ASTRONOMICAL HANDBOOK FOR SOUTHERN AFRICA

1980

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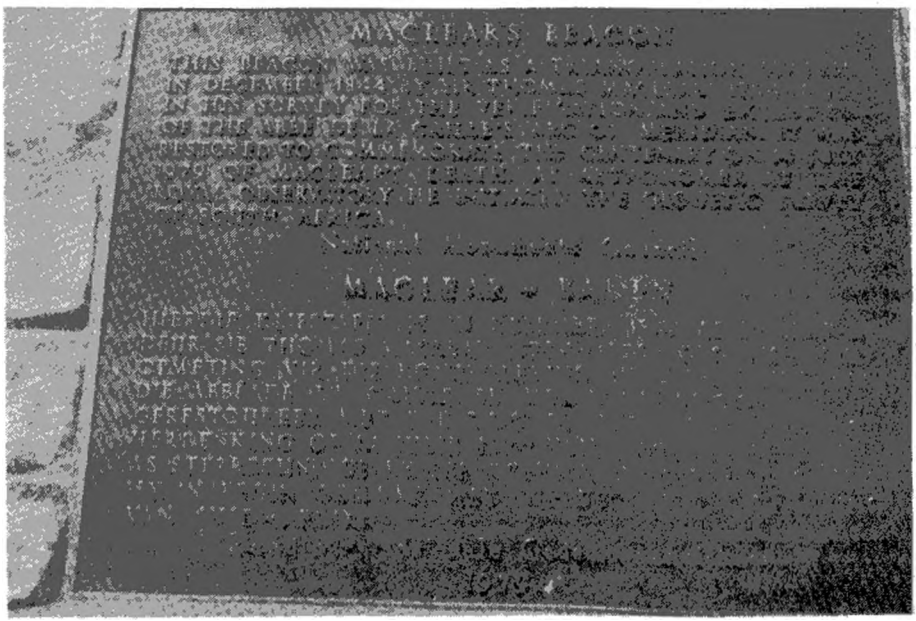
This booklet is intended both as an introduction to observational astronomy for the interested layman – even if his interest is only a passing one – and as a handbook for the established amateur or professional astronomer.



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NOTE

Unless stated otherwise, all times are SOUTH AFRICAN STANDARD TIME. In order to avoid confusion between a.m. and p.m., the 24-hour clock is used (e.g. 1800 hrs. is 6 p.m. and 2100 hrs. is 9 p.m.). Emphasis is given to phenomena visible in the evening sky - between sunset and midnight.

This handbook is produced for the Astronomical Society of Southern Africa. Most of the data it contains have been adapted for Southern Africa from the "Astronomical Ephememeris for 1980 issued jointly by the Nautical Almanac Offices of the Royal Greenwich Observatory, Herstmonceux and the U.S. Naval Observatory, Washington D.C. Additional information has also been supplied direct from the Herstmonceux Office and from the Hydrographer, South African Navy.

Thanks are due to Messrs G and C Larmuth for the preparation of much of the data.

All correspondence concerning this booklet should be addressed to the Handbook Editor, Astronomical Society of S.A 8 Glebe Road, Rondebosch 7700, Cape. Further copies can also be obtained from the same address. Enclose a postal order or cheque (in favour of the Astronomical Society of Southern Africa) for R1 per copy.

Dit is met spyt dat ons u meedeel dat as gevolg van beperkte fondse en produksiefasiliteite dit nie moontlik is om hierdie handboek in Afrikaans te laat druk nie.

R.F. HURLY
EDITOR

ASTRONOMY IN SOUTHERN AFRICA

As one of the few parts of the Earth having both access to the rich southern skies and a suitable climate, Southern Africa holds a favoured position in astronomy. Consequently it has seen the establishment of a number of professional observatories engaged in research while many individuals have become enthusiastic amateur astronomers. Planetaria and visiting nights at observatories convey to the general public much of what goes on in this field.

OBSERVATORIES

Boyden observatory, situated at Mazelspoort, 25 km from Bloemfontein is operated by the department of Astronomy of the University of The Orange Free State. Observing facilities include the 1,5m Rockefeller Reflector. The site offers good observing conditions, without being remote from a large centre. Enquiries as to use of the observatory should be addressed to the Director.

On the other hand, the observatory sites in the hearts of Cape Town and Johannesburg have become unsuitable with the rapid expansion of those cities. The South African Astronomical Observatory - a joint venture between the South African Council for Scientific and Industrial Research and the British Science Research Council, has merged their facilities and moved the larger instruments to a new site near Sutherland in the Karroo. Observing continues at Cape Town which is also the Headquarters of the S.A.A.O. The S.A.A.O. outstation at Hartebeespoort continues to share the site with the Leiden Observatory Southern Station which has a 45cm reflector and a 25cm photographic refractor.

The Radio Astronomy Observatory at Hartebeesthoek, near Krugersdorp is used by the National Institute for Telecommunications Research for observations on extragalactic radio sources while the Rhodes University Radio Astronomy Group uses the same facilities to study Ionized Hydrogen regions associated with star formation and supernova remnants within the galaxy at a wavelength of 2,3 GHz. The Rhodes group results are reduced in Grahamstown.

In addition to the professional observatories listed above, South Africa and Rhodesia have numerous private observatories, built and operated by amateur astronomers.

OBSERVATORIES OPEN TO THE PUBLIC

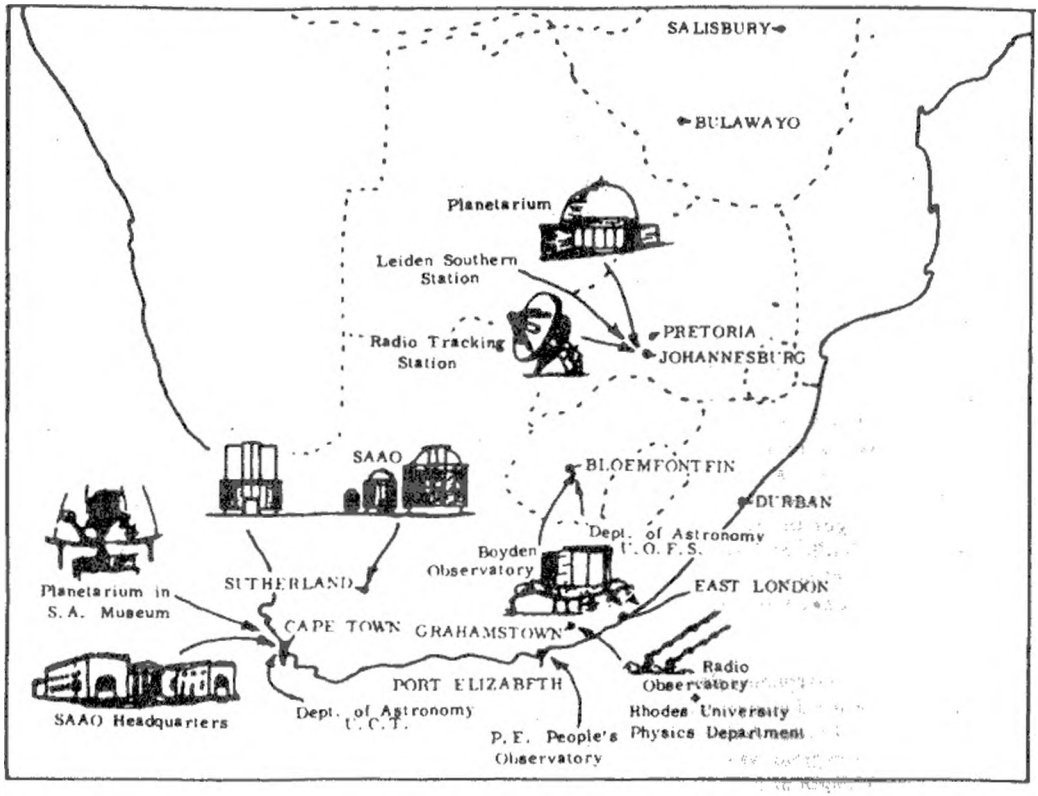
Visiting nights at Boyden Observatory are generally held around the time of first quarter. Enquiries should be made direct to the Observatory. Numbers are restricted to twenty persons on each occasion.

SAAO Headquarters, Observatory, Cape are open to visitors on the second Saturday each month at 8.00 p.m. No tickets are necessary but parties of more than ten persons should contact the observatory in advance.

PLANETARIA

The major planetarium in South Africa is that situated on the grounds of the University of the Witwatersrand (entrance in Yale Road - alongside M1). It is equipped with a highly complex Zeiss projector and seats over 400 persons.

A smaller planetarium, with a Spitz projector and seating approximately 70, is located within the South African Museum, Cape Town. Shows are given each Saturday at 3.00 p.m., each Sunday at 3.30 p.m., and at 11.00 a.m. and 3.30 p.m. on public holidays. Further information can be obtained by phoning the museum at 41-2668.



TEACHING DEPARTMENTS

Both the University of the Orange Free State and the University of Cape Town have departments of astronomy - concerned with optical astronomy - while the Physics department of Rhodes University specialises in radio astronomy. The UOFS department is incorporated into Boyden Observatory and is headed by the director, Prof. A.H. Jarrett. Prof. Brian Warner occupies the chair of Astronomy at UCT. His department makes use of the SAAO observing facilities at Sutherland. The Physics Department at Rhodes has its own radio observatory outside Grahamstown.

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 R15.00 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 CENTRES OF THE SOCIETY

Autonomous local Centres of the Society hold regular meetings in Cape Town, Durban, Johannesburg, Bloemfontein, Pietermaritzburg, Pretoria and Salisbury. Visitors are very welcome at meetings and may, if they wish, join a Centre, without becoming a full member (i.e. receiving publications for R15 subscription of the Society.

CAPE CENTRE (Cape Town) - Meetings on 2nd Wednesday of the month (except Jan. and Dec.) at the South African Astronomical Observatory at 8.00p.m. The Centre possesses a small observatory housing the 30cm Ron Atkins Telescope. There is also an active occultation section. Secretarial address: c/o S.A.A.O. Box 9 Observatory 7935. Information on meetings also available from telephone (day time) 69-8531 ext. 256, 210-3814 evenings 65-6976.

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 a 30cm cassegrain telescope arranged for photo-electric photometry, and two refracting telescopes of 18 and 15cm aperture, which is available to members of the Centre. Courses in practical astronomy are given with special emphasis on new members requirements, and there are sections catering for the observation of variable stars and grazing occultations. Secretarial address: P O Box 1595, Edenvale 1610. Telephone 609-4086.

NATAL CENTRE (Durban) - Monthly meetings are held every third Wednesday at 7.45p.m. at St. Pauls Church Hall, Church Street, Durban (near G.P.O.) and the Committee meets in private homes on the Monday evening after the general meeting. Secretarial address: c/o P O Box 840, Durban 4000. Telephone 842321 Office, 844751 Home.

NATAL MIDLANDS CENTRE (Pietermaritzburg) - Meetings are held monthly at various venues. Secretarial address: 17 Yalta Road, Pietermaritzburg 3201. Telephone 5-4038.

BLOEMFONTEIN CENTRE - Meetings are held every third Wednesday of the month. For further information contact Mr F.C. Neser telephone 22-1142, 108 Japie Neser St, Uitsig, Bloemfontein.

PRETORIA CENTRE - Meetings are held on the 4th Wednesday of each month (except December) at 8 p.m., the venue alternating between the University of South Africa and the Christian Brothers' College, Silverton Road. The Centre's observatory containing a 32cm reflector is situated on the latter site. For information contact the the Secretary, Mr J. Bennett, 90 Malan Street, Riviera,Pretoria 0084.

SALISBURY CENTRE - The Centre holds fairly frequent meetings, usually at eight 'o clock in the evening 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 Salisbury Centre is P O Box UA 428, Union Avenue, Salisbury and the Hon. Secretary (to whom communications should be addressed) is Mr W.L.Stedman telephone number 5-0921.

OBSERVING SECTIONS OF THE SOCIETY.

These sections exist to coordinate 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.

DIARY 1980

JANUARY

d	h	
3	17	Earth at perihelion
6	09	Regulus 0°.6 N of Moon Occn.
7	06	Jupiter 0°.3 N of Moon (Occn. visible from S.A.)
7	18	Mars 2° N. of Moon
8	03	Saturn stationary
8	16	Saturn 0°.2 S. of Moon Occn.
13	08	Uranus 5° S. of Moon
15	11	Neptune 4° S. of Moon
17	10	Mars stationary
20	15	Venus 1° S. of Moon Occn.
21	11	Mercury in superior conjunction
27	07	Aldebaran 0°.3 S. of Moon Occn.

FEBRUARY

2	17	Regulus 0°.5 N. of Moon Occn.
3	10	Jupiter 0°.6 N. of Moon Occn.
3	22	Mars 3° N. of Moon
4	22	Saturn 0°.1 S. of Moon Occn.
9	18	Uranus 5° S. of Moon
11	22	Neptune 4° S. of Moon
16	11	Total eclipse of sun (seen from S.A. as partial eclipse)
17	16	Mercury 2° N. of Moon
19	07	Venus 4° N. of Moon
19	14	Mercury greatest elong. E.(18°)
21	16	Vesta 1° N. of Moon Occn.
23	13	Aldebaran 0°.3 S of Moon Occn.
24	20	Jupiter at opposition
25	08	Mars at opposition
25	13	Mercury stationary
26	08	Mars nearest to Earth
29	09	Uranus stationary
29	23	Regulus 0°.5 N. of Moon (occn. visible from S.A.)

MARCH

1	10	Mars 4° N. of Moon
1	10	Jupiter 0°.9 N. of Moon Occn.
1	23	Penumbral Eclipse (visible from Africa)
2	21	Mars 3° N. of Jupiter
3	02	Saturn 0°.2 N. of Moon (Occn. visible from S.A.)
6	08	Mercury in inferior conjunction
8	02	Uranus 5° S. of Moon
10	07	Neptune 3° S. of Moon
14	04	Saturn at opposition
15	15	Mercury 3° N. of Moon
17	23	Mars 4° N. of Regulus
18	17	Mercury stationary
19	22	Venus 7° N. of Moon
20	13	Equinox
21	20	Aldebaran 0°.4 S. of Moon Occn.
28	01	Mars 4° N. of Moon
28	05	Regulus 0°.5 N of Moon Occn.
28	10	Jupiter 1° N of Moon Occn.
30	04	Saturn 0°.4 N of Moon (Occn. visible from S.A.)

APRIL

d	h	
2	19	Mercury greatest elong.W.(28°)
4	07	Uranus 5° S. of Moon
5	17	Venus greatest elong. E. (46°)
6	14	Neptune 3° S. of Moon
7	16	Mars stationary
13	11	Mercury 0°.02 N. of Moon Occn.
15	09	Venus 9° N. of Aldebaran
16	12	Ceres 1° N. of Moon Occn.
18	06	Aldebaran 0°.6 S. of Moon Occn.
18	11	Venus 9° N. of Moon
24	09	Mars 2° N. of Moon
24	11	Regulus 0°.3 N. of Moon Occn.
24	13	Jupiter 1° N. of Moon Occn.
26	07	Saturn 0°.3 N. of Moon Occn
26	19	Jupiter stationary
30	01	Mars 1°.8 N. of Regulus

APRIL

MAY

1	11	Uranus 5° S. of Moon
3	18	Neptune 3° S. of Moon
4	08	Mars 0°.8 N. of Jupiter
9	05	Venus greatest brilliancy (-4.2)
13	11	Mercury in superior conjunction
14	07	Uranus at opposition
15	16	Aldebaran 0°.6 S. of Moon Occn.
17	06	Venus 8° N. of Moon
18	08	Ceres in conjunction with Sun
21	19	Regulus 0°.02 S. of Moon (Occn. visible from S.A.)
21	22	Jupiter 0°.8 N. of Moon Occn.
22	08	Mars 0°.4 N. of Moon Occn.
23	09	Saturn stationary
23	12	Saturn 0°.1 N. of Moon Occn.
24	21	Venus stationary
28	15	Uranus 5° S. of Moon
30	23	Neptune 3° S. of Moon

JUNE

1	20	Mercury 0°.3 N. of Venus
12	02	Aldebaran 0°.7 S. of Moon Occn.
12	05	Neptune at opposition
14	16	Mercury greatest elong. E. (24°)
14	22	Mercury 4° N. of Moon
15	09	Venus in inferior conjunction
18	03	Regulus 0°.3 S. of Moon Occn.
18	12	Jupiter 0°.01 S. of Moon Occn.
19	16	Mars 2° S. of Moon
19	21	Saturn 0°.3 S. of Moon Occn.
21	08	Solstice
23	23	Mercury 8° S. of Pollux
24	21	Uranus 5° S. of Moon
25	15	Mars 1°.7 S. of Saturn
27	06	Neptune 3° S. of Moon
27	22	Mercury stationary

JULY

1	23	Mercury 10° S. of Pollux	
5	19	Earth at aphelion	
6	06	Pluto Stationary	
6	19	Venus stationary	
9	09	Aldebaran 0°.6 S. of Moon	Occn.
9	21	Venus 0°.2 S. of Moon	Occn.
11	21	Mercury in inferior conjunction	
15	11	Regulus 0°.4 S. of Moon	Occn.
16	05	Jupiter 0°.6 S. of Moon	Occn.
17	09	Saturn 0°.7 S. of Moon	Occn.
18	04	Mars 4° S. of Moon	
22	04	Venus greatest brilliancy (-4.2)	
22	05	Uranus 5° S. of Moon	
22	13	Mercury stationary	
24	14	Neptune 3° S. of Moon	
27	21	Penumbral Eclipse visible from Africa	
30	17	Uranus stationary	

AUGUST

1^d	04^h	Mercury greatest elong. W. (19°)	
5	08	Mercury 8° S. of Pollux	
5	15	Aldebaran 0°.5 S. of Moon	Occn.
7	04	Venus 0°.3 S. of Moon	Occn.
9	12	Mercury 2° N. of Moon	
10	21	Solar Eclipse not visible from S.A.	
12	23	Jupiter 1° N. of Moon	Occn.
13	21	Saturn 1° S. of Moon	Occn.
15	23	Mars 5° S. of Moon	
18	03	Mars 2° N. of Spica	
18	13	Uranus 5° S. of Moon	
20	22	Neptune 3° S. of Moon	
24	21	Venus greatestalong. W. (46°)	
26	06	Penumbral Eclipse visible from Africa	
26	14	Mercury in superior conjunction	

SEPTEMBER

1^d	05^h	Neptune stationary	
1	20	Aldebaran 0°.5 S. of Moon	Occn.
2	13	Venus 9° S. of Pollux	
5	12	Venus 0°.4 S. of Moon	Occn.
8	01	Regulus 0°.4 S. of Moon	Occn.
9	15	Mercury 1°.4 S. of Saturn	
13	12	Jupiter in conjunction with Sun	
13	20	Mars 6° S. of Moon	
14	22	Uranus 5° S. of Moon	
14	23	Pallas stationary	
17	05	Juno in conjunction with Sun	
17	06	Neptune 3° S. of Moon	
22	23	Equinox	
23	04	Saturn in conjunction with Sun	
25	04	Mercury 1° N. of Spica	
29	03	Aldebaran 0°.7 S. of Moon	Occn.

OCTOBER

3	02	Mars 1° S. of Uranus	
4	18	Venus 0°.3 S. of Regulus	
5	07	Regulus 0°.5 S. of Moon	Occn.
5	08	Venus 0°.8 S. of Moon	Occn.
7	11	Jupiter 2° S. of Moon	
11	06	Mercury 8° S. of Moon	
11	08	Mercury greatest elong. E. (25°)	
12	07	Uranus 5° S. of Moon	
12	20	Mars 6° S. of Moon	
14	14	Neptune 3° S. of Moon	
15	00	Pluto in conjunction with Sun	
20	06	Pallas at opposition	
23	08	Mercury stationary	
24	18	Mars 4° N. of Antares	
26	13	Aldebaran 0°.8 S. of Moon	Occn.
30	22	Venus 0°.5 N. of Jupiter	

NOVEMBER

1	13	Regulus 0°.8 S. of Moon	Occn.
3	11	Mercury in inferior conjunction	
4	00	Venus 0°.6 S. of Saturn	
4	03	Jupiter 3° S. of Moon	
4	12	Saturn 2° S. of Moon	
4	13	Venus 2° S. of Moon	
10	15	Mars 2° S. of Neptune	
10	21	Mars 5° S. of Moon	
10	21	Neptune 3° S. of Moon	
12	06	Mercury stationary	
17	16	Venus 4° N. of Spica	
18	03	Uranus in conjunction with Sun	
19	21	Mercury greatest elong. W. (20°)	
23	00	Aldebaran 0°.9 S. of Moon	Occn
28	03	Ceres stationary	
28	20	Regulus 1° S. of Moon	Occn.

DECEMBER

1	19	Jupiter 3° S. of Moon	
1	23	Saturn 2° S. of Moon	
3	16	Mercury 0°.9 N. of Uranus	
4	23	Venus 4° S. of Moon	
6	02	Uranus 5° S. of Moon	
9	23	Mars 4° S. of Moon	
11	15	Mercury 5° N. of Antares	
14	08	Neptune in conjunction with Sun	
15	16	Pallas stationary	
16	04	Venus 1° N. of Uranus	
20	10	Aldebaran 0°.9 S. of Moon	Occn.
21	19	Solstice	
25	06	Venus 6° N. of Antares	
26	05	Regulus 1° S. of Moon	Occn.
29	09	Jupiter 3° S. of Moon	
29	10	Saturn 2° S. of Moon	
31	06	Juno 0°.4 S. of Moon	Occn.
31	11	Mercury in superior conjunction	

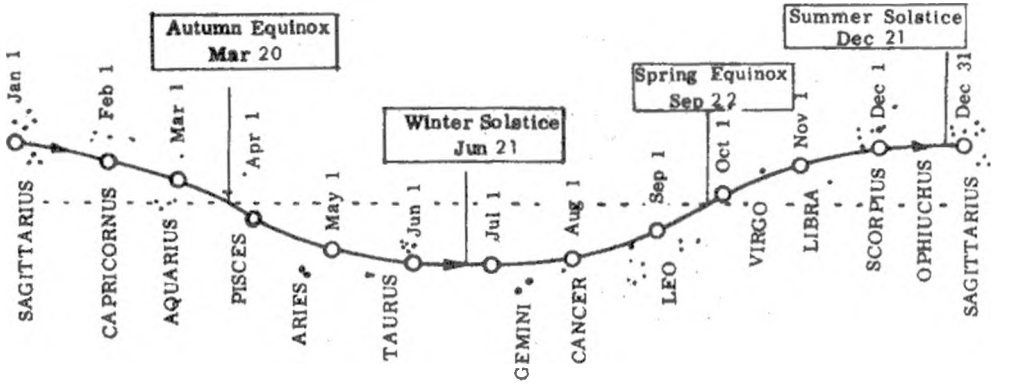
THE SUN 1980

BASIC DATA

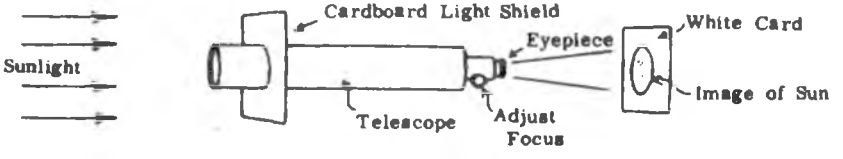
Diameter: 1 392 000 km (109 times Earc
Diameter: 1 392 000 km (109 times Earth diameter)
Mass: 1,99 x 10^{30} kg (330 000 times Earth Mass)
Surface Temperature: Approx. 6000° C
Temperature at centre: Approx. 10 million°C

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 around the Sun is not quite circular. In 1978 we will be closest to the Sun on January 2 (perihelion - approx. distance 147 million km.) and furthest from the Sun on July 5 (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.



TIMES OF SUNRISE AND SUNSET

	CAPE TOWN		DURBAN		BLOEMFONTEIN		JOHANNESBURG		SALISBURY	
	SUNRISE	SUNSET	SUNRISE	SUNSET	SUNRISE	SUNSET	SUNRISE	SUNSET	SUNRISE	SUNSET
Jan 1	05h 35m	20h 01m	04h 55m	19h 01m	05h 21m	19h 18m	05h 19m	19h 04m	05h 24m	18h 35m
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 49	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 56	18 47	05 52	18 27
Mar 1	06 33	19 23	05 46	19 30	06 08	18 48	06 00	18 39	05 55	18 21
11	06 41	19 11	05 52	18 19	06 13	18 38	06 06	18 29	05 57	18 15
21	06 49	18 58	05 59	18 08	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 05	06 24	17 22	06 42	17 44	06 31	17 38	06 10	17 37
11	07 29	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 08	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 28	06 52	17 22	06 23	17 27
21	07 51	17 44	06 51	17 04	07 08	17 27	06 55	17 24	06 26	17 28
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 08	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 48	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 08	18 38	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

Total Eclipse of the Sun on February 16 will be visible on a path across Africa about 8° south of the Equator and then through India to China. Mid Eclipse is at 10.53 a.m. It will be seen through the whole of Southern Africa as a partial eclipse from about 9.20 a.m.

The Annular Eclipse of the Sun on August 10 will be seen only from the Pacific and South America and as a partial eclipse from the southern part of North America. Mid eclipse will be at 9.12 p.m.

THE MOON 1980

BASIC DATA

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

PHASES AND VISIBILITY

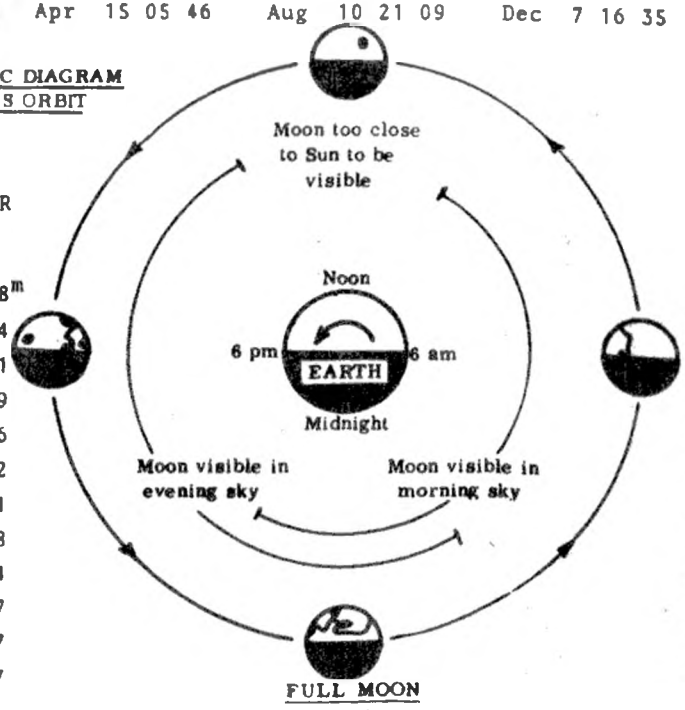
NEW MOON

Jan	$17^d23^h19^m$	May	$14^d14^h00^m$	Sep	$9^d12^h00^m$
Feb	16 10 51	Jun	12 22 38	Oct	9 04 50
Mar	16 20 56	Jul	12 08 46	Nov	7 22 43
Apr	15 05 46	Aug	10 21 09	Dec	7 16 35

SUNLIGHT

SUNLIGHT

SCHEMATIC DIAGRAM OF MOON'S ORBIT



FIRST QUARTER

Jan	$24^d15^h58^m$
Feb	23 02 14
Mar	23 14 31
Apr	22 04 59
May	21 21 16
Jun	20 14 32
Jul	20 07 51
Aug	19 00 28
Sep	17 15 54
Oct	17 05 47
Nov	15 17 47
Dec	15 03 47

LAST QUARTER

Jan	$10^d13^h49^m$
Feb	9 09 35
Mar	10 01 49
Apr	8 14 06
May	7 22 51
Jun	6 04 53
Jul	5 09 27
Aug	3 14 00
Sep	1 20 08
Oct	1 05 18
Oct	30 18 33
Nov	29 11 59
Dec	29 08 32

FULL MOON

Jan	$2^d11^h02^m$	Apr	$30^d09^h35^m$	Sep	$24^d14^h08^m$
Feb	1 04 21	May	29 23 28	Oct	23 22 52
Mar	1 23 00	Jun	28 11 02	Nov	22 08 39
Mar	31 17 14	Jul	27 20 54	Dec	21 20 08
		Aug	26 05 42		

THE MOON'S ORBIT

Dates of Apogee, when the Moon is furthest from the Earth (approx. 407 000 km) and of Perigee, when the Moon is closest to the Earth (approx. 357 000 km) are given below.

MOON AT PERIGEE						MOON AT APOGEE					
Jan	20	May	13	Sep	25	Jan	8	May	24	Oct	10
Feb	17	Jun	9	Oct	24	Feb	5	Jun	21	Nov	6
Mar	17	Jul	5	Nov	21	Mar	3	Jul	19	Dec	3
Apr	14	Jul	31	Dec	19	Mar	30	Aug	16	Dec	31
		Aug	28			Apr	27	Sep	12		

As a result of its motion around the Earth, the Moon appears to make a complete circuit of 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.

LUNAR ECLIPSE

There will be no true eclipses of the Moon this year but there will be three penumbral eclipses on March 1 at 11 p.m., July 27 at 9 p.m. and August 26 at 6 a.m. The entire event will be seen from Southern Africa in the first two cases but moonset will be obscure the second half of the August 26 event.

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 period 4,5 to 3,0 billion years ago. This has produced the heavily cratered topography 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 then 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.

MAP OF THE MOON'S NEAR SIDE

FIRST QUARTER

LAST QUARTER

LIBRATIONS

Jan 14 Feb 10 Mar 11
Apr 4 May 2/29 Jun 25
Jul 22 Aug 18 Sep 15
Oct 12 Nov 8 Dec 5

Jan 26 Feb 24 Mar 23
Apr 17 May 14 Jun 11
Jul 8 Aug 4/31 Sep 27
Oct 25 Nov 21 Dec 18

Dates of Maximum Exposure of Indicated Limbs

Jan 1/28 Feb 24 Mar 23
Apr 20 May 18 Jun 15
Jul 12 Aug 3 Sep 4
Oct 1/29 Nov 27 Dec 25

Jan 14 Feb 10 Mar 11
Apr 8 May 6 Jun 4/28
Jul 25 Aug 22 Sep 19
Oct 18 Nov 15 Dec 12

JOHANNESBURG – TIMES OF THE MOONRISE AND MOONSET

	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
1	18h17m	04h26m	19h19m	05h51m	18h34m	05h30m	18h52m	06h48m	18h44m	07h19m	19h54m	08h52m
2	19 09	05 18	19 57	06 43	19 09	06 21	19 28	07 39	19 27	08 13	20 52	09 44
3	19 57	06 12	20 34	07 35	19 43	07 11	20 05	08 31	20 13	09 07	21 52	10 34
4	20 41	07 02	21 08	08 26	20 17	08 02	20 44	09 24	21 04	10 02	22 53	11 21
5	21 22	07 59	21 42	09 17	20 51	08 52	21 29	10 17	21 59	10 55	23 54	12 05
6	21 59	08 52	22 16	10 07	21 27	09 44	22 16	11 11	22 57	11 47		12 48
7	22 34	09 43	22 51	10 58	22 05	10 36	23 09	12 05	23 57	12 35	00 56	13 30
8	23 08	10 33	23 28	11 49	22 47	11 28		12 58		13 22	01 58	14 11
9	23 42	11 23		12 42	23 32	12 23	00 05	13 49	00 59	14 06	03 01	14 54
10		12 14	00 08	13 37		13 17	01 05	14 39	02 02	14 49	04 04	15 40
11	00 11	13 06	00 52	14 33	00 22	14 12	02 08	15 26	03 05	15 32	05 08	16 27
12	00 53	13 59	01 41	15 30	01 18	15 06	03 12	16 11	04 10	16 16	06 10	17 18
13	01 32	14 54	02 36	16 26	02 18	15 59	04 18	16 56	05 15	17 01	07 11	18 13
14	02 15	15 52	03 36	17 22	03 22	16 49	05 24	17 41	06 21	17 49	08 08	19 08
15	03 03	16 49	04 39	18 14	04 28	17 37	06 31	18 26	07 25	18 39	09 00	20 05
16	03 56	17 47	05 46	19 04	05 35	18 23	07 37	19 13	08 28	19 32	09 47	21 00
17	04 55	18 44	06 52	19 51	06 42	19 08	08 42	20 02	09 27	20 27	10 30	21 55
18	05 57	19 37	07 59	20 35	07 48	19 54	09 44	20 54	10 21	21 23	11 09	22 48
19	07 02	20 28	09 04	21 20	08 54	20 39	10 44	21 46	11 10	22 18	11 45	23 39
20	08 07	21 15	10 08	22 03	09 58	21 26	11 39	22 40	11 54	23 12	12 19	
21	09 12	21 59	11 10	22 47	11 00	22 14	12 30	23 35	12 34		12 53	00 30
22	10 15	22 42	12 11	23 33	11 59	23 04	13 15		13 11	00 05	13 26	01 20
23	11 18	23 23	13 10		12 55	23 56	13 57	00 28	13 46	00 56	14 02	02 11
24	12 19		14 06	00 20	13 46		14 35	01 20	14 20	01 47	14 39	03 03
25	13 18	00 06	14 59	01 10	14 34	00 49	15 11	02 12	14 53	02 37	15 18	03 57
26	14 17	00 49	15 49	02 01	15 17	01 41	15 45	03 03	15 27	03 28	16 03	04 52
27	15 15	01 35	16 35	02 53	15 57	02 34	16 19	03 53	16 03	04 20	16 52	05 47
28	16 10	02 22	17 17	03 45	16 34	03 26	16 53	04 44	16 42	05 12	17 46	06 43
29	17 03	03 12	17 57	04 38	17 10	04 17	17 27	05 35	17 24	06 06	18 43	07 38
30	17 52	04 04			17 44	05 08	18 05	06 26	18 10	07 02	19 43	08 30
31	18 37	04 58			18 18	05 58			19 00	07 57		

JOHANNESBURG – TIMES OF MOONRISE AND MOONSET

	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
1	20h45m	09h20m	22h47m	10h12m	h m	11h05m	00h36m	11h35m	01h41m	13h07m	01h30m	13h36m
2	21 48	10 05	23 49	10 53	00 46	11 54	01 29	12 29	02 19	13 59	02 03	14 26
3	22 50	10 49		11 36	01 45	12 46	02 17	13 24	02 55	14 51	02 36	15 17
4	23 52	11 31	00 51	12 21	02 40	13 39	03 01	14 20	03 28	15 41	03 09	16 07
5		12 11	01 52	13 07	03 31	14 34	03 41	15 12	04 01	16 31	03 45	16 59
6	00 53	12 53	02 52	13 57	04 18	15 28	04 18	16 03	04 35	17 22	04 23	17 52
7	01 55	13 36	03 50	14 50	05 01	16 22	04 53	16 54	05 09	18 13	05 04	18 46
8	02 57	14 22	04 44	15 44	05 40	17 15	05 27	17 45	05 46	19 05	05 49	19 40
9	03 59	15 10	05 34	16 39	06 17	18 07	06 00	18 36	06 24	19 58	06 38	20 32
10	04 59	16 02	06 20	17 35	06 52	18 59	06 33	19 26	07 06	20 51	07 31	21 22
11	05 57	16 57	07 02	18 29	07 25	19 49	07 08	20 18	07 52	21 44	08 26	22 10
12	06 50	17 52	07 41	19 22	07 58	20 40	07 45	21 10	08 42	22 35	09 24	22 55
13	07 40	18 48	08 17	20 14	08 32	21 30	08 25	22 02	09 35	23 24	10 24	23 38
14	08 25	19 43	08 51	21 04	09 08	22 21	09 08	22 54	10 31		11 24	
15	09 06	20 37	09 25	21 55	09 46	23 14	09 55	23 46	11 30	00 10	12 25	00 19
16	09 43	21 30	09 59	22 45	10 27		10 46		12 30	00 56	13 26	00 59
17	10 18	22 21	10 33	23 37	11 12	00 06	11 41	00 37	13 32	01 39	14 30	01 41
18	10 52	23 12	11 10		12 01	01 00	12 40	01 27	14 35	02 21	15 33	02 23
19	11 26		11 49	00 29	12 56	01 53	13 41	02 15	15 40	03 03	16 39	03 08
20	11 59	00 03	12 32	01 22	13 54	02 45	14 44	03 00	16 46	03 46	17 45	03 57
21	12 35	00 54	13 20	02 12	14 56	03 36	15 50	03 44	17 54	04 31	18 47	04 50
22	13 13	01 46	14 14	03 11	16 01	04 24	16 56	04 28	19 01	05 20	19 47	05 47
23	13 56	02 39	15 12	04 06	17 07	05 11	18 04	05 13	20 06	06 12	20 42	06 46
24	14 42	03 34	16 14	04 59	18 14	05 56	19 11	05 58	21 07	07 07	21 30	07 46
25	15 33	04 30	17 18	05 49	19 20	06 40	20 18	06 45	22 04	08 05	22 14	08 44
26	16 29	05 26	18 23	06 37	20 27	07 25	21 24	07 36	22 54	09 04	22 53	09 41
27	17 30	06 20	19 30	07 23	21 33	08 11	22 25	08 29	23 39	10 02	23 29	10 35
28	18 32	07 12	20 34	08 06	22 37	08 59	23 22	09 24		10 58		11 27
29	19 37	08 00	21 40	08 50	23 38	09 49		10 21	00 19	11 52	00 03	12 18
30	20 41	08 46	22 43	09 33		10 41	00 14	11 17	00 56	12 44	00 36	13 09
31	21 44	09 30	23 46	10 19			01 00	12 13			01 09	14 00

CAPE TOWN – TIMES OF MOONRISE AND MOONSET
FOR PORT ELIZABETH SUBTRACT 28 MINUTES

	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
1	19h09m	04h51m	20h07m	06h17m	19h18m	06h01m	19h26m	07h29m	19h12m	08h07m	20h18m	09h44m
2	20 01	05 43	20 43	07 13	19 51	06 54	20 00	08 23	19 53	09 03	21 16	10 36
3	20 49	06 37	21 18	08 07	20 22	07 48	20 34	09 17	20 38	09 59	22 18	11 25
4	21 31	07 31	21 49	09 00	20 53	08 41	21 12	10 13	21 28	10 54	23 22	12 09
5	22 09	08 27	22 21	09 54	21 24	09 34	21 54	11 07	22 24	11 47		12 51
6	22 44	09 22	22 51	10 46	21 58	10 29	22 41	12 03	23 22	12 38	00 26	13 30
7	23 17	10 15	23 24	11 40	22 34	11 22	23 33	12 57		13 25	01 31	14 09
8	23 48	11 09	23 59	12 34	23 13	12 18		13 50	00 25	14 09	02 38	14 47
9		12 02		13 30	23 57	13 13	00 30	14 40	01 29	14 50	03 43	15 26
10	00 20	12 55	00 36	14 27		14 09	01 32	15 27	02 36	15 31	04 50	16 09
11	00 51	13 50	01 18	15 24	00 47	15 04	02 36	16 12	03 43	16 09	05 57	16 54
12	01 25	14 46	02 06	16 22	01 43	15 58	03 44	16 54	04 51	16 50	07 02	17 43
13	02 02	15 43	03 00	17 18	02 43	16 49	04 53	17 36	06 00	17 31	08 04	18 37
14	02 43	16 42	04 00	18 12	03 49	17 36	06 03	18 17	07 08	18 17	09 01	19 33
15	03 29	17 41	05 06	19 03	04 58	18 22	07 13	18 59	08 16	19 05	09 52	20 30
16	04 21	18 40	06 14	19 50	06 08	19 05	08 23	19 43	09 20	19 57	10 38	21 27
17	05 19	19 35	07 24	20 33	07 19	19 46	09 31	20 29	10 19	20 51	11 19	22 24
18	06 23	20 28	08 34	21 15	08 29	20 28	10 36	21 19	11 13	21 48	11 55	23 19
19	07 30	21 15	09 43	21 56	09 38	21 10	11 37	22 11	12 01	22 44	12 29	
20	08 38	21 59	10 51	22 35	10 45	21 54	12 32	23 05	12 43	23 40	13 00	00 13
21	09 45	22 41	11 57	23 17	11 50	22 40	13 21		13 22		13 31	01 07
22	10 52	23 19	12 59		12 51	23 29	14 06	00 00	13 56	00 35	14 02	02 00
23	11 58	23 58	14 01	00 00	13 47		14 46	00 54	14 28	01 29	14 34	02 54
24	13 02		14 58	00 46	14 38	00 21	15 21	01 49	14 59	02 23	15 09	03 49
25	14 05	00 37	15 52	01 34	15 25	01 14	15 55	02 44	15 30	03 16	15 46	04 45
26	15 07	01 18	16 41	02 25	16 07	02 07	16 26	03 37	16 01	04 10	16 29	05 42
27	16 06	02 01	17 26	03 18	16 45	03 01	16 58	04 30	16 35	05 04	17 16	06 39
28	17 02	02 47	18 06	04 12	17 20	03 56	17 28	05 23	17 11	05 59	18 10	07 36
29	17 55	03 37	18 44	05 06	17 53	04 49	18 00	06 18	17 50	06 56	19 08	08 30
30	18 44	04 29			18 24	05 43	18 35	07 12	18 35	07 53	20 09	09 21
31	19 27	05 23			18 55	06 36			19 24	08 59		

CAPE TOWN – TIMES OF MOONRISE AND MOONSET
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	21h13m	10h09m	23h27m	10h49m	00h35m	11h32m	01h29m	11h58m	02h30m	13h36m	02h12m	14h12m
2	22 19	10 52		11 28	01 38	12 19	02 21	12 54	03 05	14 31	02 42	15 05
3	23 24	11 32	00 33	12 07	02 38	13 10	03 09	13 50	03 38	15 25	03 12	15 59
4		12 11	01 38	12 49	03 33	14 03	03 50	14 46	04 09	16 18	03 43	16 52
5	00 30	12 49	02 42	13 34	04 23	14 59	04 29	15 42	04 39	17 12	04 16	17 47
6	01 35	13 27	03 44	14 22	05 09	15 55	05 03	16 36	05 09	18 06	04 51	18 42
7	02 40	14 06	04 42	15 13	05 50	16 51	05 35	17 30	05 41	18 59	05 29	19 38
8	03 45	14 50	05 36	16 08	06 27	17 46	06 06	18 23	06 15	19 54	06 13	20 33
9	04 49	15 36	06 26	17 05	07 01	18 41	06 36	19 17	06 51	20 48	07 01	21 25
10	05 51	16 26	07 11	18 01	07 33	19 36	07 07	21 10	07 31	21 43	07 54	22 15
11	06 50	17 20	07 51	18 58	08 04	20 29	07 40	21 04	08 16	22 37	08 51	23 02
12	07 43	18 17	08 27	19 53	08 34	21 22	08 14	21 59	09 05	23 27	09 51	23 44
13	08 32	19 14	09 00	20 48	09 05	22 15	08 51	22 53	09 59		10 53	
14	09 14	20 12	09 31	21 42	09 39	23 09	09 32	23 47	10 56	00 16	11 56	00 24
15	09 53	21 08	10 03	22 35	10 14		10 18		11 57	01 01	13 00	01 02
16	10 28	22 03	10 33	23 29	10 53	00 04	11 10	00 39	13 00	01 44	14 06	01 39
17	11 00	22 57	11 05		11 36	00 58	12 06	01 30	14 06	02 23	15 12	02 17
18	11 31	23 50	11 39	00 22	12 25	01 53	13 06	02 19	15 12	03 02	16 19	02 55
19	12 02		12 16	01 17	13 20	02 46	14 10	03 03	16 21	03 40	17 28	03 38
20	12 33	00 44	12 58	02 12	14 19	03 37	15 16	03 47	17 31	04 20	18 36	04 23
21	13 07	01 38	13 45	03 08	15 24	04 26	16 25	04 27	18 41	05 02	19 41	05 14
22	13 42	02 33	14 38	04 04	16 31	05 12	17 35	05 08	19 51	05 48	20 41	06 10
23	14 22	03 29	15 36	04 58	17 40	05 56	18 46	05 49	20 58	06 37	21 34	07 10
24	15 07	04 25	16 40	05 50	18 51	06 38	19 57	06 30	22 01	07 31	22 22	08 10
25	15 57	05 23	17 46	06 38	20 01	07 18	21 08	07 14	22 57	08 29	23 03	09 11
26	16 54	06 19	18 56	07 24	21 12	07 59	22 15	08 02	23 46	09 28	23 39	10 10
27	17 55	07 12	20 05	08 05	22 21	08 41	23 19	08 54		10 27		11 07
28	19 00	08 02	21 14	08 46	23 28	09 27		09 48	00 28	11 26	00 12	12 02
29	20 07	08 48	22 22	09 26		10 14	00 15	10 45	01 06	12 23	00 43	12 56
30	21 14	09 31	23 29	10 06	00 31	11 05	01 06	11 42	01 40	13 18	01 13	13 50
31	22 21	10 11		10 48			01 51	12 39			01 43	14 44

DURBAN – TIMES OF MOONRISE AND MOONSET
FOR BLOEMFONTEIN ADD 19 MINUTES

	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
1	18h09m	04h07m	19h09m	05h32m	18h23m	05h13m	18h37m	06h35m	18h27m	07h09m	19h34m	08h44m
2	19 01	04 59	19 47	06 26	18 57	06 05	19 12	07 27	19 08	08 04	20 32	09 36
3	19 49	05 53	20 23	07 18	19 30	06 57	19 48	08 20	19 54	08 59	21 33	10 26
4	20 32	06 46	20 56	08 11	20 03	07 48	20 27	09 14	20 45	09 54	22 35	11 12
5	21 12	07 40	21 29	09 02	20 36	08 39	21 10	10 08	21 39	10 47	23 38	11 55
6	21 49	08 34	22 02	09 53	21 11	09 32	21 57	11 03	22 38	11 38		12 36
7	22 23	09 27	22 36	10 45	21 48	10 25	22 50	11 57	23 39	12 27	00 41	13 16
8	22 56	10 18	23 12	11 38	22 29	11 19	23 45	12 50		13 12	01 44	13 57
9	23 29	11 09	23 51	12 32	23 13	12 14		13 40	00 42	13 55	02 48	14 38
10		12 01		13 28		13 09	00 46	14 29	01 45	14 37	03 53	15 22
11	00 02	12 54	00 33	14 24	00 03	14 04	01 50	15 16	02 50	15 18	04 58	16 09
12	00 37	13 49	01 22	15 22	00 58	14 58	02 55	16 00	03 57	16 00	06 01	16 59
13	01 16	14 45	02 16	16 18	01 59	15 49	04 02	16 43	05 03	16 44	07 02	17 53
14	01 57	15 43	03 16	17 13	03 03	16 39	05 10	17 26	06 10	17 31	08 00	18 48
15	02 44	16 41	04 20	18 04	04 10	17 26	06 18	18 10	07 16	18 20	08 52	19 45
16	03 37	17 39	05 27	18 54	05 18	18 11	07 26	18 56	08 19	19 13	09 39	20 41
17	04 35	18 36	06 35	19 39	06 27	18 54	08 32	19 44	09 19	20 07	10 21	21 37
18	05 38	19 28	07 43	20 22	07 35	19 38	09 35	20 35	10 13	21 03	10 59	22 31
19	06 43	20 18	08 50	21 05	08 42	20 22	10 35	21 27	11 02	21 59	11 34	23 23
20	07 49	21 04	09 55	21 47	09 47	21 08	11 31	22 20	11 45	22 53	12 07	
21	08 55	21 47	10 59	22 30	10 50	21 56	12 21	23 15	12 24	23 47	12 40	00 15
22	10 00	22 28	12 01	23 14	11 50	22 45	13 07		13 01		13 12	01 07
23	11 04	23 09	13 01		12 47	23 37	13 48	00 09	13 35	00 40	13 46	01 59
24	12 06	23 49	13 58	00 01	13 38		14 26	01 02	14 07	01 32	14 22	02 52
25	13 08		14 51	00 51	14 26	00 30	15 00	01 55	14 39	02 23	15 01	03 47
26	14 08	00 31	15 41	01 42	15 08	01 23	15 33	02 47	15 12	03 15	15 44	04 43
27	15 07	01 16	16 27	02 34	15 47	02 15	16 06	03 38	15 47	04 08	16 33	05 39
28	16 02	02 03	17 08	03 26	16 24	03 08	16 39	04 30	16 25	05 02	17 26	06 35
29	16 55	02 53	17 47	04 20	16 59	04 00	17 12	05 22	17 06	05 57	18 23	07 30
30	17 44	03 45			17 32	04 53	17 48	06 15	17 50	06 53	19 24	08 21
31	18 29	04 38			18 04	05 44			18 40	07 49		

DURBAN – TIMES OF MOONRISE AND MOONSET
FOR BLOEMFONTEIN ADD 19 MINUTES

	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
1	20h27m	09h11m	22h33m	09h58m	h m	10h47m	00h28m	11h14m	01h32m	12h49m	01h18m	13h21m
2	21 30	09 55	23 37	10 39	00 37	11 35	01 21	12 09	02 10	13 42	01 50	14 12
3	22 34	10 37		11 19	01 37	12 27	02 09	13 05	02 44	14 35	02 22	15 04
4	23 37	11 18	00 40	12 03	02 32	13 20	02 52	14 00	03 16	15 26	02 54	15 56
5		11 57	01 42	12 49	03 23	14 14	03 31	14 54	03 48	16 18	03 29	16 49
6	00 40	12 38	02 43	13 38	04 10	15 09	04 08	15 47	04 20	17 10	04 05	17 43
7	01 43	13 19	03 42	14 30	04 52	16 04	04 41	16 39	04 53	18 02	04 45	18 38
8	02 46	14 04	04 36	15 24	05 30	16 58	05 14	17 31	05 29	18 56	05 29	19 32
9	03 49	14 51	05 26	16 20	06 06	17 51	05 46	18 23	06 06	19 49	06 18	20 24
10	04 50	15 43	06 12	17 16	06 40	18 44	06 18	19 14	06 48	20 43	07 11	21 14
11	05 49	16 36	06 53	18 11	07 12	19 35	06 52	20 07	07 32	21 36	08 06	22 02
12	06 42	17 32	07 31	19 05	07 44	20 27	07 28	21 00	08 22	22 27	09 05	22 46
13	07 32	18 29	08 06	19 58	08 17	21 19	08 07	21 53	09 15	23 15	10 06	23 28
14	08 16	19 25	08 39	20 50	08 52	22 11	08 48	22 46	10 12		11 07	
15	08 56	20 20	09 11	21 42	09 29	23 05	09 35	23 38	11 11	00 02	12 10	00 07
16	09 33	21 14	09 44	22 33	10 09	23 58	10 26		12 13	00 46	13 12	00 47
17	10 07	22 06	10 17	23 26	10 52		11 21	00 29	13 16	01 28	14 17	01 27
18	10 39	22 58	10 53		11 42	00 52	12 21	01 18	14 20	02 08	15 22	02 07
19	11 12	23 50	11 32	00 19	12 35	01 45	13 23	02 06	15 27	02 49	16 29	02 51
20	11 44		12 14	01 13	13 35	02 37	14 27	02 50	16 34	03 30	17 36	03 39
21	12 19	00 42	13 01	02 08	14 38	03 27	15 34	03 33	17 43	04 14	18 39	04 31
22	12 56	01 35	13 54	03 03	15 43	04 15	16 42	04 15	18 51	05 02	19 39	05 26
23	13 37	02 30	14 52	03 58	16 50	05 00	17 51	04 58	19 57	05 53	20 34	06 26
24	14 23	03 26	15 55	04 50	17 59	05 44	19 00	05 42	20 59	06 47	21 22	07 26
25	15 14	04 22	16 59	05 39	19 07	06 26	20 08	06 28	21 56	07 45	22 05	08 25
26	16 09	05 18	18 06	06 27	20 15	07 10	21 15	07 17	22 45	08 44	22 43	09 23
27	17 10	06 12	19 14	07 11	21 22	07 54	22 17	08 10	23 30	09 43	23 18	10 18
28	18 14	07 03	20 20	07 53	22 28	08 41	23 14	09 04		10 40	23 51	11 12
29	19 19	07 51	21 27	08 35	23 29	09 30		10 01	00 09	11 35		12 04
30	20 24	08 35	22 32	09 17		10 21	00 05	10 58	00 45	12 28	00 22	12 56
31	21 29	09 17	23 36	10 01			00 52	11 54			00 54	13 48

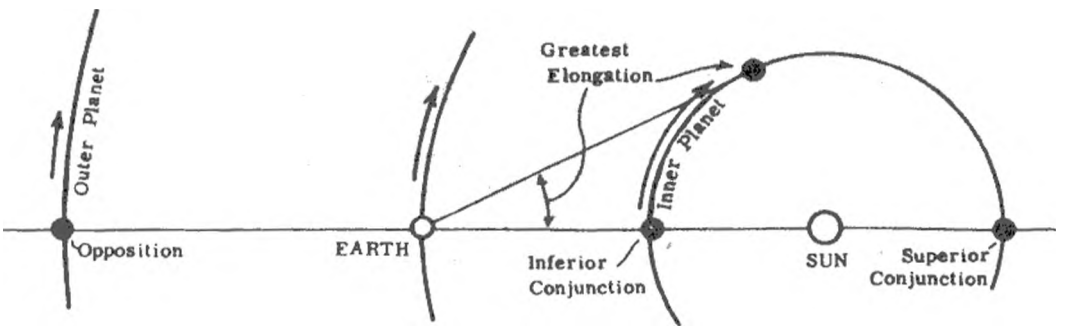
THE PLANETS 1980

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	$23^h 56^m$	$23^\circ 27'$
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

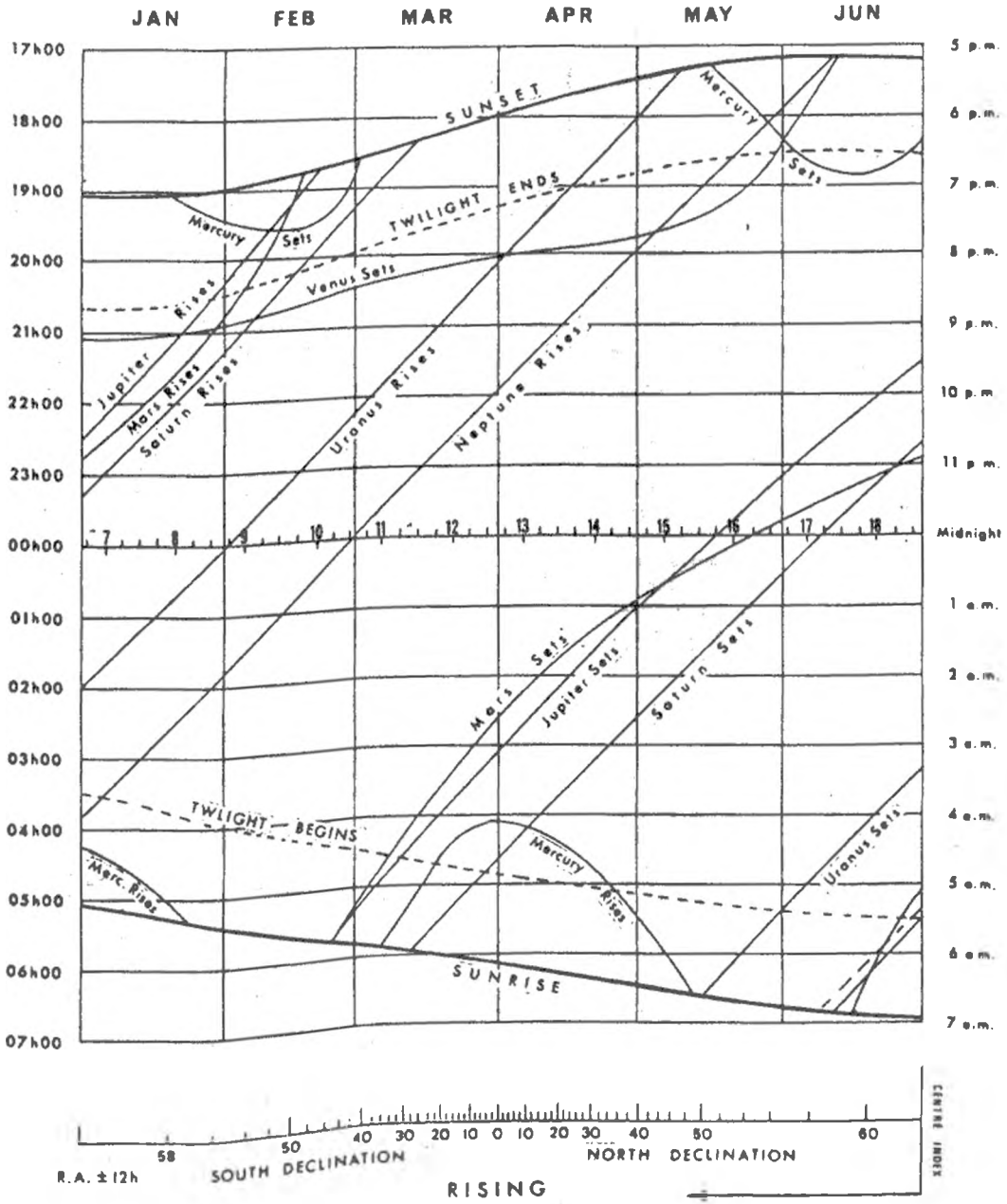
Apart from Uranus, Neptune and Pluto, the planets of our solar system are amongst the brightest objects in the night sky. Unlike the distant stars, their relative positions do not remain fixed, but continually change as, like the Earth, they orbit around the Sun. Their apparent movements against the 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 1978 are listed chronologically in the Diary (pages 4 and 5) and are also mentioned in the text below.



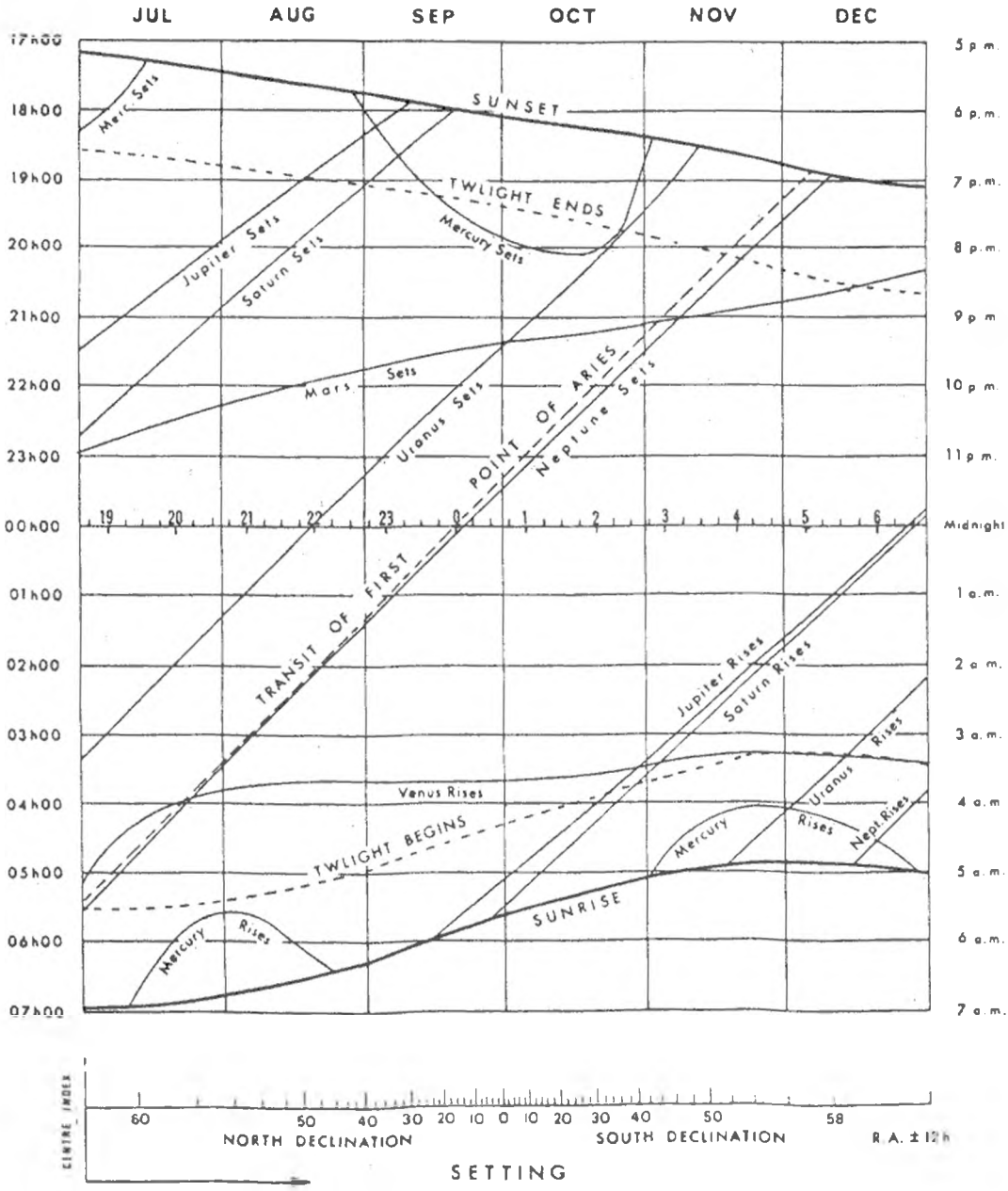
TIMES OF RISING AND SETTING

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 scales at the bottom of these pages are for finding rising or setting times of any object of which the right ascension and declination are known. Set dividers or a strip of paper from the index at the centre of the scale to the object's declination and in the direction desired for either



rising or setting. Measure this same distance and direction along the midnight line, beginning at the objects right ascension indicated by the numerals. (Should this end point fall outside the chart, 12 hours should be added to or subtracted from the right ascension. Reset the dividers using the end of the scale instead of the centre index, and measure in the opposite direction to that first used). Through the point established draw a line parallel to the First Point of Aries transit line (indicated by the dashed line on the chart).



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, resolves around the Sun faster than any of the other planets. Being close to the Sun it can only be seen just after sunset or just before sunrise, when it is near greatest elongation (greatest angle between Mercury and Sun as seen from the Earth). Except when in transit, it can never be seen near inferior conjunction (passing between Earth and Sun) or near superior conjunction (passing round the far side of the Sun). The angular diameter of Mercury's disc rarely exceeds 10 seconds of arc so it is difficult to make out any features on the disc, but phases (like those of the Moon) might just be visible. Close up photography by the Mariner 10 spacecraft has shown that the planet's surface is incredibly similar to that of the moon.

	d	h	d	h	d	h
Greatest elongation East	Feb 19	14(18°)	Jun 14	16(24°)	Oct 11	06(25°)
Stationary	Feb 25	13	Jun 27	22	Oct 23	08
Inferior conjunction ...	Mar 6	08	Jul 11	21	Nov 3	11
Stationary	Mar 18	17	Jul 22	13	Nov 12	06
Greatest elonagtion West	Apr 2	19(28°)	Aug 1	04(19°)	Nov 19	21(20°)
Superior conjunction ...	Jan 21	11	May 13	11	Aug 26	14
					Dec 31	11

VENUS

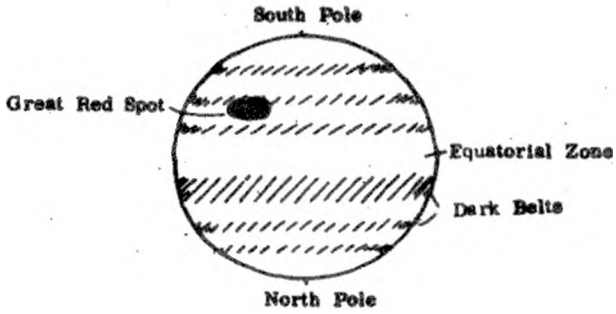
Venus will be seen in the evening sky till June but after that will be too close to the sun for viewing till about the beginning of July after which it will be in the morning sky till the end of the year. Its apparent diameter will change from 12" in January to 58" in June and to 11" at the end of the year. It will be brightest -4.2 at the beginning of May and -4.2 in late July.

MARS

Mars rises before midnight at the beginning of the year and is at opposition on February 25,when it is visible throughout the night as a reddish object in Leo. Its eastern elongation gradually decreases (while it remains in Leo, passing 4°N of Regulus on March 17 and 1.8 N. of Regulus on April 29), and from the beginning of June onwards it is visible only in the evening sky (moving from Leo through Virgo, passing 2°N. of Spica on August 18, and then through Libra and Scorpius, passing 4°N. of Antares on October 24, Ophiuchus and into Sagittarius in Mid-November). At the end of the year Mars enters Capricornus. Mars is in conjunction with Jupiter on March 2 and May 4, and with Saturn on June 25.

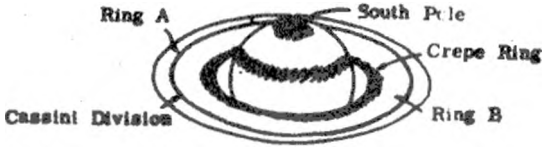
JUPITER

Jupiter is a prominent object in the evening sky till August. From November it will be a morning sky object. It is at its brightest (mag.-2.1) in February fading to -1.2 in September and then brightening to -1.6 in December. Because of its large angular size(42 seconds of arc at opposition 4.4au from Earth,28 seconds of arc at conjunction 6.4au), Jupiter makes an excellent object for a small telescope. It is often possible to see features on the disc: dark and light cloud bands running parallel to the equator and spots, in particular the famous Great Red Spot. These are indicated in the diagram below. The great Red Spot is not always visible because of the rotation of the planet. Also clearly visible are four of Jupiter's fourteen moons. An entire section of this Handbook is devoted to the movements of these satellites and the Phenomena associated with them(see page 23). Jupiter is now known to have a ring similar to those of Saturn and Uranus.



SATURN

Saturn is in the constellation of Virgo till early April and in Leo till mid July when it returns to Virgo. It will be clearly seen in the evening sky till September and in the morning sky from October until the end of the year. It is at its greatest brightness(mag. 0.8) at opposition on March 14, The diagram below shows its appearance through a small telescope (the scale is the same as for Jupiter diagram) - including the spectacular ring system. The angle varies from 6° in January to 1° in March, 6° in June 1° in October and 6° in January.

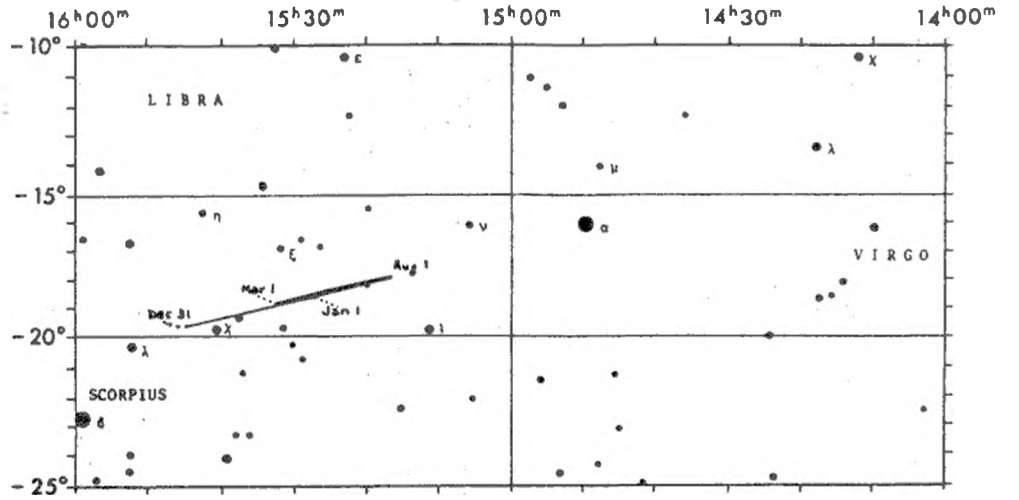


URANUS

Uranus, at opposition on May 14 and conjunction on November 18, is in the constellation of Libra all year. It is on the border of naked eye visibility (magnitude 5.7 at opposition) and may be found with the aid of binoculars and references to the accompanying finding chart, which shows all of the stars in the region down to the same faintness. With a small telescope, its disc (angular diameter 4 seconds of arc) may just be distinguished. Uranus is now known to have rings similar to those of Saturn.

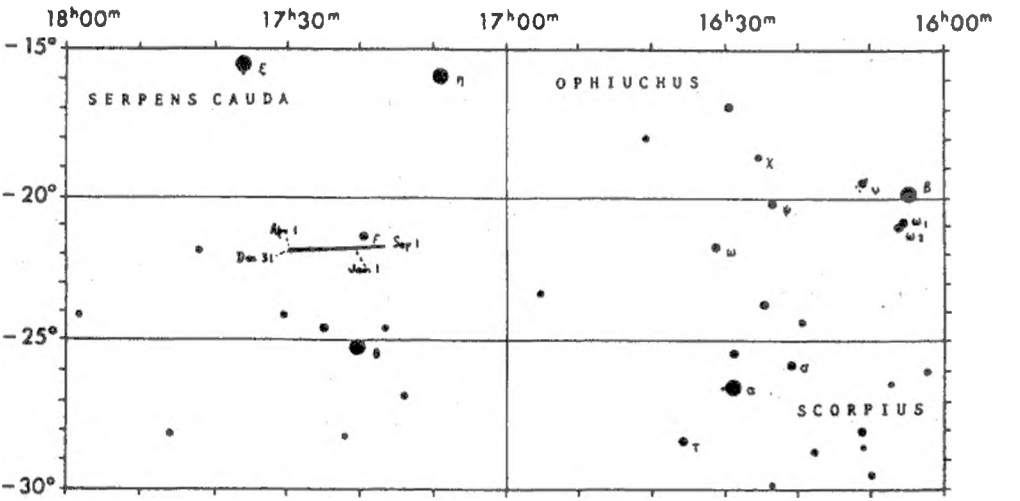
NEPTUNE

Neptune lies in the constellation of Ophiuchus close to the conspicuous constellation of Scorpius. It is far too faint to be seen with the naked eye - magnitude 7,7 at opposition on June 12 - but may be located using the finding chart below (which shows all stars down to magnitude 7,7) and a small telescope. Its angular diameter is only 2,5 seconds of arc, but its non-stellar appearance should aid in identification.



PLUTO

During the year Pluto moves in the constellation of Virgo between the coordinates RA 13^h34^m and 13^h53^m and Dec $+8^\circ37'$ and $+8^\circ51'$. Since it is very faint, magnitude 14, it can only be found using a large telescope and specially prepared finding charts.



THE MOONS OF JUPITER AND SATURN 1980

JUPITER'S MOON

One of the most popular sights for an observer with a small telescope is Jupiter and its moons. Four of Jupiter's fourteen moons are large enough to be seen very easily - they would even be visible to the naked eye were it not for the glare of the mother planet. In order of increasing distance from Jupiter, the four moons are Io, which orbits once around Jupiter in less than 2 days; Europa, 3½ days; Ganymede, 7 days; and Callisto which takes 17 days for a full circuit. All the orbits lie in Jupiter's equatorial plane and the system is seen almost edge on. As the moons circle Jupiter, they appear to oscillate from side to side alternatively passing in front of and behind the planet. Their configurations change from night to night and are shown in the diagrams on pages 26 and 27.

EVENTS RELATED TO THE MOONS PASSING IN FRONT OF AND BEHIND JUPITER

The table below lists all events occurring between the end of twilight and just after midnight when the planet is above the horizon in Southern Africa.

Explanation of table:

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

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

Phenomena - the abbreviations used are:

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

Jan	3	22^h53^m	III Sh I
	4	22 27	II Oc R
	5	23 40	I Ec D
	6	22 01	I Tr I
		23 17	I Sh E
	7	00 16	I Tr E
	9	00 02	IV Tr E
	10	00 58	II Sh I
	12	00 48	II Oc R
	13	22 54	I Sh I
		23 48	I Tr I
	14	23 12	I Oc R
		23 56	III Oc R
	16	23 57	IV Ec R
	18	22 40	II Ec D
	22	22 16	I Tr E
	27	22 19	II Sh E
		23 37	II Tr E
	28	23 49	I Ec D
	29	21 40	I Tr I
		23 26	I Sh E
	30	00 01	I Tr E

Feb	1	20 25	III Tr E
	2	22 35	IV Oc R
	3	22 01	II Sh I
		23 01	II Tr I
	5	20 49	II Oc R
		23 03	I Sh I
		23 30	I Tr I
	6	20 11	I Ec D
		22 55	I Oc R
	7	20 11	I Tr E
	8	20 18	III Tr I
		22 15	III Sh E
		23 44	III Tr E
	10	22 40	IV Sh I
	12	23 03	II Oc R
	14	21 41	I Sh E
		21 55	I Tr E
	15	22 39	III Sh I
		23 34	III Tr I
	19	22 13	II Ec D
	20	23 59	I Ec D
	21	19 26	II Sh E
		19 34	II Tr E
		21 18	I Sh I
		21 23	I Tr I

Feb	21	23^h35^m	I Sh E
		23 38	I Tr E
	22	20 49	I Oc R
	27	20 06	IV Tr E
		20 57	IV Sh E
	28	21 50	II Tr E
		22 03	II Sh E
		23 06	I Tr I
		23 12	I Sh I
	29	20 15	I Oc D
		22 41	I Ec R
Mar	4	19 46	III Oc D
	6	21 11	II Tr I
		21 44	II Sh I
		23 04	IV Oc D
	7	21 59	I Oc D
	8	19 28	II Ec R
		19 35	I Sh I
		21 32	I Tr E
		21 51	I Sh E
	11	23 03	III Oc D
	13	23 28	II Tr I
	14	23 44	I Oc D
	15	21 01	I Tr I

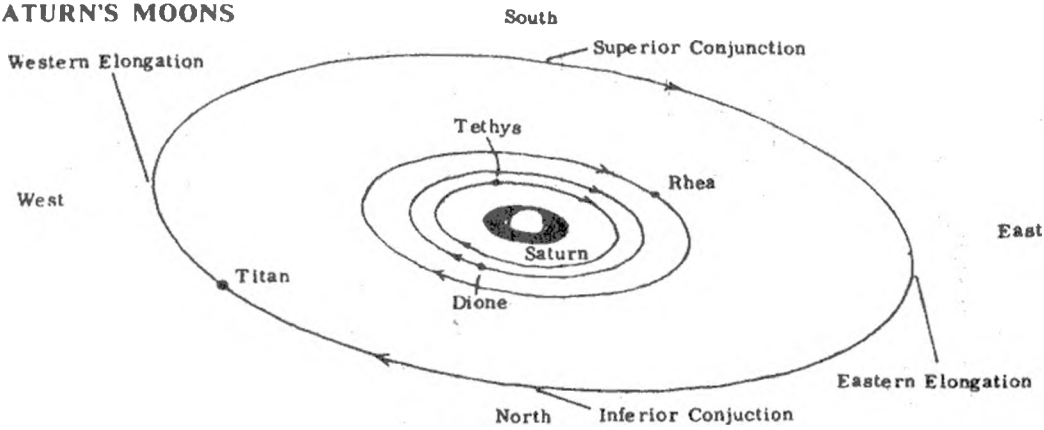
Mar	21	29	I Sh I
	22	02	II Ec R
	23	16	I Tr E
	23	45	I Sh E
16	20	58	I Ec R
22	19	30	III Tr E
	20	32	II Oc D
	22	03	III Sh E
	22	46	I Tr I
	23	23	I Sh I
23	19	37	IV Ec D
	19	56	I Oc D
	22	53	I Ec R
	23	44	IV Ec R
24	19	28	I Tr E
	20	07	I Sh E
29	19	25	III Tr I
	22	31	III Sh I
	22	50	II Oc D
	22	55	III Tr E
30	21	42	I Oc D
31	18	59	I Tr I
	19	56	I Sh I
31	20^h10^m		II Tr E
	21	08	IV Tr I
	21	14	I Tr E
	21	48	II Sh E
	22	01	I Sh E
Apr 1	19	17	I Ec R
5	22	53	III Tr I
6	23	30	I Oc D
7	19	38	II Tr I
	20	46	I Tr I
	21	31	II Sh I
	21	40	I Sh I
	22	30	II Tr E
	23	01	I Tr E
	23	56	I Sh E
8	21	12	I Ec R
9	18	24	I Sh E
	19	01	II Ec R
	20	05	III Ec R
14	22	03	II Tr I
	22	35	I Tr I
	23	35	I Sh I
15	00	08	II Sh I
	19	46	I Oc D
	23	07	I Ec R
16	18	04	I Sh I
	19	17	I Tr E
	19	49	III Oc R
	20	18	I Sh E
	20	33	III Ec D
	21	36	II Ec R
17	22	41	IV Sh I
22	21	36	I Oc D
23	18	52	I Tr I
	19	07	II Oc D
	19	57	III Oc D
	19	58	I Sh I
	21	07	I Tr E

Apr	22	13	I Sh E
	23	29	III Oc R
24	19	31	I Ec R
25	18	58	II Sh E
	20	32	IV Oc D
29	23	28	I Oc D
30	20	43	I Tr I
	21	34	II Oc D
	21	53	I Sh I
30	22^h58^m		I Tr E
	23	41	III Oc D
May 1	00	07	I Sh E
	21	26	I Ec R
2	18	36	I Sh E
	18	42	II Sh I
	19	10	II Tr E
	21	36	II Sh E
4	18	27	III Sh I
	20	37	IV Sh E
	21	53	III Sh E
7	22	35	I Tr I
	23	47	I Sh I
8	19	49	I Oc D
	23	22	I Ec R
9	18	16	I Sh I
	18	48	II Tr I
	19	18	I Tr E
	20	31	I Sh E
	21	20	II Sh I
	21	43	II Tr E
10	17	50	I Ec R
11	18	36	II Ec R
	20	52	III Tr E
	22	26	III Sh I
12	17	51	IV Oc R
15	21	42	I Oc D
16	18	56	I Tr I
	20	11	I Sh I
	21	11	I Tr E
	21	23	II Tr I
	22	25	I Sh E
	23	57	II Sh I
17	00	17	II Tr E
	19	46	I Ec R
18	21	11	II Ec R
	21	16	III Tr I
20	22	41	IV Tr I
22	20	00	III Ec R
	23	37	I Oc D
23	20	51	I Tr I
	22	06	I Sh I
	23	06	I Tr E
24	18	06	I Oc D
	21	41	I Ec R
25	18	26	II Oc D
	18	49	I Sh E

May 25	23^h46^m		II Ec R
27	18	45	II Sh E
29	18	55	III Oc R
	19	54	IV Ec D
	20	31	III Ec D
30	22	46	I Tr I
31	20	02	I Oc D
Jun 1	18	29	I Sh I
	19	30	I Tr E
	20	43	I Sh E
	21	02	II Oc D
2	18	04	I Ec R
3	18	31	II Sh I
	18	52	II Tr E
	21	22	II Sh E
5	19	25	III Oc D
	22	59	III Oc R
6	21	17	IV Tr E
7	21	59	I Oc D
8	19	11	I Tr I
	20	24	I Sh I
	21	26	I Tr E
	22	38	I Sh E
9	17	48	III Sh E
	20	00	I Ec R
10	18	39	II Tr I
	21	08	II Sh I
	21	33	II Tr E
12	18	14	II Ec R
15	21	08	I Tr I
16	18	23	III Sh I
	18	26	I Oc D
	21	47	III Sh E
	21	55	I Ec R
17	19	02	I Sh E
	21	22	II Tr I
19	20	49	II Ec R
23	17	45	III Tr I
	20	25	I Oc D
	21	16	III Tr E
24	17	35	I Tr I
	18	43	I Sh I
	19	51	I Tr E
	20	57	I Sh E
25	18	19	I Ec R
28	18	31	II Sh E
Jul 1	19	34	I Tr I
1	20^h37^m		I Sh I
3	21	06	II Oc D
4	19	53	III Ec R
5	18	17	II Sh I
	19	06	II Tr E
9	18	53	I Oc D
10	18	19	I Tr E
	19	15	I Sh E
	20	18	IV Sh E
12	19	00	II Tr I
17	18	02	I Tr I
	18	55	I Sh I
26	17	33	I Sh E
29	18	19	III Sh I
	18	50	III Tr E
30	18	12	II Sh E

May	$20^h 10^m$	II Sh E	May 9	$20^h 38^m$	II Tr E	May 16	$20^h 10^m$	II Tr I
4	22 29	I Oc D	10	18 01	IV Ec R		18 19 54	II Ec R
5	19 39	I Tr I	11	17 17	II Ec R		19 19 14	III Sh E
	20 52	I Sh I	12	21 36	I Tr I		20 20 54	I Oc D
	21 55	I Tr E		22 47	I Sh I		21 18 03	I Tr I
6	20 31	I Ec R	13	18 56	I Oc D		19 11	I Sh I
7	17 38	I Sh E	14	17 16	I Sh I		21 20 20	I Tr E
8	20 23	III Oc R		18 21	I Tr E		21 28	I Sh E
	21 47	III Ec D		19 33	I Sh E		22 18 50	I Ec R
9	17 48	II Tr I	15	20 56	III Oc D		25 17 23	II Oc D
	20 16	II Sh I						

SATURN'S MOONS

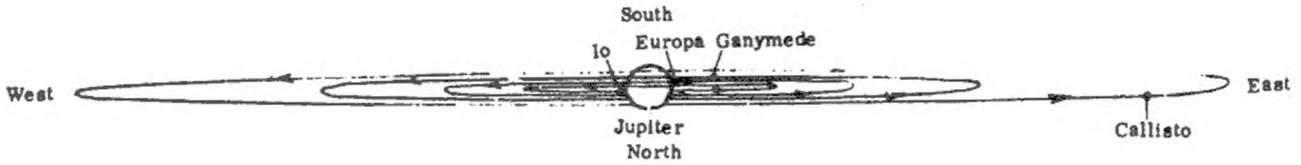


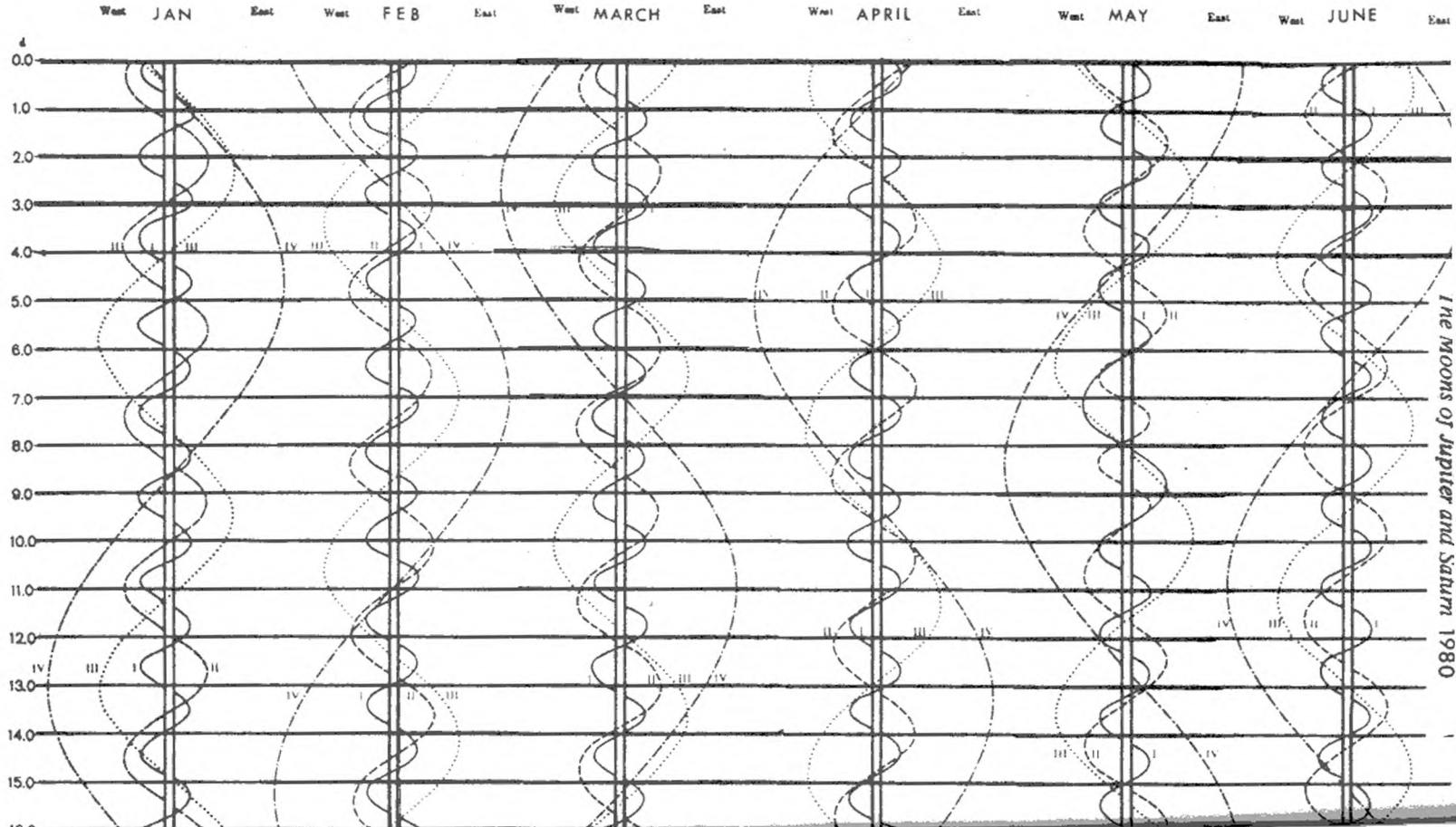
Saturn's moons are considerably fainter than the four Galilean moons of Jupiter. The diagram shows the orbits of four of Saturn's ten moons. The easiest to find is Titan (magnitude 8,5), according to the diagram and the information in the table below (which covers the period when Saturn is clearly visible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

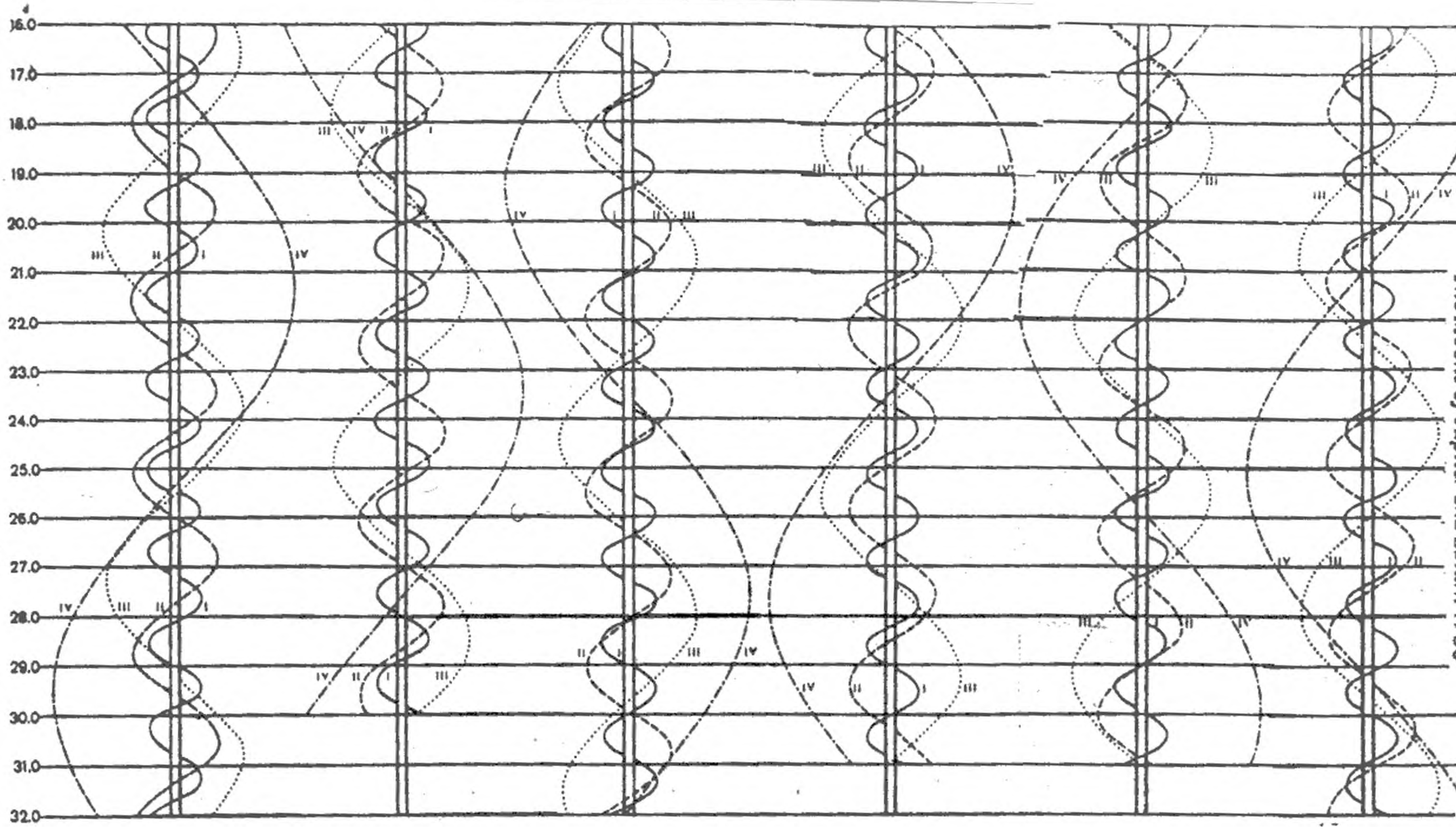
TITAN 1980

Eastern Elongation	Inferior Conjunction	Western Elongation	Superior Conjunction
Jan 9, 25	Jan 13, 29	Jan 1, 17	Jan 5, 21
Feb 10, 26	Feb 14	Feb 2, 18	Feb 6, 22
Mar 13, 29	Mar 1, 16	Mar 4, 20	Mar 9, 25
Apr 13, 29	Apr 1, 17	Apr 5, 21	Apr 9, 25
May 15, 31	May 3, 19	May 7, 23	May 11, 27
Jun 16	Jun 4, 20	Jun 8, 24	Jun 12, 28
Jul 12, 18	Jul 6, 22	Jul 10, 26	Jul 14, 30
Aug 3	Aug 7	Aug 11	Aug 15
- -	- -	- -	- -
- -	- -	Oct 30	- -
Nov 7, 23	Nov 11, 27	Nov 15	Nov 3, 19
Dec 9, 25	Dec 13, 29	Dec 1, 17	Dec 5, 21

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 chang 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 one side of the planet to the other.

COMETS AND METEORS

COMETS

Comets are celestial 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 nucleus 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, 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 well 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 the Leonids, there is a phenomenal rise in the number of meteors observed.

There is always the possibility of new showers occurring, 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.

"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 azimuth, 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 streak, are also important.

PREDICTED METEOR

	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

*Attention is drawn to the new shower in Cetus

SHOWERS 1980

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	02h - dawn	Favourable
May 5	18	07 30	02h - dawn	Unfavourable
Jun 14	?	00 30	22h - 02h	Favourable
Jun 16	8	01 00	00h - 02h	Favourable
Jun 20	8	23 30	00h - 02h	Favourable
Jun 28	?	07 40	03h - dawn	Unfavourable
Jul 25	8	00 50	23h - 02h	Unfavourable
Jul 28	35	02 10	00h - 04h	Unfavourable
Jul 30	11	02 10	00h - 04h	Unfavourable
Aug 2	10	(08 00	21h - 23h	Favourable
Aug 6	12	(01 10	22h - 01h	Favourable
Oct 21	35	(04 48	02h - dawn	Unfavourable
Nov 8	16	(08 58	22h - 02h	Favourable
Nov 17	10	06 30	02h - dawn	Favourable
Dec 4	?	20 10	21h - 24h	Favourable
Dec 14	55	02 00	00h - 04h	Favourable
Dec 29	?	03 30	22h - 24h	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 patterns, 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 α (Alpha), the next β (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 fussy balls.

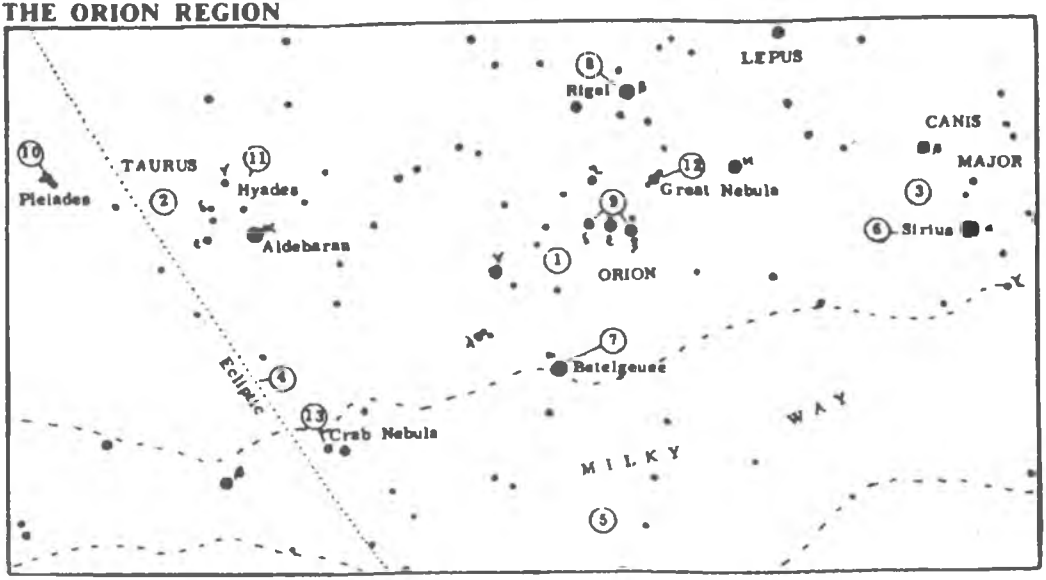
NEBULAE

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 Africa. 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.

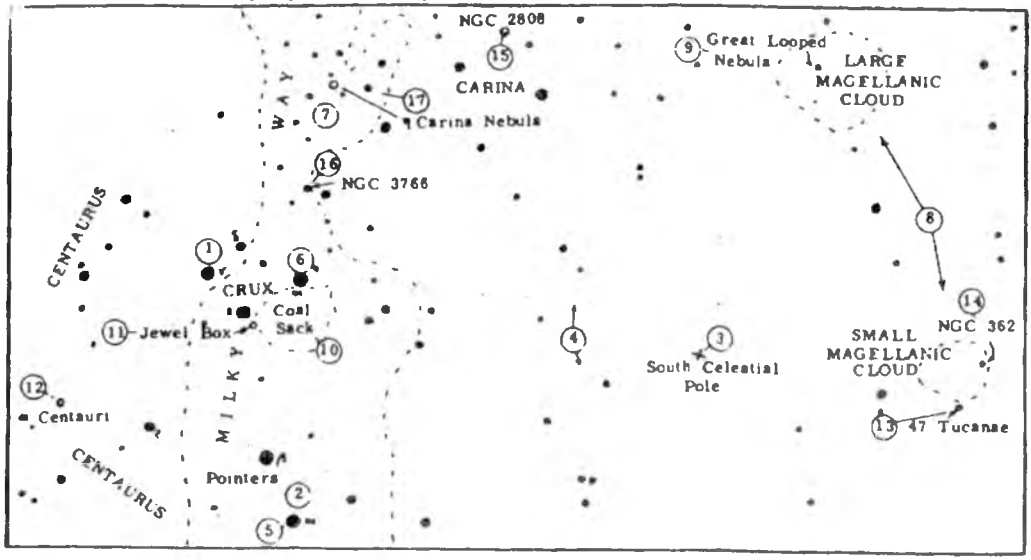
(10) The Pleiades or Seven Sisters form the best known nearby star cluster. Six or seven stars are visible to the naked eye, binoculars or a small telescope show more.

(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 million million km or 4,3 light years. A small telescope readily shows that it is a double star - the two components take 80 years to revolve 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).

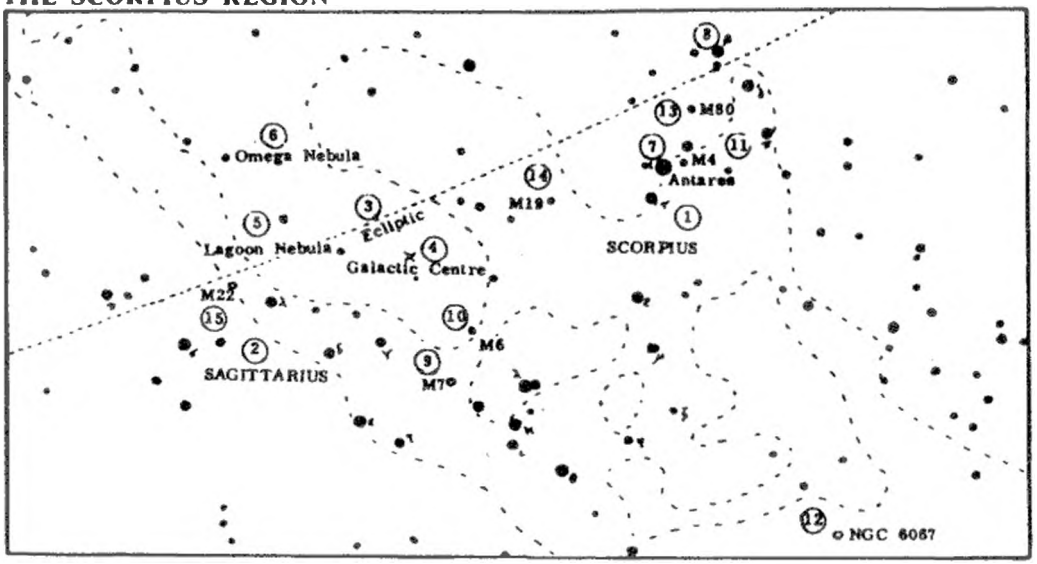
(11) Herschel's "Jewel Box" - a galactic cluster containing stars of different colours. (Small telescope or binoculars).

(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 3766 - a fine galactic cluster. (Binoculars or small telescope).

(17) The η Carinae nebula - 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 ν the claws. The distinctive tail ε — ζ — θ 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) M6, (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 lists some 20 000 stars. Professional observatories cannot possibly monitor all of these and the observation of variable stars is a field the therefore in which amateurs can make real contributions to astronomical knowledge.

Of the 20 000 stars, at least 2 000 are suitable for monitoring by Southern Hemisphere observers but less than 200 are in fact observed from South Africa and a still smaller number receive adequate attention from southern observers.

The Variable Star Section of the ASSA 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 Variable Star Observers and the Variable Star Section of the Royal Astronomical Society of New Zealand. These bodies combine the South African observers' light estimates with those from other parts of the world. The resulting light curves and tables are sent to a large number of professional observatories where astronomers are interested in investigating certain of the stars more fully.

In addition to the international work, the VSS of the ASSA supplies information direct to certain South African astronomers. It is in a position to warn observatories of sudden changes in certain "VIP" stars before the overseas bodies can do so. Some of these VIP stars are:

R Coronae Borealis variables (decrease in brightness):

123753	UW Cen	181146	RS Tel	191033	RY Sgr
145971	S Aps	181824	GU Sgr		

Increase in brightness:

U Geminorum variables:	040971	VW Hyi	132554	BV Cen
Novae:	063462a	RR Pic	174406	RS Oph
Flare star:	013418	UV Ceti		

Most of the above stars could be observed every night and would still not be over-observed.

Many long period variable stars vary through a large range of brightness. This means that even approximate estimates by beginners can generate quite acceptable light curves. Some of these stars are relatively easy to locate and identify and this makest them very suitable for new observers. Examples of this class of stars are:

025050	R Hor	043262	R Ret	134236	RT Cen	174162	W Pav
034625	U Eri	054331	S Col	161122 a	R Sco	180222a	VX Sgr
035124	T Eri	091868	RW Car	161122 b	S Sco	180363	R Pav
040725	W Eri	094953	Z Vel	165030 a	RR Sco	191019	R Sgr
						214247	R Gru

Several variable stars are situated near the South Celestial Pole and can be observed throughout the year during the evening hours. Three such stars are:

055686	R Oct	131283	U Oct	172486	S Oct

Others will need early morning observing sessions for fuller coverage.

A few variables are so bright that they can be monitored throughout their cycles without optical aid. 071044 L^2 Puppis is such a star. Norton's Star Atlas names several more.

Beginners are encouraged to practice variable star observing by following the easy-to-observe stars listed below through the brighter parts of their variations, using naked eye or binoculars.

		Approximate magnitude range	Approximate dates of maxima 1980
021403	o Ceti (Mira)	2.0 - 10.1	September 21
092962	R Carinae	3.9 - 10.0	August 2
100661	S Carinae	4.5 - 9.9	April 2, Sept. 17

From the above it can be seen that there are variable stars to suit amateurs with different amounts of experience, ability, optical aid and spare time. Amateurs who want to start observing stars in any of the above catagories should contact the Director of the Variable Star Section, Mr. J. Hers, P.O. Box 48, Sedgefield 6573, Telephone 113. New observers will be given charts of a few easy objects and (if possible) a certain amount of instruction at the eyepiece. When writing, prospective observers should give brief details of their equipment.

ORDINARY OCCULTATIONS

An occultation occurs when the moon passes in front of a star. The disappearance or reappearance of the star is an instantaneous event, or almost so, and is therefore easily timed. Time signals are broadcast continuously through the 24 hours from station ZUO (see page 43) and, radio propagation permitting, occultation timings can be made, either by eye and ear or by stop watch.

The essential record of a occultation observation consists of

(i) Date and observed time of the event (to a tenth of a second if possible). Universal Time is preferable.
(ii) The Z.C. number of the star.
(iii) Whether disappearance or reappearance.
(iv) The observer's estimate of the accuracy of the observation.
(v) Whether the time given in (i) has been corrected for personal error, and if so by how much.

Also required are the size and type of telescope used, the method of timing used, and the position of the telescope.

The telescope position must be to an accuracy of 1" or better in latitude and longitude and 30 metres or better in altitude. An observer can usually read his position off a 1/50 000 map published by the Director General of Trig. Survey, Mowbray, or his equivalent in other countries. Positions determined astronomically are NOT acceptable, no matter how carefully determined.

Timings of occultations are very valuable in determining the moon's shape and motion and constitute a field in which the amateur astronomer, often with only a small, unsophisticated telescope, can make an extremely useful contribution. Interested persons 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, Rhodesia.

Predictions of occultations of stars brighter than magnitude 7,5, supplied by H.M. Nautical Almanac Office, are reproduced on the next two pages.

Explanation of Table:

Z.C. - the number of the star in the "Catalogue of 3539 Zodiacal Stars for the Equinox 1950.0" by James Robertson (U.S. Naval Observatory, 1939). A short index of the brighter stars is given on page 47.

Mag. - the visual magnitude of the star

P - Phase. 1 = Disappearance 2 = Reappearance

El. of Moon - the elongation of the Moon. 0^{o} = New Moon, 90^{o} = First Quarter, 180^{o} = Full Moon, 270^{o} = Last Quarter.

U.T. - The predicted time in Universal Time which is exactly two hours behind South African Standard Time. For example $0^{h}55^{m},9$ UT is $2^{h}55^{m},9$ a.m. SAST.

a,b - the approximate time of an occultation at a place $\Delta\lambda$ degrees west and $\Delta\phi$ degrees north of the city concerned is

$$\text{Predicted time} + a.\Delta\lambda + b.\Delta\phi$$

where a and b are in minutes of time.

P - the position angle on the Moon's limb, measured eastward from the north point.

N - no occultation A - Moon at very low altitude

S - sunlight interferes G - grazing occultation

Date	Z.C. No.	Mag.	P.	El. of Moon	CAPE TOWN ' o E. 18.5 , S. 33.9 o				JOHANNESBURG o o E. 28.0 , S. 26.2				SALISBURY o o E. 31.1 , S. 17.7			
					U.T.	a	b	P	U.T.	a	b	P	U.T.	a	b	P
				o	h m	m	m	o	h m	m	m	o	h m	m	m	o
Jan. 7	4005	-1.9	1	234	4 57.0	-0.7	-1.7	154	5 00.7	-1.3	-0.1	114	5 09.8	-1.9	+1.3	79
7	4005	-1.9	2	234	5 59.8	-1.5	+1.7	259	6 15.0	-0.6	-0.1	298	6 08.3	-0.1	-2.0	333
10	1965	6.5	2	276	24 03.4	-0.4	-1.2	268	23 57.9	-0.6	-1.6	293	23 43.9	-0.4	-2.2	318
20	3333d	6.8	1	39	18 26.2	-0.4	+1.2	83		A				A		
23	2124	7.3	1	79		S			17 52.5	-1.9	+1.0	81	18 08.8	-1.6	+1.6	62
24	352	7.3	1	93	19 40.6	.	.	4		N				N		
24	362	6.5	1	94	20 58.8	-1.0	+1.2	87		A				A		
25	475	7.4	1	106	19 01.1	-1.6	+2.6	28	19 43.9	.	.	5		N		
27	764d	5.0	1	131	18 30.5	-2.1	+0.2	71	18 57.9	-2.5	+1.2	59	19 23.5	-2.7	+3.3	34
28	913	5.2	1	143	19 07.7	-2.2	-0.3	83	19 32.6	-2.7	+0.7	70	19 54.6	-3.1	+2.7	44
Feb. 5	1733	5.2	2	223	0 57.9	-0.9	-3.5	347		N				N		
9	2266	6.2	2	279	23 45.9	-0.1	-1.2	276	23 35.9	-0.1	-1.8	304	23 17.7	+0.3	-2.7	334
10	2278	6.4	2	280	2 14.3	-0.9	-2.1	305	1 58.9	-0.1	-4.2	345		N		
10	2279	6.2	2	280		N			2 44.0	-2.8	+0.2	253	2 47.1	-2.3	-1.2	287
20	308	6.7	1	62		N			18 47.4	.	.	146	18 42.3	-0.7	0.0	106
25	1025	7.4	1	124		S				S			16 53.7	-2.7	+0.3	75
26	1151	6.8	1	136	19 44.0	-2.3	-1.9	138	19 57.7	-2.6	-0.6	111	20 05.7	-3.2	+0.5	85
29	1487d	1.3	1	170		O			20 30.3	-2.0	-2.6	144	20 20.2	-2.8	-1.5	116
29	1487d	1.3	2	170		O			21 57.2	-3.3	+0.3	266	22 03.1	-2.7	-1.1	296
Mar. 2	4006	0.9	1	193		N				O			23 39.0	-2.0	-2.2	139
3	4006	0.9	2	193		N				O			1 09.3	-2.3	-0.2	285
9	2372d	4.4	1	261		N			1 57.0	.	.	161	1 35.8	-2.0	-2.0	124
9	2372d	4.4	2	261		N			2 54.5	.	.	237	3 11.5	-3.2	-0.4	276
9	2495d	6.0	2	272	23 59.6	-0.6	-0.8	260	23 56.2	-0.6	-1.6	293	23 40.2	0.0	-2.6	325
10	2508	6.3	2	273		N				N			2 53.3	-3.7	+2.3	235
10	2640d	6.1	2	284	24 11.0	-0.4	-0.3	245	24 09.3	-0.4	-1.1	278	23 57.8	0.0	-1.9	309
11	2647	6.4	2	284	1 03.0	-0.2	-2.1	306		N				N		
11	2653d	6.4	2	285	1 46.1	-0.8	-1.4	281	1 38.1	-0.6	-2.8	317		N		
11	2658	[illegible]	2	285	3 12.7	-1.9	+0.1	247	3 28.1	-2.2	-1.1	283	3 17.4	-1.8	-3.2	318
24	1109	7.3	1	106		S			17 42.1	-3.1	+1.0	71	18 15.1	.	.	31
25	1241d	6.4	1	118		N				N			19 31.0	-1.4	-2.6	149
26	1354	7.3	1	129	19 40.3	-2.3	-0.7	113	20 05.5	-3.1	+0.9	81		N		
27	1449	6.7	1	139		N				N			17 08.7	-2.1	-3.2	146
27	1466	5.2	1	141	23 12.2	.	.	187	22 58.6	-0.9	-0.8	133	22 59.5	-1.4	+0.2	100
30	4006	0.9	1	164	2 40.0	-0.6	+1.2	91		A				N		
Apr. 6	2460	6.1	2	242	2 00.4	-1.9	-2.5	312		N				N		
6	2578	6.4	2	253		N			22 20.2	-1.0	0.0	245	22 19.0	-0.7	-0.9	277
11	3196	6.1	2	305	1 35.1	-0.5	+0.8	216	1 41.4	-0.6	-0.3	252	1 37.4	-0.5	-1.2	285
17	609	7.5	1	36	16 55.5	-1.0	+1.0	91		A				A		
18	764d	5.0	1	50	17 29.3	-0.8	-0.4	132	17 37.9	-0.8	+0.5	100	17 47.9	-0.9	+1.2	71
19	913	5.2	1	62		G			16 39.0	-1.6	-0.6	125	16 43.1	-1.9	+0.3	96
19	915	4.7	1	62	16 36.7	-2.4	+2.3	45		N				N		
21	1203	7.1	1	88		N				A			20 45.3	-0.4	0.0	108
23	1420	6.6	1	109	17 17.2	-2.3	-1.1	111	17 40.0	-3.4	+0.4	82		N		
26	1645	6.6	1	134	0 41.8	-0.8	+2.6	65		N				N		
26	1733	5.2	1	143	19 11.8	-2.9	-0.2	81		N				N		
May 5	2715	6.5	2	236	1 33.4	-2.4	+0.3	255	1 56.4	-2.8	-0.8	284	1 47.9	.	.	322
5	2863	6.1	2	248		G			23 43.7	-2.3	+2.3	218	23 58.5	-2.1	+0.1	257
7	3005	6.2	2	261	1 13.6	-1.2	-2.8	305		N				N		
20	1385	6.5	1	79	17 32.7	-1.5	-1.1	136	17 46.6	-2.0	+0.3	100	18 03.6	-3.2	+2.5	63
21	1501	7.3	1	91	21 18.4	+0.1	-1.7	160		A				A		
21	4005	-1.7	1	91	21 22.0	-1.6	+3.6	055		A				N		
21	4005	-1.7	2	91	21 57.2	+0.5	-2.8	351		A				N		
June 1	2687	[illegible]	2	207	3 56.0	-2.0	-1.4	316		N				N		
1	2814	5.0	2	217	21 14.7	-0.8	-1.3	278	21 06.9	-0.6	-2.9	316		N		
1	2825	6.4	2	218	23 13.7	-2.4	+2.8	215	23 47.3	-2.6	+0.6	253	23 54.4	-3.0	-1.0	285
3	3108	5.5	2	243	23 41.0	-1.3	+0.3	236	23 55.0	-1.9	-0.5	266	23 50.0	-2.1	-2.4	300
4	3253	5.4	2	256	23 22.3	-0.5	-1.7	286		N				N		
5	3388d	5.6	2	269		A			23 17.0	-0.5	-0.8	267	23 06.4	-0.5	-2.6	305
7	12	6.3	2	284		N			3 37.0	-0.6	+3.8	188		G		
7	13	6.3	2	284	3 31.1	.	.	175		S				S		
7	3535	5.2	2	283		A			0 28.2	-0.6	+0.3	237	0 29.6	-0.9	-0.5	268
18	1562	7.3	1	70	18 20.6	-2.1	+1.6	80		N				N		
20	1758	7.0	1	92		G			18 46.9	-1.4	-1.4	138	18 45.6	-2.1	-0.2	105
22	1965	6.5	1	114	17 45.7	-1.3	-2.8	151	17 49.1	-2.6	-1.1	113	17 57.4	-4.3	+1.1	77
30	3064	6.0	2	212	22 14.5	-1.5	-1.4	280	22 12.3	.	.	318		N		
July 1	3206	5.2	2	225		N				N			21 06.2	-1.4	+3.1	203
6	249	4.7	2	280		N				N			2 46.6	-0.7	+3.0	196
17	1728	6.9	1	62		N				N			19 08.8	-0.1	-2.2	156
17	1733	5.2	1	62	19 40.9	-0.3	-0.8	142		A				A		
20	2048	7.2	1	95	21 13.3	.	.	41		N				N		
21	2141d	6.0	1	105		S			16 18.3	-3.1	-0.2	88		N		
22	2279	6.2	1	119	22 16.3	-1.2	+1.1	90	22 36.8	-0.5	+2.0	66		N		
25	2687	[illegible]	1	153	17 11.1	-1.5	+0.2	57		N				N		

Date	Z.C. No.	Mag.	P.	El. of Moon	CAPE TOWN E. 18.5 , S. 33.9				JOHANNESBURG E. 28.0 , S. 26.2				SALISBURY E. 31.1 , S. 17.7			
					U.T.	a	b	P	U.T.	a	b	P	U.T.	a	b	P
				°	h m	m	m	°	h m	m	m	°	h m	m	m	°
July 29	3173	5.3	2	195		N				N			2 12.6	+0.5	+4.5	186
29	3307	4.9	2	207	20 42.8	-0.9	+0.4	230	20 54.4	-1.4	-0.3	257	20 52.1	-1.8	-1.7	290
29	3310	6.4	2	207		N				G			21 20.1	-1.7	+1.6	224
30	3463	6.4	2	221		N				N			22 33.3	.	.	182
Aug. 16	2005	7.0	1	64		N			19 15.9	-0.7	-1.7	150	19 10.4	-0.6	-0.3	115
19	2365	7.1	1	99	22 09.0	-0.3	+2.3	61		A				N		
22	2791	5.4	1	134	19 01.0	-2.3	-0.5	93	19 28.0	-2.6	+1.4	66	19 57.8	.	.	30
23	2814	5.0	1	136	0 32.0	-0.6	+1.1	89	0 44.1	-0.1	+1.1	78		A		
23	2816	6.8	1	136	0 48.5	-0.3	+1.4	75	1 00.7	+0.1	+1.4	64		A		
25	3108	5.5	1	163	0 42.4	-1.8	+0.1	111	0 59.7	-1.3	+0.5	101	1 08.8	-0.8	+0.9	80
27	3526d	5.1	2	201		A			18 52.8	-0.5	-0.1	248	18 50.3	-0.7	-1.0	280
27	3535	5.2	2	202	20 30.4	-1.0	-0.9	266	20 32.5	-1.8	-2.0	291		N		
Sept. 3	888	6.0	2	285	2 12.6	-1.0	-0.8	263	2 19.4	-1.8	-0.9	272	2 15.2	-2.6	-1.9	296
3	895	5.9	2	286	3 16.0	-0.3	+2.2	201		S				S		
12	1965	6.5	1	33	17 48.6	-0.6	-0.1	124		A				A		
17	2573	7.3	1	91	20 34.5	-1.3	+0.3	112	20 48.5	-0.8	+0.7	96	20 58.2	-0.3	+1.2	72
17	2578	6.4	1	91	22 31.2	+0.3	+2.3	48		A				N		
18	2715	6.5	1	102	18 02.2	.	.	34		N				N		
18	2718	6.7	1	102	18 43.7	-2.0	+2.7	49	19 28.5	.	.	18		N		
18	2724	6.6	1	102	19 54.9	-2.4	-1.1	127	20 11.5	-1.8	+0.1	108	20 20.6	-1.3	+0.9	83
18	2733	6.4	1	103	22 00.8	-0.2	+2.6	44	22 21.0	+0.6	+3.2	28		N		
20	3011	7.0	1	127	17 49.7	-2.1	-0.4	86	18 14.2	-2.4	+1.2	62	18 40.1	-2.0	+3.5	31
21	3036	7.0	1	129	0 08.2	-1.2	-0.2	125	0 16.5	-0.6	+0.1	113		A		
21	3173	5.3	1	141		N				N			21 49.1	-2.8	-0.6	109
22	3196	6.1	1	143	1 51.1	+0.2	+2.2	35		A				N		
22	3307	4.9	1	153		S				S			16 02.1	-1.0	+2.1	30
22	3310	6.4	1	153		N			16 30.8	-0.9	-4.4	137	16 16.8	-1.0	-0.8	94
26	3684	6.3	2	212	20 12.1	0.0	+1.5	201	20 22.7	-0.5	+0.9	221	20 29.9	-1.0	+0.3	247
30	995d	4.1	2	266		A			23 31.6	-0.6	-0.3	252	23 29.6	-1.0	-0.8	275
Oct. 3	1259	5.9	2	291		N			1 35.6	.	.	208	1 48.1	-1.0	+0.5	242
14	2531	7.3	1	60	20 39.7	-0.5	-0.1	128		A				A		
16	2825	6.4	1	83	18 57.5	-1.4	+1.9	65	19 23.5	-0.7	+2.2	53	19 47.5	+0.3	+3.6	24
18	3094	7.4	1	107		S			17 03.4	-1.8	+3.1	31		N		
18	3108	5.5	1	108	20 19.5	-1.1	+2.5	42	20 47.0	-0.5	+2.7	33	21 15.9	.	.	3
19	3262	7.1	1	122	20 47.3	-2.9	-0.8	117	21 08.9	-2.3	-0.1	108	21 18.3	-1.6	+0.7	86
19	3267	7.2	1	123		N				G			23 07.9	-0.8	0.0	108
20	3388d	5.6	1	134	18 02.8	.	.	356		N				N		
20	3391	6.8	1	134	17 46.7	-1.7	0.0	73	18 08.4	-2.0	+1.1	57	18 29.2	-1.7	+2.5	33
20	3394	7.4	1	135	18 42.7	-1.7	+0.9	56	19 10.4	-1.8	+1.9	45	19 36.1	-1.1	+3.2	22
21	12	6.3	1	150	20 48.5	-2.8	-0.8	105	21 12.6	-2.8	-0.1	98	21 24.3	-2.4	+0.9	78
21	13	6.3	1	150	21 06.0	-2.6	-0.2	97	21 31.2	-2.5	+0.4	91	21 44.8	-2.1	+1.1	72
21	3535	5.2	1	148	17 17.4	-0.9	+0.5	49	17 36.2	-1.0	+2.0	28		G		
26	620	6.3	2	209	2 43.0	-1.9	-0.2	297		S				N		
27	915	4.7	2	234		A				A			21 05.8	-0.7	-0.3	260
30	1335	6.3	2	272		N				A			23 26.7	-0.3	+0.5	240
Nov. 11	2629d	6.3	1	41		S			17 55.7	-0.8	+0.1	112	18 00.9	-0.3	+0.7	88
13	3206	5.2	1	90		N			20 22.6	.	.	131	20 23.9	-1.2	+0.2	102
16	3332	7.2	1	102		S				S			17 02.7	-2.4	+1.5	59
17	3503	7.4	1	118		N				N			23 11.0	-0.5	-0.1	110
18	76	5.9	1	129		N				N			18 30.3	.	.	124
26	1171	6.3	2	229	1 38.8	-2.4	-0.1	267	2 00.2	-2.5	-0.5	290	1 57.6	-2.2	-2.1	318
27	1310d	4.2	1	242	2 48.8	.	.	163		S				S		
Dec. 11	3022	6.9	1	47		S			17 52.6	-0.4	+1.7	61	18 08.8	+0.1	+2.1	40
12	3173	5.3	1	61	20 36.2	+0.1	+1.7	58		A				A		
13	3307	4.9	1	72	18 30.1	+0.1	+3.9	8	18 59.6	.	.	355		N		
13	3310	6.4	1	72	18 34.3	-1.5	+1.1	85	18 55.7	-1.0	+1.2	79	19 09.7	-0.6	+1.5	60
14	3449	7.3	1	85		N			19 59.1	.	.	133	19 59.8	-1.2	+0.2	102
15	36	7.2	1	98		S			18 26.8	-2.0	+1.4	67	18 46.3	-1.6	+1.9	50
15	37	7.5	1	98	18 27.2	.	.	127	18 50.2	.	.	118	18 56.9	-2.4	+0.4	93
16	192	5.3	1	113		N			22 18.0	.	.	135	22 17.2	-0.7	+0.2	101
17	303	6.6	1	124		S				S			16 56.1	-1.6	+1.6	43
17	308	6.7	1	125		S			18 26.0	.	.	355		N		
17	322	5.7	1	126	20 44.4	-2.0	+0.9	81	21 10.5	-1.7	+1.3	73	21 28.3	-1.4	+1.8	53
17	327	4.5	1	127	21 50.3	-1.4	+1.5	64	22 15.6	-1.1	+1.9	51	22 38.2	-0.9	+2.9	25
18	454	5.8	1	140	20 05.5	.	.	352		N				N		
18	464	6.4	1	141		N			22 55.6	-1.3	-1.1	130	22 57.3	-1.3	+0.2	100
26	1576	5.3	2	243		N				N			21 34.1	-0.5	+1.0	235

b005 = JUPITER b006 = SATURN

GRAZING OCCULTATIONS

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 H.M. Nautical Almanac Office 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 of time which, when added to the time at the beginning of the track, 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 75mm 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: 113.

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.

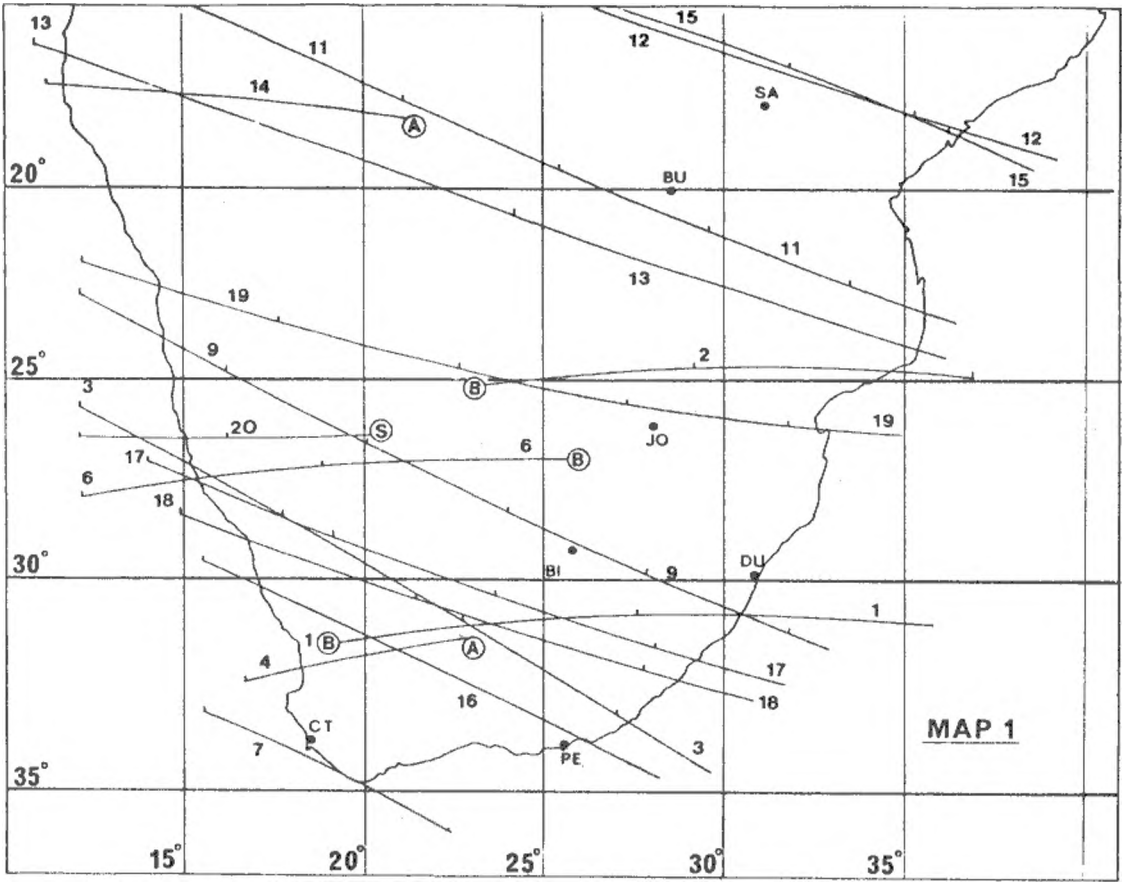
Date

Beginning an arbitrary time 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 the track)
S = southern limit (complete occultation north of the track)

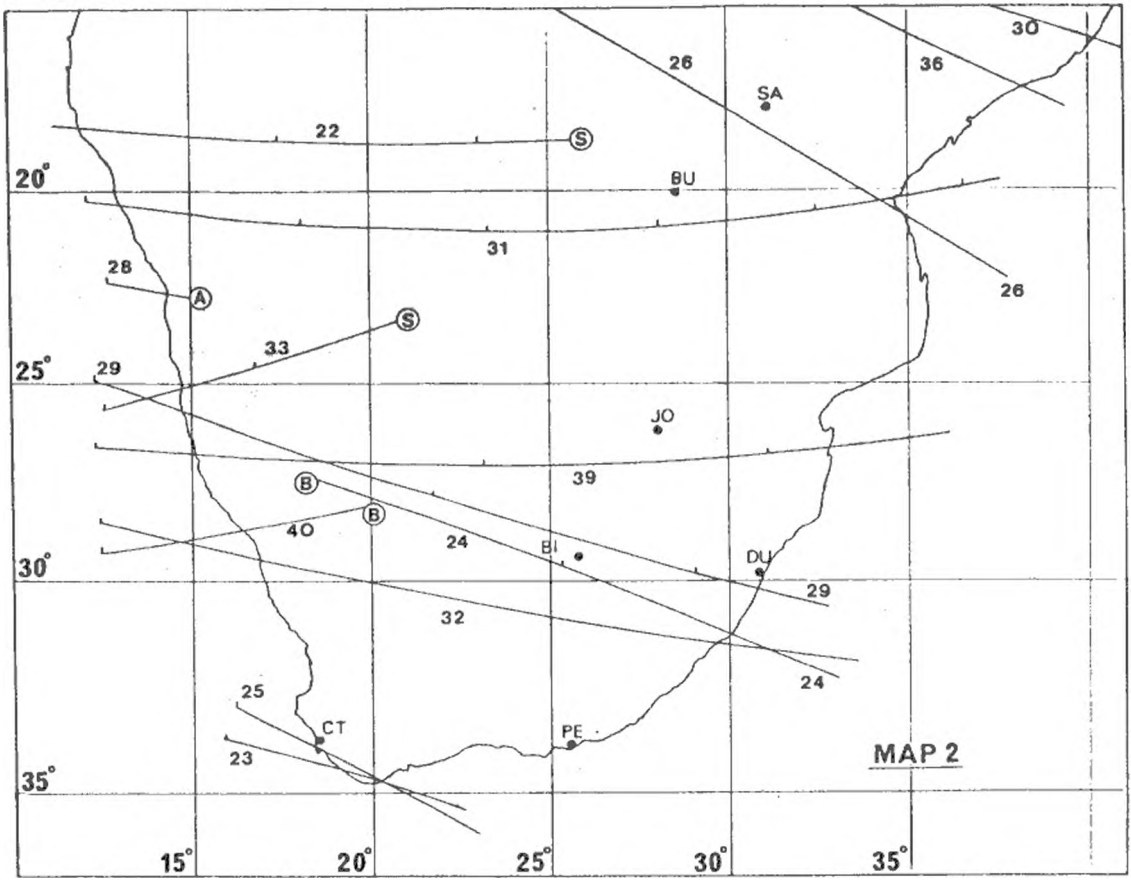
JANUARY TO MARCH



	ZC	MAG.	TIME (U.T.) AT THE BEGINNING OF THE TRACK IN THE WEST		HR	MIN	PERCENT SUNLIT %	N OR S LIMIT
1	352	7.3	JANUARY	24	20	0	53	N
2	475	7.4	JANUARY	25	19	51	64	N
3	2279	6.2	FEBRUARY	10	1	51	41	S
4	22	7.3	FEBRUARY	18	18	1	9	S
6	308	6.7	FEBRUARY	20	18	36	27	S
7	1487	1.3	FEBRUARY	29	20	49	99	S
9	2372	4.4	MARCH	9	1	49	57	S
11	2508	6.3	MARCH	10	1	53	47	S
12	2814	5.0	MARCH	12	1	49	26	S
13	2816	6.8	MARCH	12	1	56	26	S
14	393	6.8	MARCH	19	18	19	13	S
15	1109	7.3	MARCH	24	18	22	64	N
16	2578	6.4	APRIL	6	21	56	64	S
17	2596	7.3	APRIL	7	0	57	63	S
18	2758	7.0	APRIL	8	0	58	53	S
19	2763	6.7	APRIL	8	1	50	52	S
20	2773	6.1	APRIL	8	4	11	52	S

: THE TICKS ARE AT 10 MINUTE INTERVALS.

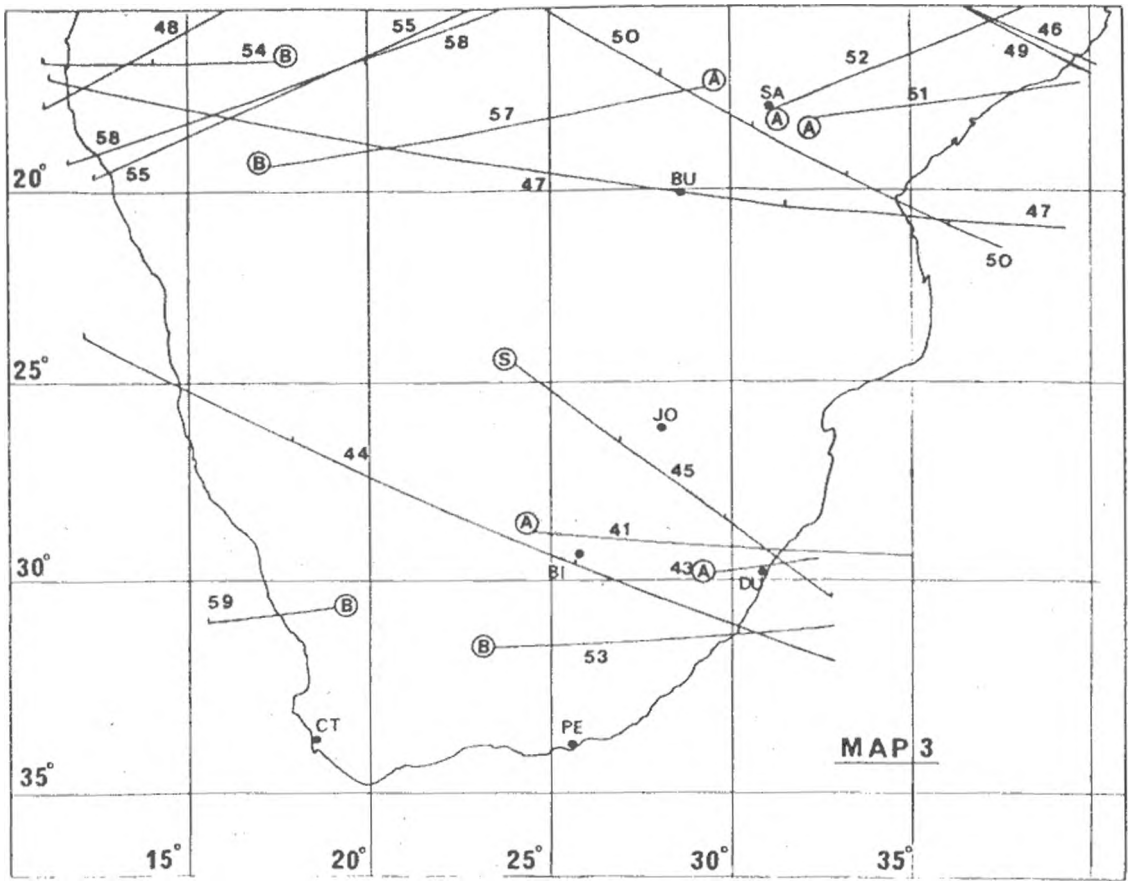
APRIL TO JUNE



	ZC	MAG.	TIME (U.T.) AT THE BEGINNING OF THE TRACK IN THE WEST		HR	MIN	PERCENT SUNLIT %	N OR S LIMIT
22	3064	6.0	APRIL	10	3	38	30	S
23	913	5.2	APRIL	19	16	43	27	S
24	915	4.7	APRIL	19	17	9	27	N
25	1202	6.9	APRIL	21	20	36	48	N
26	1420	6.6	APRIL	23	18	4	67	N
28	1644	4.1	APRIL	26	1	25	85	S
29	2863	6.1	MAY	5	23	5	68	S
30	2989	6.8	MAY	6	21	24	59	S
31	3011	7.0	MAY	7	1	35	57	S
32	3152	6.8	MAY	7	23	58	46	S
33	3313	6.8	MAY	9	4	16	34	N
36	1385	6.5	MAY	20	18	31	41	N
39	3262	7.1	JUNE	4	23	56	61	S
40	3267	7.2	JUNE	5	1	48	60	S

: THE TICKS ARE AT 10 MINUTE INTERVALS..

JUNE TO SEPTEMBER



ZC	MAG.	TIME (U.T.) AT THE BEGINNING OF THE TRACK IN THE WEST		HR	MIN		PERCENT SUNLIT %	N OR S LIMIT	
41	3391	6.8	JUNE	5	22	58		50	S
43	128	7.3	JUNE	8	0	43		27	S
44	1562	7.3	JUNE	18	18	39		34	N
45*	1856	6.6	JUNE	21	16	9		61	N
46	1965	6.5	JUNE	22	18	47		71	N
47	3206	5.2	JULY	1	20	37		85	S
48	393	6.8	JULY	7	4	0		29	N
49	2137	6.4	JULY	21	16	39		63	N
50	2141	6.0	JULY	21	16	35		63	N

ZC	MAG.	TIME (U.T.) AT THE BEGINNING OF THE TRACK IN THE WEST		HR	MIN		PERCENT SUNLIT %	N OR S LIMIT	
51	192	5.3	AUGUST	1	20	53		68	N
52*	764	5.0	AUGUST	6	0	51		23	N
53	2005	7.0	AUGUST	16	19	36		29	S
54	2791	5.4	AUGUST	22	19	23		85	N
55	888	6.0	SEPTEMBER	3	1	28		37	N
57	2184	7.0	SEPTEMBER	14	19	8		22	S
58	2571	6.9	SEPTEMBER	17	20	54		51	S
59	2715	6.5	SEPTEMBER	18	18	23		60	N

Track No.	ZC
45	1856
52	764

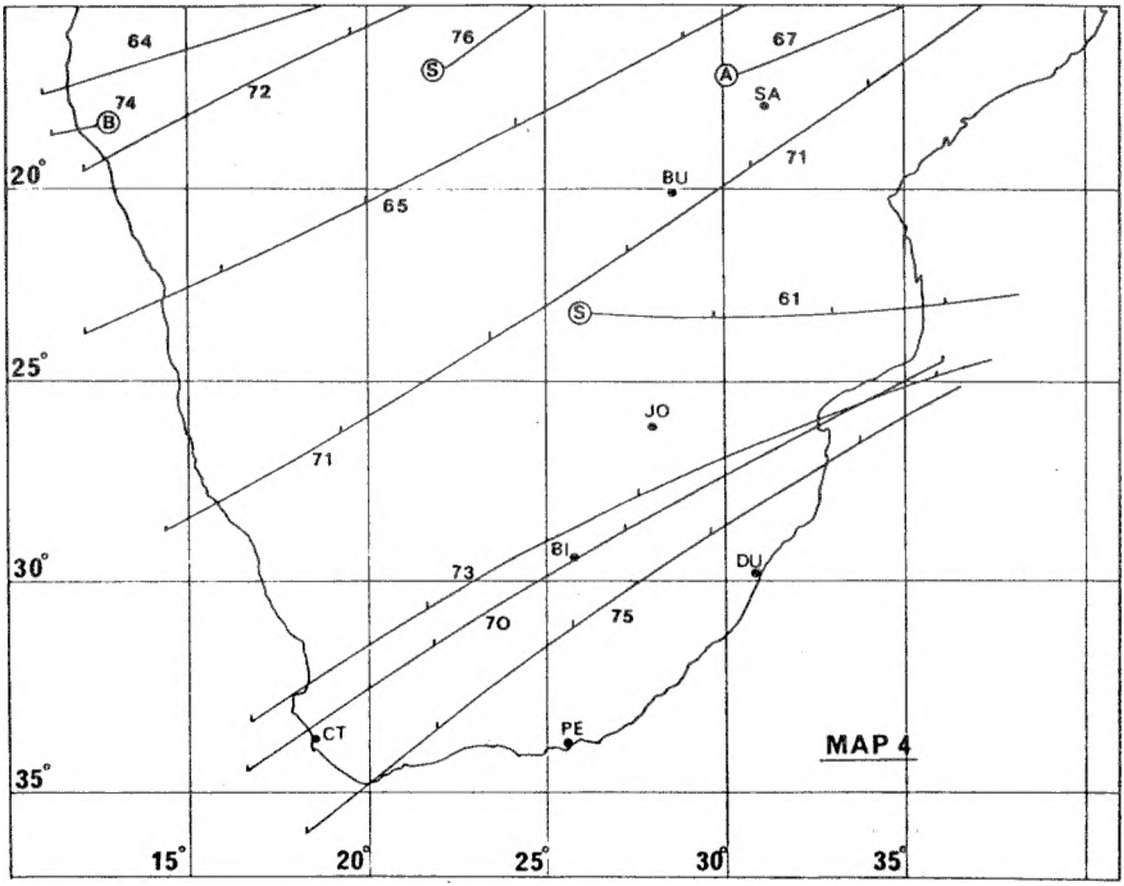
* DOUBLE STAR NOTES 1980.

1856 is the mean of the double star Aitken 8708. The components are of magnitude 7.2 and 7.6; separation 0".9 in pa. 96.

764 is the mean of the binary star Aitken 3701. The components are each of magnitude 5.6; separation 0".1 in pa. 344.

· THE TICKS ARE AT 10 MINUTE INTERVALS.

SEPTEMBER TO DECEMBER



GRAZING OCCULTATIONS 1980

KEY TO MAP 4

	ZC	MAG.	TIME (U.T.) AT THE BEGINNING OF THE TRACK IN THE WEST			PERCENT SUNLIT	N OR S LIMIT
				HR	MIN	%	
61	2863	6.1	SEPTEMBER 19	16	33	70	N
64	2399	5.0	OCTOBER 13	19	8	17	S
65	2959	7.2	OCTOBER 17	18	58	55	S
67	1077	3.7	OCTOBER 28	21	21	69	N
70	3206	5.2	NOVEMBER 15	20	13	50	S
71	76	5.9	NOVEMBER 18	18	3	82	S
72	3167	7.1	DECEMBER 12	19	18	25	S
73	3449	7.3	DECEMBER 14	19	47	46	S
74	3463	6.4	DECEMBER 14	22	26	47	S
75	37	7.5	DECEMBER 15	18	38	57	S
76	170	6.2	DECEMBER 16	17	25	68	S

: THE TICKS ARE AT 10 MINUTE INTERVALS.

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 SUO

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 signals from Johannesburg.

Carrier Frequency	Radiated Power	Time of Transmission
2,5 MHz	4 Kw	2000 - 0600 SAST
5 MHz	4 Kw	Continuous
100 MHz	80 w	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 UT1 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 for 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.

Jan	1	$12^h03^m16^s$	May	11	$11^h56^m19^s$	Sep	18	$11^h54^m03^s$
	11	12 07 41		21	11 56 33		28	11 50 34
	21	12 11 10		31	11 57 37	Oct	8	11 47 30
	31	12 13 23	Jun	10	11 59 23		18	11 45 09
Feb	10	12 14 15		20	12 01 31		28	11 43 48
	20	12 13 51		30	12 03 36	Nov	7	11 43 44
Mar	2	12 12 08	Jul	10	12 05 18		17	11 45 04
	12	12 09 43		20	12 06 18		27	11 47 44
	22	12 06 51		30	12 06 21	Dec	7	11 51 36
Apr	1	12 03 49	Aug	9	12 05 24		17	11 56 17
	11	12 00 59		19	12 03 31		27	12 01 13
	21	11 58 39		29	12 00 49		31	12 03 10
May	1	11 57 02	Sep	8	11 57 34			

SIDEREAL TIME ON THE 30° MERIDIAN

		At 0 hrs SAST	At 21 hrs SAST			At 0 hrs SAST	At 21 hrs SAST			At 0 hrs SAST	At 21 hrs SAST
Jan	1	6^h39^m	3^h42^m	May	11	15^h16^m	12^h19^m	Sep	18	23^h48^m	20^h51^m
	11	7 19	4 22		21	15 55	12 58		28	0 28	21 31
	21	7 58	5 01		31	16 35	13 38	Oct	8	1 07	22 10
	31	8 38	5 41	Jun	10	17 14	14 17		18	1 47	22 50
Feb	10	9 17	6 20		20	17 53	14 56		28	2 26	23 29
	20	9 56	6 59		30	18 33	15 36	Nov	7	3 05	0 08
Mar	2	10 40	7 43	Jul	10	19 12	16 15		17	3 45	0 48
	12	11 19	8 22		20	19 52	16 55		27	4 24	1 27
	22	11 59	9 02		30	20 31	17 34	Dec	7	5 04	2 07
Apr	1	12 38	9 41	Aug	9	21 11	18 14		17	5 43	2 46
	11	13 17	10 20		19	21 50	18 53		27	6 23	3 26
	21	13 57	11 00		29	22 29	19 32		31	6 38	3 41
May	1	14 36	11 39	Sep	8	23 09	20 12				

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	$+ 8^m$	Salisbury	$- 4^m$
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 one 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	$1^h36^m,8$	$-57^o21'$	0,6	B5	Procyon	$7^h38^m,1$	$+5^o\ 17'$	0,5	F5
Aldebaran	4 34 ,6	+16 28	1,1	K5	Regulus	10 07 ,1	+12 05	1,3	B8
Rigel	5 13 ,4	- 8 14	0,3	B8	Spica	13 24 ,0	-11 02	1,2	B2
Betelgeuse	5 53 ,9	+ 7 24	0,4	M0	Arcturus	14 14 ,6	+19 18	0,2	K0
Canopus	6 23 ,4	-52 41	-0,9	F0	Antares	16 28 ,0	-26 23	1,2	M1
Sirius	6 44 ,1	-16 41	-1,6	A0	Altair	19 49 ,7	+8 48	0,9	A5

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1925-26	W. Reid	1944-45	A.W.J. Cousins	1963-64	A.G.F. Morrisby
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1931-32	H.L. Alden	1950-51	H.E. Krumm	1969-70	J. Churms
1932-33	H. Spencer Jones	1951-52	A.D. Thackeray	1970-71	W.C. Bentley
1933-34	D.G. McIntyre	1952-53	J.C. Bentley	1971-72	A.H. Jarrett
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1936-37	H.E. Boughton	1955-56	W.H. van den Bos	1974-75	C. Papadopoulos
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1938-39	T. Mackenzie	1957-58	M.W. Feast	1976-77	S. Booysen
1939-40	R.A. Rossiter	1958-59	H. Haffner	1977-78	B. Warner
1940-41	E.B. Ford	1959-60	P. Smits	1978-79	R.F. Hurly

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1922	H.W. Schonegevel	1923	H.E. Boughton	1934	H.W. Schonegevel
1922	T. Mackenzie	1930	S. Skewes	1935	A. Menzies
1923	C.L. O'Brien Dutten	1931	H. Horrocks	1965	T.W. Russo

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

JULIAN DATE AT 1400 HOURS - 1980

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	2444	2444	2444	2444	2444	2444	2444	2444	2444	2444	2444	2444
1	240	271	300	331	361	392	422	453	484	514	545	575
2	241	272	301	332	362	393	423	454	485	515	546	576
3	242	273	302	333	363	394	424	455	486	516	547	577
4	243	274	303	334	364	395	425	456	487	517	548	578
5	244	275	304	335	365	396	426	457	488	518	549	579
6	245	276	305	336	366	397	427	458	489	519	550	580
7	246	277	306	337	367	398	428	459	490	520	551	581
8	247	278	307	338	368	399	429	460	491	521	552	582
9	248	279	308	339	369	400	430	461	492	522	553	583
10	249	280	309	340	370	401	431	462	493	523	554	584
11	250	281	310	341	371	402	432	463	494	524	555	585
12	251	282	311	342	372	403	433	464	495	525	556	586
13	252	283	312	343	373	404	434	465	496	526	557	587
14	253	284	313	344	374	405	435	466	497	527	558	588
15	254	285	314	345	375	406	436	467	498	528	559	589
16	255	286	315	346	376	407	437	468	499	529	560	590
17	256	287	316	347	377	408	438	469	500	530	561	591
18	257	288	317	348	378	409	439	470	501	531	562	592
19	258	289	318	349	379	410	440	471	502	532	563	593
20	259	290	319	350	380	411	441	472	503	533	564	594
21	260	291	320	351	381	412	442	473	504	534	565	595
22	261	292	321	352	382	413	443	474	505	535	566	596
23	262	293	322	353	383	414	444	475	506	536	567	597
24	263	294	323	354	384	415	445	476	507	537	568	598
25	264	295	324	355	385	416	446	477	508	538	569	599
26	265	296	325	356	386	417	447	478	509	539	570	600
27	266	297	326	357	387	418	448	479	510	540	571	601
28	267	298	327	358	388	419	449	480	511	541	572	602
29	268	299	328	359	389	420	450	481	512	542	573	603
30	269		329	360	390	421	451	482	513	543	574	604
31	270		330		391		452	483		544		605

ASTRONOMICAL SOCIETY OF SOUTHERN AFRICA

Forbes Essay Competition - 1980

1. The Council of the Astronomical Society of Southern Africa offers prizes for an essay competition on an astronomical subject. The funds for the prizes are mainly derived from a bequest to the Society by the late Mr. A F I Forbes, a well-known amateur astronomer and comet discoverer.

   There will be three prizes, viz. R25, R15 and R10. The competition embraces all scholars up to the age of 18 years and the matriculation standard. The judges will take age into account when assessing the merit of a particular entrant. Prizes will not be awarded if no essays of sufficient merit are received. The judges reserve the right to vary the amounts of prize money.

2. Entrants may choose any astronomical topic to their liking. As a guide some suitable subjects are enumerated here:-
   (a) Life of Gallileo (b) Magnellanic Clouds (c) An observing project
   (d) Moons of Jupiter (e) Radio Astronomy (f) Galaxies (g) Black Holes.

3. The competition will be open to scholars from duly registered schools in Southern Africa, as well as to Student Members of the Society.

4. Essays must be written in English or Afrikaans and must be not more than 2000 words in length.

5. Essays are to be submitted to the Astronomical Society of Southern Africa c/o the South African Astronomical Observatory. P O Box 9, Observatory Cape 7935 before 1980 May 31st. Name of school where applicable and date of birth must be given.

6. The results of the competition will be announced at the Annual Meeting of the Society in July. The Society has the right to publish in its Monthly Notes or to read at any of its meeting any essay entered in the competition.

7. The committee of judges will be appointed by the Council of the Society and will comprise professional astronomers, or members of the teaching staff of Universities or of schools from which no entries have been received.

8. In assessing the merit of the entries the committee will have regard to (a) the age of the competitors, (b) the evidence of accurate knowledge, real understanding and originality. The judges will give no credit for essays which consist of long extracts direct from text books. Competitors are advised to state the authorities from which they drew information.

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