ASTRONOMICAL HANDBOOK FOR SOUTHERN AFRICA

1973

published by
the Astronomical Society of Southern Africa

ASTRONOMICAL SOCIETY OF SOUTHERN AFRICA

INFORMATION FOR PROSPECTIVE MEMBERS

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 twelve numbers of "The Monthly Notes of the Astronomical Society of Southern Africa" (MNASSA) each year. 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 R6.00 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, Observatory, Cape.

Autonomous local Centres of the Society exist in Cape Town, Bloemfontein, Durban, Johannesburg and Pretoria. These centres hold regular meetings. It is not necessary to hold full membership of the society to join these centres. An Associate Member or Student Member may take part in the activities of a Centre without paying any fees or subscriptions to the Society; although he then loses the right to receive the publications issued and distributed by the Society.

Three Observing Sections exist to coordinate and encourage constructive observing programmes; namely the Comet and Meteor Section, the Occultation Section and the Variable Star Section.

Further information on the Centres and Observing Sections is given on the inside back cover of this handbook.

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All correspondence concerning this booklet should be addressed to the Handbook Editor, Astronomical Society of Southern Africa, Department of Astronomy, University of Cape Town, Rondebosch, Cape. Further copies can also be obtained from the same address. Enclose a postal order (or cheque) for 50 cents per copy.

P & P D U C T

INTRODUCTION

This booklet is intended to be of use to all persons interested in astronomy. It does not assume that the reader already has a knowledge of astronomy and explanations of tables and diagrams are put in wherever necessary - although not to the depth of a general textbook on the subject. The only exceptions to this are the two sections on occultations (towards the back of the book) which provide information needed by the advanced amateur or professional. Readers who already possess some knowledge may be able to use most tables without consulting the explanations.

The Diary (starting overleaf), besides listing events in chronological order, acts as an overall summary. More detailed information is given in the appropriate sections, as listed on the contents page opposite.

All times given in this Handbook are in South African Standard Time - the standard time in use throughout South Africa, Rhodesia and most neighbouring territories. In order to avoid confusion between a.m. and p.m., the 24-hour clock is used - for example 1800 hours is 6 p.m. and 2100 hours is 9 p.m.

CALENDAR

A dot alongside a date indicates an astronomical event listed in the Diary (overleaf). Most important dates are:

Jan 4 and June 30 (Partial eclipses of the Sun)
Jan 14 and Apr 6 (Pleiades - occultations by Moon)
Nov 10 (Transit of Mercury)

JANUARY

S		7	14	21	28
M	1	8	15	22	29
T	2	9	16	23	30
W	3	10	17	24	31
T	4	11	18	25	
F	5	12	19	26	
S	6	13	20	27	

FEBRUARY

S		4	11	18	25
M		5	12	19	26
T		6	13	20	27
W		7	14	21	28
T	1	8	15	22	
F	2	9	16	23	
S	3	10	17	24	

MARCH

S		4	11	18	25
M		5	12	19	26
T		6	13	20	27
W		7	14	21	28
T	1	8	15	22	29
F	2	9	16	23	30
S	3	10	17	24	31

APRIL

S	1	8	15	22	29
M	2	9	16	23	30
T	3	10	17	24	
W	4	11	18	25	
T	5	12	19	26	
F	6	13	20	27	
S	7	14	21	28	

MAY

S		6	13	20	27
M		7	14	21	28
T	1	8	15	22	29
W	2	9	16	23	30
T	3	10	17	24	31
F	4	11	18	25	
S	5	12	19	26	

JUNE

S		3	10	17	24
M		4	11	18	25
T		5	12	19	26
W		6	13	20	27
T		7	14	21	28
F	1	8	15	22	29
S	2	9	16	23	30

JULY

S	1	8	15	22	29
M	2	9	16	23	30
T	3	10	17	24	31
W	4	11	18	25	
T	5	12	19	26	
F	6	13	20	27	
S	7	14	21	28	

AUGUST

S		5	12	19	26
M		6	13	20	27
T		7	14	21	28
W	1	8	15	22	29
T	2	9	16	23	30
F	3	10	17	24	31
S	4	11	18	25	

SEPTEMBER

S		2	9	16	23	30
M		3	10	17	24	
T		4	11	18	25	
W		5	12	19	26	
T		6	13	20	27	
F		7	14	21	28	
S	1	8	15	22	29	

OCTOBER

S		7	14	21	28
M	1	8	15	22	29
T	2	9	16	23	30
W	3	10	17	24	31
T	4	11	18	25	
F	5	12	19	26	
S	6	13	20	27	

NOVEMBER

S		4	11	18	25
M		5	12	19	26
T		6	13	20	27
W		7	14	21	28
T	1	8	15	22	29
F	2	9	16	23	30
S	3	10	17	24	

DECEMBER

S		2	9	16	23	30
M		3	10	17	24	31
T		4	11	18	25	
W		5	12	19	26	
T		6	13	20	27	
F		7	14	21	28	
S	1	8	15	22	29	

ASTRONOMICAL DIARY

More detailed information on individual events can be found elsewhere in this Handbook, according to the page number given in brackets.

Jan 3 Earth closest to Sun (p.7)

Jan 4 New Moon - Partial eclipse of the Sun visible from South Africa (p.9)

Jan 10 Jupiter on far side of the Sun (p. 18)

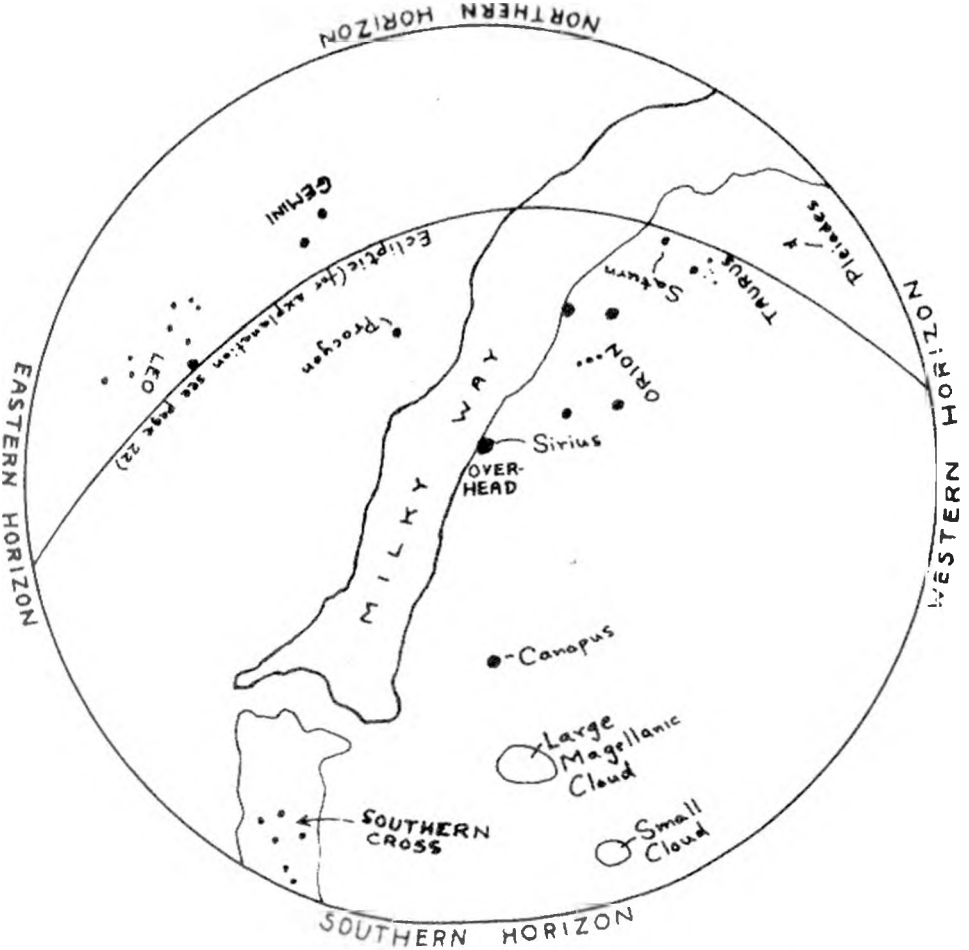
Jan 12 Moon - First Quarter (p.10)
Mars 5^{o} north of Antares - only visible before dawn
(p.23 - lower diagram)

Jan 14 Moon passes in front of Pleiades cluster - many occultations (p.37)

Jan 15 Saturn 4^{o} south of Moon at midnight

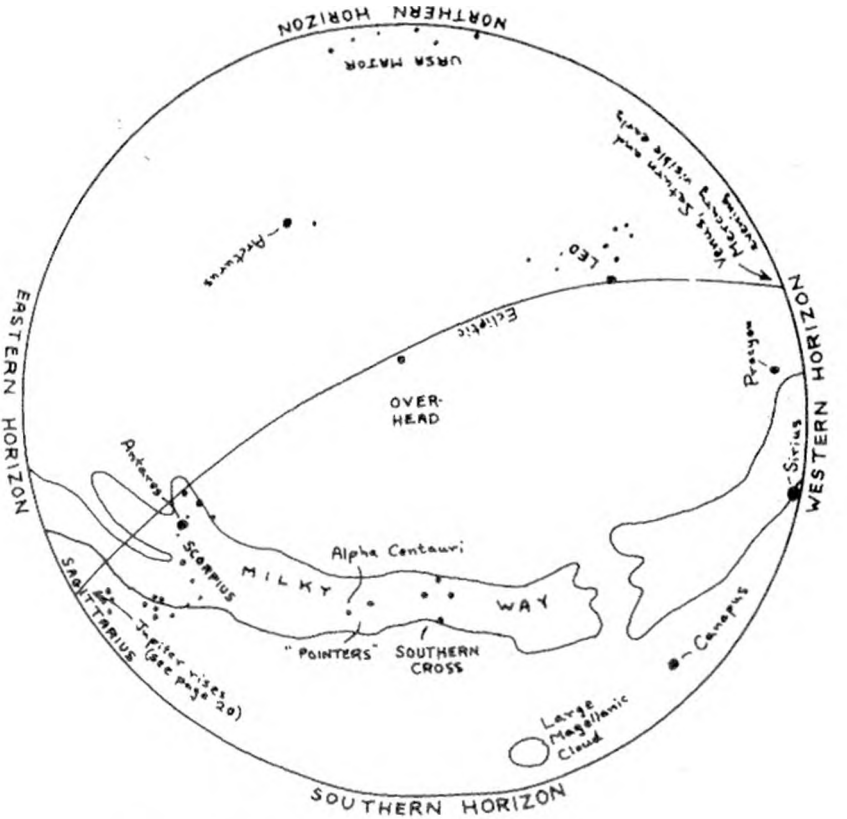
Jan 18 Full Moon (p.10)

Jan 20 Sun overhead at noon at Bulawayo



Approximate evening sky during January to March. Saturn is the only planet visible.

Jan 26	Moon - Last Quarter
Jan 28	Mercury in superior conjunction (p. 17)
Jan 30	Mars 2° north of Moon - only visible in early morning Sun overhead at noon at Salisbury
Feb 1	Venus very close to Jupiter - visible just before sunrise (p. 20)
Feb 3	New Moon
Feb 10	Moon - First Quarter (p. 10)
Feb 17	Full Moon (p. 10) Moon - Last Quarter
Feb 25	Mercury at greatest elongation - may just be seen after sunset (p. 17)
Feb 28	Mars just south of Moon - only visible in early morning
Mar 5	New Moon
Mar 11	Moon - First Quarter (p. 10) - Saturn nearby.
Mar 13	Mercury in inferior conjunction (p. 17)
Mar 19	Full Moon (p. 10)
Mar 20	Equinox (p. 7)
Mar 23	Pluto at opposition (p. 19)
Mar 27	Moon - Last Quarter
Apr 3	New Moon



Approximate evening sky during April to June. Ursa Major can only be seen from Rhodesia and SWA.

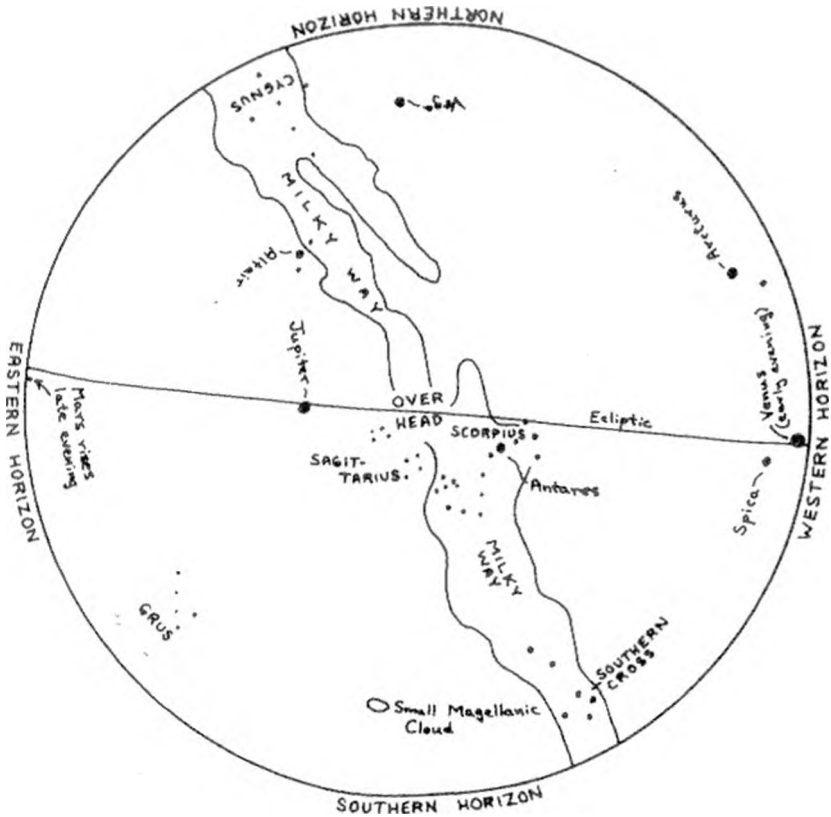
Apr 6 Moon passes in front of Pleiades cluster - many occultations (p. 37)
Mars $0^{\circ}8$ south of Jupiter (p. 22)
Apr 7 Saturn just south of Moon in evening sky
Apr 9 Venus in superior conjunction (p. 17)
Apr 10 Moon - First Quarter (p. 10)
Mercury at greatest elongation - visible in morning sky (p. 17)
Apr 11 Uranus at opposition (p. 19)
Apr 17 Full Moon (p. 10)
Apr 25 Moon - Last Quarter

May 1 - May 8 Eta Aquarid meteor shower (p. 16)
May 2 New Moon
May 9 Moon - First Quarter (p. 10)
May 10 Full Moon (p. 10)
May 20 Mercury in superior conjunction (p. 17)
Venus 6° north of Aldebaran
May 23 Jupiter close to Moon in late evening sky (p. 20)
May 25 Moon - Last Quarter
May 27 Neptune at opposition (p. 19)
May 30 Venus $1^{\circ}7$ north of Saturn

Jun 1 New Moon
Mercury $1^{\circ}2$ north of Venus
Jun 7 Moon - First Quarter (p. 10)
Jun 15 Saturn on far side of Sun
Full Moon (p. 10)
Jun 19 Jupiter close to Moon (in evening sky)
Jun 21 Midwinter solstice (p. 7)
Jun 22 Mercury at greatest elongation - most favourable time for viewing in evening sky (p. 17)
Jun 23 Moon - Last Quarter
Jun 25 Venus 5° south of Pollux (p. 22)
Jun 30 New Moon - Partial eclipse of the Sun visible from Southern Africa (p. 9)

Jul 1 Mercury 3° south of Venus
Jul 7 Moon - First Quarter (p. 10)
Jul 13 Jupiter's moons - 6 phenomena during evening (p. 24)
Jul 15 Full Moon (p. 10)
Jul 15 - Aug 15 Delta Aquarids meteor shower (p. 16)
Jul 15 - Aug 20 Pisces Australids meteor shower (p. 16)
Jul 16 Jupiter 4° south of Moon at midnight
Jul 20 Mercury in inferior conjunction (p. 17)
Jupiter's moons - 7 phenomena during evening (p. 25)
Jul 23 Moon - Last Quarter
Jul 24 Venus $1^{\circ}2$ north of Regulus (p. 23)
Jul 29 New Moon
Jul 30 Jupiter at opposition (p. 18)
Aug 6 Moon - First Quarter (p. 10)
Aug 8 Mercury at greatest elongation - may be glimpsed just before sunrise (p. 17)
Aug 11 Jupiter's moons - 5 phenomena during evening (p. 25)
Aug 12 Jupiter 3° south of Moon at midnight
Aug 14 Full Moon
Aug 21 Moon - Last Quarter
Aug 28 New Moon

Sep 2 Mercury in superior conjunction (p. 17)
Sep 4 Moon - First Quarter (p. 10)
Sep 7 Venus 2° north of Spica (p. 23)
Sep 8 Jupiter near Moon in evening sky
Sep 12 Full Moon (p. 10)
Jupiter's moons - 8 pheno-



Approximate evening sky during July to September. Jupiter and Venus visible.

mena during evening (p. 26)

Sep 19 Moon - Last Quarter
Jupiter's moons - 8 phenomena during evening (p. 26)

Sep 23 Equinox (p. 7)

Sep 26 New Moon
Jupiter's moons - 3 phenomena involving 3 different moons within the space of 11 minutes (p. 27)

Sep 27 Mercury $1^{\circ}.4$ north of Spica

Oct 4 Moon - First Quarter (p. 10)

Oct 10 - Dec 5 Taurids meteor shower (p. 16)

Oct 12 Full moon (p. 10)

Oct 14 Jupiter's moons - 6 phenomena during evening (p. 27)

Oct 17 Mars nearest to the Earth
Venus 2° north of Antares

Oct 19 Mercury at greatest elongation - visible in evening sky (p. 17)
Moon - Last Quarter

Oct 25 Mars at opposition (p. 18)

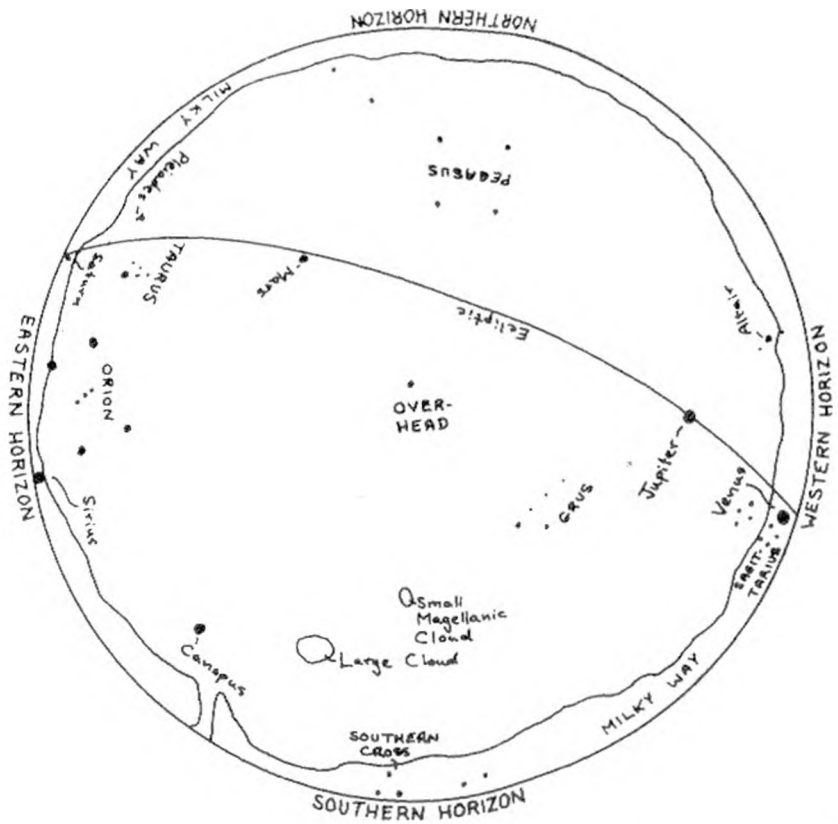
Oct 26 New Moon

Nov 2 Jupiter close to Moon in evening sky

Nov 3 Moon - First Quarter (p. 10

Nov 10 Mercury in inferior conjunction (p. 17) transits

	across solar disk (p. 9)
	Full Moon (p. 10)
Nov 12	Sun overhead at noon at Salisbury
Nov 13	Venus at greatest elongation (p. 17)
Nov 17	Moon - Last Quarter
Nov 22	Sun overhead at noon at Bulawayo
Nov 24	New Moon
Nov 27	Mercury at greatest elongation (p. 17)
Dec 3	Moon - First Quarter (p. 10)
Dec 5 - Jan 7	Velaids meteor shower (p. 16)
Dec 6	Mars near Moon in evening sky
Dec 10	Full Moon - partial eclipse in early morning (p. 10)
	Moon close to Saturn in late evening
Dec 16	Moon - Last Quarter
Dec 19	Venus at greatest brightness (p. 17)
Dec 22	Midsummer solstice (p. 7)
Dec 23	Saturn at opposition (p. 19)
Dec 24	New Moon - Annular eclipse of the Sun (not visible from Southern Africa)
Dec 27	Moon close to Venus in evening sky



Approximate evening sky during October to December. Venus, Jupiter, Mars and Saturn visible.

JULIAN DATE AT 1400 HRS

The Julian Calendar is generally used for recording the time of variable star observations. It 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 1400 hrs. (2 p.m.) SAST. The Julian date on 1973 Jan. 1, at 1400 hrs. is 2441 684,0 - the first digits are not repeated for each entry in the table below.

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	2441	2441	2441	2441	2441	2441	2441	2441	2441	2441	244	2442
1	684,0	715,0	743,0	774,0	804,0	835,0	865,0	896,0	927,0	957,0	1988,0	018,0
2	685,0	716,0	744,0	775,0	805,0	836,0	866,0	897,0	928,0	958,0	1989,0	019,0
3	686,0	717,0	745,0	776,0	806,0	837,0	867,0	898,0	929,0	959,0	1990,0	020,0
4	687,0	718,0	746,0	777,0	807,0	838,0	868,0	899,0	930,0	960,0	1991,0	021,0
5	688,0	719,0	747,0	778,0	808,0	839,0	869,0	900,0	931,0	961,0	1992,0	022,0
6	689,0	720,0	748,0	779,0	809,0	840,0	870,0	901,0	932,0	962,0	1993,0	023,0
7	690,0	721,0	749,0	780,0	810,0	841,0	871,0	902,0	933,0	963,0	1994,0	024,0
8	691,0	722,0	750,0	781,0	811,0	842,0	872,0	903,0	934,0	964,0	1995,0	025,0
9	692,0	723,0	751,0	782,0	812,0	843,0	873,0	904,0	935,0	965,0	1996,0	026,0
10	693,0	724,0	752,0	783,0	813,0	844,0	874,0	905,0	936,0	966,0	1997,0	027,0
11	694,0	725,0	753,0	784,0	814,0	845,0	875,0	906,0	937,0	967,0	1998,0	028,0
12	695,0	726,0	754,0	785,0	815,0	846,0	876,0	907,0	938,0	968,0	1999,0	029,0
13	696,0	727,0	755,0	786,0	816,0	847,0	877,0	908,0	939,0	969,0	2000,0	030,0
14	697,0	728,0	756,0	787,0	817,0	848,0	878,0	909,0	940,0	970,0	2001,0	031,0
15	698,0	729,0	757,0	788,0	818,0	849,0	879,0	910,0	941,0	971,0	2002,0	032,0
16	699,0	730,0	758,0	789,0	819,0	850,0	880,0	911,0	942,0	972,0	2003,0	033,0
17	700,0	731,0	759,0	790,0	820,0	851,0	881,0	912,0	943,0	973,0	2004,0	034,0
18	701,0	732,0	760,0	791,0	821,0	852,0	882,0	913,0	944,0	974,0	2005,0	035,0
19	702,0	733,0	761,0	792,0	822,0	853,0	883,0	914,0	945,0	975,0	2006,0	036,0
20	703,0	734,0	762,0	793,0	823,0	854,0	884,0	915,0	946,0	976,0	2007,0	037,0
21	704,0	735,0	763,0	794,0	824,0	855,0	885,0	916,0	947,0	977,0	2008,0	038,0
22	705,0	736,0	764,0	795,0	825,0	856,0	886,0	917,0	948,0	978,0	2009,0	039,0
23	706,0	737,0	765,0	796,0	826,0	857,0	887,0	918,0	949,0	979,0	2010,0	040,0
24	707,0	738,0	766,0	797,0	827,0	858,0	888,0	919,0	950,0	980,0	2011,0	041,0
25	708,0	739,0	767,0	798,0	828,0	859,0	889,0	920,0	951,0	981,0	2012,0	042,0
26	709,0	740,0	768,0	799,0	829,0	860,0	890,0	921,0	952,0	982,0	2013,0	043,0
27	710,0	741,0	769,0	800,0	830,0	861,0	891,0	922,0	953,0	983,0	2014,0	044,0
28	711,0	742,0	770,0	801,0	831,0	862,0	892,0	923,0	954,0	984,0	2015,0	045,0
29	712,0		771,0	802,0	832,0	863,0	893,0	924,0	955,0	985,0	2016,0	046,0
30	713,0		772,0	803,0	833,0	864,0	894,0	925,0	956,0	986,0	2017,0	047,0
31	714,0		773,0		834,0		895,0	926,0		987,0		048,0

THE SUN

The Earth is closest to the Sun on January 3 (perihelion - approx distance 147 million km) and furthest from the Sun on July 4 (aphelion - approx 152 million km). The Sun is over the Tropic of Cancer on June 22 (midwinter solstice) and over the Tropic of Capricorn on December 22 (midsummer solstice). It crosses the equator on March 20 and September 23 (equinoxes). During the course of the year, the Sun appears to move once around the sky - against the constellations of the Zodiac. The movement of the Sun along its apparent path, the ecliptic, appears in the planetary diagram on pages 22 and 23 (centre pages of this Handbook).

TIMES OF SUNRISE AND SUNSET

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

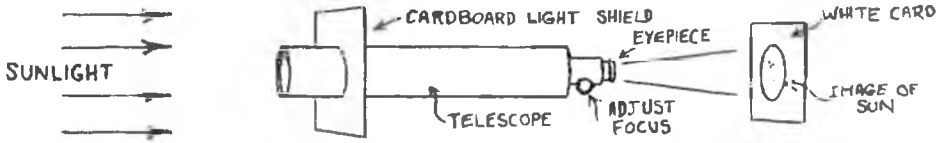
The table below gives the times of the Sun's transit, apparent noon, over the 30° meridian - for explanation of the difference between apparent noon and SAST (mean solar) noon, known as the Equation of Time, a textbook on astronomy should be consulted.

TIME OF SUN'S TRANSIT FOR LONGITUDE 30°E

Jan	1	12h 03m,6	May	11	11h 56m,3	Sep	18	11h 54m,2
	11	12 07,9		21	11 56,5		28	11 50,7
	21	12 11,4		31	11 57,5	Oct	8	11 47,6
	31	12 13,5	Jun	10	11 59,3		18	11 45,2
Feb	10	12 14,3		20	12 01,4		28	11 43,9
	20	12 13,8		30	12 03,5	Nov	7	11 43,7
Mar	2	12 12,2	Jul	10	12 05,2		17	11 45,0
	12	12 09,9		20	12 06,3		27	11 47,6
	22	12 07,0		30	12 06,4	Dec	7	11 51,5
Apr	1	12 06,0	Aug	9	12 05,5		17	11 56,6
	11	12 01,1		19	12 03,6		27	12 01,1
	21	11 58,7		29	12 00,9			
May	1	11 57,1	Sep	8	11 57,7			

OBSERVING THE SUN

Permanent damage to the eye can be caused by looking directly at the Sun. The best way of observing is to use a telescope (or half a binocular) to project an image of the solar disk onto a piece of paper - as indicated in the diagram. In this way it may be possible to distinguish tiny black sunspots.



PARTIAL ECLIPSE OF THE SUN - THURSDAY, JANUARY 4

The path of this annular eclipse (The Moon is not quite large enough to obscure completely the Sun) starts in the Pacific Ocean, crosses South America and ends just short of the African continent. In South Africa, it will be observed as a partial eclipse in the late afternoon. Predictions for Cape Town and Johannesburg are as follows:

	Cape Town	Johannesburg
Start (P. A.)	$18^h\ 16^m.7$ (294°)	$18^h\ 22^m.5$ (290°)
Middle (Magnitude)	19 00, 8 (24%)	19 08, 1 (30%)
End (P. A.)	19 42, 1 (22°)	After Sunset

The position Angle (P. A.) of the point of contact is measured eastwards from the north point of the Sun. The magnitude is the percentage of the Sun's diameter obscured.

PARTIAL ECLIPSE OF THE SUN - SATURDAY, JUNE 30

The path of this total eclipse crosses the Atlantic Ocean, the northern portion of the African continent and finishes in the Indian Ocean. It has the distinction of having the longest duration of totality for any eclipse this century, but regrattably this could only be observed from the Sahara desert. It will appear as a partial eclipse from Rhodesia, the Transvaal and Natal - the rest of the country lies outside the limits. Predictions are:

	Salisbury	Johannesburg
Start (P. A.)	$14^h\ 07^m.6$ (20°)	$14^h\ 32^m.5$ (47°)
Middle (Magnitude)	15 05, 0 (35%)	15 01, 1 (8%)
End (P. A.)	15 56, 8 (117°)	15 28, 5 (91°)

(See above for explanation of P. A. and Magnitude)

TRANSIT OF MERCURY - WEDNESDAY, NOVEMBER 10

This is a relatively rare phenomenon (previous two occasions were in 1960 and 1970) when the planet Mercury is seen to pass directly in front of the Sun. It will be seen silhouetted as a tiny black disk against the Sun. The start occurs at $9^h\ 47^m.1$ at Position Angle 117° (measured eastwards from north point of Sun). At $12^h\ 30^m$, the planet will be almost precisely at the geometric centre of the solar disk. Ending is at $15^h\ 16^m.2$ at P. A. 293°.

THE MOON

The Moon is best positioned for evening viewing from three or four days before First Quarter to shortly after Full Moon. Exact times of phases are given in the table below. Times of Moonrise and Moonset for Johannesburg and Cape Town follow on pages 12 to 15 - times for other places can be roughly estimated.

PHASES OF THE MOON

New Moon				First Quarter				Full Moon				Last Quarter			
	^{d}	^{h}	^{m}		^{d}	^{h}	^{m}		^{d}	^{h}	^{m}		^{d}	^{h}	^{m}
Jan	4	17	42	Jan	12	7	27	Jan	18	23	28	Jan	26	8	05
Feb	3	11	23	Feb	10	16	05	Feb	17	12	07	Feb	25	5	10
Mar	5	2	07	Mar	11	23	26	Mar	19	1	33	Mar	27	1	46
Apr	3	13	45	Apr	10	6	28	Apr	17	15	51	Apr	25	19	59
May	2	22	55	May	9	14	07	May	17	6	58	May	25	10	40
Jun	1	6	34	Jun	7	23	11	Jun	15	22	35	Jun	23	21	45
Jun	30	13	39	Jul	7	10	26	Jul	15	13	56	Jul	23	5	58
Jul	29	20	59	Aug	6	0	27	Aug	14	4	17	Aug	21	12	22
Aug	28	5	25	Sep	4	17	22	Sep	12	17	16	Sep	19	18	11
Sep	26	15	54	Oct	4	12	32	Oct	12	5	09	Oct	19	0	33
Oct	26	5	17	Nov	3	8	29	Nov	10	16	27	Nov	17	8	34
Nov	24	21	55	Nov	3	3	29	Nov	10	3	34	Dec	16	19	13
Dec	24	17	07												

Dates of Perigree, when the Moon is closest to the Earth (approx distance 357 000 km), and Apogee, when it reaches its furthest point (approx 407 000 km), are given below.

PERIGREE						APOGEE					
	^{d}	^{h}		^{d}	^{h}		^{d}	^{h}		^{d}	^{h}
Jan	16	23	Jul	28	09	Jan	28	18	Aug	9	12
Feb	13	13	Aug	25	09	Feb	25	15	Sep	6	05
Mar	10	10	Sep	21	00	Mar	25	11	Oct	4	01
Apr	6	06	Oct	16	03	Apr	22	04	Oct	31	21
May	4	08	Nov	12	17	May	19	16	Nov	28	15
Jun	1	16	Dec	11	00	Jun	15	19	Dec	26	00
June	30	02				Jul	13	00			

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 36) and close to visible planets (details given in Diary - page 2). On the morning of December 10, it brushes the Earth's shadow and a partial eclipse of the Moon occurs (starting time $3^{h}\ 09^{m}$, ending time $4^{h}\ 20^{m}$ - at the time of maximum eclipse, 11% of the Moon's diameter is obscured).

Terminator and Librations

During the changing phases, the terminator (boundary between night and day) progresses from left to right in the diagram. Since the Moon does not follow a perfectly circular orbit, and its axis is not parallel to the Earth's axis, it is sometimes possible to see a slightly greater proportion of one limb than the opposite one. Maximum exposure (maximum libration) of the southern limb (about 7 degrees) occurs on Jan 12, Feb 8, Mar 7, Apr 3, May 1, May 28, Jun 24, Jul 21, Aug 18, Sep 14, Oct 11, Nov 7 and Dec 5, and that of the northern limb on Jan 25, Feb 21, Mar 20, Apr 16, May 13, Jun 8, Jul 7, Aug 3, Aug 30, Sep 27, Oct 24, Nov 20 and Dec 18. Maximum exposure of the left hand limb (in diagram) occurs on Jan 23, Feb 20, Mar 19, Apr 16, May 13, Jun 8, Jul 7, Aug 3, Aug 31, Sep 28, Oct 24, Nov 20 and Dec 18, and that of the right hand limb (in diagram) on Jan 10, Feb 5, Mar 4, Mar 31, Apr 28, May 26, Jun 24, Jul 21, Aug 17, Sep 13, Oct 10, Nov 7 and Dec 5. The magnitude of the east-west librations is smallest in February and August (about 5 degrees) and largest in May and December (nearly 8 degrees).

JOHANNESBURG - MOONRISE 1973

Day	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec
1	2h 27	3h 44m	2h 29m	4h 03m	4h 49m	6h 59m	7h 41m	8h 22m	8h 43m	8h 43m	9h 59m	10h 30m
2	3 13	4 41	3 26	5 03	5 55	8 04	8 30	8 58	9 22	9 32	10 52	11 23
3	4 03	5 38	4 23	6 05	7 04	9 03	9 13	9 33	10 05	10 22	11 45	12 16
4	4 57	6 35	5 20	7 09	8 13	9 55	9 51	10 09	10 50	11 15	12 39	13 11
5	5 53	7 32	6 19	8 16	9 20	10 39	10 26	10 46	11 39	12 09	13 33	14 08
6	6 49	8 30	7 19	9 24	10 21	11 18	11 01	11 27	12 31	13 03	14 29	15 09
7	7 45	9 28	8 20	10 31	11 15	11 54	11 35	12 10	13 24	13 57	15 26	16 13
8	8 42	10 29	9 24	11 33	12 01	12 27	12 10	12 56	14 18	14 51	16 27	17 21
9	9 39	11 33	10 29	12 31	12 43	13 00	12 48	13 46	15 13	15 47	17 31	18 28
10	10 36	12 37	11 35	13 20	13 19	13 34	13 29	14 39	16 08	16 44	18 37	19 32
11	11 33	13 43	12 39	14 04	13 53	14 10	14 13	15 33	17 04	17 44	19 45	20 30
12	12 35	14 46	13 39	14 42	14 27	14 49	15 01	16 28	18 00	18 46	20 49	21 23
13	13 40	15 45	14 34	15 17	14 59	15 30	15 52	17 23	18 57	19 50	21 49	22 08
14	14 47	16 39	15 21	15 51	15 33	16 16	16 45	18 18	19 56	20 56	22 43	22 49
15	15 54	17 25	16 04	16 24	16 09	17 05	17 40	19 13	20 58	22 00	23 30	23 26
16	16 58	18 08	16 42	16 58	16 50	17 57	18 35	20 08	22 01	23 01	.....	.....
17	17 57	18 45	17 17	17 32	17 33	18 51	19 29	21 05	23 06	23 58	0 12	0 01
18	18 50	19 20	17 51	18 11	18 19	19 44	20 23	22 03	.....	.....	0 49	0 36
19	19 35	19 53	18 24	18 52	19 09	20 38	21 17	23 05	0 08	0 45	1 24	1 12
20	20 15	20 26	18 58	19 36	20 01	21 32	22 12	.....	1 06	1 31	1 59	1 50
21	20 50	21 01	19 34	20 24	20 56	22 27	23 09	0 08	2 02	2 11	2 34	2 32
22	21 24	21 38	20 14	21 15	21 50	23 22	.....	1 12	2 49	2 48	3 11	3 16
23	21 57	22 18	20 56	22 08	22 44	.....	0 09	2 15	3 33	3 23	3 51	4 03
24	22 29	23 02	21 41	23 02	23 39	0 19	1 12	3 13	4 12	3 58	4 34	4 54
25	23 04	23 48	22 30	23 57	.....	1 17	2 18	4 07	4 49	4 34	5 18	4 46
26	23 42	.....	23 23	.....	0 34	2 20	3 24	4 54	5 25	5 13	6 08	6 39
27	.....	0 39	.....	0 53	1 31	3 26	4 27	5 37	6 00	5 54	6 59	7 32
28	0 22	1 33	0 17	1 49	2 30	4 35	5 25	6 16	6 38	6 38	7 52	8 25
29	1 06		1 12	2 46	3 33	5 42	6 18	6 53	7 17	7 24	8 45	9 17
30	1 56		2 09	3 46	4 40	6 45	7 03	7 29	7 59	8 14	9 38	10 09
31	2 48		3 06		5 50		7 45	8 05		9 06		11 02

JOHANNESBURG - MOONSET 1973

Day	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec
1	16h 38m	17h 42m	16h 18m	16h 35m	16h 22m	17h 40m	18h 43m	20h 41m	22h 18m	22h 51m	23h 47m	23h 30m
2	17 29	18 21	16 55	17 11	17 06	18 48	19 51	21 40	23 14	23 42	.....	.....
3	18 18	18 58	17 31	17 49	17 58	19 58	20 56	22 38	.....	.....	0 24	0 03
4	19 03	19 33	18 05	18 32	18 56	21 05	21 57	23 34	0 09	0 29	0 59	0 36
5	19 45	20 07	18 40	19 18	20 00	22 09	22 55	.....	1 01	1 12	1 32	1 09
6	20 23	20 41	19 16	20 12	21 07	23 10	23 53	0 30	1 52	1 51	2 06	1 46
7	20 58	21 15	19 54	21 10	22 14	.....	.....	1 25	2 36	2 27	2 40	2 29
8	21 31	21 54	20 37	22 13	23 18	0 08	0 48	2 18	3 17	3 02	3 16	3 16
9	22 04	22 37	21 24	23 18	.....	1 04	1 43	3 09	3 55	3 36	3 56	4 11
10	22 38	23 26	22 18	.....	0 19	2 00	2 38	3 56	4 31	4 10	4 41	5 13
11	23 14	.....	23 16	0 22	1 17	2 55	3 32	4 40	5 06	4 45	5 33	6 20
12	23 54	0 22	.....	1 25	2 14	3 49	4 24	5 21	5 39	5 23	6 31	7 30
13	.....	1 23	0 20	2 24	3 09	4 43	5 13	5 58	6 13	6 05	7 35	8 39
14	0 39	2 28	1 25	3 22	4 04	5 36	6 00	6 33	6 48	6 52	8 41	9 44
15	1 32	3 35	2 28	4 19	4 59	6 28	6 43	7 06	7 27	7 45	9 48	10 47
16	2 31	4 40	3 31	5 14	5 54	7 16	7 22	7 39	8 09	8 43	10 53	11 46
17	3 37	5 43	4 31	6 09	6 48	8 01	7 57	8 12	8 57	9 46	11 55	12 44
18	4 46	6 44	5 29	7 05	7 41	8 43	8 31	8 48	9 51	10 51	12 54	13 42
19	5 54	7 42	6 27	8 00	8 32	9 21	9 04	9 27	10 49	11 56	13 52	14 38
20	7 00	8 39	7 23	8 55	9 19	9 55	9 37	10 10	11 52	12 59	14 49	15 34
21	8 03	9 35	8 19	9 47	10 03	10 29	10 10	10 58	12 57	13 59	15 46	16 28
22	9 01	10 31	9 15	10 37	10 44	11 02	10 46	11 54	14 03	14 59	16 43	17 22
23	9 58	11 26	10 10	11 23	11 20	11 34	11 26	12 55	15 06	15 57	17 39	18 12
24	10 54	12 20	11 03	12 06	11 55	12 09	12 12	14 01	16 08	16 55	18 34	18 59
25	11 49	13 13	11 55	12 45	12 28	12 47	13 05	15 09	17 09	17 53	19 26	19 43
26	12 43	14 04	12 44	13 21	13 01	13 31	14 04	16 16	18 08	18 51	20 16	20 22
27	13 37	14 51	13 29	13 56	13 35	14 20	15 10	17 21	19 06	19 47	21 02	20 58
28	14 30	15 36	14 11	14 30	14 13	15 18	16 20	18 23	20 04	20 42	21 44	21 32
29	15 22		14 50	15 05	14 55	16 23	17 29	19 23	21 02	21 33	22 22	22 04
30	16 12		15 26	15 43	15 42	17 33	18 36	20 22	21 58	22 22	22 57	22 36
31	16 59		16 01		16 38		19 40	21 20		23 06		23 08

Day	Jan	Feb	Mar	Apr	May
1	$2^h\ 46^m$	$4^h\ 05^m$	$2^h\ 51^m$	$4^h\ 40^m$	$5^h\ 38^m$
2	3 32	5 04	3 52	5 45	6 47
3	4 21	6 06	4 53	6 51	8 00
4	5 17	7 07	5 55	7 59	9 12
5	6 15	8 09	6 58	9 11	10 21
6	7 14	9 11	8 03	10 21	11 20
7	8 14	10 14	9 09	11 30	12 11
8	9 15	11 20	10 17	12 34	12 54
9	10 16	12 27	11 25	13 28	13 31
10	11 18	13 35	12 34	14 15	14 03
11	12 21	14 43	13 40	14 54	14 33
12	13 26	15 47	14 39	15 29	15 03
13	14 35	16 46	15 30	16 00	15 32
14	15 45	17 35	16 16	16 30	16 01
15	16 54	18 19	16 54	16 59	16 34
16	18 00	18 56	17 28	17 28	17 12
17	18 57	19 28	17 59	18 00	17 53
18	19 45	19 59	18 29	18 34	18 39
19	20 25	20 29	18 58	19 13	19 29
20	21 01	20 58	19 28	19 56	20 23
21	21 32	21 30	20 00	20 43	21 18
22	22 02	22 02	20 36	21 34	22 15
23	22 31	22 40	21 16	22 29	23 13
24	23 00	23 21	22 01	23 26	.....
25	23 30	.....	22 49	.....	0 12
26	.....	0 07	23 42	0 24	1 11
27	0 04	0 58	.....	1 23	2 13
28	0 43	1 53	0 39	2 24	3 16
29	1 26		1 37	3 26	4 24
30	2 14		2 37	4 30	5 34
31	3 08		3 38		6 47

VN – MOONRISE 1973

Jun	Jul	Aug	Sept	Oct	Nov	Dec
7h 58m	8h 37m	9h 03m	9h 09m	9h 05m	10h 22m	11h 01m
9 04	9 22	9 34	9 45	9 52	11 18	11 58
10 00	10 01	10 05	10 26	10 42	12 14	12 55
10 49	10 34	10 37	11 11	11 37	13 11	13 54
11 29	11 05	11 11	11 59	12 32	14 09	14 56
12 03	11 35	11 48	12 51	13 29	15 09	16 00
12 35	12 05	12 30	13 47	14 27	16 11	17 08
13 05	12 36	13 17	14 43	15 26	17 17	18 18
13 34	13 12	14 06	15 41	16 25	18 24	19 27
14 03	13 51	15 00	16 40	17 27	19 33	20 32
14 36	14 33	15 56	17 39	18 31	20 43	21 27
15 12	15 21	16 54	18 40	19 37	21 46	22 16
15 52	16 12	17 52	19 41	20 45	22 47	22 57
16 36	17 07	18 51	20 46	21 53	23 38	23 32
17 25	18 04	19 50	21 51	23 00	.....	.....
18 17	19 02	20 50	22 58	.....	0 21	0 06
19 12	20 00	21 51	.....	0 01	0 59	0 36
20 09	20 58	22 54	0 04	0 54	1 32	1 08
21 07	21 56	23 59	1 08	1 42	2 03	1 40
22 05	22 55	.....	2 06	2 22	2 34	2 16
23 02	23 57	1 05	2 57	2 57	3 05	2 54
.....	.....	2 12	3 43	3 30	3 39	3 37
0 02	1 01	3 15	4 22	4 01	4 15	4 24
1 02	2 08	4 12	4 56	4 32	4 56	5 14
2 07	3 16	5 02	5 29	5 04	5 40	6 08
3 14	4 24	5 46	6 00	5 39	6 28	7 03
4 22	5 27	6 25	6 33	6 17	7 20	7 59
5 34	6 22	6 59	7 06	6 59	8 14	8 54
6 43	7 11	7 31	7 42	7 45	9 09	9 50
7 44	7 54	8 03	8 21	8 34	10 06	10 46
	8 30	8 35		9 27		11 43

Day	Jan	Feb	Mar	Apr	May
1	17h 38m	18h 37m	17h 11m	17h 15m	16h 50m
2	18 29	19 13	17 45	17 46	17 31
3	19 18	19 46	18 16	18 20	18 19
4	20 01	20 16	18 47	18 56	19 17
5	20 39	20 46	19 17	19 41	20 20
6	21 13	21 16	19 48	20 31	21 28
7	21 44	21 47	20 22	21 29	22 37
8	22 14	22 22	21 01	22 33	23 46
9	22 43	23 02	21 46	23 41	.....
10	23 12	23 47	22 36	.....	0 52
11	23 44	.....	23 35	0 48	1 54
12	.....	0 40	.....	1 54	2 55
13	0 20	1 41	0 40	2 58	3 54
14	1 02	2 49	1 48	3 59	4 52
15	1 51	3 58	2 55	5 00	5 50
16	2 50	5 08	4 01	6 00	6 48
17	3 57	6 16	5 06	6 59	7 45
18	5 07	7 20	6 08	7 58	8 40
19	6 19	8 24	7 09	8 56	9 31
20	7 29	9 24	8 10	9 52	10 18
21	8 37	10 24	9 09	10 46	10 59
22	9 40	11 23	10 08	11 36	11 37
23	10 41	12 22	11 06	12 21	12 10
24	11 40	13 18	12 02	13 02	12 41
25	12 39	14 13	12 54	13 38	13 11
26	13 37	15 04	13 43	14 11	13 40
27	14 33	15 51	14 28	14 41	14 10
28	15 29	16 32	15 06	15 11	14 43
29	16 22		15 41	15 41	15 21
30	17 12		16 14	16 14	16 05
31	17 57		16 44		16 58

Jun	Jul	Aug	Sept	Oct	Nov	Dec
$17^h\ 59^m$	$19^h\ 07^m$	$21^h\ 21^m$	$23^h\ 12^m$	$23^h\ 50^m$	$0^h\ 02^m$	.....
18 07	20 15	22 24	.....	.....	0 41	0 16
20 20	21 29	23 26	0 10	0 40	1 14	0 45
21 31	22 35	.....	1 07	1 26	1 46	1 13
22 40	23 38	0 26	2 00	2 07	2 16	1 43
23 46	.....	1 25	2 49	2 49	2 45	2 16
.....	0 38	2 22	3 32	3 17	3 15	2 54
0 48	1 38	3 16	4 12	3 48	3 48	3 39
1 48	2 36	4 07	4 47	4 18	4 24	4 32
2 47	3 34	4 55	5 20	4 48	5 06	5 33
3 45	4 30	5 36	5 50	5 19	5 54	6 42
4 43	5 23	6 14	6 19	5 53	6 51	7 54
5 39	6 12	6 48	6 49	6 33	7 55	9 06
6 35	6 58	7 19	7 21	7 15	9 03	10 16
7 27	7 38	7 49	7 55	8 06	10 13	11 23
8 16	8 14	8 18	8 34	9 03	11 21	12 27
8 59	8 47	8 47	9 19	10 08	12 28	13 29
9 38	9 17	9 18	10 10	11 15	13 32	14 30
10 12	9 46	9 54	11 09	12 23	14 34	15 29
10 43	10 14	10 33	12 14	13 29	15 35	16 28
11 13	10 43	11 20	13 21	14 35	16 36	17 25
11 42	11 15	12 13	14 30	15 38	17 35	18 19
12 11	11 52	13 16	15 38	16 41	18 34	19 10
12 41	12 35	14 24	16 44	17 42	19 31	19 57
13 15	13 24	15 33	17 49	18 43	20 25	20 38
13 55	14 23	16 44	18 52	19 44	21 14	21 15
14 43	15 31	17 53	19 55	20 43	21 59	21 48
15 38	16 42	19 01	20 57	21 39	22 39	22 18
16 43	17 55	20 06	21 57	22 32	23 14	22 47
17 54	19 06	21 09	22 55	23 20	23 46	23 15
	20 15	22 11		.....		23 42

METEORS

Meteors, or shooting stars, (resulting from small bodies entering the Earth's upper atmosphere) 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, a shower can be expected. A list of these predicted showers is given in the table below.

Date	Shower	Radiant: R A.	Dec.	Maximum Date	Hourly Rate	Transit of Radiant (approx)	Recommended SAST of watch	Conditions at Maximum
Mar 14 -Mar 18	Corona Australids	16h 20m	-48°	Mar 16	5	04h 45m	02h30m - dawn	Favourable
Mar 12 -Apr 25	Hydraids	12 16	-27	Mar 25	?	00 10	22h - 02h	Unfavourable
Apr 19 -Apr 24	April Lyrids	18 08	+32	Apr 21	15	04 15	02h - dawn	Unfavourable
May 1 -May 8	Eta Aquarids	22 24	00	May 5	18	07 30	03h - dawn	Favourable
Apr 20 -Jul 30	Sco - Sgr System	18 00	-30	Jun 14	?	00 30	20h - 24h	Unfavourable
Jun 10 -Jun 21	June Lyrids	18 32	+35	Jun 16	10	01 00	00h - 03h	Unfavourable
Jun 17 -Jun 26	Ophiuchids	17 20	-20	Jun 20	12	23 30	01h - 03h	Unfavourable
Jul 10 -Aug 5	Capricornids	21 00	-15	Jul 25	10	00 50	22h - 02h	Favourable
Jul 15 -Aug 15	Delta Aquarids	22 36	-17 00	Jul 29	35	02 10	00h - 04h	Favourable
Jul 15 -Aug 20	Pisces Australids	22 40	-30	Jul 30	15	02 10	00h - 04h	Favourable
Jul 15 -Aug 25	Alpha Capricornids	20 36	-10	Aug 1	10	00 00	20h - 02h	Favourable
Jul 15 -Aug 24	Iota Aquarids	22 04 22 32	- 6 -15	Aug 5	12	01 10 01 40	00h - 03h	Favourable
Oct 16 -Oct 27	Orionids	06 24	+15	Oct 21	35	04 30	02h - dawn	Unfavourable
Oct 10 -Dec 5	Taurids	03 28 03 36	+14 +21	Nov 1	16	00 50 01 00	23h - 02h	Favourable
Nov 14 -Nov 20	Leonids	10 08	+22	Nov 17	15?	06 30	02h - dawn	Unfavourable
Dec 5	Phoenicids	01 00	-55	Dec 4	?	20 10	19h - 24h	Unfavourable
Dec 7 -Dec 15	Geminids	07 28	+32	Dec 13	55	02 00	00h - 03h	Unfavourable
Dec 5 -Jan 7	Velaids	09 56	-51	Dec 29	?	03 30	23h - 03h30m	Favourable

THE PLANETS

Notes on visibility and observing of individual planets follow in the text below. Times of rising and setting are given by the diagrams on pages 20 and 21. Movements of the planets against the starry background are shown in the maps on pages 22 and 23.

MERCURY

Being close to the Sun, Mercury 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 Earth). It can never be seen near inferior conjunction (passing between Earth and Sun) or near superior conjunction (passing round far side of Sun).

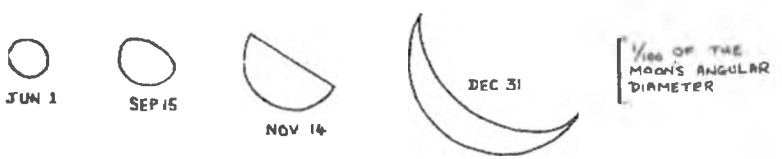
Superior conjunction:	Jan 28	May 5	Sep 2
Greatest Eastern Elongation:	Feb 25 (18°)	Jun 23 (25°)	Oct 19 (25°)
Inferior conjunction:	Mar 13	Jul 20	Nov 10
Greatest Western Elongation:	Apr 10 (28°)	Aug 8 (19°)	Nov 27 (20°)

The best times to see Mercury in the evening sky are June - early July and October. The angular diameter of Mercury's disk rarely exceeds 10 seconds of arc (about 1/200 of the Moon's angular diameter), so it is difficult to make out much detail with a small telescope, but phases (like those of the Moon) might just be visible.

On November 10, Mercury will transit across the disk of the Sun (see page 9 for details).

VENUS

During the early months of the year, Venus will appear in the morning sky (above the eastern horizon). On April 9, it passes around the far side of the Sun and thereafter appears in the evening sky. As its distance from the Earth decreases it grows brighter and for the latter part of the year will be extremely prominent in the western sky. If observed through a telescope over this period, its angular diameter will be seen to increase while its phase is seen to change from gibbons to a waning crescent - as shown in the diagram. Virtually no details can be seen on the disk of the planet because of the dense cloud covering.



Greatest elongation (greatest angle from Sun) occurs on November 13 and greatest brilliancy (magnitude -4, 2) on December 19. It passes between the Earth and Sun early in 1974.

THE PLANETS - BASIC DATA

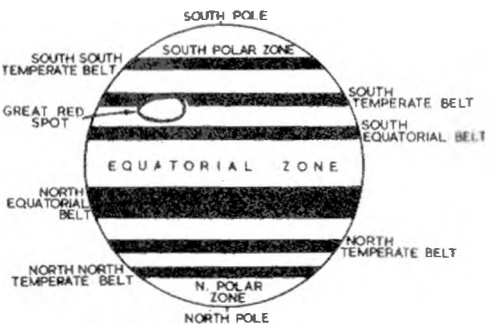
	Dist from Sun	Period of Revolution	Mass	Diameter	Rotation Period	Inclination of Equator to Orbit
	10^6 km	years	(Earth = 1)	10^3 km		
Mercury	58	0.24	0.056	4.98	59d	?
Venus	108	0.62	0.817	12.4	?	?
Earth	150	1.00	1.000	12.8	23^h56^m	$23°27'$
Mars	228	1.88	0.108	6.76	24 37	23 59
Jupiter	778	11.9	318.0	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	5886	247.6	0.9?	?	?	?

MARS

Mars can be seen only in the morning sky for the first half of 1973. However as the Earth gradually catches up and overtakes it (opposition on Oct 25) it will become prominent in the evening sky against the constellation of Aries. Its greatest angular diameter is only about 20 seconds of arc (about 1/100 of the Moon's diameter). Through a telescope it may be possible to glimpse the white polar caps and darker markings contrasting against the general "desert" orange colour of the disk. Regrettably Earth based telescopes cannot show the craters, conical volcanos and gigantic canyons that have been found on this planet. Mars has two tiny moons but a very large telescope is required to see these.

JUPITER

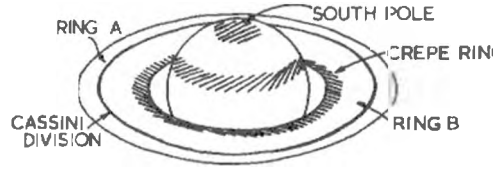
Jupiter is a prominent object in the evening sky during the latter half of the year. It is seen against the stars of Capricornus and rises high in the sky due to its southerly decliniation. It is at its brightest (magnitude -2,2) at opposition on Jul 30. Because of its large angular size (44 seconds of arc at opposition), Jupiter makes an excellent object for a small telescope. It is often possible to see features on the disk: 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 twelve Moons. An entire section of this Handbook is devoted to the movements of these satellites and the phenomena associated with them (see page 24).

SATURN

Saturn will be clearly seen in the evening sky for the first four months of 1973, and again at the end of the year. Unfortunately it will never be very high above the horizon because of its northerly declination - as it passes to the north of the constellation of Orion. It is at greatest brightness (magnitude -0,3) at opposition on December 23. The diagram shows its appearance through a small telescope (the scale is the same as for the Jupiter diagram) - including the spectacular ring system.



URANUS

At opposition, on April 11, Uranus is on the borderline of naked eye visibility (magnitude 5,5). It can however be found fairly easily with a small telescope, equipped with setting circles, by using the ephemerides given in the table below. The disk subtends an angle of about 4 seconds of arc.

POSITIONS OF URANUS AND NEPTUNE

	URANUS		NEPTUNE			URANUS		NEPTUNE	
	R.A.	Dec	R.A.	DEC		R.A.	Dec	R.A.	Dec
Jan 1	$13^h\ 25^m,1$	$-8^o\ 16'$	$16^h\ 18^m,6$	$-19^o\ 48'$	Jul 1	$13^h\ 10^m,9$	$-6^o\ 51'$	$16^h\ 14^m,3$	$-19^o\ 33'$
Feb 1	13 26,3	-8 22	16 22,1	-19 55	Aug 1	13 12,8	-7 04	16 12,3	-19 29
Mar 1	13 24,6	-8 11	16 23,6	-19 57	Sep 1	13 17,5	-7 34	16 12,3	-19 31
Apr 1	13 20,3	-7 46	16 23,1	-19 55	Oct 1	13 23,8	-8 12	16 14,3	-19 37
May 1	13 15,6	-7 18	16 20,8	-19 48	Nov 1	13 31,1	-8 56	16 18,1	-19 48
Jun 1	13 11,9	-6 56	16 17,6	-19 40	Dec 1	13 37,6	-9 33	16 22,7	-20 00
Jul 1	13 10,9	-6 51	16 14,3	-19 33	Dec 32	13 42,3	-9 59	16 27,4	-20 10

For explanation of coordinates, see section on Stars.

NEPTUNE

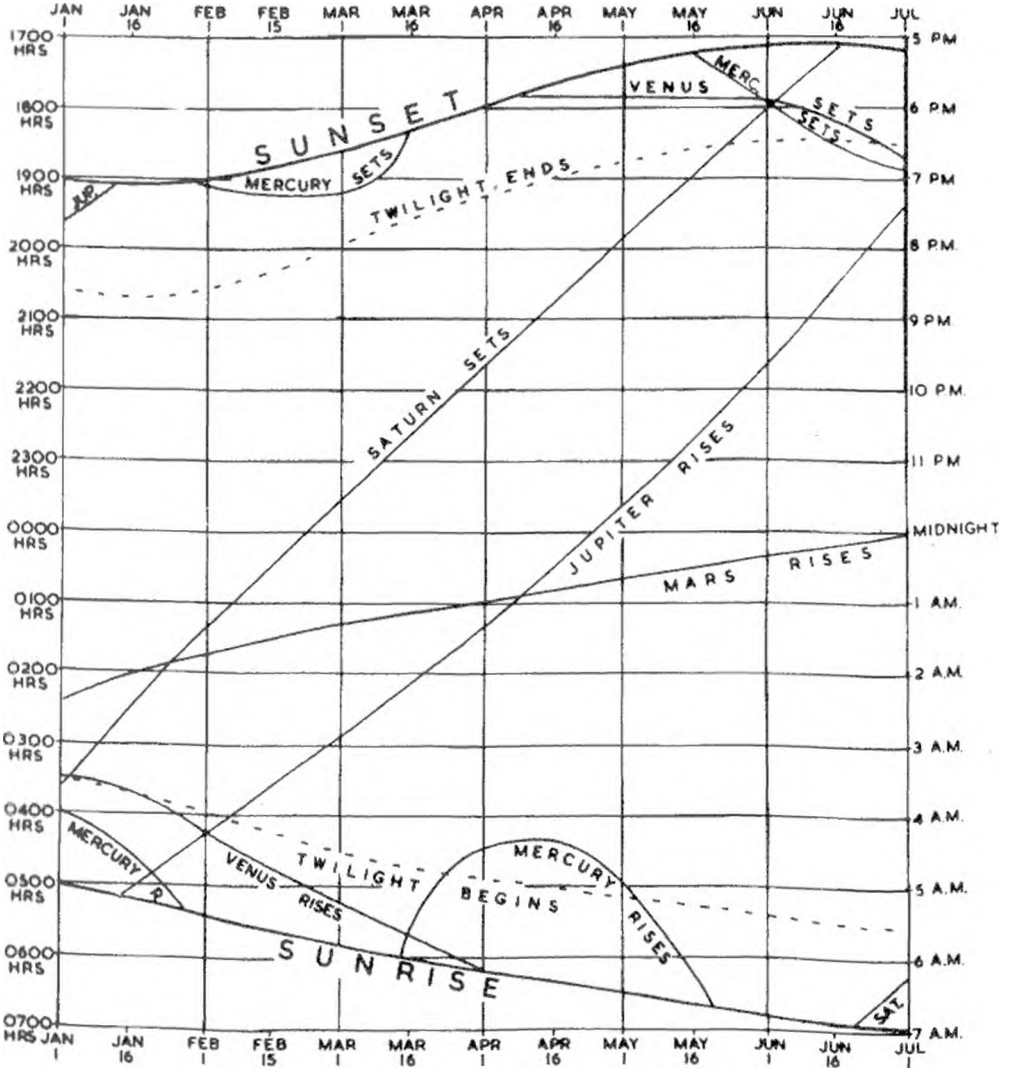
Neptune is at opposition on May 27 (magnitude 7,7). Like Uranus, it requires a telescope for observation; its position being given in the accompanying table. Although the disk has a diameter of only 2.5 seconds of arc, its non-stellar appearance aids in identification.

PLUTO

Pluto can only be found by using a large telescope and specially prepared finding charts.

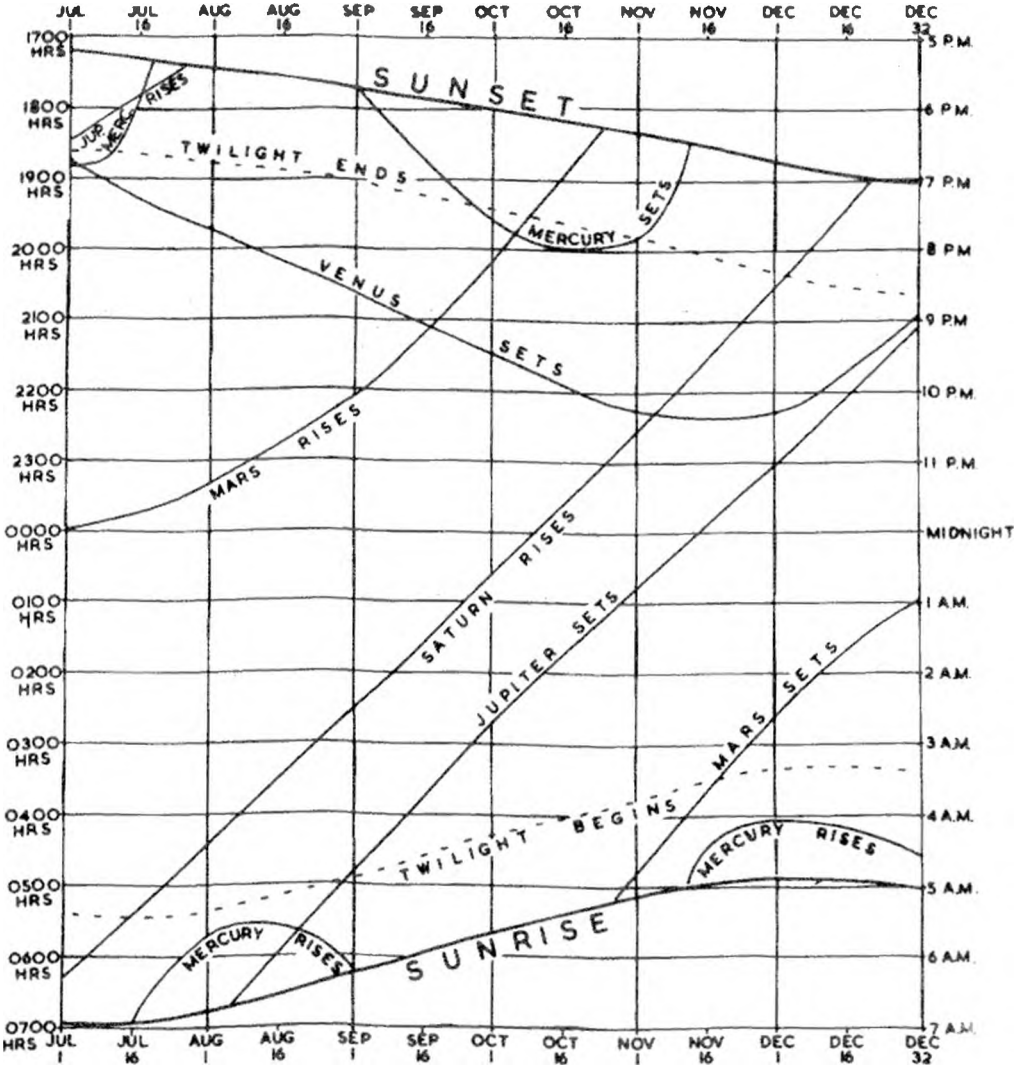
TIMES OF RISING AND SETTING 1973

To find the times of rising and setting of the planets for any particular night of the year, place a ruler (or suitable edge) vertically on the diagram according to the date given by the horizontal scale. The intersection of the ruler with the lines of rising and setting then give the appropriate times which can be read off against the vertical scale (24 hour clock on the left hand side, or conventional 12 hour clock on the right hand side).



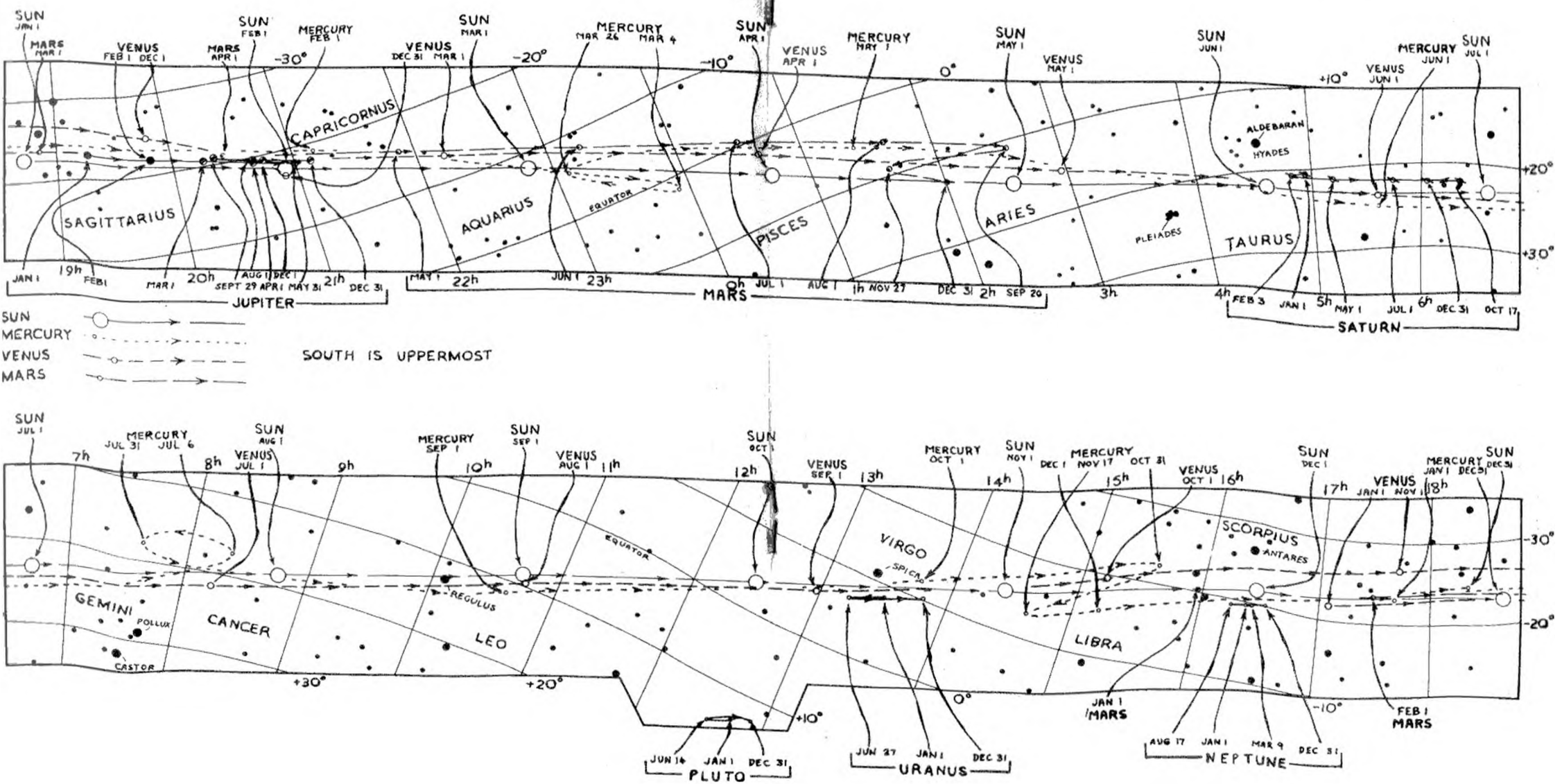
TIMES OF RISING AND SETTING 1973

The times of rising and setting given by this 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 (in minutes) for the main cities are: Bloemfontein +15^{m}; Bulawayo +6^{m}; Cape Town +46^{m}; Durban -4^{m}; East London +8^{m}; Grahamstown +14^{m}; Johannesburg +8^{m}; Kimberley +21^{m}; Port Elizabeth +18^{m}; Pretoria +7^{m}; Salisbury - 4^{m}; Windhoek +52^{m}.



MOVEMENT IN THE CONSTELLATIONS 1973

The two continuous strip maps below show that band of the sky known as the Zodiac, one half of which ould be above the horizon at any time. The central axis, called the "ecliptic", is the apparent path of the Sun ound the sky during the course of the year (resulting from the Earth revolving once around the Sun). The un's position on the first of each month is shown — that portion of the Zodiac to the right of the Sun would seen after sunset, that portion to the left of the Sun before dawn.



MOVEMENT IN THE CONSTELLATIONS 1973

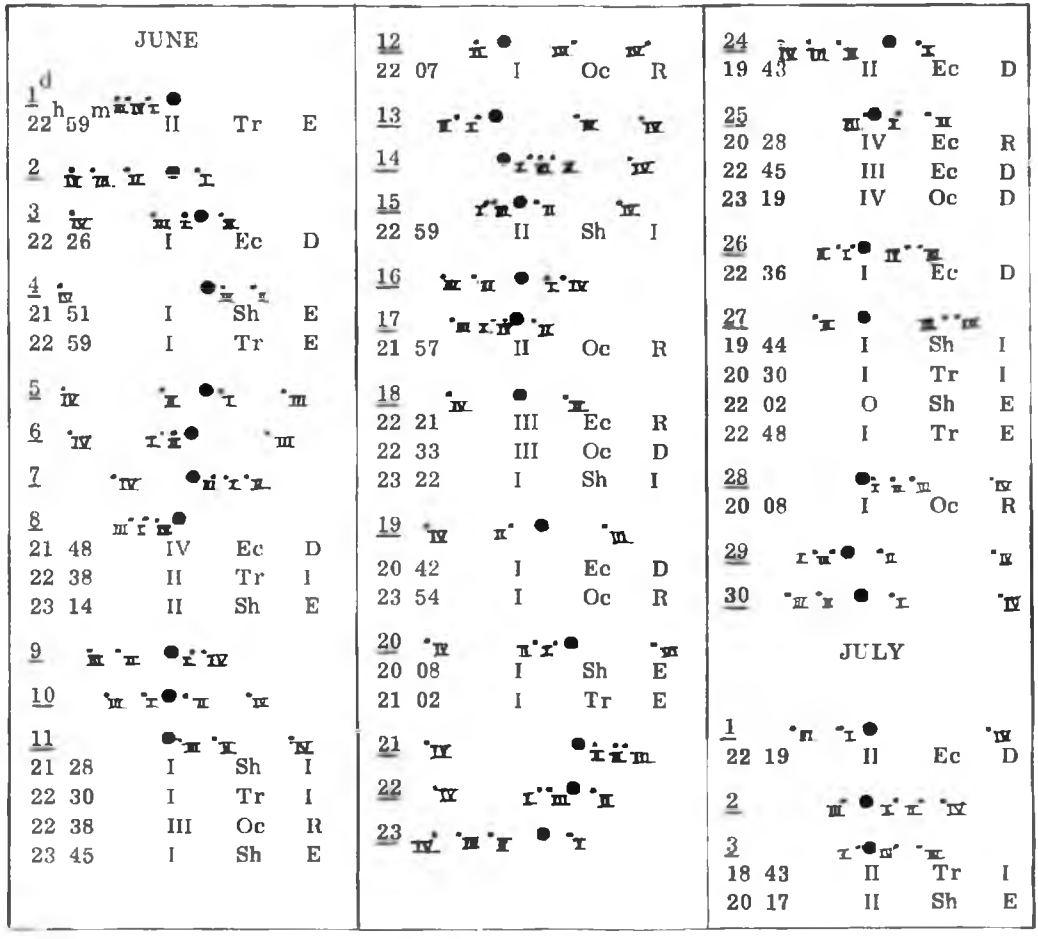
As a result of the planets' own motions and the Earth's motion, the planets appear to move against the starry background. Due to the flatness of our solar system, they are never far away from the ecliptic (representing the plane of the Earth's orbit) and consequently are confined to the constellations of the Zodiac. The diagram shows their movements relative to these constellations and against the coordinate grid of Right Ascension and Declination (for explanation see section on Stars). Note that South is uppermost.

THE MOONS OF JUPITER

Four of Jupiter's twelve moons are generally clearly visible to an observer with a small telescope. The system is seen near edge-on and consequently the moons appear to lie close to a straight line extending from the planet's equator. They can be identified by the miniature diagrams in the table below which have east towards the right: I = Io, II = Europa, III = Ganymede, IV = Callisto (one diagram for each evening when the planet is clearly visible). The additional information gives times (hours and minutes) of phenomena associated with moons passing in front of, or behind, the planet. The predicted times are for mid-phenomena and are not instantaneous. Only those occurring before midnight and visible from Southern Africa are listed.

Ec. - Eclipse: the satellite passes through the shadow of Jupiter.
Oc. - Occultation: the satellite is obscured by the disc of Jupiter.
Tr. - Transit: the satellite crosses the disc of Jupiter.
Sh. - Shadow transit: the shadow of the satellite transits the disc.

D - Disappearance
R - Reappearance
I - Ingress
E - Egress



JUNE

1d 22h 59m		II	Tr	E
2				
3 22 26		I	Ec	D
4 21 51		I	Sh	E
22 59		I	Tr	E
5				
6				
7				
8 21 48		IV	Ec	D
22 38		II	Tr	I
23 14		II	Sh	E
9				
10				
11 21 28		I	Sh	I
22 30		I	Tr	I
22 38		III	Oc	R
23 45		I	Sh	E
12 22 07		I	Oc	R
13				
14				
15 22 59		II	Sh	I
16				
17 21 57		II	Oc	R
18 22 21		III	Ec	R
22 33		III	Oc	D
23 22		I	Sh	I
19 20 42		I	Ec	D
23 54		I	Oc	R
20 20 08		I	Sh	E
21 02		I	Tr	E
21				
22				
23				
24 19 43		II	Ec	D
25 20 28		IV	Ec	R
22 45		III	Ec	D
23 19		IV	Oc	D
26 22 36		I	Ec	D
27 19 44		I	Sh	I
20 30		I	Tr	I
22 02		O	Sh	E
22 48		I	Tr	E
28 20 08		I	Oc	R
29				
30				

JULY

1 22 19		II	Ec	D
2				
3 18 43		II	Tr	I
20 17		II	Sh	E

21	33	II	Tr	E
23	59	IV	Sh	I
4				
21	38	I	Sh	I
22	15	I	Tr	I
23	56	I	Sh	E
5				
18	58	I	Ec	D
21	51	I	Oc	R
6				
18	25	I	Sh	E
19	00	I	Tr	E
19	06	III	Tr	I
20	22	III	Sh	E
22	43	III	Tr	E
7				
8				
9				
10				
20	01	II	Sh	I
20	59	II	Tr	I
22	51	II	Sh	E
23	49	II	Tr	E
11				
23	32	I	Sh	I
24	00	I	Tr	I
12				
18	03	II	Oc	R
18	49	IV	Oc	R
20	52	I	Ec	D
23	35	I	Oc	R
13				
18	01	I	Sh	I
18	26	I	Tr	I
20	19	I	Sh	E
20	44	I	Tr	E
20	46	III	Sh	I
22	26	III	Tr	I
14				
18	01	I	Oc	R
15				
16				
17				
22	36	II	Sh	I
23	13	II	Tr	I
18				
19				
20	19	II	Oc	R
22	46	I	Ec	D
20				
18	06	IV	Sh	I
19	56	I	Sh	I
20	10	I	Tr	I
20	24	IV	Tr	I
22	14	I	Sh	E
22	28	I	Tr	E
22	44	IV	Sh	E
21				
19	45	I	Oc	R
22				
23				
24				
18	57	III	Oc	R
25				
26				
19	27	II	Ec	D
22	34	II	Oc	R
27				
21	50	I	Sh	I
21	54	I	Tr	I
28				
19	09	I	Ec	D
21	29	I	Oc	R
29				
18	37	I	Sh	E
18	38	I	Tr	E
30				
31				
18	36	III	Oc	D
22	21	III	Ec	R

AUGUST

1				
2				
21	54	II	Oc	D
3				
23	38	I	Tr	I
23	45	I	Sh	I
4				
19	37	II	Tr	E
19	53	II	Sh	E
20	55	I	Oc	D
23	20	I	Ec	R
5				
18	04	I	Tr	I
18	13	I	Sh	I
20	22	I	Tr	E
20	32	I	Sh	E
6				
17	49	I	Ec	R
7				
21	52	III	Oc	D
8				
9				
10				
11				
19	01	II	Tr	I
19	38	II	Sh	I
21	51	II	Tr	E
22	28	II	Sh	E
22	39	I	Oc	D
12				
19	48	I	Tr	I
20	09	I	Sh	I
22	07	I	Tr	E
22	27	I	Sh	E

13				
19	43	I	Ec	R
14				
18	34	IV	Oc	D
15				
16				
17				
18				
18	29	III	Tr	E
20	24	III	Sh	E
21	16	II	Tr	I
22	13	II	Sh	I
19				
21	33	I	Tr	I
22	04	I	Sh	I
23	52	I	Tr	E
20				
18	50	I	Oc	D
19	35	II	Ec	R
21	38	I	Ec	R
21				
18	18	I	Tr	E
18	51	I	Sh	E
22				
23				
24				
25				
18	14	III	Tr	I
20	48	III	Sh	I
21	58	III	Tr	E
23	33	II	Tr	I
26				
23	19	I	Tr	I
23	59	I	Sh	I
27				
17	53	II	Oc	D
20	35	I	Oc	D
22	13	II	Ec	R
23	32	I	Ec	R

28				
18	28	I	Sh	I
20	04	I	Tr	E
20	46	I	Sh	E
29				
30				
31				
21	03	IV	Ec	R

SEPTEMBER

1				
21	39	III	Tr	I
2				
3				
20	14	II	Oc	D
22	21	I	Oc	D
4				
19	33	I	Tr	I
20	23	I	Sh	I
21	51	I	Tr	E
22	41	I	Sh	E
5				
18	23	III	Ec	R
19	30	II	Sh	E
19	56	I	Ec	R
6				
7				
8				
20	31	IV	Tr	E
9				
10				
22	36	II	Oc	D
11				
21	21	I	Tr	I
22	19	I	Sh	I
23	39	I	Tr	E

12				
18	25	III	Oc	R
18	36	I	Oc	D
18	46	III	Ec	D
19	16	II	Sh	I
20	10	II	Tr	E
21	51	I	Ec	R
22	05	II	Sh	E
22	24	II	Ec	R
13				
18	06	I	Tr	E
19	06	I	Sh	E
14				
15				
16				
17				
18				
23	10	I	Tr	I
19				
18	23	III	Oc	D
19	44	II	Tr	I
20	24	I	Oc	D
21	52	II	Sh	I
22	00	III	Oc	R
22	32	II	Tr	E
22	47	III	Ec	D
23	46	I	Ec	R
20				
19	55	I	Tr	E
21	01	I	Sh	E
21				
19	27	II	Ec	R
22				
23				
24				
25				
18	46	IV	Sh	I
23	31	IV	Sh	E

26				
22	03	III	Oc	D
22	09	II	Tr	I
22	14	I	Oc	D
27				
19	28	I	Tr	I
20	39	I	Sh	I
21	46	I	Tr	E
22	57	I	Sh	E
28				
20	10	I	Ec	R
22	06	II	Ec	R
29				
30				
20	30	III	Sh	E

OCTOBER

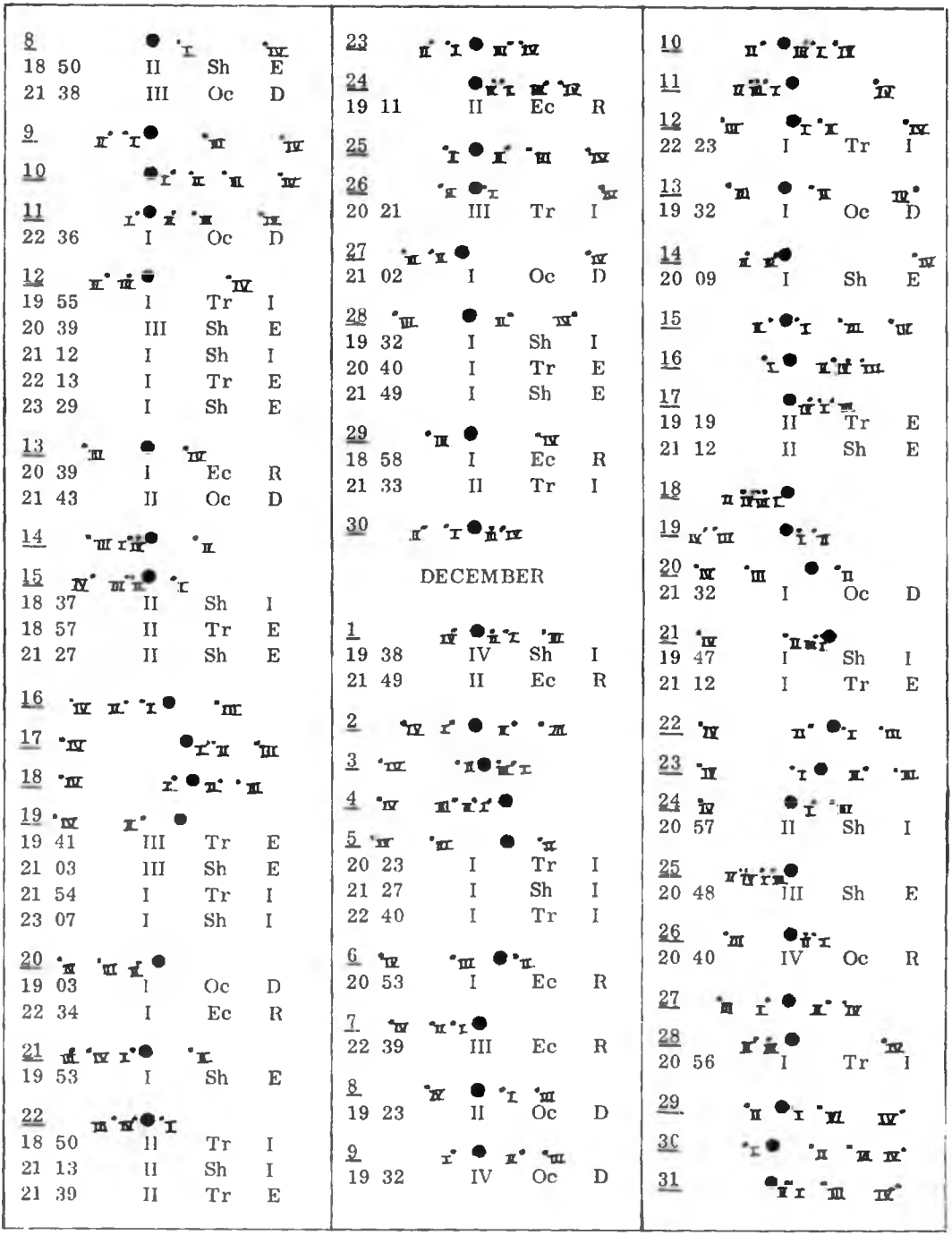
1				
2				
3				
21	45	IV	Oc	R
4				
21	20	I	Tr	I
22	35	I	Sh	I
23	38	I	Tr	E
5				
18	33	I	Oc	D
19	13	II	Oc	D
22	05	I	Ec	R
6				
19	21	I	Sh	E
7				
19	09	II	Sh	E
19	24	III	Tr	E
20	55	III	Sh	I
8				
9				
10				

11				
23	13	I	Tr	I
12				
20	26	I	Oc	D
21	47	II	Oc	D
24	00	I	Ec	R
13				
18	59	I	Sh	I
19	59	I	Tr	E
21	17	I	Sh	E
14				
18	29	I	Ec	R
18	56	II	Sh	I
19	11	II	Tr	E
19	41	III	Tr	I
21	44	II	Sh	E
23	16	III	Tr	E
15				
16				
17				
18				
18	30	III	Ec	R
19				
22	19	I	Oc	D
20				
19	36	I	Tr	I
20	55	I	Sh	I
21	54	I	Tr	E
22	44	IV	Ec	D
23	13	I	Sh	E
21				
18	56	II	Tr	I
20	24	I	Ec	R
21	31	II	Sh	I
21	44	II	Tr	E
23	38	III	Tr	I
22				
23				
19	20	II	Ec	R

24				
25				
22	31	III	Ec	R
26				
27				
21	32	I	Tr	I
22	51	I	Sh	I
23	49	I	Tr	E
28				
18	31	IV	Tr	I
18	43	I	Oc	D
21	31	II	Tr	I
22	19	I	Ec	R
23	10	IV	Tr	E
29				
19	37	I	Sh	E
30				
21	59	II	Ec	R
31				

NOVEMBER

1				
21	10	III	Oc	R
22	53	III	Ec	D
2				
3				
23	28	I	Tr	I
4				
20	39	I	Oc	D
5				
19	16	I	Sh	I
20	15	I	Tr	E
21	33	I	Sh	E
6				
18	43	I	Ec	R
19	01	II	Oc	D
21	46	IV	Ec	R
7				



8				
18	50	II	Sh	E
21	38	III	Oc	D
9				
10				
11				
22	36	I	Oc	D
12				
19	55	I	Tr	I
20	39	III	Sh	E
21	12	I	Sh	I
22	13	I	Tr	E
23	29	I	Sh	E
13				
20	39	I	Ec	R
21	43	II	Oc	D
14				
15				
18	37	II	Sh	I
18	57	II	Tr	E
21	27	II	Sh	E
16				
17				
18				
19				
19	41	III	Tr	E
21	03	III	Sh	E
21	54	I	Tr	I
23	07	I	Sh	I
20				
19	03	I	Oc	D
22	34	I	Ec	R
21				
19	53	I	Sh	E
22				
18	50	II	Tr	I
21	13	II	Sh	I
21	39	II	Tr	E
23				
24				
19	11	II	Ec	R
25				
26				
20	21	III	Tr	I
27				
21	02	I	Oc	D
28				
19	32	I	Sh	I
20	40	I	Tr	E
21	49	I	Sh	E
29				
18	58	I	Ec	R
21	33	II	Tr	I
30				

DECEMBER

1				
19	38	IV	Sh	I
21	49	II	Ec	R
2				
3				
4				
5				
20	23	I	Tr	I
21	27	I	Sh	I
22	40	I	Tr	I
6				
20	53	I	Ec	R
7				
22	39	III	Ec	R
8				
19	23	II	Oc	D
9				
19	32	IV	Oc	D
10				
11				
12				
22	23	I	Tr	I
13				
19	32	I	Oc	D
14				
20	09	I	Sh	E
15				
16				
17				
19	19	II	Tr	E
21	12	II	Sh	E
18				
19				
20				
21	32	I	Oc	D
21				
19	47	I	Sh	I
21	12	I	Tr	E
22				
23				
24				
20	57	II	Sh	I
25				
20	48	III	Sh	E
26				
20	40	IV	Oc	R
27				
28				
20	56	I	Tr	I
29				
30				
31				

THE STARS

Apart from our Sun, all the stars that we see are so incredibly distant that 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.

Because of the rotation of our Earth, the starry skies are continually changing. The portion of the heavens visible depends upon both the time of the night and the time of the year.

IDENTIFYING CONSTELLATIONS

The star maps included in this section show all the constellations that can ever be seen from Southern Africa; however their form is not particularly suited for initial identifications. The best approach is to use the diagrams in the Diary (pages 2 to 6) which show only the more easily identified constellations. Once such key constellations are located, the maps in this section can be used to fill in the details.

Sometimes the appearance of a constellation can be affected by the presence of an object that appears to be a star but is really far from stellar in nature. Usually such interlopers are the other planets of our solar system. However they can be identified from the maps in the Diary section or the centrefold maps (pages 22 and 23). Also they generally lack the twinkling appearance of a star. The other type of false stellar objects are artificial satellites - but usually their motion is fast enough for the eye to distinguish (the large number of these and the uncertainties and differences in times and positions do not permit any predictions to be included in this Handbook).

Over the entire sky, there are a total of 88 constellations (twelve of these lie close to the Sun's apparent path and form the Zodiac - further explanation on page 22). From a point out in space it would be possible to view the whole sky at once. However, on the surface of the Earth, one half is obscured by the ground beneath our feet. The half that is visible is continually changing due to the Earth's rotation. Because of our southerly latitude there is a portion of the southern sky that never sets, and a portion below the northern horizon that never rises.

STELLAR MAGNITUDES

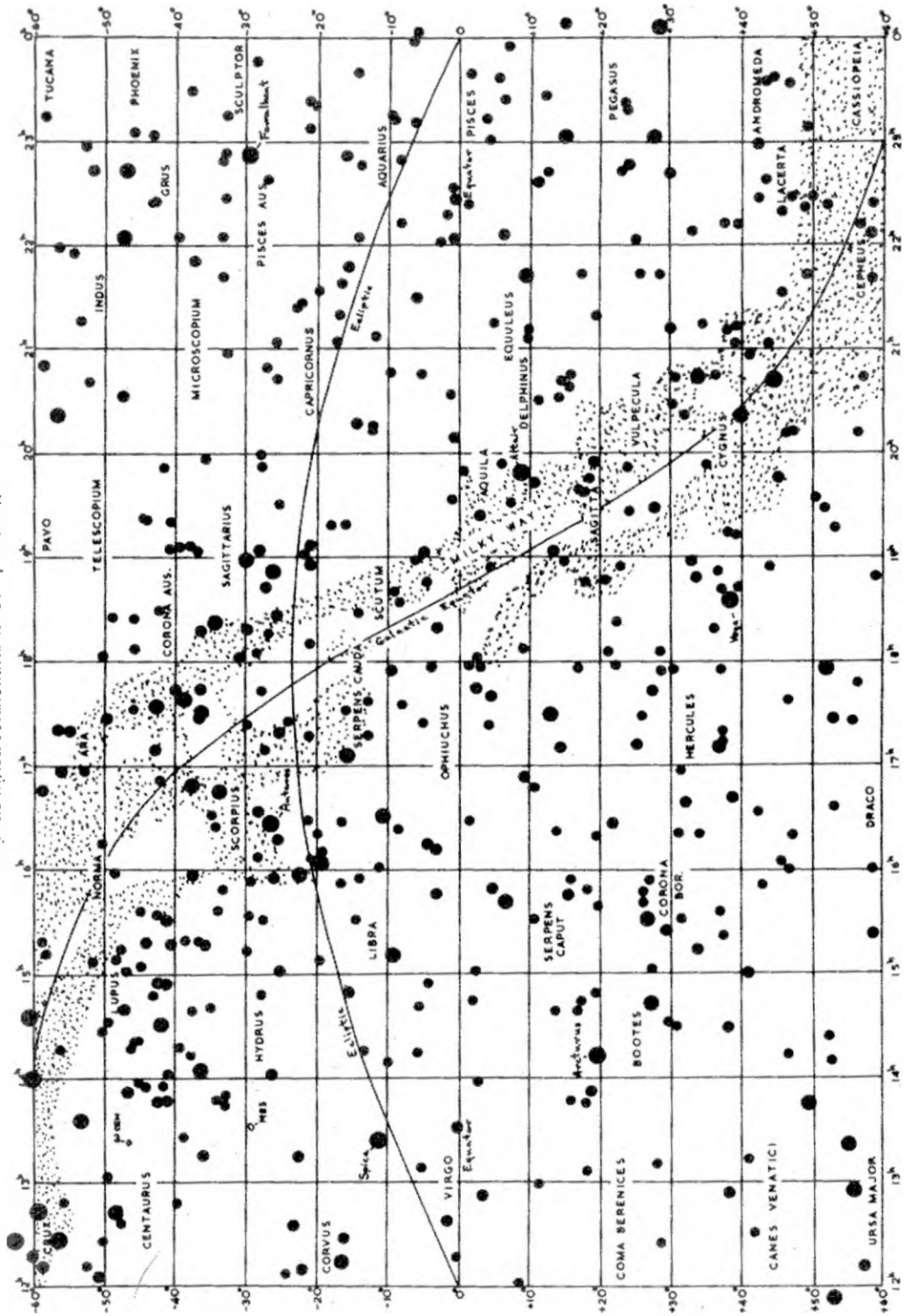
The apparent brightness of a star is indicated by its magnitude. The magnitudes of the brightest stars in the night sky are in the vicinity of 1,0 and the faintest visible to the naked eye about 6,0 (or less within a big city). Very bright objects are given negative magnitudes, while objects with magnitudes greater than 7,0 could only be visible through a telescope. The star maps in this section show stars down to magnitude 4,5.

STELLAR SPECTRAL TYPES AND COLOURS

The codes O, B, A, F, G, K, M, based on the spectra exhibited by stars are a sequence representing decreasing surface temperature. For example the surface of

STAR MAP 3 - 12 TO 24 HOURS R. A.

Most easily identified constellations: Scorpius, Sagittarius



SIDEREAL TIME

Sidereal time, or "star time" is given by the line of Right Ascension that passes through the point directly overhead. Sidereal time runs at a slightly faster rate than standard time – so as to gain 24 hours (one whole circuit of the heavens) over the course of a year. The table below gives Sidereal time (for longitude 30°E) at 0 hrs standard time (midnight) and 2100 hrs (9 p.m.). It is tabulated at 10 day intervals. For intermediate dates, a difference of 4 minutes a day needs to be taken into account (24 hours of sidereal time are 4 minutes shorter than 24 hours of standard time.

SIDEREAL TIME FOR LONGITUDE 30°E

Date		At 0 hrs	At 21 hrs
Jan	1	6h 42m	3h 45m
	11	7 21	4 24
	21	8 01	5 04
	31	8 40	5 43
Feb	10	9 19	6 22
	20	9 59	7 02
Mar	2	10 38	7 41
	12	11 18	8 21
	22	11 57	9 00
Apr	1	12 37	9 40
	11	13 16	10 19
	21	13 55	10 58

		At 0 hrs	At 21 hrs
May	1	14h 35m	11h 38m
	11	15 14	12 17
	21	15 53	12 56
	31	16 33	13 36
Jun	10	17 12	14 15
	20	17 52	14 55
	30	18 31	15 34
Jul	10	19 11	16 14
	20	19 50	16 53
	30	20 29	17 32
Aug	9	21 09	18 12
	19	21 48	18 51
	29	22 28	19 31

		At 0 hrs	At 21 hrs
Sep	8	23h 07m	20h 10m
	18	23 47	20 50
	28	0 26	21 29
Oct	8	1 06	22 08
	18	1 45	22 48
	28	2 24	23 27
Nov	7	3 04	0 07
	17	3 43	0 46
	27	4 23	1 26
Dec	7	5 02	2 05
	17	5 42	2 45
	27	6 11	3 24

The four maps in the Diary section (pages 2 to 6) show the approximate sky for sidereal times: $6^h\ 30^m$, $12^h\ 30^m$, $18^h\ 30^m$ and $0^h\ 30^m$.

A LIST OF BRIGHT STARS

Giving current positions - suitable for checking telescope setting circles - magnitudes, spectral types and distances (in light years).

	Star	R.A.	Dec.	Mag.	Sp.	Dist.
α	And	1h 07.1	+28° 56'	2.1	B9	90
β	Hyi	0 24.4	-77 23	2.8	G1	21
δ	Phe*	1 04.9	-46 51	3.3	G8	190
β	And	1 08.3	+35 30	2.0	M0	76
α	Eri	1 36.8	-57 21	0.5	B5	118
α	Ari	2 05.8	+23 20	2.0	K2	76
θ	Eri*	2 57.3	-40 24	2.9	A3	65
α	Per	3 22.6	+49 46	1.8	F5	570
γ	Eri	3 56.8	-13 35	3.0	M0	160
π	Dor	4 33.4	-55 05	3.3	A0	260
α	Tau*	4 34.5	16 28	0.9	K5	68
ε	Ori	5 13.3	- 1 14	0.1	B8	900
α	Aur	5 11.9	+45 58	0.1	G8	45
α	Ori	5 53.8	+ 7 24	0.4	M2	520
β	CMa	6 21.6	-17 56	2.0	B1	750
α	Car	6 23.4	-52 11	0.7	F0	98
α	CMa	6 44.0	16 41	-1.4	A1	8.7
δ	CMa	7 07.4	-26 21	1.9	F8	2100
α	Gem*	7 33.0	+31 57	1.6	A	45
α	CMi*	7 38.0	+ 5 17	0.4	F5	11
β	Gem	7 43.8	+28 06	1.2	K0	35
ρ	Pup	8 06.5	-24 14	2.8	F0	105
ε	Hya*	8 45.5	+ 6 30	3.4	G0	140
b	Car	9 06.9	-69 37	1.7	A0	86
α	Hya	9 26.3	- 8 33	2.0	K3	94
α	Leo*	10 07.1	+12 06	1.4	B7	84
γ	Vel*	10 45.7	-49 17	2.7	G5	108

	Star	R.A.	Dec.	Mag.	Sp.	Dist.
β	Leo	11h 12.8	20° 39'	2.6	A4	82
λ	Cen	11 34.6	-62 53	3.2	B9	370
α	Cru*	12 25.2	-62 58	1.4	B1	370
α	CVn*	12 54.9	+38 27	2.9	B9	118
ε	Vir	13 00.0	11 06	2.9	G9	90
α	Vir	13 23.8	-11 02	0.9	B1	220
α	Boo	14 14.5	+19 19	-0.1	K2	36
α	Cen*	14 38.0	-60 44	0.3	G2	4.3
α	CrB	15 33.6	26 48	2.2	A0	76
δ	Sco	15 58.9	22 33	2.3	B0	590
α	Sco	16 27.9	26 23	0.9	M1	520
β	Her	16 29.1	+21 32	2.8	G8	103
λ	Sco	17 31.9	-37 05	1.6	B1	310
α	Oph	17 33.7	-12 35	2.1	A5	58
κ	Sco	17 40.7	39 01	2.4	B2	170
μ	Her*	17 45.5	+27 15	3.4	G5	30
ε	Sgl	18 22.5	-34 24	1.8	B9	124
α	Lyr	18 36.1	+38 45	0.0	A0	27
	Sgt*	19 01.0	29 55	2.6	A2	140
α	Aql	19 49.5	- 8 48	0.9	A7	17
δ	Pav	20 23.7	-66 49	2.0	B3	310
α	Cyg	20 10.6	+45 11	1.3	A2	1600
ε	Peg*	21 42.8	+ 9 46	2.3	K2	780
γ	Gru	21 52.4	-37 29	3.0	B8	340
α	Gru	22 06.6	-47 06	1.9	B5	84
α	PsA	22 56.9	-29 45	1.2	A3	23
α	Peg	23 03.5	+15 04	2.5	B9	109

Objects suitable for small telescopes (or perhaps for visitors' nights at observatories) are listed below (including the page opposite). Current positions are provided for telescopes with setting circles, or for locating when using the star maps given earlier in this section.

A LIST OF BRIGHT DOUBLE STARS

Name	R.A.	Dec.	Mags.	Sep.
β Tuc	0h 30,4	−63° 00′	4,5 4,5	27″
δ Phe	1 05,0	−46 51	4,1 4,2	1,3
ζ Phe	1 12,4	+ 7 25	4,2 5,3	24
γ Ari	1 52,2	+19 10	4,2 4,4	8
θ Eri	2 57,3	−40 24	3,4 4,4	8
ι Eri	3 47,5	−67 42	4,8 6,4	8
Castor	7 33,0	+31 57	2,0 2,8	4
ε Pup	7 37,8	−26 44	4,5 4,8	10

Name	R.A.	Dec.	Mags.	Sep.
γ Leo	10h 18m,6	+19° 58′	2,4 3,8	4″
α Cru	12 25,1	−62 57	1,4 1,9	5
γ Vir	12 40,4	− 1 18	3,6 3,7	3
α Cen	14 38,5	−60 44	0,3 1,7	16
δ Ser	15 33,6	+10 40	3,0 4,0	4
θ Sco	17 54,9	− 4 10	1,9 1,2	22
γ CoA	19 04,8	−37 06	5,0 5,0	2,4
ζ Aqu	22 27,3	0 09	4,4 4,6	2,6

SOME VARIABLE STARS

Name	R.A.	Dec.	Mag.	Type (Period)
T Cet	0h 20m,5	−20° 12′	5,1 – 7,1	Irregular
Mira	2 18,1	− 3 05	1,7 – 9,6	Long Period (331 days)
Algol	3 06,5	+40 52	2,3 – 3,5	Eclipsing (2,9 days)
λ Taur	3 59,2	+12 24	3,3 – 4,2	Eclipsing (3,9 days)
R Lep	4 58,4	−14 51	6,0 – 10,4	Long Period (430 days)
L² Pup	7 13,4	−44 37	4,6 – 6,2	Long Period (140 days)
R Car	9 32,3	−62 41	4,5 – 10,0	Long Period (308 days)
l Car	9 14,6	−62 24	3,6 – 5,0	Cepheid (35 days)

Name	R.A.	Dec.	Mag.	Type (Period)
U Hyd	10h 36m,3	−13° 15	4,5 – 6,0	Irregular
R Hyd	13 26,3	−23 09	4,0 – 10,1	Long Period (415 days)
θ Aps	14 02,9	−76 40	5,1 – 6,6	Irregular
δ Lib	14 59,6	− 8 25	4,8 – 6,2	Eclipsing (2,3 days)
X Sgt	17 46,1	−27 50	4,3 – 5,0	Cepheid (7,0 days)
R Scu	18 46,2	− 5 44	4,7 – 7,8	Irregular
κ Pav	18 54,4	−67 16	4,0 – 5,5	Cepheid (9,1 days)
η Aql	19 51,3	+ 0 57	3,7 – 4,5	Cepheid (7,2 days)

SOME OPEN CLUSTERS

Contain of the order of 100 stars. The Pleiades, Hyades and Praesepe clusters are readily visible to the naked eye.

Name	R.A.	Dec
Pleiades	3h 44m	+24°
Hyades	4 25	+17
M41	6 46,0	−20° 42
M46	7h 40,8	−14 46
Praesepe	8 38,5	+20 25

Name	R.A.	Dec
M67	8 49,8	+11 55
NGC 3532	11 05,3	−58 32
Jewel box	12 52,2	−60 13
NGC 6025	16 01,5	−60 25
M4	16 22,1	−26 27

Name	R.A.	Dec.
M19	17 01,0	−26 13
M6	17 38,4	−32 11
M7	17 52,2	−34 45
M23	17 55,4	−19 04
M11	18 49,8	− 6 18

SOME GLOBULAR CLUSTERS

Contain of the order of 100 000 stars. Far more distant than open clusters listed above. Appear fuzzy in a small telescope (individual stars cannot be resolved).

Name	R.A.	Dec.	Mag.
47 Tuc	0h 23m,1	−72° 14	4,5
NGC 362	1 01,6	−70 58	6,0
ω Cen	13 25,2	−47 10	4,2
M5	15 17,9	+ 2 12	6,0
M4	16 22,1	−26 27	6,1
M13	16 40,7	−36 30	5,8

Name	R.A.	Dec.	Mag.
M12	16h 45m,9	1° 55′	6,7
M19	17 01,0	−26 13	6,9
M22	18 34,9	−23 56	5,2
M55	19 38,4	−31 00	6,1
M15	21 28,8	+12 03	6,3
M2	21 32,2	− 0 56	6,3

Globular clusters can generally be seen in the evening only during the winter months as they lie on one side of the sky (towards the centre of the galaxy).

NEBULAE

SOME DIFFUSE NEBULAE

Possibly one third of the matter in our region of the galaxy is in the form of gas (the remainder being contained in stars, plus a tiny amount in planets). Condensations of this gas appear as diffuse nebulae.

Name	R.A.	Dec.
Great Nebula in Orion (includes "trapezium" of stars)	$5^h\ 34^m.1$	$-5^\circ\ 24'$
Great Looped Nebula (in Large Magellanic Cloud)	5 38,1	-69 11
Keyhole Nebula in Carina	10 44,0	59 32
Lagoon Nebula in Sagittarius	18 02,1	-24 23
Omega Nebula in Sagittarius	18 19,4	-16 12

SOME PLANETARY NEBULAE

Spherical shells of matter ejected from stars during nova outbursts sometimes show disks akin to those of planets - hence the name.

Name	R.A.	Dec.	Name	R.A.	Dec.
NGC 2392	$7^h\ 27^m.7$	$+21^\circ\ 00'$	NGC 6572	$18^h\ 11^m.5$	$+6^\circ\ 50'$
NGC 2440	7 40,7	-18 08	Ring Nebula	18 52,7	+33 00
NGC 3242	10 23,7	-18 30	Dumb-bell Nebula	19 58,6	+22 39
NGC 6210	16 43,5	-23 51	NGC 7009	21 22,8	-11 27

Medium size telescopes may be able to detect the Crab Nebula (R.A. $5^h\ 33^m.0$; Dec. $+22^\circ\ 01'$), the famous supernova remnant containing an optical pulsar

GALAXIES

Our own disk-shaped galaxy, believed to contain 100 000 million stars, appears to stretch right around the sky forming the bright band known as the Milky Way (see star maps). Millions of other galaxies do exist but few are bright enough to be seen through a small telescope. However, the two closest, the Magellanic clouds, can be seen with the naked eye in the southern sky.

SOME BRIGHT GALAXIES

Name	R.A.	Dec	Mag.
Great galaxy in Andromeda M31	$0^h\ 41^m.4$	$+41^\circ\ 08'$	3,7
Elliptical companion - M32	0 41,4	+40 44	8,5
Small Magellanic Cloud	0 55	-73	
Spiral galaxy in Triangulum M33	1 32,5	+30 32	5,9
NGC 1068 ("Seviert" galaxy)	2 41,4	0 08	9,1
Large Magellanic Cloud	5 25	69	
Spiral galaxy (seen flat on) M83	13 36,6	29 45	7,5
Giant elliptical galaxy in Virgo M87	12 21,5	+12 31	9,3
Spiral galaxy - M101	14 02,3	+54 29	8,1

OCCULTATIONS

This section is intended for use by advanced amateur and professional astronomers — it will undoubtedly appear complicated to persons without detailed knowledge.

An occultation occurs when the disk of the Moon moves in front of a star. Predictions of occultations of all stars brighter than magnitude 7,5, supplied by H. M. Nautical Almanac Office, are given below. The main set of tables gives predictions for three stations, namely,

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

This does not restrict its use to observers at those centres. 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, in minutes of time, are given in the tables. Alternatively, rough times for intermediate stations can usually be estimated direct from the tables.

Occulted stars have been identified by their Z.C. numbers, that is their numbers in the "Catalogue of 3539 Zodiacal Stars for the Equinox 1950.0" by James Robertson (U.S. Naval Observatory, 1939). An index is also provided on page 39.

Timings of occultations, to a precision of one-tenth of a second if possible, are very valuable for studies of the Moon's shape and motion. Since only very modest equipment is required, amateurs can make important contributions in this field. Persons interested in making and reporting occultation observations are urged to contact the Director of the Society's Occultation Section, Mr A.G.F. Morrisby (c/o Dept. of Surveyor General, P.O. Box 8099, Causeway, Salisbury, Rhodesia).

Explanations of Abbreviations used in Tables

Z.C. - *the number of the star in the Zodiacal Catalogue. An "m" following the number indicates the star is not single*
Sp - *the spectral classification of the star*
Mag - *the visual magnitude*
Ph - *the Phase: D - Disappearance, R - Reappearance*
h.m. - *the time of the occultation is SAST*
a,b - *parameters in minutes for predicting times other than at standard stations (explained above in text)*
P.A. - *the Position Angle on the Moon's limb measured eastward from the north point*
N - *no occultation*
S - *sunlight interferes*
A - *moon at very low altitude*
G - *grazing occultation*

OCCULTATIONS - 1973

Date	Z.C.	Mag	Sp	Ph	Cape Town h.	m.	a	b	P.A.	Johannesburg h.	m.	a	b	P.A.	Salisbury h.	m.	a	b	P.A.
Jan. 8	3287m	5,8	A0	D	21	04,3	-0,2	+1,8	59			A					A		
12	263	6,5	F0	D	22	35,7	-1,2	+1,5	70	22	59,2	-1,0	+1,9	50			A		
14	536	5,4	B5	D			N					N			22	40,9	-1,3	-1,8	137
14	538	5,6	B8	D	22	11,4	-2,1	+1,3	58	22	46,6	-2,3	+2,8	35			N		
14	539	4,4	B5	D	22	29,7			153	22	36,5	-1,7	-0,4	120	22	41,6	-1,8	+0,3	95
14	541	4,0	B5	D			N					G			23	06,8	-1,3	-0,6	120
14	542	5,8	B8	D	22	39,2	-1,8	-0,5	128	22	55,1	-1,6	+0,3	103	23	05,0	-1,8	+0,9	79
14	543	6,5	B9	D	22	48,7	-1,7	-1,0	138	23	00,9	-1,5	+0,1	110	23	09,0	-1,7	+0,7	85
14	546	7,0	A0	D			N					N			23	46,5			161
14	546	6,7	B9	D	23	27,0			152	23	31,7	-1,1	0,0	115	23	38,0	-1,3	+0,6	89
14	555	6,8	K5	D	23	55,4	-1,9	+2,4	40			N					N		
15	563	6,8	B9	D			N					N			0	08,7	+0,1	-2,2	147
15	557	6,6	A0	D			N					N			0	28,3	-0,2	0,8	129
15	717	7,5	A0	D			S			20	06,5	-2,5	-0,6	99	20	11,8	-2,6	+0,2	81
16	900	4,9	B2	D	22	48,0	-2,2	0,0	87	23	15,9	-2,8	+1,3	63			N		
23	1688m	6,3	K0	R	2	26,2	-2,1	-1,2	281	2	32,1	-1,6	-2,1	316	2	14,5	-0,8	-3,2	344
26	2011	6,5	K0	R	4	15,5	-1,4	-1,9	299	1	07,2	-0,7	-3,4	339			N		
28	2227	5,8	K0	R			A			1	35,2	-0,3	-0,7	262	1	28,2	0,0	-1,1	288
28	2235	6,2	A0	R	2	26,9	-0,4	-0,8	257	2	21,4	-0,2	-1,4	290	2	07,6	+0,2	-2,0	316
Feb. 7	70	6,8	G5	D			S					S			19	41,6	-0,8	+4,2	5
12	842	6,3	F5	D	23	42,3	-1,2	+0,4	109	24	00,7	-1,4	+1,4	74			N		
13	1015	6,4	A2	D	22	19,0	-1,8	-0,7	127	22	35,5	-2,2	+0,2	98	22	48,7	-3,0	+1,4	68
13	1019m	6,7	A5	D	23	00,3	-1,1	-1,2	147	23	08,9	-1,6	-0,1	113	23	16,6	-2,3	+0,7	84
13	1023	6,5	F5	D	23	23,5	-1,9	0,4	97	23	54,0	-2,9	+2,6	55			N		
21	1845m	6,5	K0	R	0	31,7	-0,8	2,1	313	0	17,1	-0,1	3,4	349			N		
22	1970	6,2	A0	R	4	48,1	1,0	-3,6	344			N					N		
22	1967	5,7	G0	R			N			5	02,5	-3,0	+0,7	267			S		
25	2328m	6,4	B8	R			N			2	49,8	-1,9	-0,5	260	2	46,6	-1,4	-1,5	291
27	2607	5,9	0ea	R	5	16,7	-0,6	-4,3	325			N					N		
28	2747m	5,0	G5	R	4	10,6	-0,1	-2,3	301			N					N		
28	2749	5,0	K0	R	4	32,6	+0,2	-3,8	321			N					N		
Mar. 13	1110m	3,5	F0	D			N					N			22	37,8	0,0	-2,4	162
13	1110m	3,5	F0	R			N					N			23	27,3	-1,9	+1,6	250
14	1245m	7,5	K0	D			N			20	56,4	-1,3	-2,3	156	20	46,3	-2,2	-1,4	128
15	1259	5,9	F0	D	1	03,6	-2,5	-3,3	57			N					N		
22	2039	5,6	B9	R	4	44,7	-2,0	-0,9	302	4	47,9	-1,8	-3,7	341			N		
24	2398	6,1	A5	R	23	24,0	-0,4	-0,4	245	23	20,6	-0,2	-1,2	280	23	08,8	+0,2	-1,7	308
Apr. 6	552	3,0	B5p	D			S					S			19	07,9	1,6	+1,2	69
6	552	3,0	B5p	R	18	40,8	-1,7	+2,0	230	19	05,9	-1,0	-1,1	261	19	12,9	-0,5	0,0	289
6	557	6,6	A0	D			S			18	38,2	-1,8	-2,5	42			N		
6	559	6,6	F0	D			N					N			18	55,0	-0,4	-0,7	125
6	560m	3,8	B8	D	18	43,1	-0,5	-1,2	146	18	47,9	-0,8	+0,3	109	18	55,2	1,0	+0,8	82
6	561	5,2	B8p	D			S			18	46,6	-1,0	+0,8	92	18	58,9	-1,3	+1,4	64
6	562	6,6	B9	D			S			19	07,6	-2,0	+3,3	32			N		
6	567m	6,8	B9	D			N					N			19	23,6	-0,1	-0,7	128
7	733m	7,2	A0	D			N			19	01,4	-0,9	-0,5	129	19	03,5	-1,3	+0,2	100
9	1078	5,9	A0	D	22	02,2	+0,3	-1,7	163	21	59,2	-0,5	-0,1	119	22	04,0	-1,0	+0,7	87
10	1205	6,3	K0	D	19	42,8	-2,1	-0,5	112	20	08,0	-3,2	+1,2	75			N		
10	1217	6,1	A0	D			N			23	07,2	-0,7	-2,5	171	22	55,2	-0,3	-0,8	132
11	1336	5,2	A3	D	20	37,0	-2,4	-0,1	97			N					N		
13	1458	5,9	K0	D	1	52,8	-0,6	+0,5	108			A					N		
14	1564m	6,6	F5	D	0	46,2	0,0	-3,0	176	0	39,8	-1,0	-0,8	131	0	41,1	-1,5	+0,3	98
14	1662	6,3	K0	D			N			23	11,5	-0,3	-3,6	175	22	52,8	-1,7	-2,0	140
20	2227	5,8	K0	R			N			3	29,8			230	3	33,4	-2,5	+0,8	265
20	2235	6,2	A0	R			N			4	41,8	-1,6	+2,5	240	4	59,1	-1,7	+0,7	270
20	2347	4,6	A3	R			N					N			20	58,0	-1,3	+1,1	231
21	2490m	5,4	K0	R	23	35,3	+0,2	-3,1	321			N					N		
22	2500	3,4	B3	D			N					G			1	11,6	2,0	-2,1	120
22	2500	3,4	B3	R			N					G			2	46,0	-3,4	+1,1	250
23	2630m	5,1	K0	R	0	35,6	-0,5	-2,1	295			N					N		
24	2779m	3,9	G0	D	0	41,8	-1,6	+2,1	27			N					N		
24	2779m	3,9	G0	R	1	17,7	+0,2	-4,6	325			N					N		

OCCULTATIONS - 1973

Date		Z.C.	Mag	Sp	Ph	Cape Town h.	m.	a	b	P.A.	Johannesburg h.	m.	a	b	P.A.	Salisbury h.	m.	a	b	P.A.
May	7	1171	6,3	A0	D	20	28,9	-0,8	-0,2	128	20	40,6	-1,1	+0,9	88			N		
	9	1409	5,1	G5	D			N			18	49,8	-0,8	-2,6	163	18	36,5	-1,9	-1,7	134
	10	1519	6,5	F2	D			N			19	47,9	-0,5	-3,1	171	19	31,1	-1,8	-1,9	139
	11	1623	5,4	A0	D	21	24,0	-0,4	-3,1	173	21	19,5	-1,8	-1,3	129	21	20,5	-2,9	0,0	97
	12	1726	6,9	F5	D	18	27,2			191	18	04,6	-0,9	-2,5	148			S		
	13	1743	6,8	M0	D	0	31,4	-1,7	+1,2	89			N					N		
	14	1862	6,0	A0	D			N					N			2	36,5	-0,8	-2,9	162
	20	2602	5,5	A5	R			N					N			5	35,2	+0,7	+4,6	194
	20	2725m	5,8	K2	R	23	28,6	-0,3	-3,3	314			N					N		
	29	221m	3,7	G5	D	5	36,1	-0,3	+0,1	51	5	43,8	-0,5	+0,9	40			S		
	29	221m	3,7	G5	R	6	39,4	-1,0	-0,3	249			S					S		
June	8	1705	7,5	F2	D	19	36,2	-2,2	-0,8	111			G					N		
	9	1800	5,4	A0	D			N			20	46,7			179	20	24,6	-1,9	-2,2	140
	10	1918	7,0	K2	D			N					N			21	43,2			186
	11	2039	5,6	B9	D	23	48,3	-2,1	+0,8	92	24	21,4	-1,5	+3,3	56			N		
	12	2045	6,4	G5	D	1	23,1	-1,6	-2,5	156	1	26,2	-1,2	-0,6	127	1	28,6	-0,9	+0,3	98
	12	2051	5,7	A0p	D			G			2	26,3	-0,9	-1,3	143	2	23,1	-0,5	-0,2	113
	20	3187	6,2	M0	R	22	59,5	-0,4	+1,1	211	23	08,4	-0,7	+0,1	244	23	07,2	-0,8	-1,0	276
	24	31	6,2	G5	R	5	18,8	-3,2	-1,6	287	5	41,3			289			N		
	25	160	6,2	G5	R	4	15,1	-0,6	+0,5	224	4	27,7	-1,2	+0,7	232	4	36,4	-1,9	+0,3	251
	26	302	6,4	K5	R	5	44,6	-1,8	-1,3	279	5	56,2	-2,7	-1,3	283			N		
July	4	1564m	6,6	F5	D	20	46,0			50			N					N		
	5	1662	6,3	K0	D			S			17	55,0	-3,1	+0,8	85			N		
	8	1993	6,8	K0	D			N					N			19	48,2			182
	9	2011	6,5	K0	D	0	36,5	-0,7	-0,4	111	0	45,6	-0,1	+0,8	92			A		
	10	2227	5,8	K0	D			N			21	14,6			153	21	01,9	-3,1	-1,3	115
	10	2235	6,2	A0	D			N			22	15,2	-2,7	-2,2	135	22	14,3	-2,8	-0,2	102
	11	2249	6,9	K0	D	2	06,2			28			N					N		
	12	2500	3,4	B3	D			N					N			20	41,6			151
	12	2500	3,4	B3	R			N					N			21	36,4			212
	13	2630m	5,1	K0	D	18	31,0	-0,3	-1,6	105	18	30,5	-1,2	-0,1	68			G		
	19	3287m	5,8	A0	R	1	29,9	-2,2	-0,4	262	1	52,8	-3,2	-0,4	270			G		
	25	537	3,8	B5p	D	6	00,7	-0,5	-1,1	29	6	19,6	-0,0	+2,2	23			N		
	25	537	3,8	B5p	R	6	57,8	-2,6	-1,4	294			S					N		
	25	545	4,2	B5	D	6	28,9	-1,9	-0,6	88			S					S		
	25	552	3,0	B5p	D	7	10,8	-1,9	0,0	73			S					S		
Aug.	4	1958	7,5	G5	D	19	38,8	-2,3	+1,6	78			N					N		
	4	1970	6,2	A0	D	23	25,3	-0,1	+1,0	94			A					A		
	9	2584	6,8	K5	D	19	03,1	-2,1	+0,1	70	19	45,7			24			N		
	9	2589	4,8	A0	D	21	10,9	-2,4	+2,8	44	22	06,6			9			N		
	9	2593	6,7	K0	D			N					G			21	55,9	-3,5	-0,9	109
	10	2736m	6,2	F0	D	20	52,3			11			N					N		
	19	221m	3,7	G5	D	3	48,6	-2,5	-0,2	87	4	15,2	-2,9	+0,3	86	4	29,1	-2,7	+1,0	70
	19	221m	3,7	G5	R	5	03,0	-1,4	-1,9	211	5	34,7	-1,7	+2,3	215			S		
	23	822m	5,9	A0	R	5	18,7	-1,2	-0,4	251	5	31,3	-1,9	0,2	259			S		
	30	1788m	6,7	G0	D			N			18	56,4	-0,6	-1,6	152	18	50,6	-0,6	-0,4	118
Sept.	6	2682	7,0	K0	D			N			18	41,8	-3,1	-2,2	117	18	43,3	-3,3	+0,1	85
	7	2629	6,9	K0	D	19	08,5	2,2	+0,8	60	19	45,1	2,2	+3,1	35			G		
	16	311	6,5	A3	R	2	18,1	-1,3	+1,1	220	2	43,9	1,8	+1,6	222	3	03,0	-2,4	+1,4	238
	16	440m	4,6	A2	R			A			23	05,1	-2,2	-3,7	310			N		
	18	598m	5,7	F5	R	1	46,9	-1,4	-1,1	275	1	57,0	-2,1	-1,1	281	1	51,1	-3,3	-2,6	305
	20	936	5,9	K0	R			A			3	04,6	-2,1	-2,4	313			N		
	21	1110m	3,5	F0	D	6	01,0	-1,9	+0,8	18			N					N		
	29	2099	7,0	K0	D	19	43,0	-0,1	-3,0	51			N					N		
	30	2226	7,0	A0	D	20	54,1	-0,4	+1,0	95			A					A		
Oct.	1	2357m	6,6	B3	D			S			18	41,2			28			N		
	1	2359m	4,8	B5	D			S			18	51,9			23			N		
	2	2490m	5,4	K0	D			N					S			18	08,6	-3,0	-0,2	101
	2	2491	6,7	G5	D			S					S			18	23,1	-1,9	+2,6	52
	2	2507	6,7	K0	D	21	30,8	-1,0	+1,0	96	21	45,5	-0,5	+1,0	88	21	55,5	0,0	+1,2	68
	4	2778m	6,9	G0	D	19	37,0			138	19	55,4			118	20	02,2	-2,8	+0,4	92

OCCULTATIONS – 1973

Date	Z.C.	Mag	Sp	Ph	Cape Town h.	m.	a	b	P.A.	Johannesburg h.	m.	a	b	P.A.	Salisbury h.	m.	a	b	P.A.
4	2797	3,0	F2	D			N			23	36,0			139	23	33,7	-0,6	0,0	109
4	2797	3,0	F2	R			N			23	56,3			178			A		
8	3272	5,8	G5	D	19	23,8			349			N					N		
15	556	5,5	B8	R	2	35,3	-1,9	+0,7	238	3	02,8	-2,4	+0,9	248	3	15,9	-2,7	+0,3	268
15	564	6,1	B8	R	3	30,5	-2,4	-0,2	284	3	50,4	-2,3	-0,7	301			N		
17	898	6,0	B3	R	3	27,1	-1,7	+1,0	224	3	55,2	-2,6	+0,8	244	4	07,4	-2,9	+0,1	287
Nov. 2	2995	6,2	G0	D	23	47,4	-0,1	+1,7	64			A					A		
4	3229	5,6	G5	D	23	03,5	-1,4	+1,5	78	23	25,6	-0,8	+1,4	74	23	40,2	-0,5	+1,6	57
7	42	5,6	K0	D			S					S			18	27,6	+0,3	+3,6	0
17	1409	5,1	G5	R	2	01,3	-0,8	-2,3	322	1	49,3	-1,0	-3,3	344			N		
18	1519	6,5	F2	R			A			2	07,6	-0,7	-1,2	282	1	58,0	-0,7	-1,6	303
19	1623	5,4	A0	R			N			2	35,8	-0,9	+0,7	236	2	37,2	-0,8	-0,6	267
Dec. 2	3309	6,3	K0	D	23	08,1			347			N					N		
3	3417	6,8	F5	D			N					N			21	43,9	-2,3	-0,5	110
6	266	5,7	A0	D	21	51,1	-1,1	+2,2	21	22	23,8	-1,3	+3,4	14			N		
6	267	7,3	G0	D	22	08,5	-0,7	+3,0	8			G					N		
7	389m	5,7	A0	D			S					S			19	06,1	-2,0	-0,4	88
8	556	5,5	B8	D	20	56,4	-1,2	-0,2	67	21	11,4	-1,7	+0,4	62	21	24,3	-1,7	+1,6	42
12	1236m	5,1	G0	R			G			23	51,0	-1,6	+0,4	239	23	56,2	-1,9	-0,4	265
13	1241m	6,4	F0	R	0	53,5	-1,6	-0,7	262	1	05,6	-2,1	-0,9	282	1	01,7	-2,1	-1,6	305
30	3376	6,4	K0	D	21	07,8	-0,6	+2,4	37	21	31,2	-0,3	+2,6	25			A		

INDEX OF OCCULTED STARS

Z.C.		Z.C.		Z.C.		Z.C.		Z.C.	
31	36 Psc	559	26 Taur	1323	54 Canc	2226	-21°4152	2709	-23° 14580
42	41 Psc	560	27 Taur	1336	62 Canc	2227	169B Lib	2725	28 Sgtr
70	91 Psc	561	28 Taur	1409	ξ Leo	2235	177B Lib	2736	30 Sgtr
160	75 Psc	562	+23° 561	1456	83B Leo	2249	-22° 4020	2747	32 Sgtr
221	η Psc	564	+23° 563	1519	155B (Leo)	2262	-22° 4034	2749	35 Sgtr
263	+16° 196	567	+23° 569	1564	34 Sext	2270	32B Scor	2754	154B Sgtr
266	4 Arie	596	36 Taur	1623	69 Leo	2283	-23° 12597	2778	-21° 5233
267	+16° 204	717	+25° 731	1662	388B Leo	2314	27G Scor	2779	σ Sgtr
302	35B Arie	733	+25° 746	1688	431B (Leo)	2328	41G Scor	2787	π Sgtr
311	47B Arie	740	315B Taur	1705	-2° 3411	2336	90B Scor	2829	-20° 5516
370	26 Arie	822	118 Taur	1723	20B Virg	2347	19 Scor	2902	57 Sgtr
387	+18° 389	842	+25° 879	1726	24B Virg	2357	-23° 12860	2986	31B Capr
389	μ Arie	852	125 Taur	1727	19G Virg	2359	ρ Ophi	2995	27G Capr
438	134B Arie	882	132 Taur	1713	44B Virg	2398	126B Scor	3019	61B Capr
440	ε Arie	898	412B Taur	1788	163B Virg	2417	18 Ophi	3029	-16° 5690
483	+23° 442	900	139 Taur	1800	21 Virg	2459	-21° 13119	3072	9 Aquar
536	16 Taur	936	5 Gem	1845	343B Virg	2490	39 Ophi	3163	-10° 5714
537	17 Taur	954	8 Gem	1852	370B Virg	2491	157B Ophi	3187	47 Capr
538	18 Taur	1015	52B Gem	1858	-11° 3398	2499	125G Ophi	3228	30 Aquar
539	19 Taur	1019	+24° 1332	1918	496B Virg	2500	θ Ophi	3272	44 Aquar
541	20 Taur	1023	+24° 1343	1958	-14° 3767	2507	-23° 13366	3287	51 Aquar
542	21 Taur	1078	44 Gem	1967	83 Virg	2517	44 Ophi	3309	187B Aquar
543	22 Taur	1102	55H Gem	1970	85 Virg	2584	-23° 13676	3340	-3° 5505
545	23 Taur	1110	δ Cam	1993	-16° 3760	2589	4 Sgtr	3376	3 Psc
546	+23° 523	1171	79 Gem	2011	-16° 3795	2593	5 Sgtr	3397	-1° 4393
548	-24° 562	1205	217B (Gem)	2039	43H Virg	2598	-24° 13787	3417	+0° 4982
552	η Taur	1217	10H Canc	2045	231G Virg	2602	7 Sgtr	3452	+1° 4724
553	+23° 540	1236	ς Gem	2051	236G Virg	2603	9 Sgtr	3464	+1° 4731
555	+24° 571	1241	+18° 1882	2095	-19° 3939	2630	1 Sgtr		
556	104B Taur	1245	-19° 1963	2099	-18° 3862	2682	-23° 14431		
557	105B Taur	1259	20 Canc	2157	47G Virg	2692	24 Sgtr		

GRAZING OCCULTATIONS

Like the previous section, the material presented here will appear complicated to persons without detailed knowledge.

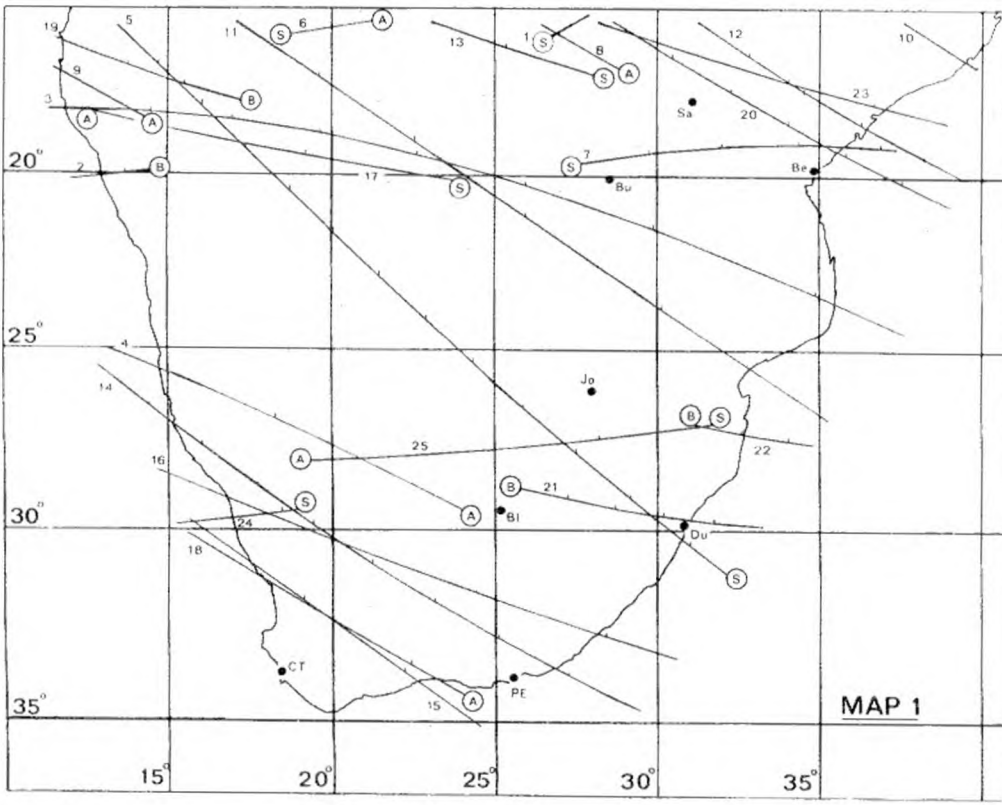
The maps show the tracks of stars brighter than 7.5 magnitude which will graze the limb of the Moon when it is at a favourable elongation from the Sun and at least 10^{o} above the observer's horizon. (2^{o} in the case of bright stars). Each track starts in the West at some arbitrary time given in the 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.

Observers positioned on, or very near, one of these tracks will probably see the star disappear and reappear several times at the edge of features on the limb of the Moon. The recorded times of these events (to a precision of a second, if possible) are very valuable in the study of the shape and motion of the Moon currently being investigated at the Royal Greewich Observatory and the U.S. Naval Observatory. The Society Coordinator for Grazing Occultations is Mr. M.D. Overbeek, 60 Edward Drive, Glendower, Edenvale, Transvaal.

*NOTES ON DOUBLE STARS

7	ZC	483	is the brighter component of the double star Aitken 2473. The companion is 9th magnitude; separation 2".5 in p. a. 316°.
9	ZC	852	is a spectroscopic binary
15	ZC	2328	is the brighter component of the double star Aitken 9967. The companion is 10th magnitude; separation 1".3 in p. a. 230°.
28	ZC	553	is a spectroscopic binary
35	ZC	2500	is a spectroscopic binary
41	ZC	221	is the brighter component of the double star Aitken 1199. The companion is 8th magnitude; separation 1" in p. a. 36°.
49	ZC	438	is the mean of the components of the double star Aitken 2253. The components are 7, 5 and 7, 6 magnitude; separation 0".4 in p. a. 257°.
51	ZC	1564	is the mean of the components of the double star Aitken 7898. The components are 8th and 9th magnitude; separation 0".4 in p. a. 197°.
57	ZC	537	is a spectroscopic binary
72	ZC	440	is the mean of the components of the double star Aitken 2257. The components are both 5th magnitude; separation 1".5 in p. a. 207°.
76	ZC	2490	is the following component of the double star Aitken 10442. The companion is 7, 0 magnitude; separation 10" in p. a. 355°.
81	ZC	2778	is the mean of the components of the double star Aitken 11989. The components are both 8th magnitude; separation 1".0 in p. a. 200°.

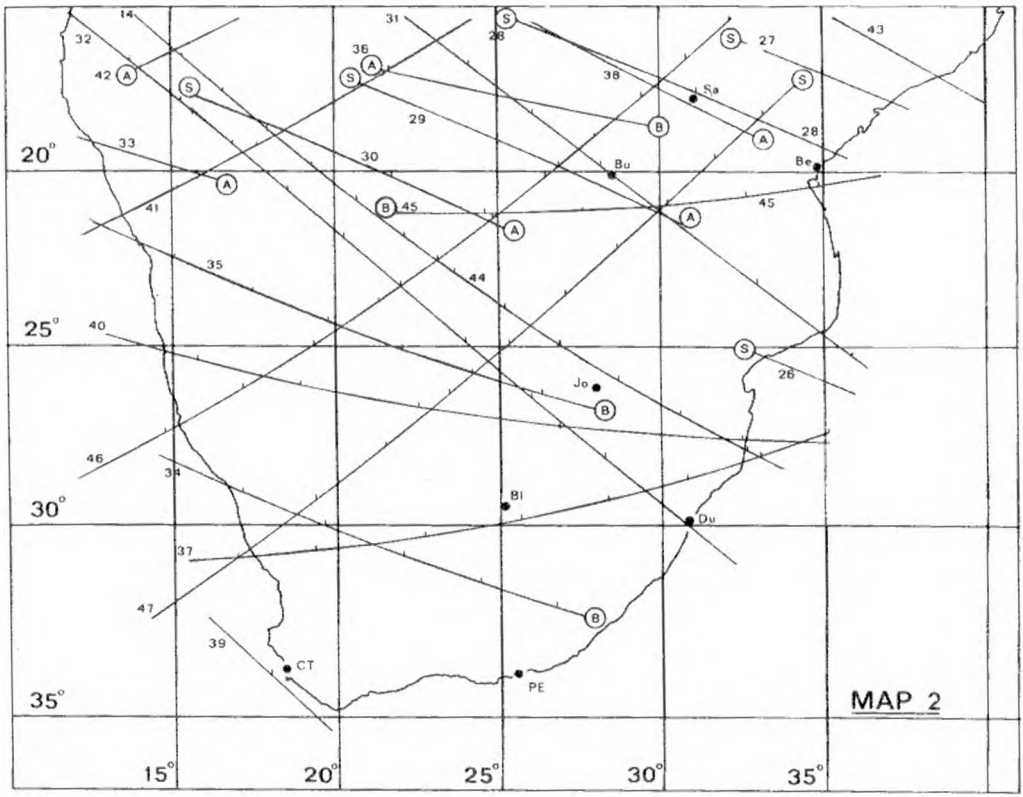
JANUARY 9 TO APRIL 1



No.	Z.C.	Mag	Date	Beginning	Sunlit	Limit
				h m		
1	3397	7.4	Jan 9	19 14	24%	S
2	536	5.4	Jan 14	22 16	79%	S
3	538	5.6	Jan 14	22 46	79%	N
4	555	6.6	Jan 15	0 21	79%	N
5	1788	6.7	Jan 24	3 37	70%	S
6	70	6.8	Feb 7	19 49	21%	N
7	483*	7.5	Feb 10	19 16	52%	N
8	842	6.3	Feb 13	0 30	76%	N
9	852*	5.0	Feb 13	1 46	77%	N
10	1015	6.4	Feb 13	23 26	85%	N
11	1023	6.5	Feb 13	23 56	85%	N
12	1852	6.0	Feb 21	3 24	85%	S
13	1852	6.5	Feb 21	5 29	84%	S

No.	Z.C.	Mag	Date	Beginning	Sunlit	Limit
				h m		
14	1967	5.7	Feb 22	3 50	77%	S
15	2328*	6.4	Feb 25	2 13	49%	S
16	2754	5.9	Feb 28	4 30	22%	S
17	3019	5.9	Mar 2	5 47	8%	N
18	1259	5.9	Mar 15	1 17	83%	N
19	2157	6.1	Mar 23	4 23	82%	S
20	2270	5.4	Mar 24	1 37	75%	S
21	2283	6.7	Mar 24	4 06	75%	N
22	2417	7.0	Mar 25	3 50	66%	N
23	2692	5.7	Mar 27	2 46	47%	S
24	2709	6.8	Mar 27	6 16	46%	N
25	3340	7.5	Apr 1	5 30	6%	N

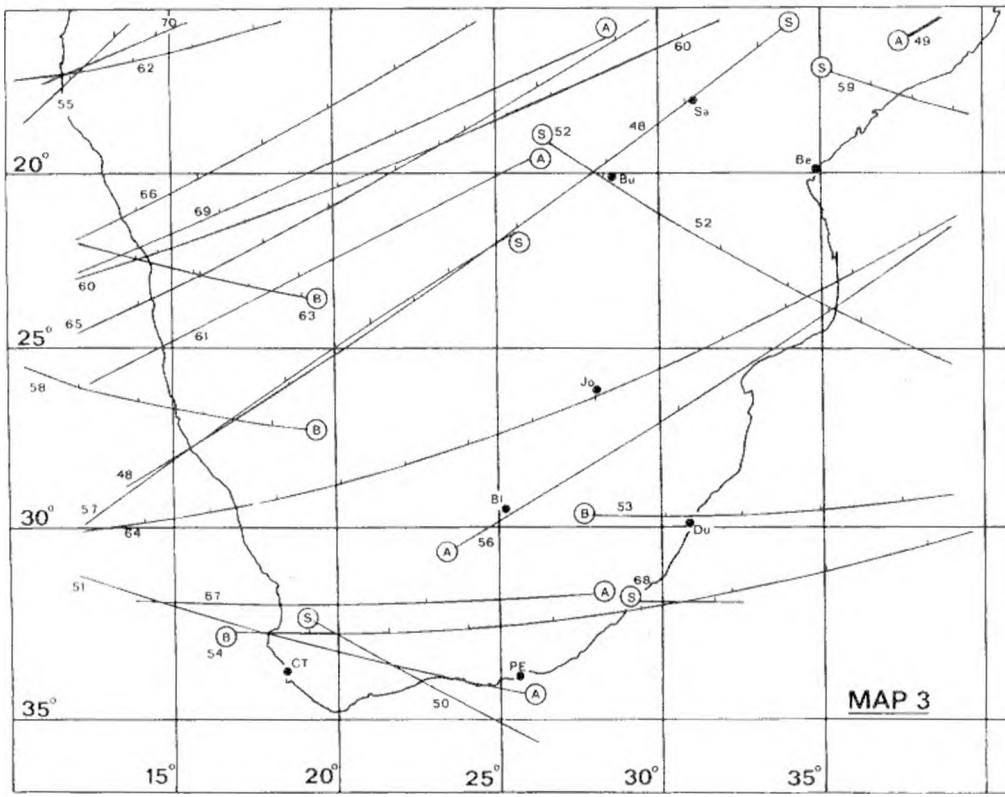
APRIL 6 TO JUNE 24



No.	Z.C.	Mag	Date	Beginning	Sunlit	Limit
26	541	4,0	Apr 6	17h 51m	14%	N
27	546	7,0	Apr 6	18 14	14%	N
28	553*	6,8	Apr 6	18 37	15%	N
29	557	6,6	Apr 6	19 00	15%	N
30	562	6,6	Apr 6	19 19	15%	N
31	1205	6,3	Apr 10	20 18	58%	N
32	1336	5,2	Apr 11	20 41	69%	N
33	1458	5,9	Apr 13	2 18	80%	N
34	2499	6,6	Apr 22	1 18	81%	S
35	2500*	3,4	Apr 22	1 22	81%	S
36	3029	6,9	Apr 26	1 31	45%	S

No.	Z.C.	Mag	Date	Beginning	Sunlit	Limit
37	3163	7,3	Apr 27	4h 10m	35%	N
38	1171	6,3	May 7	21 05	32%	N
39	1727	7,1	May 12	18 36	83%	N
40	1743	6,8	May 13	0 53	84%	N
41	221*	3,7	May 29	6 04	12%	N
42	370	6,1	May 30	6 22	5%	N
43	1102	7,4	Jun 3	18 02	9%	N
44	1705	7,5	Jun 8	19 37	60%	N
45	3072	6,6	Jun 19	23 32	85%	N
46	3452	6,8	Jun 23	3 43	57%	N
47	31	6,2	Jun 24	4 50	46%	N

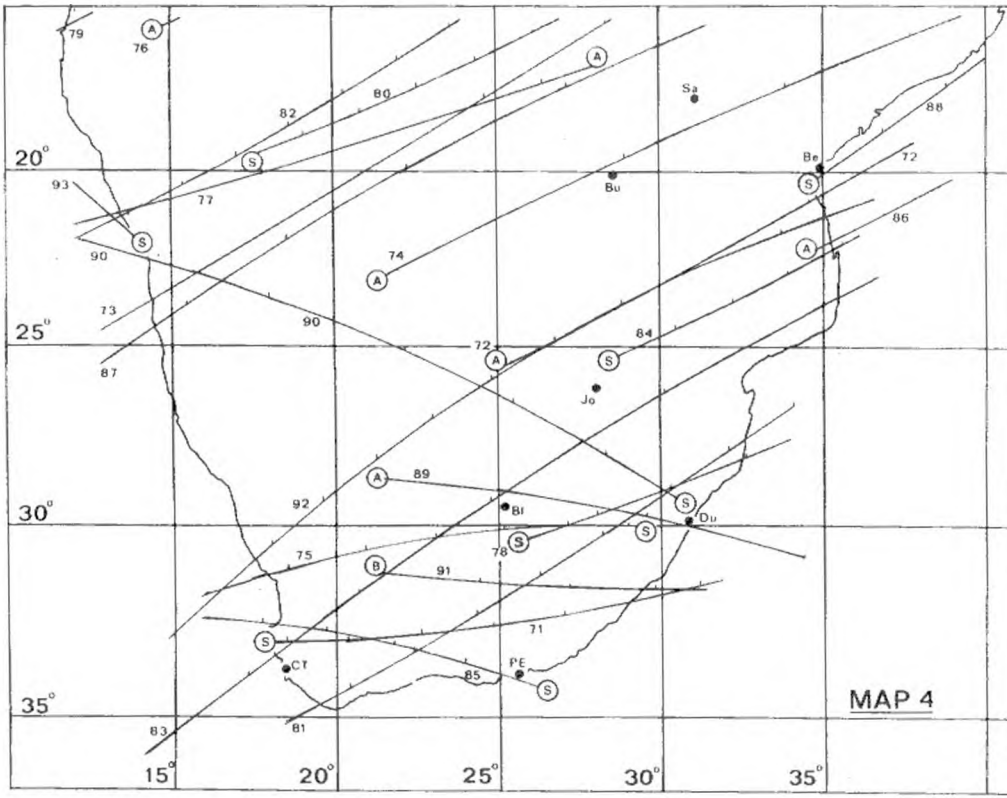
JUNE 26 TO SEPTEMBER 4



No.	Z.C.	Mag	Date	Beginning	Sunlit	Limit
				h m		
48	302	6,4	Jun 26	5 13	25%	N
49	438*	6,7	Jun 27	3 24	16%	N
50	1323	6,3	Jul 2	18 19	7%	N
51	1564	6,6	Jul 4	20 51	23%	N
52	1662	6,3	Jul 5	18 14	32%	N
53	2227	5,8	Jul 10	21 46	81%	S
54	2235	6,2	Jul 10	22 27	81%	S
55	3417	6,8	Jul 20	5 12	81%	N
56	387	6,9	Jul 24	2 51	40%	N
57	537*	3,8	Jul 25	6 19	28%	N
58	1958	7,5	Aug 4	19 51	37%	N
59	2314	5,8	Aug 7	17 50	66%	N

No.	Z.C.	Mag	Date	Beginning	Sunlit	Limit
				h m		
60	2336	6,6	Aug 7	23 00	67%	S
61	2347	4,8	Aug 8	1 25	68%	S
62	2459	7,2	Aug 8	22 00	76%	S
63	2584	6,8	Aug 9	18 20	83%	N
64	2593	6,7	Aug 9	21 39	83%	S
65	2598	6,9	Aug 9	23 29	83%	S
66	2602	5,5	Aug 9	23 39	84%	S
67	1788	6,7	Aug 30	19 12	7%	S
68	2262	7,4	Sep 3	18 13	39%	S
69	2283	6,7	Sep 3	22 26	41%	S
70	2417	7,0	Sep 4	21 59	50%	S

SEPTEMBER 6 TO DECEMBER 17



No.	Z.C.	Mag	Date	Beginning	Sunlit	Limit
71	2682	7,0	Sep 6	$18^h\ 56^m$	68%	S
72	440*	4,6	Sep 16	22 50	80%	N
73	598	5,7	Sep 18	1 10	70%	N
74	936	5,9	Sep 20	2 31	47%	N
75	954	6,1	Sep 20	4 58	46%	S
76	1102	7,4	Sep 21	3 41	35%	N
77	2095	7,2	Sep 28	19 39	9%	S
78	2490*	5,4	Oct 2	18 30	32%	S
79	2513	4,3	Oct 2	23 22	33%	S
80	2630	5,1	Oct 3	19 00	41%	S
81	2778	6,9	Oct 4	19 52	51%	S
82	2779	3,9	Oct 4	19 53	51%	S

No.	Z.C.	Mag	Date	Beginning	Sunlit	Limit
83	2797	3,0	Oct 4	$23^h\ 26^m$	52%	S
84	2902	6,0	Oct 5	18 31	60%	S
85	740	6,3	Oct 16	4 35	82%	S
86	882	5,0	Oct 16	23 15	74%	N
87	2986	6,4	Nov 2	22 43	44%	S
88	3464	7,1	Nov 6	18 18	81%	S
89	1623	5,4	Nov 19	2 22	32%	S
90	1743	6,8	Nov 20	4 00	22%	S
91	2797	3,0	Nov 28	12 24	11%	S
92	3417	6,8	Nov 3	21 14	57%	S
93	1723	7,1	Dec 17	5 43	46%	S

ASSA OFFICE BEARERS

COUNCIL

President: Mr. K. J. Sterling
Vice-Presidents: Mr. G. A. Harding, Prof. A. H. Jarrett and Dr. P.A.T. Wild
Members of Council: Mr. M. D. Overbeek, Mr. C. Papadopoulos and Dr. A. D. Thackeray
Hon. Secretary: Mr. T. W. Russo
Hon. Treasurer: Mr. G. Orpen

NATAL CENTRE

Chairman: Mr. S. S. Booysen (also Council Representative)
Hon. Secretary/Treasurer: Mrs. J. Donaldson
Committee Members: Messrs. J. Barker, G.D.E. Davidson, R.S. Garside, A. Gray, E.G. Hobson, E. Malan, Dr. J.S. Mattelaer and Miss I. Schumann, Librarian.

TRANSVAAL CENTRE

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Secretary: Mr. G. J. Sizoo
Treasurer: Mr. C. Papadopoulos
Council Representative: Mr. D. Overbeek

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Vice-Chairman: Mr. J. C. Bennett (also Treasurer)
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Council Representative: Mr. J. C. Bennett
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Curator of Instruments: Mr. R. Matthews

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Vice-Chairman: Mr. R. F. Hurly
Hon.Secretary: Mr. H. B. Molyneux
Hon. Treasurer: Mr. N. Saville
Hon. Auditor: Mr. G. Orpen
Committee Members: Messrs. R.P. de Kock, C. H. Larmuth, G.H. Larmuth, K. Rochford and C.R.G. Turk
Council Representative: Mr. J. S. Bondietti

PAST PRESIDENTS

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

HONORARY SECRETARIES

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

1965 I W. Russo

HONORARY MEMBERS

Prof. A.E. Bleksley	Dr R.O. Redman
Mr R.P. de Kock	Dr J. Schilt
Dr D.S. Evans	Dr H. Shapley
Prof. Ch. Fehrenbach	Dr R.H. Stoy
Dr W.S. Finsen	Dr W.S. van den Bos
Dr H. Haffner	Dr A.G. Velghe
Dr J.H. Oort	Sir Richard Woolley

GILL MEDALLISTS

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

INFORMATION FOR PROSPECTIVE MEMBERS

(continued from inside front cover)

Centres of the Society

NATAL CENTRE (Durban) - Meetings every 3rd Wednesday evening at 7:45 p.m. at the University City Building, Lancers Road (behind the Alhambra Theatre). Occultation and telescope making sessions. Secretarial Address: 32 Surrey Mansions, 323 Currie Road, Durban, Telephone (evenings) 34-4912.

TRANSVAAL CENTRE (Johannesburg) - Meetings of the Centre are normally held every month at the Republic Observatory, and alternate between lecture meetings and observing meetings.
There is a very enthusiastic Lunar occultation group which observes graze occultations within a radius of approx. 150 miles of Johannesburg. A variable star group is in the process of formation.
Mirror making classes are held at suitable intervals, and the centre has its own Aluminising plant operated by Mr. T. Geary, Curator of Instruments and Director of the Johannesburg Planetarium.

Chairman:	F. de J. Bateman,	Phone 46-2052
Vice-Chairman:	M.D. Overbeek,	Phone 53-5447
Secretary:	G.J. Sizoo,	Phone 46-7392
Treasurer:	C. Papadopoulos	Phone 41-5188

CAPE CENTRE (Cape Town) - Meetings on 2nd Wednesday of the month (except Jan, Feb and December) at the South African Astronomical Observatory Headquarters (previously the Royal Observatory) at 8:00 p.m. The Centre possesses a small observatory housing the twelve inch Ron Atkins Telescope. There is also an active occultation section. Secretarial Address: "Pennington", 34 Balfour Road, Rondebosch. Telephone (evenings) 6-3123. Information on meetings also available from Department of Astronomy, U.C.T. Telephone (day time) 69-8531 ext. 256.

FREE STATE CENTRE - Meetings on 2nd Thursday of the month at homes of members. For further information, contact Mr. G.J. Muller, 35 Wilcocks Road, Bloemfontein. Telephone (evenings) 7-3442 - or Mr. J. Rhodes, Telephone 7-1981 (day time). Associate members should endeavour to have communications in the hands of the secretary a week before the monthly meeting.

PRETORIA CENTRE - For information contact Mr. K.J. Sterling, 5 Hekla Road, Valhalla - Phone 71-3272.

Observing Sections of the Society

COMETS AND METEORS - Mr J.C. Bennett, 90 Malan Street, Riviera, Pretoria.

VARIABLE STARS - Mr R.P. de Kock, The South African Astronomical Observatory,. Observatory, Cape.

OCCULTATIONS - Mr A.G.F. Morrisby, Dept. of Surveyor General, P.O. Box 8099, Causeway, Salisbury, Rhodesia. Coordinator for Grazing Occultations - Mr. M.D. Overbeek, 60 Edward Drive, Edenvale, Tvl.