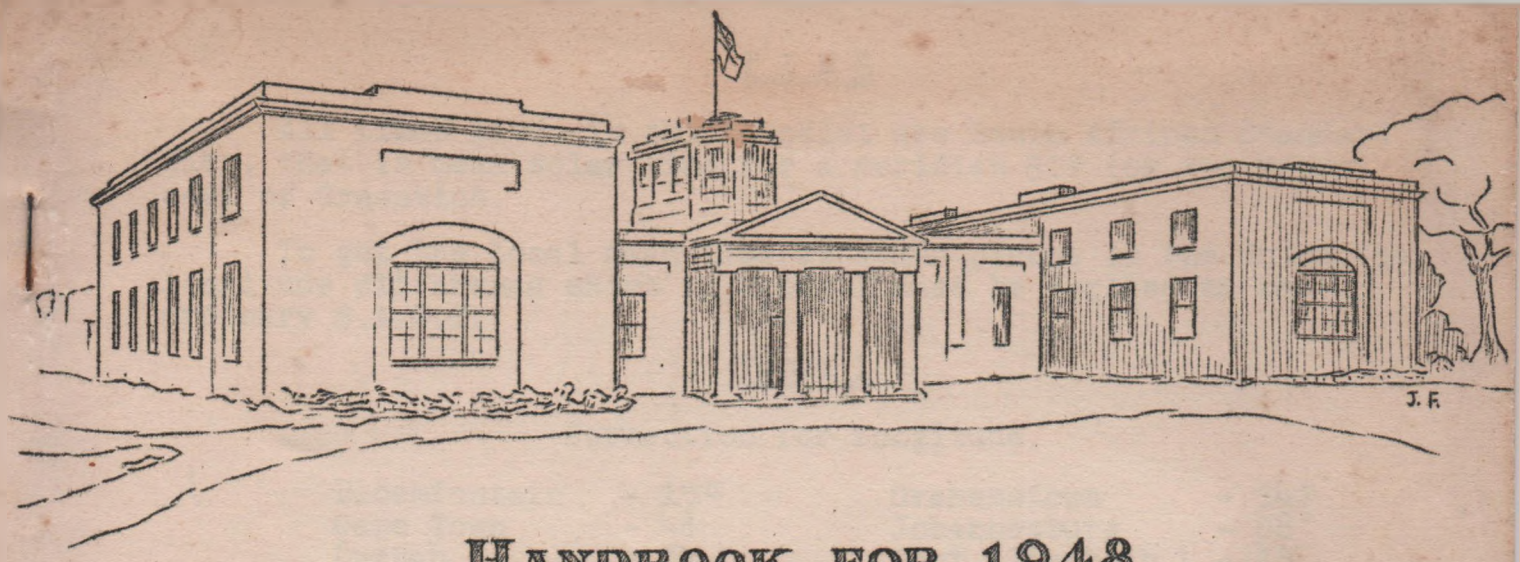


HANDBOOK FOR 1948

OF THE

ASTRONOMICAL SOCIETY OF SOUTH AFRICA

PREFACE

The Handbook for 1948 constitutes the third issue of this publication. The indications of the past two years are that the Handbook is fulfilling a definite need among the members of the Society and that it forms a useful adjunct to the star charts and other astronomical information published elsewhere.

The form of the Handbook for 1948 is similar in many respects to that for 1947. The description of the principal constellations has been retained, chiefly in view of the large number of new members elected during the latter part of 1947. The list of lunar occultations has again been omitted, as it is felt that the number of amateurs carrying out these observations is too small to justify its inclusion. A list of the times may, however, be obtained on application to the Society. Two innovations this year have been the inclusion of the office bearers and members of council for the 1947 - 48 session, and a list of past presidents of the Society.

The chief credit for the preparation of this booklet is due to Dr. R.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.

Members may obtain additional copies of this Handbook from the Editor of the Monthly Notes at 1/- each. The price to non-members is 1/6 each.

T I M E

All times given in this booklet are South African Standard Time, that is mean solar time for a meridian 30° (or two hours) east of Greenwich.

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

Table I

Correction for Longitude.

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

Conversely to get the S.A.S.T. from the local mean time these longitude corrections must be applied with the sign reversed. Thus the S.A.S.T. of local mean noon (i.e. 12.00 local mean time) at Grahamstown is $12^h\ 14^m$.

Owing to the fact that the Earth does not go round the Sun with uniform circular motion in the plane of the Earth's equator, the local apparent solar time (i.e. the time shown by a sundial) differs from the local mean solar time by a quantity which is usually referred to as the 'Equation of Time'. This quantity is given in the third column of Table II. It has to be added to the mean solar time to give the apparent solar time.

Example: Find the S.A.S.T. of apparent noon at Grahamstown on Nov.1.

S.A.S.T. of local mean noon	$12^h\ 14^m$
Subtract Equation of Time	+ 16
S.A.S.T. of noon	11 58

For many purposes sidereal time, that is local time as measured by the stars, is extremely useful. The sidereal time can be found by applying the S.A.S.T. (on a 24 hour basis) to the corresponding 'Sidereal time at 0 hours S.A.S.T.' which is given in the fourth column of Table II and correcting for longitude by means of Table I. A further small correction is needed to allow for the four minute difference in length between the solar and sidereal day. This correction is given below.

For times between S.A.S.T.	03.00	and 09.00	add 1 minute.
	09.00	15.00	2
	15.00	21.00	3
	21.00	23.59	4

Example: Find the sidereal time at 8.15 p.m. on October 4 at Grahamstown.

Sid. time at 00.00 S.A.S.T. on Oct.4		$00^h\ 50^m$
S.A.S.Time		20 15
		21 05
Correction for longitude	-	14
Interval correction	+	3
Required sidereal time		20 54

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

Example: The Julian date corresponding to 20.00 S.A.S.T. on May 11 is 2,432,683·25.

TABLE II

Date	Julian Date at 14.00	Eqn. of Time at 12.00	Sid. Time at 00.00
Jan. 1	2,432,552·0	- 3m 12s	06h 38m
11	562	- 7 40	07 17
21	572	-11 10	07 57
Feb. 1	583	-13 25	08 40
11	593	-14 21	09 20
21	603	-13 51	09 59
Mar. 1	612	-12 27	10 34
11	622	-10 08	11 14
21	632	- 7 17	11 53
Apr. 1	643	- 3 56	12 37
11	653	- 1 5	13 16
21	663	+ 1 17	13 55
May 1	673	+ 2 57	14 35
11	683	+ 3 42	15 14
21	693	+ 3 32	15 54
June 1	704	+ 2 20	16 37
11	714	+ 0 32	17 17
21	724	- 1 36	17 56
July 1	734	- 3 40	18 35
11	744	- 5 21	19 15
21	754	- 6 16	19 54
Aug. 1	765	- 6 15	20 38
11	775	- 5 07	21 17
21	785	- 3 04	21 57
Sept. 1	796	+ 0 03	22 40
11	806	+ 3 23	23 19
21	816	+ 6 56	23 59
Oct. 1	826	+10 20	00 38
11	836	+13 14	01 18
21	846	+15 20	01 57
Nov. 1	857	+16 22	02 40
11	867	+15 55	03 20
21	877	+14 05	03 59
Dec. 1	887	+10 55	04 39
11	897	+ 6 41	05 18
21	907	+ 1 51	05 58

The Sun, Moon and Planets

The Sun enters the Sign of	Aries	(Equinox)	March 21^{d} 19^{h}
	Cancer	(Solstice)	June 21 14
	Libra	(Equinox)	Sept. 23 05
	Capricorn	(Solstice)	Dec. 22 01

The Earth is at Perihelion on January 2 and at Aphelion on July 4.

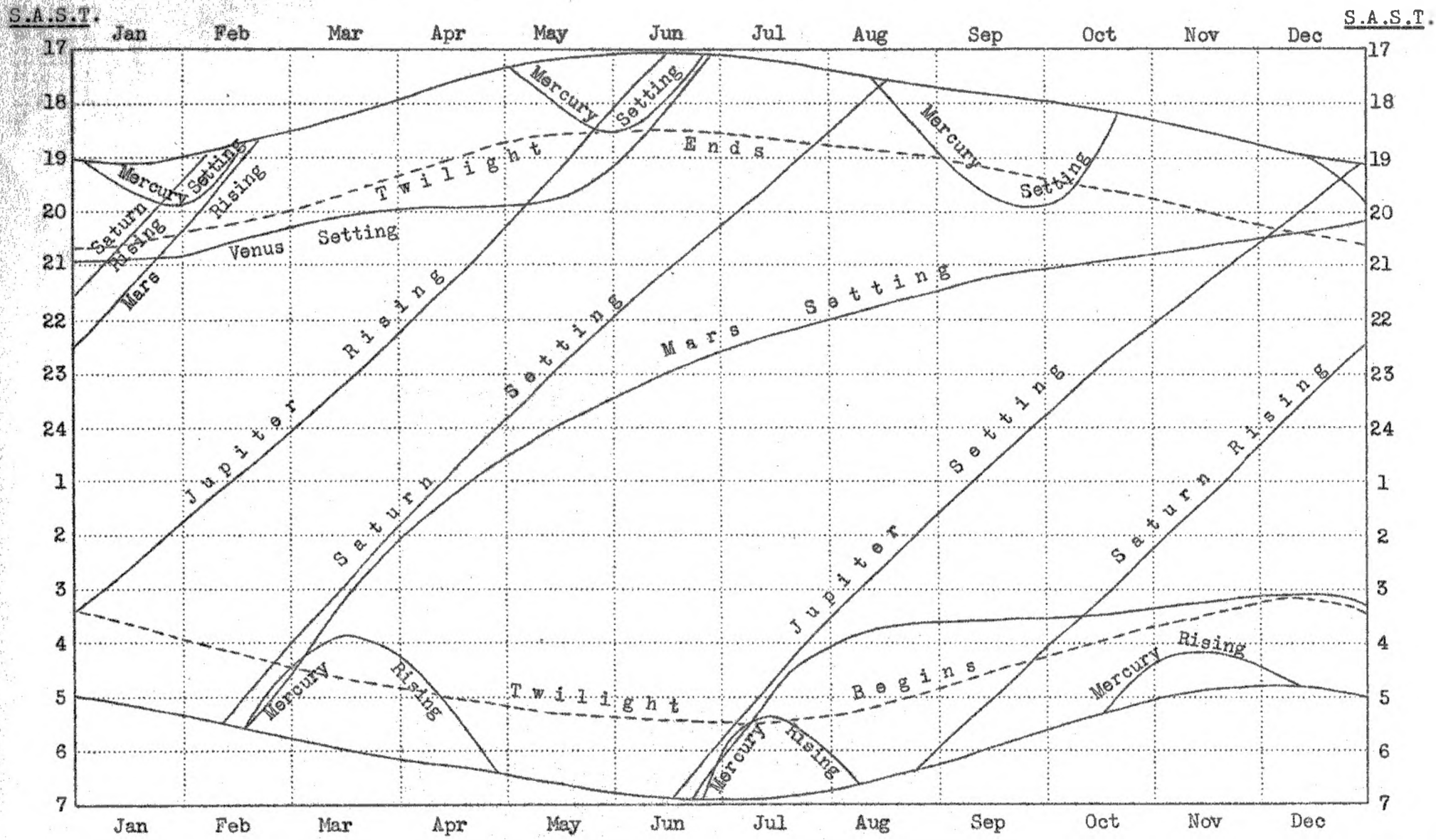
There will be only three eclipses during 1948, two of the Sun and one of the Moon. Neither the partial eclipse of the Moon on April 23 nor the annular eclipse of the Sun on May 8-9 will be visible from South Africa. The total eclipse of the Sun on November 1 will be visible from a narrow track running across East Africa, the Indian and South Pacific Oceans. It will be visible as a partial eclipse in South Africa, magnitude 0.38 in Johannesburg and 0.17 in Cape Town. As seen from South Africa, this eclipse begins soon after sunrise and ends about 07.45 a.m.

PHASES OF THE MOON

Last Quarter	New Moon	First Quarter	Full Moon
Jan. 3^{d}13^{h}13^{m}	Jan. 11^{d}09^{h}44^{m}	Jan. 19^{d}13^{h}32^{m}	Jan. 26^{d}09^{h}11^{m}
Feb. 2 02 31	Feb. 10 05 02	Feb. 18 03 55	Feb. 24 19 16
Mar. 2 18 35	Mar. 10 23 15	Mar. 18 14 27	Mar. 25 05 10
Apr. 1 12 25	Apr. 9 15 16	Apr. 16 21 42	Apr. 23 15 28
May 1 06 48	May 9 04 30	May 16 02 55	May 23 02 37
May 31 00 43	June 7 14 55	June 14 07 40	June 21 14 54
June 29 17 23	July 6 23 09	July 13 13 30	July 21 04 31
July 29 08 11	Aug. 5 06 13	Aug. 11 21 40	Aug. 19 19 32
Aug. 27 20 46	Sep. 3 13 21	Sep. 10 09 05	Sep. 18 11 43
Sep. 26 07 07	Oct. 2 21 42	Oct. 10 00 10	Oct. 18 04 23
Oct. 25 15 41	Nov. 1 08 02	Nov. 8 18 46	Nov. 16 20 31
Nov. 23 23 22	Nov. 30 20 44	Dec. 8 15 57	Dec. 16 11 11
Dec. 23 07 12	Dec. 30 11 44		

During its monthly journey round the Earth, the Moon passes close to each of the planets in turn, and thus serves as a ready method of identifying them. The table shows when these conjunctions will take place.

Mercury	Venus	Mars	Jupiter	Saturn
	Jan. 14^{d}06^{h}	Jan. 28^{d}08^{h}	Jan. 8^{d}16^{h}	Jan. 27^{d}07^{h}
Feb. 11^{d}08^{h}	Feb. 13 14	Feb. 24 04	Feb. 5 08	Feb. 23 15
Mar. 8 12	Mar. 14 17	Mar. 22 02	Mar. 3 23	Mar. 21 22
			Mar. 31 11	
Apr. 7 20	Apr. 13 10	Apr. 18 12	Apr. 27 20	Apr. 18 04
May 10 05	May 12 12	May 16 07	May 25 01	May 15 10
June 9 01	June 9 06	June 13 10	June 21 03	June 11 19
July 5 20	July 5 18	July 11 18	July 18 03	July 9 08
	Aug. 2 09	Aug. 9 07	Aug. 14 06	
	Aug. 31 05			
Sept. 4 20	Sep. 29 15	Sep. 7 00	Sep. 10 15	Sep. 30 07
Oct. 4 13	Oct. 29 09	Oct. 5 20	Oct. 08 04	Oct. 27 19
Oct. 31 02				
	Nov. 28 08	Nov. 3 19	Nov. 04 22	Nov. 24 04
	Dec. 28 08	Dec. 2 19	Dec. 02 18	Dec. 21 11
		Dec. 31 21		



THE PLANETS AS SEEN FROM SOUTH AFRICA 1948.

The Planets

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

Mercury. A glance at the chart will show that Mercury, like the god after which it is named, moves from the morning to evening sky with great rapidity. The only occasions on which Mercury is likely to be seen is near an elongation. In 1948 these are as follows:-

Eastern (Evening Star)			Western (Morning Star)		
Date	Elong.	Mag.	Date	Elong.	Mag.
Feb. 4	18°	-0.3	Mar. 17	28°	+0.4
May 29	23	+0.7	July 16	21	+0.5
Sep. 25	26	+0.2	Nov. 4	19	-0.2

Of these elongations only the morning one in March and the evening one in September are likely to be of much interest. At the other elongations Mercury will be lost in the twilight.

Mercury will be at Superior Conjunction on January 3, April 29, August 11 and December 12; at Inferior Conjunction on February 20, June 24 and October 20; at Stationary Points on February 10, March 3, June 11, July 5, October 8 and October 28.

Mercury will be in Conjunction with Venus on June 30^d21^h and with the bright star Spica on September 20^d18^h, when the two objects will be only $0^o.2$ apart.

Venus. During the first part of the year Venus is an evening star, but becomes a morning star after the Inferior Conjunction on June 24. The greatest elongation east of the Sun is 46° on April 15, and the greatest elongation west of the Sun is also 46° on September 3. Venus will be at Stationary Points on June 2 and July 16, and will attain its greatest brilliance of $-4^m.2$ on May 18 and July 31.

Venus will be in Conjunction with Saturn on October 8^d22^h and with Regulus on October 5^d23^h when the two objects will be only $0^o.4$ apart.

Mars. Mars is in Opposition with the Sun on February 17 and so will be suitably placed for observation throughout the first half of the year. This is not a favourable opposition for the study of Mars as the planet is north of the Equator and the opposition distance is almost at its maximum of 62,900,000 miles --- nearly twice as large as the 34,500,000 miles this distance can be.

At the beginning of the year Mars will be found in Leo, and its retrograde motion between January 9 and March 30 -- the two Stationary Points -- is entirely within this constellation. After March 30, the planet resumes its eastward course with a gradually increasing rate. It enters Virgo about the beginning of July and by the end of the year it has got as far as Sagittarius.

The apparent brightness of Mars increases from $0^m.0$ on January 1 to $-1^m.0$ at the time of opposition and then gradually decreases so that by July 1 it is only $+1^m.3$.

Mars will be in Conjunction with Jupiter on December 1^d10^h, the distance between the planets being then only 1°.1.

Jupiter. Jupiter will be visible throughout the year. It will be in Opposition on June 15 and will be a conspicuous evening object from June to December, in the constellations of Scorpio and Sagittarius. The brightness at the beginning of the year is $-1^m.3$ and gradually increases to $-2^m.2$ at the time of Opposition; thereafter it fades again and by the end of the year is back to $-1^m.3$.

Jupiter will be moving slowly eastwards amongst the stars except between April 15 and August 16 (the two Stationary Points) when it will be retrograding.

The four bright moons with their continuous series of eclipses, occultations, transits and shadow transits provide a perpetual source of interest to the owners of small telescopes.

Saturn. Saturn, which is in Opposition on February 9, will be visible as an evening star throughout the first part of the year. After Conjunction on August 19, it will be a morning star but not easily visible as such until October. At the beginning of the year, Saturn is retrograding slowly between Leo and Cancer. The retrograde motion ceases on April 17 (Stationary Point) and from then till December 17 (Stationary Point), Saturn moves steadily eastwards into Leo. From December 17 till the end of the year the motion is again retrograde.

The rings to which Saturn owes most of its glory are slowly closing in. Their south face is presented towards the Earth. On January 1 the apparent elevation of the rings is 13°.2 and on December 31 7°.4. The maximum value during the year is 16°.0 in the middle of April. The total brightness of Saturn plus rings varies from a maximum of $+0^m.1$ at the time of Opposition to $+0^m.9$ at the end of November.

Saturn will be in Conjunction with Regulus on September 9^d12^h, when the distance between the two objects will only be 0°.8.

Uranus. (magnitude 5.8) which is at present in Taurus will be in Conjunction with the Sun on June 17 and in Opposition on December 20. The Stationary Points are on February 29 and October 6.

It can best be observed at the beginning of the year when its position will be as follows:-

January	1	$05^h\ 31^m.7$	$+23^\circ\ 26'$
February	1	05 27.1	+23 23
March	1	05 25.6	+23 22

Neptune (magnitude 7.7) is in Virgo and will be in Opposition on April 1 and in Conjunction on October 6. The Stationary Points are on January 15 and June 22. The best months for observing Neptune are April, May and June. Its position will be

April	1	$12^h\ 45^m.3$	$-03^\circ\ 08'$
May	1	12 42.4	-02 50
June	1	12 40.4	-02 38

M E T E O R S

The following list gives the nights when meteor showers may be expected. The dates given are those when the meteors are likely to be most abundant. Those showers marked with an asterisk are not necessarily plentiful each year. The γ Aquarids are associated with Halley's Comet.

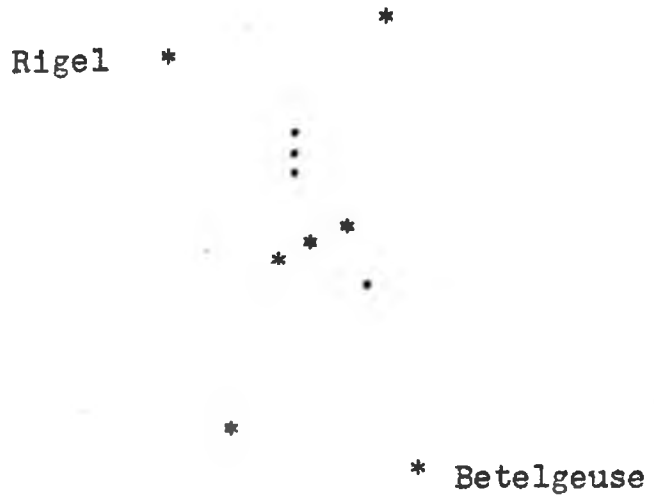
Quantrantids	January	2	-	4
Lyrids *	April	20		22
γ Aquarids	May	2		6
Pons-Winneckeids *	June	27		30
Perseids	August	10		12
β Draconids *	October	9		
Orionids	October	17		22
Leonids *	November	15		16
Geminids	December	11		14

THE CONSTELLATIONS

If you want to find a house in a large town you first find the street in which it is and then look for the particular number. In the same way if you want to find a star in the sky you first find the constellation to which it belongs and then the star number or letter. Streets rarely look like what their name suggests (who has ever seen a street looking like Queen Victoria or like Oom Paul Kruger?). The same is true of the constellations which are arbitrary groupings of stars arranged to enable us to specify easily the star or stars about which we are talking. Many of the constellations are of very ancient origin, though most of those near the South Pole are of comparatively recent origin, being arranged either by Bayer when compiling his atlas in 1603 or by La Caille when he was reducing the observations he made at the Cape in 1751 and 1752. The Southern Cross was formed into a separate constellation by Royer in 1679. In the nineteen-twenties, the International Astronomical Union appointed a special commission to rationalise the whole system of constellations. The result was 88 constellations with rectilinear boundaries covering the whole sky. Of these 88, 48 have come down from Ptolemy; or before. (Ptolemy's Almagest, compiled about 137 A.D. is the oldest star catalogue we possess, the still older one of Hipparchus compiled about 129 B.C. having been lost.)

When greater precision is needed, the position of a star in the sky is fixed by its right ascension and declination, much as the position of a point on the Earth is fixed by its longitude and latitude. In fact the right ascension and declination of any star is the longitude and latitude of the point on the Earth directly beneath it at Greenwich Noon on the day of the March Equinox (or on any other day at zero hours sidereal time at Greenwich). Latitude and declination are always measured in degrees north or south of the equator. Longitude and right ascension are measured either in degrees or in time, 360° being equal to 24 hours. (1° equals 4 minutes; 15' equals 1 minute). Right ascension is always measured eastwards from the zero celestial meridian, and so is the equivalent of the longitude measured eastwards from the Greenwich meridian. Thus the star directly over Cape Town at 0 hrs. sidereal time at Greenwich has a right ascension and declination of $18^{\circ}30'$ ($01^{h}14^{m}$) and $33^{\circ}56'$S. The coordinates of the star that will be overhead at Cape Town two hours later are $48^{\circ}30'$ ($03^{h}14^{m}$) and $33^{\circ}56'$S.

Star charts can be constructed by plotting the coordinates of the individual stars using the same sort of projections as for ordinary geographical maps. For small scale charts up to declination 50°, Mercator's projection is quite suitable; for the remainder of the sky some sort of polar projection is necessary. When using Mercator's projection for equatorial areas make 1 hour of right ascension the same length as 15° of declination. When constructing a large scale chart covering a restricted range of declination make 1 hour of right ascension equal in length to 15°cos. δ where δ denotes the mean declination.



Orion, the Hunter is the brightest, best loved and best known constellation in the sky. Lying athwart the celestial equator it is visible all over the world and dominates the evening sky from November to May. It will be recognised by the four bright stars that mark the shoulders and knees of the giant and by the three evenly spaced bright stars that form his belt. The dagger is marked by three or four fainter stars just south of the belt which form a line pointing south. About half way along the dagger is Theta, a rather diffuse star which even a small telescope shows as surrounded by a glowing cloud of gas... the much photographed Orion Nebula. The bright blue star in the south west corner (or knee) is Rigel, the orange star in the north east corner (or shoulder) is Betelgeuse, a giant star of slightly varying brightness. The belt is almost exactly on the equator and so rises due east and sets due west. When rising or setting, Orion lies on his side, but as he crosses the meridian, he stands erect, though on his head as seen from South Africa.

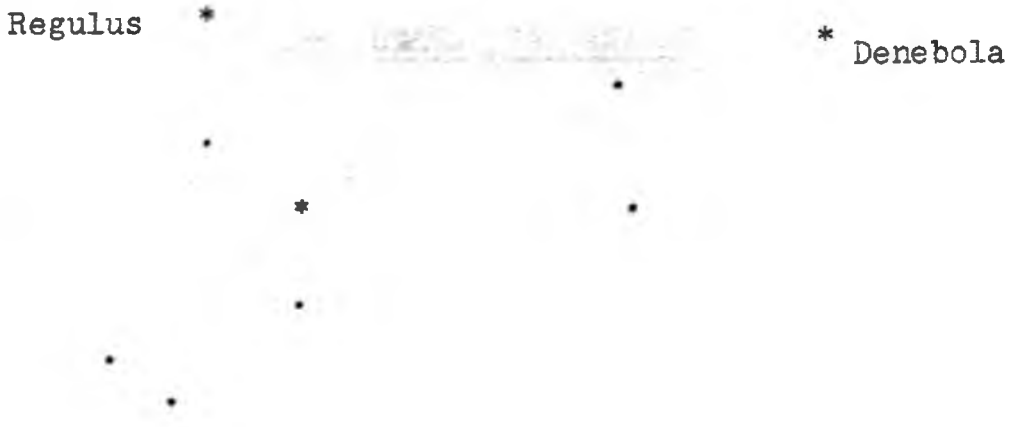
As Orion sinks in the west, Scorpio, the Scorpion rises in the east. According to the ancient fables, the giant Orion was slain by the Scorpion and still flies the sky at its appearance. Scorpio is another large bright constellation and, what is more, actually bears some resemblance to the creature after which it is named. In ancient times Scorpio was even larger, as its claws were formed from the brighter stars of the rather inconspicuous neighbouring constellation of Libra, the Balance or Scales. The sign of Libra, the seventh of the constellations of the Zodiac, is used as the sign of the September Equinox, the name Libra being supposed to signify the equality of the day and night when the Sun enters this sign.

The brightest star in Scorpio is called Antares and is similar in appearance to Mars when that planet is at an average distance from the Earth. Its name is in fact derived from two words, the first of which means "similar to" or "rival of" and the second is Ares, the Greek name for Mars. The tail of the Scorpion is in one of the richest parts of the Milky Way and contains several clusters of stars, two or three of which are just visible to the naked eye. They can, of course, be much better seen with a pair of binoculars or a low power telescope.

The Southern Cross is the most famous of the southern constellations, being to the South what the Great Bear is to the North. It is not however an ancient constellation. The stars forming it are visible in Egypt and were assigned to the Centaur. It was not till the beginning of the sixteenth century that these stars came to be associated together in the form of a cross. The Cross is visible from Cape Town throughout the year but it is most conspicuous on winter evenings when it will be found high up in the south. It is quite a small constellation and bears a greater resemblance to a badly made kite than to a cross. It owes much of its charm to the brilliancy of the surrounding Milky Way, a brilliancy best appreciated on a dark moonless night when the Cross is high in the sky. On such a night the 'Coal Sack' -- an intensely black gap in the Milky Way just south of the Cross -- is a conspicuous feature.

The Two Pointers, Alpha and Beta Centauri are usually associated with the Cross. Alpha Centauri is the Sun's nearest stellar neighbour. It is a double star. The brighter component of the pair is almost identical to our own Sun as regards size, surface temperature, etc.

The South Celestial Pole can be found from this group of stars. It is located approximately at the intersection of the line drawn along the length of the Cross with the perpendicular bisector of the line joining the Two Pointers.



Leo, the Lion is another constellation that is easy to recognise and can be seen any evening between March and July. Its front part is formed of six fairly bright stars arranged in the shape of a sickle while its back part is formed of three brightish stars forming a right angled triangle. As viewed from South Africa, the Lion is upside down. The bright star at the base of the sickle is Regulus and marks the heart of the Lion, while the star at the further end of the triangle is Denebola, which means the Tail Star.

THE STARS IN SUMMER

(February 1 10 PM)

Orion will be found high up in the sky a little west of north. Following the line of his belt to the south east we come to Sirius, the brightest star in the sky. Following the line of the belt in the opposite direction to about the same distance as Sirius, we come to a group of faint stars forming a V with a bright star at the end of one of the arms. This group is known as the Hyades and forms the head of Taurus, the Bull. The bright star is Aldebaran, and marks the fiery eye of the Bull. Continuing in the same direction and for about an equal distance beyond the Hyades we come to another, more famous cluster, the Pleiades or Seven Sisters. Tennyson describes them as "like a swarm of fire-flies tangled in a silver braid". To the naked eye they look like a small misty patch, but a pair of binoculars or a small telescope will show scores of separate stars.

Canopus, the second brightest star in the sky, will be found about halfway between Sirius and the South Pole. High in the south west is another bright star, Achernar. This star marks the mouth of the River Eridanus, whose long winding course across the sky will be easily traced back to its source close to Rigel in Orion.

Starting once more from Orion, a line from Rigel through Betelgeuse prolonged about one and a half times its own length leads to two bright stars fairly close together. These two stars mark the heads of Gemini, the Heavenly Twins: Castor is the lower one, Pollux the upper. About half way between Betelgeuse and the Twins and considerably above the line joining them is another pair of stars which is sometimes mistaken for Castor and Pollux. The upper and brighter of the two is Procyon or Alpha Canis Minoris. Its companion is Beta Canis Minoris. The ancients used to call this pair 'The Little Cubit' in contrast to Castor and Pollux which they called 'The Big Cubit'.

Capella is the bright star low down in the north, which makes an equilateral triangle with Betelgeuse and Castor.

THE STARS IN AUTUMN

(May 1 10 PM)

Orion and most of the summer stars have now passed out of the evening sky, though Sirius, Canopus, Procyon, Castor and Pollux are still to be seen in the west. Leo will be found fairly high up in the north, a little to the west of the meridian and the Southern Cross high in the south a little to the east of the meridian. Scorpio is still fairly low in the south east.

Halfway between Leo and the Southern Cross lies the small compact constellation of Corvus, the Crow, and below it is a bright star. This is Spica or Alpha Virginis. Making an equatorial triangle with Denebola and Spica is an even brighter star. This is Arcturus.

THE STARS IN WINTER

(August 1 10 PM)

On a moonless night the most conspicuous object is the bright arch of the Milky Way spanning the whole sky from Cygnus in the north east to the Southern Cross in the south east. Cygnus, the Swan, the constellation at the north east end of the Milky Way is sometimes called the Northern Cross and it is certainly far more like a cross than is its more famous southern counterpart. As viewed from the southern hemisphere, the cross is upside down, its longer member lies along the Milky Way, its cross arm at right angles to the Milky Way. The bright star at the top of the cross, that is lowest in the sky as seen from South Africa is Deneb, the Tail Star of the Swan.

Fairly low in the north, slightly above and to the west of Cygnus is a very bright blue star. This is Vega, the fourth brightest star in the sky. Making an almost equilateral triangle with Deneb and Vega is another first magnitude star ... Altair or Alpha Aquilae. Altair is right in the Milky Way and is flanked on either side by two fainter companions. The three stars together bear a certain resemblance to the Belt of Orion, or to Antares and its two flanking stars.

THE STARS IN SPRING

(November 1 10 PM)

Scorpio is setting in the west while Orion and the other stars of summer are rising in the east. Due north and about halfway up to the zenith, the Great Square of Pegasus is sprawled across the meridian. The bright star almost immediately overhead is Fomalhaut or Alpha Piscus Australis. Canopus is visible fairly low down in the south east, while Achernar is just about halfway between Fomalhaut and Canopus. On moonless nights two cloud-like objects, looking like detached portions of the Milky Way, will be seen in the triangle formed by Achernar, Canopus and the South Pole. These are the two Magellanic Clouds. The larger cloud lies in Mensa, a faint and inconspicuous constellation. The full title of this constellation is Mons Mensa. It was so named by La Caille in 1752 in honour of the famous mountain at the Cape. The Magellanic Cloud suggested to him the 'Table Cloth' that forms over Table Mountain in summer.

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