THE

ASTRONOMICAL SOCIETY

OF

SOUTH AFRICA

HANDBOOK FOR

1953

ASTRONOMICAL SOCIETY OF SOUTH AFRICA
1952—1953

The Astronomical Society of South Africa was formed in July, 1922, by the amalgamation of the Cape and Johannesburg Astronomical Associations which had been in active existence for several years. The declared objects of the Society are:—

(1) The encouragement and stimulation of the study of Astronomy in South Africa;

(2) The association of observers and their organisation in the work of astronomical observation and research;

(3) The dissemination throughout South Africa of such current astronomical information as may be helpful to observers;

(4) The publication from time to time of the results of the work accomplished by the Society.

Membership is open to all who are interested in Astronomy. The Society issues a series of duplicated notes monthly and distributes to each member a copy of *Sky and Telescope*, an illustrated monthly astronomical magazine published in America. There are also a number of autonomous local centres which hold regular meetings. Details of these will be found on the back cover.

All communications about the Society should be addressed to the Hon. Secretary, Astronomical Society of South Africa, c/o The Royal Observatory, Observatory, Cape.

CONTENTS

Mr. S. C. Venter has contributed the data for the Meteor Calendar and Mr. R. P. de Kock has calculated the information on which the Planetary Diagram is based.

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." The Equation of Time must be added to the mean solar time to give the apparent solar time. Its effect is shown in the third column of Table II which gives the S.A.S.T. of noon, that is, of the Sun's transit over the meridian.

Example: Find the S.A.S.T. of apparent noon at Port Elizabeth on November 1.

	hr.	min.
S.A.S.T. of noon at 30° E.	11	44
Correction for longitude		18
S.A.S.T. of noon at Port Elizabeth ...	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	minutes
15.00	,,	21.00	,,	3	,,
21.00	,,	23.59	,,	4	,,

Example: Find the sidereal time at 8.15 p.m. on October 1 at Port Elizabeth.

		hr.	min.
Sid. time at 00.00 S.A.S.T. on October 1		00	37
S.A.S. Time	...	20	15
		20	52
Correction for longitude	... ...	−	18
Interval Correction	... ...	+	3
Required Sidereal Time	... ...	20	37

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 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 are 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 co-ordinates known as *celestial latitude* and *longitude* is very convenient. These co-ordinates 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 of 14 hours	S.A.S.T. of Sun's Transit	Sidereal Time at 0 hrs.	Sidereal Time at 18 hrs.
January	1	2,434,379.0	12 03 33	06 41	00 44
,,	11	389	12 07 56	07 20	01 23
,,	21	399	12 11 22	08 00	02 03
February	1	410	12 13 39	08 43	02 46
,,	11	420	12 14 20	09 23	03 26
,,	21	430	12 13 44	10 02	04 05
March	1	438	12 12 28	10 34	04 37
,,	11	448	12 10 09	11 13	05 16
,,	21	458	12 07 19	11 53	05 56
April	1	2,434,469.0	12 03 58	12 36	06 39
,,	11	479	12 01 07	13 15	07 18
,,	21	489	11 58 44	13 55	07 58
May	1	499	11 57 04	14 34	08 37
,,	11	509	11 56 17	15 14	09 17
,,	21	519	11 56 27	15 53	09 56
June	1	530	11 57 38	16 36	10 39
,,	11	540	11 59 26	17 16	11 19
,,	21	550	12 01 34	17 55	11 58
July	1	2,434,560.0	12 03 39	18 35	12 38
,,	11	570	12 05 20	19 14	13 17
,,	21	580	12 06 17	19 54	13 57
August	1	591	12 06 14	20 37	14 40
,,	11	601	12 05 10	21 16	15 19
,,	21	611	12 03 09	21 56	15 59
September	1	622	12 00 02	22 39	16 42
,,	11	632	11 56 42	23 19	17 22
,,	21	642	11 53 10	23 58	18 01
October	1	2,434,652.0	11 49 45	00 37	18 40
,,	11	662	11 46 50	01 17	19 20
,,	21	672	11 44 43	01 56	19 59
November	1	683	11 43 38	02 40	20 43
,,	11	693	11 44 04	03 19	21 22
,,	21	703	11 45 52	03 58	22 01
December	1	713	11 49 00	04 38	22 41
,,	11	723	11 53 13	05 17	23 20
,,	21	2,434,733.0	11 58 02	05 57	00 00

THE SUN, MOON AND PLANETS

The Sun enters the Sign of—

Aries (Equinox ...	...	March	21 d.	0 h.
Cancer (Solstice) ...	...	June	21 d.	19 h.
Libra (Equinox) ...	...	Sept.	23 d.	10 h.
Capricorn (Solstice) ...	...	Dec.	22 d.	6 h.

The Earth is at Perihelion on January 2 and at Aphelion on July 5.

There will be five eclipses in 1953, three of the Sun and two of the Moon. Only one, the total eclipse of the Moon of January 29-30, will be visible in South Africa. The circumstances of this eclipse will be as follows:—

		d.	h.	m.
Moon enters penumbra ...	Jan.	29	22	40.1
Moon enters umbra ...		29	23	54.1
Total eclipse begins		30	01	04.6
Middle of eclipse		30	01	47.3
Total eclipse ends		30	02	29.9
Moon leaves umbra ...		30	03	40.4
Moon leaves penumbra ...		30	04	54.5
P.A. of First Contact of umbra				127°
P.A. of Last Contact with umbra				276°
Magnitude of eclipse: (Moon's diameter = 1)				1.337

There will be a Transit of Mercury over the Sun's disk on November 14. Only the ingress of the planet will be observable from South Africa. The circumstances are:—

INGRESS

	Exterior Contact	Interior Contact	P.	V
Cape of Good Hope ...	17h 36m.6	17h 40m.2	51°	291°
Johannesburg	17 36 .4	17 40 .0	51°	297°

P is the position angle of contact; V the angle from the vertex of the sun.

The least distance of centres has the geocentric value 14′ 21″.5

PHASES OF THE MOON

First Quarter				Full Moon				Last Quarter				New Moon			
	d.	h.	m.		d.	h.	m.		d.	h.	m.		d.	h.	m.
				Dec.	31	07	05	Jan.	8	12	09	Jan.	15	16	08
Jan.	22	07	43	Jan.	30	01	44	Feb.	7	06	09	Feb.	14	03	10
Feb.	20	19	44	Feb.	28	20	59	Mar.	8	20	26	Mar.	15	13	05
Mar.	22	10	10	Mar.	30	14	55	April	7	06	58	April	13	22	09
April	21	02	40	April	29	06	20	May	6	14	21	May	13	07	06
May	20	20	20	May	28	19	03	June	4	19	35	June	11	16	55
June	19	14	01	June	27	05	29	July	4	00	03	July	11	04	28
July	19	06	47	July	26	14	20	Aug.	2	05	16	Aug.	9	18	10
Aug.	17	22	08	Aug.	24	22	21	Aug.	31	12	46	Sept.	8	09	47
Sept.	16	11	49	Sept.	23	06	15	Sept.	29	23	51	Oct.	8	02	40
Oct.	15	23	44	Oct.	22	14	56	Oct.	29	15	09	Nov.	6	19	58
Nov.	14	09	52	Nov.	21	01	12	Nov.	28	10	16	Dec.	6	12	48
Dec.	13	18	30	Dec.	20	13	43	Dec.	28	07	43				

PERIGEE						APOGEE					
	d.	h.		d.	h.		d.	h.		d.	h.
Jan.	17	01	July	28	16	Jan.	5	00	July	16	17
Feb.	14	12	Aug.	25	20	Feb.	1	14	Aug.	13	09
Mar.	15	01	Sept.	23	06	Feb.	28	16	Sept.	9	18
April	12	09	Oct.	21	18	Mar.	27	20	Oct.	6	20
May	10	07	Nov.	19	01	April	24	10	Nov.	3	04
June	5	16	Dec.	16	16	May	22	04	Nov.	30	20
July	1	02				June	18	23	Dec.	28	71

BRIGHT VARIABLE STARS

Name	Position (1950) R.A.	Dec.	Range	Period	Expected Maxima 1953
o Ceti (Mira)	02h 17m	−03° 15′	3.4— 9.2	331d	Mar. 27
R Doradus	04 36	−60 10	5.8— 6.6	335	July 8
R Pictoris	04 45	−49 20	6.5—10	Irregular	
L_3 Puppis	07 12	−44 34	3.1— 6.3	140d (? irr.)	April 19 Sept. 17
R Carinae	09 31	−62 34	4.0—10	309	July 18
S Carinae	10 08	−61 18	5.4— 9.5	149	? April 8
R Hydrae	13 27	−23 01	4.2— 9.5	405	Sept. 24
T Centauri	13 39	−33 21	6.1— 8.0	91	Mar. 18 June 16 Sept. 13
R Aquarii	23 41	−15 34	6.4—10.3	387	April 4

OCCULTATIONS VISIBLE AT CAPE TOWN AND JOHANNESBURG

Date		N.Z.C.	Mag.	Phase	Cape Town			Johannesburg		
					Time		P.A.	Time		P.A.
					h.	m.	°	h.	m.	°
January	6	1635	5.4	R	1	40.2	298	1	35.6	323
January	12	2366	1.2	D	11	28.7	92	11	54.5	71
January	12	2366	1.2	R	12	48.5	271	13	06.1	286
January	19	3501	5.3	D	21	34.6	79	Too low		
February	22	890	4.5	D	No occultation			20	58.7	159
March	2	1685	4.5	D	2	36.7	92	No occultation		
March	2	1685	4.5	R	3	43.8	350	No occultation		
March	7	2349	3.1	R	23	52.7	296	23	34.2	329
March	8	2366	1.2	D	3	09.1	160	2	55.0	116
March	8	2366	1.2	R	3	56.2	235	4	20.2	280
March	28	1635	5.4	D	19	56.1	116	19	58.6	90
April	24	1599	5.0	D	No occultation			17	58.4	177
April	30	2269	5.4	R	0	15.6	328	No occultation		
May	1	2286	5.4	R	3	22.6	333	No occultation		
May	30	2672	2.9	D	20	24.1	98	20	20.3	62
May	30	2672	2.9	R	21	21.0	267	21	12.4	304
June	2	3017	5.3	R	4	53.3	175	5	27.5	183
June	4	3278	5.4	R	Too low			0	46.9	224
June	8	288	5.2	R	5	28.3	248	5	33.4	256
June	25	2349	3.1	D	4	58.9	115	Too low		
June	26	2479	5.3	D	2	13.7	110	2	32.9	96
June	26	2480	5.3	D	2	13.9	110	2	33.1	97
July	22	2269	5.4	D	2	54.1	56	Too low		
July	28	3188	5.4	R	0	31.3	201	0	59.9	211
August	18	2349	3.1	D	22	54.6	69	23	15.5	55
August	19	2349	3.1	R	0	01.3	288	0	10.5	298
August	19	2480	5.3	D	20	19.8	95	20	48.8	70
August	19	2479	5.3	D	20	19.9	94	20	49.2	70
August	23	2981	5.2	D	2	59.1	18	3	16.2	14
August	28	288	5.2	R	Too low			23	53.2	245
September	5	1310	4.2	D	Too low			5	27.5	152
Sept.	14	2286	5.4	D	19	58.9	83	20	23.6	65
Sept.	20	3188	5.4	D	Graze			21	22.5	114
Sept.	24	221	3.7	D	21	42.7	63	21	48.4	52
Sept.	24	221	3.7	R	22	43.6	233	22	54.8	240
October	14	2672	2.9	R	Sun too high			18	17.2	221
October	16	2981	5.2	D	20	40.4	39	21	08.7	37
October	16	2987	5.0	D	22	13.5	354	22	36.7	352
Nov.	18	221	3.7	D	Sun too high			19	32.4	87
Dec.	12	3320	5.3	D	No occultation			21	44.1	129

Note.—N.Z.C. 2366 is Antares.

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 are near the times of elongation. In 1953 these are as follows:

Eastern (Evening Star)				Western (Morning Star)			
Date		*Elong.*	*Mag.*	*Date*		*Elong.*	*Mag.*
March 2	...	18°	−0.2	April 15	...	27°	+0.6
June 27 ...	...	25	+0.7	August 13	...	19	+0.3
October 23	...	24	+0.1	December 1	...	19	−0.2

Mercury will be at Superior Conjunction on February 2, May 24 and September 7; at Inferior Conjunction on March 18, July 25 and November 14, and a Transit of Mercury will occur on this last date. It will be at Stationary Points on March 8, March 31, July 10, August 4, November 4 and November 23.

Mercury will be in Conjunction with Venus on April 27 at 23 hours, with Mars on June 2 at 12 hrs., and with Uranus on June 16 at 9 hrs. On August 23 at 16 hrs. it will be in Conjunction with Mars and only 6′ South of the latter. On September 29 at 19 hrs. it will be 1.6 degrees North of Spica and on September 30 at 16 hrs. 2.4 degrees South of Neptune. On October 4 at 3 hrs. Mercury will be in Conjunction with Saturn; on November 23 at 19 hrs. it will be in Conjunction with Venus and only 1.2 degrees North of the latter.

Venus is an evening star during the early part of the year until Inferior Conjunction on April 13. Greatest elongation is reached on January 31 and the planet passes a Stationary Point on March 22. At the beginning of the year the planet has a magnitude of −3.8 and brightens slowly until March 8 after which it begins to fade. During the last eight months of the year Venus is a briliant morning star reaching its greatest elongation on June 22 and its maximum brightness (magnitude −4.2) on May 19. After greatest elongation it moves slowly in towards the Sun, remaining a morning star for the rest of the year, and fading to magnitude −3.4. It passes a Stationary Point on May 2.

Venus will be in Conjunction with Mars on January 18 and, being only 12′ North of the latter, will form a striking spectacle. It is close to Aldebaran on July 16 and to Jupiter on July 22. Conjunction with Uranus is on August 22 and the planet is less than half a degree from Regulus on September 23. On October 4 at 8 hrs. Venus will be less than 2′

of arc from Mars and the pair will present a striking appearance at the beginning of morning twilight. On November 7 it will be only 6′ from Neptune and on November 14 less than a degree from Saturn.

Mars does not pass through opposition in 1953 NOR ARE THERE ANY STATIONARY POINTS. It is in Conjunction with the Sun on July 8. The planet is visible after sunset during the first half of the year and before sunrise during the latter half. Its magnitudes during these two periods are about 1.3 and 1.7 respectively. It is close to Jupiter on April 27 and near Regulus on September 13 and Neptune on December 13 The planet is not well placed for observation during this year.

Jupiter moves from the constellation of Aries to Taurus in the course of the year, passing through Stationary Points on January 5 and October 15 and through Opposition on December 13. Jupiter sets soon after 1 a.m. at the beginning of the year and steadily earlier until it sets with the Sun at Conjunction on May 25. Thereafter it is visible before sunrise in the east, and rises steadily earlier until at the beginning of October it rises at midnight and at Sunset early in December. In January it has a magnitude of −2.2 and grows fainter until in April it has a magnitude of −1.6. Towards Opposition it brightens to −2.3.

Saturn has Stationary Points on February 6 and June 24. It is in Opposition on April 14 and in Conjunction with the Sun on October 23. Saturn remains in Virgo throughout the year. At Opposition its magnitude is +0.5. The Northern face of the ring system is presented towards the earth, the angle of presentation varying between a minimum of 12° in June and a maximum of more than 18° at the end of December. Saturn is about a degree North of Neptune on May 31 and again on July 11.

Uranus (magnitude 5.8) is in Gemini. It is in Opposition on January 7 and has Stationary Points on March 22 and October 29. Conjunction is on July 11. The most suitable time for observation will be at the beginning of the year, its positions being as follows:—

		R.A.		Dec.	
January 1	...	07h	12.9m	+22°	50′
February 1	...	07	07.3	+22	59
March 1	...	07	03.8	+23	05

Neptune (magnitude 7.7) is in Virgo. It is at Stationary Points on January 25 and July 3 and in Opposition on April 12. It is in Conjunction with the Sun on October 17. It will be most readily observable in March, April and May. Its positions are:—

		R.A.		Dec.	
April 1 ...	...	13h	27.1m	−07°	16′
May 1 ...	...	13	24.1	−06	58
June 1 ...	...	13	21.6	−06	44

At the time of Opposition Neptune will be about 4° NNE of Spica and quite near Saturn, with which there is a close Conjunction on May 31 at 13 hrs., the two being then only 1° apart. A second close Conjunction occurs on July 11 at 02 hrs.

GEOCENTRIC LONGITUDES OF SUN AND BRIGHT PLANETS FOR 1953

	Sun	Mercury	Venus	Mars	Jupiter	Saturn
Jan. 1 ...	280°	262°	325°	331°	41°	207°
Jan. 31 ...	311	309	357	354	42	208
Mar. 2 ...	341	359	22	16	46	208
April 1 ...	011	350	29	38	52	206
May 1 ...	040	19	14	60	58	204
May 31 ...	069	77	27	80	65	202
June 30 ...	098	123	53	101	72	202
July 30 ...	126	118	84	120	78	203
Aug 29 ...	155	147	119	140	83	205
Sept. 28 ...	185	200	155	159	86	208
Oct. 28 ...	214	237	192	178	86	211
Nov. 27 ...	244	226	229	196	84	215
Dec. 27 ...	275	264	267	214	80	218

METEOR CALENDAR, 1953

Date	Shower	Radiant		Maximum			Nature of Current
		Long.	Lat.	Date	Rate per hour	Time of Transit	
Jan. 3 ...	Quadrantids	227°	+46°	Jan. 3 ...	40	08.5	Unknown.
Mar. 12—April 25	Hydraids	184°	—27°	Mar. 25	?	00.0	Unknown.
March 1 May 10	Virginids	203°	— 6°	April 3 ...	?	00.0	Ecliptical
April 12-24	Lyrids	273°	+35°	April 22	12	04.0	Cometary: Comet 1861 I
April 29—May 21	Eta Aquarids	338°	— 1°	May 5 ...	10	07.6	Cometary: Halley.
April 20—July 30	Sco-Sgr. System	270°	—30°	June 14	?	00.5	Ecliptical.
July 25—Aug. 10	Delta Aquarids	343°	—17°	Aug. 3	20	02.0	Ecliptical
July 20—Aug. 19	Perseids	43°	+56°	Aug. 11	50	05.6	Cometary: Comet 1862 III
July 25—Sept. 8	Cygnids	324°	+51°	Aug. 16	?	00.0	Unknown
Aug. 16—Oct. 8	Piscids	0°	+4°	Sept. 12	?	00.0	Ecliptical
Oct. 11-30	Orionids*	94°	+16°	Oct. 19	20	04.4	Cometary: Halley.
Sept. 24—Dec. 10	Taurids	58°	+21°	Nov. 13	6	00.6	Ecliptical.
Nov. 16	Leonids	151°	+21°	Nov. 16	6	06.5	Cometary: Comet 1866 I
Dec. 5-12	Geminids	113°	+30°	Dec. 12	30	02.0	Ecliptical
Dec. 5—Jan. 7	Velaids	149°	—51°	Dec. 29 ...	?	03.5	Unknown.

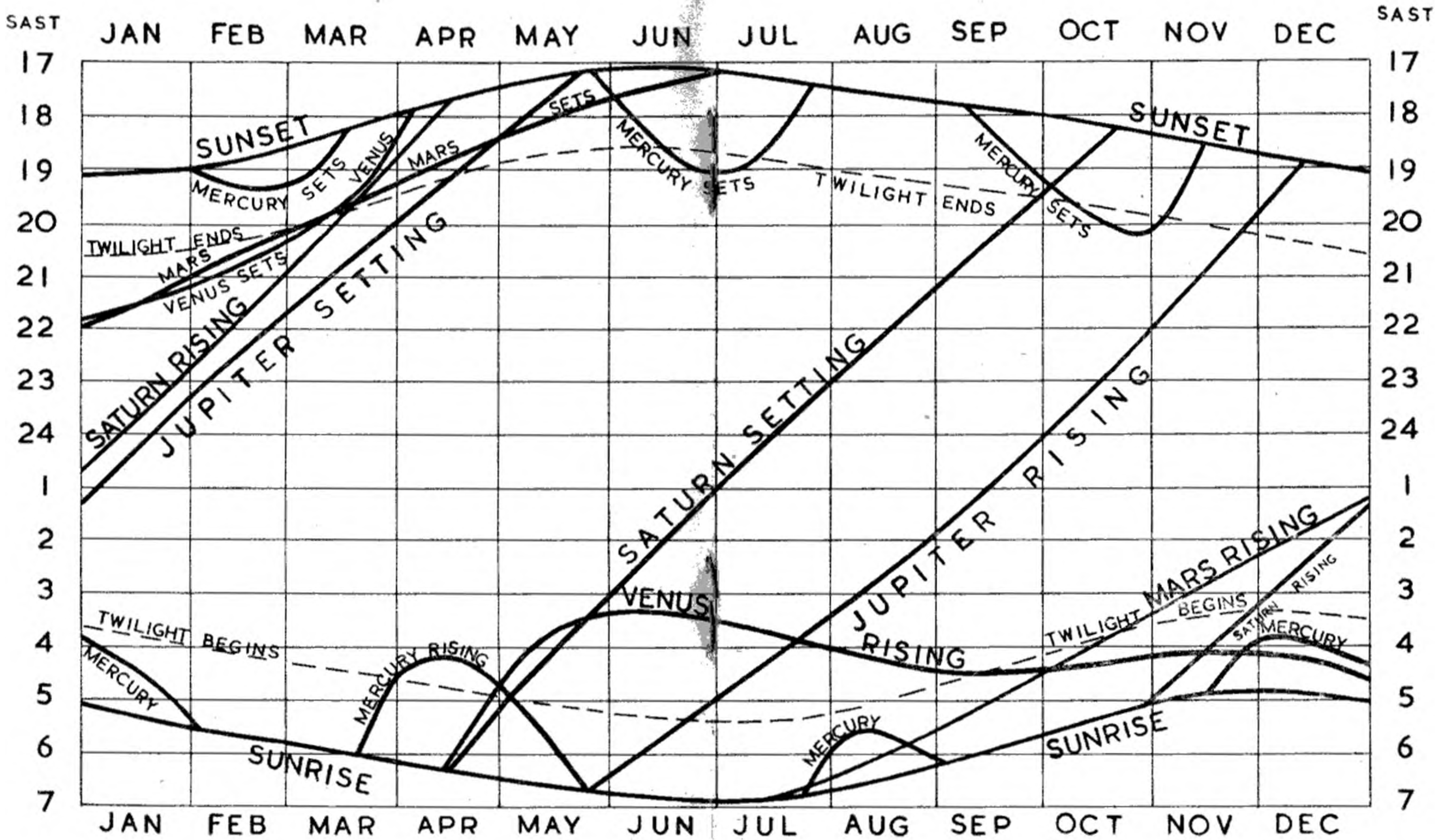
*According to Prentice (Director of the Meteor Section of the B.A.A.), this shower has a probable period of 16 years with an expected return during 1951-1955.

Much of the above information is derived from Hoffmeister's "Meteorstrome" (Meteoric Streams) published in 1948. The orbits of the Cometary Currents are closely related to the orbits of the comets indicated, and those of the Ecliptical Currents to the orbits of certain minor planets.

For the moon during the above periods see Phases of the Moon on page 00.

THE PLANETS AS SEEN FROM SOUTH AFRICA

1953



LATITUDE 30° SOUTH LONGITUDE 30° EAST

ASTRONOMICAL DIARY

JANUARY, 1953

Full Moon 30d. 01h. 44m. New Moon 15d. 16h. 08m.

Mercury in the eastern morning sky rising just before the Sun; Venus and Mars a prominent pair close together in the western evening sky; Saturn and Jupiter almost opposite each other in the sky, the former rising just after midnight and the latter setting just after 1.0 a.m.

	d.	h.	
Jan.	2		Earth at Perihelion, distance 0.983 astronomical units.
,,	5		Jupiter at a Stationary Point.
,,	7		Uranus in Opposition.
,,	9	11	Saturn in Conjunction with the Moon, Saturn 8° N.
,,	12	11	Occultation of Antares.
,,	18	04	Venus 0°.2 N. of Mars.
,,	19	03	Mars in Conjunction with the Moon. Mars 4° S.
,,	19	03	Venus in Conjunction with the Moon. Venus 4° S.
,,	23	04	Jupiter in Conjunction with the Moon, Jupiter 7° S.
,,	25		Neptune at a Stationary Point.
,,	29-30		Total Eclipse of the Moon.
,,	31		Venus at Greatest Elongation 47° E.

FEBRUARY, 1953

Full Moon 28d. 20h. 59m. New Moon 14d. 03h. 10m.

Mercury is an evening star. Venus and Mars are close together in the western evening sky. Jupiter is somewhat higher in the west at sunset. Saturn rises about 10 p.m.

	d.	h.	
Feb.	2		Mercury at Superior Conjunction.
,,	5	20	Saturn in Conjunction with the Moon, Saturn 8° N.
,,	6		Saturn at a Stationary Point.
,,	13-14		Partial Eclipse of the Sun, not visible in S. Africa.
,,	17	1	Mars in Conjunction with the Moon, Mars 5° S.
,,	17	11	Venus in Conjunction with the Moon, Venus 2° S.
,,	19	16	Jupiter in Conjunction with the Moon, Jupiter 6° S.

MARCH, 1953

Full Moon 30d. 14h. 55m. New Moon 15d. 13h. 05m.

Mercury an evening star at the beginning of the month; Venus and Mars close together in the western evening sky with Jupiter only a little higher in the sky; Saturn rising at the end of evening twilight.

	d.	h.	
Mar.	2		Mercury at Greatest Elongation, 18° East.
,,	5	01	Saturn in Conjunction with the Moon, Saturn 8° N.
,,	8		Mercury at a Stationary Point.
,,	8		Venus at greatest brilliancy.
,,	8	04	Occultation of Antares.

MARCH, 1953 (continued)

,,	17	22	Venus in Conjunction with the Moon, Venus 2° N.
,,	17	22	Mars in Conjunction with the Moon, Mars 5° S.
,,	18	01	Venus in Conjunction with Mars, Venus 7° N.
,,	18		Mercury at Inferior Conjunction.
,,	19	08	Jupiter in Conjunction with the Moon, Jupiter 6° S.
,,	21	0	Equinox.
,,	22		Venus at a Stationary Point.
,,	22		Uranus at Stationary Point.
,,	31		Mercury at a Stationary Point.

APRIL, 1953

Full Moon 29d. 06h. 20m. **New Moon 13d. 22h. 09m.**

Mercury is a morning star. Venus is a morning star in the second half of the month. Mars and Jupiter set close together immediately after sunset. Saturn rises at sunset.

	d.	h.	
April	12	04	Mercury in Conjunction with the Moon, Mercury 6° S.
,,	13		Venus at Inferior Conjunction.
,,	14		Saturn at Opposition.
,,	15		Mercury at Greatest Elongation, 27° W.
,,	15	18	Mars in Conjunction with Moon, Mars 5° S.
,,	16	04	Jupiter in Conjunction with the Moon, Jupiter 6° S.
,,	27	18	Mars in Conjunction with Jupiter, Mars 1°.1 N.
,,	27	23	Mercury in Conjunction with Venus, Mercury 7°.2 S.
,,	28	06	Saturn in Conjunction with the Moon, Saturn 8° N.

MAY, 1953

Full Moon 28d. 19h. 03m. **New Moon 13d. 07h. 06m.**

Mercury a morning star; Venus very prominent before dawn; Saturn visible most of the night and setting an hour before morning twilight.

	d.	h.	
May	2		Venus at a Stationary Point.
,,	10	21	Venus in Conjunction with the Moon, Venus 4° S.
,,	14	13	Mars in Conjunction with the Moon, Mars 4° S.
,,	15	19	Neptune in Conjunction with Spica, Neptune 4°.1 N.
,,	15	20	Mars in Conjunction with Aldebaran, Mars 6°.1 N.
,,	19		Venus at greatest brilliancy.
,,	24	13	Saturn at Conjunction with Spica, Saturn 5°.1 N.
,,	24		Mercury at Superior Conjunction.
,,	25	11	Saturn in Conjunction with the Moon, Saturn 8° N.
,,	31	13	Saturn in Conjunction with Neptune, Saturn 1° N.

JUNE, 1953

Full Moon 27d. 05h. 29m. **New Moon 11d. 16h. 55m.**

Mercury an evening star; Venus a very prominent morning star. Saturn sets in the small hours. Jupiter in the east rising just before the Sun.

JUNE, 1953 (continued)

	d.	h.	
June	2	12	Mercury in Conjunction with Mars, Mercury 1°.0 N.
,,	8	10	Venus in Conjunction with the Moon, Venus 8° S.
,,	13	09	Mercury in Conjunction with the Moon, Mercury 0°.1 N.
,,	16	09	Mercury in Conjunction with Uranus, Mercury 1°.4 N.
,,	20	23	Mercury in Conjunction with Pollux, Mercury 5°.4 S.
,,	21	02	Jupiter in Conjunction with Aldebaran, Jupiter 4°.9 N.
,,	21	18	Saturn in Conjunction with the Moon, Saturn 8° N.
,,	21	19	Solstice.
,,	22		Venus at Greatest Elongation West.
,,	24		Saturn at a Stationary Point.
,,	27		Mercury at Greatest Elongation, 25° E.

JULY, 1953

Full Moon 26d. 14h. 20m. **New Moon 11d. 04h. 28m.**

Mercury an evening star for the first half of the month. Venus a prominent morning star. Jupiter rises three hours before dawn. Saturn sets at midnight.

	d.	h.	
July	3		Neptune at a Stationary Point.
,,	5		Earth at Aphelion, distance 1.017 astronomical units.
,,	7	15	Venus in Conjunction with the Moon, Venus 8° S.
,,	8		Mars in Conjunction with the Sun.
,,	8	13	Jupiter in Conjunction with the Moon, Jupiter 5° S.
,,	10		Mercury at a Stationary Point.
,,	11		Partial eclipse of the Sun, not visible in S. Africa.
,,	11	02	Saturn in Conjunction with Neptune, Saturn 0°.9 N.
,,	12	17	Mercury in Conjunction with the Moon, Mercury 3° S.
,,	16	13	Venus in Conjunction with Aldebaran Venus 2°.8 N.
,,	19	03	Saturn in Conjunction with the Moon, Saturn 8° N.
,,	23	00	Venus in Conjunction with Jupiter, Venus 1°.9 S.
,,	25		Mercury at Inferior Conjunction.
,,	25	23	Saturn in Conjunction with Spica, Saturn 4°.8 N.
,,	26		Total eclipse of the Moon not visible in S. Africa.

AUGUST, 1953

Full Moon 24d. 22h. 21m. **New Moon 9d. 18h. 10m.**

Mercury and Venus morning stars; Mars rising in morning twilight. Jupiter rising in the small hours. Saturn visible in the west in the evening.

	d.	h.	
Aug.	4		Mercury at Stationary Point.
,,	5	05	Jupiter in Conjunction with the Moon, Jupiter 4° S.
,,	6	04	Venus in Conjunction with the Moon, Venus 5° S.
,,	8	04	Mercury in Conjunction with the Moon, Mercury 3° S.
,,	9		Partial eclipse of the Sun, invisible in S. Africa.
,,	13		Mercury at Greatest Elongation, 19° W.
,,	15	13	Saturn in Conjunction with the Moon, Saturn 8° N.

AUGUST, 1953 (continued)

	d.	h.	
,,	19	20	Neptune in Conjunction with Spica, Neptune 4°.0 N.
,,	22	19	Venus in Conjunction with Uranus, Venus 1°.3 S.
,,	23	16	Mercury in Conjunction with Mars, Mercury 0°.1 S.
,,	24	22	Venus in Conjunction with Pollux, Venus 7°.5 S.

SEPTEMBER, 1953

Full Moon 23d. 06h. 15m. **New Moon 8d. 09h. 47m.**

Mercury very close to the Sun as an evening star. Venus and Mars morning stars rising in the twilight. Jupiter rising soon after midnight. Saturn in the West setting just after dark.

	d.	h.	
Sept.	1	18	Jupiter in Conjunction with the Moon, Jupiter 4° S.
,,	5	05	Venus in Conjunction with the Moon, Venus 0°.3 N.
,,	6	19	Mars in Conjunction with the Moon, Mars 3° N.
,,	7		Mercury at Superior Conjunction.
,,	12	0	Saturn in Conjunction with the Moon, Saturn 8° N.
,,	13	03	Mars in Conjunction with Regelus, Mars 0°.8 N.
,,	23	10	Equinox.
,,	23	11	Venus in Conjunction with Regulus, Venus 0°.4 N.
,,	29	05	Jupiter in Conjunction with the Moon, Jupiter 4° S.
,,	29	19	Mercury in Conjunction with Spica, Mercury 1°.6 N.
,,	30	16	Mercury in Conjunction with Neptune, Mercury 2°.4 S.

OCTOBER, 1953

Full Moon 22d. 14h. 56m. **New Moon 8d. 02h. 40m.**

Mercury and Saturn evening stars close together in the evening twilight at the beginning of the month. Venus a morning star rising in the morning twilight. Mars rises somewhat earlier than Venus. Jupiter visible after midnight.

	d.	h.	
Oct.	4	03	Mercury in Conjunction with Saturn, Mercury 3°.5 S.
,,	4	08	Venus in Conjunction with Mars, Venus 0°.03 S.
,,	5	15	Mars in Conjunction with the Moon, Mars 5° N.
,,	5	17	Venus in Conjunction with the Moon, Venus 5° N.
,,	10	03	Mercury in Conjunction with the Moon, Mercury 3° N.
,,	10	12	Saturn in Conjunction with the Moon, Saturn 8° N.
,,	15		Jupiter at a Stationary Point.
,,	17		Neptune in Conjunction with the Sun.
,,	23		Mercury at Greatest Elongation, 24° E.
,,	23		Saturn in Conjunction with the Sun.
,,	26	14	Jupiter in Conjunction with the Moon, Jupiter 3° S.
,,	29		Uranus at a Stationary Point.

NOVEMBER, 1953

Full Moon 21d. 01h. 12m. **New Moon 6d. 19h. 58m.**

Mercury an evening star at the beginning of the month. Mercury at the end of the month, Venus and Saturn rising in morning twilight with

NOVEMBER, 1953 (continued)

Mars rising an hour before first light. Jupiter rises in the evening and is visible for the rest of the night.

	d.	h.	
Nov.	3	11	Mars in Conjunction with the Moon, Mars 6° N.
,,	4		Mercury at a Stationary Point.
,,	5	05	Venus in Conjunction with the Moon, Venus 7° N.
,,	5	06	Venus in Conjunction with Spica, Venus 3°.9 N.
,,	7	09	Venus in Conjunction with Neptune, Venus 0°.1 S.
,,	8	03	Mercury in Conjunction with the Moon, Mercury 2° N.
,,	14		Mercury at Inferior Conjunction. Transit of Mercury.
,,	14	06	Venus in Conjunction with Saturn, Venus 0°.9 S.
,,	22	21	Jupiter in Conjunction with the Moon, Jupiter 3° S.
,,	23		Mercury at a Stationary Point.
,,	23	19	Mercury in Conjunction with Venus, Mercury 1°.2 N.

DECEMBER, 1953

Full Moon 20d. 13h. 43m. **New Moon 6d. 12h. 48m.**

Mercury and Venus very close to the Sun in the morning twilight. Mars and Saturn rising in the East close together in the morning. Jupiter rises at sunset and is visible throughout the night.

	d.	h.	
Dec.	1		Mercury at Greatest Elongation, 19° W.
,,	2	06	Mars in Conjunction with the Moon, Mars 7° N.
,,	3	14	Saturn in Conjunction with the Moon, Saturn 8° N.
,,	4	23	Mercury in Conjunction with the Moon, Mercury 7° N.
,,	5	12	Venus in Conjunction with the Moon, Venus 5° N.
,,	7	04	Mars in Conjunction with Spica, Mars 3°.5 N.
,,	12	09	Venus in Conjunction with Antares, Venus 5°.2 N.
,,	13		Jupiter in Opposition.
,,	13	10	Mars in Conjunction with Neptune, Mars 0°.5 S.
,,	16	11	Mercury in Conjunction with Antares, Mercury 5°.4 N.
,,	20	01	Jupiter in Conjunction with the Moon, Jupiter 3° S.
,,	22	06	Solstice.
,,	31	01	Mars in Conjunction with the Moon, Mars 7° N.
,,	31	04	Saturn in Conjunction with the Moon, Saturn 8° N.

TRANSITS OF MERCURY AND VENUS

A feature which distinguishes the year 1953 astronomically is the fact that a transit of Mercury, partly visible from South Africa, will occur on November 14. Transit of Mercury are relatively rare, and those of Venus, exceedingly rare. In the past Transits of Venus have been regarded as of high astronomical importance, for they offered a means, now superseded by more accurate methods, for the determination of the distance of the Earth from the Sun. Transits of Mercury were never of great value in this connection and are now chiefly of interest in that they offer an opportunity for the exact measurement of the angular diameter of the planet, and may yield results of interest in connection with any traces of atmosphere that Mercury may possess. On a larger view, the occurrence of the phenomena at the times and under the circumstances predicted form a general verification, if that is still needed, of the accuracy of modern planetary theory and an opportunity to determine small corrections of position. However, although one may at the moment deprecate somewhat the astronomical importance of the phenomenon, there is no telling that, perhaps in the near future, the unusual circumstances presented, will not be realised as an opportunity for undertaking observations of a novel type.

Were the orbits of all the planets in exactly the same plane a hypothetical observer situated on any one of the planets would see each planet interior to his own pass in front of the Sun's disc at intervals equal to the synodic period of each pair of planets concerned. If these circumstances obtained there would be a Transit of Mercury every 116 days and a Transit of Venus every 584 days. Observers on Mars, Jupiter and Saturn would see Transits of the Earth at intervals of 780, 399 and 378 days respectively, and Neptunian and Plutonian observers would reckon Earth Transits as an annual (every terrestrial year) event.

The rarity of Transits arises from a cause similar to that which makes eclipses rare, namely, that the orbits concerned are not all in the same plane. The planes of any two orbits are inclined to one another and intersect in a line. In the case of the orbit of the Earth and the orbit of any other planet this line defines the two opposite directions from the Earth to the apparent intersections (the Nodes) of the two orbits on the Celestial Sphere. We may envisage the problem in locomotive terms, where each orbit represents a railway or a road. Transits and eclipses are then analogous to collisions, which require not only an intersection of the two tracks, but also the simultaneous presence close to the intersection of the entities—trains, cars, or planets—which run along these tracks.

The case of transits is somewhat simpler than that of eclipses, for the planets concerned may be regarded as practically points, and the problem of predicting a transit is to discover whether or not these points will pass before the solar disc. In eclipse problems there are concerned always two discs of finite size—those of the Sun, Moon, or shadow of the Earth as the case may be. The two cases are however similar in this respect, that on either side of each of the nodes of the orbits of Mercury and of

Venus there is a certain angular range, such that, if Inferior Conjunction of the planet and the Sun occurs within this angular range, there will be a transit at that node. These Transit Limits are analogous to the Ecliptic Limits in the case of eclipses: then an eclipse can be predicted if Full or New Moon occurs within a certain angular range of the nodes of the Moon's orbit.

The orbit of Mercury is inclined at 7 degrees to the Ecliptic, and the Sun passes through the nodes of the orbit on May 7 and November 9 each year. The estimation of the transit limits is complicated by a number of factors, and especially by the fact that the orbit of Mercury is markedly elliptical. The distance of Mercury from the Sun varies from about 0.31 astronomical units at perihelion, to about 0.47 astronomical units at aphelion. The positions of the nodes on the orbit are fairly close to the positions of perihelion and aphelion, the latter being close to the direction of the node through which the Sun passes in May. When conditions are favourable for a transit the Sun is near one of the nodes and Mercury in its orbit is near the same node. Thus, if a transit is to take place in May of a certain year, the Sun, Mercury and the Earth will all be closely in line, and Mercury will be almost as close as it can be to the Earth, about 0.5 astronomical units. If a transit is to take place in November of a certain year, the Sun, Mercury and the Earth will again be almost exactly in line, and Mercury will be at the greatest possible distance from the Earth which can occur at Inferior Conjunction, about 0.7 astronomical units. Imagine a cone with vertex at the Earth, drawn with the solar disc as base, constructed for May 7 and November 9 in any year. Since these are the times of passage of the Sun through the nodes of the orbit of Mercury, the orbit of the planet will slice through these cones, and if the planet happens to be on the parts of its orbit so defined, there will be a transit. But from what has gone before, it will be clear that for the conditions which obtain in May, the orbit of Mercury slices through the cone relatively near the Earth, its vertex, so that only a short length of Mercury's orbit is favourable for the occurrence of a transit. In November, the orbit being nearer the Sun, the path of Mercury goes through the cone nearer its base, and a greater length of the orbit is favourable for the occurrence of a transit.

Matters are still further complicated by the fact that, of course, the rate of travel of Mercury in its orbit is different when the planet is near aphelion from what it is at perihelion. Considered from a terrestrial viewpoint, the whole matter can be summed up in the statement that for May transits, the limit is that Inferior Conjunction with the Sun must occur within 2° 40′ on either side of the node, whereas for November transits, the limit is 4° 45′ on either side of the node. This means that November transits are about twice as common as May transits. Since the Sun moves about a degree per day, it means that November transits can occur up to about five days on either side of nodal passage, that is, as early as November 4 or as late as November 14, while the May transits must always be within two or three days on either side of the seventh, that is, the earliest date is approximately May 5 and the latest about May 9.

The synodic period of Mercury is 115.88 days, after which, relative positions of the Sun, Mercury and Earth repeat themselves, so far as a "plan view" of the solar system is concerned. If we want to consider the recurrence of transits, we must not only make the relative positions of the three bodies correct, but must consider too the positions relative to the nodes of Mercury's orbit. If a transit occurred on a certain day, then, 116 days later, there would be another Inferior Conjunction, but it would not take place near a node of the orbit, and there would be no transit. Twenty-two synodic periods of Mercury are 7.4 days short of seven years, and during 7.4 days the Sun will move roughly an equal number of degrees. This is a little less than twice 4° 45′, so that if a November transit occurs with Inferior Conjunction at one end of the range of Transit Limits for November, there can be another November transit seven years later. The approximation of 22 synodic periods to seven years is, however, not close enough for a repetition of a May transit ot occur after seven years. Forty-one synodic periods differ from 13 years by only 2.8 days, so that a repetition of a November transit after 13 years is very probable, and of a May transit, a possibility. Finally, 145 synodic periods differ from 46 years by only 1.1 days, so that a repetition of a transit at the same node after 46 years is almost certain. The dates of the transits of Mercury in the twentieth century, listed below, illustrate well the facts explained above:—

1907, November 12	
1914, November 6	1924, May 7
1927, November 8	
1940, November 12	
1953, November 14	1957, May 5
1960, November 6	1970, May 9
1973, November 9	
1986, November 12	
1999, November 14	

On 1937, May 11, thirteen years after the first May transit listed above, Mercury approached so close to the Sun that the late Dr. Bernard Lyot was able to photograph it as a black dot superposed on the corona.

Transits of Venus are much rarer events than transits of Mercury. The inclination of the orbit is only 3° 24′ and the Transit Limit is only 1° 45′ on either side of the node so that transits if they occur must do so within a day or so on either side of the dates of nodal passage which are on June 7 and December 8. Since the orbit of Venus is the least eccentric of all the planets, there is not the same variation from one node to another that there is in the case of Mercury. By arguments similar to those used in the case of Mercury it can be shown that if a transit occurs at a given node another one may occur at the same node eight years later. This recurrence is not certain: it only occurs if the track of the first transit is more than 12′ from the centre of the solar disc. If it does happen no further transit at the same node is possible for 235 years or 243 years although there will be a transit at the other node after about half this time.

December transits of Venus occurred in 1631, 1639, 1874 and 1882 and the next pair will occur in 2117 and 2125. The dates of June transits are

1761, 1769, 2004 and 2012. The importance of transits in the past was that, by timing the interval required for the planet to cross the disc (it is about eight hours for a central transit) as seen from points on the Earth separated by a large difference in latitude, it was possible to estimate the distance of the Earth from the Sun. The two timings enabled the angular displacement of the path of the planet to be determined, and then the knowledge of the relative dimensions of the orbits of the Earth and Venus, plus a knowledge of the separation between the observing stations in miles, led to the desired distance. Unfortunately there is an optical effect which smudges out the black disc of the planet as it enters the border of the solar disc, making the determination of the exact instant of contact difficult. In addition the angular diameter of the solar disc is used as an intermediate datum and this is not a quantity readily determinable with the highest precision. In consequence, although the transits of 1769, 1874 and 1882 were observed extensively, the results for the solar parallax were not very accurate, and this method is now outmoded. A transit of Mercury is not suitable for this purpose because the distance of the planet from the Earth at the time of transit is too large for the effect of changing the observer's latitude to be of a size sufficient for it to be measured with the necessary precision.

Nevertheless exact timings by South African observers (taking the very necessary precautions against damage to eyesight by concentrated sunlight) of the moments of contact of Mercury and the solar disc, and especially of the moment when the disc of the planet is just fully seen against the sun (second contact) will be of value in establishing corrections to orbital data for Mercury.

At the Rome meeting of the International Astronomical Union in September the following Resolution was passed by the Commissions on Ephemerides and on Celestical Mechanics:

> "Commissions 4 and 7 recommend all observatories to take part as far as possible in precise observations of the Transit of Mercury which will take place in November, 1953."

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A number of observing sections has been formed to encourage amateurs to undertake useful research. Enquiries about these observing sections should be addressed to the Directors whose names and addresses are given below:—

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