THE
ASTRONOMICAL SOCIETY
OF
SOUTHERN AFRICA

HANDBOOK FOR

1964

THE ASTRONOMICAL SOCIETY OF SOUTHERN AFRICA

1963 - 1964

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The Astronomical Society of South Africa was formed in July 1922, by the amalgamation of the Cape and Johannesburg Astronomical Associations which had been in active existence for several years. Its name was changed to the Astronomical Society of Southern Africa in 1956. The declared objects of the Society are:—

(1) The encouragement and stimulation of the study of Astronomy in Southern Africa;

(2) The association of observers and their organisation in the work of astronomical observation and research;

(3) The dissemination throughout Southern Africa of such current astronomical information as may be helpful to observers;

(4) The publication from time to time of the results of the work accomplished by the Society.

Membership is open to all who are interested in Astronomy. The Society issues, usually, eleven numbers of "The Monthly Notes of the Astronomical Society of Southern Africa" (M.N.A.S.S.A.) each year, and distributes to each member copies of "Sky and Telescope", an illustrated monthly astronomical magazine published in the United States.

Candidates for election as members of the Society must be proposed and seconded by two members (not associate or student members). The annual subscription for members is R5.00 with an entrance fee of R2.50.

M.N.A.S.S.A. is also on sale to non-members of the Society. Enquiries concerning subscriptions and remittances by non-members should be addressed to the Circulation Manager, Mr. H. E. Krumm, 3, Leeuwendal Crescrent, Cape Town.

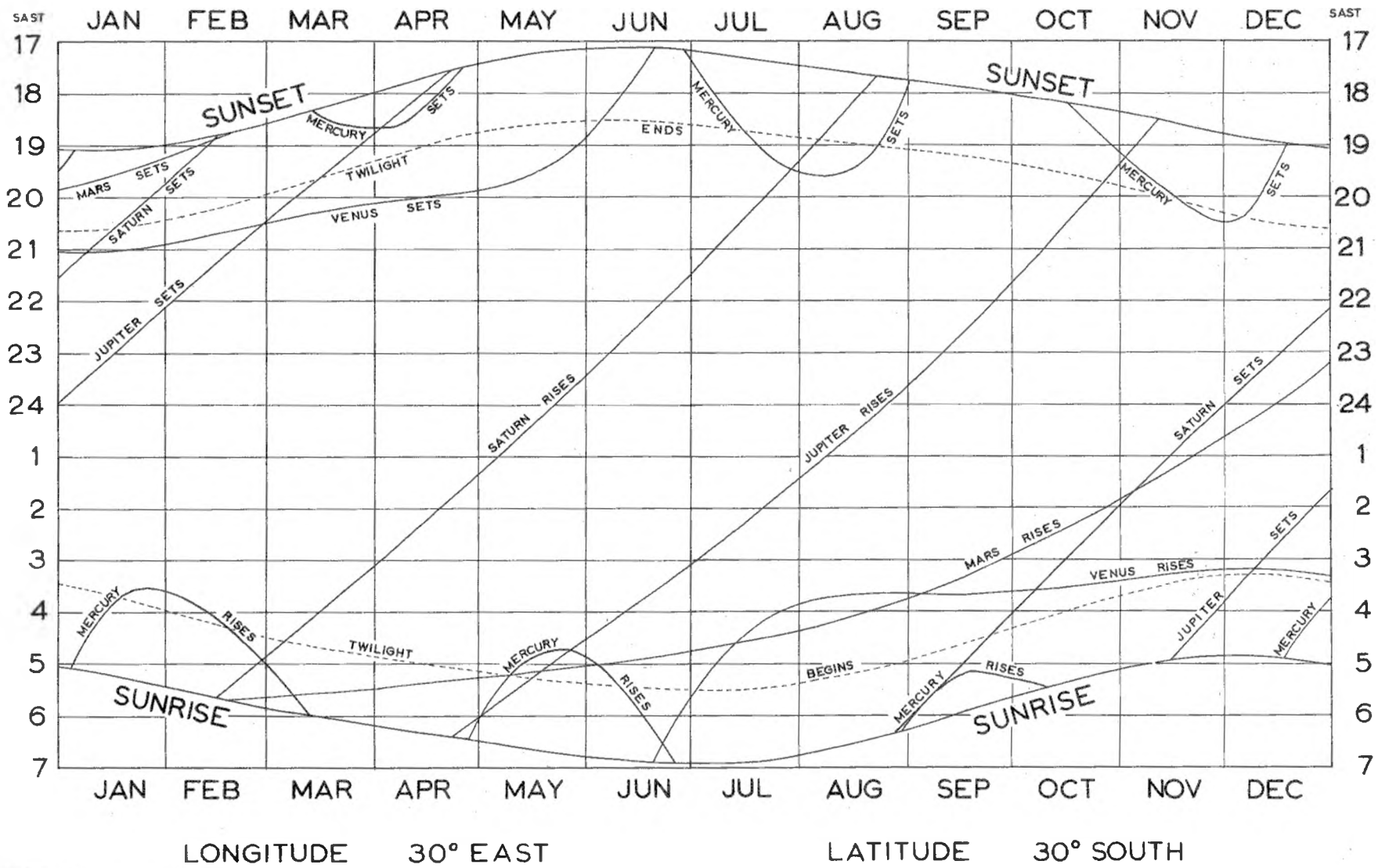
All other communications for the Society should be addressed to the Hon. Secretary, Astronomical Society of Southern Africa, c/o The Royal Observatory, Observatory, Cape Province.

SOCIETY'S CALENDAR FOR 1964

Material and Notes for M.N.A.S.S.A. by	20th of the month.
Nominations for Gill Medal by	April 8.
Essay Competition closes	May 31.
Nominations for Officers and Council by	June 15.
Subscriptions due	July 1.
Annual General Meeting at all Centres	4th Wednesday in July.

THE PLANETS AS SEEN FROM SOUTH AFRICA

1964



LONGITUDE 30° EAST LATITUDE 30° SOUTH

THE HANDBOOK OF THE ASTRONOMICAL SOCIETY OF SOUTHERN AFRICA 1964

Price to Non-Members: 25 cents

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Acknowledgement is made to the following Members of the Society who have assisted in the preparation of the Handbook:- Mr. G. R. Atkins, Dr. David S. Evans, Messrs A. P. Fairall, R. P. de Kock, P. L. Meadows, S. C. Venter and I. Weinberg: to Miss Y. Z. R. Thomas who typed the manuscript, and to H. M. Nautical Almanac Office for the occultation predictions.

INTRODUCTION

All the times given in this booklet are South African Standard Time, that is, mean solar time for a meridian 30°, or two hours, east of Greenwich. This is also the Standard Time in use in the Rhodesias, the Protectorates, Mozambique, and the eastern part of the Congo Republic.

To obtain the local mean time at other places the longitude differences shown in Table I must be applied to the ordinary S.A.S.T.

TABLE I

CORRECTION FOR LONGITUDE

Bloemfontein	-15^m	Grahamstown	-14^m
Cape Town	-46	Johannesburg	-08
Durban	+04	Port Elizabeth	-18
East London	-08	Pretoria	-07
Salisbury	+04	Bulawayo	-06

Conversely, to obtain the S.A.S.T. from the local mean time these longitude corrections must be applied with the sign reversed. Thus the S.A.S.T. of local mean noon (i.e. 12h 00m local mean time) at Port Elizabeth is 12h 18m.

Owing to the fact that the Earth does not go round the Sun with uniform circular motion in the plane of the Earth's equator, the local apparent solar time (i.e. the time shown by a sundial) differs from the local mean solar time by a quantity which is usually referred to as the "Equation of Time". The Equation of Time must be added to the mean solar time to give the apparent solar time. Its effect is shown in the third column of Table II which gives the S.A.S.T. of apparent noon, that is, of the Sun's transit over the meridian.

For example, the S.A.S.T. of apparent noon at Bloemfontein in 1964 September 27 is 12.06 S.A.S.T., found by applying the longitude correction of +15m to the tabulated value for 30° E.

For many purposes, sidereal time, that is, local time as measured by the stars, is extremely useful. The sidereal time can be found by applying the S.A.S.T. (on a 24 hour basis) to the corresponding "Sidereal Time at 0 hours S.A.S.T." which is given in the fourth column of Table II, and correcting for longitude by means of Table I. A further small correction is needed to allow for the four-minute difference in length between the solar and sidereal days.

The correction is +1m for times between 03.00 and 09.00 S.A.S.T., +2m between 09.00 and 15.00, +3m between 15.00 and 21.00, and +4m between 21.00 and 23.59.

Example: Find the sidereal time at 8.45 p.m. on October 7 at Bulawayo.

Sid. time at $00^h\ 00^m$ S.A.S.T. on October 7	1	02
S.A.S.T. elapsed	20	45
	21	47
Correction for longitude		-06
Interval correction		+ 3
Required sidereal time	21	44

For recording the time of variable star observations, the Julian Day calendar is usually used. This numbers the days consecutively from the beginning of the Julian era in 4713 B.C. The Julian Day begins at Greenwich mean noon, that is, at 14.00 (2 p.m.) S.A.S.T.

The position of a star in the sky is fixed by its right ascension and declination, much as the position of a point on the Earth is fixed by its longitude and latitude. In fact, the right ascension and declination of any star are the longitude and latitude of the point on the Earth directly beneath it at zero hours sidereal time at Greenwich. Latitude and declination are always measured in degrees north or south of the equator. Longitude and right ascension are measured either in degrees or in time, 360° being equal to 24 hours (1° equals 4 minutes; 15' equals 1 minute). Right ascension is always measured eastwards from the zero celestial meridian, and thus is the equivalent of the longitude measured eastwards from the Greenwich meridian.

For considering the motions of the Sun, Moon, and planets, the system of co-ordinates known as celestial latitude and longitude is very convenient. These co-ordinates define the position of a celestial body with reference to the ecliptic in exactly the same way as right ascension and declination define its position with reference to the celestial equator. The (celestial) latitude is the angular distance of the body north or south of the ecliptic, while the longitude is the distance from the vernal equinox as measured eastwards along the ecliptic. Celestial latitude and longitude are usually measured in degrees.

The ecliptic is defined by the apparent path of the Sun about the Earth. The latitude of the Sun is therefore always (approximately) zero, whilst its longitude increases by approximately 1° per day.

TABLE II

Date 1964	Julian Date at 14 hours	S. A. S. T. of Sun's transit Longitude 30°E	Sidereal Time for Longitude 30° E S.A.S.T. 0 hours	S.A.S.T. 18 hours
		h. m. s.	h. m.	h. m.
January 1	2,438,396.0	12 03 12	6 38	0 41
" 11	406.0	12 07 38	7 18	1 21
" 21	416.0	12 11 08	7 57	2 00
" 31	426.0	12 13 22	8 37	2 40
February 10	436.0	12 14 16	9 16	3 19
" 20	446.0	12 13 54	9 56	3 59
March 1	456.0	12 12 23	10 35	4 38
" 11	466.0	12 10 03	11 14	5 17
" 21	476.0	12 07 13	11 54	5 57
" 31	486.0	12 04 11	12 33	6 36
April 10	2,438,496.0	12 01 18	13 13	7 16
" 20	506.0	11 58 54	13 52	7 55
" 30	516.0	11 57 10	14 32	8 34
May 10	526.0	11 56 20	15 11	9 14
" 20	536.0	11 56 27	15 50	9 53
" 30	546.0	11 57 26	16 30	10 33
June 9	556.0	11 59 08	17 09	11 12
" 19	566.0	12 01 14	17 49	11 52
" 29	576.0	12 03 21	18 28	12 31
July 9	2,438,586.0	12 05 07	19 08	13 10
" 19	596.0	12 06 12	19 47	13 50
" 29	606.0	12 06 22	20 26	14 29
August 8	616.0	12 05 33	21 06	15 09
" 18	626.0	12 03 47	21 45	15 48
" 28	636.0	12 01 10	22 25	16 28
September 7	646.0	11 57 58	23 04	17 07
" 17	656.0	11 54 28	23 43	17 46
" 27	666.0	11 50 58	0 23	18 26
October 7	2.438,676.0	11 47 50	1 02	19 05
" 17	686.0	11 45 22	1 42	19 45
" 27	696.0	11 43 54	2 21	20 24
November 6	706.0	11 43 41	3 01	21 04
" 16	716.0	11 44 50	3 40	21 43
" 26	726.0	11 47 22	4 19	22 22
December 6	736.0	11 51 07	5 00	23 03
" 16	746.0	11 55 43	5 38	23 41
" 26	756.0	12 00 39	6 18	0 21

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

The table gives for five typical places in Southern Africa the S.A.S.T. of Sunrise and Sunset, i.e. the times when the upper limb of the Sun, as affected by refraction, is on the horizon. The last three columns give the approximate duration of Twilight at Durban, Bloemfontein and Johannesburg. For Cape Town the durations given must be increased by 2, 4, and 6 minutes for Civil, Nautical and Astronomical Twilight respectively, while for Luanshya they must be decreased by 3, 6, and 9 minutes.

	JOHANNESBURG				LUANSHYA				DURATION OF TWILIGHT (mins)		
	SUNRISE		SUNSET		SUNRISE		SUNSET		CIVIL	NAUTICAL	ASTRON
Jan 1	05h	18m	19h	04m	05h	44m	18h	38m	27	59	94
11	05	25	19	05	05	50	18	42	27	59	92
21	05	33	19	04	05	55	18	42	26	57	90
Feb 1	05	42	19	00	05	59	18	40	25	55	87
11	05	49	18	55	06	03	18	37	25	54	85
21	05	56	18	47	06	06	18	34	25	53	83
Mar 1	06	00	18	39	06	09	18	31	25	53	81
11	06	06	18	29	06	10	18	25	24	52	80
21	06	11	18	19	06	11	18	18	24	52	79
Apr 1	06	17	18	06	06	12	18	09	24	52	79
11	06	21	17	56	06	13	18	04	24	52	79
21	06	25	17	47	06	14	17	58	24	52	79
May 1	06	31	17	38	06	15	17	53	24	52	80
11	06	37	17	31	06	17	17	50	25	53	81
21	06	41	17	26	06	20	17	48	25	54	83
Jun 1	06	47	17	23	06	23	17	47	25	55	84
11	06	52	17	22	06	26	17	47	25	55	84
21	06	55	17	24	06	28	17	48	26	55	85
Jul 1	06	57	17	27	06	31	17	51	26	55	85
11	06	55	17	30	06	31	17	54	26	55	84
21	06	53	17	35	06	30	17	57	25	54	84
Aug 1	06	48	17	41	06	27	18	00	25	54	83
11	06	41	17	46	06	24	18	01	25	53	81
21	06	32	17	50	06	19	18	02	25	52	80
Sep 1	06	21	17	54	06	13	18	03	24	52	79
11	06	11	17	59	06	05	18	03	24	52	79
21	05	59	18	03	05	57	18	03	24	52	79
Oct 1	05	50	18	08	05	51	18	04	25	52	80
11	05	39	18	12	05	44	18	05	25	52	81
21	05	27	18	17	05	38	18	06	25	54	83
Nov 1	05	19	18	24	05	33	18	09	25	55	85
11	05	13	18	32	05	30	18	13	25	55	87
21	05	08	18	39	05	29	18	17	26	57	89
Dec 1	05	07	18	46	05	31	18	22	26	59	92
11	05	08	18	53	05	33	18	27	27	60	94
21	05	12	19	00	05	37	18	32	27	60	94

Civil Twilight is defined as beginning or ending when the Sun's centre is 6° below the horizon and includes the time during which operations requiring daylight may still continue. Nautical Twilight begins and ends when the Sun's centre is 12° below the horizon which, for all practical purposes, is the time when it is "dark". The limit of Astronomical Twilight corresponds to the Sun's centre being 18° below the horizon, at which time there is no light from the Sun whatever.

PERIGEE			APOGEE		
Date	S. D.	H. P.	Date	S. D.	H. P.
Jan 26^{d} 03^{h}	16' 20"	59' 58"	Jan 10^{d} 02^{h}	14' 44"	54' 05"
Feb 21 10	16 08	59 14	Feb 6 22	14 46	54 13
Mar 17 18	16 16	59 42	Mar 5 19	14 47	54 15
Apr 14 12	16 30	60 34	Apr 2 14	14 46	54 10
May 12 18	16 40	61 11	Apr 30 04	14 44	54 04
Jun 10 04	16 43	61 22	May 27 11	14 43	53 59
Jul 8 13	16 38	61 04	Jun 23 14	14 43	53 59
Aug 5 17	16 27	60 24	Jul 20 23	14 44	54 05
Sep 2 04	16 14	59 35	Aug 17 14	14 46	54 12
Sep 27 07	16 10	59 20	Sep 14 09	14 47	54 16
Oct 24 00	16 22	60 06	Oct 12 05	14 46	54 13
Nov 21 02	16 36	60 57	Nov 9 00	14 44	54 05
Dec 19 13	16 45	61 27	Dec 6 14	14 42	53 58

S.D. = Semi-diameter H.P. = Horizontal Parallax

The distance of the Moon from the Earth in miles may be found by dividing 817,500,000 by the H.P. in seconds of arc.

MAXIMUM LIBRATION

Longitude				Latitude			
+ West Limb exposed - East Limb exposed				+ North Limb exposed - South Limb exposed			
	°		°		°		°
Jan 4	+6.9	Jul 2	-7.1	Jan 6	-6.8	Jul 2	+6.8
18	-5.6	15	+7.2	21	+6.8	15	-6.8
Feb 1	+5.7	29	-5.9	Feb 3	-6.8	29	+6.7
14	-5.2	Aug 12	+6.5	17	+6.6	Aug 11	-6.7
29	+4.7	25	-4.9	Mar 1	-6.6	25	+6.6
Mar 12	-6.0	Sep 8	+5.7	15	+6.5	Sep 7	-6.5
26	+4.7	20	-5.0	28	-6.6	22	+6.5
Apr 9	-7.0	Oct 6	+5.2	Apr 11	+6.5	Oct 4	-6.5
21	+5.8	18	-5.9	24	-6.6	19	+6.6
May 7	-7.7	Nov 1	+5.7	May 9	+6.6	Nov 1	-6.6
19	+7.0	15	-7.0	21	-6.7	15	+6.8
Jun 4	-7.8	28	+7.0	Jun 5	+6.8	28	-6.8
16	+7.4	Dec 13	-7.6	17	-6.8	Dec 12	+6.8
		26	+7.8			25	-6.8

MOONRISE AND MOONSET

1964 JANUARY

DAY	At 0h S.A.S.T.		JOHANNESBURG		CAPE TOWN	
	J.D. 2438000+	AGE	MOONRISE S.A.S.T.	MOONSET S.A.S.T.	MOONRISE S.A.S.T.	MOONSET S.A.S.T.
W 1	395.4	15.8	21h 09m	7h 09m	22h 03m	7h 32m
T 2	396.4	16.8	21 54	8 12	22 46	8 38
F 3	397.4	17.8	22 36	9 14	23 23	9 42
S 4	398.4	18.8	23 12	10 12	23 56	10 45
S 5	399.4	19.8	23 45	11 09	.....	11 44
M 6	400.4	20.8	.....	12 01	0 26	12 40
T 7	401.4	21.8	0 18	12 53	0 54	13 36
W 8	402.4	22.8	0 51	13 45	1 24	14 31
T 9	403.4	23.8	1 23	14 36	1 53	15 26
F 10	404.4	24.8	1 57	15 29	2 25	16 21
S 11	405.4	25.8	2 35	16 22	3 00	17 16
S 12	406.4	26.8	3 18	17 15	3 40	18 11
M 13	407.4	27.8	4 02	18 07	4 25	19 04
T 14	408.4	28.8	4 52	18 57	5 14	19 54
W 15	409.4	0.1	5 46	19 45	6 08	20 41
T 16	410.4	1.1	6 43	20 30	7 06	21 23
F 17	411.4	2.1	7 40	21 12	8 07	22 02
S 18	412.4	3.1	8 38	21 51	9 08	22 37
S 19	413.4	4.1	9 37	22 27	10 11	23 10
M 20	414.4	5.1	10 36	23 04	11 14	23 43
T 21	415.4	6.1	11 36	23 41	12 18	.....
W 22	416.4	7.1	12 37	.....	13 23	0 16
T 23	417.4	8.1	13 40	0 21	14 31	0 51
F 24	418.4	9.1	14 45	1 04	15 38	1 31
S 25	419.4	10.1	15 50	1 51	16 47	2 16
S 26	420.4	11.1	16 56	2 45	17 54	3 07
M 27	421.4	12.1	17 57	3 43	18 55	4 05
T 28	422.4	13.1	18 54	4 46	19 49	5 09
W 29	423.4	14.1	19 44	5 51	20 37	6 15
T 30	424.4	15.1	20 28	6 55	21 18	7 22
F 31	425.4	16.1	21 07	7 55	21 52	8 26

PHASES OF THE MOON

Last Quarter	Jan 6d	17h	58m
New Moon	14	22	44
First Quarter	22	07	29
Full Moon	29	01	23

MOONRISE AND MOONSET

1964 FEBRUARY

DAY	At 0^h S.A.S.T.		JOHANNESBURG		CAPE TOWN	
	J.D. 2438000+	AGE	MOONRISE S.A.S.T.	MOONSET S.A.S.T.	MOONRISE S.A.S.T.	MOONSET S.A.S.T.
S 1	426.4	17.1	$21^h\ 42^m$	$8^h\ 53^m$	$22^h\ 24^m$	$9^h\ 28^m$
S 2	427.4	18.1	22 15	9 50	22 54	10 27
M 3	428.4	19.1	22 48	10 43	23 24	11 25
T 4	429.4	20.1	23 21	11 35	23 53	12 20
W 5	430.4	21.1	23 55	12 28	.....	13 16
T 6	431.4	22.1	.....	13 20	0 23	14 11
F 7	432.4	23.1	0 32	14 13	0 57	15 07
S 8	433.4	24.1	1 12	15 05	1 35	16 01
S 9	434.4	25.1	1 56	15 58	2 18	16 55
M 10	435.4	26.1	2 43	16 50	3 06	17 46
T 11	436.4	27.1	3 36	17 38	3 58	18 35
W 12	437.4	28.1	4 33	18 25	4 55	19 20
T 13	438.4	29.1	5 30	19 09	5 56	19 59
F 14	439.4	0.4	6 29	19 49	6 58	20 37
S 15	440.4	1.4	7 29	20 28	8 02	21 11
S 16	441.4	2.4	8 29	21 05	9 06	21 45
M 17	442.4	3.4	9 30	21 43	10 11	22 18
T 18	443.4	4.4	10 31	22 21	11 16	22 53
W 19	444.4	5.4	11 33	23 03	12 23	23 31
T 20	445.4	6.4	12 37	23 47	13 30	.....
F 21	446.4	7.4	13 41	.....	14 38	0 13
S 22	447.4	8.4	14 45	0 38	15 43	1 01
S 23	448.4	9.4	15 46	1 33	16 44	1 55
M 24	449.4	10.4	16 43	2 32	17 39	2 55
T 25	450.4	11.4	17 34	3 35	18 28	3 58
W 26	451.4	12.4	18 19	4 37	19 11	5 04
T 27	452.4	13.4	19 00	5 39	19 48	6 08
F 28	453.4	14.4	19 38	6 38	20 21	7 12
S 29	454.4	15.4	20 12	7 36	20 52	8 12

PHASES OF THE MOON

Last Quarter	Feb	5^d	$14^h\ 43^m$
New Moon		13	15 02
First Quarter		20	15 25
Full Moon		27	14 40

MOONRISE AND MOONSET

1964 MARCH

DAY	At 0h S.A.S.T.		JOHANNESBURG		CAPE TOWN	
	J.D. 2438000+	AGE	MOONRISE S.A.S.T.	MOONSET S.A.S.T.	MOONRISE S.A.S.T.	MOONSET S.A.S.T.
S 1	455.4	16.4	20h 45m	8h 32m	21h 22m	9h 11m
M 2	456.4	17.4	21 18	9 25	21 51	10 08
T 3	457.4	18.4	21 52	10 18	22 21	11 05
W 4	458.4	19.4	22 28	11 11	22 55	12 01
T 5	459.4	20.4	23 07	12 04	23 30	12 56
F 6	460.4	21.4	23 49	12 56	.....	13 51
S 7	461.4	22.4	.....	13 49	0 11	14 45
S 8	462.4	23.4	0 34	14 40	0 56	15 37
M 9	463.4	24.4	1 24	15 30	1 46	16 26
T 10	464.4	25.4	2 19	16 16	2 41	17 13
W 11	465.4	26.4	3 16	17 01	3 40	17 54
T 12	466.4	27.4	4 15	17 43	4 43	18 33
F 13	467.4	28.4	5 15	18 23	5 46	19 08
S 14	468.4	29.4	6 16	19 01	6 52	19 43
S 15	469.4	0.8	7 18	19 40	7 58	20 16
M 16	470.4	1.8	8 21	20 19	9 05	20 52
T 17	471.4	2.8	9 25	21 01	10 13	21 29
W 18	472.4	3.8	10 30	21 45	11 21	22 11
T 19	473.4	4.8	11 35	22 35	12 30	22 58
F 20	474.4	5.8	12 40	23 28	13 37	23 49
S 21	475.4	6.8	13 41	.....	14 40	.....
S 22	476.4	7.8	14 39	0 26	15 36	0 48
M 23	477.4	8.8	15 30	1 27	16 26	1 50
T 24	478.4	9.8	16 16	2 28	17 09	2 53
W 25	479.4	10.8	16 58	3 29	17 47	3 57
T 26	480.4	11.8	17 35	4 28	18 20	4 59
F 27	481.4	12.8	18 10	5 26	18 52	6 01
S 28	482.4	13.8	18 43	6 21	19 22	6 59
S 29	483.4	14.8	19 16	7 15	19 51	7 57
M 30	484.4	15.8	19 50	8 08	20 20	8 54
T 31	485.4	16.8	20 24	9 01	20 52	9 51

PHASES OF THE MOON

Last Quarter	Mar 6d	12h	00m
New Moon	14	04	14
First Quarter	20	22	40
Full Moon	28	04	49

MOONRISE AND MOONSET

1964 APRIL

DAY	At 0h S.A.S.T.		JOHANNESBURG		CAPE TOWN	
	J.D. 2438000+	AGE	MOONRISE	MOONSET	MOONRISE	MOONSET
			S.A.S.T.	S.A.S.T.	S.A.S.T.	S.A.S.T.
W 1	486.4	17.8	21h 02m	9h 54m	21h 27m	10h 47m
T 2	487.4	18.8	21 43	10 48	22 05	11 43
F 3	488.4	19.8	22 27	11 40	22 48	12 36
S 4	489.4	20.8	23 14	12 32	23 36	13 29
S 5	490.4	21.8	.....	13 22	.....	14 19
M 6	491.4	22.8	0 06	14 09	0 28	15 06
T 7	492.4	23.8	1 02	14 54	1 24	15 49
W 8	493.4	24.8	1 59	15 37	2 25	16 27
T 9	494.4	25.8	2 58	16 16	3 27	17 04
F 10	495.4	26.8	3 58	16 55	4 32	17 38
S 11	496.4	27.8	5 00	17 33	5 37	18 12
S 12	497.4	28.8	6 03	18 12	6 45	18 47
M 13	498.4	0.4	7 08	18 54	7 54	19 24
T 14	499.4	1.4	8 15	19 38	9 05	20 05
W 15	500.4	2.4	9 23	20 27	10 17	20 51
T 16	501.4	3.4	10 30	21 21	11 26	21 43
F 17	502.4	4.4	11 35	22 19	12 34	22 40
S 18	503.4	5.4	12 35	23 20	13 33	23 43
S 19	504.4	6.4	13 29	.....	14 25	.....
M 20	505.4	7.4	14 17	0 23	15 11	0 46
T 21	506.4	8.4	14 59	1 23	15 49	1 50
W 22	507.4	9.4	15 37	2 22	16 23	2 52
T 23	508.4	10.4	16 11	3 20	16 54	3 53
F 24	509.4	11.4	16 44	4 15	17 24	4 51
S 25	510.4	12.4	17 17	5 08	17 53	5 49
S 26	511.4	13.4	17 50	6 01	18 22	6 45
M 27	512.4	14.4	18 24	6 54	18 52	7 42
T 28	513.4	15.4	19 00	7 47	19 25	8 38
W 29	514.4	16.4	19 39	8 41	20 02	9 35
T 30	515.4	17.4	20 22	9 34	20 44	10 30

PHASES OF THE MOON

Last Quarter	Apr 5d	07h	46m
New Moon	12	14	38
First Quarter	19	06	10
Full Moon	26	19	50

MOONRISE AND MOONSET

1964 MAY

DAY	At 0h S.A.S.T.		JOHANNESBURG		CAPE TOWN	
	J.D. 2438000+	AGE	MOONRISE	MOONSET	MOONRISE	MOONSET
			S.A.S.T.	S.A.S.T.	S.A.S.T.	S.A.S.T.
F 1	516.4	18.4	21h 08m	10h 26m	21h 29m	11h 23m
S 2	517.4	19.4	21 58	11 16	22 19	12 14
S 3	518.4	20.4	22 51	12 04	23 13	13 01
M 4	519.4	21.4	23 47	12 49	.....	13 45
T 5	520.4	22.4	.....	13 32	0 10	14 24
W 6	521.4	23.4	0 44	14 11	1 11	15 01
T 7	522.4	24.4	1 42	14 49	2 13	15 34
F 8	523.4	25.4	2 41	15 26	3 17	16 08
S 9	524.4	26.4	3 43	16 04	4 22	16 41
S 10	525.4	27.4	4 46	16 44	5 30	17 17
M 11	526.4	28.4	5 53	17 27	6 41	17 55
T 12	527.4	0.0	7 01	18 14	7 53	18 40
W 13	528.4	1.0	8 11	19 08	9 07	19 30
T 14	529.4	2.0	9 20	20 06	10 17	20 27
F 15	530.4	3.0	10 25	21 09	11 24	21 30
S 16	531.4	4.0	11 23	22 13	12 20	22 36
S 17	532.4	5.0	12 15	23 16	13 09	23 42
M 18	533.4	6.0	13 00	.....	13 51	.....
T 19	534.4	7.0	13 39	0 17	14 27	0 46
W 20	535.4	8.0	14 14	1 15	14 58	1 47
T 21	536.4	9.0	14 47	2 11	15 28	2 46
F 22	537.4	10.0	15 20	3 04	15 57	3 44
S 23	538.4	11.0	15 52	3 57	16 26	4 40
S 24	539.4	12.0	16 25	4 49	16 55	5 36
M 25	540.4	13.0	17 00	5 42	17 26	6 32
T 26	541.4	14.0	17 38	6 36	18 01	7 28
W 27	542.4	15.0	18 20	7 28	18 42	8 24
T 28	543.4	16.0	19 04	8 21	19 25	9 18
F 29	544.4	17.0	19 53	9 12	20 13	10 10
S 30	545.4	18.0	20 45	10 01	21 06	10 59
S 31	546.4	19.0	21 40	10 46	22 02	11 43

PHASES OF THE MOON

Last Quarter	May 5d	00h	20m
New Moon	11	23	02
First Quarter	18	14	43
Full Moon	26	11	29

MOONRISE AND MOONSET

1964 JUNE

DAY	At 0^h S.A.S.T.		JOHANNESBURG		CAPE TOWN	
	J.D. 2438000+	AGE	MOONRISE S.A.S.T.	MOONSET S.A.S.T.	MOONRISE S.A.S.T.	MOONSET S.A.S.T.
M 1	547.4	20.0	$22^h\ 35^m$	$11^h\ 30^m$	$23^h\ 01^m$	$12^h\ 24^m$
T 2	548.4	21.0	23 32	12 10	.....	13 00
W 3	549.4	22.0	.....	12 47	0 00	13 34
T 4	550.4	23.0	0 29	13 23	1 01	14 06
F 5	551.4	24.0	1 27	13 59	2 04	14 38
S 6	552.4	25.0	2 27	14 36	3 10	15 11
S 7	553.4	26.0	3 31	15 17	4 17	15 47
M 8	554.4	27.0	4 37	16 01	5 27	16 28
T 9	555.4	28.0	5 46	16 51	6 40	17 15
W 10	556.4	29.0	6 56	17 48	7 53	18 09
T 11	557.4	0.7	8 05	18 50	9 03	19 11
F 12	558.4	1.7	9 09	19 56	10 07	20 18
S 13	559.4	2.7	10 06	21 02	11 02	21 26
S 14	560.4	3.7	10 55	22 06	11 48	22 34
M 15	561.4	4.7	11 38	23 07	12 27	23 37
T 16	562.4	5.7	12 15	.....	13 00	.....
W 17	563.4	6.7	12 49	0 05	13 31	0 39
T 18	564.4	7.7	13 22	0 59	14 01	1 37
F 19	565.4	8.7	13 55	1 52	14 29	2 35
S 20	566.4	9.7	14 27	2 45	14 58	3 31
S 21	567.4	10.7	15 00	3 37	15 28	4 27
M 22	568.4	11.7	15 37	4 31	16 02	5 22
T 23	569.4	12.7	16 18	5 24	16 40	6 19
W 24	570.4	13.7	17 02	6 17	17 23	7 13
T 25	571.4	14.7	17 49	7 08	18 10	8 06
F 26	572.4	15.7	18 41	7 58	19 01	8 56
S 27	573.4	16.7	19 35	8 45	19 57	9 42
S 28	574.4	17.7	20 30	9 30	20 54	10 24
M 29	575.4	18.7	21 26	10 10	21 54	11 01
T 30	576.4	19.7	22 22	10 47	22 53	11 36

PHASES OF THE MOON

Last Quarter	Jun 3^d	13^h	08^m
New Moon	10	06	23
First Quarter	17	01	02
Full Moon	25	03	09

MOONRISE AND MOONSET

1964 JULY

DAY	At 0h S.A.S.T.		JOHANNESBURG		CAPE TOWN	
	J.D. 2438000+	AGE	MOONRISE S.A.S.T.	MOONSET S.A.S.T.	MOONRISE S.A.S.T.	MOONSET S.A.S.T.
W 1	577.4	20.7	23h 19m	11h 23m	23h 54m	12h 07m
T 2	578.4	21.7	.....	11 58	.....	12 39
F 3	579.4	22.7	0 16	12 33	0 56	13 10
S 4	580.4	23.7	1 16	13 11	2 00	13 43
S 5	581.4	24.7	2 19	13 52	3 08	14 20
M 6	582.4	25.7	3 25	14 37	4 16	15 03
T 7	583.4	26.7	4 33	15 30	5 29	15 52
W 8	584.4	27.7	5 42	16 28	6 39	16 49
T 9	585.4	28.7	6 48	17 33	7 47	17 54
F 10	586.4	0.4	7 49	18 41	8 47	19 03
S 11	587.4	1.4	8 44	19 47	9 38	20 12
S 12	588.4	2.4	9 30	20 52	10 21	21 21
M 13	589.4	3.4	10 11	21 52	10 59	22 26
T 14	590.4	4.4	10 48	22 50	11 31	23 27
W 15	591.4	5.4	11 22	23 45	12 01	.....
T 16	592.4	6.4	11 55	.....	12 31	0 26
F 17	593.4	7.4	12 38	0 39	13 00	1 23
S 18	594.4	8.4	13 01	1 32	13 29	2 20
S 19	595.4	9.4	13 37	2 25	14 03	3 16
M 20	596.4	10.4	14 16	3 18	14 39	4 12
T 21	597.4	11.4	14 59	4 11	15 20	5 07
W 22	598.4	12.4	15 45	5 04	16 06	6 01
T 23	599.4	13.4	16 36	5 54	16 56	6 52
F 24	600.4	14.4	17 29	6 43	17 51	7 40
S 25	601.4	15.4	18 25	7 28	18 48	8 24
S 26	602.4	16.4	19 21	8 10	19 48	9 02
M 27	603.4	17.4	20 18	8 48	20 48	9 38
T 28	604.4	18.4	21 14	9 25	21 49	10 10
W 29	605.4	19.4	22 11	9 59	22 49	10 42
T 30	606.4	20.4	23 08	10 34	23 52	11 12
F 31	607.4	21.4	.....	11 10	.....	11 44

PHASES OF THE MOON

Last Quarter	Jul	2d	22h	31m
New Moon		9	13	31
First Quarter		16	13	48
Full Moon		24	17	58

MOONRISE AND MOONSET

1964 AUGUST

DAY	At 0h S.A.S.T.		JOHANNESBURG		CAPE TOWN	
	J.D. 2438000+	AGE	MOONRISE S.A.S.T.	MOONSET S.A.S.T.	MOONRISE S.A.S.T.	MOONSET S.A.S.T.
S 1	608.4	22.4	0h 09m	11h 49m	0h 56m	12h 18m
S 2	609.4	23.4	1 12	12 31	2 03	12 57
M 3	610.4	24.4	2 17	13 19	3 11	13 42
T 4	611.4	25.4	3 24	14 13	4 20	14 34
W 5	612.4	26.4	4 30	15 14	5 29	15 34
T 6	613.4	27.4	5 32	16 19	6 30	16 01
F 7	614.4	28.4	6 29	17 26	7 25	17 49
S 8	615.4	0.1	7 20	18 32	8 13	18 59
S 9	616.4	1.1	8 03	19 36	8 53	20 07
M 10	617.4	2.1	8 43	20 36	9 28	21 12
T 11	618.4	3.1	9 18	21 34	10 00	22 13
W 12	619.4	4.1	9 53	22 29	10 30	23 12
T 13	620.4	5.1	10 26	23 24	10 59	.....
F 14	621.4	6.1	11 00	.....	11 29	0 10
S 15	622.4	7.1	11 35	0 17	12 02	1 07
S 16	623.4	8.1	12 13	1 11	12 37	2 04
M 17	624.4	9.1	12 55	2 03	13 17	2 59
T 18	625.4	10.1	13 39	2 57	14 00	3 54
W 19	626.4	11.1	14 29	3 48	14 49	4 46
T 20	627.4	12.1	15 21	4 37	15 43	5 35
F 21	628.4	13.1	16 17	5 24	16 39	6 21
S 22	629.4	14.1	17 13	6 08	17 39	7 01
S 23	630.4	15.1	18 10	6 48	18 39	7 38
M 24	631.4	16.1	19 08	7 25	19 41	8 12
T 25	632.4	17.1	20 05	8 00	20 43	8 43
W 26	633.4	18.1	21 04	8 36	21 46	9 14
T 27	634.4	19.1	22 03	9 11	22 50	9 46
F 28	635.4	20.1	23 05	9 49	23 56	10 19
S 29	636.4	21.1	.....	10 29	.....	10 57
S 30	637.4	22.1	0 09	11 14	1 03	11 38
M 31	638.4	23.1	1 14	12 05	2 11	12 26

PHASES OF THE MOON

Last Quarter	Aug	1d	05h	30m
New Moon		7	21	17
First Quarter		15	05	20
Full Moon		23	07	26
Last Quarter		30	11	16

MOONRISE AND MOONSET

1964 SEPTEMBER

DAY	At 0h S.A.S.T.		JOHANNESBURG		CAPE TOWN	
	J.D. 2438000+	AGE	MOONRISE S.A.S.T.	MOONSET S.A.S.T.	MOONRISE S.A.S.T.	MOONSET S.A.S.T.
T 1	639.4	24.1	2h 18m	13h 02m	3h 17m	13h 22m
W 2	640.4	25.1	3 20	14 04	4 19	14 25
T 3	641.4	26.1	4 18	15 09	5 15	15 32
F 4	642.4	27.1	5 10	16 14	6 04	16 40
S 5	643.4	28.1	5 55	17 19	6 46	17 48
S 6	644.4	29.1	6 37	18 20	7 24	18 54
M 7	645.4	0.7	7 13	19 19	7 56	19 56
T 8	646.4	1.7	7 48	20 16	8 27	20 58
W 9	647.4	2.7	8 22	21 12	8 57	21 57
T 10	648.4	3.7	8 56	22 06	9 27	22 56
F 11	649.4	4.7	9 31	23 01	9 59	23 53
S 12	650.4	5.7	10 08	23 55	10 33	.....
S 13	651.4	6.7	10 49	.....	11 11	0 50
M 14	652.4	7.7	11 33	0 49	11 54	1 45
T 15	653.4	8.7	12 20	1 40	12 41	2 38
W 16	654.4	9.7	13 11	2 30	13 31	3 28
T 17	655.4	10.7	14 06	3 18	14 28	4 15
F 18	656.4	11.7	15 02	4 03	15 26	4 58
S 19	657.4	12.7	15 59	4 44	16 27	5 35
S 20	658.4	13.7	16 56	5 22	17 29	6 11
M 21	659.4	14.7	17 55	5 58	18 31	6 43
T 22	660.4	15.7	18 55	6 34	19 35	7 15
W 23	661.4	16.7	19 56	7 10	20 40	7 46
T 24	662.4	17.7	20 58	7 48	21 47	8 20
F 25	663.4	18.7	22 02	8 28	22 55	8 56
S 26	664.4	19.7	23 07	9 12	.....	9 37
S 27	665.4	20.7	.....	10 01	0 03	10 24
M 28	666.4	21.7	0 12	10 56	1 11	11 16
T 29	667.4	22.7	1 15	11 56	2 14	12 16
W 30	668.4	23.7	2 13	12 58	3 11	13 21

PHASES OF THE MOON

New Moon	Sep 6d	06h	35m
First Quarter	13	23	24
Full Moon	21	19	31
Last Quarter	28	17	02

MOONRISE AND MOONSET

1964 OCTOBER

DAY	At 0^h S.A.S.T.		JOHANNESBURG		CAPE TOWN	
	J.D. 2438000+	AGE	MOONRISE	MOONSET	MOONRISE	MOONSET
			S.A.S.T.	S.A.S.T.	S.A.S.T.	S.A.S.T.
T 1	669.4	24.7	3^h 05^m	14^h 03^m	4^h 01^m	14^h 27^m
F 2	670.4	25.7	3 51	15 06	4 44	15 34
S 3	671.4	26.7	4 33	16 07	5 22	16 39
S 4	672.4	27.7	5 11	17 06	5 55	17 42
M 5	673.4	28.7	5 46	18 04	6 26	18 44
T 6	674.4	0.2	6 19	19 00	6 56	19 43
W 7	675.4	1.2	6 53	19 55	7 26	20 43
T 8	676.4	2.2	7 28	20 50	7 56	21 41
F 9	677.4	3.2	8 04	21 45	8 30	22 39
S 10	678.4	4.2	8 44	22 39	9 06	23 35
S 11	679.4	5.2	9 26	23 32	9 47	.....
M 12	680.4	6.2	10 12	.....	10 32	0 30
T 13	681.4	7.2	11 01	0 23	11 21	1 21
W 14	682.4	8.2	11 54	1 11	12 15	2 09
T 15	683.4	9.2	12 49	1 56	13 11	2 52
F 16	684.4	10.2	13 45	2 39	14 11	3 32
S 17	685.4	11.2	14 42	3 18	15 11	4 08
S 18	686.4	12.2	15 40	3 55	16 14	4 41
M 19	687.4	13.2	16 39	4 30	17 17	5 13
T 20	688.4	14.2	17 40	5 05	18 24	5 44
W 21	689.4	15.2	18 44	5 43	19 31	6 17
T 22	690.4	16.2	19 49	6 23	20 40	6 52
F 23	691.4	17.2	20 56	7 07	21 51	7 32
S 24	692.4	18.2	22 04	7 55	23 01	8 18
S 25	693.4	19.2	23 09	8 50	.....	9 10
M 26	694.4	20.2	.....	9 49	0 09	10 09
T 27	695.4	21.2	0 09	10 52	1 08	11 13
W 28	696.4	22.2	1 04	11 56	2 00	12 19
T 29	697.4	23.2	1 52	12 59	2 45	13 26
F 30	698.4	24.2	2 34	14 00	3 24	14 30
S 31	699.4	25.2	3 12	14 58	3 57	15 33

PHASES OF THE MOON

New Moon	Oct 5^d	18^h	20^m
First Quarter	13	18	57
Full Moon	21	06	46
Last Quarter	27	23	59

MOONRISE AND MOONSET

1964 NOVEMBER

DAY	At 0h S.A.S.T.		JOHANNESBURG		CAPE TOWN	
	J.D. 2438000+	AGE	MOONRISE	MOONSET	MOONRISE	MOONSET
			S.A.S.T.	S.A.S.T.	S.A.S.T.	S.A.S.T.
S 1	700.4	26.2	3h 46m	15h 56m	4h 29m	16h 34m
M 2	701.4	27.2	4 19	16 51	4 58	17 34
T 3	702.4	28.2	4 52	17 46	5 27	18 32
W 4	703.4	29.2	5 26	18 41	5 57	19 31
T 5	704.4	0.6	6 02	19 37	6 29	20 29
F 6	705.4	1.6	6 39	20 31	7 03	21 27
S 7	706.4	2.6	7 21	21 24	8 43	22 22
S 8	707.4	3.6	8 05	22 16	8 26	23 15
M 9	708.4	4.6	8 53	23 05	9 13	.....
T 10	709.4	5.6	9 44	23 51	10 04	0 04
W 11	710.4	6.6	10 38	.....	11 00	0 49
T 12	711.4	7.6	11 33	0 34	11 57	1 29
F 13	712.4	8.6	12 28	1 13	12 56	2 05
S 14	713.4	9.6	13 25	1 50	13 56	2 39
S 15	714.4	10.6	14 22	2 25	14 58	3 09
M 16	715.4	11.6	15 21	3 00	16 01	3 41
T 17	716.4	12.6	16 22	3 36	17 07	4 12
W 18	717.4	13.6	17 27	4 14	18 16	4 46
T 19	718.4	14.6	18 36	4 56	19 28	5 24
F 20	719.4	15.6	19 45	5 42	20 41	6 07
S 21	720.4	16.6	20 54	6 36	21 53	6 57
S 22	721.4	17.6	21 59	7 35	22 59	7 56
M 23	722.4	18.6	22 58	8 40	23 56	9 01
T 24	723.4	19.6	23 50	9 46	.....	10 09
W 25	724.4	20.6	.....	10 52	0 45	11 17
T 26	725.4	21.6	0 35	11 54	1 26	12 23
F 27	726.4	22.6	1 14	12 54	2 01	13 27
S 28	727.4	23.6	1 49	13 51	2 32	14 28
S 29	728.4	24.6	2 22	14 46	3 02	15 27
M 30	729.4	25.6	2 55	15 40	3 31	16 25

PHASES OF THE MOON

New Moon	Nov 4d	09h	17m
First Quarter	12	14	21
Full Moon	19	17	43
Last Quarter	26	09	11

MOONRISE AND MOONSET

1964 DECEMBER

DAY	At 0^h S.A.S.T.		JOHANNESBURG		CAPE TOWN	
	J.D. 2438000+	AGE	MOONRISE S.A.S.T.	MOONSET S.A.S.T.	MOONRISE S.A.S.T.	MOONSET S.A.S.T.
T 1	730.4	26.6	$3^h\ 28^m$	$16^h\ 35^m$	$4^h\ 00^m$	$17^h\ 24^m$
W 2	731.4	27.6	4 02	17 29	4 30	18 21
T 3	732.4	28.6	4 38	18 24	5 03	19 19
F 4	733.4	29.6	5 18	19 18	5 40	20 15
S 5	734.4	0.9	6 02	20 11	6 22	21 09
S 6	735.4	1.9	6 48	21 01	7 08	21 59
M 7	736.4	2.9	7 38	21 48	7 58	22 46
T 8	737.4	3.9	8 30	22 32	8 52	23 28
W 9	738.4	4.9	9 24	23 12	9 47	.....
T 10	739.4	5.9	10 19	23 48	10 45	0 05
F 11	740.4	6.9	11 14	.....	11 43	0 38
S 12	741.4	7.9	12 09	0 23	12 43	1 09
S 13	742.4	8.9	13 06	0 56	13 43	1 39
M 14	743.4	9.9	14 03	1 30	14 46	2 09
T 15	744.4	10.9	15 05	2 06	15 52	2 40
W 16	745.4	11.9	16 10	2 45	17 00	3 14
T 17	746.4	12.9	17 18	3 28	18 13	3 54
F 18	747.4	13.9	18 28	4 18	19 26	4 41
S 19	748.4	14.9	19 38	5 15	20 37	5 35
S 20	749.4	15.9	20 42	6 19	21 42	6 39
M 21	750.4	16.9	21 40	7 27	22 36	7 48
T 22	751.4	17.9	22 29	8 36	23 23	8 59
W 23	752.4	18.9	23 12	9 42	.....	10 09
T 24	753.4	19.9	23 50	10 45	0 01	11 17
F 25	754.4	20.9	.....	11 44	0 34	12 20
S 26	755.4	21.9	0 24	12 42	1 05	13 21
S 27	756.4	22.9	0 57	13 37	1 34	14 20
M 28	757.4	23.9	1 30	14 30	2 03	15 18
T 29	758.4	24.9	2 04	15 25	2 32	16 15
W 30	759.4	25.9	2 38	16 19	3 05	17 13
T 31	760.4	26.9	3 17	17 13	3 40	18 09

PHASES OF THE MOON

New Moon	Dec	4^d	$03^h\ 19^m$
First Quarter		12	08 02
Full Moon		19	04 42
Last Quarter		25	21 27

ECLIPSES

During 1964 there are six eclipses, four of the Sun and two of the Moon.

1.	January 14.	Partial eclipse of the Sun, invisible in Southern Africa.
2.	June 10.	Partial eclipse of the Sun, invisible in Southern Africa.
3.	June 24-25.	Total eclipse of the Moon.
4.	July 9.	Partial eclipse of the Sun, invisible in Southern Africa.
5.	December 3-4.	Partial eclipse of the Sun, invisible in Southern Africa.
6.	December 19.	Total eclipse of the Moon, the ending invisible in Southern Africa.

Total Eclipse of the Moon
June 24 - 25

Moon enters penumbra	$24^d 23^h 58^m$ S.A.S.T.	
Moon enters umbra	25 01 09	in P.A. 86° East of north point.
Total eclipse begins	25 02 16	
Middle of the eclipse	25 03 06	
Total eclipse ends	25 03 57	
Moon leaves umbra	25 05 03	in P.A. 77° West of north point.
Moon leaves penumbra	25 06 14	
Magnitude of eclipse	1.561	

Total Eclipse of the Moon
December 19

Moon enters penumbra	$19^d 02^h 01^m$ S.A.S.T.	
Moon enters umbra	19 02 59	in P.A. 105° East of north point.
Total eclipse begins	19 04 07	
Middle of the eclipse	19 04 37	
Total eclipse ends	19 05 07	
Magnitude of eclipse	1.181	

OCCULTATIONS OF BRIGHT STARS

Date	Z.C.	Sp	Mag	(1950.0) Dec.	Ph	Cape Town			
						P.A.	h. m.	a	b
Jan									
9	2133	K0	5.6	-11° 13'	R	316°	03 52.2	-0.2	-2.2
10	2245	K0	6.4	-14 53	R	343	03 47.8	+0.5	-2.8
10	2247	A5	5.6	-15 31	R	-	-	-	-
18	3392	A2	7.1	-10 42	D	-	-	-	-
21	249	K0	4.7	+ 5 14	D	-	-	-	-
24	668	K0	3.6	+19 04	D	-	-	-	-
24	668	K0	3.6	+19 04	R	-	-	-	-
25	691	F8	6.6	+19 47	D	124	00 54.5	-0.7	0.0
25	817m	B3	4.8	+21 54	D	-	-	-	-
25	828	K0	6.5	+22 26	D	68	20 59.0	-1.9	+0.2
Feb									
8	2456	B3	6.2	-20 26	R	-	-	-	-
20	617	F8	6.6	+18 18	D	-	-	-	-
21	766	B3p	6.0	+21 38	D	-	-	-	-
21	784	A0	6.2	+22 14	D	10	23 18.2	Graze	
21	784	A0	6.2	+22 14	R	343	23 34.7		
22	956	B2	6.3	+23 46	D	58	22 57.3	-2.1	+1.7
22	960	G5	6.6	+23 37	D	85	23 54.6	-1.5	+1.1
23	962	B0	7.0	+23 29	D	113	00 10.3	-1.0	+0.4
23	964	B9	7.0	+23 18	D	-	-	-	-
24	1118	A0	6.0	+23 03	D	-	-	-	-
Mar									
5	2271	K0	4.3	-16 35	D	-	-	-	-
5	2271	K0	4.3	-16 35	R	-	-	-	-
9	2822	A5	5.6	-22 30	R	308	03 14.4	+0.3	-2.1

m indicates that the star is not single

The approximate time of an occultation at a place $\Delta\lambda$ degrees west and $\Delta\phi$ degrees north of one of the standard stations given above may be found from

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

where a and b are in minutes of time.

OCCULTATIONS OF BRIGHT STARS

Date	Z.C.	Johannesburg				Luanshya			
		P.A.	h. m.	a	b	P.A.	h. m.	a	b
Jan									
9	2133	348°	03 32.4	+0.3	-3.4	-	-	-	-
10	2245	-	-	-	-	-	-	-	-
10	2247	-	-	-	-	284°	04 23.9	-0.9	-1.0
18	3392	128	19 33.4	-	-	82	19 35.4	-0.9	+0.8
21	249	-	-	-	-	100	21 31.0	-1.5	+0.1
24	668	-	-	-	-	155	21 35.8	Graze	
24	668	-	-	-	-	169	21 46.8		
25	691	-	-	-	-	54	01 18.9	-1.0	+1.6
25	817m	136	19 37.0	-	-	87	19 19.3	-2.3	-0.2
25	828	59	21 23.5	-2.3	+1.0	12	21 55.2	-	-
Feb									
8	2456	248	04 18.6	-1.9	0.0	289	04 10.3	-1.0	-1.2
20	617	-	-	-	-	107	20 13.9	-2.6	-0.5
21	766	-	-	-	-	24	19 01.5	-1.7	+3.4
21	784	-	-	-	-	-	-	-	-
21	784	-	-	-	-	-	-	-	-
22	956	-	-	-	-	-	-	-	-
22	960	50	24 21.1	-1.7	+2.4	-	-	-	-
23	962	81	00 25.7	-1.0	+1.1	21	00 55.3	-	-
23	964	123	00 32.2	-0.4	-0.2	82	00 35.9	-1.0	+0.7
24	1118	-	-	-	-	137	01 55.6	+0.1	-1.2
Mar									
5	2271	167	00 58.2	+0.4	-3.4	127	00 26.8	-0.2	-1.6
5	2271	249	01 46.2	-2.3	+0.1	289	01 37.6	-1.2	-1.2
9	2822	-	-	-	-	-	-	-	-

Date	Z.C.	Sp	Mag	(1950.0) Dec.	Ph	Cape. Town			
						P.A.	h. m.	a	b
Mar									
10	2961	K0	6.0	-21° 58'	R	-	-	-	-
16	298	F2	7.2	+ 7 37	D	-	-	-	-
17	437	G5	7.4	+13 24	D	93°	19 59.0	-1.0	+1.0
20	907	A2	6.9	+22 54	D	-	-	-	-
21	1070	K0	5.2	+24 17	D	21	22 47.7	Graze	
21	1070	K0	5.2	+24 17	R	358	23 01.8		
22	1200	K0	6.9	+23 19	D	90	20 22.3	-2.4	-0.1
23	1221	M3	6.2	+22 47	D	121	00 24.3	-0.7	+0.1
23	1222	G0	7.2	+22 36	D	-	-	-	-
25	1462	K0	7.4	+16 42	D	-	-	-	-
26	1689	M3	5.5	+ 8 25	D	165	22 11.5	-0.9	-2.9
27	1702	M0	4.2	+ 6 49	D	-	-	-	-
Apr									
5	2754	B8	5.9	-23 14	R	-	-	-	-
17	1019m	A5	6.7	+24 30	D	-	-	-	-
19	1308	A0	4.7	+21 39	D	-	-	-	-
21	1544	M0	5.7	+14 24	D	-	-	-	-
24	1773	K0	5.1	+ 3 35	D	162	03 56.3	-0.1	-1.7
29	2316	F5	6.4	-18 13	R	250	02 10.0	-3.4	+1.2
29	2331	K0	6.4	-18 25	R	295	05 47.5	-1.5	0.0
29	2425	G5	5.9	-20 20	R	256	22 04.2	-0.7	-0.8
May									
1	2557	K0	6.2	-22 28	R	272	00 10.7	-1.1	-1.2
1	2706	B9	5.8	-23 33	R	-	-	-	-
2	2714	A2	6.1	-23 53	R	-	-	-	-
14	954	G5	6.1	+23 59	D	150	18 58.2	-0.1	-1.2
14	956	B2	6.3	+23 46	D	-	-	-	-
17	1393	G5	6.7	+20 00	D	88	20 08.9	-2.2	+0.8
18	1514	B9	6.1	+15 14	D	-	-	-	-
19	1621	M3	7.5	+11 34	D	114	20 11.9	-2.1	-0.8
21	1739	F5	6.5	+ 5 50	D	116	00 06.4	-1.1	+0.1
Jun									
1	3078	A3	4.9	-20 03	R	321	01 35.7	-	-
13	1342	G5	7.5	+21 22	D	-	-	-	-
13	1342	G5	7.5	+21 22	R	-	-	-	-
15	1586	K0	7.5	+12 38	D	-	-	-	-
18	1813	M0	6.0	+ 2 08	D	101	00 27.4	-0.5	+0.8
22	2246	K0	7.4	-16 43	D	-	-	-	-
27	2928	F5	6.5	-22 44	R	223	05 26.3	-0.7	+2.7

Date	Z.C.	Johannesburg				Luanshya			
		P.A.	h. m.	a	b	P.A.	h. m.	a	b
Mar									
10	2961	–	–	–	–	246°	04 54.3	-1.3	+0.5
16	298	–	–	–	–	125	19 33.7	-0.4	-1.3
17	437	–	–	–	–	–	–	–	–
20	907	–	–	–	–	168	22 58.4	–	–
21	1070	–	–	–	–	–	–	–	–
21	1070	–	–	–	–	–	–	–	–
22	1200	64°	20 51.5	-3.1	+1.4	–	–	–	–
23	1221	–	–	–	–	–	–	–	–
23	1222	–	–	–	–	71	00 54.5	-1.0	+1.2
25	1462	–	–	–	–	171	00 09.9	+0.1	-3.4
26	1689	132	22 06.6	-1.9	-1.9	99	21 48.8	-2.9	-0.8
27	1702	–	–	–	–	157	04 18.1	-0.1	-2.1
Apr									
5	2754	242	00 16.1	-0.5	0.0	–	–	–	–
17	1019m	35	18 40.1	–	–	–	–	–	–
19	1308	139	20 34.0	-1.3	-1.2	102	20 24.6	-2.5	-0.3
21	1544	–	–	–	–	167	20 31.6	-1.0	-3.7
24	1773	–	–	–	–	–	–	–	–
29	2316	292	02 38.6	-2.7	-0.9	342	02 07.3	–	–
29	2331	–	–	–	–	–	–	–	–
29	2425	289	22 01.0	-0.5	-1.5	326	21 37.6	+0.3	-2.3
May									
1	2557	308	00 07.5	-0.9	-2.3	–	–	–	–
1	2706	230	23 26.6	-1.6	+0.9	277	23 25.6	-0.7	-0.7
2	2714	–	–	–	–	239	01 25.1	-3.1	+1.5
14	954	110	19 00.2	-0.6	+0.2	69	19 08.7	-1.2	+1.1
14	956	–	–	–	–	114	19 27.1	-0.4	-0.3
17	1393	–	–	–	–	–	–	–	–
18	1514	180	22 51.7	+0.9	-3.7	126	22 30.1	-0.7	-0.9
19	1621	68	20 41.0	–	–	–	–	–	–
21	1739	72	00 25.4	-1.4	+2.1	–	–	–	–
Jun									
1	3078	–	–	–	–	–	–	–	–
13	1342	96	17 55.5	-1.8	+0.4	34	18 21.4	Graze	
13	1342	–	–	–	–	17	18 32.3		
15	1586	159	20 37.4	-0.2	-1.9	115	20 23.0	-1.4	-0.6
18	1813	–	–	–	–	–	–	–	–
22	2246	–	–	–	–	122	02 21.2	-1.1	-0.8
27	2928	230	05 50.2	-0.4	+2.2	–	–	–	–

Date	Z.C.	Sp	Mag	(1950.0) Dec.	Ph	Cape Town			
						P.A.	h. m.	a	b
Jun									
27	3031	A0	5.9	-21° 42'	R	-	-	-	-
30	3304	A0	6.4	-14 51	R	-	-	-	-
Jul									
1	3428m	A0	5.2	- 9 53	R	283°	00 26.2	-0.4	-1.8
3	150m	F0	6.2	+ 1 06	R	212	04 20.4	-0.9	+1.3
12	1535	K0	7.1	+14 36	D	-	-	-	-
12	1544	M0	5.7	+14 24	D	-	-	-	-
18	2196	K2	6.7	-14 57	D	-	-	-	-
19	2210	G5	6.8	-15 32	D	-	-	-	-
19	2313	G0	7.0	-18 07	D	199	19 01.2	Graze	
19	2313	G0	7.0	-18 07	R	217	19 14.4		
19	2316	F5	6.4	-18 13	D	150	19 45.6	-1.1	-3.2
19	2331	K0	6.4	-18 25	D	86	23 11.4	-2.2	+1.1
20	2345	A0	6.9	-18 43	D	98	02 21.7	-0.5	+0.9
20	2445	K0	7.4	-21 23	D	-	-	-	-
21	2457	A0	6.3	-21 30	D	174	01 08.1	Graze	
21	2457	A0	6.3	-21 30	R	197	01 24.8		
22	2595m	B0	5.7	-22 47	D	48	03 23.0	-0.1	+2.7
31	249	K0	4.7	+ 5 14	R	-	-	-	-
Aug									
1	362	G0	6.5	+ 9 59	R	-	-	-	-
13	2043	K0	6.6	- 8 39	D	-	-	-	-
13	2047	K0	6.7	- 8 48	D	-	-	-	-
19	2706	B9	5.8	-23 33	D	121	03 31.4	-0.4	+0.2
21	3078	A3	4.9	-20 03	D	25	19 42.7	-1.7	+2.5
27	327	G5	4.5	+ 8 37	D	-	-	-	-
27	322	G0	5.7	+ 8 20	R	-	-	-	-
28	327	G5	4.5	+ 8 37	R	-	-	-	-
30	614	G5	5.7	+19 29	R	306	04 49.1	-	-
31	752	A5	4.7	+21 31	R	-	-	-	-
Sep									
1	936	K0	5.9	+24 26	R	281	05 18.4	-1.6	-1.3
2	1092	F5	5.8	+24 13	R	-	-	-	-
10	2110	G5	6.4	-12 38	D	-	-	-	-
10	2110	G5	6.4	-12 38	R	-	-	-	-
12	2353	K0	4.6	-19 55	D	-	-	-	-
14	2630m	K0	5.1	-23 43	D	136	22 47.7	-2.2	-1.4
17	2921	G5	6.1	-22 53	D	115	01 14.7	-1.4	+0.2
17	2928	F5	6.5	-22 44	D	124	02 30.1	-0.8	0.0

Date	Z.C.	Johannesburg				Luanshya			
		P.A.	h. m.	a	b	P.A.	h. m.	a	b
Jun									
27	3031	-	-	-	-	204°	22 21.6	-	-
30	3304	192°	00 09.2	-	-	249	00 30.6	-1.6	+0.5
Jul									
1	3428m	-	-	-	-	-	-	-	-
3	150m	223	04 41.7	-1.4	+1.4	263	04 53.2	-2.9	+0.1
12	1535	-	-	-	-	194	18 22.5	-	-
12	1544	182	19 59.5	+1.0	-3.8	125	19 39.3	-0.4	-0.7
18	2196	147	21 12.1	-1.9	-2.6	101	20 53.8	-3.2	-0.4
19	2210	-	-	-	-	122	01 06.1	-0.6	-0.7
19	2313	138	18 28.8	-1.3	-2.6	-	-	-	-
19	2313	-	-	-	-	-	-	-	-
19	2316	110	19 45.9	-2.6	-1.3	59	19 49.3	-	-
19	2331	51	23 47.6	-1.4	+3.8	-	-	-	-
20	2345	-	-	-	-	-	-	-	-
20	2445	-	-	-	-	126	20 37.6	-2.6	-2.1
21	2457	135	01 04.7	-1.8	-1.3	86	01 03.0	-1.4	+0.7
21	2457	-	-	-	-	-	-	-	-
22	2595m	32	03 42.0	+0.8	+3.2	-	-	-	-
31	249	-	-	-	-	188	05 20.0	-0.5	+3.7
Aug									
1	362	226	01 39.1	-0.4	+0.6	272	01 40.4	-1.1	-0.6
13	2043	83	18 26.2	-3.1	+1.1	-	-	-	-
13	2047	94	18 55.2	-2.5	+0.5	-	-	-	-
19	2706	-	-	-	-	-	-	-	-
21	3078	-	-	-	-	-	-	-	-
27	327	118	23 42.3	-1.7	-3.0	64	23 32.5	-0.6	+0.5
27	322	-	-	-	-	228	23 37.0	-0.5	+1.0
28	327	179	00 16.0	+0.5	+3.6	231	00 40.3	-1.0	+1.1
30	614	312	05 06.2	-	-	-	-	-	-
31	752	-	-	-	-	218	01 44.9	+0.2	+1.2
Sep									
1	936	288	05 27.6	-2.4	-1.3	-	-	-	-
2	1092	-	-	-	-	248	04 05.6	-0.5	+0.3
10	2110	-	-	-	-	191	20 51.1	Graze	
10	2110	-	-	-	-	202	20 57.2		
12	2353	-	-	-	-	127	19 34.2	-2.5	-1.6
14	2630m	119	22 59.5	-1.4	-0.3	76	23 05.7	-0.7	+1.0
17	2921	108	01 27.6	-0.8	+0.3	71	01 36.9	-0.1	+1.0
17	2928	-	-	-	-	-	-	-	-

Date	Z.C.	Sp	Mag	(1950.0) Dec.	Ph	Cape Town P.A.	h. m.	a	b
Sep									
17	3031	A0	5.9	-21 42	D	-	-	-	-
19	3197	K0	6.5	-17 05	D	80°	03 49.1	-0.3	+1.4
Oct									
9	2301	F5	6.8	-18 24	D	-	-	-	-
10	2432m	B8	6.8	-21 29	D	-	-	-	-
10	2445	K0	7.4	-21 23	D	61	21 35.7	0.0	+2.2
12	2714	A2	6.1	-23 53	D	4	20 56.4	Graze	
12	2714	A2	6.1	-23 53	R	340	21 13.8		
13	2857	K5	6.7	-23 58	D	124	20 27.6	-3.0	-1.5
13	2872m	A0	6.2	-23 33	D	95	23 36.4	-0.7	+1.0
13	2875	K0	6.1	-23 33	D	100	23 46.0	-0.7	+0.9
16	3243	G5	7.4	-16 47	D	-	-	-	-
17	3271	F8	7.1	-14 54	D	354	02 02.3	-	-
18	3392	A2	7.1	-10 42	D	42	00 49.5	-0.8	+2.2
18	3506	K2	6.3	- 6 39	D	-	-	-	-
25	839	B3	5.3	+24 00	R	245	03 42.3	-2.0	+0.5
26	1030m	G5	3.2	+25 11	D	120	05 03.8	-2.3	-0.9
27	1155	F0	6.3	+24 28	R	-	-	-	-
27	1157	A0	6.0	+24 20	R	-	-	-	-
27	1170m	G5	3.7	+24 31	D	157	03 46.1	-	-
27	1170m	G5	3.7	+24 31	R	206	04 19.4	-	-
Nov									
9	2811	F8	6.2	-24 16	D	-	-	-	-
12	3081	K0	6.7	-20 23	D	107	00 17.8	-0.3	+0.7
15	3478	K0	6.5	- 7 44	D	52	01 11.2	-0.4	+1.9
16	49	K0	6.3	- 2 30	D	81	00 56.2	-1.2	+1.4
16	170	K0	6.2	+ 2 11	D	-	-	-	-
22	1099m	K0	6.0	+24 58	R	-	-	-	-
23	1117	G5	5.1	+25 09	R	243	04 34.5	-2.4	+1.0
Dec									
8	3031	A0	5.9	-21 42	D	141	21 30.3	-	-
10	3284	F5	7.1	-15 12	D	92	20 27.3	-1.9	+1.0
16	384	F5	5.7	+12 14	D	60	01 04.8	-1.2	+1.7
17	517	K0	6.4	+17 40	D	345	02 06.9	Graze	
17	517	K0	6.4	+17 40	R	341	02 09.1		
25	1707	A0	5.2	+ 8 31	R	4	01 38.6	-	-
26	1813	M0	6.0	+ 2 08	R	-	-	-	-
31	Venus		-3.4	-21 39	D	125	17 35.9	-0.2	+0.1

Date	Z.C.	Johannesburg				Luanshya			
		P.A.	h. m.	a	b	P.A.	h. m.	a	b
Sep									
17	3031	-	-	-	-	84°	19 55.4	-3.2	+0.1
19	3197	-	-	-	-	-	-	-	-
Oct									
9	2301	49°	18 52.9	-0.8	+3.7	-	-	-	-
10	2432m	91	18 53.8	-1.7	+0.8	33	19 22.8	-	-
10	2445	-	-	-	-	-	-	-	-
12	2714	-	-	-	-	-	-	-	-
12	2714	-	-	-	-	-	-	-	-
13	2857	109	20 48.7	-2.5	-0.1	66	20 59.2	-1.5	+1.5
13	2872m	89	23 48.2	-0.2	+0.9	-	-	-	-
13	2875	93	23 56.7	-0.2	+0.8	-	-	-	-
16	3243	-	-	-	-	96	19 24.3	-3.5	-0.7
17	3271	-	-	-	-	-	-	-	-
18	3392	40	01 13.1	-0.5	+2.2	359	01 49.1	+0.7	+4.1
18	3506	358	19 53.7	-	-	-	-	-	-
25	839	255	04 08.6	-2.4	+0.7	290	04 10.6	-3.0	-0.8
26	1030m	-	-	-	-	-	-	-	-
27	1155	219	01 18.5	-0.1	+1.0	262	01 22.8	-1.0	-0.2
27	1157	-	-	-	-	227	01 42.3	-0.5	+1.3
27	1170m	137	03 47.9	-2.6	-2.3	98	03 29.8	-2.5	-0.6
27	1170m	232	04 53.0	-2.7	+1.4	270	05 02.2	-3.0	-0.1
Nov									
9	2811	88	19 56.8	-1.2	+1.0	49	20 16.2	-0.2	+2.0
12	3081	-	-	-	-	-	-	-	-
15	3478	44	01 28.0	0.0	+1.9	-	-	-	-
16	49	74	01 16.2	-0.7	+1.4	42	01 36.7	-0.4	+1.9
16	170	-	-	-	-	104	22 08.7	-4.4	-0.9
22	1099m	216	23 50.0	-0.3	+1.2	258	23 56.8	-1.3	0.0
23	1117	-	-	-	-	-	-	-	-
Dec									
8	3031	129	21 35.2	-0.8	-0.6	-	-	-	-
10	3284	91	20 51.2	-1.4	+1.0	58	21 08.0	-0.7	+1.6
16	384	44	01 29.1	-0.9	+2.0	-	-	-	-
17	517	-	-	-	-	-	-	-	-
17	517	-	-	-	-	-	-	-	-
25	1707	-	-	-	-	-	-	-	-
26	1813	-	-	-	-	271	03 26.0	-2.1	-0.6
31	Venus	-	-	-	-	-	-	-	-

THE PLANETS

The chart (frontispiece) shows the S.A.S.T. of the rising and setting of the Sun and the planets for position 30° E, 30° S. The approximate times for other places can be found by applying the longitude differences shown in Table I with the sign reversed, e.g. for Cape Town add 46 minutes, for Durban subtract 4 minutes. The correction in latitude will, in general, be sufficiently small to be ignored and in no case will it exceed 15 minutes.

Mercury will be best seen shortly after sunset near the greatest eastern elongation on August 5 and may possibly be glimpsed during the greatest elongation in April and November/December. Best morning visibility will be during the greatest western elongations of January and May, while it may just be seen during the greatest elongation in September.

Venus will appear as a prominent object in the evening sky during the first half of the year reaching maximum eastern elongation in April. On June 20 it will pass between the Earth and the Sun to appear in the morning sky, reaching its maximum western elongation in August. It will reach its greatest brilliancy (magnitude -4.2) shortly before and after its inferior conjunction.

Mars will be too close to the Sun for observation during the first half of the year, after which it will rise successively earlier in the morning sky, gradually brightening to magnitude 0.5 at the end of the year. It moves from Taurus in July to Gemini in August and into Cancer until mid-October. For the rest of the year it is in Leo.

Jupiter will be an evening object early in the year and after conjunction on April 22 will be seen in the morning sky. By the end of the year, it will again be prominent in the evening sky reaching maximum brightness (magnitude -2.4) at opposition on November 13. Before conjunction Jupiter is in Pisces. After conjunction it is in Aries, moves into Taurus in August and back into Aries in November.

The movement of Saturn is similar to that of Jupiter. Conjunction occurs on February 15 and opposition on August 24, when the planet is at maximum brightness (magnitude 0.6). Saturn is in Aquarius throughout the latter part of the year.

Uranus (at opposition February 27) and Neptune (at opposition May 7) require optical aid but can be found fairly easily from the ephemeris given.

EPHEMERIS FOR URANUS AND NEPTUNE 1964

		Uranus		Neptune	
		R.A.	Dec.	R.A.	Dec.
Jan	1	$10^h\ 47^m.2$	+ 8° 34'	$15^h\ 00^m.9$	- 15° 18'
	21	10 45.5	+ 8 45	15 02.6	- 15 24
Feb	10	10 42.8	+ 9 02	15 03.5	- 15 27
Mar	1	10 39.6	+ 9 21	15 03.4	- 15 25
	21	10 36.4	+ 9 40	15 02.5	- 15 21
Apr	10	10 33.8	+ 9 55	15 01.0	- 15 13
	30	10 32.3	+ 10 03	14 58.9	- 15 04
May	20	10 32.0	+ 10 04	14 56.8	- 14 55
Jun	9	10 33.1	+ 9 56	14 54.8	- 14 47
	29	10 35.4	+ 9 42	14 53.4	- 14 42
Jul	19	10 38.8	+ 9 21	14 52.6	- 14 39
Aug	8	10 42.9	+ 8 56	14 52.7	- 14 41
	28	10 47.5	+ 8 28	14 53.6	- 14 46
Sep	17	10 52.2	+ 8 00	14 55.2	- 14 54
Oct	7	10 56.6	+ 7 33	14 57.6	- 15 05
	27	11 00.5	+ 7 10	15 00.3	- 15 17
Nov	16	11 03.3	+ 6 53	15 03.3	- 15 30
Dec	6	11 05.0	+ 6 43	15 06.2	- 15 42
	26	11 05.4	+ 6 42	15 08.8	- 15 51

The coordinates are apparent geocentric positions for the equinox of date.

METEOR CALENDAR 1964

Date	Shower	Radiant	Maximum		
		R.A. Dec	Date	Hourly Rate	Transit of Radiant
Jan 3	Quadrantids	227° + 46°	Jan 3	40	$08^h\ 30^m$
Mar 12 -Apr 25	Hydraids	184 - 27	Mar 25	?	00 00
Mar 1 -May 10	Virginiids	200 - 6	Apr 3	?	00 00
Apr 2 -Apr 24	Lyrids.	273 + 35	Apr 21	12	04 00
Apr 29 -May 21	Eta Aquarids	338 - 1	May 6	10	07 36
Apr 20 -Jul 30	Sco - Sgr System	270 - 30	Jun 14	?	00 30
Jul 25 -Aug 10	Delta Aquarids	343 - 17	Jul 28	20	02 00
Jul 18 -Jul 30	Alpha Capricornids	304 - 12	?	?	-- --
Jul 20 -Aug 19	Perseids	43 + 56	Aug 12	50	05 36
Aug 16 -Oct 8	Piscids	0 + 14	Sep 12	?	00 30
Oct 11 -Oct 30	Orionids	94 + 16	Oct 22	20	04 24
Sep 24 -Dec 10	Taurids	58 + 21	Nov 13	6	00 36
Nov 16	Leonids	151 + 21	Nov 16	6	06 32
Dec 5 -Dec 12	Geminids	113 + 30	Dec 12	30	02 00
Dec 5 -Jan 7	Velaids	149 - 51	Dec 29	?	03 30

The hourly rates would apply if the radiants were in the observer's zenith. The orbits of the cometary currents are closely related to the orbits of the comets named: the orbits of ecliptical currents to those of certain minor planets.

Recommended SAST of watch	Conditions at Maximum	Nature of current	Appearance
Difficult in SA.			
22h - 24h	Unfavourable	Unknown	
22h - 24h	Unfavourable	Ecliptical	
02h - 04h	Favourable	Cometary: Comet 1861 I	Swift with streaks
03h - dawn	Unfavourable	Cometary: Halley	Very swift, long paths
20h - 24h	Favourable	Ecliptical	
23h - 02h	Favourable	Ecliptical	Slow, long paths
22h - 02h	-	Cometary: Comet 1881 IV	Very slow, bright
03h - dawn	Favourable	Cometary: Comet 1862 III	
22h - 24h	Favourable	Ecliptical	
02h30m - 04h30m	Unfavourable	Cometary: Halley	Swift, with streaks
22h - 24h	Favourable	Ecliptical	
03h - dawn	Favourable *	Cometary: Comet 1866 I	
23h - 02h	Favourable	Ecliptical	Medium speed, white
23h - 03h30m	Unfavourable	Unknown	

* Although the period of this shower is 33½ years, (next expected maximum 1966), there was a slight increase in activity two years ago. Last spectacular shower. 1866: those of 1899 and 1932-33 disappointing (perturbation by Jupiter). Close watch for possible increase in activity recommemded during coming years.

ASTRONOMICAL DIARY

JANUARY 1964

	d.	h.	
Jan	2	20	Earth at perihelion.
	14	23	Partial solar eclipse invisible in Africa.
	17	19	Venus 3° N of Moon.
	20	21	Jupiter 4° N of Moon.
	27	02	Mercury at greatest elongation, 25° W.
	31	05	Uranus 4° S of Moon.

FEBRUARY 1964

	d.	h.	
Feb	15	08	Saturn in conjunction with Sun.
	17	05	Mars in conjunction with Sun.
	27	16	Uranus at opposition.

MARCH 1964

	d.	h.	
Mar	3	14	Pluto at opposition.
	4	02	Neptune 2° S of Moon.
	13	10	Mercury in superior conjunction.
	20	16	Equinox.
	25	18	Uranus 4° S of Moon.

APRIL 1964

	d.	h.	
Apr	7	20	Mercury at greatest elongation, 19° E.
	10	11	Venus at greatest elongation, 46° E.
	15	20	Venus 6° N of Moon.

APRIL 1964

	d.	h.	
Apr	21	22	Uranus 4° S of Moon.
	22	16	Jupiter in conjunction with Sun.
	27	12	Mercury in inferior conjunction.

MAY 1964

	d.	h.	
May	7	02	Neptune at opposition.
	13	21	Venus at greatest brilliancy.
	14	18	Venus 4° N of Moon.
	18	09	Juno at opposition.
	18	19	Pallas at opposition.
	24	20	Neptune 2° S of Moon.
	24	22	Mercury at greatest elongation, 25° W.

JUNE 1964

	d.	h.	
Jun	5	12	Earth at aphelion.
	10	06	Partial solar eclipse, invisible in Africa.
	20	01	Venus in inferior conjunction.
	21	00	Neptune 2° S of Moon.
	21	11	Solstice.
	21	12	Ceres at opposition.
	25	03	Total eclipse of the Moon.
	27	09	Mercury in superior conjunction.
	30	02	Saturn 3° N of Moon.

JULY 1964

	d.	h.	
Jul	9	14	Partial solar eclipse, invisible in Africa.
	26	18	Venus at greatest brilliancy.
	27	05	Saturn 3° N of Moon.

AUGUST 1964

	d.	h.	
Aug	2	05	Jupiter 2° N of Moon.
	5	21	Mercury at greatest elongation, 27° E.
	24	22	Saturn at opposition.
	29	12	Venus at greatest elongation, 46° W.

SEPTEMBER 1964

	d.	h.	
Sep	2	03	Vesta at opposition.
	2	09	Mercury in inferior conjunction.
	3	00	Uranus in conjunction with Sun.
	6	16	Pluto in conjunction with Sun.
	10	23	Neptune 2° S of Moon.
	18	14	Mercury at greatest elongation, 18° W.
	23	02	Equinox.
	25	21	Jupiter 1° N of Moon.

OCTOBER 1964

	d.	h.	
Oct	1	02	Mars 2° S of Moon.
	2	05	Venus 5° S of Moon.
	15	21	Mercury in superior conjunction.
	16	20	Saturn 3° N of Moon.
	23	01	Jupiter 1° N of Moon.

NOVEMBER 1964

	d.	h.	
Nov	4	03	Mars 1°.3 N of Regulus.
	10	01	Neptune in conjunction with Sun.
	13	12	Jupiter at opposition.
	27	01	Uranus 5° S of Moon.
	30	12	Mercury at greatest elongation, 21° E.

DECEMBER 1964

	d.	h.	
Dec	1	06	Venus 2° S of Moon.
	2	04	Neptune 1° S of Moon.
	4	03	Partial solar eclipse invisible in Africa.
	10	06	Venus 0°.1 S of Neptune.
	18	23	Mercury in inferior conjunction.
	19	05	Total eclipse of the Moon, the ending invisible in Southern Africa.
	21	01	Juno in conjunction with Sun.
	21	22	Solstice.

BRIGHT VARIABLE STARS

Name	Position (1950) R.A.	Dec.	Range	Period Days	Expected Maxima 1964
o Ceti (Mira)	$02^h\ 16^m.8$	- 3° 12'	2.6-9.4	331	Feb 29
R Doradus	04 36.2	-60 11	5.3-6.4	Irr.	
R Pictoris	04 44.8	-49 20	6.9-9.2	172?	
L_2 Puppis	07 12.0	-44 33	3.1-6.3	140?	Apr 1, Aug 19
R Carinae	09 31.0	-62 34	4.5-9.4	309	Jul 1
S Carinae	10 07.8	-61 18	5.7-8.3	149	May 4, Sep 30
R Hydrae	13 27.0	-23 01	4.7-9.6	386	May 31
T Centauri	13 38.9	-33 21	6.0-8.2	90	Mar 14, Jun 13, Sep 12, Dec 12
R Centauri	14 12.9	-59 41	5.7-12.0	547	.....
R Aquarii	23 41.2	-15 34	6.7-11.6	387	Apr 22

SOUTH AFRICAN OBSERVATORIES

Name	Place	E. Long.	S. Lat.	Alt.	Director
		1h+		ft	
Republic	Johannesburg	52m 18s.0	26°10'55".3	5925	W. S. Finsen
Republic Annexe	Hartebeespoort	51m 30s	25°46'22"	4002	
Royal Observatory	Cape Town	13m 54s.6	33°56'02".5	26	R. H. Stoy
Radcliffe	Pretoria	52m 54s.9	25°47'18"	5059	A. D. Thackeray
Boyden	Bloemfontein	45m 37s.4	29°02'20"	4550	
Leiden	Hartebeespoort	51m 30s	25°46'22"	4002	D. F. Stevenson
People's	Port Elizabeth	42m 19s.2	33°57'11"	330	P. E. Centre
Lamont-Hussey	Bloemfontein	44m 56s.8	29°05'46".1	4825	F. Holden
Smithsonian Satellite-Tracking Station	Olifantsfontein	52m 59s.6	25°57'33".9	5066	R. Citron
Radio Space Research Station	Krugersdorp	48m 16s.3	25°53'14".5	4515	D. Hogg
E.S.O. Station	Zeekoegat	29m 51s.2	33°05'15"	3200	L. Prévot
W. Bell	Johannesburg	52m 05s.8	26°08'10".6	5210	
J. H. Botham	Johannesburg	52m 17s.3	26°11'23".3	5605	
K. G. Fuhr	Cape Town	13m 54s.5	33°57'09"	26	
N. M. Hoogenhout	Pretoria	52m 58s.6	25°46'46"	4725	
J. L. Jooste	Pretoria	52m 47s.2	25°45'14"	4359	
G. F. G. Knipe	Johannesburg	52m 11s.6	26°11'18".3	5915	
M. D. Overbeek	Germiston	52m 33s.7	26°11'42"	5605	
S. C. Venter	Pretoria	52m 46s.9	25°40'14".8	4050	
C. N. Williams	Johannesburg	52m 28s.4	26°12'00"	5590	
L. L. van Zyl	Boksburg	52m 58s.9	26°12'05"	5429	

PAST PRESIDENTS

1922 - 23	S. S. Hough	1942 - 43	A. F. I. Forbes
1923 - 24	R. T. A. Innes	1943 - 44	W. H. van den Bos
1924 - 25	J. K. E. Halm	1944 - 45	A. W. J. Cousins
1925 - 26	W. Reid	1945 - 46	R. H. Stoy
1926 - 27	H. Spencer Jones	1946 - 47	W. P. Hirst
1927 - 28	A. W. Roberts	1947 - 48	J. Jackson
1928 - 29	A. W. Long	1948 - 49	A. E. H. Bleksley
1929 - 30	H. E. Wood	1949 - 50	W. S. Finsen
1930 - 31	D. Cameron-Swan	1950 - 51	H. E. Krumm
1931 - 32	H. L. Alden	1951 - 52	A. D. Thackeray
1932 - 33	H. Spencer Jones	1952 - 53	J. C. Bentley
1933 - 34	D. G. McIntyre	1953 - 54	David S. Evans
1934 - 35	J. K. E. Halm	1954 - 55	P. Kirchhoff
1935 - 36	J. Jackson	1955 - 56	W. H. van den Bos
1936 - 37	H. E. Houghton	1956 - 57	S. C. Venter
1937 - 38	J. S. Paraskevopoulos	1957 - 58	M. W. Feast
1938 - 39	T. MacKenzie	1958 - 59	H. Haffner
1939 - 40	R. A. Rossiter	1959 - 60	P. Smits
1940 - 41	E. B. Ford	1960 - 61	G. G. Cillié
1941 - 42	H. Knox Shaw	1961 - 62	M. D. Overbeek
		1962 - 63	A. J. Wesselink

HONORARY MEMBERS

Dr. R. O. Redman
Sir Richard Woolley
Dr. H. Haffner .
Dr. W. H. van den Bos
Dr. J. Schilt
Dr. H. Knox Shaw
Dr. H. L. Alden
Dr. J. H. Oort
Dr. H. Shapley
Mr. D. G. McIntyre

HONORARY SECRETARIES

1922	H. W. Schonegevel
1922 August	T. MacKenzie
1923	C. L. O'Brien Dutton
1923 October	H. E. Houghton
1930 July	S. Skewes
1931	H. Horrocks
1934 November	H. W. Schonegevel
1935	A. Menzies

THE GILL MEDAL

Medallists

1956	H. Knox Shaw	1958	J. Jackson
1957	W. P. Hirst	1960	W. H. van den Bos
	1963 A. W. J. Cousins		

The Gill Medal commemorates Sir David Gill, H.M. Astronomer at the Cape (1879-1907) renowned for his numerous researches, especially in positional and mathematical astronomy and geodesy, and for his part in consolidating astronomical science in Southern Africa.

The medal was designed by Dr. P. Kirchhoff, President of the Society at the time, in 1955. The obverse carries a bas-relief portrait of Gill: the reverse incorporates a representation of the heliometer with which Gill undertook much of his positional work including a determination of the solar parallax. The medal which is struck in silver is awarded by Council for services to astronomy with special consideration to services in southern africa.

NOTE

The compilers of the Handbook find considerable difficulty in ensuring that information such as the spelling of names, initials, addresses, coordinates of private observatories etc. is correct. Users are requested to notify any errors or omissions and in particular to forward corrections of names in BLOCK CAPITALS or typewriting.

OBSERVING SECTIONS

The Observing Sections exist to encourage amateurs in carrying out useful research. Enquiries about their activities should be addressed to the Directors of the Observing Sections, whose names and addresses are given below:—

Comets and Meteors:
Mr. S. C. Venter, P.O. Box 1416, Pretoria.

Variable Stars:
Mr. R. P. de Kock, The Royal Observatory, Observatory, Cape.

Nova Search Section:
The Rev. L. L. Dawson, 94 Tramway Street, Turffontein, Johannesburg.

A number of autonomous local Centres of the Society exists, which hold regular meetings. Information on local activity in fields such as "Moonwatch" (observation of artificial satellites), and telescope construction can be obtained through Centre Secretaries. Details of Centre organisation are as follows:—

CAPE CENTRE:

Chairman:	Mr. G. R. Atkins.
Vice-Chairman:	Mr. J. Simenhoff.
Hon. Secretary:	Mr. N. Saville.
Hon. Treasurer:	Mr. H. E. Krumm.
Hon. Auditor:	Mr. A. Menzies.
Members of Committee:	Messrs. J. S. Bondietti, R. F. Horn, H. B. Molyneux, H. C. Lagerweij and Dr. A. W. J. Cousins.
Centre Representative on Council:	Mr. W. C. Bentley.

Meetings in winter on 2nd Wednesday of month at the Royal Observatory.
Secretarial address, c/o The Royal Observatory, Observatory, Cape.

TRANSVAAL CENTRE:

Chairman:	Mr. C. Mollink.
Vice-Chairman:	Mr. C. R. Jacobs.
Hon. Secretary:	Mr. B. J. C. Maurick.
Hon. Treasurer:	Mr. B. J. C. Maurick.
Members of Committee:	Dr. P. Kirchhoff, Messrs. J. H. Botham, N. Malan and E. F. von Malitz.
Republic Observatory Representative:	Mr. G. F. G. Knipe.
Centre Representative on Council:	Mr. W. Bell.
Curator of Instruments:	Mr. T. E. Geary.
Hon. Librarian:	Mr. T. E. Geary.

Observing and lecture meetings in alternate months.
Secretarial address, 8, Eider Road, Florida Lake, Transvaal.

PORT ELIZABETH CENTRE:

Chairman:	Mr. J. C. Bentley.
Vice-Chairman:	Mr. G. B. Anderson.
Hon. Secretary:	Mr. R. Maasdorp.
Hon. Treasurer:	Mr. J. C. Bentley.
Curator of Instruments:	Mr. E. Blignaut.
Members: of Committee:	Messrs. J. Arnold, D. Blood, S. A. Foster, J. Maritz, W. L. Schlesinger, B. A. Simpson, V. Smit, J. W. Taylor, E. Warring and G. White.

Secretarial address, 3, Lucas Street, Port Elizabeth.

BLOEMFONTEIN CENTRE:

Chairman:	Mr. G. N. Walker.
Hon. Secretary:	Mr. N. Lincoln.
Hon. Treasurer:	Mr. N. Lincoln.
Members of Committee:	Messrs. P. Keuris and J. C. Loggerenberg and Dr. C. B. van Wyk.
Centre Representative on Council:	Mr. N. Lincoln.

Secretarial address, c/o Bloemfontein Club, P.O. Box 83, Bloemfontein.

NATAL CENTRE:

For information apply to:
Mr. Gregory Roberts, 62, Dragonwyck, St. George's Street, Durban.