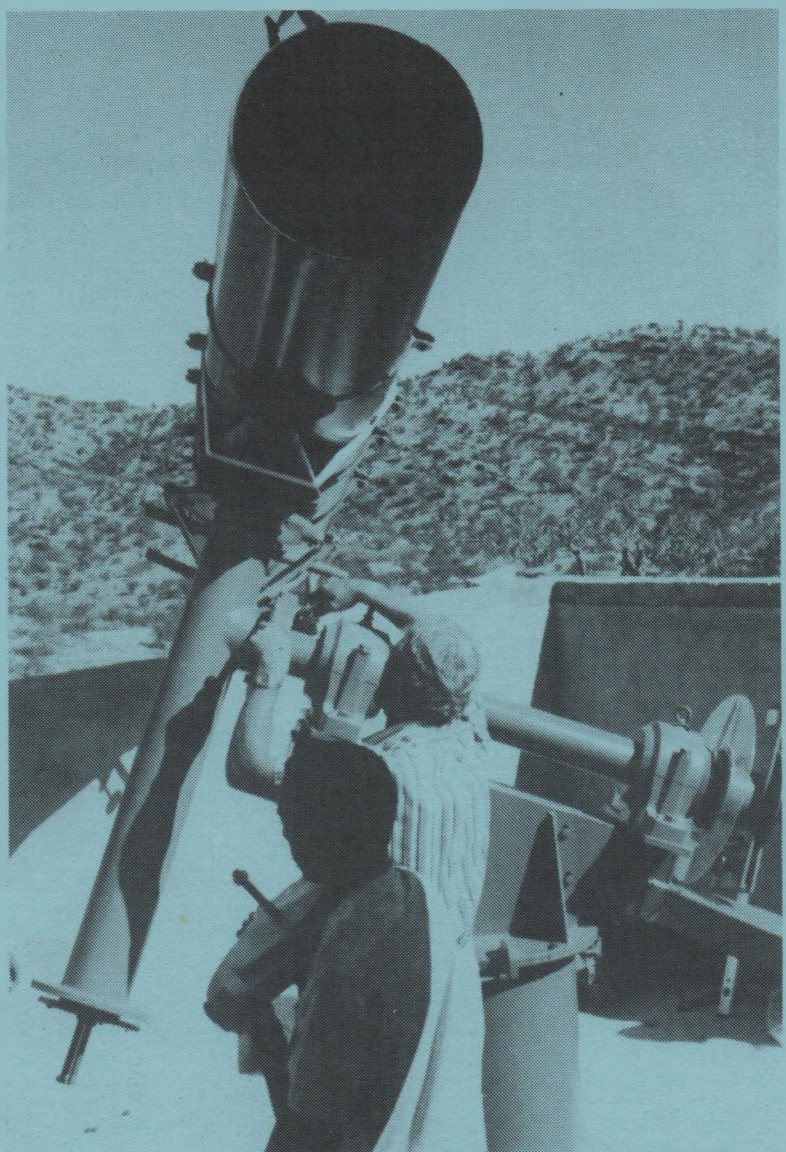
ASTRONOMICAL HANDBOOK FOR SOUTHERN AFRICA

1992



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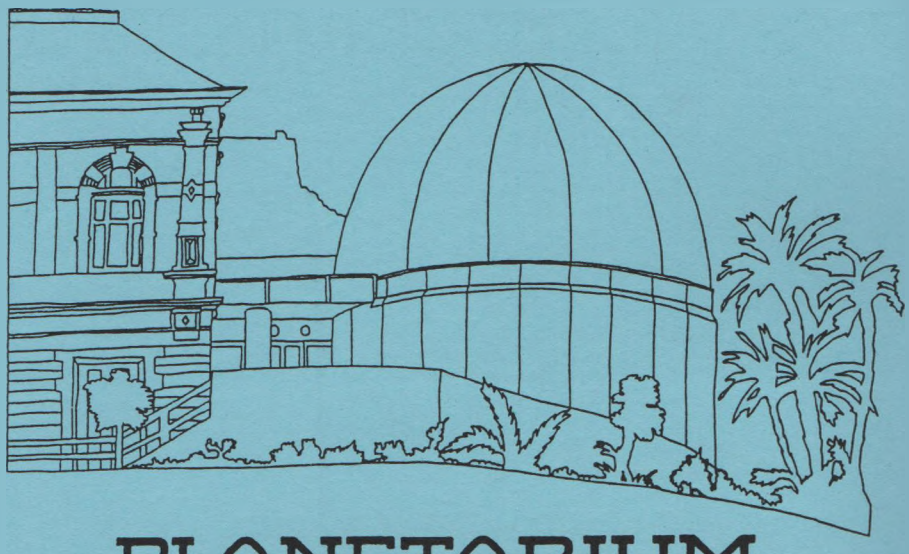

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ASTRONOMICAL HANDBOOK FOR SOUTHERN AFRICA 1992

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

Front cover
The .36m telescope at the Brakwater Agricutural Center outside Windhoek, the observing site of the Astronomical Work Group. Photograph courtesy of Mrs S. Enke.

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NOTE

All times are SAST unless otherwise stated. Right Ascension and Declination are given for equinox of date unless otherwise stated.

This handbook is produced for the Astronomical Society of Southern Africa. The data it contains has been adapted for Southern Africa from data obtained from The Astronomical Almanac for 1992, the Handbook of the British Astronomical Association for 1992 and the International Lunar Occultation Centre,Tokyo. The star charts on pages 32, 34, 36 and 38 are from "A Beginner's Guide to the Southern Stars" by J.S. Bondietti, published by the South African Museum. The Minor Planet Occultations were provided by Edwin Goffin, who wishes to thank Dr. Josef de Kerfo, General Manager of Agfa-Gevaert IVV (Mortsel, Belguim) for making the computing facilities available.

Assistance in the compilation of this booklet was received from the Directors of the observing sections of the ASSA.

Further copies of this booklet are available at R5.00 per copy from The Business Manager, Astronomical Society of Southern Africa, P O Box 9, Observatory, 7935. All other correspondence concerning this booklet should be addressed to the Handbook Editor, Astronomical Society of Southern Africa, 10 Bristol Rd., Observatory, 7925.

P.J.Booth
Editor

ASTRONOMY IN SOUTHERN AFRICA

Southern Africa, enjoying the rich southern skies and a suitable climate, has a number of professional observatories engaged in research while many individuals have become enthusiastic amateur astronomers. Thus South Africa, Namibia and Zimbabwe have numerous private observatories, built and operated by amateur astronomers. Planetaria and visiting nights at observatories convey to the general public much of what goes on in this field.

OBSERVATORIES

The South African Astronomical Observatory (SAAO), part of the Foundation for Research and Developement, has headquarters in Cape Town and an observing station at Sutherland in the Karoo, where there are 1.9-m, 1.0-m, 0.75-m and 0.5-m telescopes. The headquarters in Cape Town also carrys out a limited amount of observing. Research is undertaken in many areas, with considerable effort being put into the study of variable stars, the Galactic Centre, the Magellanic Clouds and sources detected by satellites. These studies involve the use of spectroscopic, photometric and infrared techniques. Besides providing research facilities for its own staff, SAAO observing time is allocated to astronomers from South African universities and elsewhere in the world.

Boyden Observatory, situated at Mazelspoort, 25 km from Bloemfontein, is owned by the Dept of Physics and Astronomy of the University of the Orange Free State. Observing facilities include a 1.52-m and two 0.41-m telescopes, as well as the 0.25-m Metcalf camera, a 0.33-m refractor and a 0.20-m solar installation.

The Hartebeesthoek Radio Astronomy Observatory, 30 km NW of Krugersdorp, is a national facility managed by the Foundation for Research Development. The Director is Dr G D Nicolson. The 26 m telescope operates at 18, 13, 6, 3.6 and 2.5 cm wavelengths and is used for observations of interstellar and circumstellar molecules, pulsars, x-ray sources as well as quasars and active galaxies. The observatory provides research facilities for astronomers in South African universities as well as its own staff and frequently collaborates in global networks of telescopes using the technique of very long baseline interferometry.

The Nooitgedacht Gammaa Ray Telescope, established in 1985 in the Vredefort area south of Potchefstroom, is operated as a facility of the FRD/PU Cosmic Ray Research unit of the Potchefstroom University, under the leadership of Prof B C Raubenheimer. It consists of twelve parabolic mirrors with a total reflecting area of 21 square metres. The weak blue Cerenkov light emitted by high energy gamma rays in the atmosphere is detected by fast coincidence techniques. Radio pulsars, X-ray binaries, Supernova Remnants and Cataclysmic Variables are some of the objects studied.

OBSERVATORIES OPEN TO THE PUBLIC

SAAO headquarters in Observatory, Cape Town is open to visitors on the second Saturday of each month at 20h00. It is not necessary to make a booking, unless there are more than ten persons in a party. Day visits are possible to the SAAO observing site near Sutherland, and enquiries should be made to Sutherland prior to the intended visit.

BOYDEN OBSERVATORY, BLOEMFONTEIN. Enquiries as to visits should be made to the Dept of Physics and Astronomy of the University of the Orange Free State. Tel 051-4012321 (Mr. Hofman) or 051-4012843 (Mr. J. Galitz).

THE NOOITGEDACHT TELESCOPE, POTCHEFSTROOM. Interested individuals or groups are welcome to contact Prof. B C Raubenheimer to arrange visits.

The PORT ELISABETH PEOPLES OBSERVATORY SOCIETY. The Observatory, situated on the corner of Westview Drive and MacFarlane Road, is open to the public on the 1st and 3rd Wednesdays of every month and on every Wednesday during December and January. Admission is free. Donations are accepted to help with running costs. Viewing evenings are arranged for groups at other times during the month.

THE CEDERBERG OBSERVATORY. This observatory, situated 250 km by road north of Cape Town, is operated by 5 amateur astronomers. It has excellent dark skys and public open nights are held twice monthly at Last Quarter and New Moon. Enquiries to Mr. Chris Forder Tel 021-9134200.

PLANETARIA

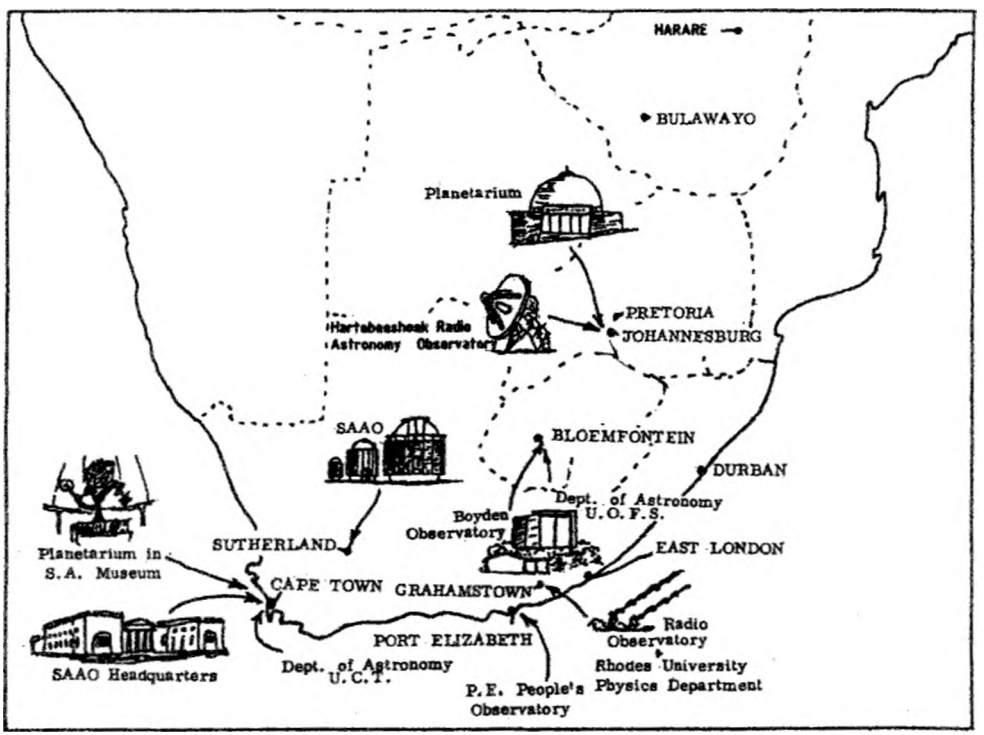
A planetarium is located within the South African Museum in Cape Town, containing a Minolta Series 4 projector and seating 120.

A planetarium is situated in the grounds of the University of the Witwatersrand in Johannesburg (entrance in Yale Road, alongside the M1). It is equipped with a Zeiss projector and seats over 400 persons.

Regular shows are given at both of these planetaria, from which details may be obtained.

UNIVERSITIES

Several universities undertake research in astronomy and offer teaching courses. The chair of astronomy at UCT is occupied by Brian Warner, whose department uses the SAAO observing facilities at Sutherland. The Dept of Applied Mathematics, UCT has a group carrying out research in theoretical cosmology lead by Profs G F R Ellis and D R Matravers. The University of OFS has a Dept of Physics and Astronomy, headed by Prof. P E Viljoen, incorporated with the Boyden Observatory. The Dept of Physics and Electronics at Rhodes University, under Prof. E E Baart, specialises in radio astronomy, and has its own observatory outside Grahamstown. The Dept of Mathematics, Applied Mathematics and Astronomy at UNISA offers a number of courses in astronomy and astrophysics. Prof. W F Wargau is the head of Astronomy at UNISA. Courses in Gamma Ray Astronomy and General Astrophysics form part of the regular honors and masters courses of the Department of Physics at Potchefstroom.



ASTRONOMICAL SOCIETIES

THE ASTRONOMICAL SOCIETY OF BULAWAYO, ZIMBABWE. This society holds meetings on the second Monday of every month at the City Club, 95 Josiah Tongara St. Visitors are welcome. The Society also publishes monthly newsletters. Secretarial address: c/o Mr. Derek Shaw, 2 Sinclair Ave., Bulawayo - Tel. 75439.

THE ASTRONOMICAL WORK GROUP, NAMIBIA. This Society, situated in Windhoek, is active in the fields of astrophotography, solar and occultation observing. It has an observing site, housing a .36m telescope, at the Brakwater Agricultural Centre outside Windhoek. Exibitions and public viewing sessions are organised. For further information contact Mrs. S. Enke, P O Box 5198, Windhoek.

The PORT ELISABETH PEOPLES OBSERVATORY SOCIETY. Society meetings are held bi-monthly on the 3rd Monday. Secretarial address: P. O. Box 7988, Newton Park, Port Elizabeth. 6055.

THE ASTRONOMICAL SOCIETY OF SOUTHERN AFRICA. This Society is a body consisting of both amateur and professional astronomers. Membership is open to all interested persons, regardless of knowledge or experience. In addition to this Handbook, the Society issues the "Monthly Notes of the Astronomical Society of Southern Africa" (MNASSA). Members also receive the popular monthly magazine "Sky and Telescope" published in the USA, which provides information on professional and amateur activities, together with news of space research and other related subjects. The Society's annual subscription is R75.00 and there is an entrance fee of R10.00. A prospectus and application form may be obtained from the Honorary Secretary, Astronomical Society of Southern Africa, c/o S A Astronomical Observatory, P O Box 9, Observatory 7935, or telephone 021-7612112 (Mrs. A. Joubert).

AUTONOMOUS LOCAL CENTRES OF THE ASSA hold regular meetings in Cape Town, Durban, Johannesburg, Bloemfontein, Pietermaritzburg, Pretoria and Harare.Visitors are very welcome at meetings and may, if they wish, join a Centre without becoming a full member of the Society. Centre members receive neither Society publications, nor "Sky and Telescope". Some Centres publish newsletters and journals carrying information on meetings, centre activities and topics of interest.
CAPE CENTRE (Cape Town): Formal meetings are held on the second Wednesday of the month (except in January and December) when lectures on the latest topics in Astronomy are presented. Informal meetings involving discussion groups and observing sessions are held on most other Wednesdays except during January and December. Meetings are held at the SAAO, Observatory Road, Observatory at 20h00. Two or three out-of-town weekend observing sessions are held annually in areas where dark skies are available. The Centre publishes a journal, the "Cape Observer" and a monthly newsletter. Secretarial address: P.O.Box 13018, Mowbray, 7705, or tel. 021-725897.

TRANSVAAL CENTRE (Johannesburg): General meetings, consisting of lectures, films or observing evenings are held on the second Wednesday of each month, excluding December, in the Sir Herbert Baker building in the grounds of the former Republic Observatory, 18A Gill Street, Observatory, Johannesburg at 20h00. There are two small observatories on the site, one houses the 30cm F8 Newtonian Jacobs telescope, and the Papadopoulos Dome houses a combined instrument comprising a 18cm F16 refractor, a 15cm refractor and a 30cm F16 Cassegrain reflector. Informal observing evenings are held every Friday night. The Centre publishes a monthly newsletter "Canopus". Secretarial address: P O Box 93145, Yeoville 2143, tel. 011-8865602.

NATAL CENTRE (Durban): Regular monthly meetings are held at 19h45 on the second Wednesday of each month at Marist Brothers School, South Ridge Road, Durban. The Centre publishes a monthly magazine "Ndaba". Secretarial address: P O Box 5330, Durban, 4000, or telephone 031-3072093 / 7011104 / 7013178 / 0323-51647.

NATAL MIDLANDS CENTRE (Pietermaritzburg): Regular monthly meetings on the second Wednesday of each month at 19h45. Secretarial address: P O Box 2106, Pietermaritzburg, 3200 or by phoning 0331-33646.

BLOEMFONTEIN CENTRE: Meetings are held every fourth Friday of the month. Secretarial address: Mrs. T Venter, P O Box 1238, Bloemfontein, 9300 or tel.051-224977.

PRETORIA CENTRE: Meetings are held on the fourth Wednesday of each month (except December) at 19h00 at the Christian Brothers' College, Silverton Road, where the Centre's observatory containing a 30cm reflecting telescope is situated. Secretarial address: Mr N Young at 201 Kritzinger St., Meyers Park, Pretoria, 0184 tel. 012-833765.

HARARE CENTRE: The Centre holds a meeting on the last Wednesday of each month (except December). These are usually held at 17h30 at the Queen Victoria Museum and consist of lectures, films or general discussions. Informal observing sessions are also held at the homes of members. Secretarial address: P O Box UA 428, Union Avenue, Harare, Zimbabwe.

OBSERVING SECTIONS OF THE SOCIETY

These sections exist to co-ordinate constructive observing programmes. More information on a section is given in the appropriate parts of this handbook.

DIARY OF PHENOMENA

	d	h	
Jan	1	14	Venus 5° N. of Moon
	3	3	Mercury 3° N. of Moon
	3	12	Mars 0°.8 N. of Moon
	3	17	Earth at perihelion
	5	1	NEW MOON
	5	3	Uranus in conjunction with Sun
	6	14	Moon at apogee
	7	1	Saturn 3° S. of Moon
	7	15	Neptune in conjunction with Sun
	7	21	Venus 7° N. of Antares
	8	1	Juno 0°.2 S. of Moon
	10	22	Mercury 0°.6 N. of Mars
	13	5	FIRST QUARTER
	19	23	FULL MOON
	20	0	Moon at perigee
	20	5	Mercury 0°.6 S. of Uranus
	21	13	Mercury 1°.9 S. of Neptune
	23	3	Jupiter 7° N. of Moon
	26	17	LAST QUARTER
	29	22	Vesta stationary
	29	23	Mars 0°.4 S. of Uranus
	30	0	Saturn in conjunction with Sun
	31	19	Venus 1°.0 N. of Moon
Feb	1	10	Mars 1°.5 S. of Neptune
	1	11	Uranus 0°.9 S. of Moon
	1	14	Neptune 0°.03 N. of Moon
	1	15	Mars 1°.5 S. of Moon
	2	14	Moon at apogee
	3	21	NEW MOON
	7	9	Venus 0°.9 N. of Uranus
	8	17	Venus 0°.3 S. of Neptune
	11	18	FIRST QUARTER
	12	11	Mercury in superior conjunction
	17	13	Moon at perigee
	18	10	FULL MOON
	19	9	Jupiter 6° N. of Moon
	20	0	Venus 0°.9 N. of Mars
	25	10	LAST QUARTER
	28	4	Pluto stationary
	28	20	Uranus 1°.2 S. of Moon
	28	23	Neptune 0°.2 S. of Moon
	29	3	Jupiter at opposition
	29	4	Venus 0°.1 N. of Saturn
	29	23	Moon at apogee
Mar	1	20	Mars 4° S. of Moon
	2	3	Saturn 4° S. of Moon
	2	8	Venus 4° S. of Moon
	4	15	NEW MOON
	6	8	Mercury 4° S. of Moon
	6	15	Mars 0°.4 S. of Saturn
	8	14	Juno in conjunction with Sun
	9	6	Vesta at opposition
	9	23	Mercury greatest elong. E. (18°)
	12	5	FIRST QUARTER
	16	17	Mercury stationary
	16	20	Moon at perigee
	17	14	Jupiter 6° N. of Moon
	18	20	FULL MOON
	20	11	Equinox
	26	4	LAST QUARTER
	26	17	Mercury in inferior conjunction
	27	5	Uranus 1°.5 S. of Moon
	27	7	Neptune 0°.5 S. of Moon
	28	16	Moon at apogee
	29	16	Saturn 4° S. of Moon
	31	3	Mars 6° S. of Moon
Apr	1	21	Venus 7° S. of Moon
Apr	2	10	Mercury 4° S. of Moon
	3	7	NEW MOON
	6	1	Mercury 2° N. of Venus
	8	3	Mercury stationary
	10	12	FIRST QUARTER
	13	9	Moon at perigee
	13	18	Jupiter 6° N. of Moon
	17	7	FULL MOON
	20	13	Neptune stationary
	22	3	Uranus stationary
	23	14	Uranus 1°.8 S. of Moon
	23	16	Neptune 0°.7 S. of Moon
	23	17	Mercury greatest elong. W. (27°)
	24	6	Pallas stationary
	25	0	LAST QUARTER
	25	12	Moon at apogee
	26	4	Saturn 5° S. of Moon
	27	9	Vesta stationary
	29	9	Mars 7° S. of Moon
	30	23	Mercury 8° S. of Moon
May	1	7	Jupiter stationary
	2	20	NEW MOON
	8	14	Moon at perigee
	9	18	FIRST QUARTER
	11	0	Jupiter 6° N. of Moon
	12	3	Pluto at opposition
	16	18	FULL MOON
	20	22	Uranus 2° S. of Moon
	20	23	Neptune 0°.9 S. of Moon
	23	7	Moon at apogee
	23	14	Saturn 5° S. of Moon
	24	18	LAST QUARTER
	28	11	Mars 7° S. of Moon
	29	5	Saturn stationary
	31	18	Mercury in superior conjunction
Jun	1	6	NEW MOON
	4	4	Moon at perigee
	7	9	Jupiter 7° N. of Moon
	7	14	Ceres stationary
	7	23	FIRST QUARTER
	13	18	Venus in superior conjunction
	15	7	FULL MOON — Eclipse
	17	3	Uranus 1°.9 S. of Moon
	17	6	Neptune 0°.9 S. of Moon
	19	1	Pallas at opposition
	19	21	Saturn 5° S. of Moon
	20	0	Moon at apogee
	21	5	Solstice
	23	4	Mercury 5° S. of Pollux
	23	10	LAST QUARTER
	26	10	Mars 6° S. of Moon
	30	14	NEW MOON — Eclipse
Jul	2	3	Moon at perigee
	2	12	Mercury 4° N. of Moon
	3	14	Earth at aphelion
	4	22	Jupiter 7° N. of Moon
	6	3	Mercury greatest elong. E. (26°)
	7	5	FIRST QUARTER
	8	1	Uranus at opposition
	9	15	Neptune at opposition
	14	8	Uranus 1°.8 S. of Moon
	14	11	Neptune 0°.8 S. of Moon
	14	21	FULL MOON
	17	1	Saturn 5° S. of Moon
	17	13	Moon at apogee
	19	5	Mercury stationary
	23	0	LAST QUARTER

CONFIGURATIONS OF SUN, MOON AND PLANETS

	d	h	
Jul	25	6	Mars 4° S. of Moon
	25	17	Mercury 6° S. of Venus
	26	0	Ceres at opposition
	29	22	NEW MOON
	30	10	Moon at perigee
Aug	1	14	Jupiter 7° N. of Moon
	2	23	Mercury in inferior conjunction
	4	11	Pluto stationary
	5	13	FIRST QUARTER
	6	20	Venus 1°.1 N. of Regulus
	7	12	Saturn at opposition
	10	12	Uranus 1°.8 S. of Moon
	10	16	Neptune 0°.8 S. of Moon
	11	11	Mars 5° N. of Aldebaran
	12	15	Mercury stationary
	13	3	Saturn 5° S. of Moon
	13	12	FULL MOON
	13	18	Moon at apogee
	14	3	Pallas stationary
	21	4	Mercury greatest elong. W. (18°)
	21	12	LAST QUARTER
	22	23	Mars 1°.4 S. of Moon
	23	5	Venus 0°.3 N. of Jupiter
	27	3	Mercury 5° N. of Moon
	27	20	Moon at perigee
	28	5	NEW MOON
	29	21	Venus 7° N. of Moon
Sep	3	1	Mercury 1°.2 N. of Regulus
	4	1	FIRST QUARTER
	6	17	Uranus 1°.9 S. of Moon
	6	21	Neptune 0°.9 S. of Moon
	9	5	Saturn 5° S. of Moon
	9	21	Moon at apogee
	12	4	FULL MOON
	15	6	Mercury in superior conjunction
	16	14	Ceres stationary
	17	21	Jupiter in conjunction with Sun
	19	7	Venus 3° N. of Spica
	19	22	LAST QUARTER
	20	11	Mars 0°.9 N. of Moon
	22	21	Equinox
	23	2	Uranus stationary
	25	5	Moon at perigee
	26	13	NEW MOON
	27	18	Neptune stationary
	28	17	Venus 4° N. of Moon
Oct	3	0	Mercury 2° N. of Spica
	3	16	FIRST QUARTER
	4	0	Uranus 2° S. of Moon
	4	4	Neptune 1°.2 S. of Moon
	6	10	Saturn 5° S. of Moon
	7	8	Moon at apogee
	11	20	FULL MOON
	16	6	Saturn stationary
Oct	18	17	Mars 3° N. of Moon
	19	6	LAST QUARTER
	23	7	Moon at perigee
	24	2	Jupiter 7° N. of Moon
	25	23	NEW MOON
	27	9	Venus 3° N. of Antares
	27	17	Mercury 0°.5 S. of Moon
	28	17	Venus 0°.4 S. of Moon
	31	9	Uranus 2° S. of Moon
	31	12	Neptune 1°.4 S. of Moon
	31	18	Mercury greatest elong. E. (24°)
Nov	2	11	FIRST QUARTER
	2	18	Saturn 5° S. of Moon
	4	1	Moon at apogee
	4	23	Mars 5° S. of Pollux
	10	11	FULL MOON
	11	16	Mercury stationary
	15	2	Pluto in conjunction with Sun
	15	14	Mars 5° N. of Moon
	17	6	Juno stationary
	17	14	LAST QUARTER
	19	2	Moon at perigee
	20	18	Jupiter 7° N. of Moon
	22	0	Mercury in inferior conjunction
	24	11	NEW MOON
	26	14	Venus 1°.9 S. of Uranus
	27	15	Venus 3° S. of Neptune
	27	20	Uranus 3° S. of Moon
	27	23	Neptune 1°.6 S. of Moon
	27	23	Venus 5° S. of Moon
	29	18	Mars stationary
	30	5	Saturn 5° S. of Moon
Dec	1	8	Mercury stationary
	1	22	Moon at apogee
	2	8	FIRST QUARTER
	4	12	Vesta in conjunction with Sun
	9	16	Mercury greatest elong. W. (21°)
	10	2	FULL MOON — Eclipse
	12	21	Mars 6° N. of Moon
	13	23	Moon at perigee
	16	21	LAST QUARTER
	18	7	Jupiter 7° N. of Moon
	19	5	Mercury 6° N. of Antares
	21	17	Solstice
	21	18	Venus 1°.1 S. of Saturn
	22	16	Mercury 1°.5 N. of Moon
	22	23	Mars 3° S. of Pollux
	24	3	NEW MOON
	27	19	Saturn 6° S. of Moon
	28	4	Juno at opposition
	28	9	Venus 7° S. of Moon
	29	19	Moon at apogee

THE SUN

BASIC DATA:

Diameter: 1 392 000 km (109 times Earth diameter)

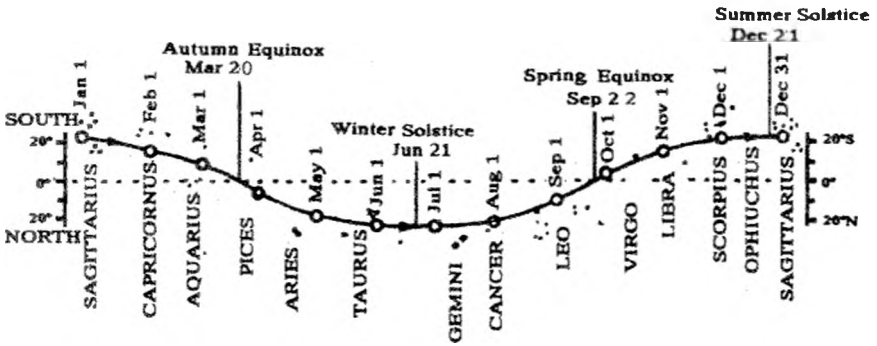
Mass: 1,99 x 10^{30}kg (330 000 times Earth mass)

Surface Temperature: Approximately 6 000°C

Temperature at centre: Approximately 10 million°C

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

The Earth's orbit round the Sun is not quite circular. In 1992 we will be closest to the Sun on January 3 (perihelion - approximate distance 147 million km) and furthest from the Sun on July 3 (aphelion - approximately 152 million km). During the year, the Sun appears to us to make a complete circuit of the sky (i.e. relative to the starry background) as indicated in the diagram.



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

THE SUN'S DECLINATION AT 02 HOURS:

Jan	1	-23° 5'	Apr	10	7°58'	Jul	19	20°50'	Oct	27	-12°48'
	11	-21 57		20	11 32		29	18 45	Nov	6	-15 59
	21	-20 7		30	14 47	Aug	8	16 8		16	-18 45
	31	-17 39	May	10	17 38		18	13 5		26	-20 57
Feb	10	-14 39		20	19 59		28	9 42	Dec	6	-22 30
	20	-11 16		30	21 47	Sep	7	6 3		16	-23 19
Mar	1	-7 34	Jun	9	22 56		17	2 15		26	-23 22
	11	-3 42		19	23 25		27	-1 39			
	21	0 15		29	23 14	Oct	7	-5 31			
	31	4 10	Jul	9	22 21		17	-9 16			

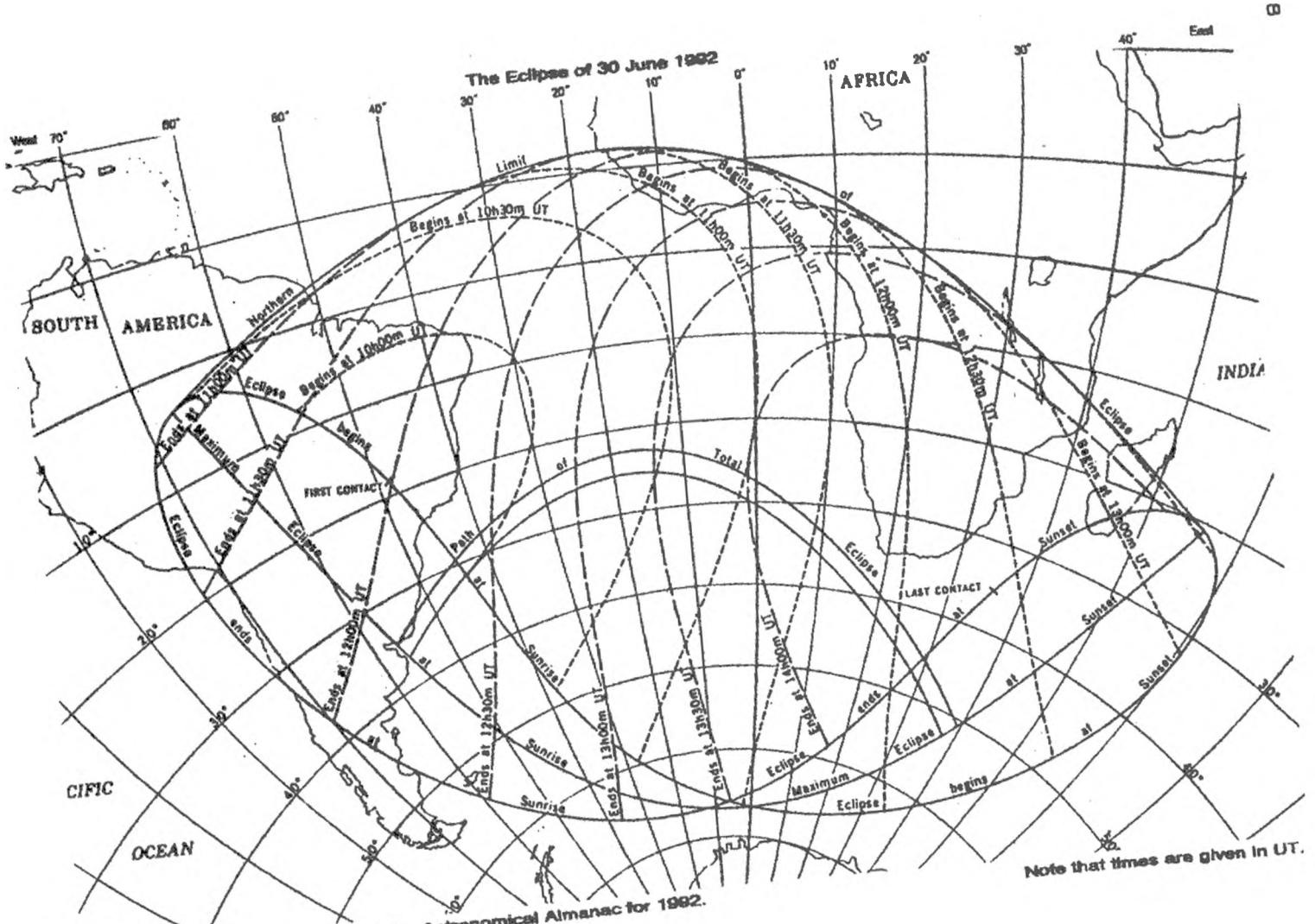
TIMES OF SUNRISE AND SUNSET FOR THE MAIN CITIES OF SOUTHERN AFRICA

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

ECLIPSES OF THE SUN

Three eclipses of the Sun take place during the year. Two, the annular eclipse of January 4-5 and the partial eclipse of December 23-24 are not visible from Southern Africa.

The total eclipse of June 30 will be visible all over Southern Africa as a partial eclipse. The path of totality begins on the coast of South America and extends along towards the west coast of Southern Africa but then heads southwards below Cape Town. A large part of Southern Africa will see more than 50% of the Sun's disk covered by the Moon at the time of middle eclipse.


The Eclipse of 30 June 1992
SOUTH AMERICA
AFRICA
INDIA
CIFIC
OCEAN
Limit
Begins at 10h30m UT
Begins at 11h00m UT
Begins at 11h30m UT
Begins at 12h00m UT
Begins at 12h30m UT
Begins at 13h00m UT
Northern
Eclipse
Ends at 11h00m UT
Maximum
Ends at 11h30m UT
Begins
FIRST CONTACT
Path
of
Total
Ends at 12h00m UT
Ends at 12h30m UT
Ends at 13h00m UT
Ends at 13h30m UT
Sunrise
Sunset
LAST CONTACT
Maximum
begins
Note that times are given in UT.
This map has been copied from the Astronomical Almanac for 1992.

Predictions

	Start	PA°	Middle	Mag.	PA°	End	PA°
	h m		h m			h m	
Bloemfontein	14 10.3	-89.1	15 22.8	0.675	201.3	16 27.5	131.1
Bulawayo	14 24.7	254.5	15 25.2	0.396	202.4	16 19.9	149.9
Cape Town	13 51.9	-77.8	15 11.9	0.900	200.2	16 23.9	117.6
Durban	14 19.8	267.7	15 27.6	0.620	201.1	16 28.5	134.0
East London	14 11.6	-85.6	15 23.9	0.742	200.7	16 28.6	126.5
Harare	14 35.0	246.8	15 27.3	0.291	202.5	16 15.1	157.9
Johannesburg	14 16.7	265.1	15 25.1	0.570	201.7	16 26.4	137.8
Kimberley	14 07.6	-88.6	15 21.2	0.683	201.4	16 27.0	130.7
Pietermaritzburg	14 18.8	267.9	15 27.1	0.623	201.1	16 28.4	134.0
Port Elisabeth	14 06.8	-82.7	15 21.2	0.798	200.5	16 27.9	123.3
Pretoria	14 17.5	264.2	15 25.3	0.554	201.7	16 26.0	138.8
Windhoek	13 50.7	269.2	15 09.9	0.650	201.9	16 20.3	133.7

Note: PA is the position angle of the Moon counterclockwise from the north point of the Sun's disk. Mag. is the fraction of the Sun's diameter covered.

SOLAR SECTION

The work undertaken by this section covers a broad range of techniques to observe activity on the sun's disk. Members of the section note their observations on appropriate forms, which are then forwarded to various organisations in the United States of America, the United Kingdom, the Federal Republic of Germany and South Africa. The results we provide are further reduced by these organisations and incorporated with the information provided by other world-wide groups or Solar Observers, such as ours. The data produced is then fed to over 450 scientific institutions all over the world, where it is used by a very wide range of scientific disciplines.

Observational techniques employed include the visual observation of the sun's disk (using suitable filters or by projecting the image onto an appropriate screen) to determine sun spots and active areas, the monitoring of solar flares by very low frequency radio waves and monitoring changes in the earth's magnetic field caused by solar activity. Other activities such as photographing and the drawing of visible solar features are also undertaken.

Towards the end of 1986, the Sun entered the new 11 year Solar cycle and this cycle is characterised by a steady climb over approximately 4½ years, followed by a slower decline to minimum lasting approximately 6½ years. The present Solar (cycle 22) has been rather special and very unusual, with the fastest rise to maximum yet recorded. It is also experiencing a protracted level of high activity after its very early maximum, and this activity is expected to continue in 1992. Large sunspot groups will continue to be seen every three to four weeks throughout this period.

A word of caution - NEVER observe the sun directly without adequate filtration as permanent eye damage can occur,and do not use the screw-in filters provided with some commercial telescopes, as they are inclined to shatter! Large instruments are not a prerequisite! Any telescope from 50mm, reflector or refractor can be used and provides an ideal opportunity for owners of small instruments to contribute immediately to Science. If one has no filter, then the only safe method is to project the image on to a white card. Image quality will be enhanced if the card is kept in the shade, or enclosed in a screen. Details of suitable filters are best sought from experienced solar observers or from the Director of the Solar Section.

Persons interested in observing the sun,or requiring information are invited to contact The Director of the Solar Section:

Jim Knight, 17 Mars Street, Atlasville, Boksburg, 1459 or tel. 011-9731380.

The Moon

BASIC DATA

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

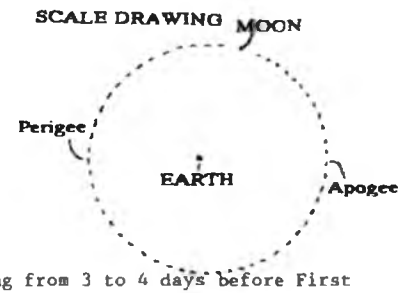
THE SURFACE OF THE MOON

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

THE MOON'S ORBIT

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.

The Moon's orbit around the Earth is slightly elliptical; the Earth is situated at one of the foci of the ellipse. Thus the Earth-Moon distance varies slightly during the course of a revolution. Dates of Apogee, when the moon is furthest from the Earth (approximately 407 000 km) and of Perigee, when the Moon is closest to the Earth (approximately 357 000 km) are given on the next page.



The Moon is best positioned for evening viewing from 3 to 4 days before First Quarter to shortly after Full Moon.

ECLIPSES OF THE MOON

The first part of the partial eclipse of the moon on June 15 will be visible from Southern Africa but the Moon will have set before it ends. The total eclipse of the Moon on December 9/10 will be seen in its entirety.
The eclipse data is as follows:

	d	h	m
Moon enters penumbra	Jun 15	4	09.1
Moon enters umbra	15	5	26.6
Middle of eclipse	15	6	57.0
Moon leaves umbra	15	8	27.2
Moon leaves penumbra	15	9	44.9

	d	h	m
Moon enters penumbra	Dec 9	22	55.4
Moon enters umbra	9	23	59.4
Moon enters totality	10	1	06.8
Middle of eclipse	10	1	44.1
Moon leaves totality	10	2	21.5
Moon leaves umbra	10	3	28.8
Moon leaves penumbra	10	2	32.7

Contacts of Umbra with Limb of Moon	Position Angles from the North Point
First	48°.0 to East
Last	54°.4 to West

Magnitude of the eclipse: 0.687

Contacts of Umbra with Limb of Moon	Position Angles from the North Point
First	108°.7 to East
Last	107°.5 to West

Magnitude of the eclipse: 1.276

Moon set at	h	m
Harare	6	28
Durban	6	54
Johannesburg	6	58
Bloemfontein	7	12
Port Elizabeth	7	27
Cape Town	7	57

Moon rise at	h	m
Harare	17	47
Durban	18	29
Johannesburg	18	33
Bloemfontein	18	47
Port Elisabeth	19	02
Cape Town	19	32

TERMINATOR AND LIBRATION

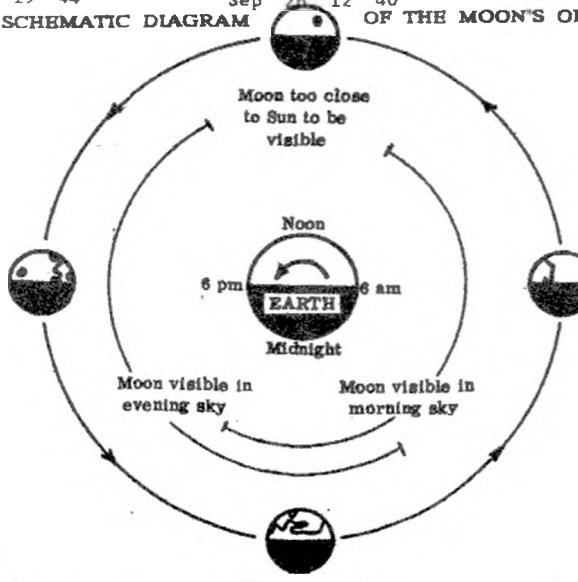
During the changing phases, the terminator (the boundary between illuminated and dark portions) progresses from left to right in the diagram on page 10. Since the moon does not follow a perfectly circular orbit and its axis is not parallel to the Earth's axis, it is sometimes possible to see a slightly greater proportion of one limb than the opposite one. This effect is known as libration.

PHASES and VISIBILITY

NEW MOON

	d	h	m
Jan	5	01	10
Feb	3	21	00
Mar	4	15	22
Apr	3	07	01
May	2	19	44
Jun	1	05	57
	30	14	18
Jul	29	21	35
Aug	28	04	42
Sep	26	12	40
Oct	25	22	34
Nov	24	11	11
Dec	24	02	43

SCHEMATIC DIAGRAM OF THE MOON'S ORBIT



FIRST QUARTER

	d	h	m
Jan	13	04	32
Feb	11	18	15
Mar	12	04	36
Apr	10	12	06
May	9	17	43
Jun	7	22	47
Jul	7	04	43
Aug	5	12	58
Sep	4	00	39
Oct	3	16	12
Nov	2	11	11
Dec	2	08	17

LAST QUARTER

	d	h	m
Jan	26	17	27
Feb	25	09	56
Mar	26	04	30
Apr	24	23	40
May	24	17	53
Jun	23	10	11
Jul	23	00	12
Aug	21	12	01
Sep	19	21	53
Oct	19	06	12
Nov	17	13	39
Dec	16	21	13

FULL MOON

	d	h	m
Jan 19	23	28	
Feb	18	10	04
Mar	18	20	18
Apr	17	06	42
May 16	18	03	
Jun	15	06	50
Jul	14	21	06
Aug	13	12	27
Sep 12	04	17	
Oct	11	20	03
Nov	10	11	20
Dec	10	01	41

MOON at PERIGEE

d	h	d	h	d	h
Jan 20	0	Jun 4	4	Oct 23	7
Feb 17	13	Jul 2	3	Nov 19	2
Mar 16	20	30	10	Dec 13	23
Apr 13	9	Aug 27	20		
May 8	14	Sep 25	5		

MOON at APOGEE

d	h	d	h	d	h
Jan 6	14	May 23	7	Oct 7	8
Feb 2	14	Jun 20	0	Nov 4	1
29	23	Jul 17	13	Dec 1	22
Mar 28	16	Aug 13	18	29	19
Apr 25	12	Sep 9	21		

MAP OF THE MOON'S NEAR SIDE

LIBRATION

Maximum Date d	Size °	P.A. °	Minimum Date d	Size °	P.A. °	Maximum Date d	Size °	P.A. °	Minimum Date d	Size °	P.A. °
			Jan 5	1.3	227	Jul 7	9.1	339	Jul 14	3.4	220
Jan 13	10.1	109	Jan 19	2.0	54	Jul 22	9.1	110	Jul 29	4.0	50
Jan 25	10.2	333	Feb 1	1.9	214	Aug 4	9.5	332	Aug 11	4.2	214
Feb 9	9.5	111	Feb 16	3.2	53	Aug 19	8.4	110	Aug 26	5.1	50
Feb 22	9.6	333	Feb 29	2.5	215	Sep 1	9.1	325	Sep 8	4.9	208
Mar 7	8.5	116	Mar 14	3.9	60	Sep 15	7.5	118	Sep 22	5.8	55
Mar 21	8.5	336	Mar 27	2.9	213	Sep 29	8.0	321	Oct 5	5.4	206
Apr 3	8.0	120	Apr 10	3.3	69	Oct 11	7.0	130	Oct 17	5.2	79
Apr 17	7.6	346	Apr 23	3.0	218	Oct 25	6.9	345	Nov 1	5.6	215
Apr 30	8.2	120	May 7	2.4	64	Nov 7	7.1	132	Nov 13	4.1	73
May 13	7.7	351	May 20	2.9	224	Nov 20	6.9	9	Nov 27	5.1	247
May 28	8.7	116	Jun 3	2.3	58	Dec 5	7.4	126	Dec 11	4.1	62
Jun 9	8.3	346	Jun 17	3.0	225	Dec 17	7.4	358	Dec 24	4.8	248
Jun 24	9.1	112	Jul 1	2.9	52						

NOTE: Size of libration is given as an angle measured at the centre of the Moon. Position Angle (P.A.) is measured through East on the face of the Moon from the North point of the disk.

1992 TIMES OF MOON RISE AND SET CAPETOWN

For PORT ELIZABETH subtract 28 MINUTES

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

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

1992 TIMES OF MOON RISE AND SET JOHANNESBURG

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

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

1992 TIMES OF MOON RISE AND SET DURBAN

For BLOEMFONTEIN add 19 MINUTES

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

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

COMPUTING SECTION

This section invites all those interested in Astronomical Computing in any form to share their expertise and any Software they may have with other members in the Society.

The objectives of the Computing Section were outlined in MNASSA. Vol 46 Nos. 5 & 6 June 1987 Page 66. Please refer to this write up for detailed information. Persons interested in the activities of the Computing Section are urged to contact the Director of the Societies Computing Section:

Mr Tony Hilton, P O Box 68846, Bryanston, 2021. Phone (w) (011) 53 8714
(h) (011) 465 2257.

Mr Hilton has compiled a comprehensive DATA BASE of all interested person's, equipment, available software etc. This report will be available to all interested persons. If you wish to become a subscriber to this DATA BASE list please contact Mr Hilton for the relevant quuestionnaire.

Furthermore, if you are embarking on any Computer Projects, Mr Hilton would like to hear from you, and would make himself or any other competent individuals available to supply expert advice or additional information where necessary.

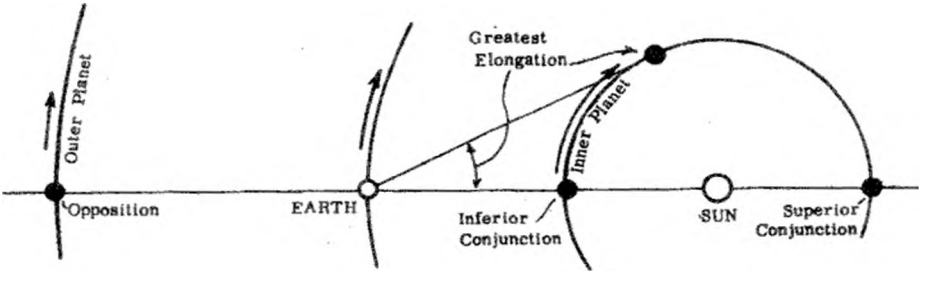
THE PLANETS

BASIC DATA

	Dist from Sun 10^6 km	Period of Revolution years	Mass (Earth = 1)	Equatorial Diameter 10^3 km	Rotation Period	Inclination of Equator to orbit	No. of known satellites
Mercury	58	0.24	0.055	4.98	58.65d	0°	0
Venus	108	0.62	0.815	12.10	243d R	178°	0
Earth	150	1.00	1.000	12.76	23h56m	23°27'	1
Mars	228	1.88	0.107	6.79	24h37m	23°59'	2
Jupiter	778	11.9	318.867	142.80	09h51m	03°04'	16
Saturn	1 426	29.5	95.142	120.00	10h14m	26°44'	18
Uranus	2 868	84.0	14.559	52.00	17.2h	97°52'	15
Neptune	4 494	164.8	17.207	48.40	17.8h	29°34'	8
Pluto	5 896	247.6	0.002	3.00	6.39d	118°?	1

GENERAL

Apart from Uranus, Neptune and Pluto, the planets of our solar system are amongst the brightest objects in the night sky. Their apparent brightness is measured in magnitudes. A planet of magnitude 1.0, that of the brightest stars, will be 100 times brighter than one of magnitude 6.0, the limit of visibility to the naked eye in the total absence of artificial lighting. Unlike the distant stars, the relative positions of the planets do not remain fixed, but continually change as, like the Earth, they orbit around the Sun. Their apparent movements against the starry background are complicated as they result from a combination of their own motion and the Earth's motion. Their brightnesses also vary considerably, as both their distances from the Earth and the visible portions of their sunlit hemispheres change. Since the period of a planet increases with increasing distance from the Sun, so we find that the inner planets - Mercury and Venus - appear to "overtake" the Earth in their orbits, while the Earth in turn "overtakes" the outer planets - Mars, Jupiter and Saturn. The terms given in astronomy to the various Sun-Earth-Planet configurations are illustrated in the accompanying diagram. Dates of such configurations occuring in 1992 are listed chronologically in the Diary (pages 4 and 5) and are also mentioned in the text below.

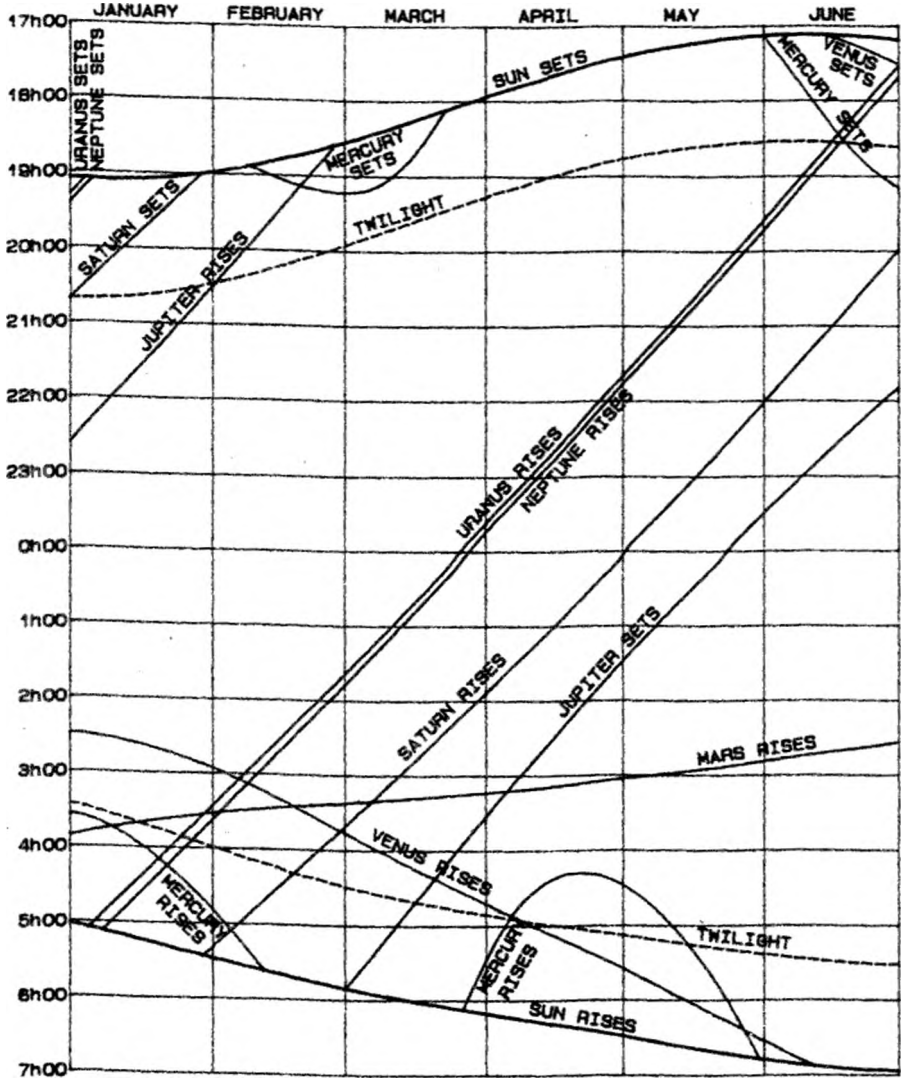


OBSERVING THE PLANETS

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

TIMES OF RISING AND SETTING

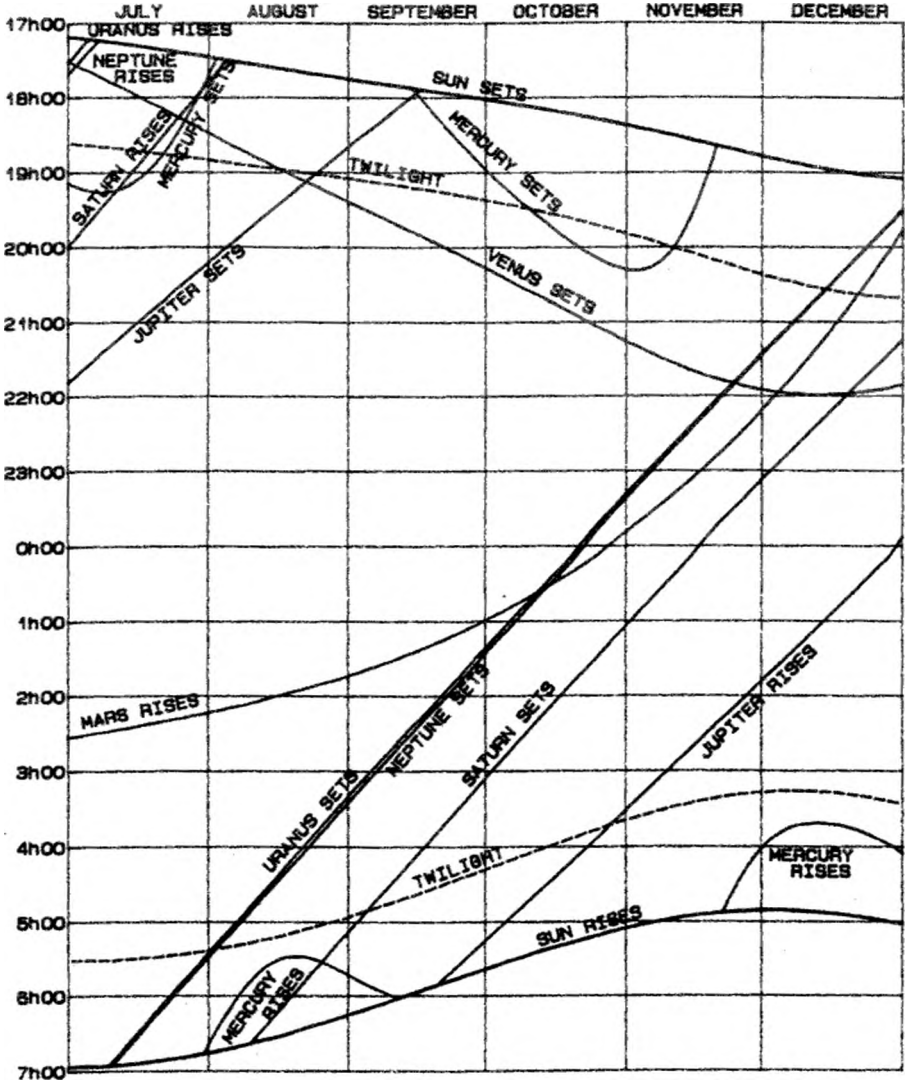
The times of rising and setting given by the diagram are accurate for position 30° East, 30° South and approximately correct for other places in Southern Africa. Strictly speaking, corrections for latitude and longitude should be applied, but the latitude correction is in general sufficiently small to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



CORRECTION FOR PLACES NOT ON THE 30° E MERIDIAN

Approximate longitude corrections from the 30° East meridian are:

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



MERCURY

The planet may be seen low in the east before sunrise between the following approximate dates:

January 1 (at mag.-0.3) to January 30 (at mag.-0.7),
April 3 (at mag.+2.8) to May 24 (at mag.-1.3),
August 11 (at mag.+2.4) to September 6 (at mag.-1.4) and
November 28 (at mag.+1.4) to December 31 (at mag.-0.5).

The best conditions for viewing will occur in April when Mercury is in Pisces until mid May when Mercury is in Aries.

Mercury may also be seen low in the west after sunset between the following approximate dates:

February 23 (at mag.-1.3) to March 19 (at mag.+2.1),
June 8 (at mag.-1.4) to July 26 (at mag.+2.9) and
September 27 (at mag.-0.8) to November 13 (at mag.+1.8)

The best conditions for viewing will be from the third week in June until the third week in July as the planet passes from Gemini to Cancer and again from the second week in October until near mid November when it is in Libra passing to Scorpius.

	d h	d h	d h
Superior Conjunction	Feb 12 11	May 31 18	Sep 15 6
Greatest Elongation East	Mar 9 23 (18°)	Jul 6 3 (26°)	Oct 31 18 (24°)
Stationary	Mar 16 17	Jul 19 5	Nov 11 16
Inferior Conjunction	Mar 26 17	Aug 2 23	Nov 22 0
Stationary	Apr 8 3	Aug 12 15	Dec 1 8
Greatest Elongation West	Apr 23 17 (27°)	Aug 21 4 (18°)	Dec 9 16 (21°)

VENUS

Venus will be in the morning sky from January (at mag.-4.0) until the second week of May (at mag.-3.8).

It will be in the evening sky from mid July (at mag. -3.8) until the end of the year (at mag.-4.1).

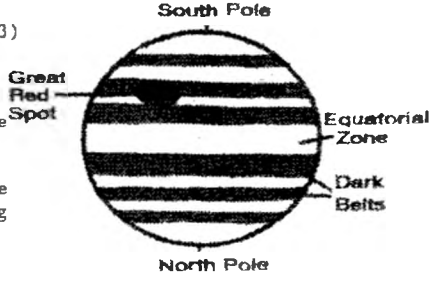
	d h
Superior conjunction	Jun 13 18

MARS

Mars, visible in the morning sky, begins the year in the constellation of Ophiuchus, passing to Sagittarius early in January (at mag. +1.4), to Capricornus in mid February (at mag. +1.3), to Aquarius in late March (at mag. +1.2), to Pisces in late April (at mag. +1.1), to Aries in mid June (at mag. +0.9), to Taurus in mid July (at mag.+0.8) and in early September to Gemini (at mag. +0.6). In late November, Mars will pass briefly into Cancer and return to Gemini in mid December (at mag. -1.3) when it will be visible throughout the night.

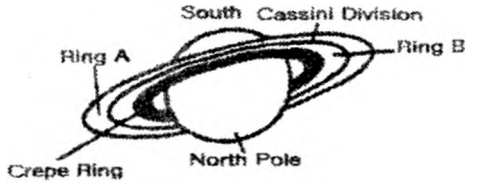
JUPITER

Jupiter begins the year in Leo (at mag.-2.3) where by late February it is visible for most of the night. It will be an evening sky object by early June (at mag.-2.0),becoming too close to the Sun in early September to be seen. Jupiter re-appears in the morning sky at the beginning of October (at mag. -1.6) having passed to Virgo in the mean time where it remains for the rest of the year, reaching magnitude -2.0 at the end of the year.



SATURN

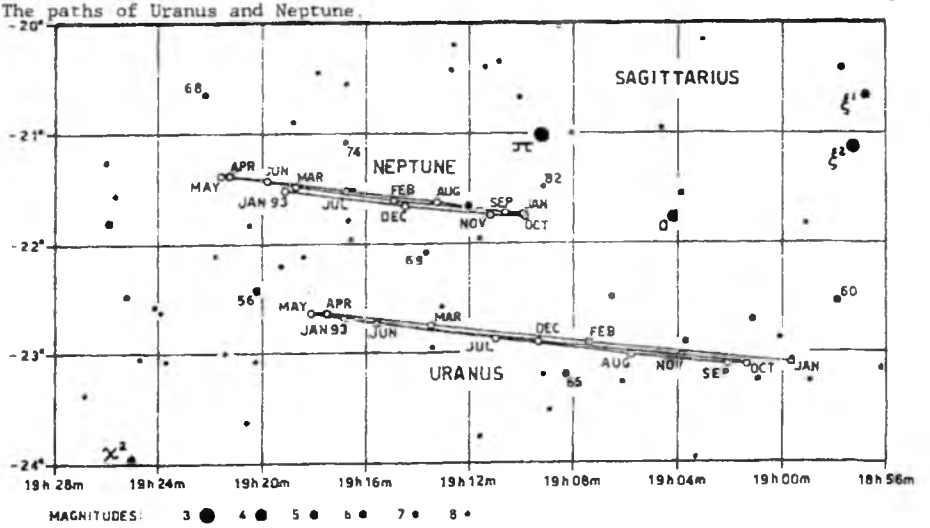
Saturn in Capricornus where it remains all year, will be in the evening sky from 1 January until mid January. It will reappear in the morning sky in mid February (at mag.+0.7). It will be an all night object by early August (at mag. +0.3) but becomes an evening sky object from early November at magnitude +0.6.



URANUS AND NEPTUNE

Uranus and Neptune are both in Sagittarius all year. Uranus is at magnitude 5.6 at opposition on July 7 and Neptune is at magnitude +7.9. at opposition on July 9.

The paths of Uranus and Neptune.



PLUTO

Pluto at magnitude +14 in Serpens is visible only in a telescope of at least 25cm aperture.

EVENTS OF INTEREST

Evening Sky:

29 Feb.	to 19 Mar.	Mercury and Jupiter visible.
8 Jun.	to 19 Jul.	Mercury and Jupiter visible.
20 Jul.	to 26 Jul.	Mercury, Venus and Jupiter visible.
25 Jul.		Venus and Mercury in conjunction.
27 Jul.	to 6 Aug.	Venus and Jupiter visible.
7 Aug.	to 4 Sep.	Venus, Jupiter and Saturn visible.
23 Aug.		Venus and Jupiter in conjunction.
5 Sep.	to 26 Sep.	Venus and Saturn visible.
27 Sep.	to 16 Nov.	Mercury, Venus and Saturn visible.
17 Nov.	to 31 Dec.	Venus and Saturn visible.
21 Dec.		Venus and Saturn in conjunction.

Morning Sky:

1 Jan.	to 30 Jan.	Mercury, Venus, Mars and Jupiter visible.
10 Jan.		Mercury and Mars in conjunction.
30 Jan.	to 15 Feb.	Venus, Mars and Jupiter visible.
16 Feb.	to 29 Mar.	Venus, Mars, Jupiter and Saturn visible.
20 Feb.		Venus and Mars in conjunction.
29 Feb.		Venus and Saturn in conjunction.

1 Mar. to 2 Apr. Venus, Mars and Saturn visible.
3 Apr. to 7 May Mercury, Venus, Mars and Saturn visible.
6 Apr. Venus and Mercury in conjunction.
8 May to 24 May Mercury, Mars and Saturn visible.
25 May to 8 Aug. Mars and Saturn visible.
11 Aug. to 6 Sep. Mercury and Mars visible.
1 Oct. to 27 Nov. Mars and Jupiter visible.
28 Nov. to 31 Dec. Mercury, Mars and Jupiter visible.

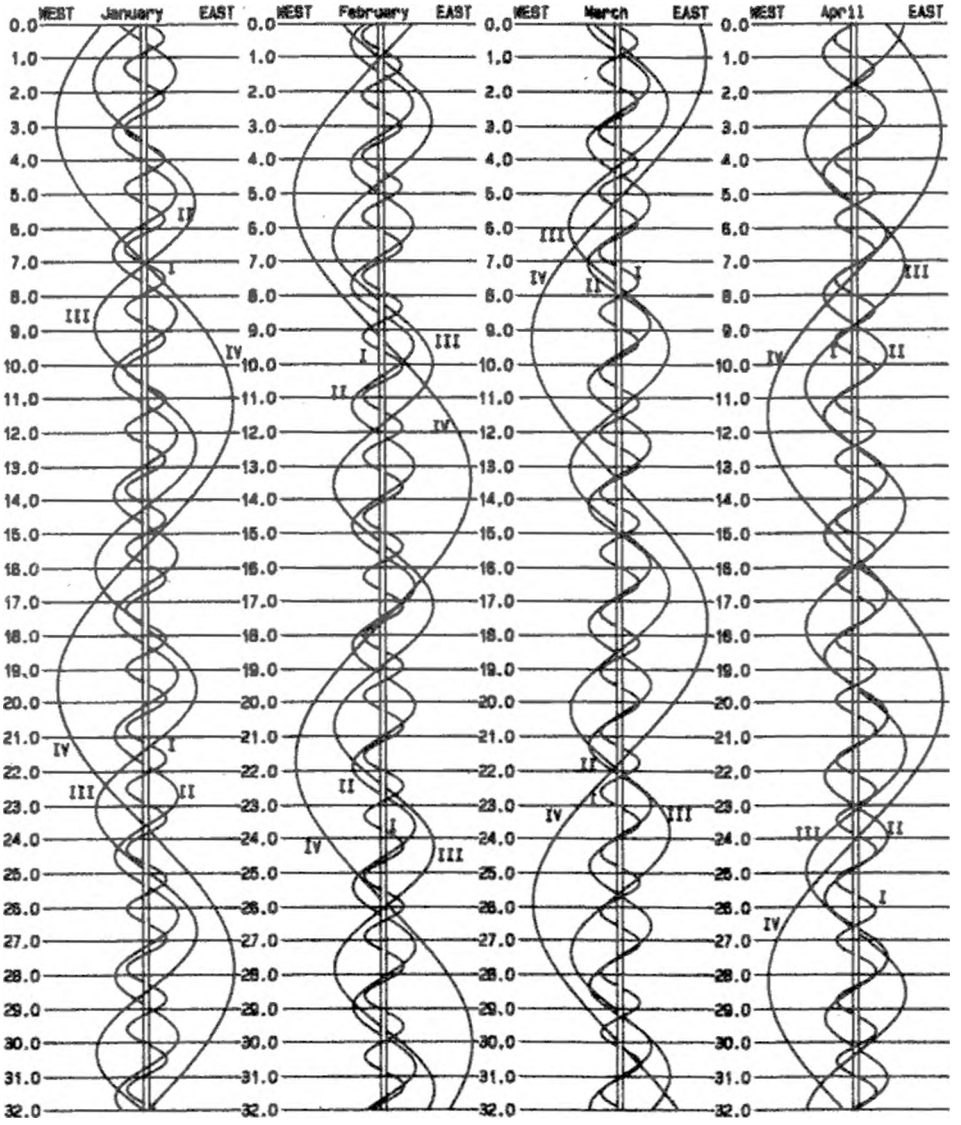
APPARENT PLACES:

	Mercury		Venus		Mars		Jupiter	
	RA	DEC	RA	DEC	RA	DEC	RA	DEC
	h m	° ′	h m	° ′	h m	° ′	h m	° ′
Jan 1	17 8.6	-21 28	15 55.0	-18 10	17 32.8	-23 45	11 5.2	7 8
Jan 11	18 5.7	-23 23	16 45.3	-20 31	18 5.2	-24 0	11 4.5	7 15
Jan 21	19 10.2	-23 34	17 37.3	-21 58	18 37.8	-23 49	11 2.7	7 30
Jan 31	20 18.0	-21 34	18 30.2	-22 22	19 10.5	-23 13	10 59.8	7 50
Feb 10	21 27.3	-17 12	19 23.3	-21 41	19 43.1	-22 12	10 55.9	8 16
Feb 20	22 36.7	-10 26	20 15.5	-19 55	20 15.4	-20 47	10 51.4	8 45
Mar 1	23 42.4	-1 56	21 6.4	-17 11	20 47.1	-18 59	10 46.6	9 16
Mar 11	0 28.7	5 29	21 55.5	-13 39	21 18.3	-16 52	10 41.7	9 45
Mar 21	0 32.2	7 18	22 43.0	-9 29	21 48.8	-14 28	10 37.2	10 12
Mar 31	0 5.8	3 1	23 29.2	-4 53	22 18.8	-11 49	10 33.4	10 33
Apr 10	23 56.1	-0 51	0 14.6	-0 4	22 48.1	-9 0	10 30.5	10 49
Apr 20	0 15.6	-0 43	0 59.9	4 48	23 17.0	-6 3	10 28.6	10 58
Apr 30	0 54.9	2 44	1 45.8	9 30	23 45.5	-3 2	10 27.9	11 1
May 10	1 48.1	8 23	2 32.8	13 51	0 13.7	0 1	10 28.3	10 56
May 20	2 55.3	15 16	3 21.5	17 39	0 41.7	3 2	10 29.9	10 45
May 30	4 19.4	21 46	4 11.9	20 41	1 9.6	5 59	10 32.5	10 28
Jun 9	5 53.0	25 8	5 4.1	22 47	1 37.6	8 48	10 36.1	10 5
Jun 19	7 16.4	24 15	5 57.5	23 48	2 5.6	11 27	10 40.5	9 37
Jun 29	8 19.6	20 40	6 51.2	23 39	2 33.7	13 53	10 45.7	9 5
Jul 9	9 0.5	16 15	7 44.3	22 20	3 1.9	16 5	10 51.6	8 28
Jul 19	9 15.7	12 43	8 36.1	19 57	3 30.1	18 1	10 58.0	7 48
Jul 29	9 1.5	11 55	9 26.0	16 37	3 58.2	19 39	11 4.8	7 5
Aug 8	8 34.6	14 19	10 13.9	12 32	4 26.2	21 0	11 12.0	6 19
Aug 18	8 37.5	16 52	11 0.2	7 54	4 53.8	22 2	11 19.5	5 31
Aug 28	9 25.9	15 58	11 45.4	2 55	5 20.7	22 46	11 27.3	4 41
Sep 7	10 37.6	10 35	12 30.0	-2 13	5 46.8	23 14	11 35.2	3 50
Sep 17	11 47.5	2 57	13 14.8	-7 19	6 11.7	23 26	11 43.1	2 59
Sep 27	12 50.2	-4 50	14 0.5	-12 9	6 35.1	23 27	11 51.1	2 8
Oct 7	13 48.2	-11 52	14 47.6	-16 33	6 56.7	23 19	11 58.9	1 17
Oct 17	14 43.7	-17 44	15 36.6	-20 16	7 16.1	23 5	12 6.7	0 28
Oct 27	15 35.9	-22 3	16 27.5	-23 6	7 32.8	22 51	12 14.2	-0 20
Nov 6	16 16.5	-24 9	17 20.0	-24 54	7 46.2	22 42	12 21.4	-1 6
Nov 16	16 18.4	-22 41	18 13.1	-25 30	7 55.8	22 41	12 28.3	-1 48
Nov 26	15 31.9	-17 12	19 5.9	-24 53	8 0.5	22 55	12 34.6	-2 27
Dec 6	15 28.8	-16 15	19 57.2	-23 6	7 59.7	23 26	12 40.3	-3 2
Dec 16	16 11.6	-19 30	20 46.0	-20 16	7 53.0	24 13	12 45.4	-3 32
Dec 26	17 10.5	-22 40	21 31.8	-16 36	7 40.5	25 10	12 49.6	-3 56

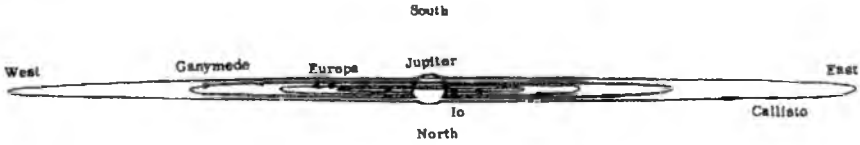
	Saturn		Uranus		Neptune		Pluto	
	RA	DEC	RA	DEC	RA	DEC	RA	DEC
	h m	° ′	h m	° ′	h m	° ′	h m	° ′
Jan 1	20 33.5	-19 22	18 59.6	-23 6	19 10.0	-21 44	15 33.6	-4 11
Jan 11	20 38.2	-19 6	19 2.2	-23 2	19 11.6	-21 41	15 34.7	-4 12
Jan 21	20 43.0	-18 48	19 4.7	-22 59	19 13.2	-21 38	15 35.6	-4 11
Jan 31	20 47.9	-18 30	19 7.2	-22 55	19 14.8	-21 36	15 36.3	-4 10
Feb 10	20 52.8	-18 12	19 9.5	-22 51	19 16.2	-21 33	15 36.9	-4 7
Feb 20	20 57.5	-17 53	19 11.6	-22 48	19 17.6	-21 30	15 37.2	-4 3
Mar 1	21 2.1	-17 35	19 13.5	-22 45	19 18.8	-21 28	15 37.2	-3 59
Mar 11	21 6.4	-17 17	19 15.1	-22 42	19 19.8	-21 26	15 37.1	-3 54
Mar 21	21 10.4	-17 1	19 16.5	-22 40	19 20.6	-21 24	15 36.7	-3 49
Mar 31	21 14.1	-16 46	19 17.4	-22 39	19 21.2	-21 23	15 36.1	-3 43
Apr 10	21 17.3	-16 33	19 18.0	-22 38	19 21.5	-21 22	15 35.4	-3 38
Apr 20	21 19.9	-16 22	19 18.3	-22 38	19 21.7	-21 22	15 34.6	-3 33
Apr 30	21 22.1	-16 14	19 18.2	-22 38	19 21.6	-21 22	15 33.6	-3 28
May 10	21 23.6	-16 8	19 17.7	-22 39	19 21.2	-21 22	15 32.5	-3 24
May 20	21 24.5	-16 6	19 16.9	-22 41	19 20.7	-21 23	15 31.5	-3 21
May 30	21 24.8	-16 6	19 15.9	-22 43	19 20.0	-21 25	15 30.5	-3 19
Jun 9	21 24.4	-16 10	19 14.5	-22 46	19 19.1	-21 26	15 29.5	-3 17
Jun 19	21 23.4	-16 16	19 13.0	-22 49	19 18.1	-21 28	15 28.6	-3 17
Jun 29	21 21.8	-16 25	19 11.3	-22 52	19 17.0	-21 30	15 27.8	-3 19
Jul 9	21 19.7	-16 36	19 9.6	-22 55	19 15.8	-21 32	15 27.2	-3 21
Jul 19	21 17.2	-16 49	19 7.9	-22 58	19 14.7	-21 35	15 26.8	-3 25
Jul 29	21 14.4	-17 3	19 6.2	-23 0	19 13.6	-21 37	15 26.5	-3 29
Aug 8	21 11.5	-17 17	19 4.7	-23 3	19 12.5	-21 39	15 26.5	-3 35
Aug 18	21 8.5	-17 31	19 3.4	-23 4	19 11.6	-21 41	15 26.7	-3 42
Aug 28	21 5.7	-17 43	19 2.4	-23 6	19 10.9	-21 42	15 27.1	-3 49
Sep 7	21 3.2	-17 54	19 1.7	-23 7	19 10.3	-21 43	15 27.7	-3 56
Sep 17	21 1.1	-18 3	19 1.3	-23 7	19 10.0	-21 44	15 28.5	-4 5
Sep 27	20 59.6	-18 10	19 1.2	-23 7	19 9.8	-21 45	15 29.5	-4 13
Oct 7	20 58.6	-18 14	19 1.6	-23 7	19 9.9	-21 45	15 30.6	-4 21
Oct 17	20 58.3	-18 15	19 2.3	-23 5	19 10.3	-21 45	15 31.9	-4 29
Oct 27	20 58.7	-18 13	19 3.3	-23 4	19 10.9	-21 44	15 33.2	-4 37
Nov 6	20 59.8	-18 8	19 4.7	-23 2	19 11.6	-21 43	15 34.7	-4 44
Nov 16	21 1.6	-18 0	19 6.4	-22 59	19 12.7	-21 42	15 36.2	-4 51
Nov 26	21 3.9	-17 50	19 8.3	-22 56	19 13.8	-21 40	15 37.7	-4 56
Dec 6	21 6.8	-17 37	19 10.5	-22 52	19 15.2	-21 38	15 39.2	-5 1
Dec 16	21 10.2	-17 22	19 12.8	-22 48	19 16.6	-21 35	15 40.6	-5 5
Dec 26	21 14.0	-17 5	19 15.3	-22 44	19 18.2	-21 33	15 42.0	-5 7

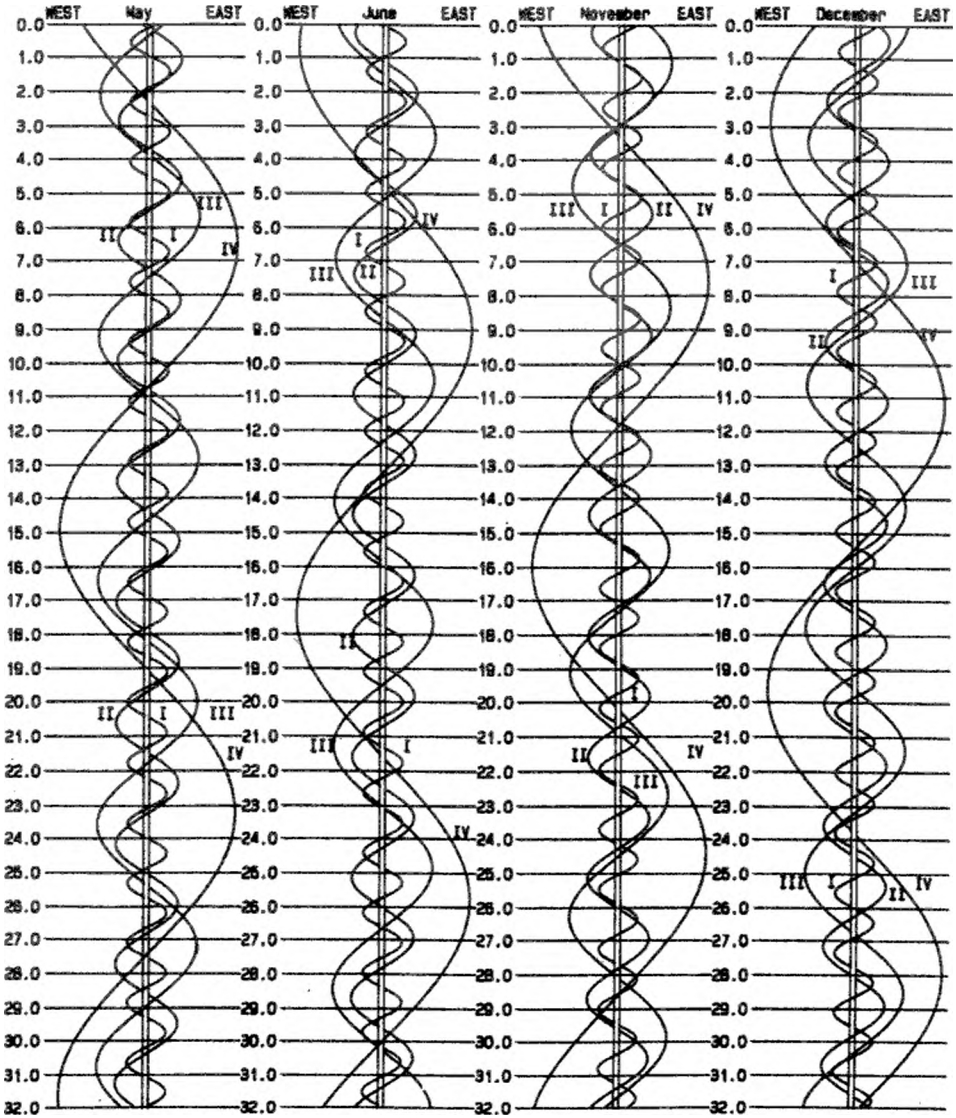
THE MOONS OF JUPITER

One of the most popular sights for an observer with a small telescope is Jupiter and its moons. Four of the sixteen - Io, Europa, Ganymede and Callisto - are generally clearly visible - they would just be visible to the naked eye were it not for the glare from the mother planet. As the diagram on the next page indicates, the system is seen almost edge-on so the moons always lie close to a straight line extending from the planet's equator. As they orbit, so they appear to oscillate from one side to the other, alternately passing in front and behind the planet. This motion is represented in the following diagrams which show how their positions along such a straight line change during the 8 months when Jupiter is prominent. For each month, time increases downward; the disc of Jupiter is stretched to make the central column, and horizontal lines representing midnight



(0 am SAST), are shown for every day of the month. The wavy lines show how the moons appear to ossilate from each side of the planet to the other.





When the moons pass in front and behind the planet, transits, occultations and eclipses occur. Details of such phenomena, occurring between the end of astronomical twilight in the evening and its commencement in the morning when the planet is above the horizon in Southern Africa, are given in the table below.

EXPLANATION OF THE TABLE.

- Date and predicted times are given; these are for mid-phenomean and are not instantaneous.
- The moon concerned are I - Io, II - Europa, III - Ganymede and IV - Callisto.
- Phenomena - the abbreviations used are D - Disappearance; Ec - Eclipse ie.the satellite passes through the shadow of Jupiter; R - Reappearance; Oc - Occultation ie.the satellite is obscured by the disc of Jupiter; I - Ingress; Sh - Shadow Transit ie.the shadow of the satellite transits the disc; E - Egress; Tr - Transit ie.the satellite crosses the disc of Jupiter.

d	h	m		d	h	m		d	h	m		d	h	m	
Jan 02	03	08	II.Sh.I.	Jan 28	03	58	I.Ec.D.	Feb 15	01	30	III.Ec.D.	Mar 04	05	50	III.Sh.E.
	05	23	II.Tr.I.		23	23	II.Oc.R.		20	18	I.Sh.E.		05	01	55	IV.Tr.I.
	03	04	42	III.Ec.D.	29	01	18	I.Sh.I.		20	36	I.Tr.E.		02	51	IV.Sh.I.
	04	03	11	II.Oc.R.		02	01	I.Tr.I.	18	21	55	III.Sh.E.		05	23	IV.Tr.E.
	05	03	49	I.Ec.D.		03	34	I.Sh.E.		22	52	III.Tr.E.	06	02	12	II.Tr.I.
	06	01	10	I.SE.I.		04	16	I.Tr.E.	19	02	55	II.Ec.D.		02	29	II.Sh.I.
		02	14	I.Tr.I.		22	27	I.Ec.D.	20	04	09	I.Ec.D.		04	58	II.Tr.E.
		03	26	I.Sh.E.	30	01	25	I.Oc.R.		21	16	II.Sh.I.		05	06	I.Tr.I.
		04	29	I.Tr.E.		22	03	I.Sh.E.		21	42	II.Tr.I.		05	14	I.Sh.I.
	22	57	III.Tr.I.		22	42	I.Tr.E.	21	00	04	II.Sh.E.		05	17	II.Sh.E.
07	01	32	IV.Oc.R.	31	21	20	IV.Tr.I.		00	27	II.Tr.E.	07	02	16	I.Oc.D.
	01	38	I.Oc.R.	Feb 01	00	38	IV.Tr.E.		01	27	I.Sh.I.		04	43	I.Ec.R.
	02	21	III.Tr.E.		02	40	III.Oc.R.		01	39	I.Tr.I.		19	58	III.Ec.R.
	22	56	I.Tr.E.	03	02	46	II.Sh.I.		03	43	I.Sh.E.		20	59	II.Oc.D.
11	00	49	II.Ec.D.		04	02	II.Tr.I.		03	54	I.Tr.E.		23	32	I.Tr.I.
12	23	45	II.Tr.E.		05	35	II.Sh.E.		22	37	I.Ec.D.		23	43	I.Sh.I.
13	03	04	I.Sh.I.	04	21	48	II.Ec.D.	22	01	05	I.Oc.R.	08	00	06	II.Ec.R.
	04	02	I.Tr.I.	05	01	40	II.Oc.R.		19	55	I.Sh.I.		01	47	I.Tr.E.
	05	20	I.Sh.E.		03	11	I.Sh.I.		20	05	I.Tr.I.		01	59	I.Sh.E.
	22	35	III.Sh.I.		03	45	I.Tr.I.		22	11	I.Sh.E.		20	42	I.Oc.D.
14	00	11	I.Ec.D.		05	28	I.Sh.E.		22	20	I.Tr.E.		23	12	I.Ec.R.
	02	07	III.Sh.E.	06	00	20	I.Ec.D.	23	19	30	I.Oc.R.	09	20	13	I.Tr.E.
	02	32	III.Tr.I.		03	10	I.Oc.R.	25	22	03	IV.Oc.R.		20	27	I.Sh.E.
	03	26	I.Oc.R.		21	40	I.Sh.I.		22	22	III.Sh.I.	11	05	14	III.Tr.I.
	22	29	I.Tr.I.		22	11	I.Tr.I.		22	44	III.Tr.I.	13	04	28	II.Tr.I.
	23	48	I.Sh.E.		23	56	I.Sh.E.	26	01	53	III.Sh.E.		05	06	II.Sh.I.
15	01	43	I.Tr.E.	07	00	26	I.Tr.E.		02	08	III.Tr.E.	14	04	00	I.Oc.D.
	01	05	IV.Sh.E.		21	36	I.Oc.R.		05	29	II.Ec.D.		19	01	III.Oc.D.
18	03	23	II.Ec.D.	08	00	31	III.Ec.D.	27	23	53	II.Sh.I.		23	12	II.Oc.D.
19	23	23	II.Tr.I.		23	32	IV.Ec.D.		23	57	II.Tr.I.		23	56	III.Ec.R.
20	00	24	II.Sh.E.	09	03	39	IV.Ec.R.	28	02	41	II.Sh.E.	15	01	16	I.Tr.I.
	02	07	II.Tr.E.		04	27	IV.Oc.D.		02	42	II.Tr.E.		01	37	I.Sh.I.
	04	57	I.Sh.I.	10	05	22	II.Sh.I.		03	21	I.Sh.I.		02	39	II.Ec.R.
21	02	04	I.Ec.D.	12	00	22	II.Ec.D.		03	22	I.Tr.I.		03	31	I.Tr.E.
	02	32	III.Sh.I.		03	55	II.Oc.R.		05	37	I.Sh.E.		03	53	I.Sh.E.
	05	13	I.Oc.R.		05	05	I.Sh.I.		05	38	I.Tr.E.		22	26	I.Oc.D.
	23	25	I.Sh.I.		05	29	I.Tr.I.	Mar 01	00	31	I.Ec.D.	16	01	06	I.Ec.R.
22	00	15	I.Tr.I.	13	02	14	I.Ec.D.		02	49	I.Ec.R.		19	42	I.Tr.I.
	01	41	I.Sh.E.		04	54	I.Oc.R.		21	32	II.Ec.R.		20	05	I.Sh.I.
	02	30	I.Tr.E.		21	28	II.Sh.E.		21	48	I.Tr.I.		20	23	II.Tr.E.
	23	39	I.Oc.R.		22	11	II.Tr.E.		21	49	I.Sh.I.		21	13	II.Sh.E.
23	05	30	IV.Ec.D.		23	33	I.Sh.I.		00	03	I.Tr.E.		21	57	I.Tr.E.
24	23	16	III.Oc.R.		23	55	I.Tr.I.		00	05	I.Sh.E.		22	21	I.Sh.E.
27	00	11	II.Sh.I.	14	01	49	I.Sh.E.		21	17	I.Ec.R.	17	19	35	I.Ec.R.
	01	43	II.Tr.I.		02	10	I.Tr.E.	04	01	59	III.Tr.I.	21	19	47	IV.Tr.E.
	02	59	II.Sh.E.		20	43	I.Ec.D.		02	20	III.Sh.I.		20	51	IV.Sh.I.
	04	27	II.Tr.E.		23	21	I.Oc.R.		05	23	III.Tr.E.		22	19	III.Oc.D.

d	h	m	
Mar 22	00	39	IV.Sh.E.
	01	27	II.Oc.D.
	03	00	I.Tr.I.
	03	31	I.Sh.I.
	03	54	III.Ec.R.
23	00	11	I.Oc.D.
	03	01	I.Ec.R.
	19	54	II.Tr.I.
	21	02	II.Sh.I.
	21	26	I.Tr.I.
	22	00	I.Sh.I.
	22	41	II.Tr.E.
	23	42	I.Tr.E.
	23	49	II.Sh.E.
24	00	15	I.Sh.E.
	21	30	I.Ec.R.
25	18	44	I.Sh.E.
29	01	41	III.Oc.D.
	03	43	II.Oc.D.
	23	05	IV.Oc.D.
30	01	57	I.Oc.D.
	02	50	IV.Oc.R.
	22	14	II.Tr.I.
	23	12	I.Tr.I.
	23	40	II.Sh.I.
	23	54	I.Sh.I.
31	01	00	II.Tr.E.
	01	28	I.Tr.E.
	02	09	I.Sh.E.
	02	26	II.Sh.E.
	20	24	I.Oc.D.
	23	25	I.Ec.R.
Apr 01	18	44	III.Tr.E.
	19	54	I.Tr.E.
	20	38	I.Sh.E.
	21	04	II.Ec.R.
	21	43	III.Sh.E.
07	00	35	II.Tr.I.
	00	59	I.Tr.I.
	01	48	I.Sh.I.
	02	17	II.Sh.I.
	03	14	I.Tr.E.
	03	21	II.Tr.E.
	22	11	I.Oc.D.
08	01	20	I.Ec.R.
	18	44	III.Tr.I.
	19	11	II.Oc.D.
	19	26	I.Tr.I.
	20	17	I.Sh.I.
	21	41	I.Tr.E.
	22	12	III.Tr.E.
	22	14	III.Sh.I.
	22	32	I.Sh.E
	23	38	II.Ec.R.
09	01	41	III.Sh.E.
	19	48	I.Ec.R.
14	02	46	I.Tr.I.
	23	59	I.Oc.D.
15	21	13	I.Tr.I.
	21	32	II.Oc.D.
	22	11	I.Sh.I.
	22	16	III.Tr.I.
	23	29	I.Tr.E.

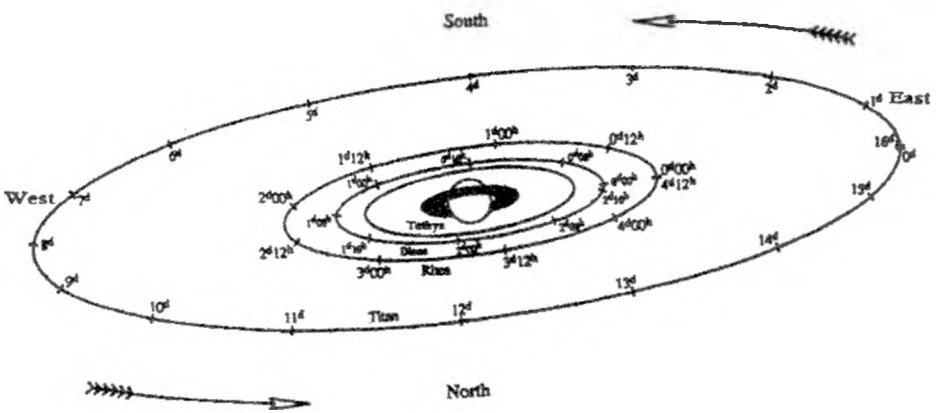
d	h	m	
Apr 15	23	44	IV.Ec.D.
16	00	26	I.Sh.E.
	01	44	III.Tr.E.
	02	13	II.Ec.R.
	02	13	III.Sh.I.
	21	43	I.Ec.R.
17	18	55	I.Sh.E.
	18	57	II.Tr.E.
	20	58	II.Sh.E.
19	19	50	III.Ec.R.
22	01	49	I.Oc.D.
	23	03	I.Tr.I.
	23	55	II.Oc.D.
23	00	06	I.Sh.I.
	01	18	I.Tr.E.
	01	51	III.Tr.I.
	20	16	I.Oc.D.
	22	40	IV.Tr.I.
	23	39	I.Ec.R.
24	18	34	I.Sh.I.
	18	36	II.Tr.I.
	19	45	I.Tr.E.
	20	49	I.Sh.E.
	20	51	II.Sh.I.
	21	23	II.Tr.E.
	23	35	II.Sh.E.
26	19	20	III.Oc.R.
	20	22	III.Ec.D.
	23	49	III.Ec.R.
30	00	53	I.Tr.I.
	22	07	I.Oc.D.
May 01	01	34	I.Ec.R.
	19	20	I.Tr.I.
	20	29	I.Sh.I.
	21	05	II.Tr.I.
	21	36	I.Tr.E.
	22	44	I.Sh.E.
	23	28	II.Sh.I.
	23	52	II.Tr.E.
02	20	03	I.Ec.R.
	21	21	IV.Ec.R.
03	19	32	III.Oc.D.
	20	39	II.Ec.R.
	23	03	III.Oc.R.
04	00	21	III.Ec.D.
07	23	19	I.Oc.D.
08	21	12	I.Tr.I.
	22	24	I.Sh.I.
	23	27	I.Tr.E.
	23	36	II.Tr.I.
09	00	38	I.Sh.E.
	18	27	I.Oc.D.
	21	58	I.Ec.R.
10	19	07	I.Sh.E.
	19	14	IV.Tr.E.
	23	13	II.Ec.R.
	23	19	III.Oc.D.
14	21	33	III.Sh.E.
15	23	05	I.Tr.I.
16	00	18	I.Sh.I.
	20	20	I.Oc.D.
	23	53	I.Ec.R.
17	18	47	I.Sh.I.

d	h	m	
May 17	19	48	I.Tr.E.
	20	34	II.Oc.D.
	21	01	I.Sh.E.
18	18	22	I.Ec.R.
	23	28	IV.Oc.D.
19	20	45	II.Sh.E.
21	20	30	III.Tr.E.
	22	10	III.Sh.I.
23	22	15	I.Oc.D.
24	19	27	I.Tr.I.
	20	42	I.Sh.I.
	21	42	I.Tr.E.
	22	56	I.Sh.E.
	23	07	II.Oc.D.
25	20	17	I.Ec.R.
26	20	39	II.Sh.I.
	20	50	II.Tr.E.
	23	22	II.Sh.E.
27	20	59	IV.Sh.I.
28	20	59	III.Tr.I.
31	21	22	I.Tr.I.
	22	37	I.Sh.I.
	23	37	I.Tr.E.
Jun 01	18	39	I.Oc.D.
	19	44	III.Ec.R.
	22	12	I.Ec.R.
02	19	20	I.Sh.E.
	20	42	II.Tr.I.
	23	17	II.Sh.I.
	23	28	II.Tr.E.
04	20	15	II.Ec.R.
	21	34	IV.Oc.R.
07	23	17	I.Tr.I.
08	18	44	III.Oc.R.
	20	19	III.Ec.D.
	20	35	I.Oc.D.
09	19	00	I.Sh.I.
	20	02	I.Tr.E.
	21	14	I.Sh.E.
10	18	36	I.Ec.R.
11	22	50	II.Ec.R.
13	18	11	IV.Sh.E.
15	19	19	III.Oc.D.
	22	32	I.Oc.D.
	22	51	III.Oc.R.
16	19	43	I.Tr.I.
	20	55	I.Sh.I.
	21	59	I.Tr.E.
17	20	31	I.Ec.R.
18	20	18	II.Oc.D.
20	20	30	II.Sh.E.
23	21	41	I.Tr.I.
24	19	00	I.Oc.D.
	22	26	I.Ec.R.
25	18	26	I.Tr.E.
	19	33	I.Sh.E.
26	21	26	III.Sh.E.
27	20	25	II.Sh.I.
	20	53	II.Tr.E.
Jul 01	20	59	I.Oc.D.
02	19	13	I.Sh.I.
	20	24	I.Tr.E.
	21	28	I.Sh.E.

d	h	m	
Jul 03	18	50	I.Ec.R.
	21	09	III.Tr.E.
04	20	51	II.Tr.I.
06	19	53	II.Ec.R.
08	21	07	IV.Ec.R.
09	20	07	I.Tr.I.
	21	08	I.Sh.I.
10	20	44	I.Ec.P.
14	19	36	III.Ec.R.
17	19	27	I.Oc.D.
18	19	46	I.Sh.E.
20	20	34	II.Oc.D.
21	20	06	III.Oc.R.
	20	16	III.Ec.D.
22	20	12	II.Sh.E.
25	18	36	I.Tr.I.
	19	26	I.Sh.I.
26	19	03	I.Ec.R.
29	20	08	II.Sh.I.
Nov 01	04	11	II.Oc.R.
10	04	07	III.Tr.E.
15	04	40	I.Ec.D.
16	04	09	I.Sh.E.
17	04	16	II.Tr.E.
	04	47	III.Sh.E.
23	03	49	I.Sh.I.
	04	47	I.Tr.I.
24	04	13	I.Oc.R.
	04	27	II.Tr.I.
28	02	56	III.Oc.R.
Dec 01	02	54	I.Ec.D.
02	02	24	I.Sh.E.
	03	27	I.Tr.E.
03	04	37	II.Oc.R.
05	02	47	III.Ec.R.
	04	12	III.Oc.D.
08	04	47	I.Ec.D.
09	02	04	I.Sh.I.
	03	12	I.Tr.I.
	04	18	I.Sh.E.
10	02	26	II.Ec.D.
	02	36	I.Oc.R.
12	03	39	III.Ec.D.
16	03	58	I.Sh.I.
	05	08	I.Tr.I.
17	04	31	I.Oc.R.
	05	02	II.Ec.D.
18	01	49	I.Tr.E.
19	01	47	II.Tr.I.
	01	57	II.Sh.E.
	04	15	II.Tr.E.
23	02	30	III.Tr.I.
24	03	01	I.Ec.D.
25	01	32	I.Tr.I.
	02	33	I.Sh.E.
	03	44	I.Tr.E.
26	01	58	II.Sh.I.
	04	24	II.Tr.I.
	04	30	II.Sh.E.
28	01	55	II.Oc.R.
30	01	29	III.Sh.I.
	04	29	III.Sh.E.
31	04	54	I.Ec.D.

THE MOONS OF SATURN

Saturn's moons are considerably fainter than the 4 Galilean moons of Jupiter. The diagram shows the orbits of 4 of Saturn's moons at opposition on August 7. The easiest to find is Titan (magnitude +8.5), according to the diagram and information in the table below.



TITAN

Eastern Elongation			Inferior Conjunction			Western Elongation			Superior Conjunction		
	d	h		d	h		d	h		d	h
Jan	1	04.3	Jan	5	06.5	Jan	9	11.2	Jan	13	09.1
	17	04.9		21	07.3		25	11.9		29	09.7
Feb	2	05.5	Feb	6	08.1	Feb	10	12.7	Feb	14	10.3
	18	06.1		22	08.8		26	13.3	Mar	1	10.7
Mar	5	06.6	Mar	9	09.4	Mar	13	13.7		17	11.0
	21	07.0		25	09.8		29	14.0	Apr	2	11.1
Apr	6	07.0	Apr	10	09.9	Apr	14	13.9		18	10.9
	22	06.8		26	09.6		30	13.5	May	4	10.3
May	8	06.2	May	12	08.9	May	16	12.7		20	09.4
	24	05.2		28	07.8	Jun	1	11.5	Jun	5	08.1
Jun	9	03.7	Jun	13	06.3		17	09.8		21	06.4
	25	01.9		29	04.4	Jul	3	07.8	Jul	7	04.3
Jul	10	23.8	Jul	15	02.1		19	05.5		23	02.1
	26	21.4		30	23.6	Aug	4	03.1	Aug	7	23.6
Aug	11	19.0	Aug	15	21.0		20	00.6		23	21.2
	27	16.5		31	18.6	Sep	4	22.2	Sep	8	19.0
Sep	12	14.3	Sep	16	16.3		20	20.1		24	17.0
	28	12.3	Oct	2	14.4	Oct	10	15.4	Oct	10	15.4
Oct	14	10.8		18	13.0		22	17.0		26	14.2
	30	09.7	Nov	3	12.0	Nov	7	16.1	Nov	11	13.4
Nov	15	09.0		19	11.5		23	15.7		27	12.9
Dec	1	08.7	Dec	5	11.4	Dec	9	15.6	Dec	13	12.9
	17	08.8		21	11.6		25	15.8		29	13.0

COMETS AND METEORS

COMETS

A typical comet consists of a solid nucleous surrounded by a very large envelope of gas and dust, called the coma; in some instances, comets might develop a tail. Depending on the length of their periods around the Sun, comets are classed into 2 groups: Short-period comets, with an average of a 7 year period, an orbital inclination of about 13 degrees and small orbital eccentricities, (0.2 to 0.9) and usually travel in a direct motion: Long-period comets have a period greater than 200 years, random orbital inclinations and about 0.9999 eccentricity and random motion.

About a dozen comets are observed each year and of these, 5 or 6 are new discoveries. As a comet approaches or moves away from the Sun its visual appearance changes drastically and it might become bright enough to be observed with modest equipment such as a good pair of binoculars or a telescope with an aperture not less than 75mm; on rare occasions a very bright comet may become visible to the naked-eye.

Interested observers can contribute with valuable information by reporting on their visual appearance such as coma magnitude, apparent diameter and degree of condensation; if the comet sports a tail, its length in degrees and its p.a. (position angle) should also be reported, as well as the type of instrument and magnification used.

Another area much in need of observers, is that of regularly conducting visual searches of possible new comets, namely in the southern celestial hemisphere. Interested members are asked to contact the Director of the Comet and Meteor Section:

Jose Campos, 19 Fiskaal Place, Woodhaven, Durban 4001.

METEORS

Orbiting within the solar system, METEOROIDS often collide with the Earth's atmosphere and as a result, they heat to incandescence by friction with the atmosphere's gaseous molecules and an emission of light takes place due to ionization; while in flight through the atmosphere they are called METEORS and they disintegrate completely. There are two types of meteors: Sporadic ones which may be seen at any time of the night, anywhere in the sky; the shower meteors are associated with known meteor showers that are active during certain times of the year (See the Table on the next page). Bright meteors of visual magnitude equal or greater than that of Venus (-4.0 mag.), are classed as Fireballs and if they explode while in flight, they are termed Bolides. Fireballs of visual magnitude equal or brighter than that of the Full Moon are known to produce debris that when found on the ground are called METEORITES. Interested persons are asked to contact the Director:

Jose Campos, 19 Fiskaal Place, Woodhaven, Durban 4001.

In the event of Fireballs, please phone 031-423684 at any time.

Predicted Limits	Meteor Shower	Radiant (1950) R.A.	Dec	Date at Maximum	Transit of Radiant SAST	Alt	Conditions at Maximum	Z.H.R.	Recommended watch at Max. Beginning: SAST	Alt	Ending: SAST	Alt	V km/s
Jan 06-28	Alha Crucids	12h48	-63	Jan 19	04h56	57	Full Moon	?	-		-		50
Jan 23-Mar 12	Theta Centaurids	14h00	-40	Feb 08	05h05	76	Good	?	00h00	31	04h00	70	60
Mar 01-12?	Pyxids (new)	09h00	-35	Mar 06?	22h02	85	Good	6?	20h00	63	03h15	26	
Mar 13-18	Corona Australids	16h20	-48	Mar 16	04h43	72	Poor	5	23h15	26	04h30	71	
Mar 21-Apr 08	Delta Pavonids	20h10	-65	Mar 29?	07h43	55	Good	7	02h00	28	04h00	41	
Apr 16-25	April Lyrids	18h05	+34	Apr 22	04h06	28	Poor	15	03h00	26	05h00	26	49
Apr 11-May 12	Alpha Scorpids	16h00	-22	May 03	01h16	82	Good	7	21h00	33	04h30	46	
Apr 20-Jul 30	Sco-Sgr System	18h00	-30	Jun 14	00h29	90	Poor	10	21h00	45	04h00	44	30
Apr 19-May 28	Eta Aquarids	22h24	-01	May 03	07h23	60	Good	30	14h00	31	05h00	43	
May 25-Jun 20	Chi Scorpids	16h28	-13	Jun 05	23h30	73	Good	6?	19h00	25	04h10	25	
Jun 08-16	Sagittarids	20h16	-35	Jun 11	02h59	85	Poor	4?	21h45	26	05h10	62	
Jun 08-16	Theta Ophiuchids	17h48	-28	Jun 13	00h23	88	Poor	5?	20h00	34	05h00	30	
Jun 10-21	June Lyrids	18h32	+35	Jun 16	00h53	25	Poor	5	23h30	22	01h30	24	31
Jun 17-26	Ophiuchids	17h20	-20	Jun 20	23h22	80	Poor	10	19h00	30	02h00	53	
Jun 26-29	Cetids (new)	02h00	-15	Jun 28	07h35	75	Good	?	03h00	25	05h20	56	
Jul 10-Aug 05	Capricornids	21h00	-15	Jul 26	00h47	75	Favourable	8	20h30	30	05h15	25	
Jul 14-Aug 25	North Delta Aquarids	22h36	-05	Aug 12	01h13	65	Poor	5	21h00	26	04h30	37	42
Jul 03-Aug 25	Alpha Capricornids	20h36	-10	Jul 30	23h41	70	Good	8	20h00	33	04h00	29	23
Jul 09-Aug 17	Piscis Australids	22h40	-30	Jul 29	02h03	89	New Moon	12	21h30	32	05h00	51	35
Jul 15-Aug 25	South Iota Aquarids	22h20	-15	Aug 05	01h29	75	Favourable	3	22h00	40	04h00	52	34
Aug 11-Sep 20	North Iota Aquarids	21h48	-06	Aug 20	23h51	66	Favourable	10	20h00	31	04h00	28	31
Jul 08-Aug 19	South Delta Aquarids	22h12	-17	Jul 29	02h07	77	New Moon	20	22h00	33	05h00	47	41
Sep 15-Nov 26	Southern Taurids	03h22	+14	Nov 03	00h31	46	Poor	12	21h30	28	03h00	34	27
Sep 13-Dec 01	Northern Taurids	03h53	+22	Nov 13	00h27	38	Poor	8	23h30	36	01h00	37	29
Oct 02-Nov 07	Orionids	06h24	+15	Oct 22	04h23	45	Favourable	20	02h00	33	03h20	42	66
Nov 14-21	Leonids	10h08	+22	Nov 17	06h21	38	Favourable	10	03h00	18	03h30	23	71
Nov 28-Dec 09	December Phoenicids	01h00	-55	Dec 05	20h07	65	Poor	5?	20h30	64	01h00	33	18
Dec 04-16	Geminids	07h28	+33	Dec 14	01h55	28	Favourable	50	23h30	19	03h00	26	35
Dec 05-Jan 07	Velaids	09h56	-51	Dec 29	03h25	69	Good	15?	23h00	37	03h30	69	40

The times (SAST) and the altitudes (Alt) given, are for an observer stationed at E 30.5 S 29.5 (Durban), to be used as a guide for meteor observers elsewhere. The times for the recommended watch and the conditions, are based on the radiant altitude and on moonlight and twilight interference during the date of the predicted maximum meteor activity. The Zenithal Hourly Rate (ZHR) is the probable number of meteors expected to be seen by an experienced observer during 1 hour, when the radiant is at the zenith and with seeing conditions corresponding to a naked-eye limiting magnitude of +6.5 mag. near the zenith.

For meaningful visual work, the minimum altitude of the radiant should be 25 degrees above the horizon. Depending on the altitude (Alt) of the radiant at the time of observations, the following table gives the factor (F) by which the hourly observed rate should be multiplied to compute the ZHR:

Alt (deg)	21	27	35	43	52	66	90
F	2.0	1.67	1.43	1.25	1.11	1.0	

The perception coefficient (P-value) varies from observer to observer, hence the absolute necessity of keeping the count per hour (hourly rate) on an individual basis when working in group. A high P-value can mean that a specific observer gets a higher ZHR under the reported seeing conditions than the "average" observer and this can be explained by the fact that the observer may have really seen more meteors/hour or more frequently, that the limiting magnitude at the time of the observation, is not properly estimated. Hence, it is important that the faintest naked-eye star seen near the zenith, be carefully derived from reliable star atlases or catalogues.

The Stars

CONSTELLATIONS

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

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

STAR NAMES

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

STELLAR MAGNITUDES AND STELLAR DISTANCES

The apparent brightness of a star - which depends both on its true luminosity and its distance - is indicated by its magnitude. Equal intervals of magnitude represent equal ratios in light intensity.

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

DOUBLE STARS

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

STAR CLUSTERS

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

NEBULAE

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

THE STAR CHARTS

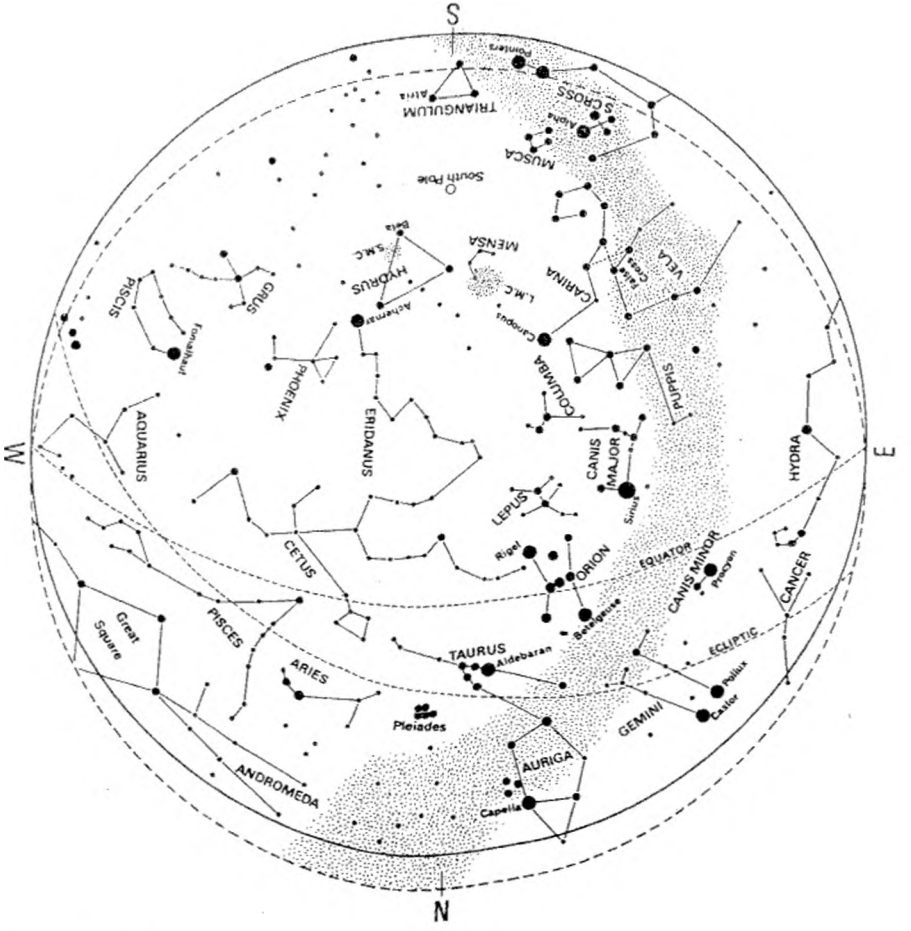
The star charts in this section show the night sky for each of the four seasons of the year. These seasonal charts depict stars down to magnitude 3.5 which is approximately what will be visible to the naked eye in city areas. Charts of 3 of the most interesting regions in the sky (showing stars down to magnitude 4.5) - the Orion region, visible in Summer; the Scorpius region, visible in Winter and the Southern Cross Region, visible all year round - are featured. They are rich in interesting objects visible to the naked eye, or with the aid of binoculars or a small telescope. To use them locate the constellations in the sky from the seasonal chart and rotate the regional chart to match the orientation of the constellations in the sky.

THE SUMMER SKY

The chart below represents the sky in Cape Town on December 1 at midnight, January 1 at 10 pm and February 1 at 8 pm. Corrections for places other than Cape Town are

Bloemfontein and Port Elisabeth	-30 minutes
Johannesburg	-40 minutes
Durban	-50 minutes
Harare	-52 minutes

Correct times for places elsewhere may be found by subtracting 4 minutes for each degree of longitude east of Cape Town or adding 4 min for each degree of longitude west of Cape Town.



Courtesy of the

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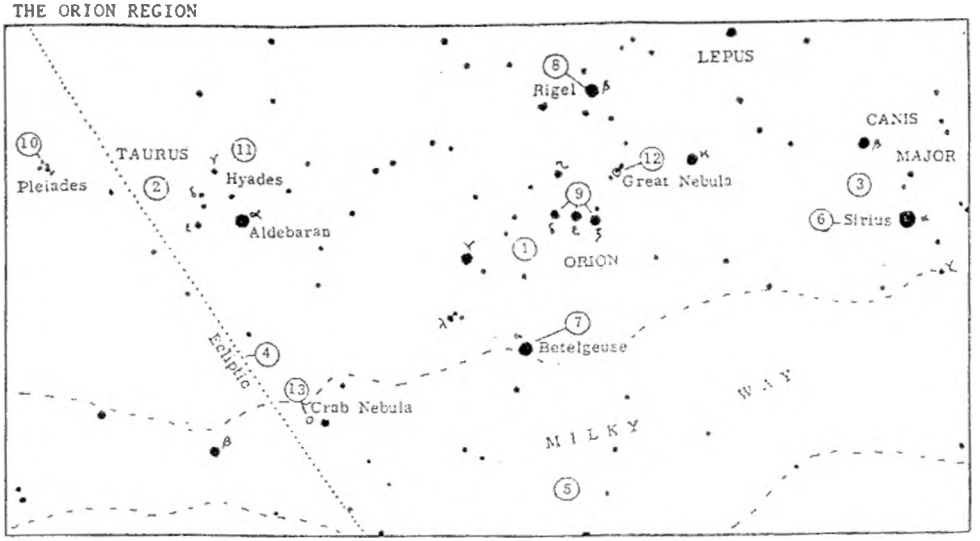
THE ORION REGION



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

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

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

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

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

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

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

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

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

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

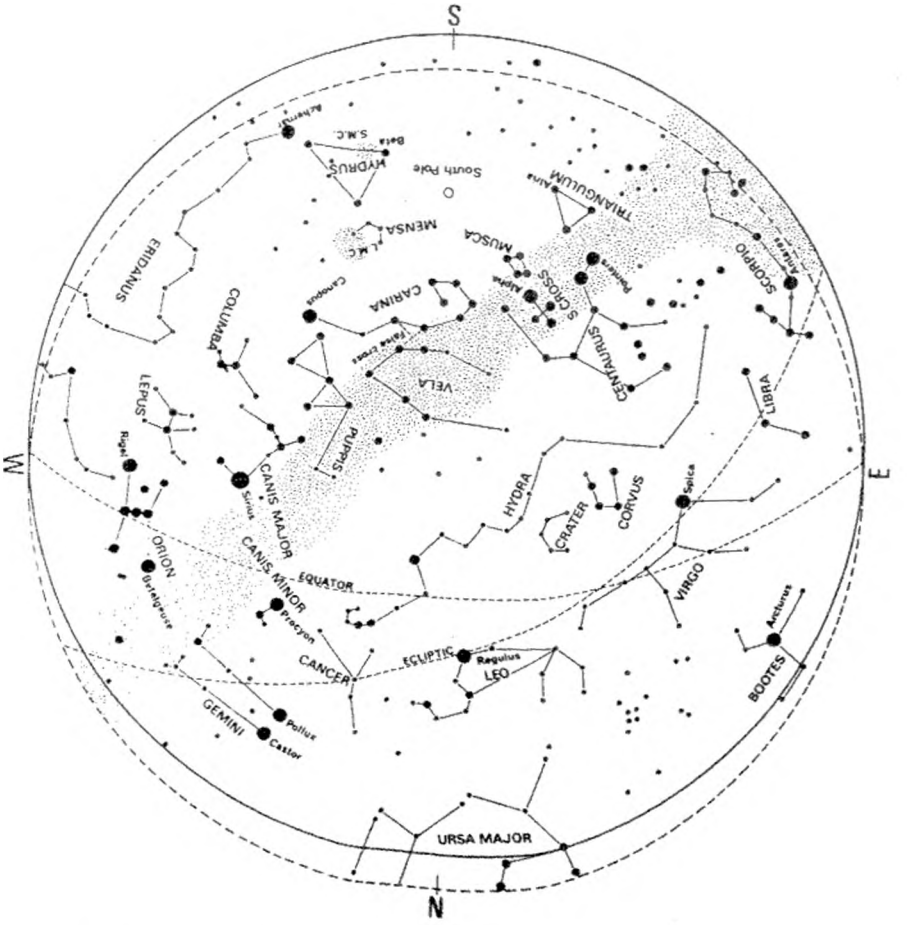
(13) The Crab Nebula, the remnant of a supernova recorded by the Chinese in 1054, requires a moderate sized telescope for observation. In its heart is located the extraodinary pulsar which emits a double flash of light 30 times every second. The current belief is that it is a rapidly rotating neutron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

THE AUTUMN SKY

The chart below represents the sky in Cape Town on March 1 at midnight, April 1 at 10 pm and May 1 at 8 pm. Corrections for places other than Cape Town are

Bloemfontein and Port Elisabeth	-30 minutes
Johannesburg	-40 minutes
Durban	-50 minutes
Harare	-52 minutes

Correct times for places elsewhere may be found by subtracting 4 minutes for each degree of longitude east of Cape Town or adding 4 min for each degree of longitude west of Cape Town.



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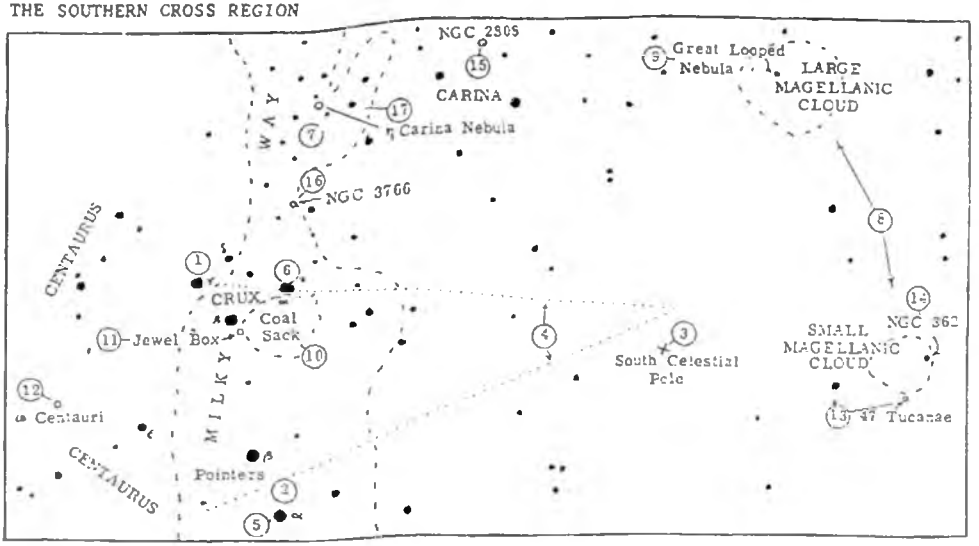
THE SOUTHERN CROSS REGION



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

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

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

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

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

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

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

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

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

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

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

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

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

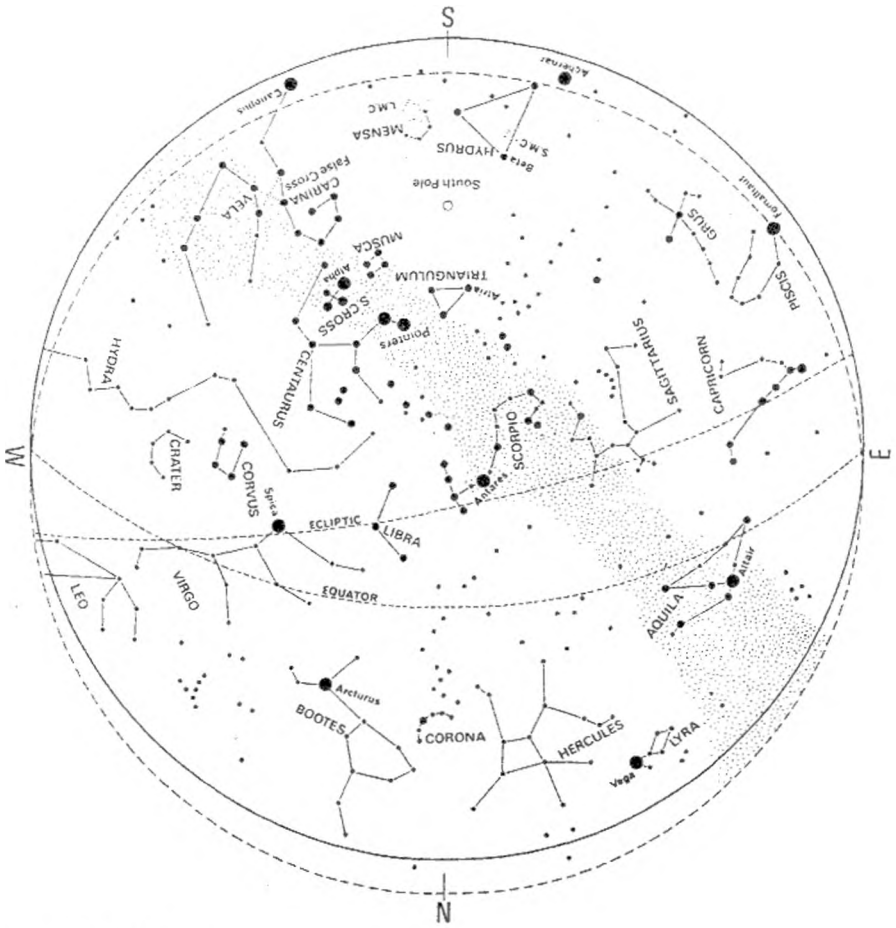
(17) The η Carinae nebula - site of a slow supernova that brightened to magnitude -0,8 in 1843 and is now of magnitude 6,4.

THE WINTER SKY

The chart below represents the sky in Cape Town on June 1 at midnight, July 1 at 10 pm and August 1 at 8 pm. Corrections for places other than Cape Town are

Bloemfontein and Port Elisabeth	-30 minutes
Johannesburg	-40 minutes
Durban	-50 minutes
Harare	-52 minutes

Correct times for places elsewhere may be found by subtracting 4 minutes for each degree of longitude east of Cape Town or adding 4 min for each degree of longitude west of Cape Town.



Courtesy of the

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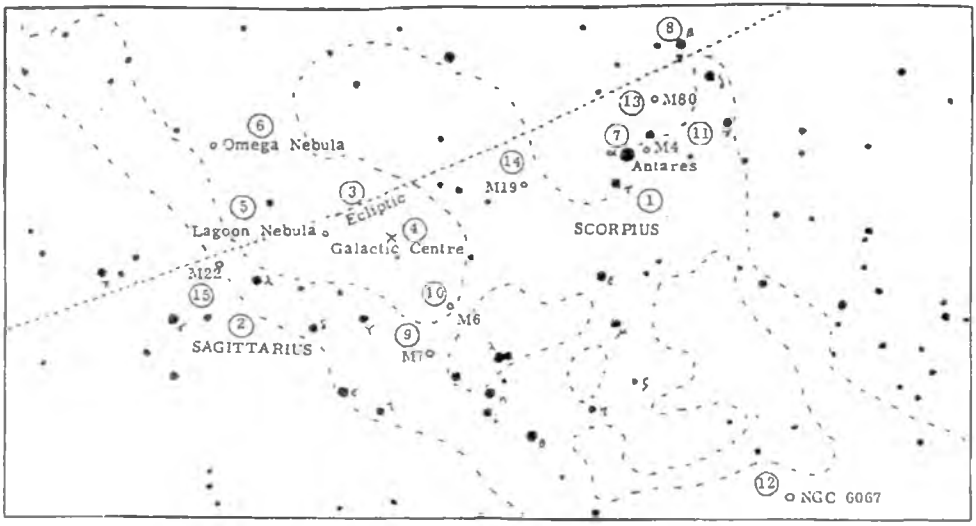
THE SCORPIUS REGION



(1) The constellation of Scorpius. The creature is depicted with α in the centre of the body and δ and π the claws. The distinctive tail ε — ζ — η curls round to the sting λ.

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

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

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

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

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

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

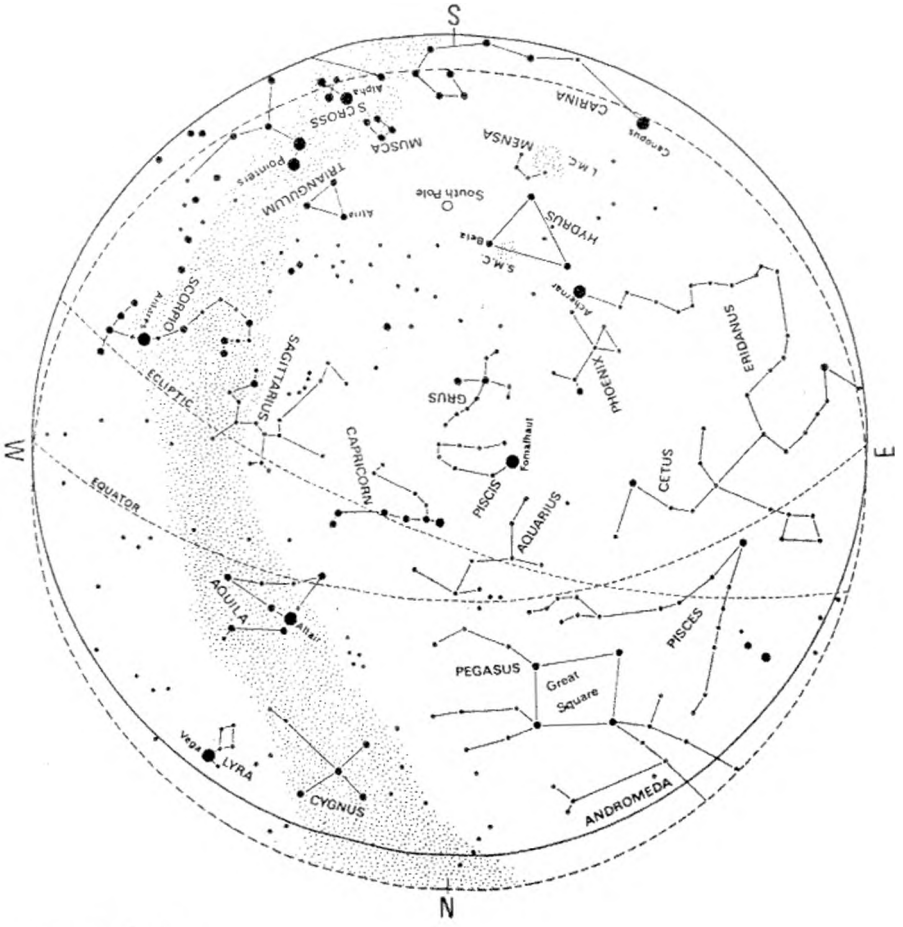
Further from the plane of the Milky Way are some globular clusters: (13) M80 (14) M19 and (15) M22.

THE SPRING SKY

The chart below represents the sky in Cape Town on September 1 at midnight, October 1 at 10 pm and November 1 at 8 pm. Corrections for places other than Cape Town are

Bloemfontein and Port Elisabeth	-30 minutes
Johannesburg	-40 minutes
Durban	-50 minutes
Harare	-52 minutes

Correct times for places elsewhere may be found by subtracting 4 minutes for each degree of longitude east of Cape Town or adding 4 min for each degree of longitude west of Cape Town.



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VARIABLE STAR OBSERVING

The latest (1985) edition of the "General Catalogue of Variable Stars" lists more than 28 000 stars. Professional observatories cannot possibly monitor all of these, and this makes the observation of variable stars a field in which amateurs can make a real contribution to astronomical knowledge.

Of these 28 000 stars at least 2 000 are suitable for visual monitoring in the southern hemisphere. However, the number of active observers in this part of the world remains woefully small, and less than 400 variables are at present being observed from Southern Africa.

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

In recent years amateur observers have played an invaluable part by alerting the operators of orbiting satellite observatories whenever outburst occurred of certain eruptive variables.

Visual estimates of magnitude are made by comparing the variable with two or more comparison stars, respectively brighter and fainter than the unknown variable. Suitable comparison stars are shown on special charts, which have been prepared for each variable, mainly by the two variable star organisations mentioned above. The use of these charts is essential for accurate, standardized observations and intending new observers are therefore advised to obtain the necessary data by contacting the Director of the Variable Star Section,

Mr. J. Hers, P.O. Box 48, Sedgefield, 6573, Telephone (04455) 31736.

They will then be sent charts of a few easy objects and data on stars which may be observed with the equipment at their disposal.

Prospective observers should, when writing, give brief details of their equipment. Larger, more powerful telescopes will naturally greatly increase the number of stars which may be measured, but many variables are bright enough to be observed through most of their cycles with quite modest equipment, e.g. binoculars. Some stars, such as 071044 L2 Puppis, are so bright that they may be observed without optical aid whatever.

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

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

Most suitable for beginners are the long period variables (or Mira variables, named after the typical representative Mira = o Ceti) which belongs to the class of pulsating stars. They are giant stars which vary through a range of brightness of 2.5 to 5 magnitudes or more, and which have well defined periodicities, ranging from 80 to 1000 days. In most cases one observation per observer every 10 days will suffice.

Typical examples include:

			Approximate magnitude range
021403	o	Ceti(Mira)	2.0-10.1
092962	R	Carinae	3.9-10.0
100661	S	Carinae	4.5-9.9

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

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

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

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

NOVA SEARCHING

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

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

ORDINARY OCCULTATIONS

These phenomena concern a specialised branch of observational astronony in which both professional and amateur participate. The tables of predictions must necessarily occupy a number of pages as this handbook is the sole published source for Southern Africa.

An occultation occurs when the disk of the Moon moves in front of a star. Timings of occultations, to a precision of one-tenth of a second if possible are very valuable for studies of the Moon's shape and motion. Since only very modest equipment is required, amateurs can make important contributions in this field. Persons interested in making and reporting occultation observations are urged to contact the Director of the Society's Occultation Section:
Mr. M.D. Overbeek, P.O. Box 212, Edenvale, 1610 Tel: (011) 453 6918

Predictions of occultations of all stars brighter than magnitude 7.5 supplied by Hydrographic Dept., Tokyo are given below. The main set of tables give predictions for three stations, namely:

	Longitude	Latitude
Cape Town	18°.475 E	33°.933 S
Johannesburg	28°.075 E	26°.182 S
Harare	31°.000 E	17°.800 S

This does not restrict its use to observers in those centres. The approximate time of an occultation at a place $\Delta\lambda$ degrees west and $\Delta\varphi$ degrees north of one of the standard stations given above may be found from:

Approximate time = predicted time + a.$\Delta\lambda$ + b.$\Delta\varphi$

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

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

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

EXPLANATIONS OF ABBREVIATIONS USED IN THE TABLES:

Z.C.	-	the number of the star in the Zodiacal Catalogue. An "m" following the number indicates the star is not single.
Mag.	-	the visual magnitude
Ph	-	the Phase: D = Disappearance, R = Reappearance
h.m.	-	the time of the occultation in UT
a,b	-	parameters in minutes for predicting times other than at standard stations (as explained above in the text)
P.A.	-	The Position Angle on the Moon's limb measured eastward from the north point

UT					CAPE TOWN E 18.5 S 33.9				JOHANNESBURG E 28.1 S 26.2				HARARE E 31.0 S 17.8			
DATE	I.C.	Mag.	Ph	ELG	TIME	a.	b.	P.A.	TIME	a.	b.	P.A.	TIME	a.	b.	P.A.
M D				°	h m	m	m	°	h m	m	m	°	h m	m	m	°
Jan 11	21	7.9	DD	75	19 36.2	-0.9	+2.3	39								
Jan 13	267	7.3	DD	98	19 11.2	-4.3	-6.1	147	19 22.0	-1.9	-0.4	119	19 28.1	-1.7	+0.5	94
Jan 13	266m	5.7	DD	98					19 26.1			141	19 23.3	-1.8	-0.1	106
Jan 15	537m	3.8	DD	124	20 36.7	-2.0	+0.4	102	20 59.9	-1.8	+1.0	80	21 17.3	-2.0	+1.9	54
Jan 15	536	5.4	DD	124	20 37.6	-2.0	+1.3	64	21 12.5	-2.3	+2.8	37				
Jan 15	541	4.0	DD	125	21 17.2	-2.0	+1.8	51								
Jan 15	539	4.4	DD	125	21 20.6			10								
Jan 15	546	7.0	DD	125	21 30.1	-1.7	+1.1	80	21 57.8	-1.7	+2.1	52				
Jan 15	545	4.3	DD	125	22 01.2			177	21 51.2	-0.8	-0.2	121	21 55.7	-1.1	+0.5	93
Jan 15	553m	6.8	DD	125	22 3.8	-1.5	+1.3	76								
Jan 15	552	3.0	DD	125	22 6.4	-1.0	+0.3	116	22 20.9	-1.0	+0.9	87	22 34.7	-1.3	+1.7	58
Jan 15	551	7.1	DD	125					22 26.9	-0.3	-0.5	131	22 27.9	-0.7	+0.3	100
Jan 15	550	6.8	DD	125									22 32.0	-0.3	-0.7	126
Jan 15	557	6.6	DD	125	22 36.8	-1.3	+1.6	66								
Jan 15	561	5.2	DD	125	22 56.3	-0.6	+0.5	112								
Jan 15	560m	3.8	DD	126	23 2.5	-0.2	-0.3	134								
Jan 15	552	3.0	RB	126	23 8.0	-1.2	+1.8	240								
Jan 16	733m	7.2	DD	139	23 33.1	-0.5	-0.1	129								
Jan 29	2347	4.8	RD	298	2 53.1			226	3 11.2	-1.8	-0.9	273	3 3.6	-1.3	-2.0	304
Feb 1	2762	6.0	RD	331									2 53.3	-1.1	+1.2	226
Feb 9	221m	3.7	DD	67									18 10.7	-1.1	-0.4	115
Feb 13	822m	5.9	DD	119	22 31.4	-0.2	-0.4	138	22 36.0	-0.5	+0.5	100	22 45.7	-0.9	+1.4	68
Feb 15	1125	6.5	DD	143									16 59.6	-2.0	-1.6	123
Feb 15	1129	5.3	DD	143					17 50.9	-1.9	-3.6	163	17 34.8	-2.2	-2.0	133
Feb 23	2039	5.6	RD	244	3 35.6	-2.7	+0.8	262								
Mar 8	311	6.5	DD	48									16 44.8	-0.9	-2.0	134
Mar 10	598m	5.7	DD	74	19 23.1	-0.1	-1.0	145	19 25.6	-0.5	+0.4	107	19 33.3	-0.8	+1.0	78
Mar 13	1078	5.9	DD	111	17 42.1	-2.1	-0.8	113	18 1.8	-2.7	+0.2	88	18 19.5	-4.1	+2.5	55
Mar 14	1217	6.1	DD	125					17 53.8	-0.9	-3.7	172	17 36.0	-2.0	-2.1	140
Mar 14	1241m	6.4	DD	128									23 18.6	-0.2	-0.6	127
Mar 20	1970m	6.2	RD	210					23 51.4	-3.4	+0.9	256	23 58.4	-2.6	-1.0	292
Mar 24	2510	6.3	RD	257					22 0.1	-1.2	+1.0	225	22 4.1	-0.6	-0.3	261
Mar 24	2513	4.3	RD	257	22 32.5	-2.4	+3.2	205	22 47.1	-0.9	-0.5	258	22 41.9	-0.5	-1.2	288
Mar 25	2523	4.9	RD	258	1 32.5	-1.3	-2.5	304								
Apr 8	880	7.2	DD	68	17 39.4	-1.6	+0.5	102	18 3.7	-1.9	+1.7	66				
Apr 10	1186	6.1	DD	95	20 9.7	-0.4	-1.1	151	20 13.0	-0.9	+0.1	111	20 21.5	-1.6	+1.3	76
Apr 12	1428	3.8	DD	121									18 35.0	-0.4	-3.4	173
Apr 13	1564m	6.6	DD	137	22 44.1	-1.6	+0.7	95								
Apr 14	1662	6.3	DD	147									18 2.9	-0.7	-3.0	164
Apr 19	2290	2.5	RD	212	18 27.9	+0.1	-0.9	265	18 17.7	+0.2	-1.3	295	18 3.2	+0.6	-1.9	323
Apr 21	2589	4.8	RD	237									22 26.3	-2.2	+1.1	235
Apr 22	2736m	6.2	RD	248									21 25.1	-0.9	+0.7	235
Apr 25	3015	5.3	RD	273	4 8.3	-3.1	-1.6	285								
May 10	1519	6.5	DD	105	19 41.4	-2.5	+1.3	80								
May 11	1623	5.4	DD	118	18 42.1	-1.6	-1.4	131	18 58.2	-2.9	+0.4	89				
May 12	1743	6.8	DD	131	18 48.2	-1.4	-2.0	140	18 56.9	-2.7	-0.5	101	19 18.8			51
May 17	2290	2.5	DB	187	5 7.6	+0.2	+1.5	72								
May 18	2523	4.9	RD	205									18 1.6	-1.3	+1.8	219
Jun 3	1086	6.5	DD	34					15 54.9	+0.4	-2.3	167				
Jun 4	1236m	5.1	DD	47	16 16.9	-0.8	-0.9	144	16 24.8	-1.3	+0.3	104	16 37.3	-2.3	+2.0	66

UT DATE M D	Y.C.	Mag.	Ph	ELG °	CAPE TOWN E 18.5 S 33.9 TIME h m	a. b. m m	P.A. °	JOHANNESBURG E 28.1 S 26.2 TIME h m	a. b. m m	P.A. °	HARARE E 31.0 S 17.8 TIME h m	a. b. m m	P.A. °
Jun 4	1241m	6.4	DD	48	17 8.9	-1.4 +1.0	90						
Jun 6	1489	6.8	DD	76							20 7.0	+0.0 -1.9	160
Jun 8	1723	7.1	DD	103	21 3.2	-0.9 -0.6	133	21 12.3	-0.9 +0.6	99	21 25.9	-0.8 +2.7	60
Jun 10	1958	7.5	DD	128	21 2.5	-1.8 -0.9	126	21 19.8	-1.8 +0.7	92	21 40.1	-1.7 +3.6	52
Jun 11	1970m	6.2	DD	130	0 46.7	-0.6 -0.8	144						
Jun 13	2359m	4.8	DD	165	21 52.9	-2.6 +1.0	74						
Jun 16	2797	3.0	RD	200	23 45.6	-2.0 +2.6	219	24 23.3	-2.1 +2.0	235	24 43.3	-2.7 +1.0	257
Jun 20	3272	5.8	DD	244							22 55.7		332
Jun 20	3272	5.8	RD	244	23 13.8	-1.1 -0.4	250	23 22.6	-2.0 -1.1	272	23 8.5		315
Jul 3	1440	6.7	DD	45							17 19.9	-0.2 -1.4	148
Jul 4	1566	6.6	DD	60	19 8.5	+0.1 -3.3	180	18 58.5	-0.3 -0.7	135	18 57.4	-0.4 +0.1	103
Jul 6	1788m	6.7	DD	85	17 52.0	+0.3 -5.7	187	17 40.8	-1.6 -1.4	136	17 39.7	-2.2 -0.2	103
Jul 6	1800	5.4	DD	87				21 23.6	-0.5 -2.3	164	21 14.2	-0.3 -0.6	127
Jul 8	2039	5.6	DD	111				19 5.5	-1.9 -3.0	153	18 56.4	-2.4 -1.0	118
Jul 10	2290	2.5	DD	133	15 24.3	-1.2 -0.7	76						
Jul 10	2290	2.5	RB	133	16 25.5	-0.6 -2.7	319						
Jul 10	2305	5.9	DD	135							20 3.3		153
Jul 21	42	5.6	RD	249	2 14.8	-0.7 +2.4	196	2 43.7	-1.0 +3.0	196	3 11.2	-1.7 +2.6	212
Jul 22	160	6.2	RD	260	2 12.6	-2.0 -0.1	255	2 36.2	-2.7 +0.4	256	2 46.7	-3.8 -0.3	274
Jul 25	556	5.5	RD	297	3 59.2	-1.7 -0.7	265	4 14.1	-2.4 -0.5	271			
Jul 25	564	6.1	RD	297	4 35.5	-3.7 -3.5	317						
Aug 2	1745	7.0	DD	54							16 25.9		191
Aug 3	1872	7.3	DD	68				16 44.9	-0.9 -4.3	174	16 28.4	-1.8 -1.5	133
Aug 5	2129	7.4	DD	94	18 19.3	-2.4 +2.4	63						
Aug 6	2274	6.7	DD	107	21 4.2	-1.7 -0.5	126	21 17.3	-1.1 +0.2	108	21 24.5	-0.7 +0.8	84
Aug 6	2290	2.5	DD	108	23 46.3	-0.0 +0.9	95						
Aug 7	2290	2.5	RB	108	0 41.2	+0.4 +1.1	262						
Aug 7	2430	7.0	DD	120	23 40.5	-0.3 +1.3	83	23 50.9	+0.1 +1.2	75			
Aug 9	2567	7.1	DD	132	1 0.7	+0.5 +2.5	35						
Aug 11	2863	6.1	DD	154	2 13.6	+0.1 +2.0	48						
Aug 18	233	6.2	RD	241							21 46.9	+0.7 +3.4	184
Aug 21	501	6.1	RD	267	3 37.2	-4.9 -4.8	325						
Aug 22	652	6.4	RD	278	2 33.5	-2.4 -2.2	302	2 42.5	-3.5 -2.8	312			
Aug 24	983	6.0	RD	304				2 38.0	-1.1 -0.8	268	2 34.0	-1.5 -1.2	288
Aug 31	1958	7.5	DD	51							18 11.6	-0.7 -1.3	141
Sep 2	2216	7.0	DD	76				18 23.1	-2.1 -2.3	146	18 19.3	-1.6 -0.3	113
Sep 3	2359m	4.8	DD	87							16 10.1	-3.1 +0.2	89
Sep 4	2507	6.7	DD	99				18 15.0		143	18 9.6	-3.0 -0.5	107
Sep 6	2797	3.0	DD	122				17 47.5		146	17 33.0	-3.6 -0.9	101
Sep 15	317	6.4	RD	222							19 57.0	-0.4 +0.4	240
Sep 19	767	5.5	RD	262	4 4.2	-2.4 +1.1	235						
Sep 24	1468	4.9	RD	327				3 10.0	-0.6 -0.1	248	3 8.2	-0.8 -0.7	273
Sep 30	2290	2.5	DD	55	13 56.4		184	13 39.8	-2.5 -1.8	125	13 40.2	-3.0 -0.0	93
Sep 30	2290	2.5	RB	55	14 7.9		199	15 2.7	-2.3 +1.6	251	15 15.7	-2.5 -0.1	281
Oct 2	2595	5.7	DD	81	18 39.1	-2.3 -0.3	116	18 58.4	-1.6 +0.3	105	19 7.5	-1.1 +0.9	84
Oct 2	2604	6.6	DD	81	19 21.0	-2.0 -0.2	118	19 37.3	-1.3 +0.2	109	19 44.5	-0.7 +0.7	87
Oct 2	2608	6.9	DD	82							20 24.6		141
Oct 3	2746	5.8	DD	92							18 28.4	-3.4 -1.3	118
Oct 3	2757	5.1	DD	93	20 9.1	-0.8 +2.1	57	20 30.4	-0.3 +2.0	51	20 48.9	+0.3 +2.5	31
Oct 3	2760	6.7	DD	93	21 0.7	+0.5 +3.5	17	21 21.6		6			

UT					CAPE TOWN E 18.5 S 33.9				JOHANNESBURG E 28.1 S 26.2				HARARE E 31.0 S 17.8			
DATE	Z.C.	Mag.	Ph	ELG	TIME	a.	b.	P.A.	TIME	a.	b.	P.A.	TIME	a.	b.	P.A.
M D				°	h m	m	m	°	h m	m	m	°	h m	m	m	°
Oct 7	3229	5.6	DD	135	17 20.5	+0.4	+6.9	350								
Oct 14	435	5.9	RD	208	2 39.0	-1.9	+2.0	229								
Oct 15	716	6.2	RD	230									23 19.2	-1.4	+2.3	214
Oct 28	2403	7.5	DD	37	18 38.6	-0.1	+1.1	89								
Oct 30	2704	5.8	DD	62					20 12.6			139				
Oct 30	2708	5.9	DD	62	20 22.6	+0.0	+1.4	73								
Nov 2	3093	4.5	DD	96	22 9.6	-0.5	+1.2	93	22 20.4	-0.0	+1.1	84				
Nov 5	3417	6.8	DD	126									17 11.2			349
Nov 13	976	3.2	RD	223					20 22.1	+0.0	+0.8	224	20 26.3	-0.6	+0.1	249
Nov 14	1127	5.9	RD	237	23 6.3	-1.3	-1.5	289	23 9.0	-1.9	-1.8	304	22 55.4	-2.2	-3.2	330
Nov 26	2635	5.7	DD	29	18 38.6	+0.2	+1.3	75								
Nov 29	3045	6.0	DD	64	21 3.8	+0.4	+2.4	23								
Dec 2	3376	6.4	DD	96					18 40.6	-0.4	+3.9	7				
Dec 4	65	7.3	DD	118									19 20.5			130
Dec 11	1086	6.5	RD	206	23 50.6	-1.8	-1.9	326								
Dec 14	1468	4.9	RD	246	23 13.5	-0.8	-2.3	327	22 58.5			357				
Dec 27	3104	6.5	DD	42					17 36.2	+0.2	+2.9	17				
Dec 31	31	6.2	DD	87	20 27.5	-0.9	+2.3	46								
Dec 31	31	6.2	DD	87	20 27.5	-0.9	+2.3	46								

GRAZING OCCULTATIONS

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

The maps on the following pages have been prepared by the Hydrographic Dept., Tokyo to show the tracks of stars brighter than 7.5 magnitude which will graze the limb of the Moon when it is at a favourable elongation from the Sun and at least 10° above the observer's horizon (2° in the case of bright stars). Each track starts in the west at some arbitrary time given in the key and ends beyond the area of interest, except where the Moon is at a low altitude, the bright limb or sunlight interferes.

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

The equipment needed is similar to that used for ordinary or "total" occultations, but must, of course, be portable. A 75 mmn refractor is ideal for average events, but instruments with a larger aperture have often shown their superiority under difficult conditions. Timing is best carried out with a portable tape recorder and a small FM radio tuned to a pre-arranged transmission.

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

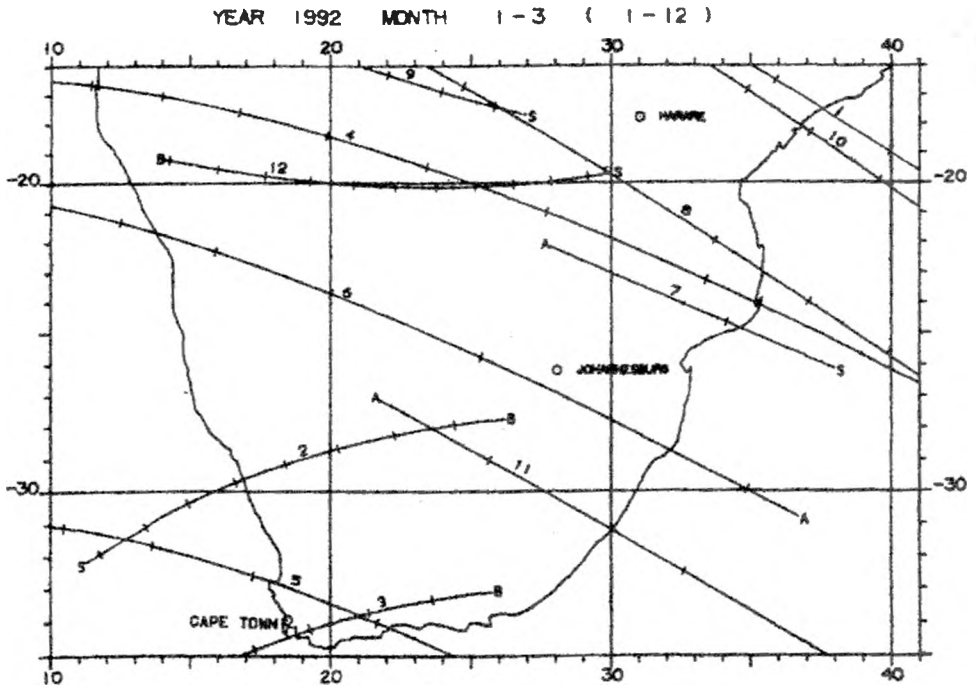
Interested observers - especially those living in the more distant regions - who wish to be informed of favourable grazes occurring in their neighbourhood, are therefore invited to contact the co-ordinator for grazing occultations:

Mr.M.D. Overbeek, P.O. Box 212, Edenvale, 1610. Tel: (011) 453 6918

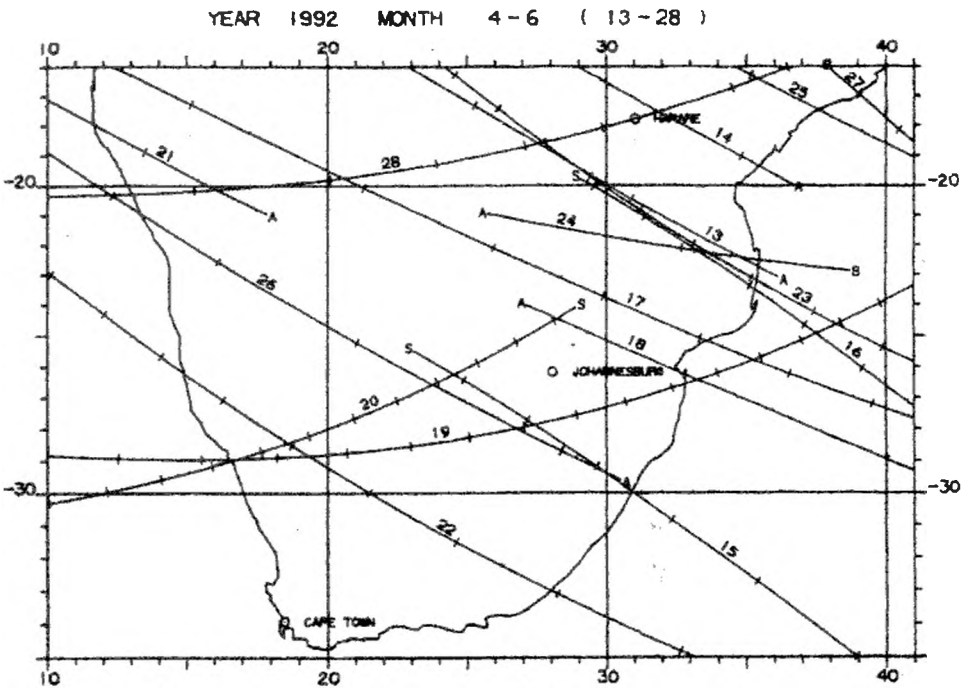
EXPLANATION OF THE COLUMN HEADINGS IN THE TABLES:

SEQ	: Sequential number in the year. The same number is attached to the corresponding track on the map.
NZC NO	: Zodiacal Catalogue number of the star.
MAG	: Magnitude of the star.
MON, DAY, H. M, S	: Month, day, hour, minute and second in SAST for the west end of the track.
SUNLIT (%)	: Percentage of the Moon sunlit (a minus sign indicates a waning Moon).
LIMIT	: Whether the track is the north (N) or the south (S) limit of the occultatlon. (A) denotes that the Moon is at a low altitude. (B) denotes that the star is occultated at bright limb. (S) denotes that the daylight interferes.

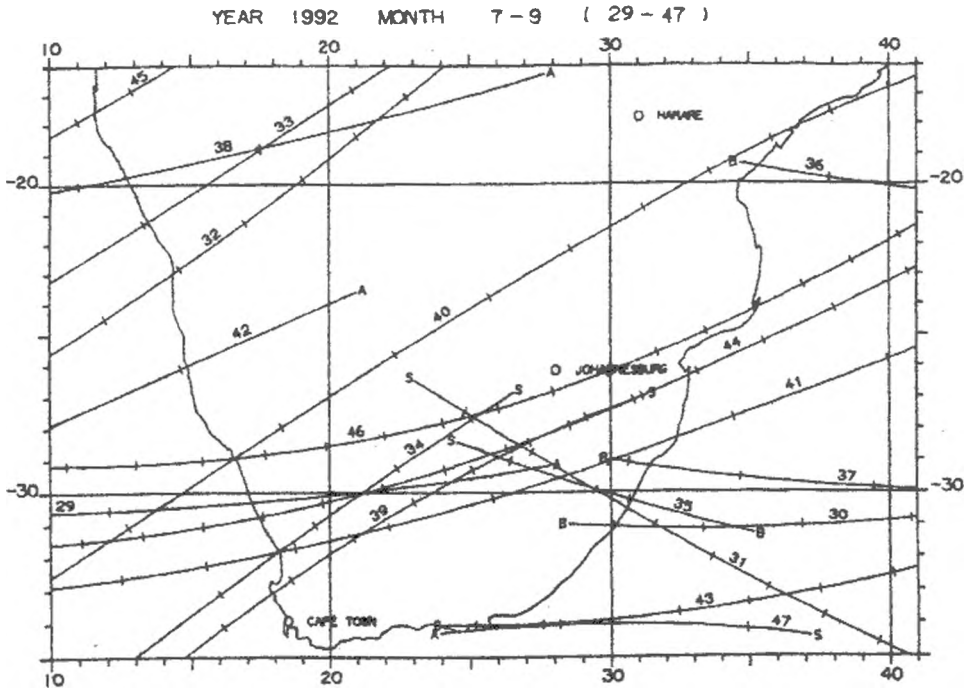
The map gives the graze tracks or the limits of occultations. Along each track on the map tick marks are qiven for the points corresponding to the multiples of five minutes of every hour, while the prediction for the west end of each track is shown in the table. e.g.if the time for the west end of a track is 5h 43m 21s, the tick marks proceeding eastward correspond to 5h 45m 00s, 5h 50m 00s, 5h 55m 00s etc.



SEQ	NZC NO	MAG	MON	DAY	H	M	S	SUNLIT(%)	LIMIT		
1	2235	6.21	1	1	3	49	4.82	-12.86	S	( )	( )
2	266m	5.73	1	13	20	53	29.07	57.08	S	(S)	(B)
3	267	7.32	1	13	21	13	30.86	57.12	S	( )	(B)
4	536	5.43	1	15	23	12	0.60	78.11	N	( )	( )
5	539	4.37	1	15	23	19	11.43	78.20	N	( )	( )
6	541	4.02	1	15	23	45	53.69	78.26	N	( )	(A)
7	2762	6.04	2	1	4	32	5.71	-5.86	S	(A)	(S)
8	2283	6.68	2	25	0	53	58.51	-52.97	S	( )	( )
9	2443	5.78	2	26	5	32	38.52	-41.65	S	( )	(S)
10	1078	5.91	3	13	20	46	54.14	68.24	N	( )	( )
11	2510	6.26	3	24	23	43	8.18	-60.79	S	(A)	( )
12	2675	7.08	3	26	4	49	40.41	-49.37	N	(B)	(S)

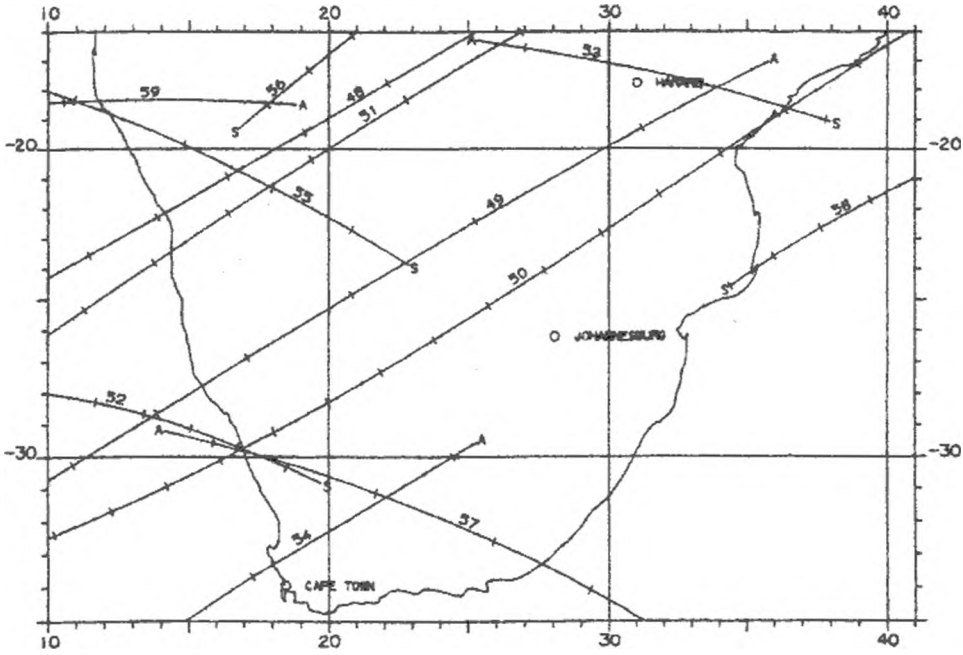


SEQ	NZC NO	MAG	MON	DAY	H	M	S	SUNLIT(%)	LIMIT		
13	880	7.16	4	8	20	27	17.33	31.17	N	( )	(A)
14	882	5.02	4	8	21	7	20.14	31.35	N	( )	(A)
15	1036	6.51	4	9	18	40	51.40	41.60	N	(S)	( )
16	1171	6.28	4	10	18	18	42.20	52.91	N	(S)	( )
17	2589	4.76	4	21	23	43	19.86	-76.54	S	( )	( )
18	2736m	6.24	4	22	23	2	29.08	-68.08	S	(A)	( )
19	3008	6.93	4	25	3	46	9.53	-47.66	N	( )	( )
20	3015	5.30	4	25	5	14	48.67	-47.28	N	( )	(S)
21	1150	6.80	5	7	21	57	24.16	28.89	N	( )	(A)
22	1519	6.50	5	10	21	44	37.12	62.85	N	( )	( )
23	1623	5.40	5	11	21	8	48.02	73.30	N	( )	( )
24	3072	6.63	5	22	23	37	22.87	-65.60	S	(A)	(B)
25	1236m	5.10	6	4	18	59	29.44	15.84	N	( )	( )
26	1241m	6.43	6	4	19	26	23.88	16.10	N	( )	(A)
27	1705	7.50	6	8	17	26	12.39	58.82	N	(S)	( )
28	3272	5.80	6	21	0	30	58.61	-71.54	N	( )	( )



SEQ	NZC NO	MAG	MON	DAY	H	M	S	SUNLIT(%)	LIMIT		
29	1800	5.41	7	6	23	33	55.03	46.79	S	( )	(A)
30	2039	5.58	7	8	21	37	27.74	67.62	S	(B)	( )
31	2290	2.54	7	10	17	46	25.48	84.63	N	(S)	( )
32	160	6.22	7	22	3	26	44.04	-57.95	N	( )	( )
33	556	5.51	7	25	5	11	47.85	-26.88	N	( )	( )
34	564	6.11	7	25	6	11	12.92	-26.65	N	( )	(S)
35	1623	5.40	8	1	18	2	23.41	11.62	N	(S)	(B)
36	1745	7.00	8	2	18	41	48.22	20.48	S	(B)	( )
37	1872	7.34	8	3	19	9	5.94	30.75	S	(B)	( )
38	2011	6.53	8	4	22	44	4.91	42.87	S	( )	(A)
39	501	6.11	8	21	5	17	11.40	-52.55	N	( )	(S)
40	652	6.35	8	22	3	58	10.03	-42.23	N	( )	( )
41	2216	7.03	9	2	20	15	38.58	37.40	S	( )	( )
42	2226	6.95	9	2	23	11	58.58	38.31	S	( )	(A)
43	2357m	6.56	9	3	18	32	26.49	47.26	S	(S)	( )
44	2507	6.72	9	4	19	52	23.88	58.01	S	( )	( )
45	2661	7.06	9	5	22	37	24.38	68.20	S	( )	( )
46	2797	3.02	9	6	19	18	48.85	76.36	S	( )	( )
47	1468	4.89	9	24	4	58	8.10	-7.73	S	(A)	(S)

YEAR 1992 MONTH 10 - 12 (48 - 59)



SEQ	NZC NO	MAG	MON	DAY	H	M	S	SUNLIT(%)	LIMIT		
48	2597	7.00	10	2	21	16	48.72	41.74	S	( )	( )
49	2608	6.86	10	2	22	8	27.57	42.01	S	( )	(A)
50	2746	5.75	10	3	19	54	22.47	51.42	S	( )	( )
51	2759	3.61	10	3	22	37	11.97	52.04	S	( )	( )
52	1047	5.22	10	18	5	20	1.08	-61.33	S	( )	(S)
53	1662	6.28	10	23	4	18	54.96	-10.04	S	(A)	(S)
54	2704	5.80	10	30	22	12	40.85	25.73	S	( )	(A)
55	1743	6.84	11	20	4	48	55.67	-21.05	S	( )	(S)
56	3154	7.39	11	30	19	41	34.67	35.48	S	(S)	( )
57	1705	7.50	12	17	1	43	54.51	-47.33	S	(A)	( )
58	3452	6.82	12	30	18	59	54.53	36.20	S	(S)	( )
59	31	6.19	12	31	23	19	32.43	46.91	N	( )	(A)

MINOR PLANET OCCULTATIONS

A number of A.S.S.A. members and professional observatories form part of a worldwide network which observes the above events. The Southern Africa network comprises approximately 35 observers and more observers are badly needed. Very little experience is needed, apart from the ability to locate some of the fainter naked eye stars and familiarity with the user's telescope, which does not have to be a large equatorial. The only other equipment needed is a small FM radio and portable tape recorder.

Observations, especially when made by more than one observer, can be used to refine our knowledge of the size, shape and orbit of a minor planet, to greater accuracy than that obtainable with large Earth-based instruments.

Further information and detailed instructions on finding the occulted stars can be obtained from:

M.D. Overbeek, P O Box 212, Edenvale, 1610. Tel (011) 453-6918.

OCCULTATAONS BY MINOR PLANETS

Date	SAST	MINOR PLANET	Pmag	CAT STAR	Smag	Mag drop	Duration seconds
d	h m						
JAN 7	23 14	94 AURORA	12.6	PPM 92040	11.0	2.1	83.3
JAN 15	1 24	511 DAVIDA	10.2	FAC 389326	11.0	0.6	29.4
JAN 23	23 08	2060 CHIRON	15.9	FAC 361318	11.0	4.8	20.1
FEB 29	5 42	654 ZELINDA	12.2	PPM 596071	8.2	4.0	13.5
FEB 29	21 18	51 NEMAUSA	12.0	FAC 122166	11.0	1.6	9.1
MAR 12	18 58	38 LEDA	12.6	AGK3R R 5917	7.0	5.7	11.3
MAR 20	5 48	195 EURYKLEIA	14.5	SAO 185781	9.1	5.4	5.7
MAR 31	18 34	51 NEMAUSA	12.3	FAC 148107	11.0	2.3	5.3
APR 1	20 16	29 AMPHITRITE	10.6	PPM 96641	10.0	1.4	11.9
APR 18	4 38	1149 VOLGA	15.3	PPM 549435	9.5	5.8	4.7
MAY 2	6 11	308 POLYXO	12.4	AC 24647	11.2	1.5	37.9
MAY 3	3 45	97 KLOTHO	13.3	PPM 511997	9.4	4.0	6.2
MAY 13	4 49	223 ROSA	15.2	LickV 5575	10.8	4.3	12.5
MAY 30	4 35	175 ANDROMACHE	12.6	PPM 552490	7.7	4.9	11.1
JUN 5	1 54	27 EUTERPE	10.6	PPM 551949	9.2	1.7	9.2
JUN 10	6 22	510 MABELLA	13.6	PPM 172711	10.0	4.4	4.8
JUN 22	5 50	109 FELICITAS	13.5	PPM 577158	8.4	5.2	6.0
JUL 4	5 17	68 LETO	10.9	PPM 532316	9.2	1.9	17.3
JUL 18	3 34	52 EUROPA	12.1	FAC 52331	11.0	1.9	14.5
AUG 7	18 26	30 URANIA	11.4	LickV 881	10.4	1.4	35.1
AUG 11	0 04	279 THULE	15.1	AC 11126	10.7	4.4	17.6
SEP 6	5 14	18 MELPOMENE	10.6	FAC 215734	12.0	0.5	5.1
SEP 11	23 51	307 NIKE	15.8	LickV 4239	10.5	5.2	7.2
SEP 13	20 06	380 FIDUCIA	14.5	PPM 551121	9.1	5.4	3.4
SEP 22	22 32	21 LUTETIA	11.2	AC 13908	10.9	0.9	7.6
SEP 24	4 58	88 THISBE	13.0	LickV 2318	10.6	2.6	9.1
NOV 2	23 54	756 LILLIANA	15.2	PPM 148519	10.0	5.9	5.5
NOV 12	20 14	546 HERODIAS	13.7	PPM 144083	9.0	4.9	7.7
NOV 2	13 47	769 TATJANA	14.4	PPM 556139	7.5	6.9	3.3
NOV 25	2 14	41 DAPHNE	12.2	PPM 148139	6.0	6.8	11.4
DEC 6	19 54	41 DAPHNE	12.2	PPM 147883	9.0	4.0	11.3
DEC 30	20 59	18 MELPOMENE	9.1	FAC 317543	10.0	0.5	14.6

TIME SYSTEMS

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

TIME SIGNALS

CSIR offers a time service with an accuracy to within one millisecond, in place of the discontinued ZUO service. The service is available through the telephone line.

Prospective users need have access to a telephone, an IBM-compatible PC with a modem and a "pulse buffer unit" which will be needed to synchronise other timing equipment external to the PC.

Registered users will be supplied with an authorised access code and user manual on a floppy disc. On running the software supplied, the user's computer automatically dials the CSIR time service number and establishes a link with the time service computer. The user's PC is then set to within one electronic "clock tick" of CSIR's national time standard. At the same time a pulse is generated at a pin on the printer port of the user's computer which is accurate to within one millisecond of the national time standard. This pulse can be used to synchronise other timing equipment external to the PC.

Users must pay a registration fee, a monthly fee and a fee for each call made to the system to the CSIR. In addition the user incurs the normal Post Office telephone charges.

Enquiries to: CSIR Time Service, Rm 230, Division of Production Technology, CSIR, P O Box 395, Pretoria, 0001. Tel: (012) 841-2036/841-4623. Telefax: (012) 841-2131

SOUTH AFRICAN STANDARD TIME

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

TIME OF SUN'S TRANSIT OVER 30° MERIDIAN

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

	h	m	s		h	m	s		h	m	s
Jan 1	12	3	17	May 10	11	56	22	Sep 17	11	54	22
11	12	7	43	20	11	56	30	27	11	50	53
21	12	11	10	30	11	57	31	Oct 7	11	47	45
31	12	13	22	Jun 9	11	59	15	17	11	45	18
Feb 10	12	14	15	19	12	1	21	27	11	43	52
20	12	13	49	29	12	3	28	Nov 6	11	43	40
Mar 1	12	12	18	Jul 9	12	5	13	16	11	44	51
11	12	9	58	19	12	6	16	26	11	47	25
21	12	7	6	29	12	6	25	Dec 6	11	51	11
31	12	4	5	Aug 8	12	5	34	16	11	55	47
Apr 10	12	1	14	18	12	3	44	26	12	0	45
20	11	58	50	28	12	1	6	31	12	3	11
30	11	57	9	Sep 7	11	57	54				

CORRECTION FOR PLACES NOT ON THE 30° MERIDIAN

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

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

SIDEREAL TIME ON THE 30° MERIDIAN

	At 0 hrs	At 21 hrs		At 0 hrs	At 21 hrs		At 0 hrs	At 21 hrs
	h m	h m		h m	h m		h m	h m
Jan 1	6 39	3 43	May 10	15 12	12 15	Sep 17	23 44	20 48
11	7 19	4 22	20	15 51	12 55	27	0 24	21 27
21	7 58	5 2	30	16 31	13 34	Oct 7	1 3	22 7
31	8 38	5 41	Jun 9	17 10	14 14	17	1 43	22 46
Feb 10	9 17	6 20	19	17 50	14 53	27	2 22	23 26
20	9 56	7 0	29	18 29	15 32	Nov 6	3 2	0 5
Mar 1	10 36	7 39	Jul 9	19 8	16 12	16	3 41	0 44
11	11 15	8 19	19	19 48	16 51	26	4 20	1 24
21	11 55	8 58	29	20 27	17 31	Dec 6	5 0	2 3
31	12 34	9 38	Aug 8	21 7	18 10	16	5 39	2 43
Apr 10	13 14	10 17	18	21 46	18 50	26	6 19	3 22
20	13 53	10 56	28	22 26	19 29	31	6 38	3 42
30	14 32	11 36	Sep 7	23 5	20 8			

CORRECTION FOR PLACES NOT ON THE 30° MERIDIAN

Approximate longitude corrections from the 30° East Meridian are provided below. To find the sidereal times at SAST 0 hrs and SAST 21 hrs apply the following corrections to the data in the table.

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

TELESCOPE SETTING

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

A LIST OF BRIGHT STARS FOR CHECKING TELESCOPE CIRCLES (1992.5)

Star	R.A. h m	Dec. ° ′	Mag.	Sp.	Star	R.A. h m	Dec. ° ′	Mag.	Sp.
ACHERNAR	1 37.4	-57 16	0.6	B5	PROCYON	7 38.9	5 15	0.5	F5
ALDEBARAN	4 35.5	16 30	1.1	K5	REGULUS	10 8.0	12 0	1.3	B8
RIGEL	5 14.2	-8 13	0.3	B8	SPICA	13 24.8	-11 7	1.2	B2
BETELGEUSE	5 54.8	7 24	0.4	M0	ARCTURUS	14 15.3	19 13	0.2	K0
CANOPUS	6 23.8	-52 41	-0.9	F0	ANTARES	16 29.0	-26 25	1.2	M1
SIRIUS	6 44.8	-16 42	-1.6	A0	ALTAIR	19 50.5	8 51	0.9	A5

JULIAN DATE AT 1400 HOURS - EAST 1992

	JAN. 2448	FEB. 2448	MAR. 2448	APR. 2448	MAY 2448	JUN. 2448	JUL. 2448	AUG. 2448	SEP. 2448	OCT. 2448	NOV. 2448	DEC. 2448
1	623	654	683	714	744	775	805	836	867	897	928	958
2	624	655	684	715	745	776	806	837	868	898	929	959
3	625	656	685	716	746	777	807	838	869	899	930	960
4	626	657	686	717	747	778	808	839	870	900	931	961
5	627	658	687	718	748	779	809	840	871	901	932	962
6	628	659	688	719	749	780	810	841	872	902	933	963
7	629	660	689	720	750	781	811	842	873	903	934	964
8	630	661	690	721	751	782	812	843	874	904	935	965
9	631	662	691	722	752	783	813	844	875	905	936	966
10	632	663	692	723	753	784	814	845	876	906	937	967
11	633	664	693	724	754	785	815	846	877	907	938	968
12	634	665	694	725	755	786	816	847	878	908	939	969
13	635	666	695	726	756	787	817	848	879	909	940	970
14	636	667	696	727	757	788	818	849	880	910	941	971
15	637	668	697	728	758	789	819	850	881	911	942	972
16	638	669	698	729	759	790	820	851	882	912	943	973
17	639	670	699	730	760	791	821	852	883	913	944	974
18	640	671	700	731	761	792	822	853	884	914	945	975
19	641	672	701	732	762	793	823	854	885	915	946	976
20	642	673	702	733	763	794	824	855	886	916	947	977
21	643	674	703	734	764	795	825	856	887	917	948	978
22	644	675	704	735	765	796	826	857	888	918	949	979
23	645	676	705	736	766	797	827	858	889	919	950	980
24	646	677	706	737	767	798	828	859	890	920	951	981
25	647	678	707	738	768	799	829	860	891	921	952	982
26	648	679	708	739	769	800	830	861	892	922	953	983
27	649	680	709	740	770	801	831	862	893	923	954	984
28	650	681	710	741	771	802	832	863	894	924	955	985
29	651	682	711	742	772	803	833	864	895	925	956	986
30	652		712	743	773	804	834	865	896	926	957	987
31	653		713		774		835	866		927		988

JANUARY

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

FEBRUARY

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

MARCH

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

APRIL

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

MAY

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

JUNE

Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

JULY

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

AUGUST

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

SEPTEMBER

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

OCTOBER

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

NOVEMBER

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

DECEMBER

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

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