The Astronomical Society of South Africa

HANDBOOK FOR 1949

THE ASTRONOMICAL SOCIETY OF SOUTH AFRICA

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PREFACE

The Handbook for 1949, which constitutes the fourth issue of this publication, is similar in many respects to its predecessors except chiefly in the matter of size. In the past, circumstancess have discouraged the committee from effecting any alteration in this respect, but thanks to the willing co-operation of a member of the Society, Mr.A.F. Barwick, it has been found possible this year to reduce the handbook to a more convenient size. We trust that members will find this change an improvement.

It has been decided to drop the section dealing with the principal constellations, and to re-introduce the list of "Celestial Objects of interest". Times of occultations of stars down to the 5th magnitude visible at the Cape and Johannesburg are included, along with a short list of grazing occultations visible from Cape Town.

The chief credit for the preparation of this booklet is again due to Dr. R.H.Stoy, but sincere thanks are tendered to Mr.R.P.de kock for the numerical data of the rising and setting of the planets, and to Mr.A.W.J.Cousins for his active co-operation.

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 the cover design.

Extra Copies may be obtained from the Editor of the monthly Notes. Members 1/-. Non-members 1/6.

T I M E

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

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. $12^h\ 00^m$ local mean time) at Port Elizabeth is $12^h\ 18^m$.

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 Port Elizabeth on November 1.

S.A.S.T. of local mean noon	$12^h\ 18^m$
Subtract Equation of Time	+ 16
S.A.S.T. of noon	12 02

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 Port Elizabeth.

Sid. time at 00.00 S.A.S.T. on Oct. 4		$00^h\ 49^m$
S.A.S.Time		20 15
		21 04
Correction for longitude	−	18
Interval Correction	+	3
Required Sidereal Time		20 49

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

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

For considering the motions of the Sun, Moon and Planets, the system of coordinates known as *celestial latitude* and *longitude* is very convenient. These coordinates define the position of a celestial body with reference to the Ecliptic in exactly the same way as right ascension and declination define its position with reference to the Celestial Equator. The (celestial) latitude is the angular distance of the body north or south of the ecliptic while the longitude is the distance from the Vernal Equinox as measured eastwards along the Ecliptic. Celestial latitude and longitude are usually measured in degrees.

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

TABLE II

Date	Julian Date at 14.00	Eqn. of Time at 12.00	Sidereal Time at 00.00	Sidereal Time at 18.00
Jan. 1	2,432,918.0	- 3^m 34^s	06^h 41^m	00^h 44^m
11	928	- 7 57	07 20	01 23
21	938	-11 22	08 00	02 03
Feb. 1	949	-13 41	08 43	02 46
11	959	-14 22	09 23	03 26
21	969	-13 46	10 02	04 05
Mar. 1	977	-12 31	10 34	04 36
11	987	-10 12	11 13	05 16
21	997	- 7 21	11 52	05 55
Apr. 1	2,433,008.0	- 4 01	12 36	06 39
11	018	- 1 09	13 15	07 18
21	028	+ 1 15	13 55	07 58
May 1	038	+ 2 55	14 34	08 37
11	048	+ 3 43	15 13	09 16
21	058	+ 3 34	15 53	09 56
June 1	069	+ 2 22	16 36	10 39
11	079	+ 0 35	17 16	11 19
21	089	- 1 32	17 55	11 58
July 1	2,433,099.0	- 3 38	18 35	12 37
11	109	- 5 18	19 14	13 17
21	119	- 6 14	19 53	13 56
Aug. 1	130	- 6 13	20 37	14 40
11	140	- 5 08	21 16	15 19
21	150	- 3 07	21 56	15 59
Sep. 1	161	- 0 02	22 39	16 42
11	171	+ 3 19	23 18	17 21
21	181	+ 6 51	23 58	18 01
Oct. 1	2,433,191.0	+10 14	00 37	18 40
11	201	+13 11	01 17	19 20
21	211	+15 18	01 56	19 59
Nov. 1	222	+16 22	02 39	20 42
11	232	+15 58	03 19	21 22
21	242	+14 09	03 58	22 01
Dec. 1	252	+11 01	04 38	22 41
11	262	+ 6 49	05 17	23 20
21	272	+ 1 59	05 57	00 00

THE SUN, MOON AND PLANETS.

The Sun enters the Sign of Aries (Equinox) March 21^{d} 01^{h}
Cancer (Solstice) June 21 20
Libra (Equinox) Sept. 23 11
Capricorn (Solstice) Dec. 22 06

The Earth is in Perihelion on January 3 and in Aphelion on July 2.

There will be four eclipses during 1949, two of the Sun and two of the Moon. Neither the partial eclipse of the Sun on April 28 nor the partial eclipse of the Sun on October 21 will be visible from South Africa. The Circumstances of these Eclipses are:-

Moon enters penumbra	April 13^{d} 03^{h} 31^{m}.6	Oct. 7^{d} 01^{h} 50^{m}.1
Moon enters umbra	04 27.7	03 04.7
Total eclipse begins	05 28.0	04 19.5
Middle of the eclipse	06 10.9	04 56.4
Total eclipse ends	06 53.8	05 33.2
Moon leaves umbra	07 54.1	06 48.1
Moon leaves penumbra	08 50.3	08 02.7
P.A. of First Contact	131°	42°
P.A. of Last Contact	283	260
Magnitude of eclipse (Moon's diameter = 1.0)	1.432	1.228

PHASES OF THE MOON.

First Quarter	Full Moon	Last Quarter	New Moon
Jan. 7^{d} 13^{h} 51^{m}	Jan. 14^{d} 23^{h} 59^{m}	Jan. 21^{d} 16^{h} 07^{m}	Jan. 29^{d} 04^{h} 42^{m}
Feb. 6 10 05	Feb. 13 11 08	Feb. 20 02 43	Feb. 27 22 55
Mar. 8 02 42	Mar. 14 21 03	Mar. 21 15 10	Mar. 29 17 11
Apr. 6 15 01	Apr. 13 06 08	Apr. 20 05 27	Apr. 28 10 02
May 5 23 33	May 12 14 51	May 19 21 22	May 28 00 24
June 4 05 27	June 10 23 45	June 18 14 29	June 26 12 02
July 3 10 08	July 10 09 41	July 18 08 01	July 25 21 33
Aug. 1 14 57	Aug. 8 21 33	Aug. 17 00 59	Aug. 24 05 59
Aug. 30 21 16	Sep. 7 11 59	Sep. 15 16 29	Sep. 22 14 21
Sep. 29 06 16	Oct. 7 04 52	Oct. 15 06 06	Oct. 21 23 23
Oct. 28 18 04	Nov. 5 23 09	Nov. 13 17 47	Nov. 20 09 29
Nov. 27 12 01	Dec. 5 17 15	Dec. 13 03 48	Dec. 19 20 55
Dec. 27 08 31			

PERIGEE			APOGEE		
Jan. 17	June 7	Oct. 21	Jan. 5	May 22	Oct. 7
Feb. 14	July 3	Nov. 19	Feb. 2	June 19	Nov. 3
Mar. 14	July 29	Dec. 17	Mar. 1	July 17	Dec. 1
Apr. 12	Aug. 25		Mar. 28	Aug. 13	Dec. 29
May 10	Sept. 23		Apr. 25	Sept. 10	

During its monthly journey round the Earth, the Moon passes close to each of the planets in turn. The table shows when these conjunctions will take place.

Mercury	Venus	Mars	Jupiter	Saturn
	Jan.27^{d} 10^{h}		Jan.27^{d} 08^{h}	Jan.17^{d} 17^{h}
Feb.25^{d} 09^{h}	Feb 26 17		Feb.24 01	Feb.14 00
Mar.28 07			Mar.23 16	Mar.13 08
Apr.29 23			Apr.20 05	Apr. 9 15
		May 26 18	May 17 16	May 6 22
June24 20	June27 23	June24 17	June14 00	June 3 06
	July27 20	July23 13	July11 04	June30 15
Aug.25 21	Aug.26 17	Aug.21 07	Aug. 7 05	July28 03
Sep.23 19	Sep.25 12	Sep.19 00	Sep. 3 06	Sep.21 10
Oct.20 18	Oct.25 06	Oct.17 15	Sep.30 12	Oct.19 02
	Nov.23 21	Nov.15 03	Oct.27 23	Nov.15 16
Dec.21 01	Dec.23 01	Dec.12 11	Nov.24 15	Dec.13 01
			Dec.22 10	

OCCULTATIONS VISIBLE AT CAPE TOWN AND JOHANNESBURG

Date	N.Z.C	Mag	Phase	Cape Town Time	P.A.	Johannesburg Time	P.A.
Feb. 16	1881	4.4	D	22^{h}48^{m}.2	115^{c}	22^{h}41^{m}.2	95^{c}
Feb. 16	1881	4.4	R	23 46.1	309	23 34.5	334
Mar. 10	1189	5.0	D	21 29.3	172	21 28.7	135
Apr. 6	1134	5.0	D	19 33.8	74	Graze	
Apr. 6	1137	5.1	D	19 53.5	112	20 16.7	83
May 6	1484	3.6	D	20 59.8	167	20 59.5	126
June 8	2172	4.7	D	21 15.8	104	No occ^{n}	
Aug. 30	2349	3.1	D	22 21.4	157	22 25.2	133
Aug. 30	2349	3.1	R	22 55.0	216	23 15.2	236
Sept 29	2784	3.4	D	22 07.9	95	22 27.9	90
Sept 29	2784	3.4	R	23 14.1	228	23 30.4	233
Oct 20	545	4.2	D	Low		23 01.4	66
Oct 20	552	3.0	D	23 39.6	70	23 46.1	68
Dec. 31	537	3.8	D	Sun		19 06.0	60

GRAZING OCCULTATIONS VISIBLE FROM CAPE TOWN.

Date	N.Z.C.	Mag.	Disappearance. Time	P.A.	Reappearance. Time	P.A.
July 19	326	6.0	02^{h}58^{m}	342^{c}	03^{h}15^{m}	315^{c}
Aug. 12	50	6.0	22 30	326	22 43	311
Oct. 10	537	3.8	22 50	351	23.11	315
Dec. 31	539	4.4	Very near miss about 20^{h}00^{m}			
Dec. 31	542	5.8	Very near miss about 20^{h}30^{m}			
			(Sunset on Dec.31 is at 20.00)			

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 moves from the morning to the evening sky with great rapidity. The only occasions on which Mercury is likely to be seen is near an elongation. In 1949 these are as follows:-

Eastern (Evening Star)			Western (Morning Star)		
Date	Elong.	Mag.	Date	Elong	Mag.
Jan. 18	19°	-0.3	Feb. 28	27°	+0.4
May 10	22	+0.5	June 28	22	+0.7
Sept. 7	27	+0.4	Oct. 19	18	-0.3

Of these elongations only the morning one in February 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 April 13, July 26 and November 21; at Inferior Conjunction on February 2, June 3 and October 3; at Stationary Points on January 24, February 14, May 23, June 15, September 21 and October 12.

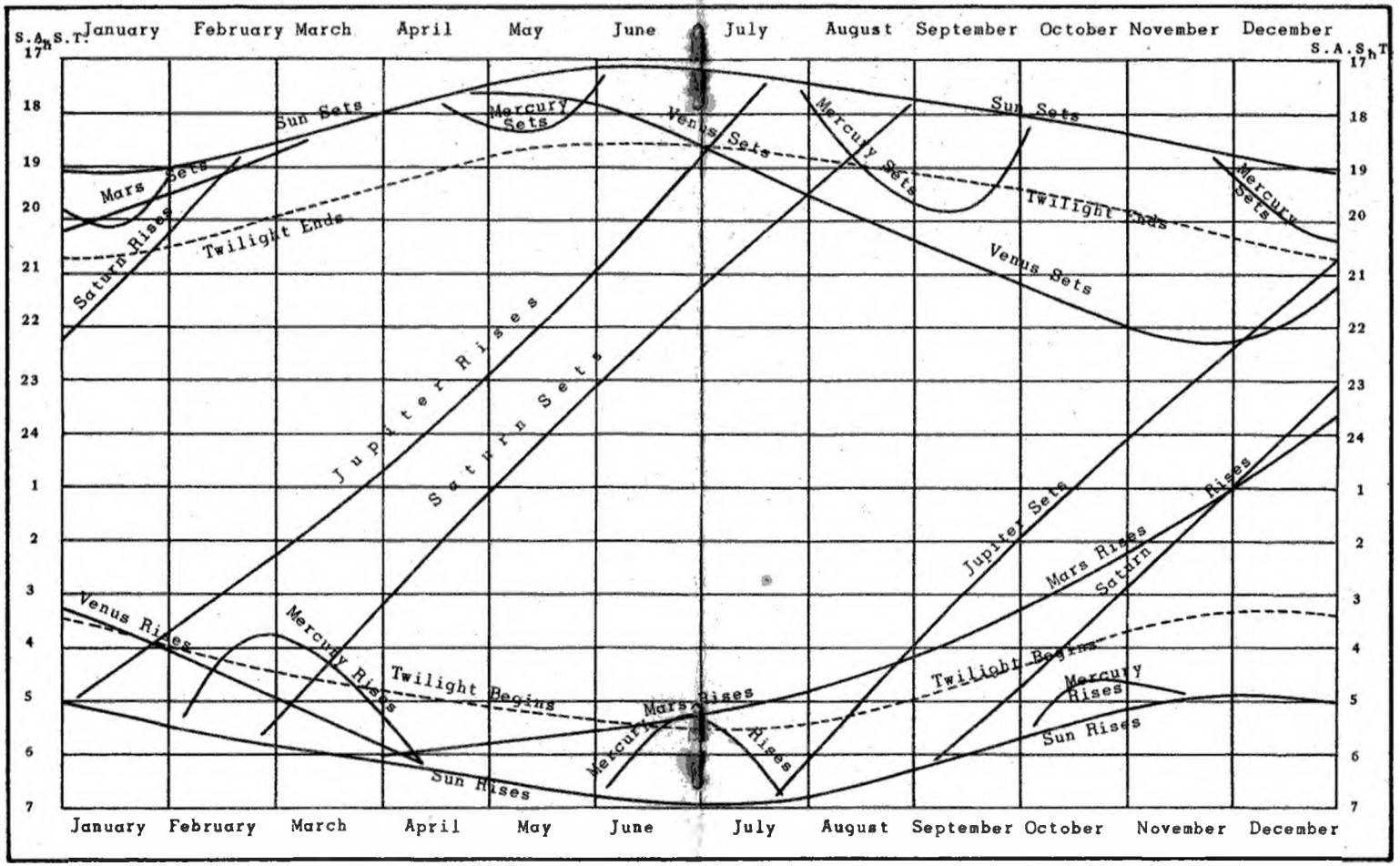
Mercury will be in conjunction with Mars on January $7^{d}\ 20^{h}$ and January $27^{d}\ 23^{h}$; with Venus on February $10^{d}\ 10^{h}$ and May $27^{d}\ 14^{h}$ and with Saturn on August $13^{d}\ 16^{h}$.

Venus is a morning star at the beginning of the year, but becomes an evening star after the Superior Conjunction on April 16. It will not be easily seen from about the middle of March until the middle of May. The greatest elongation east of the Sun, (i.e. as an evening star) is 47° on November 20, but the time of greatest brilliance is December 26 when the planet will have an apparent magnitude of -4.4.

Venus will be in conjunction with Jupiter on January $26^{d}\ 10^{h}$, and on December $7^{d}\ 05^{h}$ and with Saturn on July $31^{d}\ 08^{h}$.

Mars is not well placed for observation in 1949. It is in conjunction with the Sun on March 17, but will not reach opposition until March 1950. Towards the end of the year, Mars will be visible as a not very conspicuous morning star moving steadily eastwards through the constellation of Leo. Its brightness will gradually increase from +1.7 on October 1 to +0.8 on December 31.

THE PLANETS AS SEEN FROM SOUTH AFRICA - 1949.



Mars will be in conjunction with Saturn on November $30^d\ 23^h$ when the distance between the planets will be only 0°2.

Jupiter is in conjunction with the Sun on January 1 and in opposition on July 20. It will not be visible therefore at the beginning of the year but will be well placed for observation from June onwards. Jupiter will move steadily eastwards from Sagittarius into Capricornus except between May 20 and September 18 (the two stationary points) when it will be slowly retrograding. Its brightness will gradually increase from -1^m4 at the beginning of February to -2^m3 at the time of opposition and then gradually decrease again to -1^m6 at the end of the year.

Saturn, which is in opposition on February 21, will be visible as an evening star throughout the first part of the year. After conjunction on September 2 it will become a morning star, but it will not be readily visible as such until November. At the beginning of the year, Saturn is retrograding slowly in Leo. This motion ceases on May 1 (Stationary Point) and from then until December 31 (Stationary Point), Saturn moves slowly eastwards.

Uranus (magnitude 5.8) which is at present in Taurus, will be in conjunction with the Sun on June 22 and in opposition on December 25. The Stationary Points are on March 5 and October 11. Uranus can best be observed at the beginning of the year when its position will be as follows:-

January 1	$05^h\ 51^m5$	23° 39′
February 1	05 46.7	23 37
March 1	05 44.8	23 37

Neptune (magnitude 7.7) is in Virgo and will be in opposition on April 3 and in conjunction on October 8. The Stationary Points are on January 17 and June 24. The best months for observing Neptune are April, May and June. Its position will be:-

April 1	$12^h\ 53^m7$	−03° 59′
May 1	12 50.7	−03 41
June 1	12 48.6	−03 28

GEOCENTRIC LONGITUDES OF THE SUN AND PLANETS FOR 1949.

	Sun	Mercury	Venus	Mars	Jupiter	Saturn
Jan. 1	280°	339	255	297	280	156
Jan. 31	311	317	292	331	287	155
Mar. 2	341	314	330	344	294	152
Apr. 1	11	359	7	8	299	150
May 1	40	58	44	31	302	149
May 31	69	75	81	53	302	150
June 30	98	76	118	74	300	152
July 30	127	130	154	94	296	155
Aug. 29	155	180	190	114	293	159
Sep. 28	185	196	226	133	293	163
Oct. 28	214	199	260	151	295	166
Nov. 27	244	247	292	167	299	169
Dec. 27	275	293	315	182	305	170

METEORS

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
δ Draconids *	October		9	
Orionids	October	17		22
Leonids *	November	15		16
Geminids	December	11		14

CELESTIAL OBJECTS OF INTEREST

The following lists of special objects are not exhaustive. They attempt to give only a few of the brightest objects in each class. The owners of small telescopes are likely to find the planetary nebulae and the extra-galactic nebulae rather disappointing; the former because they are so small and the latter because they are so faint. For these latter objects, as for the open clusters, the lowest possible power (Comet eyepiece) should be used.

Most of the objects given are marked on the southern sky maps given in the "Sky and Telescope". They can also be found in Norton's "Star Atlas", a book every astronomical student should possess.

It will be noticed that the nebulae are distinguished by an N.G.C. or an M number. The former stands for the New General Catalogue of Nebulae and Clusters compiled by Dreyer in 1888. It is essentially a revision of the list compiled by Sir John Herschel. The M number is older. It was assigned by the French astronomer Messier who published a list of 103 nebulae and star clusters in 1781

DOUBLE STARS

Name	1950 Position		Magnitude	P.A.	Sep.	Sp Type	Ins.*
k Scl	00h06m8	-28° 16'	6.2,6.2	286°	1.3	F2	4
β Phe	01 03.9	-46 59	4.1,4.2	350	1.4	K0	3
α Psc	01 59.4	+02 31	4.3,5.2	301	2.2	A2	2
θ Eri	02 56.4	-40 30	3.4,4.4	88	8.2	A2	
32 Eri	03 51.8	-03 06	5.0,6.3	348	6.9	G5,A	
γ Cae	05 02	-35 33	4.7,8.3	309	3.0	K0	3
β Ori	05 12.1	-08 15	0.3,6.7	203	9.5	B8	
η Ori	05 22.0	-02 26	3.9,4.7	78	1.4	B1	3
θ Ori	05 32.8	-05 25	Trapezium in Orion Nebula				
β Mon	06 26.4	-07 00	4.7,5.2	132	7.3	B2	
			5.2,5.6	105	2.8		2
ε Cma	06 56.7	-28 54	1.6,7.6	160	7.7	B1	
α Gem	07 31.4	+32 00	2.0,2.8	190	3.0	A0	2
k Pup	07 36.8	-26 41	4.5,4.6	318	9.9	B8,B8	
ζ Cnc	08 09.3	+17 46	5.6,6.0	50	1.0	G0	4
			6.3	100	5.6		
δ Vel	08 43.3	-54 31	2.1,5.1	158	3.0	A0	3
ψ Vel	09 28.8	-40 15	4.1,4.9	118	1.2	F5	4
υ Crr	09 45.9	-64 50	3.2,6.0	127	5.0	F0	2
γ Leo	10 17.2	+20 06	2.6,3.8	120	4.2	K0	1
ξ UMa	11 15.6	+31 49	4.4,4.9	236	1.7	G0	3
ε Hya	11 50.4	-33 38	4.8,5.6	5	1.1	B9	4
α Cru	12 23.7	-62 49	1.6,2.1	115	4.4	B1	1
γ Cen	12 38.8	-48 41	3.1,3.1	10	1.1	A0	4
γ Vir	12 39.1	-01 11	3.7,3.7	314	5.6	F0	1
α Cvn	14 36.6	-60 38	0.3,1.7	13	9.6	G0,K5	
ξ Boo	14 49.1	+19 19	4.8,6.8	0	5.8	G5,K5	1
π Lup	15 01.7	-46 51	4.7,4.8	76	1.4	B5,,B5	3
γ Cir	15 19.4	-59 09	5.2,5.5	55	1.0	B5,F8	4
σ Lup	15 32.4	-44 48	5.0,7.0	3	2.3	B3	2
α Scr	16 26.5	-26 20	1.2,5.2	274	3.0	Ma,B3	4
A Oph	17 12.3	-26 30	5.3,5.3	170	4.3	K0,K0	1
α Her	17 12.4	+14 27	3.5,5.4	109	4.7	M5	1
τ Oph	18 00.4	-08 11	5.3,6.0	268	2.0	F0	3
γ CrA	19 03.1	-37 08	5.0,5.0	230	2.5	F8,F8	2
ν Dal	20 44.4	+15 57	4.5,5.5	269	10.0	G5,F8	
θ Ind	21 16.3	-53 40	4.7,7.0	275	5.4	A5	1
ν PsA	21 58.0	-28 42	5.8,6.8	115	1.8	B8	3
ζ Aqr	22 26.2	-00 17	4.4,4.6	270	2.1	F2	2
γ PsA	22 49.8	-33 07	4.6,8.0	262	4.2	A0	3
ε Gru	23 04.1	-43 47	4.5,7.0	60	1.3	F5	4

* This column gives a rough estimate in inches of the minimum aperture which should show duplicity if the telescope is optically satisfactory.

VARIABLE STARS

(a) Long Period

Name	1950 Position		Magnitude	Period	Spec.	
o Cet	$02^h16.^m8$	-03°12'	3.4 - 9.2	334^d	M5e	(Mira)
R Lep	04 57.3	-14 53	6.4 - 9.8	447	N	
L^2 Pup	07 12.0	-44 34	3.6 - 5.2	141	Me	
R Car	09 31.0	-62 34	4.5 - 9.6	307	Me	
S Car	10 07.8	-61 19	5.5 - 8.8	149	Me	
R Hya	13 26.9	-23 01	4.4 - 9.3	408	M7e	
T Cen	13 38.9	-33 21	6.0 - 8.3	91	Me	
R Cen	14 13.0	-59 41	6.0 -10.7	543	Me	
RR Scr	16 53.4	-30 30	5.9 -11.9	278	Me	

(b) Irregular

Name	1950 Position		Magnitude	Spec.	
α Ori	$05^h52^m.5$	+07°24'	0.5 - 1.1	M2	(Betelgeuse)
U Hya	10 35.1	-13 07	4.5 - 6.0	N	
θ Aps	14 00.5	-76 33	5.1 - 6.6	M3	
R Sct	18 44.9	-05 46	4.5 - 9.0	K5e	
RY Sgr	19 13.3	-33 37	6.1 -14.0	G0ep	

(c) Cepheid

Name	1950 Position		Magnitude	Period	Spec.
β Dor	$05^h33^m.2$	-62°31'	3.6 - 4.2	$9^d.84$	cF5
l Car	09 43.9	-62 17	3.4 - 4.3	35.53	G0
U Car	10 55.8	-59 28	5.9 - 7.0	38.75	G6
S Mus	12 10.1	-69 52	5.9 - 6.4	9.66	cG1
X Sgr	17 44.5	-27 49	4.4 - 4.9	7.01	F8
W Sgr	18 01.8	-29 35	4.5 - 5.2	7.59	F5
κ Pav	18 51.8	-67 18	4.0 - 4.8	9.09	F5
η Aql	19 50.0	+00 53	3.7 - 4.5	7.18	G4

(d) Eclipsing

Name	1950 Position		Magnitude	Period	Spec.	
β Per	$03^h02^m.0$	+38°39'	2.3 - 3.5	$2^d.87$	B8	(Algol)
λ Tau	03 57.8	+12 20	3.3 - 4.2	3.9	B3	
E CMa	07 17.2	-16 18	5.9 - 6.7	1.14	F	
V Pup	07 56.7	-49 06	4.1 - 4.9	3.9	B3	
δ Lib	14 58.3	-08 19	4.8 - 6.2	2.33	A0	

GALACTIC CLUSTERS

N.G.C.	M.	1950 Position	Con.	Size	Remarks
	45	$03^h44^m.5$ +23°57′	Tau.		The Pleiades
		04 23.0 +16 25	Tau.		The Hyades
2323	50	07 00.5 −08 16	Mon.	10′ × 10′	
2477		07 50.3 −37 58	Pup.	25′ × 25′	
2632	44	08 37.2 +20 10	Cnc.		Praesepe
3532		11 04.3 −58 24	Car.	60′ × 60′	
3766		11 33.9 −61 20	Cen.	10′ × 10′	
4755		12 50.7 −60 05	Cru.	10′ × 10′	Herschel's
6405	6	17 36.7 −32 10	Scr.	25′ × 25′	[Jewel Box.
6475	7	17 50.7 −34 48	Scr.	60′ × 60′	
6494	23	17 52.0 −19 01	Sgr.	25′ × 25′	
6611	16	18 16.0 −13 48	Ser.	25′ × 25′	

GLOBULAR CLUSTERS

N.G.C.	M.	1950 Position	Con.	Size	Remarks
104		$00^h21^m.9$ −72°22	Tuc.	23′ × 23′	47 Tucanae
2808		09 11.0 −64 39	Car.	6′ × 6′	
5139		13 23.7 −47 03	Cen.	23′ × 23′	ω Centauri
5272	3	13 39.9 +28 28	CVn.	10′ × 10′	
5904	5	15 15.9 +02 16	Ser.	13′ × 13′	
6121	4	16 20.5 −26 24	Scr.	14′ × 14′	
6218	12	16 44.6 −01 52	Oph.	9′ × 9′	
6254	10	16 54.5 −04 02	Oph.	8′ × 8′	
6656	22	18 33.3 −23 57	Sgr.	17′ × 17′	
6752		19 06.4 −60 04	Pav.	13′ × 13′	
6809	55	19 36.9 −31 04	Sgr.	10′ × 10′	
7089	2	21 30.9 −01 04	Aqr.	8′ × 8′	

GALACTIC NEBULAE

(a) Planetary Nebulae

N.G.C.	M.	1950 Position	Con.	Size	Remarks
2440		$07^h39^m.6$ −18°05′	Pup.	54″ × 20″	
3242		10 22.3 −18 23	Hya.	40 × 35	
6572		18 10.2 +06 50	Oph.	16 × 13	
6720	57	18 52.0 +32 58	Lyr.	83 × 59	Ring Nebula
7009		21 01.4 −11 34	Aqr.	25 × 12	Saturn Nebula
6853	27	19 57.4 +22 35	Vul.	8′ × 4′	Dumbell Nebula

(b) Bright Diffuse Nebulae

N.G.C.	M.	1950 Position	Con.	Size	Remarks
1952	1	$05^h31^m.5$ +21°59′	Tau.	4′ x 6′	Crab Nebula
1976	42	05 32.5 −05 25	Ori.	30′ x 30′	Great Orion Nebula
1982	43	05 32.7 −05 18	Ori.		
2068	78	05 43.7 +00 04	Ori.		
2070		05 39.1 −69 09	Dor.		30 Doradus (Looped)
3372		10 43.0 −59 25	Car.		Keyhole Neb. η Argus
6514	20	17 59.3 −23 02	Sgr.	24′ x 24′	Trifid Nebula
6523	8	18 00.6 −24 23	Sgr.	50′ x 50′	Lagoon Nebula
6618	17	18 18.0 −16 12	Sgr.	26′ x 26′	Horseshoe Neb.

(c) Dark Nebulae

1950 Position	Con.	Size	Remarks
$05^h38^m.0$ −02°29′	Ori.	4′ x 4′	Horse's Head
12 48 −63	Cru.	5° x 5°	Coal Sack
17 20.5 −23 32	Oph.	20′ x 20′	S Nebula
17 59.8 −27 52	Sgr.	5′ x 5′	
18 12.8 −18 16	Sgr.	15′ x 15′	

EXTRA-GALACTIC NEBULAE

N.G.C.	M.	1950 Position	Con.	Size	Remarks
224	31	$00^h40^m.0$ +41°00′	And.	160′ x 40′	Great Andromeda Nebula
		00 50 −73 00	Tuc.	220′ x 220′	Small Mag. Cloud
598	33	01 31.0 +30 24	Tri.	60′ x 40′	
253		00 45.1 −25 34	Scl.	22′ x 6′	
		05 26 −69	Men.	432′ x 432′	
3623	65	11 16.3 +13 23	Leo.	8′ x 2′	
3627	66	11 17.6 +13 17	Leo.	8′ x 2′	
4374	84	12 22.6 +13 10	Vir.	3′ x 3′	
4382	85	12 22.8 +18 28	Com.	4′ x 2′	
4472	49	12 27.3 +08 16	Vir.	4′ x 4′	
4594		12 37.3 −11 21	Vir.	7′ x 1′	
4649	60	12 41.1 +11 49	Vir.	4′ x 3′	
5236	83	13 34.3 −29 37	Hya.	10′ x 8′	
6822		19 42.1 −14 53	Sgr.	20′ x10′	

PRINCIPAL ELEMENTS OF THE SOLAR SYSTEM

ORBITAL ELEMENTS

Planet	Mean Distance from Sun ⊕ =1	Mean Distance from Sun millions of miles	Period (P)	Eccentricity (e)	Inclination (i)	Long. of Node (Ω)	Long. of Perihelion (π)
					°	°	°
Mercury	.387	36.0	88.0days	.206	7.0	47.6	76.5
Venus	.723	67.2	224.7	.007	3.4	76.1	130.7
Earth	1.000	92.9	365.3	.017	...	.....	101.9
Mars	1.524	141.5	687.0	.093	1.9	49.1	334.9
Jupiter	5.203	483.3	11.86yrs.	.048	1.3	99.8	13.3
Saturn	9.54	886.	29.46	.056	2.5	113.1	91.8
Uranus	19.19	1783.	84.0	.047	0.8	73.7	169.7
Neptune	30.07	2793.	164.8	.009	1.8	131.1	44.1
Pluto	39.46	3666.	247.7	.249	17.1	109.5	223.4

PHYSICAL ELEMENTS

Object	Mean Diameter miles	Mass ⊕ =1	Density water =1	Axial Rotation	Mean Surface Gravity ⊕ =1	Albedo Bond's
Sun	864,000	332,000	1.4	$24^d.7$ (equatorial)	27.9	
Moon	2,160	.0123	3.3	$27^d\ 7.7^h$	.16	.07
Mercury	3,010	.056	3.8	88^d	.27	.07
Venus	7,580	.82	4.9	30^d ?	.85	.59
Earth	7,918	1.00	5.5	$23^h\ 56^m$	1.00	.29
Mars	4,220	.108	4.0	$24^h\ 37^m$	.38	.15
Jupiter	87,000	318.	1.3	$9^h 50^m \pm$	2.6	.56 ?
Saturn	72,000	95.	.7	$10^h 15^m \pm$	1.2	.63 ?
Uranus	31,000	14.6	1.3	$10^h.8 \pm$	.9	.63 ?
Neptune	33,000	17.2	1.3	16^h ?	1.0	.73 ?
Pluto	4,000?	.8 ?				

CALENDAR FOR 1949

JANUARY						
S	M	T	W	Th	F	S
30	31	-	-	-	-	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

FEBRUARY						
S	M	T	W	Th	F	S
-	-	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	-	-	-	-	-

MARCH						
S	M	T	W	Th	F	S
-	-	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						
S	M	T	W	Th	F	S
-	-	-	-	-	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						
S	M	T	W	Th	F	S
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						
S	M	T	W	Th	F	S
-	-	-	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						
S	M	T	W	Th	F	S
31	-	-	-	-	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

AUGUST						
S	M	T	W	Th	F	S
-	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						
S	M	T	W	Th	F	S
-	-	-	-	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						
S	M	T	W	Th	F	S
30	31	-	-	-	-	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

NOVEMBER						
S	M	T	W	Th	F	S
-	-	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						
S	M	T	W	Th	F	S
-	-	-	-	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

M. L^TD