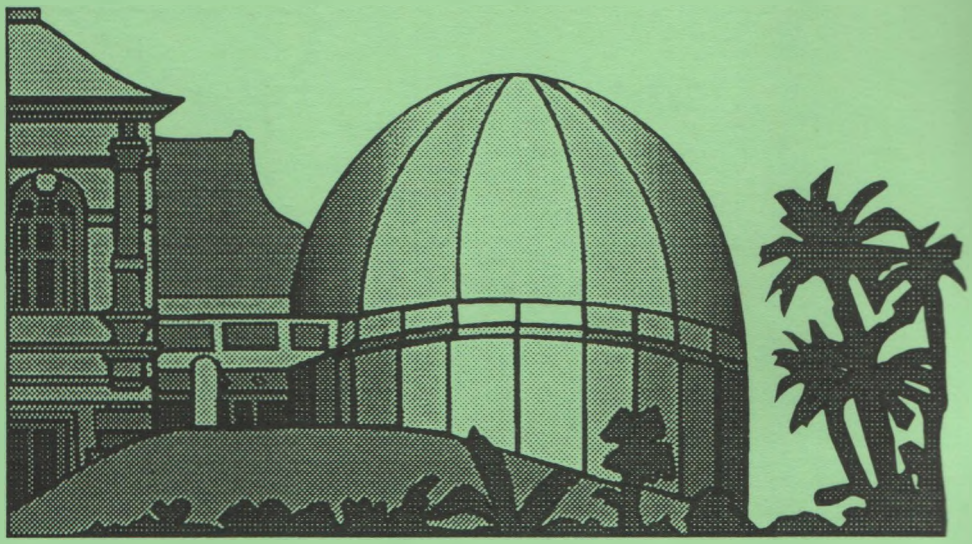
ASTRONOMICAL HANDBOOK FOR SOUTHERN AFRICA

1996

Astronomical Society of Southern Africa

ASSA



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ASTRONOMICAL HANDBOOK FOR SOUTHERN AFRICA

1996

The 50th Year of Publication

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.

This edition is dedicated to all my predecessors:
the Editors,
the Computers,
the Draughtsmen,
the Typists,
the Proof Readers and
all who have contributed to the Handbook in the past fifty years

Front cover
Members of the Transvaal Centre Computing Section - J Churms, G Knipe, K Fuhr, H Lagerweij - at work in the library of the then Union Observatory in the 1950's.

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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 1996, the Handbook of the British Astronomical Association for 1996 and the International Lunar Occultation Centre,Tokyo. The star charts on pages 36, 38, 40 and 42 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. The Editor is indebted to the South African Astronomical Observatory for supplying the additional data of The Horizon Chart for the Visibility of the Lunar Cresent at Sunset. R F Hurly contributed the article "A Short History of The Handbook" Assistance in the compilation of this booklet was received from the Directors of the sections of the ASSA and G Jacobs.

Further copies of this booklet are available at R15,00 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.

The ASSA regrets that due to the restriction of funds it is not possible to print this handbook in any of the other official languages of South Africa.

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), directed by Dr. R. Stobie is part of the Foundation for Research and Developement. It 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 carries 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 telescope, which is gradually being upgraded as funds become available, as well as a 0.41-m telescope, 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 GAMMA 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. M. Hofman).

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.

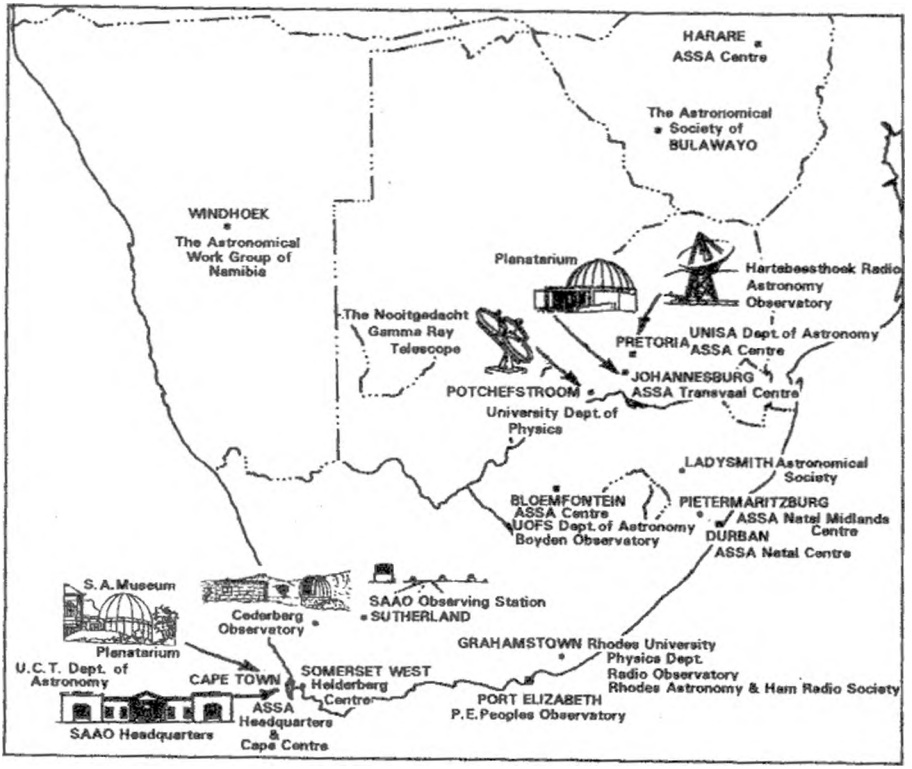
THE CEDERBERG OBSERVATORY. This observatory, situated 250 km by road north of Cape Town, is operated by 6 amateur astronomers. It has excellent dark skys and public open nights are held twice monthly at Last Quarter and New Moon. Enquiries to Mr. Chris Forder Tel 021-9134200.

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.



EDUCATIONAL INSTITUTIONS

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.

The Dept. of Computational and Applied Mathematics, University of Witwatersrand, offers an Introductory first year course in Astronomy and a postgraduate course in Cosmology/Astrophysics. Unique research facilities are available, such as Photomicrographic Tubes, the Schmidt Surveys (in blue and red) and SUN work stations. Contact Prof D.L. Block.

The EDUCATION CENTRE Deale Rd. BLOEMFONTEIN offers short courses in astronomy to school children. Contact Mrs M. Schoch for more details.

ASTRONOMICAL SOCIETIES

THE ASTRONOMICAL SOCIETY OF BULAWAYO, ZIMBABWE. The 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. The 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 LADYSMITH ASTRONOMICAL SOCIETY, NATAL. The society holds meetings on the third Wednessday of every month which are alturnatly a talk or an observing evening. Visitors are welcome. The society publishes a monthly journal ΣOctantis. For further information contact 0361-22992 a/h.

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 RHODES ASTRONOMY AND HAM RADIO SOCIETY, RHODES UNIVERSITY, GRAHAMSTOWN. The society meets twice monthly in Physics Department during the university terms. Meetings consist of talks, discussions, slide shows and videos. Frequent observing sessions including public evenings are held. The society is active in fields of astrophotography, variable star and comet observing. It also has an astronomy education program for schools. Although this is largely a student society membership is open to all interested persons as well as bodies such as school clubs. Secretarial address: c/o The Physics Department, Rhodes University, Grahamstown. 6140. For information about meetings contact 0461-22023 ext 450 o/h or 0461-26063 a/h.

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 may 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 has an entrance fee of R40.00 and an annual subscription of R200.00 inclusive of Sky and Telescope or R80.00 for MNASSA and Handbook only. A prospectus and application form may be obtained from the Honorary Secretary, Astronomical Society of Southern Africa, 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, Harare and Somerset West. 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". Centres publish newsletters and journals carrying information on meetings, centre activities and topics of interest.

BLOEMFONTEIN CENTRE: Meetings are usually held on the last Thursday of the month in the Physics Dept. UOFS or at Boyden Observatory, Mazelspoort. The Centre publishes a monthly newsletter 'Clear Skys'. Secretarial address: P O Box 1599, Bloemfontein,

9300 or telephone 051-4012321(o/h), 051-4058730(o/h) or 051-471921(a/h).

CAPE CENTRE (Cape Town): Formal meetings, involving lectures on the latest Astronomical topics are held on the second Wednesday of the month (except in January and December). Informal meetings are held on other Wednesdays except during January and December. Meetings are held at the SAAO, Observatory Road, Observatory at 20h00. The Centre publishes a journal, the "Cape Observer" and a monthly newsletter. Secretarial address: P.O.Box 13018, Mowbray, 7705, or tel. 021-6852664.

HARARE CENTRE: The Centre holds a meeting on the last Wednesday of each month (except December). These are usually held at 17h30 at the Harry Robinson Study Centre Prince Edward School, 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.

HELDERBERG CENTRE, SOMERSET WEST. The society holds meetings on the last Thursday of every month at the Hottentots Holland High School at 7:30pm. Secretarial address: P. O. Box 358, Somerset West, 7129. Tel. 024-8521405 o/h or 024-8524630 a/h.

JOHANNESBURG CENTRE: 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 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 031-255979 / 7011104 / 288213.

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

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: P O Box 40654, Arcadia, 0007 tel.012-833765.

SECTIONS OF THE ASSA

These sections exist to co-ordinate the activities of special interest groups within the Society. Several of these sections co-ordinate constructive observing programmes and more information on an observing section is given in the appropriate part of this handbook.

THE 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. If you wish to become a subscriber to this DATA BASE list please contact Mr Hilton for the relevant questionnaire.

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 HISTORICAL SECTION. This section was formed for the purpose of establishing a stronger historical record than hitherto available relating to astronomy in Southern Africa and in particular, to the ASSA and its members. Amongst the activities are

- maintaining an archive of photographic and other material of historical interest;
- undertaking research into specific topics and publishing articles, obituaries etc;
- following up specific enquiries.

All members (and families of deceased members) are invited to donate material to the archive and to participate in the other activities of the Section.

For further information, contact the Director :
Jonathan H. Spencer Jones, P O Box 398, Cape Town, 8000. Tel: 021-4623412

DIARY OF PHENOMENA

	d	h	
Jan	1	3	Mercury 0°·9 S. of Uranus
	1	9	Mars 1°·6 S. of Neptune
	2	18	Mercury greatest elong. E. (19°)
	4	9	Earth at perihelion
	5	14	Moon at apogee
	5	23	FULL MOON
	8	2	Mars 0°·6 S. of Uranus
	9	14	Mercury stationary
	13	2	Mercury 3° N. of Mars
	13	23	LAST QUARTER
	16	5	Neptune in conjunction with Sun
	18	22	Jupiter 5° S. of Moon
	19	0	Mercury in inferior conjunction
	20	1	Moon at perigee
	20	15	NEW MOON
	21	9	Uranus in conjunction with Sun
	23	10	Venus 5° S. of Moon
	24	6	Saturn 5° S. of Moon
	26	7	Juno in conjunction with Sun
	27	13	FIRST QUARTER
	30	8	Mercury stationary
Feb	1	18	Moon at apogee
	3	4	Venus 1°·3 N. of Saturn
	4	18	FULL MOON
	11	16	Mercury 0°·07 N. of Neptune
	11	23	Mercury greatest elong. W. (26°)
	12	4	Passage of the Earth through the ring-plane of Saturn from N to S
	12	11	LAST QUARTER
	15	17	Jupiter 5° S. of Moon
	16	22	Neptune 5° S. of Moon
	17	0	Mercury 0°·2 N. of Uranus
	17	7	Uranus 6° S. of Moon
	17	8	Mercury 5° S. of Moon
	17	11	Moon at perigee
	19	2	NEW MOON
	20	21	Saturn 4° S. of Moon
	22	7	Venus 0°·06 N. of Moon
	26	8	FIRST QUARTER
	29	9	Moon at apogee
Mar	4	16	Mars in conjunction with Sun
	5	11	FULL MOON
	7	22	Pluto stationary
	12	19	LAST QUARTER
	13	2	Pallas stationary
	14	8	Jupiter 5° S. of Moon
	15	7	Neptune 5° S. of Moon
	15	18	Uranus 6° S. of Moon
	16	8	Moon at perigee
	17	21	Saturn in conjunction with Sun
	19	13	NEW MOON
	20	10	Equinox
	22	22	Mars 1°·3 N. of Saturn
	23	2	Venus 5° N. of Moon
	23	13	Mercury 0°·3 N. of Saturn
	23	22	Mercury 0°·9 S. of Mars
	27	4	FIRST QUARTER
	28	5	Moon at apogee
	28	10	Mercury in superior conjunction
	29	10	Vesta stationary
Apr	1	3	Venus greatest elong. E. (46°)
	4	2	FULL MOON — Eclipse
	8	14	Ceres 1°·0 N. of Moon
	9	21	Ceres stationary
	10	19	Jupiter 5° S. of Moon
	11	2	LAST QUARTER
	11	5	Moon at perigee
	11	14	Neptune 5° S. of Moon
	12	2	Uranus 6° S. of Moon
	16	0	Venus 10° N. of Aldebaran
	16	3	Saturn 4° S. of Moon
	18	1	NEW MOON
	18	23	Pallas at opposition
	19	12	Mercury 5° N. of Moon
	21	16	Venus 9° N. of Moon
	23	10	Mercury greatest elong. E. (20°)
	25	0	Moon at apogee
	25	23	FIRST QUARTER
	29	11	Neptune stationary
May	3	14	FULL MOON
	4	12	Mercury stationary
	4	16	Venus greatest brilliancy
	4	19	Jupiter stationary
	5	17	Ceres 0°·3 N. of Moon
	7	0	Moon at perigee
	8	2	Jupiter 5° S. of Moon
	8	19	Neptune 5° S. of Moon
	8	23	Vesta at opposition
	9	2	Uranus stationary
	9	8	Uranus 6° S. of Moon
	10	7	LAST QUARTER
	13	15	Saturn 3° S. of Moon
	15	3	Mercury in inferior conjunction
	16	5	Mars 1°·7 N. of Moon
	17	14	NEW MOON
	20	3	Venus 8° N. of Moon
	20	9	Venus stationary
	22	16	Pluto at opposition
	22	18	Moon at apogee
	25	16	FIRST QUARTER
	27	9	Mercury stationary
	30	2	Ceres at opposition
	31	8	Mercury 4° S.of Mars
Jun	1	17	Ceres 0°·8 S. of Moon
	1	23	FULL MOON
	3	18	Moon at perigee
	4	8	Jupiter 5° S. of Moon
	5	2	Neptune 5° S. of Moon
	5	14	Uranus 6° S. of Moon
	8	13	LAST QUARTER
	10	0	Saturn 3° S. of Moon
	10	11	Mercury greatest elong. W. (24°)
	10	18	Venus in inferior conjunction
	14	2	Mercury 0°·4 N. of Moon
	14	3	Mars 4° N. of Moon
	14	15	Mercury 3° S. of Mars
	15	11	Pallas stationary
	16	4	NEW MOON
	19	8	Moon at apogee
	21	4	Solstice
	21	13	Mercury 4° N. of Aldebaran
	23	14	Mercury 1°·6 N. of Venus
	24	7	FIRST QUARTER
	24	18	Vesta stationary
	27	14	Mars 6° N. of Aldebaran
	30	6	Venus 4° S. of Mars
Jul	1	6	FULL MOON
	1	12	Jupiter 5° S. of Moon
	2	0	Moon at perigee
	2	2	Venus stationary
	2	10	Neptune 4° S. of Moon
	2	22	Uranus 5° S. of Moon
	4	14	Jupiter at opposition
	5	20	Earth at aphelion

CONFIGURATIONS OF SUN, MOON AND PLANETS

	d	h	
Jul	7	8	Saturn 3° S. of Moon
	7	21	LAST QUARTER
	11	11	Mercury in superior conjunction
	12	11	Venus 0°·4 S. of Moon
	13	1	Mars 5° N. of Moon
	15	18	NEW MOON
	16	16	Moon at apogee
	17	11	Venus greatest brilliancy
	18	20	Neptune at opposition
	20	2	Saturn stationary
	20	20	Ceres stationary
	23	20	FIRST QUARTER
	25	9	Uranus at opposition
	28	18	Jupiter 5° S. of Moon
	29	20	Neptune 4° S. of Moon
	30	6	Uranus 5° S. of Moon
	30	10	Moon at perigee
	30	13	FULL MOON
Aug	1	12	Mercury 0°·5 N. of Regulus
	3	15	Saturn 3° S. of Moon
	4	5	Juno 0°·1 S. of Moon
	6	7	LAST QUARTER
	8	9	Aldebaran 1°·0 S. of Moon
	10	6	Venus 1°·2 N. of Moon
	10	23	Mars 6° N. of Moon
	12	18	Moon at apogee .
	13	19	Pluto stationary
	14	10	NEW MOON
	16	20	Mercury 0°·3 N. of Moon
	20	6	Venus greatest elong W. (46°)
	21	18	Mercury greatest elong. E. (27°)
	21	21	Vesta 0°·9 S. of Moon
	22	6	FIRST QUARTER
	25	0	Jupiter 5° S. of Moon
	26	5	Neptune 5° S. of Moon
	26	15	Uranus 5°S. of Moon
	27	19	Moon at perigee
	28	20	FULL MOON
	30	23	Saturn 3° S. of Moon
	31	19	Mars 6° S. of Pollux
Sep	2	7	Venus 9° S. of Pollux
	2	13	Juno stationary
	3	16	Jupiter stationary
	3	22	Mercury stationary
	4	16	Aldebaran 0°·9 S. of Moon
	4	17	Venus 3° S. of Mars
	4	21	LAST QUARTER
	8	21	Mars 6° N. of Moon
	9	1	Venus 3° N. of Moon
	9	4	Moon at apogee
	13	1	NEW MOON
	17	15	Mercury in inferior conjunction
	20	13	FIRST QUARTER
	21	8	Jupiter 6° S. of Moon
	22	13	Neptune 5° S. of Moon
	22	20	Equinox
	22	23	Uranus 6° S. of Moon
	25	0	Moon at perigee
	26	0	Mercury stationary
	26	21	Saturn at opposition
	27	5	FULL MOON — Eclipse
	27	6	Saturn 3° S. of Moon

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

THE SUN

BASIC DATA:

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

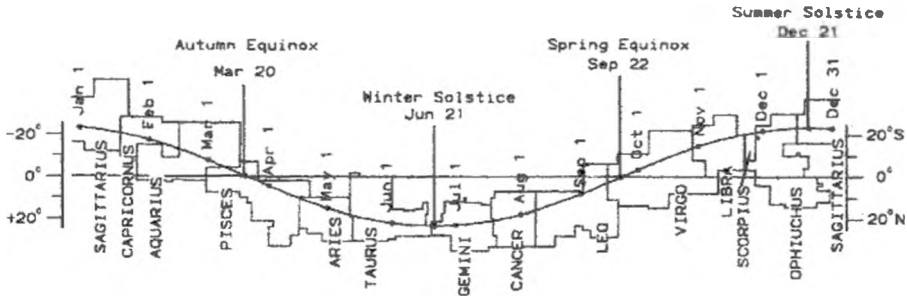
Mass: 1,99 x 10^{30}kg (330 000 times Earth mass)

Surface Temperature: Approximately 6 000°C

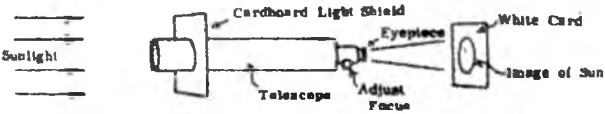
Temperature at centre: Approximately 10 million°C

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 1996 we will be closest to the Sun on January 4 (perihelion - approximate distance 147 million km) and furthest from the Sun on July 5 (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° 4'	Apr 10	7°58'	Jul 19	20°50'	Oct 27	-12°48'
Jan 11	-21 57	Apr 20	11 32	Jul 29	18 44	Nov 6	-16 0
Jan 21	-20 6	Apr 30	14 48	Aug 8	16 7	Nov 16	-18 45
Jan 31	-17 38	May 10	17 38	Aug 18	13 5	Nov 26	-20 57
Feb 10	-14 39	May 20	19 59	Aug 28	9 41	Dec 6	-22 30
Feb 20	-11 15	May 30	21 47	Sep 7	6 3	Dec 16	-23 19
Mar 1	-7 33	Jun 9	22 56	Sep 17	2 14	Dec 26	-23 22
Mar 11	-3 41	Jun 19	23 25	Sep 27	-1 39	Dec 31	-23 5
Mar 21	0 16	Jun 29	23 13	Oct 7	-5 31		
Mar 31	4 11	Jul 9	22 21	Oct 17	-9 16		

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

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

ECLIPSES OF THE SUN

Two partial eclipses of the Sun, the first on April 17-18 and the other on October 12, take place during the year. Neither will be visible from Southern Africa.

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 of 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.

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

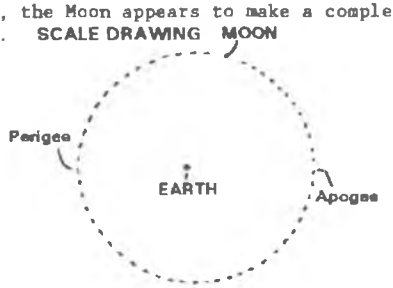
THE SURFACE OF THE MOON

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

Both total eclipses of the moon, that of April 3-4 and that of September 27, will be visible from Southern Africa, although the latter, except for the north western areas, will still be in the partial phase as the moon sets.
The eclipse data is as follows:

		d	h	m
Moon enters penumbra	Apr	3	23	15.7
Moon enters umbra		4	0	20.9
Moon enters totality		4	1	26.5
Middle of eclipse		4	2	09.7
Moon leaves totality		4	2	53.0
Moon leaves umbra		4	3	58.7
Moon leaves penumbra		4	5	03.7

Contacts of Umbra with Limb of Moon	Position Angles from the North Point
First	92.5 to East
Last	58.4 to West

Magnitude of the eclipse: 1.384

		d	h	m
Moon enters penumbra	Sep	27	2	12.4
Moon enters umbra		27	3	12.3
Moon enters totality		27	4	19.3
Middle of eclipse		27	4	54.4
Moon leaves totality		27	5	29.4
Moon leaves umbra		27	6	36.3
Moon leaves penumbra		27	7	36.4

Contacts of Umbra with Limb of Moon	Position Angles from the North Point
First	91.9 to East
Last	127.3 to West

Magnitude of the eclipse: 1.245

	h	m
Moon set at Harare	5	45
Durban	5	42
Johannesburg	5	55
Bloemfontein	6	02
Port Elizabeth	6	03
Cape Town	6	33
Windhoek	6	41

PHASES and VISIBILITY

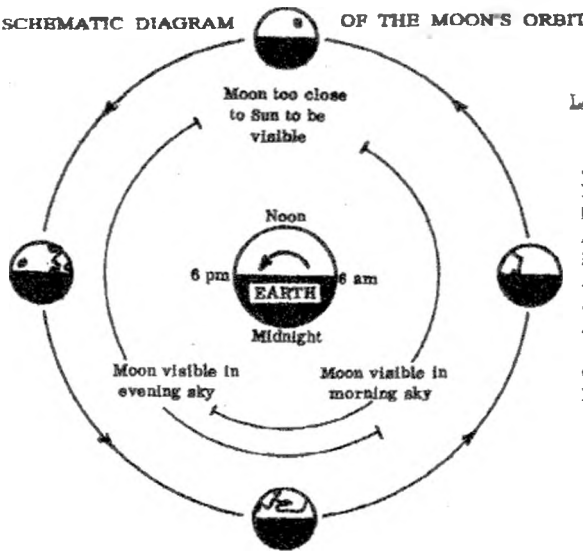
NEW MOON

d	h	m
Jan 20	14	50
Feb 19	1	30
Mar 19	12	45
Apr 18	0	49

d	h	m
May 17	13	46
Jun 16	3	36
Jul 15	18	15
Aug 14	9	34

d	h	m
Sep 13	1	07
Oct 12	16	14
Nov 11	6	16
Dec 10	18	56

SCHEMATIC DIAGRAM OF THE MOON'S ORBIT



FIRST QUARTER

d	h	m
Jan 27	13	14
Feb 26	7	52
Mar 27	3	31
Apr 25	22	40
May 25	16	13
Jun 24	7	23
Jul 23	19	49
Aug 22	5	36
Sep 20	13	23
Oct 19	20	09
Nov 18	3	09
Dec 17	11	31

LAST QUARTER

d	h	m
Jan 13	22	45
Feb 12	10	37
Mar 12	19	15
Apr 11	1	36
May 10	7	04
Jun 8	13	05
Jul 7	20	55
Aug 6	7	25
Sep 4	21	06
Oct 4	14	04
Nov 3	9	50
Dec 3	7	06

FULL MOON

d	h	m
Jan 5	22	51
Feb 4	17	58
Mar 5	11	23
Apr 4	2	07
May 3	13	48

d	h	m
Jun 1	22	47
Jul 1	5	58
30	12	35
Aug 28	19	52
Sep 27	4	51

d	h	m
Oct 26	16	11
Nov 25	6	10
Dec 24	22	41

MOON at PERIGEE

d	h	d	h	d	h
Jan 20	1	Jun 3	18	Oct 22	11
Feb 17	11	Jul 2	0	Nov 16	7
Mar 16	8	30	10	Dec 13	6
Apr 11	5	Aug 27	19		
May 7	0	Sep 25	0		

MOON at APOGEE

d	h	d	h	d	h
Jan 5	14	May 22	18	Oct 6	20
Feb 1	18	Jun 19	8	Nov 3	16
29	9	Jul 16	16	Dec 1	13
Mar 28	5	Aug 12	18	29	7
Apr 25	0	Sep 9	4		

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 the next page. 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.

MAP OF THE MOON'S NEAR SIDE

LIBRATION

Maximum			Minimum			Maximum			Minimum		
Date	Size	P.A.	Date	Size	P.A.	Date	Size	P.A.	Date	Size	P.A.
d	°	°	d	°	°	d	°	°	d	°	°
			Jan 2	5.8	311	Jun 27	8.0	134	Jul 3	6.3	186
Jan 14	7.6	121	Jan 19	6.5	171	Jul 10	7.6	289	Jul 19	5.3	62
Jan 24	7.8	230	Jan 31	6.5	330	Jul 25	8.8	138	Jul 31	5.5	192
Feb 3	6.6	17	Feb 7	6.2	85	Aug 7	8.5	292	Aug 16	4.5	70
Feb 13	7.5	143	Feb 19	6.0	195	Aug 23	8.9	141	Aug 28	4.5	197
Feb 25	6.9	287	Mar 7	5.3	102	Sep 4	8.8	301	Sep 12	3.8	77
Mar 13	7.2	155	Mar 19	5.0	215	Sep 19	8.4	145	Sep 26	3.5	204
Mar 26	6.9	341	Apr 4	5.1	117	Oct 2	8.6	311	Oct 10	3.6	80
Apr 10	6.9	167	Apr 16	4.5	231	Oct 17	7.6	153	Oct 23	3.0	214
Apr 23	6.8	354	May 2	5.8	131	Oct 30	8.1	319	Nov 6	3.8	74
May 8	6.8	179	May 14	5.1	246	Nov 13	7.2	157	Nov 20	3.5	222
May 20	6.7	352	May 24	6.4	56	Nov 26	7.7	323	Dec 3	3.9	67
May 29	6.9	125	Jun 3	6.6	166	Dec 9	7.7	148	Dec 16	4.6	216
Jun 6	6.7	196	Jun 11	6.3	257	Dec 23	7.8	318	Dec 30	3.7	64
Jun 16	6.8	332	Jun 21	6.0	55						

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.

1996 TIMES OF MOON RISE AND SET CAPE TOWN

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

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

1996 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	15 19		16 31	02 35	15 52	02 10	16 18	03 32	16 05	04 07	17 01	05 55
2	16 11	02 20	17 14	03 25	16 31	03 01	16 54	04 27	16 46	05 06	17 59	06 59
3	17 01	03 04	17 55	04 16	17 09	03 54	17 32	05 23	17 31	06 07	19 01	08 00
4	17 48	03 50	18 33	05 08	17 45	04 48	18 11	06 21	18 20	07 10	20 06	08 58
5	18 33	04 39	19 10	06 01	18 21	05 42	18 53	07 21	19 15	08 13	21 12	09 50
6	19 16	05 29	19 45	06 54	18 57	06 37	19 38	08 21	20 13	09 14	22 17	10 38
7	19 55	06 21	20 20	07 48	19 34	07 33	20 28	09 23	21 15	10 12	23 20	11 22
8	20 32	07 13	20 56	08 43	20 13	08 31	21 23	10 23	22 18	11 06		12 02
9	21 08	08 06	21 33	09 39	20 55	09 29	22 21	11 22	23 22	11 55	00 21	12 41
10	21 43	08 59	22 12	10 36	21 41	10 29	23 22	12 17		12 39	01 20	13 20
11	22 18	09 53	22 55	11 35	22 32	11 29		13 08	00 24	13 21	02 18	13 58
12	22 53	10 48	23 43	12 35	23 27	12 29	00 25	13 55	01 26	14 01	03 15	14 38
13	23 32	11 44		13 36		13 26	01 28	14 39	02 26	14 40	04 11	15 20
14		12 43	00 36	14 36	00 27	14 21	02 31	15 21	03 25	15 18	05 06	16 04
15	00 13	13 44	01 35	15 35	01 29	15 11	03 33	16 01	04 23	15 58	05 58	16 51
16	00 59	14 47	02 38	16 30	02 34	15 59	04 34	16 40	05 21	16 39	06 48	17 39
17	01 51	15 50	03 44	17 21	03 39	16 43	05 34	17 20	06 17	17 22	07 35	18 29
18	02 49	16 52	04 51	18 08	04 43	17 25	06 33	18 01	07 12	18 08	08 18	19 21
19	03 52	17 51	05 58	18 52	05 46	18 06	07 31	18 44	08 04	18 56	08 59	20 12
20	05 00	18 45	07 03	19 34	06 48	18 46	08 27	19 29	08 53	19 45	09 37	21 04
21	06 08	19 35	08 06	20 14	07 49	19 27	09 21	20 15	09 38	20 36	10 13	21 56
22	07 16	20 20	09 07	20 54	08 48	20 08	10 11	21 03	10 21	21 27	10 47	22 48
23	08 21	21 02	10 06	21 34	09 45	20 52	10 59	21 53	11 00	22 19	11 22	23 42
24	09 24	21 42	11 03	22 15	10 39	21 37	11 43	22 44	11 37	23 11	11 57	
25	10 24	22 20	11 57	22 58	11 31	22 23	12 24	23 35	12 13		12 33	00 37
26	11 22	22 59	12 50	23 43	12 19	23 12	13 02		12 48	00 03	13 13	01 34
27	12 18	23 38	13 39		13 05		13 39	00 28	13 23	00 57	13 57	02 33
28	13 13		14 26	00 30	13 48	00 02	14 15	01 21	13 59	01 52	14 46	03 35
29	14 06	00 19	15 10	01 19	14 28	00 53	14 50	02 14	14 38	02 50	15 40	04 38
30	14 57	01 02			15 06	01 45	15 27	03 10	15 21	03 49	16 41	05 41
31	15 45	01 48			15 42	02 38			16 08	04 51		

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

1996 TIMES OF MOON RISE AND SET HARARE

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

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

1996 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	15 26		16 37	02 55	15 59	02 28	16 30	03 47	16 20	04 18	17 20	06 02
2	16 17	02 39	17 21	03 44	16 40	03 19	17 07	04 40	17 02	05 16	18 18	07 05
3	17 07	03 23	18 02	04 34	17 18	04 11	17 46	05 35	17 49	06 16	19 21	08 06
4	17 54	04 10	18 42	05 26	17 56	05 03	18 26	06 32	18 39	07 17	20 25	09 04
5	18 40	04 58	19 19	06 17	18 33	05 56	19 10	07 30	19 34	08 19	21 30	09 58
6	19 23	05 48	19 56	07 10	19 10	06 50	19 57	08 29	20 33	09 20	22 33	10 47
7	20 03	06 39	20 33	08 02	19 49	07 45	20 47	09 30	21 34	10 18	23 34	11 32
8	20 41	07 30	21 09	08 55	20 29	08 41	21 42	10 30	22 37	11 13		12 14
9	21 18	08 22	21 48	09 50	21 13	09 38	22 41	11 28	23 39	12 03	00 34	12 55
10	21 54	09 14	22 29	10 46	22 00	10 37	23 41	12 23		12 49	01 32	13 34
11	22 30	10 06	23 13	11 43	22 51	11 36		13 16	00 40	13 32	02 28	14 14
12	23 08	10 59		12 42	23 47	12 35	00 43	14 04	01 40	14 13	03 24	14 56
13	23 47	11 55	00 02	13 42		13 32	01 45	14 49	02 38	14 53	04 19	15 38
14		12 52	00 56	14 42	00 46	14 27	02 46	15 32	03 36	15 33	05 12	16 23
15	00 30	13 52	01 54	15 41	01 48	15 19	03 46	16 14	04 33	16 14	06 04	17 10
16	01 17	14 53	02 57	16 37	02 51	16 08	04 46	16 55	05 29	16 57	06 54	17 59
17	02 10	15 56	04 02	17 29	03 55	16 53	05 45	17 36	06 25	17 41	07 41	18 49
18	03 09	16 58	05 08	18 18	04 57	17 37	06 42	18 18	07 18	18 27	08 25	19 39
19	04 12	17 58	06 13	19 03	05 59	18 19	07 39	19 02	08 10	19 15	09 07	20 30
20	05 18	18 53	07 17	19 46	07 00	19 01	08 34	19 47	08 59	20 04	09 45	21 20
21	06 26	19 44	08 18	20 28	07 59	19 43	09 27	20 34	09 45	20 55	10 22	22 11
22	07 32	20 30	09 17	21 09	08 56	20 26	10 18	21 23	10 28	21 45	10 58	23 02
23	08 35	21 14	10 15	21 51	09 52	21 10	11 05	22 12	11 08	22 36	11 34	23 54
24	09 37	21 55	11 11	22 33	10 46	21 56	11 49	23 02	11 46	23 27	12 10	
25	10 35	22 35	12 04	23 17	11 37	22 43	12 31	23 53	12 23		12 48	00 48
26	11 32	23 15	12 56		12 26	23 31	13 11		12 59	00 18	13 29	01 43
27	12 27	23 56	13 45	00 03	13 12		13 49	00 44	13 36	01 10	14 14	02 42
28	13 20		14 33	00 50	13 55	00 21	14 26	01 36	14 14	02 04	15 04	03 42
29	14 12	00 38	15 17	01 38	14 36	01 11	15 03	02 28	14 54	03 00	16 00	04 45
30	15 03	01 21			15 15	02 02	15 40	03 22	15 38	03 58	17 01	05 47
31	15 51	02 07			15 52	02 54			16 26	04 59		

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

1996 TIMES OF MOON RISE AND SET WINDHOEK

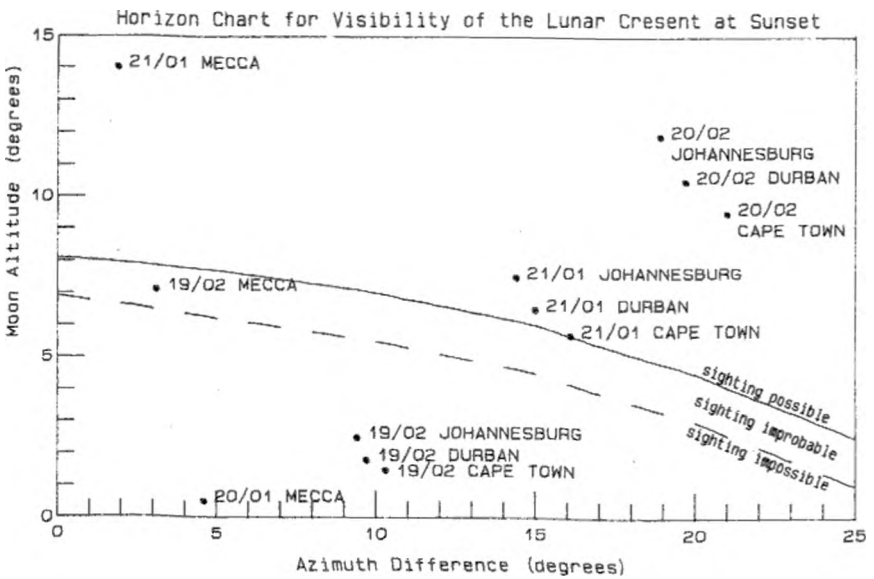
	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
1	16 06		17 16	03 47	16 39	03 20	17 14	04 34	17 07	05 02	18 11	06 42
2	16 56	03 30	18 00	04 36	17 20	04 10	17 52	05 26	17 51	05 59	19 10	07 44
3	17 46	04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

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

PREDICTIONS FOR YOUNG CRESCENT VISIBILITY FOR RAMADAAN AND SHAWWALL

The tabulation below is for the difference in altitude and azimuth between the Sun and the Moon at sunset for the period after New Moon on each occasion when the moon is above the horizon. Positions of the moon at altitudes less than 15° and differences of azimuth less than 25° in the table, are plotted on the accompanying chart.

DATE		CAPE TOWN		JOHANNESBURG		DURBAN		MECCA	
d	m	Alt°	Azm°	Alt°	Azm°	Alt°	Azm°	Alt°	Azm°
20	01							0.5	4.6
21	01	5.7	16.1	7.5	14.4	6.5	15.0	14.0	1.9
22	01	14.5	26.7	17.8	23.9	16.2	25.1	27.5	1.1
19	02	1.5	10.3	2.5	9.4	1.8	9.7	7.1	3.1
20	02	9.5	21.0	11.9	18.9	10.5	19.7	20.4	1.9



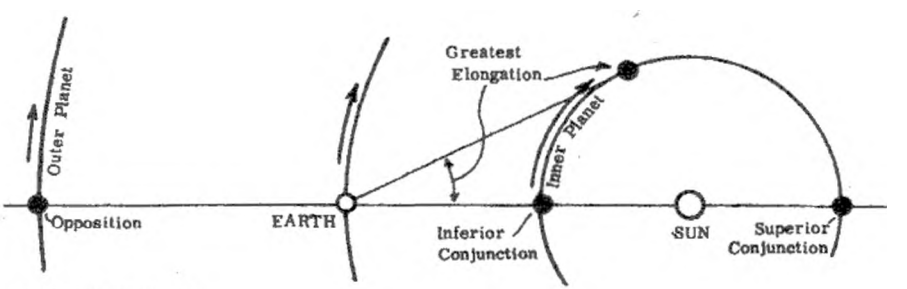
THE PLANETS

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 during the year are listed chronologically in the DIARY OF PHENOMENA 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.

MERCURY

The planet may be seen low in the east before sunrise as follows:
January 25 (at mag.+1.9) to March 19 (at mag.-1.0),
May 24 (at mag.+3.1) to July 4 (at mag.-1.5) and
September 25 (at mag.+1.6) to October 20 (at mag.-1.1)
The best conditions for viewing will occur during the last three weeks of February when Mercury is in Sagitarius and after mid month in Capricornus.

Mercury may also be seen low in the west after sunset as follows:
January 1 (at mag.-0.6) to January 13 (at mag.+1.6),
April 6 (at mag.-1.5) to May 5 (at mag.+2.6),
July 19 (at mag.-1.2) to September 11 (at mag.+2.5) and
November 19 (at mag.-0.6) to December 27 (at mag.+1.5).
The best conditions for viewing will be from early August, when the planet will be in Leo and after the third week in August in Virgo, until early September.

	d h	d h	d h	d h
Superior Conjunction		Mar 28 10	Jul 11 11	Nov 2 2
Greatest Elongation East	Jan 2 18 (19°)	Apr 23 10 (20°)	Aug 21 18 (27°)	Dec 15 21 (20°)
Stationary	Jan 9 14	May 4 12	Sep 3 22	Dec 23 16
Inferior Conjunction	Jan 19 0	May 15 3	Sep 17 15	
Stationary	Jan 30 8	May 27 9	Sep 26 0	
Greatest Elongation West	Feb 11 23 (26°)	Jun 10 11 (24°)	Oct 3 8 (18°)	

VENUS

Venus will be in the evening sky (at mag.-4.0) until middle of the first week of June. Venus reaches greatest brilliancy on May 4 at magnitude -4.5.

It returns to the morning sky from the middle of June (at mag. -3.9) and remains a morning sky object until the end of the year. Venus reaches greatest brilliancy on Jul 17 at magnitude -4.5.

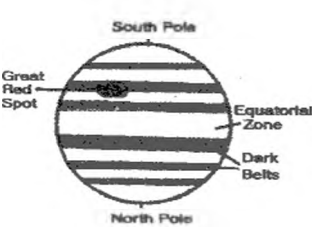
	d h
Greatest Elongation East	Apr 1 3 (46°)
Stationary	May 20 9
Inferior Conjunction	Jun 10 18

MARS

Mars, being to close to the sun, will not be visible until the middle of May when it returns to the morning sky (at mag.+1.4) in Aries. It passes to Taurus in early June (at mag.+1.4), to Gemini in the last week of July (at mag.+1.5), to Cancer in early September (at mag.+1.5), to Leo in the second week of October (at mag.+1.4) and then to Virgo after mid December (at mag.+0.8), when it will be visible for more than half the night.

JUPITER

Jupiter will be found throughout the year in Sagittarius. It rises just before the sun at the beginning of the year (at mag.-1.8), becomes visible for more than half the night by the second week in April (at mag.-2.2) so that by early July (at mag.-2.7) it will be visible all night. It will be seen only in the evening sky from the beginning of October (at mag.-2.2) until the end of the year (at mag.-1.9)



SATURN

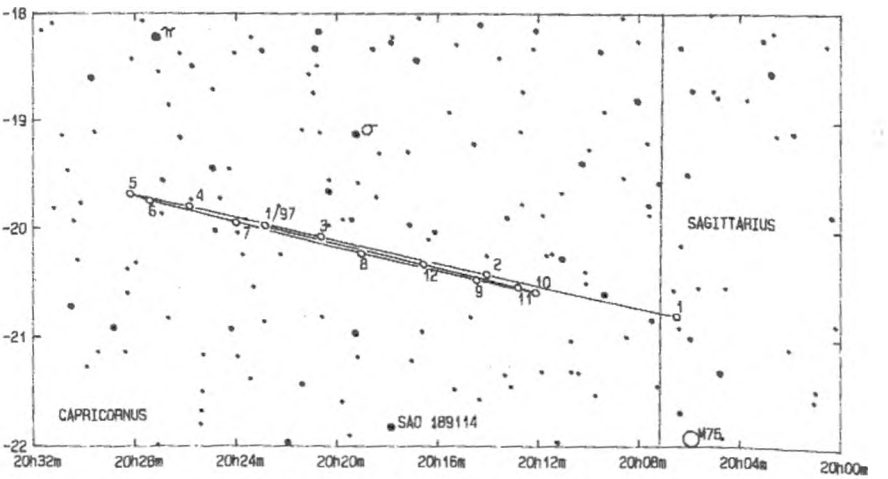
Saturn, begins the year in Aquarius as an evening sky object from 1 January (at mag.+1.2) until the end of February. Once again the Earth passes through the ring plane in the early morning of 12 February making the rings, in the edge on position, difficult to see in a small telescope during this period.
It will reappear in the morning sky in the first week of April (at mag +1.1) in

Pisces. It passes to Cetus in early June (at mag.+1.0) and returns to Pisces at the end of August (at mag.+0.6) where it remains for the rest of the year. It will be an all night object by the end of September (at mag. +0.5) but becomes an evening sky object from the middle of December (at mag.+1.0).

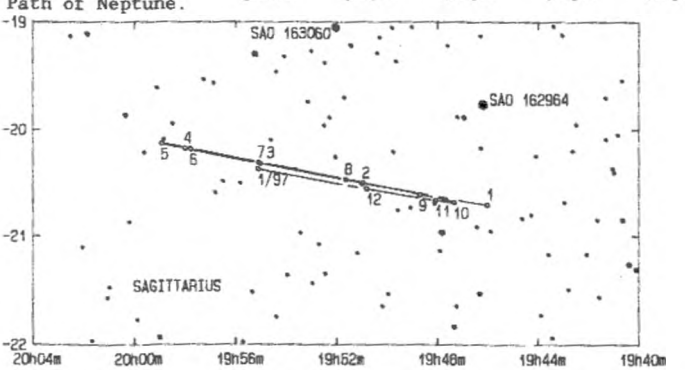
URANUS AND NEPTUNE

Uranus,in Capricornus, visible with optical aid from mid February, will be at magnitude 5.6 at opposition on July 20. Neptune, in Sagittarius all year, visible with optical aid from mid February, is at magnitude +7.9. at opposition on July 17.

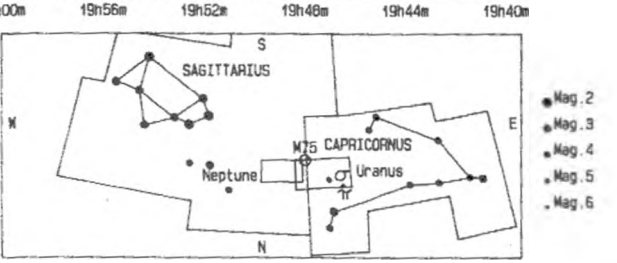
The Path of Uranus.



The Path of Neptune.



Sky Chart for the Paths of Uranus and Neptune



PLUTO

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

EVENTS OF INTEREST

Evening Sky:

1 Jan	- 13 Jan	Mercury, Saturn and Venus visible
14 Jan	- 29 Feb	Saturn and Venus visible
3 Feb		Saturn and Venus in conjunction
1 Apr	- 5 May	Mercury and Venus visible
19 Jul	- 11 Sep	Jupiter and Mercury visible
26 Sep	- 18 Nov	Jupiter and Saturn visible
19 Nov	- 27 Dec	Jupiter, Mercury and Saturn visible
28 Dec	- 31 Dec	Jupiter and Saturn visible

Morning Sky:

25 Jan	- 19 Mar	Jupiter and Mercury visible
4 Apr	- 13 May	Jupiter and Saturn visible
14 May	- 23 May	Jupiter, Mars and Saturn visible
24 May	- 4 Jun	Jupiter, Mars, Mercury and Saturn visible
31 May		Mars and Mercury in conjunction
5 Jun	- 16 Jun	Jupiter, Mars, Mercury and Saturn visible
14 Jun		Mars and Mercury in conjunction
17 Jun	- 4 Jul	Jupiter, Mars, Mercury, Saturn and Venus visible
23 Jun		Mercury and Venus in conjunction
30 Jun		Mars and Venus in conjunction
5 Jul	- 24 Sep	Mars, Saturn and Venus visible
4 Sep		Mars and Venus in conjunction
25 Sep	- 26 Sep	Mars, Mercury, Saturn and Venus visible
27 Sep	- 20 Oct	Mars, Mercury and Venus visible
21 Oct	- 31 Dec	Mars and Venus visible

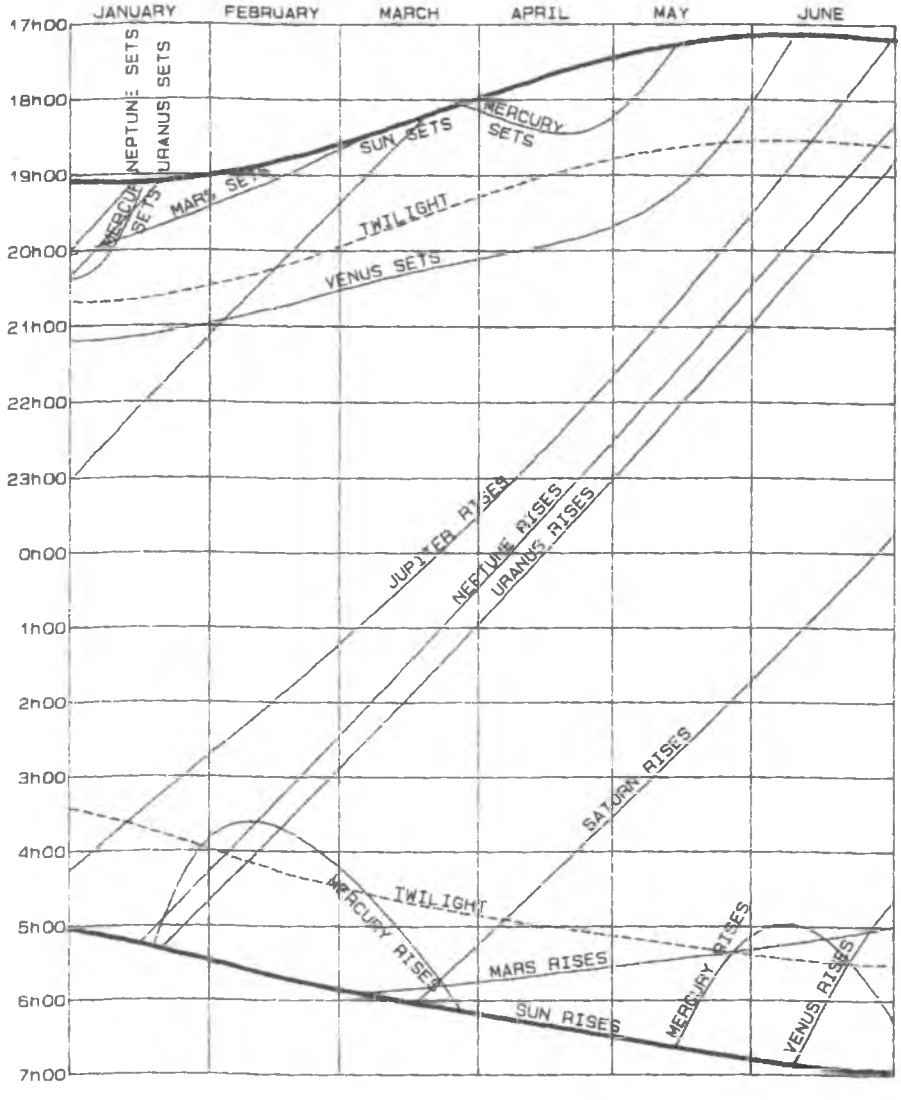
	Saturn		Uranus		Neptune		Pluto	
	RA	DEC	RA	DEC	RA	DEC	RA	DEC
	h m	° ′	h m	° ′	h m	° ′	h m	° ′
Jan 1	23 24.3	-6 9	20 6.5	-20 48	19 46.0	-20 42	16 9.7	-7 56
Jan 11	23 27.1	-5 50	20 8.9	-20 41	19 47.6	-20 38	16 10.9	-7 57
Jan 21	23 30.2	-5 28	20 11.3	-20 34	19 49.2	-20 34	16 12.0	-7 57
Jan 31	23 33.8	-5 4	20 13.8	-20 26	19 50.8	-20 30	16 12.9	-7 57
Feb 10	23 37.8	-4 37	20 16.2	-20 19	19 52.3	-20 26	16 13.7	-7 55
Feb 20	23 41.9	-4 10	20 18.5	-20 11	19 53.7	-20 23	16 14.2	-7 53
Mar 1	23 46.3	-3 41	20 20.6	-20 4	19 55.0	-20 19	16 14.4	-7 50
Mar 11	23 50.8	-3 12	20 22.6	-19 58	19 56.2	-20 16	16 14.5	-7 46
Mar 21	23 55.4	-2 42	20 24.3	-19 53	19 57.2	-20 13	16 14.3	-7 42
Mar 31	24 0.0	-2 13	20 25.7	-19 48	19 57.9	-20 11	16 13.9	-7 38
Apr 10	0 4.4	-1 45	20 26.8	-19 45	19 58.5	-20 9	16 13.3	-7 33
Apr 20	0 8.7	-1 18	20 27.7	-19 42	19 58.8	-20 8	16 12.6	-7 29
Apr 30	0 12.8	-0 53	20 28.1	-19 41	19 58.9	-20 8	16 11.7	-7 25
May 10	0 16.7	-0 30	20 28.3	-19 41	19 58.8	-20 8	16 10.7	-7 22
May 20	0 20.2	-0 9	20 28.1	-19 42	19 58.5	-20 9	16 9.6	-7 19
May 30	0 23.2	0 8	20 27.5	-19 44	19 57.9	-20 11	16 8.6	-7 17
Jun 9	0 25.9	0 23	20 26.7	-19 47	19 57.2	-20 13	16 7.5	-7 15
Jun 19	0 28.0	0 34	20 25.6	-19 51	19 56.3	-20 15	16 6.5	-7 15
Jun 29	0 29.6	0 41	20 24.3	-19 56	19 55.3	-20 18	16 5.6	-7 16
Jul 9	0 30.6	0 44	20 22.8	-20 1	19 54.2	-20 21	16 4.9	-7 17
Jul 19	0 31.0	0 44	20 21.2	-20 7	19 53.1	-20 24	16 4.3	-7 20
Jul 29	0 30.7	0 39	20 19.5	-20 12	19 52.0	-20 27	16 3.8	-7 23
Aug 8	0 29.9	0 31	20 17.9	-20 18	19 50.9	-20 30	16 3.6	-7 28
Aug 18	0 28.4	0 19	20 16.3	-20 23	19 49.9	-20 33	16 3.6	-7 33
Aug 28	0 26.5	0 4	20 14.9	-20 27	19 49.0	-20 36	16 3.8	-7 39
Sep 7	0 24.1	-0 13	20 13.8	-20 31	19 48.3	-20 38	16 4.2	-7 45
Sep 17	0 21.5	-0 31	20 12.9	-20 33	19 47.7	-20 39	16 4.8	-7 52
Sep 27	0 18.7	-0 50	20 12.2	-20 35	19 47.4	-20 40	16 5.7	-7 59
Oct 7	0 15.8	-1 8	20 12.0	-20 36	19 47.3	-20 41	16 6.7	-8 6
Oct 17	0 13.1	-1 25	20 12.0	-20 35	19 47.4	-20 41	16 7.8	-8 13
Oct 27	0 10.7	-1 40	20 12.4	-20 34	19 47.8	-20 40	16 9.1	-8 20
Nov 6	0 8.7	-1 51	20 13.2	-20 31	19 48.4	-20 39	16 10.5	-8 26
Nov 16	0 7.3	-1 58	20 14.3	-20 27	19 49.2	-20 37	16 12.0	-8 32
Nov 26	0 6.4	-2 2	20 15.7	-20 22	19 50.2	-20 35	16 13.5	-8 37
Dec 6	0 6.2	-2 1	20 17.4	-20 17	19 51.4	-20 32	16 15.1	-8 42
Dec 16	0 6.6	-1 55	20 19.4	-20 10	19 52.7	-20 28	16 16.6	-8 45
Dec 26	0 7.7	-1 46	20 21.5	-20 3	19 54.2	-20 25	16 18.0	-8 48

APPARENT PLACES:

	Mercury		Venus		Mars		Jupiter	
	RA	DEC	RA	DEC	RA	DEC	RA	DEC
	h m	° ′	h m	° ′	h m	° ′	h m	° ′
Jan 1	20 6.4	-21 42	21 2.5	-18 46	19 45.1	-22 20	17 57.7	-23 11
Jan 11	20 28.6	-18 2	21 51.0	-14 50	20 18.0	-20 46	18 7.5	-23 12
Jan 21	19 46.7	-17 41	22 37.3	-10 15	20 50.4	-18 50	18 17.1	-23 10
Jan 31	19 21.3	-19 26	23 21.7	-5 15	21 22.2	-16 33	18 26.3	-23 6
Feb 10	19 45.9	-20 22	0 4.7	-0 2	21 53.1	-13 58	18 35.1	-23 0
Feb 20	20 34.0	-19 30	0 46.8	5 11	22 23.4	-11 10	18 43.4	-22 53
Mar 1	21 31.5	-16 32	1 28.6	10 13	22 53.1	-8 11	18 51.0	-22 45
Mar 11	22 33.6	-11 27	2 10.3	14 53	23 22.3	-5 5	18 57.8	-22 37
Mar 21	23 39.6	-4 18	2 52.0	19 0	23 51.0	-1 56	19 3.7	-22 29
Mar 31	0 50.5	4 34	3 33.4	22 25	0 19.5	1 13	19 8.7	-22 22
Apr 10	2 4.2	13 41	4 13.3	25 2	0 47.8	4 20	19 12.5	-22 17
Apr 20	3 6.5	20 7	4 50.2	26 46	1 16.1	7 21	19 15.0	-22 13
Apr 30	3 40.2	22 15	5 21.5	27 39	1 44.5	10 13	19 16.3	-22 12
May 10	3 38.9	20 19	5 43.7	27 43	2 13.1	12 54	19 16.3	-22 13
May 20	3 19.4	16 15	5 52.4	27 1	2 42.0	15 22	19 14.9	-22 17
May 30	3 13.7	14 7	5 44.0	25 28	3 11.2	17 33	19 12.3	-22 23
Jun 9	3 34.5	15 27	5 21.3	23 2	3 40.6	19 27	19 8.5	-22 31
Jun 19	4 20.6	19 2	4 56.9	20 17	4 10.4	21 2	19 3.8	-22 39
Jun 29	5 31.4	22 47	4 44.1	18 20	4 40.2	22 16	18 58.5	-22 49
Jul 9	7 2.2	23 52	4 47.1	17 40	5 10.1	23 9	18 53.0	-22 57
Jul 19	8 32.4	20 42	5 3.5	17 58	5 40.0	23 41	18 47.6	-23 5
Jul 29	9 46.6	14 49	5 29.5	18 42	6 9.5	23 52	18 42.8	-23 12
Aug 8	10 44.9	8 4	6 2.6	19 26	6 38.6	23 42	18 38.8	-23 17
Aug 18	11 29.8	1 40	6 40.8	19 47	7 7.2	23 13	18 36.0	-23 20
Aug 28	11 59.3	-3 20	7 22.4	19 31	7 35.0	22 27	18 34.4	-23 23
Sep 7	12 4.6	-5 7	8 6.2	18 30	8 2.1	21 25	18 34.2	-23 24
Sep 17	11 38.2	-1 13	8 51.2	16 41	8 28.3	20 9	18 35.3	-23 24
Sep 27	11 19.3	4 12	9 36.5	14 3	8 53.5	18 42	18 37.8	-23 22
Oct 7	11 51.5	2 51	10 21.7	10 44	9 17.8	17 5	18 41.6	-23 20
Oct 17	12 50.3	-3 25	11 6.5	6 49	9 41.2	15 22	18 46.5	-23 15
Oct 27	13 52.8	-10 32	11 51.2	2 30	10 3.5	13 34	18 52.5	-23 9
Nov 6	14 55.2	-16 50	12 36.0	-2 3	10 24.8	11 44	18 59.3	-23 0
Nov 16	15 58.7	-21 44	13 21.5	-6 38	10 45.1	9 54	19 6.9	-22 49
Nov 26	17 4.0	-24 50	14 8.0	-11 3	11 4.3	8 7	19 15.2	-22 36
Dec 6	18 9.0	-25 47	14 56.1	-15 4	11 22.2	6 25	19 24.1	-22 20
Dec 16	19 4.7	-24 24	15 46.2	-18 29	11 38.7	4 51	19 33.3	-22 1
Dec 26	19 21.0	-21 40	16 38.1	-21 5	11 53.5	3 27	19 42.9	-21 40

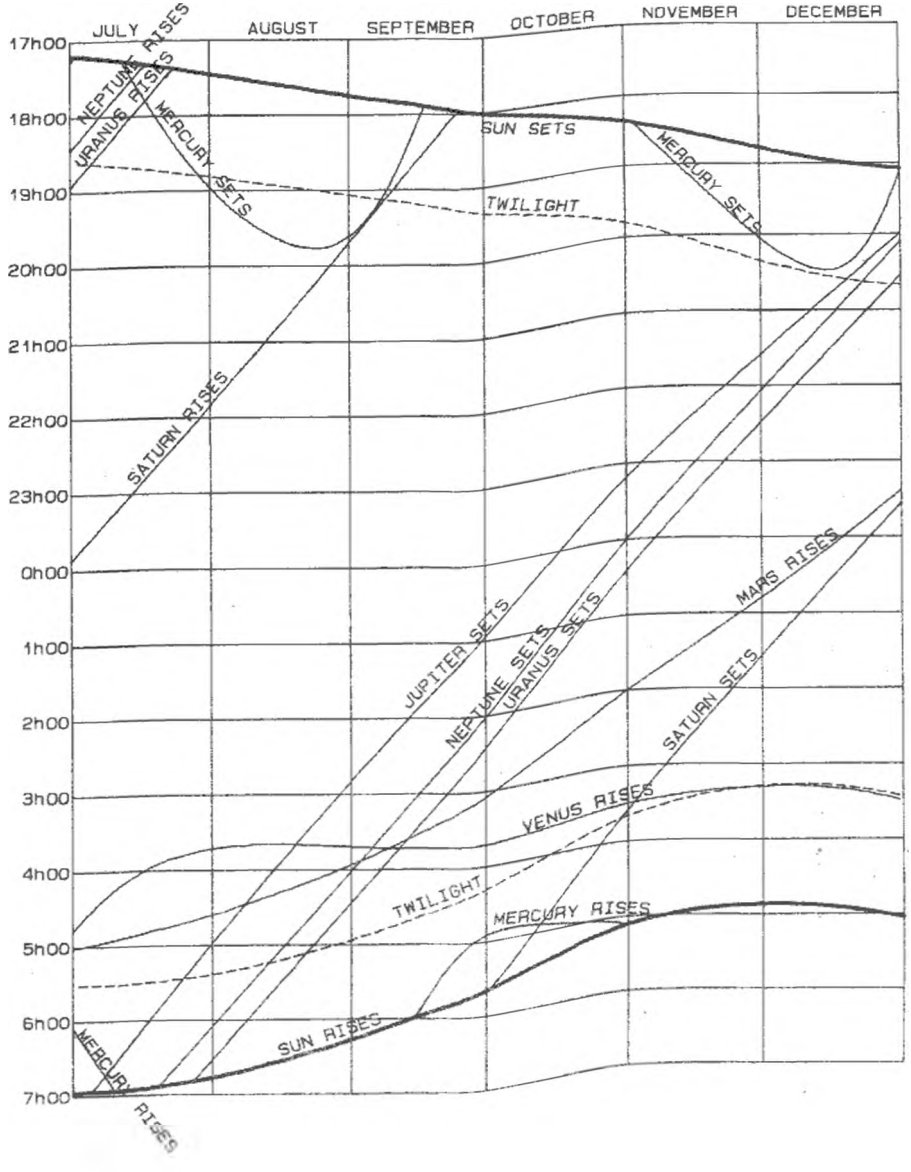
TIMES OF RISING AND SETTING

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.



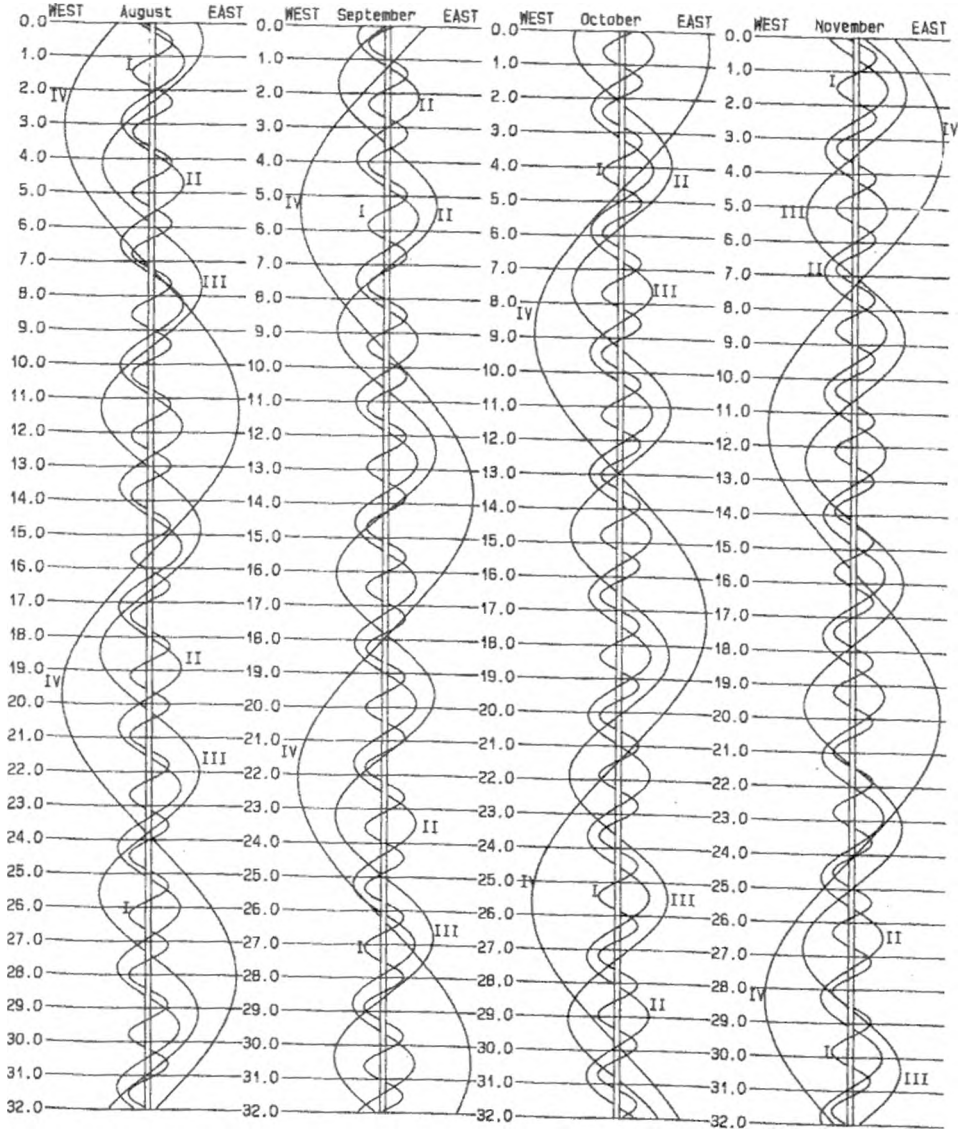
CORRECTION FOR PLACES NOT ON THE 30° E MERIDIAN
Approximate longitude corrections from the 30° East meridian are:

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

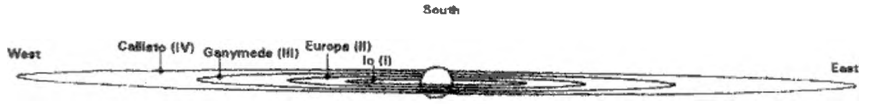


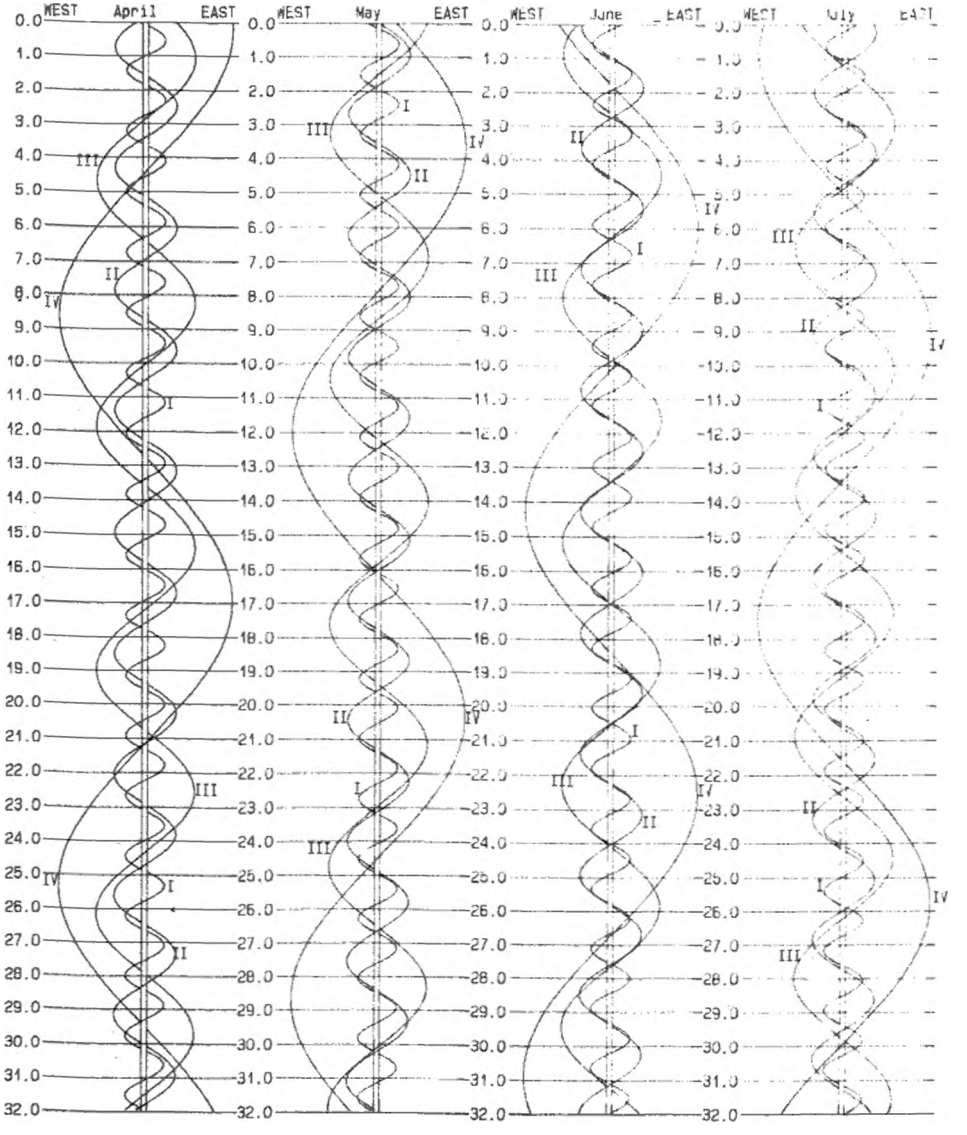
THE MOONS OF JUPITER

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 disk of Jupiter is stretched to make the central column, and horizontal lines representing midnight (0am 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.

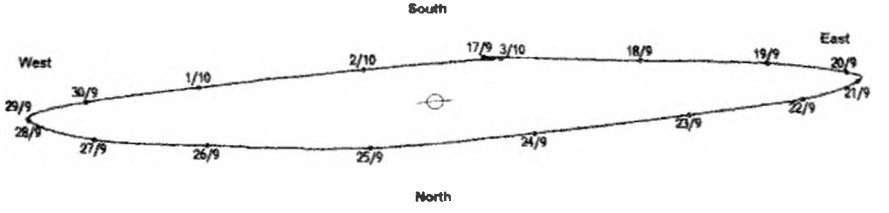
- Date and predicted times are given; these are for mid-phenomean and are not instantaneous.
- The moon concerned are I - Io, II - Europa, III - Ganymede and IV - Callisto.
- Phenomena - the abbreviations used are D - Disappearance; Ec - Eclipse ie.the satellite passes through the shadow of Jupiter; 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	04	04	26	II.Oc.R.	Apr	21	03	07	IV.Tr.E.	May	22	23	50	III.Tr.E.	Jun	10	02	32	IV.Tr.E.
	05	04	51	III.Tr.E.			04	31	II.Tr.E.		23	00	36	II.Tr.I.		13	04	56	III.Sh.I.
	06	04	55	I.Ec.D.		22	02	21	I.Sh.I.			01	32	II.Sh.E.		14	04	34	I.Sh.I.
	07	03	11	I.Tr.I.			03	36	I.Tr.I.			01	41	I.Ec.D.		15	01	01	II.Ec.D.
		04	16	I.Sh.E.			04	35	I.Sh.E.			03	22	II.Tr.E.			01	49	I.Ec.D.
	08	02	47	I.Oc.R.		23	03	09	I.Oc.R.			04	51	I.Oc.R.			04	32	I.Oc.R.
	10	04	28	IV.Oc.D.		24	00	18	I.Tr.E.			22	52	I.Sh.I.			04	49	II.Oc.R.
	12	04	11	III.Sh.E.			01	07	III.Sh.I.			23	47	I.Tr.I.			23	03	I.Sh.I.
	14	03	57	I.Sh.I.			04	04	III.Sh.E.		24	00	36	IV.Sh.I.			23	30	I.Tr.I.
	15	04	44	I.Oc.R.		28	01	50	II.Sh.I.			01	07	I.Sh.E.		16	01	18	I.Sh.E.
	18	04	34	II.Ec.D.			04	14	II.Tr.I.			02	02	I.Tr.E.			01	46	I.Tr.E.
	20	03	11	II.Tr.I.			04	34	II.Sh.E.			02	59	IV.Sh.E.			20	18	I.Ec.D.
		02	27	II.Sh.E.		29	01	33	IV.Ec.R.			23	17	I.Oc.R.			20	34	II.Tr.I.
		04	56	II.Tr.E.			04	16	I.Sh.I.		30	00	01	III.Sh.E.			22	30	II.Sh.E.
	22	03	10	I.Ec.D.		30	01	22	II.Oc.R.			00	12	III.Tr.I.			22	58	I.Oc.R.
	23	02	32	I.Sh.E.			01	32	I.Ec.D.			01	20	II.Sh.I.			23	21	II.Tr.E.
		03	22	III.Oc.R.			04	59	I.Oc.R.			02	54	II.Tr.I.			23	44	III.Oc.R.
		03	47	I.Tr.E.			23	54	I.Tr.I.			03	19	III.Tr.E.		17	20	12	I.Tr.E.
	27	01	47	IV.Oc.R.	May	01	00	57	I.Sh.E.			03	34	I.Ec.D.		22	03	38	II.EcD.
		02	18	II.Sh.I.			02	09	I.TR.E.			04	06	II.Sh.E.			03	43	I.Ec.D.
		04	49	II.TR.I.		04	23	43	III.Oc.D.		31	00	46	I.Sh.I.		23	00	57	I.Sh.I.
	29	01	50	II.Oc.R.		05	02	50	III.Oc.R.			01	33	I.Tr.I.			01	14	I.Tr.I.
	30	02	11	III.Ec.R.			04	24	II.Sh.I.			03	01	I.Sh.E.			03	13	I.Sh.E.
		02	12	I.Sh.I.		07	03	26	I.Ec.D.			03	49	I.Tr.E.			03	30	I.Tr.E.
		03	28	I.Tr.I.			03	50	II.Oc.R.			22	02	I.Ec.D.			22	12	I.Ec.D.
		04	24	III.Oc.D.		08	00	37	I.Sh.I.	Jun	01	00	12	II.Oc.R.			22	18	II.Sh.I.
		04	25	I.Sh.E.			01	44	I.Tr.I.			01	03	I.Oc.R.			22	48	II.Tr.I.
	31	03	03	I.Oc.R.			02	51	I.Sh.E.			21	30	I.Sh.E.			22	52	III.Ec.D.
Apr	03	04	52	II.Sh.I.			03	59	I.Tr.E.			22	15	I.Tr.E.		24	00	42	I.Oc.R.
	05	04	27	II.Oc.R.		09	01	16	I.Oc.R.		06	00	57	III.Sh.I.			01	04	II.Sh.E.
	06	03	14	III.Ec.D.		11	23	03	III.Ec.D.			03	38	III.Tr.I.			01	35	II.Tr.E.
		04	06	I.Sh.I.		12	02	04	III.Ec.R.			03	54	II.Sh.I.			03	02	III.Oc.R.
	07	01	25	I.Ec.D.			03	23	III.Oc.D.			04	01	III.Sh.E.			19	40	I.Tr.I.
		04	57	I.Oc.R.		14	01	17	II.Ec.D.		07	02	40	I.Sh.I.			21	42	I.Sh.E.
	08	02	05	I.Tr.E.		15	02	30	I.Sh.I.			03	19	I.Tr.I.			21	56	I.Tr.E.
	10	01	24	III.Tr.E.			03	33	I.Tr.I.			04	55	I.Sh.E.		25	20	13	II.Oc.R.
	12	01	37	II.Ec.D.			04	45	I.Sh.E.			22	25	II.Ec.D.		30	02	52	I.Sh.I.
	14	02	00	II.Tr.E.			22	58	II.Sh.E.			23	56	I.Ec.D.			02	58	I.Tr.I.
		03	18	I.Ec.D.			23	47	I.Ec.D.		08	02	31	II.Oc.R.	Jul	01	00	05	I.Ec.D.
	15	01	44	I.TR.I.		16	01	01	II.Tr.E.			02	48	I.Oc.R.			00	51	II.Sh.I.
		02	41	I.Sh.E.			02	48	IV.Oc.D.			21	09	I.Sh.I.			01	02	II.Tr.I.
		03	58	I.Tr.E.			03	04	I.Oc.R.			21	45	I.Tr.I.			02	26	I.Oc.R.
	16	01	18	I.Oc.R.			23	13	I.Sh.E.			23	24	I.Sh.E.			02	51	III.Ec.D.
	17	02	17	III.Tr.I.		17	00	14	I.Tr.E.		09	00	01	I.Tr.E.			03	38	II.Sh.E.
	19	04	12	II.Ec.D.		19	03	01	III.Ec.D.			21	06	II.Tr.E.			03	48	II.Tr.E.
	21	00	23	IV.Tr.I.		21	03	53	II.Ec.D.			21	09	IV.Sh.E.			21	20	I.Sh.I.
		01	45	II.Tr.I.		22	04	24	I.Sh.I.			21	14	I.Oc.R.			21	24	I.Tr.I.
		02	00	II.Sh.E.			22	47	II.Sh.I.			23	56	IV.Tr.I.			23	36	I.Sh.E.

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

THE MOONS OF SATURN

Saturn's moons are considerably fainter than the 4 Galilean moons of Jupiter. The diagram shows the orbit of TITAN, the largest of Saturn's moons, at opposition on September 26. Titan (at magnitude +8.5) may be found using 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	06.1	Jan	5	01.7
Jan	8	23.4	Jan	13	03.9		17	06.0		21	01.6
	24	23.5		29	04.1	Feb	2	06.1	Feb	6	01.7
Feb	9	23.8	Feb	14	04.5		18	06.4		22	02.0
	26	00.2	Mar	1	05.1	Mar	5	06.9	Mar	9	02.4
Mar	13	00.8		17	05.7		21	07.4		25	02.9
	29	01.4	Apr	2	06.4	Apr	6	07.9	Apr	10	03.3
Apr	14	02.0		18	06.9		22	08.3		26	03.7
	30	02.4	May	4	07.4	May	8	08.6	May	12	03.9
May	16	02.7		20	07.6		24	08.6		28	03.8
Jun	1	02.7	Jun	5	07.5	Jun	9	08.4	Jun	13	03.5
	17	02.4		21	07.1		25	07.8		29	02.9
Jul	3	01.7	Jul	7	06.4	Jul	11	06.9	Jul	15	01.9
	19	00.6		23	05.2		27	05.6		31	00.5
Aug	3	23.1	Aug	8	03.5	Aug	12	03.9	Aug	15	22.7
	19	21.2		24	01.5		28	01.9		31	20.6
Sep	4	18.9	Sep	8	23.2	Sep	12	23.6	Sep	16	18.3
	20	16.5		24	20.7		28	21.1	Oct	2	15.9
Oct	6	14.0	Oct	10	18.1	Oct	14	18.7		18	13.5
	22	11.6		26	15.8		30	16.5	Nov	3	11.3
Nov	7	09.4	Nov	11	13.7	Nov	15	14.5		19	09.5
	23	07.6		27	12.0	Dec	1	13 0	Dec	5	08.0
Dec	9	06.2	Dec	13	10.7		17	11.8		21	07.0
	25	05.3		29	09.9						

COMETS AND METEORS

COMETS

Located at the outer extremes of the solar system is a cloud of material, probably left over from the formation of the solar system itself. This cloud, known as the Oort Cloud, is believed to be the reservoir from which the comets emanate. At such vast distances from the sun this material, consisting of gases and dust, is preserved in the same state as when the sun and planets were formed, and thus a study of comets is important to understanding the birth of the solar system.

Every now and then, part of the material may break away from the cloud, and under the influence of gravity, accelerates towards the sun as a comet. These comets, travelling in parabolic orbits, are known as long period comets and by definition have orbital periods greater than 200 years, though the actual periods are generally a few thousand years or more. Occasionally the orbits of comets travelling in the same plane as the planets may be perturbed by the gravitational effects of the major planets, mainly Jupiter, into elliptical orbits. These comets have shorter periods, by definition less than 200 years, and since their orbits are known fairly precisely, their returns can be predicted with some degree of accuracy. The table below lists comets predicted to appear during 1996, and which are predicted to become brighter than about magnitude 12. The table does not of course include any new comets which might possibly be discovered during the year.

COMET	PERIHELION DATE	PREDICTED MAXIMUM MAGNITUDE
de Vico	1995 October 6	5
Honda Mrkos Pajdusakova	1995 December 26	7
Churyumov-Gerasimenko	1996 January 17	11
Kopff	1996 July 2	7
Gunn	1996 July 24	12
Machholz 1	1996 October 15	3
Iras	1996 October 31	11
Hale-Bopp	1997 April 1	?

In the cold depths of space, comets are no more than chunks of frozen gases, ices and dust. However, in the vicinity of the sun the constituents of the nucleus vaporise, and the gases and dust form a coma around the nucleus. Under the influence of the solar wind the gas and dust in the coma is swept away to form the tail, such that the tail always points away from the sun.

The Director of the Comet and Meteor Section welcomes all observations of comets, but to be of scientific value the observer should concentrate on the following:

- Estimates of the total visual magnitude of the comet, preferably made over the entire apparition to allow construction of a light curve
- Estimates of the diameter of the coma
- Estimates of the degree of condensation of the comet
- Estimates of the length and position angle of the tail
- Detailed visual descriptions, sketches and photographs of the comet

In making the above observations it is essential that the observer uses the standard procedures developed and used by observers world-wide. Detailed notes on observing techniques and visibility of comets may be obtained from the Director at the address below. *Beginning observers should note that comets are notoriously unpredictable, and that the predicted brightness in the above table is given as a guide only.* The magnitude given is the total magnitude of the coma and the brightness is spread out across the whole diameter of the comet. For this reason the comet will appear much fainter than a star of the same magnitude. As a guide, a comet of magnitude 10-11 would appear about as bright as a star of magnitude 12-13.

Details on how to observe either comets or meteors are available from the Director of the Comet and Meteor Section, T P Cooper, P O Box 14740, Bredell, 1623. Tel. 011-967-2250.

METEORS

The name given to particles travelling through space is *meteoroids*. Several thousand tonnes of these particles, mostly smaller than grains of sand, enter the earths atmosphere every day. When a particle enters the atmosphere, it heats up due to the effects of friction and may become visible before burning up. The resultant streak of light is known as a *meteor*. Those which become equal or brighter than Venus are termed *fireballs*. In general, meteors appear in the upper atmosphere, at an altitude of between 80-120 km and disappear at between 60-80 km. Heavier and slower fireballs may descend below this, and bodies which reach the earths surface are called *meteorites*.

Most meteors entering the atmosphere are *sporadic*, particles travelling through space in isolation. However, several meteor *showers*, streams of particles which are left behind by comets in their passage around the sun, may be observed throughout the year. The table below lists the showers requiring observation.

SHOWER	MAX DATE	SHOWER DURATION	RADIANT RA 2000.0	RADIANT DEC °	ZHR	VEL km/s	REC.WATCH BEGIN SAST	REC.WATCH END SAST	OBSERVING CONDITIONS 1996
α Crucids	Jan19	Jan06-Jan28	12h48	-63	<5	50	00h00	03h30	Favourable
θ Centaurids	Feb 8	Jan28-Feb23	14h00	-40	5	60	22h00	03h30	Unfavourable
Pyxids	Mar 6	Mar03-Mar09	09h00	-35	<5	?	20h00	03h30	Unfavourable
γ Normids	Mar 14	Feb25-Mar22	16h36	-51	5	56	00h00	04h30	Good
δ Pavonids	Apr 6	Mar11-Apr16	20h32	-63	5	59	02h00	04h30	Unfavourable
April Lyrids	Apr 22	Apr16-Apr24	18h05	+34	15	49	03h00	05h00	Favourable
π Puppids	Apr 23	Apr16-Apr25	07h20	-45	<5	18	19h00	22h00	Favourable
α Scorpiids	May 3	Apr11-May12	16h00	-27	5	35	21h00	04h00	Full moon
η Aquarids	May 4	Apr21-May12	22h24	-02	30	65	04h00	05h30	Unfavourable
χ Scorpiids	Jun 5	May27-Jun20	16h32	-14	5	21	21h00	04h30	Unfavourable
Sagittarids	Jun 11	Jun08-Jun16	20h16	-35	<5	52	03h30	05h30	Favourable
θ Ophiuchids	Jun 13	Jun08-Jun16	17h48	-20	5	27	20h00	05h30	Favourable
June Lyrids	Jun 16	Jun11-Jun21	18h32	+35	9	31	23h30	02h00	New moon
Cetids	Jun 28	Jun26-Jun29	02h00	-15	<5	?	03h00	05h30	Poor
Capricornids	Jul 26	Jul10-Aug05	21h00	-15	8	?	20h30	05h30	Poor
Piscis Australids	Jul 28	Jul19-Aug17	22h40	-30	8	35	21h30	05h00	Unfavourable
South δ Aquarids	Jul 29	Jul21-Aug29	22h36	-16	30	42	22h00	05h00	Unfavourable
α Capricornids	Jul 30	Jul15-Aug25	20h28	-10	10	25	20h00	04h00	Full moon
South ι Aquarids	Aug 5	Jul15-Aug25	22h12	-15	<5	34	22h00	04h30	Poor
North δ Aquarids	Aug 12	Jul14-Aug25	22h28	-05	10	42	23h00	05h00	Favourable
North ι Aquarids	Aug 20	Jul15-Sep20	21h48	-06	10	36	20h00	05h00	Favourable
Orionids	Oct 21	Oct02-Nov07	06h20	+16	30	68	02h00	04h00	Good
Southern Taurids	Nov 3	Sep15-Dec01	03h20	+14	10	29	21h30	03h30	Poor
Northern Taurids	Nov 13	Sep19-Dec01	04h00	+23	5	31	21h30	03h30	Favourable
Leonids	Nov 17	Nov14-Nov20	10h08	+22	5	70	03h00	04h00	Favourable
Dec. Phoenicids	Dec 5	Dec03-Dec05	01h12	-53	5	22	20h30	01h00	Good
Geminids	Dec 14	Dec04-Dec16	07h28	+33	50	36	23h30	03h00	Good
Velids	Dec 29	Dec05-Jan07	09h56	-51	5	40	22h30	03h30	Unfavourable

Notes to Table: 1.)The radiant of most showers drifts slightly eastward each night. The position given is for night of maximum. 2.)The ZHR is the expected maximum rate under observing conditions when stars of magnitude 6.5 can be discerned and with the radiant at the zenith. Rates under poorer conditions and when the radiant is low will consequently be lower. 3.)Showers listed as favourable are the best prospects for observation. Those listed as good may be observed under slight hindrance from the moon

The Stars

CONSTELLATIONS

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

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

STAR NAMES

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

STELLAR MAGNITUDES 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

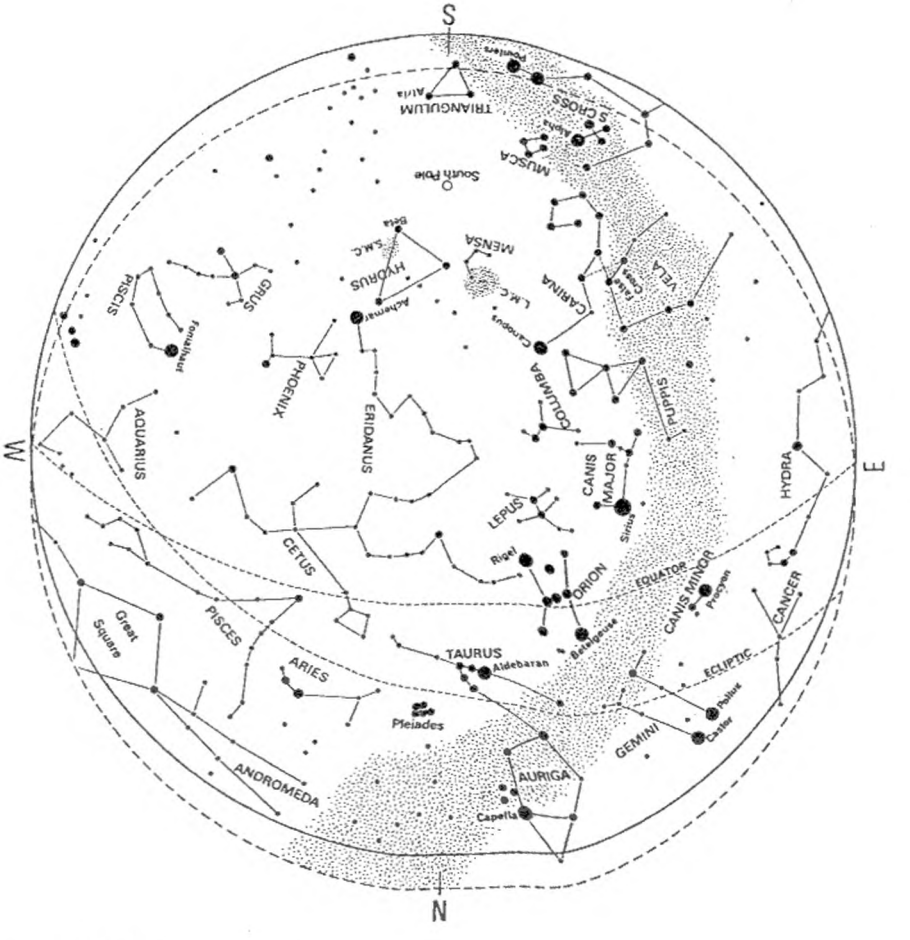
The star charts in this section show the night sky for each of the four seasons of the year. These seasonal charts depict stars down to magnitude 3.5 which is approximately what will be visible to the naked eye in city areas. Charts of 3 of the most interesting regions in the sky (showing stars down 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

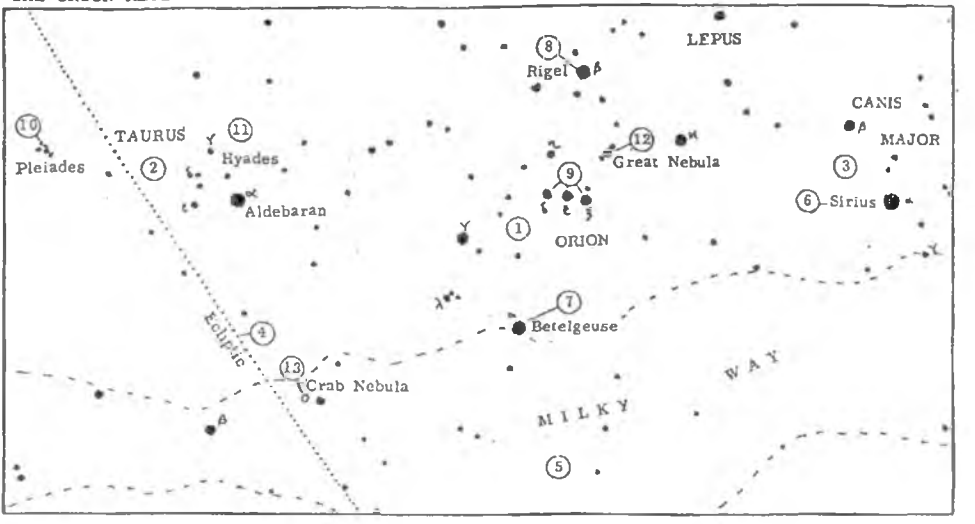
Correct times for places elsewhere may be found by subtracting 4 minutes for each degree of longitude east of Cape Town or adding 4 min for each degree of longitude west of Cape Town.



Courtesy of the

PLANETARIUM SA MUSEUM

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.

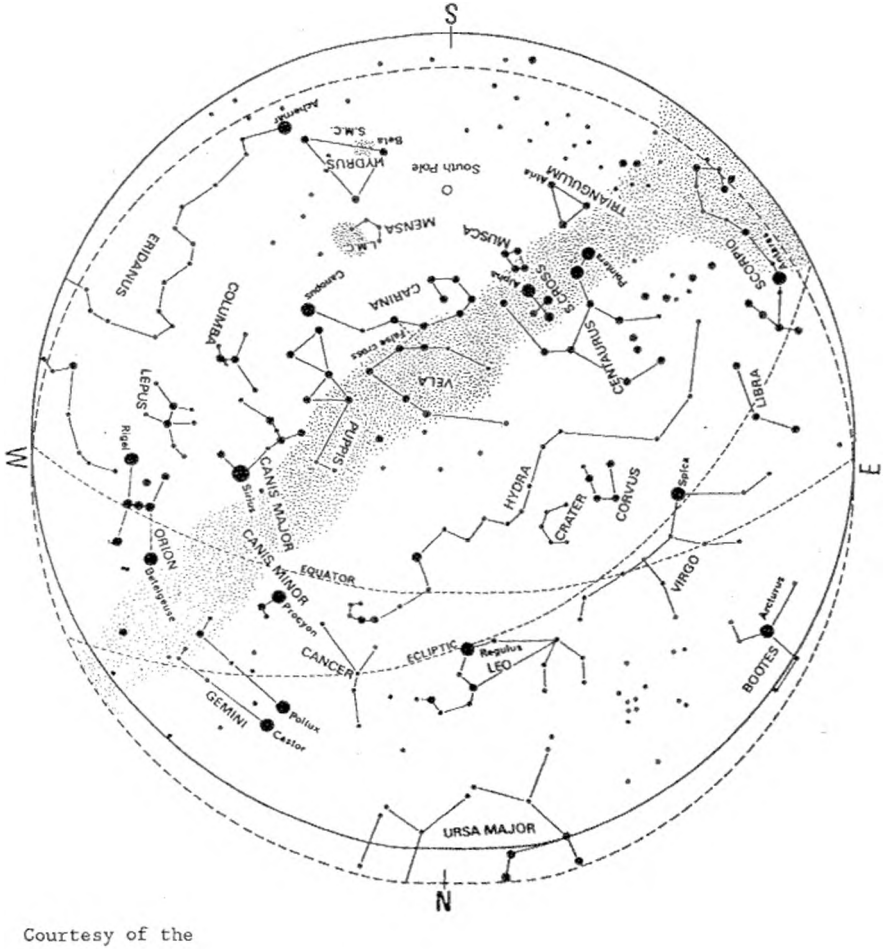
(13) The Crab Nebula, the remnant of a supernova recorded by the Chinese in 1054, requires a moderate sized telescope for observation. In its heart is located the extraodinary pulsar which emits a double flash of light 30 times every second. The current belief is that it is a rapidly rotating neutron 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 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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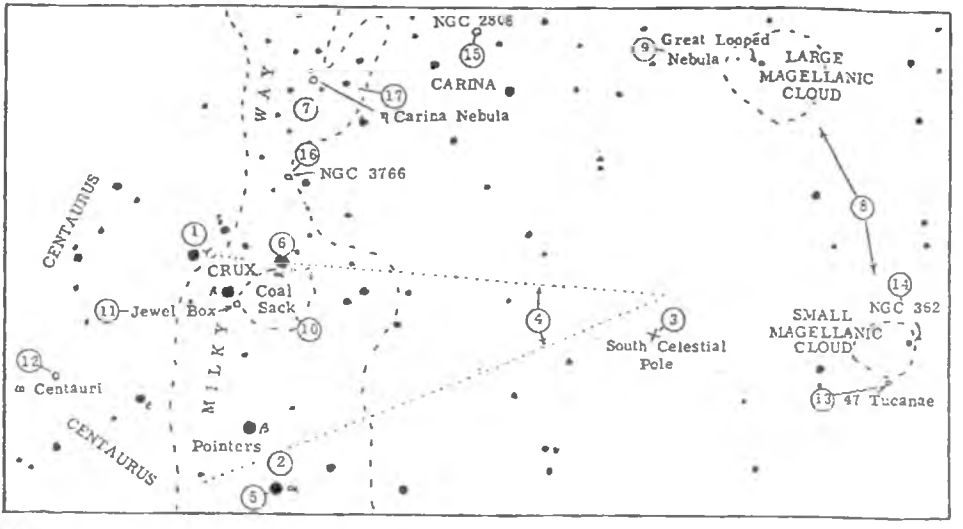
THE SOUTHERN CROSS REGION



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

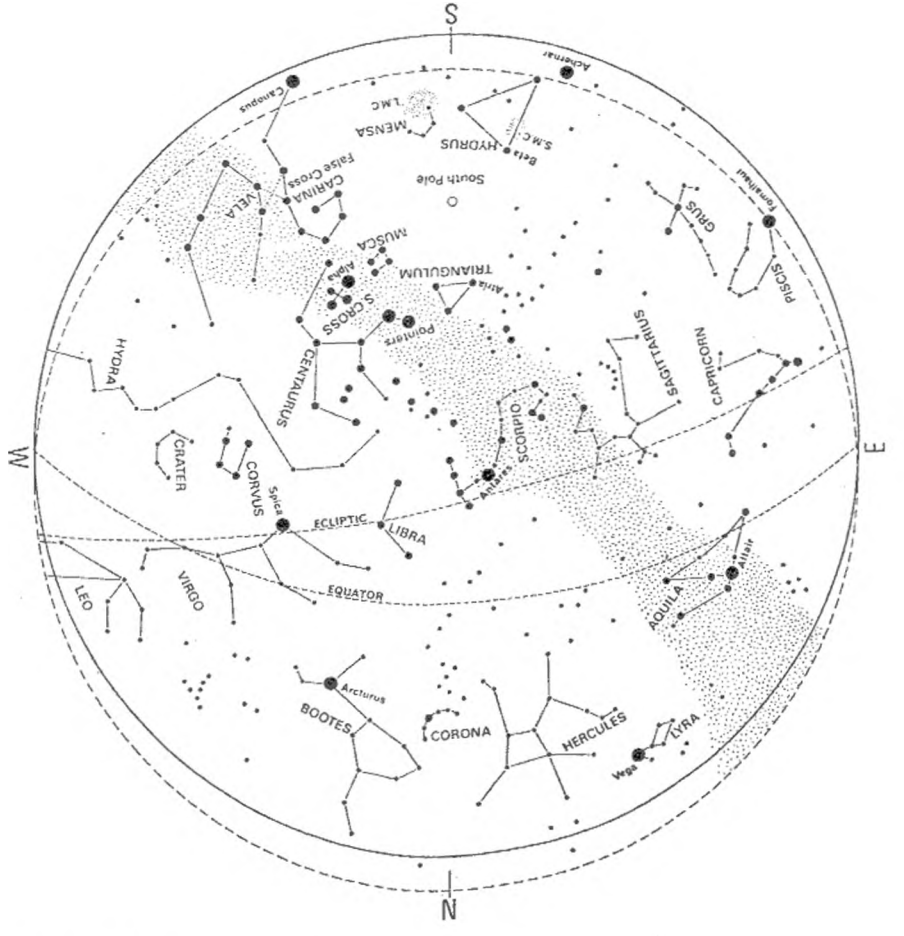
(17) The η Carinae nebula - site of a slow supernova that brightened to magnitude -0,8 in 1843 and is now of magnitude 6,4.

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

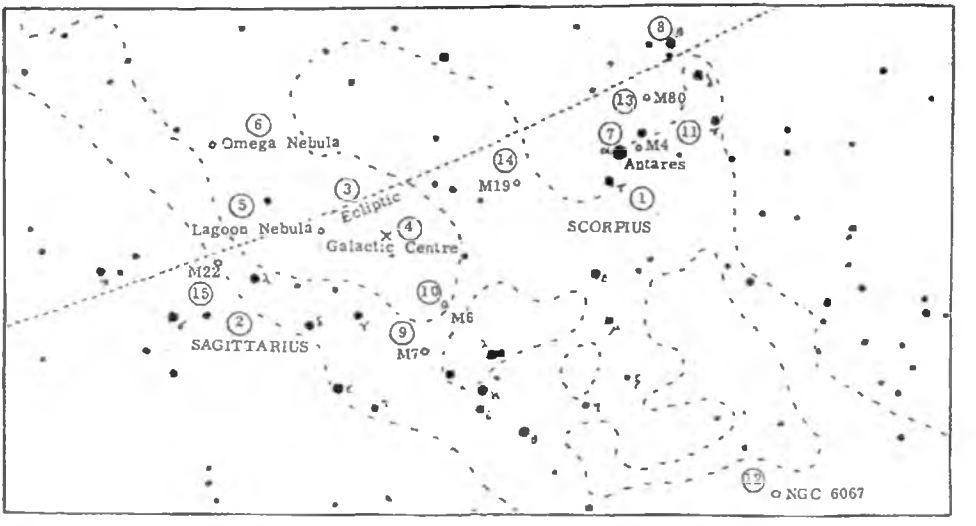
Correct times for places elsewhere may be found by subtracting 4 minutes for each degree of longitude east of Cape Town or adding 4 min for each degree of longitude west of Cape Town.



Courtesy of the

PLANETARIUM SA MUSEUM

THE SCORPIUS REGION



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

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

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

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

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

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

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

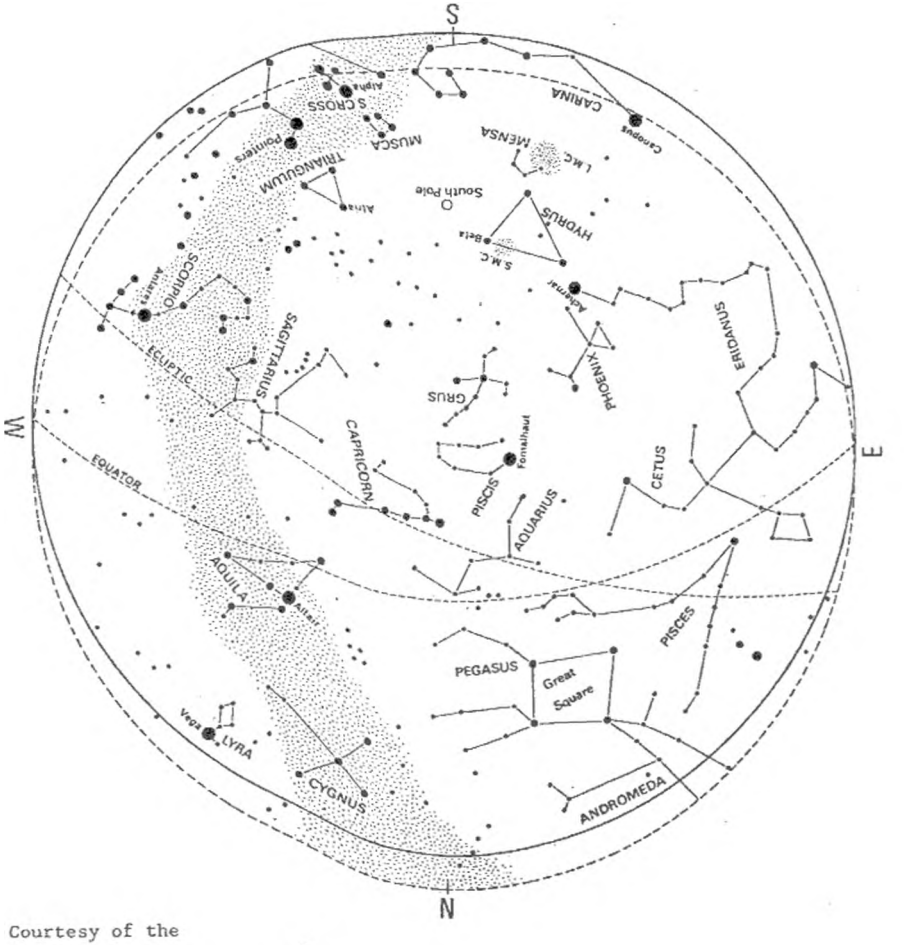
Further from the plane of the Milky Way are some globular clusters: (13) M80 (14) M19 and (15) M22.

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.

DEEP SKY SECTION

The Deep-Sky Observing Section is dedicated to observing objects outside our solar system: clusters, nebulae and galaxies. New members receive a brief observing guide explaining some of the basics of deep-sky observing.

In order to promote visual observing, the Section offer a Bennett Certificate to those who observe the comet-like objects listed by the late Jack Bennett, past director of the Comet and Meteor Section. These and other observations will contribute to the long-term goal of the Section, namely the production of a handbook of southern deep-sky objects.

ASSA members who would like more information or who would like to join the Section are encouraged to write to the Director :

Mr Auke Slotegraaf, PO Box 608, Stellenbosch, 7599. (Tel. 021-887-887-8)

TOTAL LUNAR 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

DATE		S.C.	Mag.	Ph	ELG	CAPE TOWN E 18.5 S 33.9				JOHANNESBURG E 28.1 S 26.2				HARARE E 31.0 S 17.8			
						UT	a.	b.	P.A.	UT	a.	b.	P.A.	UT	a.	b.	P.A.
M	D					h m	m	m	°	h m	m	m	°	h m	m	m	°
Jan	1	532	7.2	DD	137					21 28.7	-2.0	-0.9	126	21 32.3	-2.1	+0.2	98
Jan	10	1518	6.3	RD	227	2 29.8	-4.1	+2.7	239								
Jan	26	264	7.0	DD	83	20 24.1	-0.8	-0.4	129								
Jan	27	380	7.4	DD	94									20 4.7	-1.0	-1.3	128
Jan	28	505	7.0	DD	106	21 38.7	-1.1	+1.3	85								
Jan	29	629	7.5	DD	117	20 28.8	-1.9	-1.0	132	20 44.2	-1.7	+0.3	104	20 55.4	-1.9	+1.1	78
Jan	29	643	6.7	DD	118	22 36.9	-0.9	+1.0	97								
Feb	25	590	6.3	DD	86									20 17.5	-0.4	-0.3	116
Feb	26	726	6.8	DD	96					18 8.6	-2.5	-0.1	106	16 19.4	-2.7	+0.9	81
Feb	26	730	5.1	DD	96	19 38.0	-1.8	+0.6	101	20 2.5	-1.7	+1.5	73	20 28.0	-2.3	+4.1	35
Feb	27	862	7.5	DD	108					20 27.2	-1.1	-0.7	129	20 29.6	-1.5	+0.3	99
Feb	27	863	6.7	DD	108					20 42.9	-1.0	-0.5	127	20 45.9	-1.4	+0.4	96
Feb	29	1116	7.4	DD	129	20 16.8	-2.1	-0.9	126	20 36.5	-2.5	+0.4	95	20 55.2	-3.5	+2.5	60
Mar	10	2247	5.6	RD	246					20 55.0	+0.1	-1.6	303				
Mar	11	2271	4.3	RD	249					2 13.5			210	2 44.9	-3.1	+0.6	261
Mar	16	3045	6.0	RD	315					2 14.3	-0.5	-0.4	256	2 9.0	-0.4	-1.3	288
Mar	21	272	5.9	DD	29					16 58.6	-0.7	+2.4	41				
Mar	24	663	6.9	DD	64									16 42.2	-2.5	+1.6	65
Mar	25	800	7.5	DD	76	18 20.3	-1.3	-0.9	138	18 31.5	-1.4	+0.4	104	18 42.4	-1.6	+1.3	75
Mar	26	943	6.2	DD	87	19 22.0			169	19 17.7	-1.1	-0.3	122	19 22.4	-1.5	+0.6	92
Mar	27	1072	6.2	DD	98					18 29.4	-1.6	-1.6	139	18 27.1	-2.4	-0.4	109
Mar	28	1190	7.1	DD	109	19 40.5	-1.5	-1.3	140	19 53.0	-2.0	+0.1	104	20 6.4	-2.7	+1.7	71
Mar	28	1197	6.0	DD	110	21 49.0	-0.6	-0.5	136	21 56.4	-0.8	+0.6	99	22 9.6	-1.3	+2.2	62
Mar	31	1518	6.3	DD	144	23 2.9	-0.8	-1.7	153	23 6.9	-1.3	-0.1	114	23 15.5	-1.7	+1.3	79
Apr	2	1635	5.4	DD	157	2 47.1	-0.1	-1.0	148								
Apr	9	2674	6.0	RD	256					21 37.8	-0.3	-0.4	255	21 32.6	+0.0	-1.0	285
Apr	12	3002	6.2	RD	284					1 24.7			191	1 46.2	-1.6	+0.9	237
Apr	24	1141	5.6	DD	77					16 33.4	-2.9	+0.6	87	16 58.4			49
Apr	25	1257	7.5	DD	89	17 25.1	-1.7	-1.8	144	17 36.5	-2.4	-0.3	110	17 47.2	-3.3	+1.2	78
Apr	27	1458	5.9	DD	110					16 21.5	-2.5	-2.5	108	16 25.5	-3.6	+0.3	80
Apr	27	1465	6.3	DD	111									18 41.4	-0.9	-3.6	163
Apr	27	1468	4.9	DD	112									20 23.1	-0.6	-2.7	159
Apr	27	1478	7.2	DD	113	22 47.7	-0.6	+0.2	117								
May	5	2460	6.1	RD	212	20 19.0			342								
May	7	2647	6.4	RD	228									0 57.1	-2.7	+2.0	233
May	20	985	6.9	DD	37	17 24.2	-0.8	+0.8	101								
May	24	1428	3.7	DD	81	18 7.7	-0.6	-2.6	164	18 8.2	-1.5	-0.5	121	18 13.8	-2.2	+0.7	89
May	26	1635	5.4	DD	104									20 5.9	-1.0	-1.9	145
May	28	1865	7.3	DD	128	21 50.9	-1.4	-0.7	129	22 4.9	-1.4	+0.7	95	22 22.2	-1.4	+3.0	56
May	29	1973	6.2	DD	140	19 23.1			180	19 10.5	-2.0	-1.9	131	19 7.2	-2.9	-0.5	99
Jun	4	2913	5.1	RD	224	23 44.1	-1.8	+1.0	232	24 8.1	-2.3	+0.2	258	24 12.5	-2.9	-1.2	288
Jun	22	1599m	5.1	DD	74									19 7.9	-0.6	-1.4	141
Jun	23	1708	6.2	DD	86					20 6.2	-0.6	-1.2	142	20 3.3	-0.8	-0.1	109
Jun	24	1814	7.1	DD	98	21 2.8	-0.8	-1.9	156	21 3.3	-0.7	-0.2	120	21 7.3	-0.7	+0.7	89
Jun	25	1946	7.2	DD	111	23 18.0	-0.4	+0.3	115								
Jun	26	2060	6.3	DD	122	21 51.0	-1.5	+1.3	83	22 19.5	-0.8	+3.5	48				
Jun	26	2064	6.5	DD	123	22 42.6	-0.9	+3.4	51								
Jun	27	2196	6.7	DD	136	23 53.3	-1.1	-0.4	129	24 1.2	-0.6	+0.3	108	24 7.5	-0.3	+0.9	81
Jul	2	3002	6.2	RD	206	23 45.3	-2.0	+0.3	256	24 8.4	-2.6	-0.1	274	24 8.4	-4.0	-2.9	306
Jul	6	3467	6.5	RD	249					2 32.8			174	3 8.8	-1.3	+3.1	204

DATE	I.C.	Mag.	Ph	ELG	CAPE TOWN E 18.5 S 33.9				JOHANNESBURG E 28.1 S 26.2				HARARE E 31.0 S 17.8			
M D					UT	a.	b.	P.A.	UT	a.	b.	P.A.	UT	a.	b.	P.A.
				°	h m	m	m	°	h m	m	m	°	h m	m	m	°
Jul 8	180	5.6	RD	273	0 52.8	-1.0	-1.3	274	0 53.0	-2.1	-2.5	295				
Jul 8	181	6.5	RD	273	0 53.7	-1.0	-1.3	274	0 54.0	-2.1	-2.5	295				
Jul 18	1458	5.9	DD	33					15 51.2			189				
Jul 23	1997	6.8	DD	89					16 4.0	-2.7	-0.6	104	16 17.4	-4.1	+2.1	66
Jul 23	1996	6.9	DD	89					16 6.4	-4.3	+3.0	58				
Jul 25	2280	6.8	DD	118	23 13.0	-0.4	+1.5	76	23 27.6	+0.1	+1.9	57				
Aug 4	136	6.3	RD	244	3 3.2	-2.4	+0.2	266	3 30.6	-2.7	+0.3	273	3 36.3	-3.7	-1.6	298
Aug 4	257	4.5	RD	254					21 55.3			188	22 9.6	-0.3	+1.0	225
Aug 7	527	6.3	RD	281	4 45.1	-3.0	-1.3	294								
Aug 8	653	4.8	RD	291									0 19.2	-0.4	+0.0	253
Aug 11	1072	6.2	RD	325									3 29.0			197
Aug 18	1855	7.1	DD	50	18 23.4			22								
Aug 19	1962	5.2	DD	60									16 6.5	-2.4	+0.7	87
Aug 20	2088	6.2	DD	73	18 39.9	-1.4	-0.8	133	18 50.6	-1.1	+0.3	105	19 0.0	-0.8	+1.3	75
Aug 21	2208	7.4	DD	84	16 45.5			139	16 57.6	-2.4	-0.3	104	17 9.9	-2.7	+1.5	71
Aug 22	2352	6.7	DD	97									16 12.9	-3.1	+0.4	82
Aug 23	2508	6.3	DD	111									18 20.5	-3.1	-3.9	145
Aug 24	2674	6.0	DD	124	18 48.8	-2.2	+0.3	83	19 18.6	-2.1	+1.8	58	19 49.8	-1.1	+5.1	22
Aug 25	2705	6.8	DD	127	0 16.5	+0.1	+2.4	40								
Aug 25	2856	6.6	DD	139	21 22.1	-2.5	-0.8	116	21 42.1	-2.1	+0.2	100	21 52.8	-1.6	+1.0	77
Aug 26	2883	5.5	DD	142	1 55.2	+0.2	+1.7	54								
Aug 26	3002	6.2	DD	153	20 0.3	-2.0	+0.2	77	20 26.8	-2.1	+1.4	59	20 50.3	-1.6	+3.0	32
Sep 1	214	6.4	RD	224									0 37.1	-0.6	+4.4	188
Sep 4	610	6.2	RD	261	0 3.1			329								
Sep 4	620	6.3	RD	262	3 11.4	-1.9	+1.1	228								
Sep 7	1040	6.2	RD	296	3 8.7	-0.5	+1.9	210	3 30.6	-1.8	+1.1	230				
Sep 17	2180	7.1	DD	55					17 12.4	-1.3	+0.3	103	17 22.8	-1.0	+1.3	74
Sep 19	2460	6.1	DD	81	17 59.3	-1.9	+1.0	83	18 26.4	-1.2	+2.0	62	19 53.2			26
Sep 20	2646	6.0	DD	96	23 12.5	+0.4	+2.0	47								
Sep 21	2789	7.3	DD	107					18 40.0	-3.0	-1.7	124	18 43.0	-2.5	+0.2	94
Sep 22	2936	6.8	DD	121	18 51.9	-2.7	-1.7	119	19 11.8	-2.6	-0.1	99	19 23.0	-2.3	+1.0	75
Sep 23	3093	4.5	DD	135	20 10.7	-1.1	+3.2	23	20 48.3			6				
Oct 2	832	4.7	RD	253	23 17.4	-0.4	+0.0	233	23 24.4	-1.1	+0.0	246	23 26.2	-1.7	-0.5	268
Oct 2	836	5.5	RD	253	23 45.9			201	24 3.1	-1.0	+1.4	219	24 15.6	-1.8	+0.6	244
Oct 15	2280	6.8	DD	39	18 7.0	-1.1	-1.6	150	18 7.7	-0.5	-0.3	126				
Oct 18	2737	6.8	DD	77	18 1.1	-1.3	+2.2	54	18 29.8	-0.6	+2.8	39				
Oct 20	3045	6.0	DD	104	19 23.0	-1.4	+2.0	52	19 51.3	-0.9	+2.3	42	20 16.7	+0.0	+3.6	17
Oct 21	3185	5.3	DD	116	18 9.0			353								
Oct 21	3187	6.2	DD	116	18 11.6	-2.2	+0.5	75	18 39.8	-2.1	+1.3	64	19 0.7	-1.7	+2.3	43
Oct 21	3199	6.8	DD	118	21 5.4	-2.4	-0.5	119	21 23.8	-1.7	+0.1	108	21 32.0	-1.2	+0.8	85
Oct 22	3328	7.0	DD	130	18 3.5	-1.8	+0.7	60	18 30.7	-1.9	+1.7	49	18 55.1	-1.4	+3.0	26
Oct 22	3344	6.8	DD	132	22 12.1	-0.7	+2.7	27	22 40.0	-0.2	+3.3	15				
Oct 23	3474	6.0	DD	142									16 12.4	-1.4	+0.7	61
Oct 28	620	6.3	RD	208	20 33.8	-1.0	-1.0	268	20 37.8	-1.7	-1.2	280	20 27.7	-2.9	-3.3	310
Oct 29	648	3.9	RD	212	2 57.3			198								
Oct 29	764	5.0	RD	220					20 59.9	-2.0	-2.8	308				
Nov 14	2705	6.8	DD	47	19 6.0			19								
Nov 15	2856	6.6	DD	60					17 28.4	-1.4	+0.5	97	17 38.9	-1.0	+1.1	75
Nov 16	3002	6.2	DD	73					18 9.4	-1.2	+1.3	75	18 24.9	-0.8	+1.7	55
Nov 19	3460	7.1	DD	115	23 3.6	-0.5	+1.7	62								

					CAPE TOWN E 18.5 S 33.9				JOHANNESBURG E 28.1 S 26.2				HARARE E 31.0 S 17.8			
DATE M D	I.C.	Mag.	Ph	ELG °	UT h m	a. m	b. m	P.A. °	UT h m	a. m	b. m	P.A. °	UT h m	a. m	b. m	P.A. °
Nov 21	180	5.6	DD	140	22 15.1	-1.1	+3.0	21	22 57.2			352				
Nov 21	181	6.5	DD	140	22 16.2	-1.1	+3.0	21	22 58.4			352				
Nov 21	184	6.2	DD	141									23 19.5			154
Nov 29	1141	5.6	RD	226									2 35.2			227
Dec 3	1660	6.2	RD	279	24 22.4	-0.5	-1.7	293	24 12.9	-0.7	-2.2	314	23 51.1	-0.5	-3.8	345
Dec 4	1663	5.2	RD	279	1 7.8	-0.9	-1.5	283	1 3.9	-1.1	-2.0	305	0 46.3	-0.9	-3.1	332
Dec 16	3411	7.2	DD	83	21 17.0	-0.4	+1.4	78								
Dec 19	257	4.5	DD	119									16 55.6	-2.5	+0.8	67
Dec 22	658	4.2	DD	155					18 12.6			2				

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 mm 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.

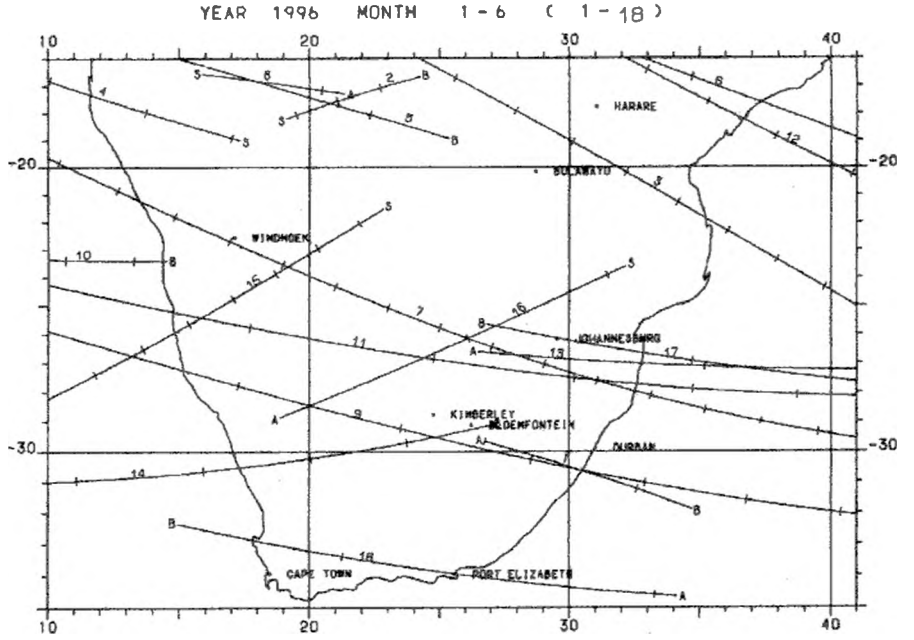
Interested observers - especially those living in the more distant regions - who wish to be informed of favourable grazes occurring in their neighbourhood, are therefore invited to contact the co-ordinator for grazing occultations:

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

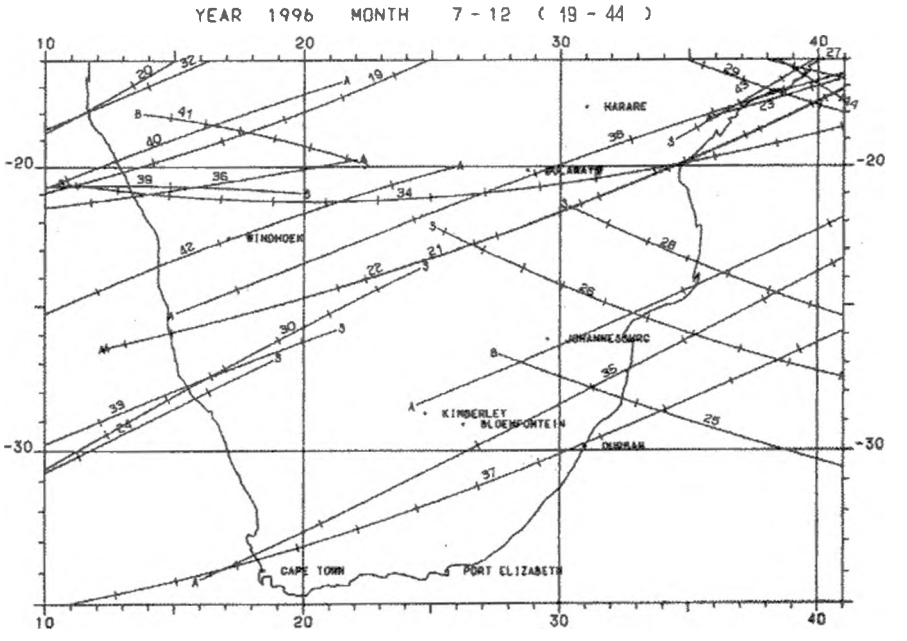
EXPLANATION OF THE COLUMN HEADINGS IN THE TABLES:

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 occultation. (A) denotes that the Moon is at a low altitude. (B) denotes that the star is occulted 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 given 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	1946	7.21	1	14	0	41	59.99	-48.58	N	(A)	(B)
2	252	7.45	1	26	19	48	44.97	42.48	S	(S)	(B)
3	2036	6.92	2	11	1	52	9.39	-64.04	S	( )	( )
4	2640	6.08	2	15	6	9	54.02	-19.39	S	( )	(S)
5	2808	7.38	2	16	4	55	54.90	-11.22	S	( )	(B)
6	730	5.12	2	26	22	48	56.98	55.23	N	( )	( )
7	2271	4.34	3	11	3	19	4.26	-67.78	S	( )	( )
8	272	5.94	3	21	19	27	50.42	5.92	N	(S)	(A)
9	2856	6.60	4	11	2	10	51.65	-48.89	S	( )	( )
10	2876	5.45	4	11	5	23	45.25	-47.70	S	( )	(B)
11	3002	6.24	4	12	3	1	25.13	-37.11	S	( )	( )
12	1141	5.64	4	24	19	23	1.48	38.78	N	( )	( )
13	3248	6.63	5	11	1	36	52.27	-40.41	S	(A)	( )
14	3216	6.60	6	7	2	23	59.04	-65.43	S	( )	(B)
15	3366	6.61	6	8	6	0	14.99	-52.95	N	( )	(S)
16	469	7.34	6	13	5	55	40.78	-7.66	N	(A)	(S)
17	1599m	5.05	6	22	21	36	53.83	35.51	S	(B)	( )
18	1708	6.24	6	23	22	25	26.72	45.52	S	(B)	(A)



SEQ	NZC NO	MAG	MON	DAY	H	M	S	SUNLIT(%)	LIMIT		
19	3460	7.10	7	6	2	28	10.57	-68.44	N	( )	( )
20	53	6.89	7	7	5	0	37.29	-56.72	N	( )	( )
21	180	5.57	7	8	2	18	55.30	-46.73	N	(A)	( )
22	181	6.49	7	8	2	19	41.85	-46.72	N	(A)	( )
23	301	6.83	7	9	1	27	58.82	-36.71	N	(A)	( )
24	718	6.13	7	12	6	58	56.87	-10.43	N	( )	(S)
25	1458	5.93	7	18	18	1	6.82	7.53	S	(B)	( )
26	1996	6.92	7	23	18	19	6.97	49.24	N	(S)	( )
27	1997	6.77	7	23	19	6	56.66	49.29	N	( )	( )
28	2110	6.42	7	24	18	0	8.64	59.85	N	(S)	( )
29	2247	5.55	7	25	18	22	55.97	70.54	N	( )	( )
30	527	6.33	8	7	5	55	26.60	-39.99	N	( )	(S)
31	658	4.24	8	8	2	45	9.23	-31.45	N	(A)	( )
32	800	7.50	8	9	5	11	37.20	-22.00	N	( )	( )
33	947	5.18	8	10	6	42	59.38	-14.30	N	( )	(S)
34	2508	6.29	8	23	19	55	7.45	67.60	S	(B)	( )
35	610	6.19	9	4	1	52	27.50	-57.26	N	(A)	( )
36	2060	6.30	9	16	20	38	49.21	13.53	S	( )	(A)
37	2789	7.31	9	21	20	25	51.85	64.57	S	( )	( )
38	985	6.86	10	4	1	58	52.81	-54.13	N	(A)	( )
39	1549m	5.17	10	9	5	56	39.63	-10.83	N	( )	(S)
40	2913	5.05	10	20	0	29	24.50	51.33	S	( )	(A)
41	1072	6.20	11	1	4	56	0.75	-70.34	S	(B)	(S)
42	3163	7.33	11	17	23	22	29.25	47.63	S	( )	(A)
43	3285m	6.11	11	18	18	22	35.92	57.24	S	(S)	( )
44	1830	6.84	12	33	3	36	38.42	-49.78	S	( )	( )

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 25 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.

OCCULTATIONS BY MINOR PLANETS

Date	SAST	CAT STAR		MINOR	PLANET
d	h m				
Feb 12	00 33	PPM 190311	occulted by	895	Helio
Mar 2	21 25	PPM 95997	occulted by	47	Aglaja
Mar 29	03 31	PPM 196509	occulted by	308	Polyxo
Mar 30	20 18	CMC 709304	occulted by	912	Maritima
May 2	21 15	PPM 264897	occulted by	714	Ulula
May 6	20 40	PPM 262688	occulted by	764	Gedania
May 7	00 28	GSC 6237 01396	occulted by	146	Lucina
May 24	22 33	PPM 322731	occulted by	54	Alexandra
May 28	04 40	GSC 6223 00850	occulted by	146	Lucina
Jun 10	04 36	PPM 231555	occulted by	1	Ceres
Jun 12	01 50	GSC 6225 00781	occulted by	146	Lucina
Jun 20	00 52	DM-28 3129	occulted by	9	Metis
Jun 23	21 38	PPM 178942	occulted by	40	Harmonia
Jun 26	02 31	GSC 0006 00373	occulted by	3	Juno
Jul 5	05 00	PPM 236841	occulted by	558	Carmen
Jul 10	19 06	PPM 719786	occulted by	654	Zelinda
Jul 29	19 13	PPM 735280	occulted by	203	Pompeja
Aug 5	04 25	PPM 722611	occulted by	133	Cyrene
Aug 9	00 07	PPM 298133	occulted by	446	Aeternitas
Aug 18	02 01	PPM 722927	occulted by	30	Urania
Aug 18	20 20	PPM 270520	occulted by	449	Hamburga
Sep 15	21 34	PPM 203374	occulted by	712	Boliviana
Sep 17	03 55	PPM 207489	occulted by	659	Nestor
Oct 13	20 14	PPM 720575	occulted by	74	Galatea
Oct 23	00 17	PPM 89571	occulted by	1437	Diomedes
Nov 10	19 46	PPM 207237	occulted by	3596	Meriones
Nov 10	21 27	PPM 204712	occulted by	12	Victoria
Dec 13	03 40	CMC 706577	occulted by	289	Nenetta
Dec 28	01 48	GSC 1947 00361	occulted by	451	Patientia
Dec 29	01 04	Lick4 1378	occulted by	112	Iphigenia

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 has recently developed a new time service available through the telephone line with an accuracy to within one millisecond. This service replaces the ZUO service which has been discontinued.

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	18	May 10	11	56	22	Sep 17	11	54	22
11	12	7	42	20	11	56	31	27	11	50	52
21	12	11	10	30	11	57	33	Oct 7	11	47	43
31	12	13	23	Jun 9	11	59	16	17	11	45	18
Feb 10	12	14	14	19	12	1	23	27	11	43	51
20	12	13	49	29	12	3	29	Nov 6	11	43	39
Mar 1	12	12	18	Jul 9	12	5	13	16	11	44	51
11	12	9	57	19	12	6	17	26	11	47	24
21	12	7	7	29	12	6	25	Dec 6	11	51	10
31	12	4	6	Aug 8	12	5	33	16	11	55	48
Apr 10	12	1	14	18	12	3	45	26	12	0	45
20	11	58	51	28	12	1	6	31	12	3	10
30	11	57	10	Sep 7	11	57	53				

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 21	19	17 50	14 53	27	2 22	23 26
20	9 57	7 0	29	18 29	15 33	Nov 6	3 2	0 5
Mar 1	10 36	7 39	Jul 9	19 9	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 57	28	22 26	19 29	31	6 42	3 42
30	14 33	11 36	Sep 7	23 5	20 9			

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 (1996.5)

Star	R.A. h m	Dec. ° ′	Mag.	Sp.	Star	R.A. h m	Dec. ° ′	Mag.	Sp.
ACHERNAR	1 37.6	-57 15	0.6	B5	PROCYON	7 39.1	5 14	0.5	F5
ALDEBARAN	4 35.7	16 30	1.1	K5	REGULUS	10 8.2	11 59	1.3	B8
RIGEL	5 14.4	-8 12	0.3	B8	SPICA	13 25.0	-11 9	1.2	B2
BETELGEUSE	5 55.0	7 24	0.4	M0	ARCTURUS	14 15.5	19 12	0.2	K0
CANOPUS	6 23.8	-52 42	-0.9	F0	ANTARES	16 29.2	-26 25	1.2	M1
SIRIUS	6 45.0	-16 43	-1.6	A0	ALTAIR	19 50.6	8 52	0.9	A5

JULIAN DATE AT 1400 HOURS - SAST 1996

	JAN. 2450	FEB. 2450	MAR. 2450	APR. 2450	MAY 2450	JUN. 2450	JUL. 2450	AUG. 2450	SEP. 2450	OCT. 2450	NOV. 2450	DEC. 2450
1	084	115	144	175	205	236	266	297	328	358	389	419
2	085	116	145	176	206	237	267	298	329	359	390	420
3	086	117	146	177	207	238	268	299	330	360	391	421
4	087	118	147	178	208	239	269	300	331	361	392	422
5	088	119	148	179	209	240	270	301	332	362	393	423
6	089	120	149	180	210	241	271	302	333	363	394	424
7	090	121	150	181	211	242	272	303	334	364	395	425
8	091	122	151	182	212	243	273	304	335	365	396	426
9	092	123	152	183	213	244	274	305	336	366	397	427
10	093	124	153	184	214	245	275	306	337	367	398	428
11	094	125	154	185	215	246	276	307	338	368	399	429
12	095	126	155	186	216	247	277	308	339	369	400	430
13	096	127	156	187	217	248	278	309	340	370	401	431
14	097	128	157	188	218	249	279	310	341	371	402	432
15	098	129	158	189	219	250	280	311	342	372	403	433
16	099	130	159	190	220	251	281	312	343	373	404	434
17	100	131	160	191	221	252	282	313	344	374	405	435
18	101	132	161	192	222	253	283	314	345	375	406	436
19	102	133	162	193	223	254	284	315	346	376	407	437
20	103	134	163	194	224	255	285	316	347	377	408	438
21	104	135	164	195	225	256	286	317	348	378	409	439
22	105	136	165	196	226	257	287	318	349	379	410	440
23	106	137	166	197	227	258	288	319	350	380	411	441
24	107	138	167	198	228	259	289	320	351	381	412	442
25	108	139	168	199	229	260	290	321	352	382	413	443
26	109	140	169	200	230	261	291	322	353	383	414	444
27	110	141	170	201	231	262	292	323	354	384	415	445
28	111	142	171	202	232	263	293	324	355	385	416	446
29	112	143	172	203	233	264	294	325	356	386	417	447
30	113		173	204	234	265	295	326	357	387	418	448
31	114		174		235		296	327		388		449

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				

A SHORT HISTORY OF THE HANDBOOK

From the preface of the Handbook for 1946, it appears that prior to 1946 the monthly notes contained a "sky page". This first edition of the Handbook states that it had previously been suggested that this information should be made available in the form of an annual handbook. This was published as a roneod foolscap sized 12 page document. Additional copies were available to members from the Secretary at 1/- each or for non-members at 1/6 from Juta and Co., Darling St., CT. Acknowledgements for data were made to R.P. de Kock, Dr van den Bos and Mr Cousins.

"Suggestions of how this handbook can be improved, if its reception is sufficiently flattering to justify its publication in future years will be very welcome." Fifty years later its existence has certainly been justified.

There is no mention of who was responsible for editing the book. The 1947 edition contained a list of members of the Society including 15 schools and 8 other institutions.

In 1948 it is recorded "the chief credit for the preparation of this booklet is due to Dr H. Stoy of the Royal Observatory, but sincere thanks are also tendered to Mr R.P. de Kock for the numerical data of the rising and setting of the planets."

The 1949 Handbook was printed and the size reduced to 165mm x 114mm. It comprised 16 pages with a light blue cover. Here credit is again given to Dr R.H. Stoy and thanks tendered to Mr R.P. de Kock and Dr Cousins and "The Society is deeply indebted to Mrs du Toit and to Mr Barwick whose joint efforts have made it possible to publish the Handbook in its present form. Mr P. Achten is responsible for its newer design." These 3 names do not appear in the list of members as of 31/12/1947.

A new format was brought in 1957 by which time the Transvaal Centre's branch of the computing section prepared most of the material with Mr R.P. de Kock providing data on bright and variable stars and it was edited at the Cape. It was again roneod on quarter sized paper.

The 1960 edition was "computed and prepared by the computing section of the Transvaal centre and the editorial board of MNASSA". It was now priced at 2/- for non-members.

The 1961 edition again included a list of members.

In 1962 it cost 25 cents and the acknowledgements indicate Cape Town had now become the source of data. Mentioned are Drs Evans, Lourens and Fuhr, Messrs Churms, Smits, de Kock, Venter and van Zyl and to Miss Y.Z.R. Thomas who typed the manuscript.

In 1969 it changed to its present size. The name of Miss Y.Z.R. Thomas appears, acknowledging her preparation of the manuscript, until the 1972 edition and from the 1973 edition the UCT Astronomy Dept. took over with Pat Wild as editor. From 1974-1975 it was prepared by Tony Fairhall as editor.

Rupert Hurly produced the next 13 issues until Pat Booth took over for the 1990 edition and this jubilee issue is her seventh.

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1930-31 S Skewes
1931-34 H Horrocks
1934-35 H W Schonegevel
1935-65 A Menzies
1965-80 T W Russo
1981-82 Mrs M Fitzgerald
1983-91 H E Krumm
1992- B Skinner

HONORARY TREASURERS

1922 J F Skjellerup
1922-23 A F I Forbes
1923-37 W H Smith
1937-40 Miss J R Robinson
1940-42 J B G Turner
1942-50 H E Krumm
1950-87 F N G Orpen
1987-89 Mrs E C Olsen
1989-93 D Duprez
1994- C Gray

HONORARY MEMBERS

Mr W C Bentley
Dr A W J Cousins
Mr J da S. Campos
Dr D S Evans
Prof Ch Fehrenbach
Dr G Heyman
Mr H C Krumm
Mr F N G Orpen
Mr M D Overbeek

GILL MEDALLISTS

1956 H Knox Shaw
1957 W P Hirst
1958 J Jackson
1960 W H van den Bos
1963 A W J Cousins
1965 R H Stoy
1967 W S Pinsen
1970 J C Bennett
1976 A D Thackeray
1981 C Papadopoulos
1983 M W Feast
1984 M D Overbeek
1988 D S Evans
1992 B Warner

McINTYRE AWARDS

1971 D S Evans, T J Deeming, Mrs B K Evans & S Goldfarb
1983 B Warner

LONG SERVICE AWARDS

1984 J Churms
1988 R F Hurly
1993 H E Krumm

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