centres. It is worth remembering, however, that a team of many observers, while ideal, is by no means essential; that a single good observer is worth more than many unsuccessful ones, and that one good observation is worth infinitely more than no observation at all.

Interested observers - especially those living in the more distant regions - who wish to be informed of favourable grazes occurring in their neighbourhood, are therefore invited to contact the co-ordinator for grazing occultations: Mr J Hers, P O Box 48, Sedgefield, 6573. Telephone No: 04455 - 736.

EXPLANATION OF COLUMN HEADINGS IN TABLES:

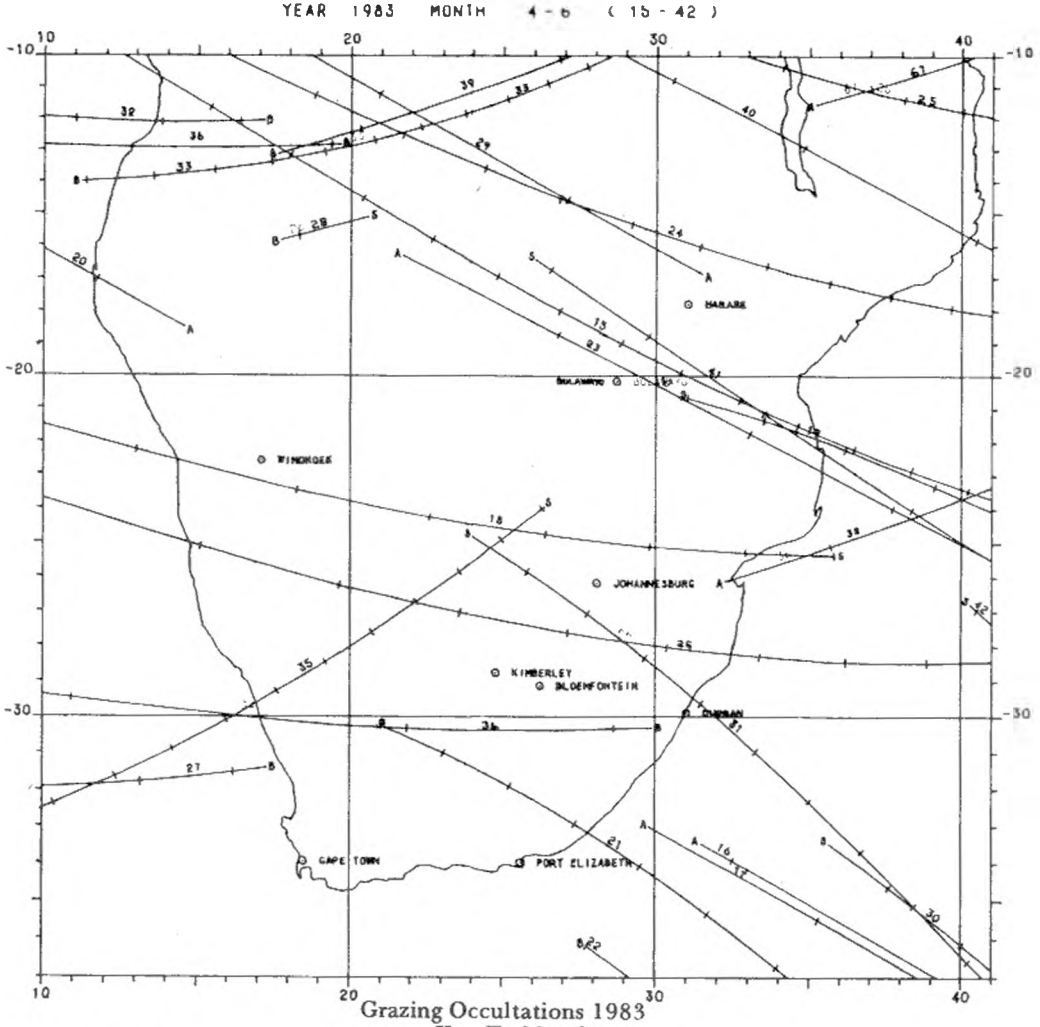
No.	-	the number of the track on the map. An asterisk denotes that the same is double - notes are given below.
Z.C.	-	the number of the star in the Zodiacal Catalogue.
Date		
Beginning	-	an arbitrary time (U T) of the beginning of the track in the west.
Sunlit	-	the percentage of the Moon's disk lit by the Sun.
Limit	-	N = northern limit (a complete occultation takes place south of track)
		S = southern limit (complete occultation north of the track).



GRAZING OCCULTATIONS 1983
KEY TO MAP 1

SEQ	NZC NO	MAG	MON	DAY	H	M	S	SUNLIT(%)	LIMIT
1	2089	6.78	1	8	2	4	26.15	-30.29	S
2	2208	7.37	1	9	2	15	45.73	-21.41	S
3	2345	6.89	1	10	3	47	54.00	-13.55	S
4	3428	5.16	1	18	18	52	27.88	18.92	S
5	249	6.68	1	21	18	0	37.76	46.83	S
6	2180	7.05	2	5	2	43	26.95	-44.37	S
7	2706	5.75	2	9	3	32	8.78	-12.30	S
8	503	5.76	2	20	17	41	32.01	69.98	S
9	1090	5.21	2	23	19	3	5.19	81.73	S
10	2246	7.40	3	5	1	9	28.02	-64.10	S
11	2921	6.08	3	10	0	54	25.41	-18.67	S
12	532	7.17	3	19	18	0	37.20	23.96	S
13	859	6.69	3	21	17	31	52.69	65.67	S
14	1195	6.74	3	23	22	46	21.24	69.84	N

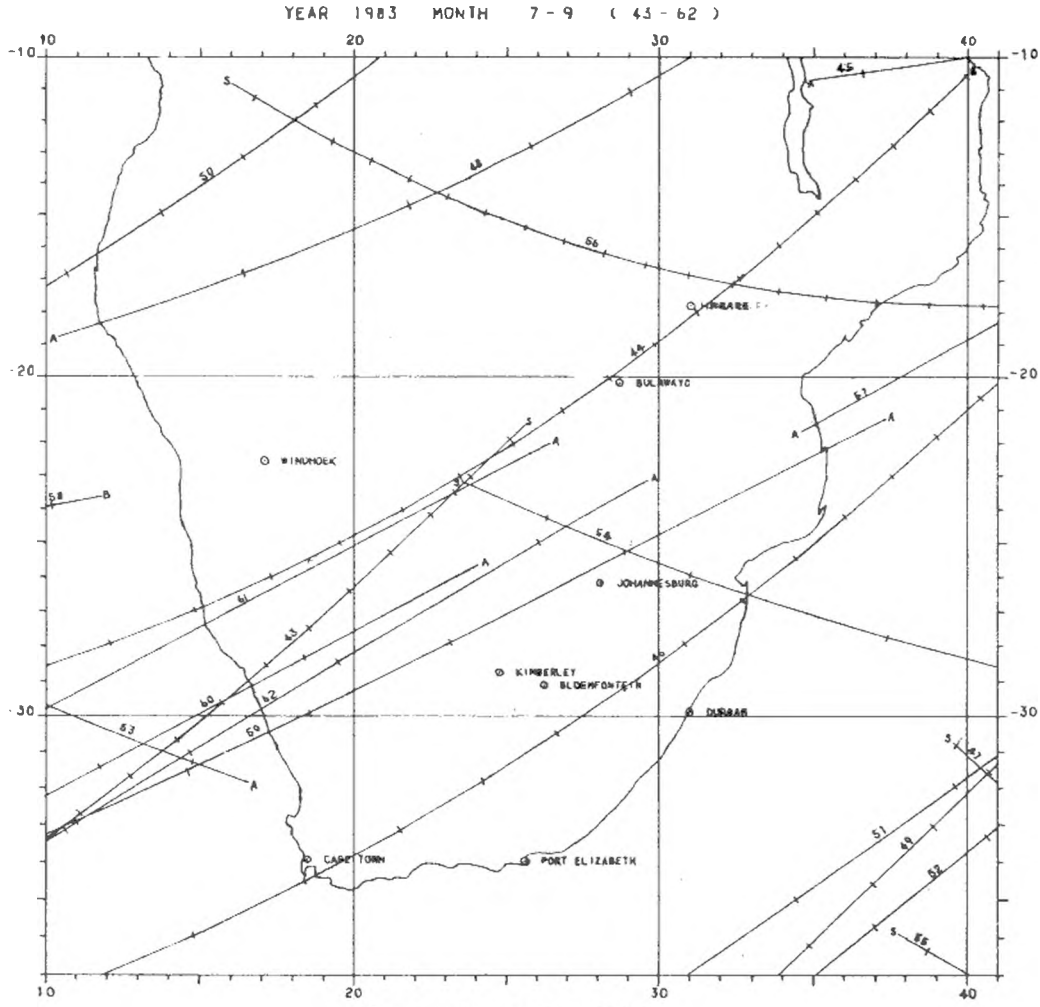
Grazing Occultations 1983



Grazing Occultations 1983
Key To Map 2

SEQ	NZC NO	MAG	MON	DAY	H	M	S	SUN ALT(D)	CLIMIT
15	2589	4.76	4	4	0	35	6.27	-61.93	S
16	2872	6.24	4	5	22	24	35.13	-43.79	S
17	2875	6.13	4	5	22	32	21.74	-43.73	S
18	3150	6.54	4	8	2	52	38.04	-24.38	S
19	977	6.54	4	18	16	4	58.01	30.71	N
20	1159	6.32	4	19	21	23	56.01	43.68	N
21	1408	7.37	4	21	16	50	34.98	65.04	N
22	1651	4.08	4	23	17	14	55.72	84.76	N
23	2823	6.95	5	2	21	27	19.77	-70.03	S
24	2835	7.08	5	2	23	50	35.54	-69.29	S
25	2834	5.01	5	3	0	16	57.71	-68.36	S
26	3092	6.15	5	5	0	50	20.46	-50.33	S
27	3228	6.49	5	6	3	30	6.79	-40.04	S
28	170	6.20	5	10	4	24	22.67	-7.71	N
29	1099	6.02	5	16	18	2	35.05	18.77	N
30	1373	6.09	5	18	15	10	35.40	38.80	N
31	1734	4.57	5	21	15	55	40.03	72.79	N
32	3175	4.82	6	2	1	8	17.03	-66.59	S
33	3304	6.37	6	3	1	39	62.11	-57.13	S
34	3413	6.37	6	4	0	14	43.92	-47.88	S
35	3428	5.16	6	4	3	49	7.20	-46.81	N
36	3536	4.66	6	5	1	1	15.69	-37.90	S
37	352	7.27	6	8	1	49	4.75	-11.66	N
38	354	5.53	6	8	2	18	15.66	-11.52	N
39	360	6.78	6	8	3	3	33.52	-11.30	N
40	1030	3.18	6	12	14	32	49.34	9.64	N
41	1336	7.01	6	14	14	14	6.41	16.11	N
42	1701	5.06	6	17	14	44	15.12	47.56	N

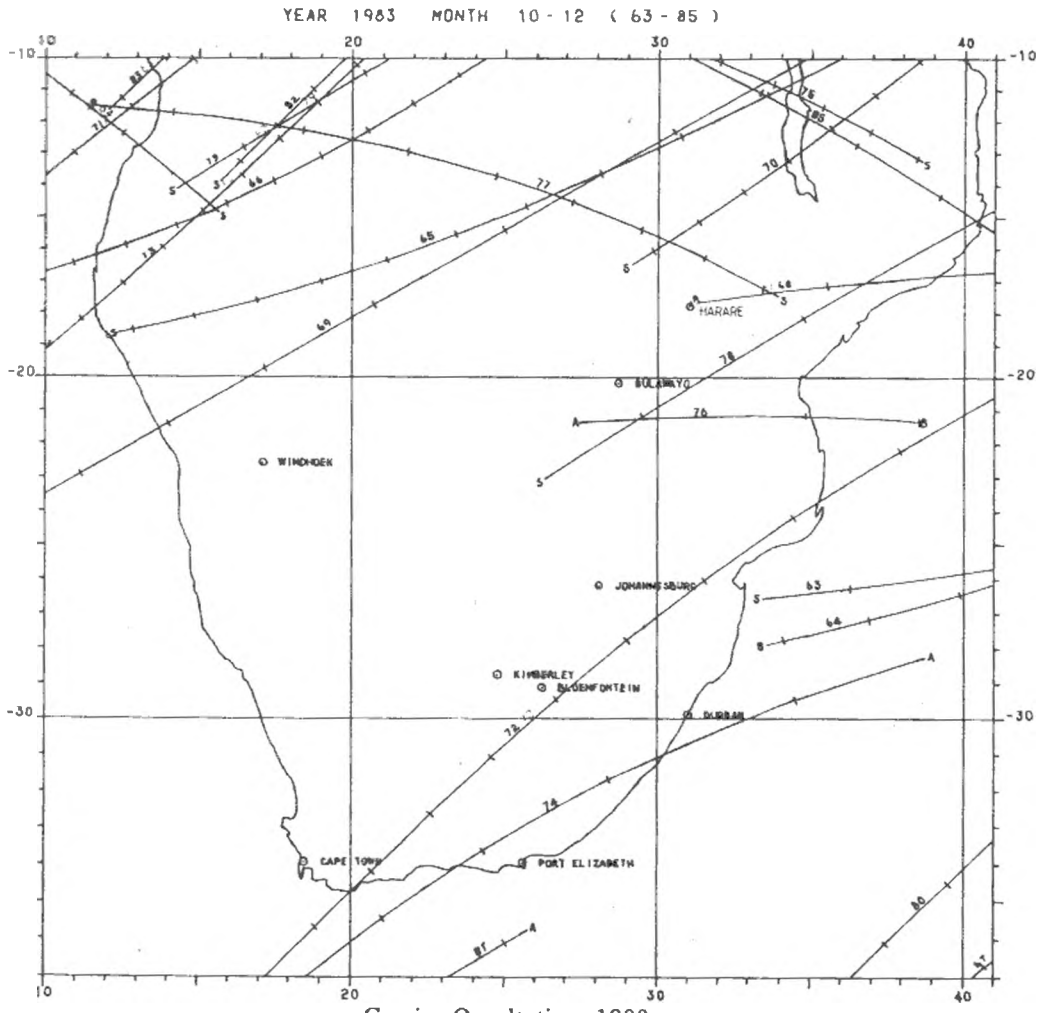
Grazing Occultations 1983



Grazing Occultations 1983
Key To Map 3

BEA	MIC NO	MAG	MON	DAY	H	M	S	SUNALT(S)	LIMIT
43	3508	6.27	7	2	1	34	40.10	-62.01	N
44	66	6.78	7	3	1	46	34.78	-53.61	N
45	178	6.82	7	3	22	40	9.71	-44.71	N
46	192	5.28	7	4	2	16	25.10	-43.38	N
47	1897	7.37	7	16	16	6	33.00	44.46	M
48	376	7.00	8	2	0	11	18.47	-49.67	N
49	384	5.68	8	2	2	17	39.68	-48.85	N
50	505	7.02	8	3	2	44	1.47	-37.98	N
51	646	6.11	8	4	1	57	26.08	-28.09	N
52	651	5.92	8	4	2	42	40.80	-27.88	N
53	1821	7.46	8	10	17	27	24.96	5.42	N
54	1739	6.52	8	11	16	31	22.91	11.80	N
55	2210	6.80	8	15	15	22	18.36	51.05	N
56	2353	6.59	8	16	17	2	2.84	62.09	N
57	939	7.44	8	31	23	24	46.73	-43.75	N
58	2584	6.85	9	14	19	34	26.90	56.66	N
59	2593	6.72	9	14	21	23	33.00	57.17	S
60	2598	6.87	9	14	22	43	22.68	57.59	S
61	2602	5.49	9	14	22	51	59.21	57.63	S
62	2756	7.44	9	15	22	50	0.54	67.11	S

Grazing Occultations 1983



Grazing Occultations 1983
Key To Map 4

SEQ	HIC NO	MAG	MON	DAY	H	M	S	SUNLIT(S)	LIMB
63	2110	6.42	10	8	16	12	46.82	4.06	N
64	2523	4.89	10	11	16	28	56.84	29.19	S
65	2678	6.23	10	12	17	33	20.03	39.23	S
66	3089	5.27	10	15	18	2	25.85	68.07	S
67	3062	6.15	10	15	19	59	3.46	68.27	S
68	1651	4.08	11	1	1	14	7.35	-18.48	N
69	2780	6.87	11	9	18	27	51.09	23.17	S
70	3164	4.72	11	12	16	22	31.39	50.18	S
71	3175	4.82	11	12	20	17	23.76	51.23	S
72	3304	6.37	11	13	20	30	36.04	60.92	S
73	3413	6.37	11	14	18	55	45.29	69.68	S
74	3428	5.16	11	14	22	45	36.84	70.67	S
75	1621	7.48	11	28	2	4	10.46	-42.39	S
76	1734	4.59	11	29	0	12	53.69	-32.05	N
77	1759	6.52	11	29	1	57	39.13	-31.22	S
78	2861	5.68	12	7	17	16	9.95	0.78	S
79	2864	4.64	12	7	17	31	49.76	0.84	S
80	3243	7.44	12	10	19	27	8.02	32.81	S
81	3265	6.60	12	10	21	8	38.47	34.06	S
82	3490	7.08	12	12	17	42	18.92	51.76	S
83	170	6.20	12	14	17	53	30.53	70.87	S
84	1950	5.75	12	28	3	47	37.66	-34.48	S
85	2056	7.36	12	29	1	21	58.04	-25.31	S

TIME SYSTEMS AND TELESCOPE SETTINGS

This section is intended to serve established amateurs and professional astronomers - i.e. those having some knowledge of time and coordinate systems. Space in the booklet does not permit full explanation, which in any case would appear complicated to the layman.

TIME SIGNALS FROM RADIO STATION ZUO

Radio signals of mean solar time are generated by the Precise Physical Measurements Division of the National Physical Research Laboratory in Pretoria. They are broadcast by the Post Office, the 2.5 and 5 MHz signals from Olifantsfontein, and the 100 MHz signal from Johannesburg.

Carrier Frequency	Radiated Power	Time of Transmission
2,5 MHz	4 Kw	2000 - 0600 SAST
5 MHz	4 Kw	Continuous

The signals consist of one pulse per second, each pulse consisting of 5 cycles of 1000 Hz tone. The first pulse in every minute is lengthened to 500 milliseconds. Morse code announcements are made during the minute preceding every fifth minute. They consist of the call sign ZUO (repeated 3 times) and the Universal Time (formally known as Greenwich Mean Time) at the next minute. (A special coding indicating UTI minus UTC is also indicated in the first 15 seconds of the minute by slightly lengthened second pulses).

SOUTH AFRICAN STANDARD TIME

South African Standard Time (as in everyday use) is mean solar time and the 30° East meridian (which runs east of Johannesburg and just west of Durban) and is exactly 2 hours ahead of Universal Time.

TIME OF SUN'S TRANSIT OVER 30° MERIDIAN

The table below gives the SAST when the Sun transits the 30° meridian - and a sundial on that meridian reads noon.

		$12^h03^m24^s$			$11^h56^m20^s$			$11^h54^m18^s$
Jan	1	12 03 24	May	11	11 56 20	Sep	18	11 54 18
	11	12 07 48		21	11 56 30		28	11 50 48
	21	12 11 15		31	11 57 32	Oct	8	11 47 41
	31	12 13 25	Jun	10	11 59 16		18	11 45 15
Feb	10	12 14 16		20	12 01 23		28	11 43 50
	20	12 13 50		30	12 03 30	Nov	7	11 43 40
Mar	2	12 12 17	Jul	10	12 05 14		17	11 44 42
	12	12 09 54		20	12 06 17		27	11 47 28
	22	12 07 04		30	12 06 23			
Apr	1	12 04 01	Aug	9	12 05 31	Dec	7	11 51 17
	11	12 01 11		19	12 03 42		17	11 55 55
	21	11 58 48		29	12 01 02		27	12 00 51
May	1	11 57 07	Sep	8	11 57 49		31	12 02 49

SIDEREAL TIME ON THE 30° MERIDIAN

		At 0 hrs SAST	At 21 hrs SAST			At 0 hrs SAST	At 21 hrs SAST			0 hrs SAST	21 hrs SAST
Jan	1	6^h40^m	3^h43^m	May	11	15^h13^m	12^h16^m	Sep	18	23^h45^m	20^h48^m
	11	7 20	4 23		21	15 52	12 55		28	0 25	21 28
	21	7 59	5 02		31	16 32	13 35	Oct	8	1 04	22 07
	31	8 39	5 42	Jun	10	17 11	14 14		18	1 44	22 47
Feb	10	9 18	6 21		20	17 51	14 54		28	2 23	23 26
	20	9 57	7 01		30	18 30	15 33	Nov	7	3 02	0 06
Mar	2	10 37	7 40	Jul	10	19 09	16 13		17	3 42	0 45
	12	11 16	8 19		20	19 49	16 52		27	4 21	1 24
	22	11 56	8 59		30	20 28	17 31	Dec	7	5 00	2 04
Apr	1	12 35	9 38	Aug	9	21 08	18 11		17	5 40	2 43
	11	13 15	10 18		19	21 47	18 50		27	6 19	3 23
	21	13 54	10 57		29	22 27	19 30		31	6 35	3 39
May	1	14 33	11 37	Sep	8	23 06	20 09				

CORRECTION FOR PLACES NOT ON THE 30° MERIDIAN

Approximate longitude corrections from the 30° East Meridian are provided below. To find time of Sun's transit over local meridian, apply the longitude corrections to the data in the table above.

To find the sidereal times at SAST 0 hrs and SAST 21 hrs apply the corrections with the sign reversed to the data in the table.

Bloemfontein	$+15^m$	East London	$+ 8^m$	Port Elizabeth	$+18^m$
Bulawayo	$+ 6^m$	Grahamstown	$+14^m$	Pretoria	$+ 7^m$
Cape Town	$+46^m$	Johannesburg	$+ 8^m$	Harare	$- 4^m$
Durban	$- 4^m$	Kimberley	$+21^m$	Windhoek	$+52^m$

TELESCOPE SETTING

When a telescope equipped with setting circles is aimed on the meridian, its R.A. circle should read the sidereal time. Thus once can calculate the sidereal time and then set the circle, but is is usually simpler to aim the telescope at one of the well known stars given below and then to adjust the R.A. circle.

A LIST OF BRIGHT STARS FOR CHECKING TELESCOPE CIRCLES

Star	R.A.	Dec.	Mag.	Sp.	Star	R.A.	Dec.	Mag.	Sp.
Achernar	$1^h37^m,1$	-57°19	0,6	B5	Procyon	$7^h38^m,4$	+ 5°16'	0,5	F5
Aldebaran	4 35,0	+16 29	1,1	K5	Regulus	10 07,5	+12 03	1,3	B8
Rigel	5 13,7	- 8 13	0,3	B8	Spica	13 24,3	-11,05	1,2	B2
Betelgeuse	5 54,3	+ 7 24	0,4	M0	Arcturus	14 14,9	+19 16	0,2	K0
Canopus	6 23,6	-52,41	-0,9	F0	Antares	16 28,4	-26 24	1,2	M1
Sirius	6 44,4	-16,42	-1,6	A0	Altair	19 50,0	+ 8 49	0,9	A5

ASSA OFFICE BEARERS

COUNCIL

President: Mr J Vincent
Vice
Presidents: Prof E E Baart, Prof A P Fairall, Mr J Bondietti
Members: Dr M Feast, Mr M A Gray, Mr H Krumm, Mr J Hers
Hon. Treasurer: Mr G Orpen
Hon. Secretary:
Business Manager: Mr W C Bentley

BLOEMFONTEIN CENTRE

Chairman: Mr P T B Erasmus
Vice Chairman: Mr B D Viljoen
Secretary: Mr F C Neser
Council Representative: Mr G N Walker

PRETORIA CENTRE

Chairman: Dr P D Bennewith
Vice Chairman: Mr J Wolterbeek
Secretary
Treasurer: Mr J C Bennett
Librarian: Dr P D Bennewith
Council Rep: Mr J Wolterbeek
Curator of
Instruments: Mr R B Matthews
Committee: Messrs: K J Sterling;
W R Windisch; P Faller; J R Starkey;
G Labuschagne and Mrs R Fasser

CAPE CENTRE

Chairman: Mike Kramer
Vice Chairman: Mr Soltynski
Secretary: Mr W Duckitt
Treasurer: Mr P Kramer
Committee: Mr Leeuenberg, Eric Banner;
J Bondietti; Mr Shipley; Mr Spencer-Jones;
Pat Booth; Mr Noack
Council Rep: Cliff Turk

HARARE CENTRE

Chairman: Mr C B Archer
Treasurer: Mr C D M Forder
Secretary: Mr W L Stedman
Committee: Mr J V Vincent;
Mr R Fleet; Mr N T Higgs;
Miss O M E Benzies; Miss D Matthias

NATAL CENTRE

Chairman: Mr P Cramb
Vice Chairman: Mr R Blore
Treasurer: Mr N Lavarack
Secretary: Mrs P Cramb
Assistant Secretaries:
Messrs: R Blore and A Hilton
P.R.O. Mr S Booysen
Curator of Instruments: Mr R Blore
Librarian: J Tory
Committee: Mrs J Barker; Mr W Spiers
Observing Section: Messrs R Field and A Hilton
Council Rep: Mr J Barker

TRANSVAAL CENTRE

Chairman: Mr E van Zyl
Vice Chairman: Mr A Gray
Treasurer: Mr G Paxton
Secretary: Mr D Blane
P.R.O. Mr J Richards
Curator of Instruments: Mr P Wise
CSIR Liaison Officer: Mr G Pulik
Librarian: Mr D Michie
Members: Mr B Fraser; Mr J Barsby;
Mr C Papadopoulos; Mr C Winskill;
Mr T Voorvelt; Mr C Pereira;
Mr F Bateman; Mr G Marshall;
Mr R Williams; Dr G Willies;
Dr P Amoils
Council Rep: Mr D Overbeek

NATAL MIDLANDS CENTRE

Chairman: Mr C S Lake
Secretary: Mr J Watson
Treasurer: Mrs T Brophy
Librarian: Mr P Welch
Council Rep: Mr J Watson
Committee: Mr P Welch; Mr A Roberts
Mrs S Dale; Mrs C Couling Student Rep: Mr A Hesselman

ASSA OFFICE BEARERS

PAST PRESIDENTS

1922 - 23	S S Hough	1942 - 43	A F I Forbes	1962 - 63	A J Wesselink
1923 - 24	R T A Innes	1943 - 44	W H van den Bos	1963 - 64	A G F Morrisby
1924 - 25	J K E Halm	1944 - 45	A W J Cousins	1964 - 65	H C Lagerwey
1925 - 26	W Reid	1945 - 46	R H Stoy	1965 - 66	A Menzies
1926 - 27	H Spencer Jones	1946 - 47	W P Hirst	1966 - 67	G R Atkins
1927 - 28	A W Roberts	1947 - 48	J Jackson	1967 - 68	J Hers
1928 - 29	A W Long	1948 - 49	A E H Bleksley	1968 - 69	J C Bennett
1929 - 30	H E Wood	1949 - 50	W S Finsen	1969 - 70	J Churms
1930 - 31	D Cameron-Smith	1950 - 51	H E Krumm	1970 - 71	W C Bentley
1931 - 32	H L Alden	1951 - 52	A D Thackeray	1971 - 72	A H Jarrett
1932 - 33	H Spencer Jones	1952 - 53	J C Bentley	1972 - 73	K J Sterling
1933 - 34	D G McIntyre	1953 - 54	David S Evans	1973 - 74	G A Harding
1934 - 35	J K E Halm	1954 - 55	P Kirchhoff	1974 - 75	C Papadopoulos
1935 - 36	J Jackson	1955 - 56	W H van den Bos	1975 - 76	P A T Wild
1936 - 37	H E Houghton	1956 - 57	S C Venter	1976 - 77	S Booysen
1937 - 38	J S Paraskevopoulos	1957 - 58	M W Feast	1977 - 78	B Warner
1938 - 39	T Mackenzie	1958 - 59	H Haffner	1978 - 79	R F Hurly
1939 - 40	R A Rossiter	1959 - 60	P Smits	1979 - 80	M W Feast
1940 - 41	E B Ford	1960 - 61	G G Cillie	1980 - 81	M A Gray
1941 - 42	H Knox Shaw	1961 - 62	M D Overbeek	1981 - 82	E Baart
				1982 - 83	J Vincent

HONORARY SECRETARIES

1922	H W Schonegevel	1923	H E Houghton	1934	H W Schonegvel
1922	T Mackenzie	1930	S Skewes	1935	A Menzies
1923	C L O'Brien Dutten	1931	H Horrocks	1965	T W Russo
				1981	Mrs M Fitzgerald

HONORARY MEMBERS

Prof A E Bleksley	Mr A Menzies	Dr R H Stoy
Dr A W J Cousins	Dr J H Oort	Dr A G Velghe
Dr David S Evans	Mr G Orpen	Dr A J Wesselink
Prof Ch Fehrenbach	Mr M D Overbeek	Sir Richard Woolley
Mr H E Krumm	Dr J Schilt	

GILL MEDALLISTS

1956	H Knox Shaw	1963	A W J Cousins	1976	A D Thackeray
1957	W P Hirst	1965	R H Stoy	1981	C Papadopoulos
1958	J Jackson	1967	W S Finsen		
1960	W H van den Bos	1970	J C Bennett		

JULIAN DATE AT 1400 HOURS - 1983

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
	2445	2445	2445	2445	2445	2445	2445	2445	2445	2445	2445	2445
1	336	367	395	426	456	487	517	548	579	609	640	670
2	337	368	396	427	457	488	518	549	580	610	641	671
3	338	369	397	428	458	489	519	550	581	611	642	672
4	339	370	398	429	459	490	520	551	582	612	643	673
5	340	371	399	430	460	491	521	552	583	613	644	674
6	341	372	400	431	461	492	522	553	584	614	645	675
7	342	373	401	432	462	493	523	554	585	615	646	676
8	343	374	402	433	463	494	524	555	586	616	647	677
9	344	375	403	434	464	495	525	556	587	617	648	678
10	345	376	404	435	465	496	526	557	588	618	649	679
11	346	377	405	436	466	497	527	558	589	619	650	680
12	347	378	406	437	467	498	528	559	590	620	651	681
13	348	379	407	438	468	499	529	560	591	621	652	682
14	349	380	408	439	469	500	530	561	592	622	653	683
15	350	381	409	440	470	501	531	562	593	623	654	684
16	351	382	410	441	471	502	532	563	594	624	655	685
17	352	383	411	442	472	503	533	564	595	625	656	686
18	353	384	412	443	473	504	534	565	596	626	657	687
19	354	385	413	444	474	505	535	566	597	627	658	688
20	355	386	414	445	475	506	536	567	598	628	659	689
21	356	387	415	446	476	507	537	568	599	629	660	690
22	357	388	416	447	477	508	538	569	600	630	661	691
23	358	389	417	448	478	509	539	570	601	631	662	692
24	359	390	418	449	479	510	540	571	602	632	663	693
25	360	391	419	450	480	511	541	572	603	633	664	694
26	361	392	420	451	481	512	542	573	604	634	665	695
27	362	393	421	452	482	513	543	574	605	635	666	696
28	363	394	422	453	483	514	544	575	606	636	667	697
29	364		423	454	484	515	545	576	607	637	668	698
30	365		424	455	485	516	546	577	608	638	669	699
31	366		425		486		547	578		639		700