THE OBSERVER'S HANDBOOK FOR 1923

PUBLISHED BY

The Royal Astronomical Society of Canada

EDITED BY C. A. CHANT.

FIFTEENTH YEAR OF PUBLICATION

TORONTO
198 COLLEGE STREET
PRINTED FOR THE SOCIETY
1923

1923 CALENDAR 1923

JANUARY						
Sun.	.	.	7	14	21	28
Mon.	.	1	8	15	22	29
Tues.	.	2	9	16	23	30
Wed.	.	3	10	17	24	31
Thur.	.	4	11	18	25	..
Fri.	.	5	12	19	26	..
Sat.	.	6	13	20	27	..

FEBRUARY						
Sun.	.	.	4	11	18	25
Mon.	.	.	5	12	19	26
Tues.	.	.	6	13	20	27
Wed.	.	.	7	14	21	28
Thur.	.	1	8	15	22	..
Fri.	.	2	9	16	23	..
Sat.	.	3	10	17	24	..

MARCH						
Sun.	.	.	4	11	18	25
Mon.	.	.	5	12	19	26
Tues.	.	.	6	13	20	27
Wed.	.	.	7	14	21	28
Thur.	.	1	8	15	22	29
Fri.	.	2	9	16	23	30
Sat.	.	3	10	17	24	31

APRIL						
Sun.	.	1	8	15	22	29
Mon.	.	2	9	16	23	30
Tues.	.	3	10	17	24	..
Wed.	.	4	11	18	25	..
Thur.	.	5	12	19	26	..
Fri.	.	6	13	20	27	..
Sat.	.	7	14	21	28	..

MAY						
Sun.	.	.	6	13	20	27
Mon.	.	.	7	14	21	28
Tues.	.	1	8	15	22	29
Wed.	.	2	9	16	23	30
Thur.	.	3	10	17	24	31
Fri.	.	4	11	18	25	..
Sat.	.	5	12	19	26	..

JUNE						
Sun.	.	3	10	17	24	..
Mon.	.	4	11	18	25	..
Tues.	.	5	12	19	26	..
Wed.	.	6	13	20	27	..
Thur.	.	7	14	21	28	..
Fri.	1	8	15	22	29	..
Sat.	2	9	16	23	30	..

JULY						
Sun.	.	1	8	15	22	29
Mon.	.	2	9	16	23	30
Tues.	.	3	10	17	24	31
Wed.	.	4	11	18	25	..
Thur.	.	5	12	19	26	..
Fri.	.	6	13	20	27	..
Sat.	.	7	14	21	28	..

AUGUST						
Sun.	.	.	5	12	19	26
Mon.	.	.	6	13	20	27
Tues.	.	.	7	14	21	28
Wed.	.	1	8	15	22	29
Thur.	.	2	9	16	23	30
Fri.	.	3	10	17	24	31
Sat.	.	4	11	18	25	..

SEPTEMBER						
Sun.	.	2	9	16	23	30
Mon.	.	3	10	17	24	..
Tues.	.	4	11	18	25	..
Wed.	.	5	12	19	26	..
Thur.	.	6	13	20	27	..
Fri.	.	7	14	21	28	..
Sat.	1	8	15	22	29	..

OCTOBER						
Sun.	.	.	7	14	21	28
Mon.	.	1	8	15	22	29
Tues.	.	2	9	16	23	30
Wed.	.	3	10	17	24	31
Thur.	.	4	11	18	25	..
Fri.	.	5	12	19	26	..
Sat.	.	6	13	20	27	..

NOVEMBER						
Sun.	.	.	4	11	18	25
Mon.	.	.	5	12	19	26
Tues.	.	.	6	13	20	27
Wed.	.	.	7	14	21	28
Thur.	.	1	8	15	22	29
Fri	.	2	9	16	23	30
Sat.	.	3	10	17	24	..

DECEMBER						
Sun.	.	2	9	16	23	30
Mon.	.	3	10	17	24	31
Tues.	.	4	11	18	25	..
Wed.	.	5	12	19	26	..
Thur.	.	6	13	20	27	..
Fri.	.	7	14	21	28	..
Sat.	1	8	15	22	29	..

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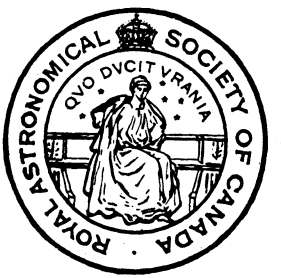

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CONTENTS

PREFACE

The HANDBOOK for 1923 follows the same lines as that for 1922. The general sketch of the planets, it is hoped, will be found useful in giving a view for the entire year, while the detailed account for each month gives the observer the times for the phenomena each day.

Descriptions of the constellations and the star maps are not included, since fuller information is available in a better form and at a reasonable price in many publications, such as: Young's *Uranography* (72c.), Upton's *Star Atlas* ($3.00) and McKready's *Beginners' Star Book* (about $4.00).

The HANDBOOK is somewhat delayed this year through the Editor's absence on the eclipse expedition to Australia. Especial thanks are due to Mr. J. A. Pearce, M.A., now at the Lick Observatory; Mr. R. M. Motherwell, M.A., and Dr. R. J. McDiarmid, Dominion Observatory, Ottawa; and to Messrs. J. H. Horning, M.A., H. F. Balmer, B.A., and J. P. Dandy, Toronto.

THE EDITOR.

TORONTO, December, 1922.

ANNIVERSARIES AND FESTIVALS, 1923

New Year's Day	Mon., Jan. 1	Victoria Day	Thurs., May 24
Epiphany	Sat., Jan. 6	Trinity Sunday	May 27
Septuagesima Sunday	Jan. 28	Corpus Christi	Thur., May 31
Quinquagesima (Shrove Sunday)	Feb. 11	St. John Baptist	Sun., June 24
Ash Wednesday	Feb. 14	Dominion Day	Sun., July 1
St. David	Thurs. Mar. 1	Labor Day	Mon., Sept. 3
St. Patrick	Sat., Mar. 17	St. Michael (Michaelmas Day)	Sat., Sept. 29
Palm Sunday	Mar. 25	All Saints Day	Thurs., Nov. 1
Good Friday	Mar. 30	St. Andrew	Fri., Nov. 30
Easter Sunday	Apr. 1	First Sunday in Advent	Dec. 2
St. George	Mon., Apr. 23	Conception Day	Sat., Dec. 8
Rogation Sunday	May 6	St. Thomas	Fri., Dec. 21
Ascension Day (Holy Thursday)	May 10	Christmas Day	Tues., Dec. 25
Pentecost (Whit Sunday)	May 20		

King George V., born June 3, 1865; began to reign May 6, 1910.
Queen Mary, born May 26, 1867.
Prince of Wales, born June 23, 1894.

SYMBOLS AND ABBREVIATIONS

SIGNS OF THE ZODIAC

♈ Aries..... 0°	♌ Leo.....120°	♐ Sagittarius...240°
♉ Taurus .....30°	♍ Virgo.....150°	♑ Capricornus..270°
♊ Gemini .....60°	♎ Libra.....180°	♒ Aquarius....300°
♋ Cancer.....90°	♏ Scorpio ....210°	♓ Pisces.....330°

SUN, MOON AND PLANETS

☉ The Sun.	☾ The Moon generally.	♃ Jupiter.
● New Moon.	☿ Mercury.	♄ Saturn.
○ Full Moon.	♀ Venus.	♅ or ♅ Uranus.
☽ First Quarter	⊕ Earth.	♆ Neptune.
☾ Last Quarter.	♂ Mars.	

ASPECTS AND ABBREVIATIONS

☌ Conjunction, or having the same Longitude or Right Ascension.
☍ Opposition, or differing 180° in Longitude or Right Ascension.
□ Quadrature, or differing 90° in Longitude or Right Ascension.
☊ Ascending Node; ☋ Descending Node.
α or A.R., Right Ascension; δ Declination.
h, m, s, Hours, Minutes, Seconds of Time.
° ′ ″, Degrees, Minutes, Seconds of Arc.

THE GREEK ALPHABET

A, α,	Alpha.	I, ι,	Iota.	P, ρ,	Rho.
B, β,	Beta.	K, κ,	Kappa.	Σ, σ, ς,	Sigma.
Γ, γ,	Gamma.	Λ, λ,	Lambda.	T, τ,	Tau.
Δ, δ,	Delta.	M, μ,	Mu.	Υ, υ,	Upsilon.
E, ε,	Epsilon.	N, ν,	Nu.	Φ, ϕ,	Phi.
Z, ζ,	Zeta.	Ξ, ξ,	Xi.	X, χ,	Chi.
H, η,	Eta.	O, o,	Omicron.	Ψ, ψ,	Psi.
Θ, θ, ϑ,	Theta.	Π, π,	Pi.	Ω, ω,	Omega.

In the Configurations of Jupiter's Satellites (pages 29, 31, etc.), O represents the disc of the planet, d signifies that the satellite is on the disc, * signifies that the satellite is behind the disc or in the shadow. Configurations are for an inverting telescope.

SOLAR AND SIDEREAL TIME

In practical astronomy three different kinds of time are used, while in ordinary life we use a fourth.

1. *Apparent Time*—By apparent noon is meant the moment when the sun is on the meridian, and apparent time is measured by the distance in degrees that the sun is east or west of the meridian. Apparent time is given by the sun-dial.

2. *Mean Time*—The interval between apparent noon on two successive days is not constant, and a clock cannot be constructed to keep apparent time. For this reason *mean time* is used. The length of a mean day is the average of all the apparent days throughout the year. The *real sun* moves about the ecliptic in one year; an imaginary *mean sun* is considered as moving uniformly around the celestial equator in one year. The difference between the times that the real sun and the mean sun cross the meridian (*i. e.* between apparent noon and mean noon) is the *equation of time.* (See next page).

3. *Sidereal Time*—This is time as determined from the stars. It is sidereal noon when the Vernal Equinox or First of Aries is on the meridian. In accurate time-keeping the moment when a star is on the meridian is observed and the corresponding mean time is then computed with the assistance of the Nautical Almanac. When a telescope is mounted equatorially the position of a body in the sky is located by means of the sidereal time.

4. *Standard Time*—In everyday life we use still another kind of time. A moment's thought will show that in general two places will not have the same mean time; indeed, difference in longitude between two places is determined from their difference in time. But in travelling it is very inconvenient to have the time varying from station to station. For the purpose of facilitating transportation the system of *Standard Time* was introduced in 1883. Within a certain belt approximately 15° wide, all the clocks show the same time, and in passing from one belt to the next the hands of the clock are moved forward or backward one hour.

In Canada we have six standard time belts, as follows;—60th meridian or Atlantic Time, 4h. slower than Greenwich; 75th meridian or Eastern Time, 5h.; 90th meridian or Central Time, 6h.; 105th meridian or Mountain Time, 7h.; 120th meridian or Pacific Time, 8h.; and 135th meridian or Yukon Time, 9h. slower than Greenwich.

Notice also that in civil reckoning the day lasts from midnight to midnight, while in astronomical reckoning it begins at noon and lasts until the next noon.

1923, EPHEMERIS OF SUN AT GREENWICH MEAN NOON

Date	R.A.	Equation of Time	Declination	Date	R.A.	Equation of Time	Declination
	h m s	m s	° ′ ″		h m s	m s	° ′ ″
Jan. 1	18 43 48	+ 3 20.5	S 23 3 53	Apr. 1	0 39 29	+ 4 12.2	N 4 15 10
" 4	18 57 1	+ 4 44.5	22 47 58	" 4	0 50 25	+ 3 18.1	5 24 24
" 7	19 10 12	+ 6 5.0	22 27 58	" 7	1 1 22	+ 2 25.4	6 32 46
" 10	19 23 18	+ 7 21.4	22 3 58	" 10	1 12 21	+ 1 34.8	7 40 8
" 13	19 36 19	+ 8 33.0	21 36 6	" 13	1 23 22	+ 0 46.6	8 46 22
" 16	19 49 15	+ 9 39.2	21 4 27	" 16	1 34 27	+ 0 1.3	9 51 17
" 19	20 2 5	+10 39.2	20 29 12	" 19	1 45 34	− 0 40.8	10 54 44
" 22	20 14 48	+11 32.7	19 50 27	" 22	1 56 45	− 1 19.4	11 56 34
" 25	20 27 24	+12 19.1	19 8 24	" 25	2 8 0	− 1 54.3	12 56 37
" 28	20 39 53	+12 58.2	18 23 11	" 28	2 19 19	− 2 25.0	13 54 45
" 31	20 52 14	+13 29.9	17 34 59				
Feb. 3	21 4 28	+13 54.1	16 44 0	May 1	2 30 43	− 2 51.2	14 50 49
" 6	21 16 34	+14 11.1	15 50 22	" 4	2 42 11	− 3 12.7	15 44 41
" 9	21 28 34	+14 21.0	14 54 17	" 7	2 53 44	− 3 29.1	16 36 13
" 12	21 40 27	+14 23.9	13 55 56	" 10	3 5 23	− 3 40.2	17 25 16
" 15	21 52 12	+14 20.0	12 55 31	" 13	3 17 6	− 3 46.0	18 11 43
" 18	22 3 52	+14 9.6	11 53 13	" 16	3 28 56	− 3 46.6	18 55 25
" 21	22 15 24	+13 52.8	10 49 14	" 19	3 40 50	− 3 42.1	19 36 15
" 24	22 26 51	+13 30.0	9 43 45	" 22	3 52 49	− 3 32.7	20 14 4
" 27	22 38 12	+13 1.5	8 36 57	" 25	4 4 52	− 3 18.7	20 48 47
				" 28	4 17 0	− 3 0.4	21 20 16
				" 31	4 29 13	− 2 37.9	21 48 26
Mar. 2	22 49 29	+12 27.9	7 29 2	June 3	4 41 29	− 2 11.5	22 13 12
" 5	23 0 40	+11 49.8	6 20 8	" 6	4 53 48	− 1 41.6	22 34 28
" 8	23 11 48	+11 7.7	5 10 27	" 9	5 6 11	− 1 8.5	22 52 12
" 11	23 22 52	+10 22.3	4 0 8	" 12	5 18 36	− 0 32.9	23 6 19
" 14	23 33 53	+ 9 34.0	2 49 22	" 15	5 31 3	+ 0 4.5	23 16 47
" 17	23 44 52	+ 8 43.4	1 38 19	" 18	5 43 32	+ 0 43.1	23 23 33
" 20	23 55 50	+ 7 51.0	S 0 27 10	" 21	5 56 0	+ 1 22.2	23 26 36
" 23	0 6 45	+ 6 57.1	N 0 43 56	" 24	6 8 29	+ 2 1.0	23 25 56
" 26	0 17 40	+ 6 2.4	1 54 48	" 27	6 20 56	+ 2 39.0	23 21 34
" 29	0 28 35	+ 5 7.2	3 5 16	" 30	6 33 23	+ 3 15.6	23 13 29

1923, EPHEMERIS OF SUN AT GREENWICH MEAN NOON

Date	R.A.	Equation of Time	Declination	Date	R.A.	Equation of Time	Declination
	h m s	m s	° ′ ″		h m s	m s	° ′ ″
July 3	6 45 47	+3 50.3	N 23 1 45	Oct. 1	12 26 43	−10 3.6	S 2 53 17
" 6	6 58 9	+4 22.7	22 46 24	" 4	12 37 36	−11 0.6	4 3 5
" 9	7 10 28	+4 52.2	22 27 29	" 7	12 48 31	−11 54.5	5 12 28
" 12	7 22 44	+5 18.3	22 5 5	" 10	12 59 31	−12 44.7	6 21 17
" 15	7 34 56	+5 40.4	21 39 16	" 13	13 10 34	−13 30.8	7 29 20
" 18	7 47 3	+5 58.0	21 10 7	" 16	13 21 42	−14 12.5	8 36 27
" 21	7 59 6	+6 10.7	20 37 45	" 19	13 32 55	−14 49.2	9 42 27
" 24	8 11 3	+6 18.3	20 2 16	" 22	13 44 14	−15 20.6	10 47 11
" 27	8 22 55	+6 20.5	19 23 47	" 25	13 55 38	−15 46.1	11 50 28
" 30	8 34 41	+6 17.3	18 42 24	" 28	14 7 8	−16 5.1	12 52 7
				" 31	14 18 46	−16 17.4	13 51 58
Aug. 2	8 46 22	+6 8.8	18 13 16	Nov. 3	14 30 30	−16 22.4	14 49 51
" 5	8 57 58	+5 55.0	17 11 28	" 6	14 42 23	−16 20.0	15 45 35
" 8	9 9 29	+5 35.9	16 22 9	" 9	14 54 22	−16 10.0	16 38 57
" 11	9 20 54	+5 11.7	15 30 28	" 12	15 6 29	−15 52.5	17 29 48
" 14	9 32 14	+4 42.4	14 36 32	" 15	15 18 44	−15 27.5	18 17 55
" 17	9 43 30	+4 8.0	13 40 31	" 18	15 31 6	−14 55.1	19 3 9
" 20	9 54 40	+3 28.9	12 42 33	" 21	15 43 36	−14 15.3	19 45 17
" 23	10 5 46	+2 45.2	11 42 47	" 24	15 56 12	−13 28.2	20 24 12
" 26	10 16 48	+1 57.5	10 41 21	" 27	16 8 56	−12 34.2	20 59 43
" 29	10 27 46	+1 6.0	9 38 24	" 30	16 21 46	−11 33.4	21 31 42
Sept. 1	10 38 42	+0 11.5	8 34 3	Dec. 3	16 34 43	−10 26.4	22 0 0
" 4	10 49 34	−0 45.7	7 28 27	" 6	16 47 46	− 9 13.6	22 24 29
" 7	11 0 24	−1 45.1	6 21 46	" 9	17 0 53	− 7 55.8	22 45 4
" 10	11 11 13	−2 46.2	5 14 6	" 12	17 14 5	− 6 34.0	23 1 36
" 13	11 22 0	−3 48.6	4 53 9	" 15	17 27 19	− 5 8.9	23 14 3
" 16	11 32 46	−4 52.0	2 56 34	" 18	17 40 36	− 3 41.6	23 22 19
" 19	11 43 32	−5 55.8	1 46 58	" 21	17 53 55	− 2 12.7	23 26 22
" 22	11 54 18	−6 59.5	N 0 37 3	" 24	18 7 14	− 0 43.2	23 26 11
" 25	12 5 5	−8 2.4	S 0 33 4	" 27	18 20 33	+ 0 46.2	23 21 45
" 28	12 15 53	−9 4.0	1 43 14	" 30	18 33 51	+ 2 14.5	23 13 6

To obtain the Sidereal Time or R.A. of Mean Sun, subtract the Equation of Time from the Right Ascension.

In the Equation of Time the sign + means that the watch is faster than the sun, − that it is slower. To obtain Local Mean Time, in the former case add the Equation of Time to, and in the latter case subtract it from, apparent or sun-dial time.

OCCULTATIONS OF STARS BY THE MOON, 1923

Eastern Standard Time, the hours numbering from noon.

Date	Star	Mag.	Immersion	Emersion	Position Angle	
					Immer.	Emer.
1923			h m	h m	°	°
Jan. 27	θ^1Tauri	4.2	.....	2 47.4	...	243
Jan. 27	θ^2Tauri	3.6	.....	2 42.2	...	220
Jan. 27	αTauri	1.1	5 49.1	7 07.8	62	270
Feb. 6	κVirginis	4.3	12 29.6	13 30.1	123	280
Feb. 23	γTauri	3.9	8 34.4	9 04.6	152	197
Mar. 19	ξ^1Ceti	4.5	21 48.3	22 57.9	66	252
Apr. 19	θ^1Tauri	4.2	0 24.6	1 05.8	136	197
Apr. 19	αTauri	1.1	5 16.4	6 32.7	78	272
June 9	ξ^1Ceti	4.5	16 51.1	17 56.1	42	272
June 22	θVirginis	4.4	9 40.6	10 40.9	139	263
July 2	λAquarii	3.8	16 46.8	18 07.3	65	245
July 9	γTauri	3.9	15 25.0	16 26.0	79	250
July 9	θ^1Tauri	4.2	21 05.2	21 21.7	155	176
July 10	αTauri	1.1	1 30.0	2 33.1	68	285
July 18	βVirginis	3.8	1 49.6	3 03.9	110	300
July 30	ϕAquarii	4.4	11 11.9	12 10.9	31	287
Aug. 14	ηVirginis	4.0	20 50.6	21 33.8	148	250
Sept. 2	θ^1Tauri	4.2	12 17.5	12 57.7	27	306
Sept. 2	θ^2Tauri	3.6	12 09.4	13 07.6	53	278
Sept. 29	γTauri	3.9	16 42.8	17 56.3	111	228
Oct. 12	γLibrae	4.0	0 33.9	1 10.1	48	347
Oct. 20	ϕAquarii	4.4	9 02.1	10 17.6	40	268
Nov. 2	ALeonis	4.6	16 31.4	17 32.4	33	281
Nov. 20	ξ^1Ceti	4.5	14 09.4	14 33.4	3	323
Nov. 23	θ^1Tauri	4.2	8 01.9	9 00.2	115	212
Nov. 23	αTauri	1.1	12 52.7	14 15.7	97	242
Dec. 2	βVirginis	3.8	0 50.6	.....	133	...

TIMES OF SUNRISE AND SUNSET

In the tables on pages 10 to 21 are given the times of sunrise and sunset for places in latitudes 44°, 46°, 48°, 50° and 52°, which cover pretty well the populated parts of Canada. The times are given in Mean Solar Time, and in the table on page following this, are given corrections to change these times to the Standard or Railroad times of the cities and towns named, or for places near them.

How the Tables are Constructed

The time of sunrise and sunset at a given place, in mean solar time, varies from day to day, and depends principally upon the declination of the sun. Variations in the equation of time, the apparent diameter of the sun and atmospheric refraction at the points of sunrise and sunset also affect the final result. These quantities, as well as the solar declination, do not have precisely the same values on corresponding days from year to year, and so it is impossible to give in any general table the exact time of sunrise and sunset day by day.

With this explanation the following general table has been computed, giving the rising and setting of the upper limb of the sun, corrected for refraction, using the values of the solar declination and equation of time given in the Nautical Almanac for 1899; these are very close average values and may be accepted as approximately correct for years. It must also be remembered that these times are computed for the sea horizon, which is only approximately realised on land surfaces, and is generally widely departed from in hilly and mountainous localities. The greater or less elevation of the point of view above the ground must also be considered, to get exact results.

The Times for Any Station

In order to find the time of sunrise and sunset for any place on any day, first from the list below find the approximate latitude of the place and the correction, in minutes, which follows the name. Then find in the monthly table the time of sunrise and sunset for the proper latitude, on the desired day, and apply the correction.

44°		46°		48°		50°		52°	
	mins.		mins.		mins.		mins.		mins.
Barrie	+ 17	Charlotte-.		Port Arthur	+ 57	Brandon	+ 40	Calgary	+ 36
Brantford	+ 21	town	+ 13	Victoria	+ 13	Indian		Edmon-	
Chatham	+ 29	Fredericton	+ 26			Head	- 5	ton	+ 34
Goderich	+ 27	Montreal	- 6			Kamloops	+ 2	Prince	
Guelph	+ 21	Ottawa	+ 3			Kenora	+ 18	Albert	+ 4
Halifax	+ 14	Parry Sound	+ 20			Medicine		Saska-	
Hamilton	+ 20	Quebec	- 15			Hat	+ 22	toon	+ 6
Kingston	+ 6	Sherbrooke	- 12			Moosejaw	+ 2		
London	+ 25	St. John,				Moosomin	+ 40		
Orillia	+ 18	N.B.	+ 24			Nelson	- 11		
Owen Sound	+ 24	Sydney	+ 1			Portage La			
Peterboro	+ 13	Three Rivers	- 10			Prairie	+ 33		
Port Hope	+ 14					Regina	- 2		
Stratford	+ 24					Vancouver	+ 12		
Toronto	+ 18					Winnipeg	+ 28		
Windsor	+ 32								
Woodstock	+ 23								
Yarmouth	+ 24								

Example.—Find the time of sunrise at Owen Sound, also at Regina, on February 11.

In the above list Owen Sound is under "44°", and the correction is + 24 min. On page 11 the time of sunrise on February 11 for latitude 44° is 7.05; add 24 min. and we get 7.29 (Eastern Standard Time). Regina is under "50°", and the correction is - 2 min. From the table the time is 7.18, and subtracting 2 min. we get the time of sunrise 7.16 (Central Standard Time).

JANUARY

Day of Month	Latitude 44°		Latitude 46°		Latitude 48°		Latitude 50°		Latitude 52°	
	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	7 35	4 33	7 42	4 26	7 50	4 18	7 59	4 9	8 9	3 59
2	7 35	4 34	7 42	4 26	7 50	4 19	7 59	4 10	8 8	4 0
3	7 35	4 35	7 42	4 27	7 50	4 20	7 59	4 11	8 8	4 2
4	7 35	4 36	7 42	4 28	7 50	4 21	7 58	4 12	8 7	4 3
5	7 35	4 37	7 42	4 29	7 50	4 22	7 58	4 13	8 7	4 4
6	7 35	4 38	7 42	4 30	7 49	4 23	7 58	4 14	8 6	4 6
7	7 35	4 39	7 42	4 32	7 49	4 24	7 58	4 16	8 6	4 7
8	7 34	4 40	7 41	4 33	7 49	4 25	7 57	4 17	8 5	4 8
9	7 34	4 41	7 41	4 34	7 49	4 26	7 57	4 18	8 5	4 9
10	7 34	4 42	7 41	4 35	7 48	4 27	7 56	4 19	8 4	4 11
11	7 34	4 43	7 40	4 36	7 48	4 29	7 56	4 21	8 4	4 12
12	7 33	4 44	7 40	4 38	7 47	4 30	7 55	4 22	8 3	4 14
13	7 33	4 45	7 39	4 39	7 47	4 31	7 55	4 23	8 2	4 15
14	7 32	4 46	7 39	4 40	7 46	4 33	7 54	4 25	8 1	4 17
15	7 32	4 48	7 38	4 41	7 45	4 34	7 53	4 26	8 0	4 19
16	7 31	4 49	7 38	4 42	7 45	4 36	7 52	4 28	8 0	4 21
17	7 30	4 50	7 37	4 44	7 44	4 37	7 52	4 29	7 59	4 22
18	7 30	4 52	7 36	4 45	7 43	4 38	7 51	4 31	7 58	4 24
19	7 29	4 53	7 35	4 47	7 42	4 40	7 50	4 32	7 57	4 26
20	7 28	4 54	7 34	4 48	7 41	4 41	7 49	4 34	7 56	4 27
21	7 28	4 55	7 34	4 49	7 40	4 43	7 48	4 36	7 55	4 29
22	7 27	4 57	7 33	4 51	7 40	4 44	7 46	4 37	7 54	4 31
23	7 26	4 58	7 32	4 52	7 39	4 46	7 45	4 39	7 52	4 32
24	7 25	4 59	7 31	4 54	7 38	4 47	7 44	4 41	7 51	4 34
25	7 25	5 1	7 30	4 55	7 36	4 49	7 43	4 42	7 50	4 36
26	7 24	5 2	7 29	4 56	7 35	4 50	7 42	4 44	7 49	4 38
27	7 23	5 3	7 28	4 58	7 34	4 52	7 40	4 46	7 47	4 39
28	7 22	5 5	7 27	4 59	7 33	4 54	7 39	4 47	7 46	4 41
29	7 21	5 6	7 26	5 1	7 32	4 55	7 38	4 49	7 45	4 43
30	7 20	5 8	7 25	5 3	7 30	4 57	7 36	4 51	7 43	4 44
31	7 18	5 9	7 23	5 4	7 29	4 58	7 35	4 52	7 42	4 46

For an explanation of this table and its use at various places, see pages 8 and 9.

FEBRURAY

Day of Month	Latitude 44°		Latitude 46°		Latitude 48°		Latitude 50°		Latitude 52°	
	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	7 17	5 10	7 22	5 5	7 28	5 0	7 33	4 54	7 40	4 48
2	7 16	5 12	7 21	5 7	7 26	5 1	7 32	4 56	7 38	4 50
3	7 15	5 13	7 20	5 8	7 25	5 3	7 30	4 58	7 36	4 52
4	7 14	5 14	7 19	5 10	7 24	5 5	7 29	4 59	7 34	4 54
5	7 13	5 15	7 18	5 11	7 22	5 6	7 27	5 1	7 33	4 56
6	7 12	5 17	7 17	5 12	7 21	5 8	7 26	5 3	7 31	4 57
7	7 10	5 18	7 15	5 14	7 19	5 9	7 24	5 5	7 29	4 59
8	7 9	5 20	7 13	5 15	7 18	5 11	7 23	5 6	7 27	5 1
9	7 8	5 21	7 12	5 17	7 16	5 13	7 21	5 8	7 25	5 3
10	7 6	5 23	7 11	5 18	7 15	5 14	7 19	5 10	7 23	5 5
11	7 5	5 24	7 10	5 19	7 13	5 16	7 18	5 11	7 21	5 7
12	7 3	5 25	7 8	5 21	7 12	5 17	7 16	5 13	7 19	5 9
13	7 2	5 27	7 6	5 23	7 10	5 19	7 14	5 15	7 18	5 10
14	7 1	5 28	7 4	5 24	7 8	5 21	7 12	5 17	7 16	5 12
15	6 59	5 29	7 3	5 26	7 6	5 22	7 10	5 18	7 14	5 14
16	6 58	5 31	7 1	5 27	7 5	5 24	7 9	5 20	7 12	5 16
17	6 56	5 32	7 0	5 29	7 3	5 26	7 7	5 22	7 10	5 18
18	6 55	5 34	6 58	5 30	7 1	5 27	7 5	5 23	7 9	5 19
19	6 53	5 35	6 56	5 32	6 59	5 29	7 3	5 25	7 7	5 21
20	6 52	5 36	6 54	5 33	6 58	5 30	7 1	5 27	7 5	5 23
21	6 50	5 38	6 53	5 35	6 56	5 32	6 59	5 29	7 3	5 25
22	6 48	5 39	6 51	5 36	6 54	5 33	6 57	5 30	7 0	5 27
23	6 47	5 40	6 49	5 38	6 52	5 35	6 55	5 32	6 58	5 29
24	6 45	5 42	6 47	5 39	6 50	5 36	6 53	5 34	6 56	5 31
25	6 44	5 43	6 46	5 41	6 49	5 38	6 51	5 35	6 54	5 33
26	6 42	5 44	6 44	5 42	6 47	5 39	6 49	5 37	6 51	5 34
27	6 40	5 45	6 42	5 43	6 45	5 41	6 48	5 38	6 49	5 36
28	6 38	5 47	6 41	5 45	6 43	5 42	6 45	5 40	6 47	5 38

For an explanation of this table and its use at various places, see pages 8 and 9.

MARCH

Day of Month	Latitude 44°		Latitude 46°		Latitude 48°		Latitude 50°		Latitude 52°	
	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
1	6 37	5 48	6 39	5 46	6 41	5 44	6 43	5 42	6 43	5 41
2	6 35	5 49	6 37	5 47	6 39	5 45	6 41	5 44	6 42	5 42
3	6 34	5 50	6 35	5 49	6 37	5 47	6 39	5 45	6 40	5 44
4	6 32	5 52	6 33	5 50	6 35	5 48	6 37	5 47	6 38	5 45
5	6 30	5 53	6 31	5 52	6 33	5 50	6 35	5 48	6 36	5 47
6	6 28	5 55	6 30	5 53	6 31	5 51	6 33	5 50	6 34	5 49
7	6 26	5 56	6 28	5 54	6 29	5 53	6 31	5 52	6 32	5 51
8	6 25	5 57	6 26	5 56	6 27	5 54	6 28	5 53	6 29	5 52
9	6 23	5 58	6 24	5 57	6 25	5 56	6 26	5 55	6 27	5 54
10	6 21	6 0	6 22	5 59	6 23	5 57	6 24	5 56	6 25	5 56
11	6 19	6 1	6 20	6 0	6 21	5 59	6 22	5 58	6 23	5 57
12	6 18	6 2	6 18	6 1	6 19	6 0	6 20	6 0	6 21	5 59
13	6 16	6 4	6 16	6 3	6 17	6 2	6 18	6 2	6 19	6 1
14	6 14	6 5	6 15	6 4	6 15	6 3	6 15	6 3	6 16	6 3
15	6 12	6 6	6 13	6 5	6 13	6 5	6 13	6 5	6 14	6 4
16	6 10	6 7	6 11	6 7	6 11	6 6	6 11	6 6	6 11	6 6
17	6 8	6 8	6 9	6 8	6 9	6 8	6 9	6 8	6 9	6 8
18	6 7	6 10	6 7	6 9	6 7	6 9	6 7	6 9	6 7	6 10
19	6 5	6 11	6 5	6 11	6 5	6 11	6 5	6 11	6 4	6 12
20	6 3	6 12	6 3	6 12	6 3	6 12	6 3	6 13	6 2	6 13
21	6 1	6 13	6 1	6 14	6 1	6 14	6 0	6 14	5 59	6 15
22	5 59	6 14	5 59	6 15	5 59	6 15	5 58	6 16	5 57	6 17
23	5 58	6 16	5 57	6 16	5 56	6 17	5 56	6 17	5 55	6 19
24	5 56	6 17	5 55	6 17	5 54	6 18	5 54	6 19	5 52	6 20
25	5 54	6 18	5 53	6 19	5 52	6 20	5 52	6 20	5 50	6 22
26	5 52	6 19	5 51	6 20	5 50	6 21	5 50	6 22	5 48	6 24
27	5 50	6 21	5 49	6 22	5 48	6 23	5 47	6 24	5 46	6 26
28	5 48	6 22	5 47	6 23	5 46	6 24	5 45	6 25	5 43	6 27
29	5 47	6 23	5 46	6 24	5 44	6 26	5 43	6 27	5 41	6 29
30	5 45	6 24	5 44	6 25	5 42	6 27	5 41	6 28	5 39	6 31
31	5 43	6 25	5 42	6 27	5 40	6 28	5 38	6 30	5 36	6 32

For an explanation of this table and its use at various places, see pages 8 and 9.

APRIL

Day of Month	Latitude 44°		Latitude 46°		Latitude 48°		Latitude 50°		Latitude 52°	
	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	5 41	6 27	5 40	6 28	5 38	6 30	5 36	6 31	5 34	6 34
2	5 39	6 28	5 38	6 30	5 36	6 31	5 34	6 33	5 32	6 36
3	5 38	6 29	5 36	6 31	5 34	6 33	5 32	6 35	5 30	6 37
4	5 36	6 30	5 34	6 32	5 32	6 34	5 30	6 36	5 27	6 39
5	5 34	6 32	5 32	6 33	5 30	6 36	5 28	6 38	5 25	6 41
6	5 32	6 33	5 30	6 34	5 28	6 37	5 26	6 39	5 23	6 43
7	5 30	6 34	5 28	6 36	5 26	6 38	5 24	6 41	5 21	6 44
8	5 29	6 35	5 26	6 37	5 24	6 40	5 21	6 42	5 19	6 46
9	5 27	6 36	5 24	6 39	5 22	6 41	5 19	6 44	5 16	6 48
10	5 25	6 37	5 23	6 40	5 20	6 43	5 17	6 46	5 14	6 49
11	5 24	6 38	5 21	6 41	5 18	6 44	5 15	6 47	5 11	6 51
12	5 22	6 40	5 19	6 43	5 16	6 45	5 13	6 49	5 9	6 53
13	5 20	6 41	5 17	6 44	5 14	6 47	5 11	6 50	5 7	6 54
14	5 18	6 42	5 15	6 45	5 12	6 48	5 9	6 52	5 5	6 56
15	5 17	6 43	5 14	6 46	5 10	6 50	5 7	6 53	5 3	6 58
16	5 15	6 45	5 12	6 48	5 8	6 51	5 5	6 55	5 1	7 0
17	5 13	6 46	5 10	6 49	5 6	6 53	5 2	6 56	4 58	7 1
18	5 11	6 47	5 8	6 50	5 5	6 54	5 1	6 58	4 56	7 3
19	5 10	6 48	5 6	6 52	5 3	6 55	4 59	6 59	4 54	7 5
20	5 8	6 49	5 5	6 53	5 1	6 57	4 57	7 1	4 52	7 6
21	5 7	6 50	5 3	6 54	4 59	6 58	4 55	7 2	4 50	7 8
22	5 5	6 52	5 1	6 56	4 57	7 0	4 53	7 4	4 48	7 10
23	5 3	6 53	4 59	6 57	4 55	7 1	4 50	7 6	4 46	7 11
24	5 2	6 54	4 58	6 58	4 54	7 3	4 49	7 7	4 44	7 13
25	5 0	6 56	4 56	7 0	4 52	7 4	4 47	7 9	4 42	7 14
26	4 59	6 57	4 54	7 1	4 50	7 5	4 45	7 10	4 40	7 16
27	4 57	6 58	4 53	7 2	4 48	7 7	4 43	7 12	4 38	7 18
28	4 56	6 59	4 51	7 3	4 47	7 8	4 41	7 13	4 36	7 19
29	4 54	7 0	4 50	7 5	4 45	7 10	4 39	7 15	4 34	7 21
30	4 53	7 1	4 48	7 6	4 43	7 12	4 38	7 16	4 32	7 22

For an explanation of this table and its use at various places, see pages 8 and 9.

MAY

Day of Month	Latitude 44°		Latitude 46°		Latitude 48°		Latitude 50°		Latitude 52°	
	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	4 51	7 3	4 47	7 7	4 42	7 12	4 36	7 18	4 30	7 24
2	4 50	7 4	4 45	7 9	4 40	7 14	4 34	7 20	4 28	7 26
3	4 48	7 5	4 43	7 10	4 38	7 15	4 32	7 21	4 26	7 27
4	4 47	7 6	4 42	7 11	4 37	7 17	4 31	7 23	4 24	7 29
5	4 46	7 8	4 41	7 13	4 35	7 18	4 29	7 24	4 22	7 31
6	4 44	7 9	4 39	7 14	4 34	7 19	4 27	7 26	4 21	7 33
7	4 43	7 10	4 38	7 15	4 32	7 21	4 26	7 27	4 19	7 34
8	4 42	7 11	4 36	7 16	4 31	7 22	4 24	7 29	4 17	7 36
9	4 40	7 12	4 35	7 17	4 29	7 23	4 22	7 30	4 15	7 38
10	4 39	7 13	4 34	7 19	4 28	7 25	4 21	7 32	4 13	7 39
11	4 38	7 14	4 32	7 20	4 26	7 26	4 20	7 33	4 11	7 41
12	4 37	7 16	4 31	7 21	4 25	7 28	4 18	7 34	4 10	7 42
13	4 36	7 17	4 30	7 23	4 24	7 29	4 16	7 36	4 8	7 44
14	4 35	7 18	4 49	7 24	4 22	7 30	4 15	7 37	4 7	7 45
15	4 34	7 19	4 28	7 25	4 21	7 31	4 14	7 39	4 5	7 47
16	4 32	7 20	4 26	7 26	4 20	7 33	4 12	7 40	4 4	7 48
17	4 31	7 21	4 25	7 27	4 18	7 34	4 11	7 42	4 3	7 50
18	4 30	7 22	4 24	7 28	4 17	7 35	4 10	7 43	4 1	7 51
19	4 30	7 23	4 23	7 30	4 16	7 36	4 8	7 44	4 0	7 52
20	4 29	7 24	4 22	7 31	4 15	7 38	4 7	7 46	3 58	7 54
21	4 28	7 25	4 21	7 32	4 14	7 39	4 6	7 47	3 57	7 55
22	4 27	7 26	4 20	7 33	4 13	7 40	4 5	7 48	3 56	7 56
23	4 26	7 27	4 19	7 34	4 12	7 41	4 4	7 49	3 55	7 58
24	4 25	7 28	4 18	7 35	4 11	7 43	4 3	7 51	3 53	7 59
25	4 24	7 29	4 17	7 36	4 10	7 44	4 2	7 52	3 52	8 1
26	4 24	7 30	4 16	7 37	4 9	7 45	4 0	7 53	3 51	8 2
27	4 23	7 31	4 16	7 38	4 8	7 46	3 59	7 54	3 50	8 3
28	4 22	7 32	4 15	7 39	4 7	7 47	3 58	7 56	3 49	8 5
29	4 22	7 33	4 14	7 40	4 6	7 48	3 58	7 57	3 47	8 6
30	4 21	7 34	4 14	7 41	4 5	7 49	3 57	7 58	3 46	8 8
31	4 21	7 34	4 13	7 42	4 5	7 50	3 56	7 59	3 45	8 9

For an explanation of this table and its use at various places, see pages 8 and 9.

JUNE

Day of Month	Latitude 44°		Latitude 46°		Latitude 48°		Latitude 50°		Latitude 52°	
	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	4 20	7 35	4 12	7 43	4 4	7 51	3 56	8 0	3 45	8 10
2	4 19	7 36	4 12	7 44	4 4	7 52	3 55	8 1	3 44	8 11
3	4 19	7 37	4 11	7 44	4 3	7 52	3 54	8 2	3 44	8 11
4	4 18	7 38	4 11	7 45	4 3	7 53	3 54	8 3	3 43	8 12
5	4 18	7 39	4 10	7 46	4 2	7 54	3 53	8 4	3 43	8 13
6	4 17	7 39	4 10	7 47	4 2	7 55	3 52	8 4	3 43	8 14
7	4 17	7 40	4 10	7 48	4 1	7 56	3 52	8 5	3 42	8 15
8	4 17	7 41	4 9	7 48	4 1	7 57	3 52	8 6	3 42	8 15
9	4 17	7 41	4 9	7 49	4 1	7 57	3 51	8 7	3 41	8 16
10	4 16	7 42	4 9	7 49	4 0	7 58	3 51	8 8	3 41	8 17
11	4 16	7 42	4 9	7 50	4 0	7 59	3 50	8 8	3 41	8 18
12	4 16	7 43	4 9	7 51	4 0	7 59	3 50	8 9	3 41	8 18
13	4 16	7 43	4 8	7 51	4 0	8 0	3 50	8 10	3 40	8 19
14	4 16	7 44	4 8	7 52	4 0	8 0	3 50	8 10	3 40	8 19
15	4 16	7 44	4 8	7 52	4 0	8 1	3 50	8 11	3 40	8 20
16	4 16	7 45	4 8	7 53	4 0	8 1	3 50	8 11	3 40	8 21
17	4 17	7 45	4 8	7 53	4 0	8 2	3 50	8 12	3 40	8 21
18	4 17	7 45	4 8	7 54	4 0	8 2	3 50	8 12	3 39	8 22
19	4 17	7 46	4 8	7 54	4 0	8 2	3 50	8 12	3 39	8 23
20	4 17	7 46	4 8	7 54	4 0	8 3	3 50	8 13	3 39	8 23
21	4 17	7 46	4 8	7 54	4 0	8 3	3 50	8 13	3 39	8 23
22	4 18	7 46	4 9	7 55	4 0	8 3	3 50	8 13	3 39	8 23
23	4 18	7 46	4 9	7 55	4 1	8 3	3 51	8 13	3 40	8 23
24	4 18	7 47	4 10	7 55	4 1	8 3	3 51	8 13	3 40	8 23
25	4 18	7 47	4 10	7 55	4 1	8 3	3 51	8 13	3 40	8 23
26	4 19	7 47	4 10	7 55	4 2	8 3	3 52	8 13	3 41	8 23
27	4 19	7 47	4 11	7 55	4 2	8 3	3 52	8 13	3 41	8 23
28	4 19	7 47	4 11	7 55	4 3	8 3	3 53	8 13	3 42	8 23
29	4 20	7 47	4 12	7 55	4 3	8 3	3 53	8 13	3 42	8 23
30	4 20	7 47	4 12	7 54	4 4	8 3	3 54	8 13	3 43	8 23

For an explanation of this table and its use at various places, see pages 8 and 9.

JULY

Day of Month	Latitude 44°		Latitude 46°		Latitude 48°		Latitude 50°		Latitude 52°	
	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	4 21	7 47	4 13	7 54	4 4	8 3	3 55	8 12	3 44	8 23
2	4 21	7 46	4 14	7 54	4 5	8 2	3 56	8 12	3 45	8 22
3	4 22	7 46	4 14	7 54	4 6	8 2	3 56	8 12	3 46	8 22
4	4 22	7 46	4 15	7 54	4 6	8 2	3 57	8 11	3 47	8 21
5	4 23	7 46	4 15	7 53	4 7	8 2	3 58	8 11	3 48	8 21
6	4 24	7 45	4 16	7 53	4 8	8 1	3 59	8 10	3 48	8 20
7	4 24	7 45	4 17	7 53	4 9	8 1	4 0	8 10	3 49	8 20
8	4 25	7 45	4 18	7 52	4 10	8 0	4 0	8 9	3 50	8 19
9	4 26	7 44	4 18	7 52	4 10	8 0	4 1	8 9	3 51	8 19
10	4 27	7 43	4 19	7 51	4 11	7 59	4 2	8 8	3 52	8 18
11	4 28	7 43	4 20	7 50	4 12	7 59	4 3	8 7	3 53	8 17
12	4 29	7 42	4 21	7 50	4 13	7 58	4 4	8 7	3 54	8 16
13	4 29	7 42	4 22	7 49	4 14	7 57	4 5	8 6	3 56	8 15
14	4 30	7 41	4 23	7 48	4 15	7 56	4 6	8 5	3 57	8 14
15	4 31	7 40	4 24	7 48	4 16	7 56	4 7	8 4	3 58	8 13
16	4 32	7 40	4 25	7 47	4 17	7 55	4 8	8 3	3 59	8 12
17	4 33	7 39	4 26	7 46	4 18	7 54	4 10	8 2	4 0	8 11
18	4 34	7 38	4 27	7 45	4 19	7 53	4 11	8 1	4 2	8 10
19	4 34	7 38	4 28	7 44	4 20	7 52	4 12	8 0	4 3	8 9
20	4 36	7 37	4 29	7 43	4 21	7 51	4 13	7 59	4 4	8 8
21	4 37	7 36	4 30	7 42	4 23	7 50	4 15	7 58	4 5	8 7
22	4 38	7 35	4 31	7 41	4 24	7 49	4 16	7 57	4 7	8 5
23	4 39	7 34	4 32	7 40	4 25	7 48	4 17	7 56	4 8	8 4
24	4 40	7 33	4 33	7 39	4 26	7 47	4 18	7 54	4 10	8 2
25	4 40	7 32	4 34	7 38	4 27	7 46	4 20	7 53	4 11	8 1
26	4 41	7 31	4 35	7 37	4 28	7 44	4 21	7 52	4 12	8 0
27	4 42	7 30	4 36	7 36	4 30	7 43	4 22	7 50	4 14	7 58
28	4 44	7 29	4 38	7 35	4 31	7 42	4 24	7 49	4 15	7 57
29	4 45	7 28	4 39	7 34	4 32	7 40	4 25	7 47	4 17	7 55
30	4 46	7 27	4 40	7 33	4 33	7 39	4 26	7 46	4 18	7 54
31	4 47	7 26	4 41	7 32	4 35	7 38	4 28	7 44	4 20	7 52

For an explanation of this table and its use at various places, see pages 8 and 9.

AUGUST

Day of Month	Latitude 44°		Latitude 46°		Latitude 48°		Latitude 50°		Latitude 52°	
	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
1	4 48	7 24	4 42	7 30	4 36	7 36	4 29	7 43	4 21	7 50
2	4 49	7 23	4 44	7 29	4 37	7 35	4 31	7 41	4 23	7 49
3	4 50	7 22	4 45	7 27	4 39	7 33	4 32	7 40	4 24	7 47
4	4 51	7 21	4 46	7 26	4 40	7 32	4 33	7 38	4 26	7 45
5	4 52	7 19	4 47	7 24	4 41	7 30	4 35	7 37	4 28	7 43
6	4 53	7 18	4 48	7 23	4 43	7 29	4 36	7 35	4 29	7 41
7	4 54	7 17	4 49	7 22	4 44	7 27	4 38	7 33	4 31	7 40
8	4 56	7 15	4 51	7 20	4 45	7 26	4 39	7 32	4 32	7 38
9	4 57	7 14	4 52	7 19	4 46	7 24	4 40	7 30	4 34	7 36
10	4 58	7 12	4 53	7 17	4 48	7 22	4 42	7 28	4 36	7 34
11	4 59	7 11	4 54	7 16	4 49	7 21	4 44	7 26	4 37	7 32
12	5 0	7 9	4 56	7 14	4 51	7 19	4 45	7 25	4 39	7 30
13	5 2	7 8	4 57	7 12	4 52	7 17	4 47	7 23	4 40	7 28
14	5 3	7 6	4 58	7 11	4 53	7 16	4 48	7 21	4 42	7 26
15	5 4	7 5	4 59	7 9	4 55	7 14	4 50	7 19	4 44	7 24
16	5 5	7 3	5 1	7 8	4 56	7 12	4 51	7 17	4 45	7 22
17	5 6	7 2	5 2	7 6	4 57	7 10	4 53	7 15	4 47	7 20
18	5 7	7 0	5 3	7 4	4 59	7 9	4 54	7 13	4 48	7 18
19	5 8	6 59	5 4	7 3	5 0	7 7	4 55	7 12	4 50	7 16
20	5 10	6 57	5 6	7 1	5 2	7 5	4 57	7 9	4 52	7 14
21	5 11	6 55	5 7	6 59	5 3	7 3	4 59	7 7	4 53	7 12
22	5 12	6 54	5 8	6 57	5 4	7 1	5 0	7 5	4 55	7 10
23	5 13	6 52	5 9	6 56	5 6	6 59	5 2	7 3	4 56	7 8
24	5 14	6 50	5 11	6 54	5 7	6 57	5 3	7 1	4 58	7 6
25	5 15	6 49	5 12	6 52	5 8	6 56	5 4	7 0	5 0	7 4
26	5 16	6 47	5 13	6 50	5 10	6 54	5 6	6 57	5 1	7 2
27	5 18	6 45	5 14	6 48	5 11	6 52	5 8	6 55	5 3	7 0
28	5 19	6 44	5 16	6 46	5 12	6 50	5 9	6 53	5 4	6 58
29	5 20	6 42	5 17	6 45	5 14	6 48	5 10	6 51	5 6	6 56
30	5 21	6 40	5 18	6 43	5 15	6 46	5 12	6 49	5 8	6 54
31	5 22	6 38	5 19	6 41	5 17	6 44	5 14	6 47	5 10	6 51

For an explanation of this table and its use at various places, see pages 8 and 9.

SEPTEMBER

Day of Month	Latitude 44°		Latitude 46°		Latitude 48°		Latitude 50°		Latitude 52°	
	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	5 23	6 36	5 20	6 39	5 18	6 42	5 15	6 45	5 11	6 49
2	5 24	6 35	5 22	6 37	5 19	6 40	5 16	6 43	5 13	6 46
3	5 25	6 33	5 23	6 35	5 21	6 38	5 18	6 40	5 15	6 44
4	5 27	6 31	5 24	6 33	5 22	6 36	5 20	6 38	5 17	6 42
5	5 28	6 29	5 26	6 31	5 23	6 34	5 21	6 36	5 19	6 39
6	5 29	6 28	5 27	6 29	5 25	6 32	5 23	6 34	5 20	6 37
7	5 30	6 26	5 28	6 27	5 26	6 30	5 24	6 32	5 22	6 34
8	5 31	6 24	5 30	6 26	5 27	6 28	5 25	6 30	5 24	6 32
9	5 32	6 22	5 31	6 24	5 29	6 26	5 27	6 28	5 26	6 30
10	5 33	6 20	5 32	6 22	5 30	6 24	5 28	6 25	5 27	6 27
11	5 34	6 19	5 33	6 20	5 31	6 22	5 30	6 23	5 29	6 25
12	5 36	6 17	5 34	6 18	5 33	6 20	5 31	6 21	5 30	6 23
13	5 37	6 15	5 36	6 16	5 34	6 17	5 33	6 19	5 32	6 21
14	5 38	6 13	5 37	6 14	5 36	6 15	5 34	6 17	5 33	6 18
15	5 39	6 11	5 38	6 12	5 37	6 13	5 36	6 14	5 35	6 16
16	5 40	6 9	5 39	6 10	5 38	6 11	5 38	6 12	5 36	6 14
17	5 41	6 8	5 41	6 8	5 40	6 9	5 39	6 10	5 38	6 11
18	5 42	6 6	5 42	6 6	5 41	6 7	5 41	6 8	5 39	6 9
19	5 44	6 4	5 44	6 4	5 42	6 5	5 42	6 5	5 41	6 7
20	5 45	6 2	5 45	6 2	5 44	6 3	5 43	6 3	5 42	6 4
21	5 46	6 0	5 46	6 0	5 45	6 1	5 45	6 1	5 44	6 2
22	5 47	5 58	5 47	5 58	5 47	5 59	5 46	5 59	5 46	6 0
23	5 48	5 56	5 48	5 56	5 48	5 56	5 48	5 56	5 48	5 58
24	5 49	5 55	5 50	5 54	5 50	5 54	5 50	5 54	5 49	5 55
25	5 50	5 53	5 51	5 52	5 51	5 52	5 51	5 52	5 51	5 53
26	5 52	5 51	5 52	5 50	5 52	5 50	5 52	5 50	5 53	5 51
27	5 53	5 49	5 54	5 48	5 54	5 48	5 54	5 48	5 54	5 48
28	5 54	5 47	5 55	5 46	5 55	5 46	5 55	5 46	5 56	5 46
29	5 55	5 45	5 56	5 44	5 57	5 44	5 57	5 44	5 58	5 44
30	5 56	5 43	5 57	5 43	5 58	5 42	5 58	5 41	5 59	5 41

For an explanation of this table and its use at various places, see pages 8 and 9.

OCTOBER

Day of Month	Latitude 44°		Latitude 46°		Latitude 48°		Latitude 50°		Latitude 52°	
	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
1	5 58	5 41	5 58	5 41	5 59	5 40	6 0	5 39	6 1	5 39
2	5 59	5 40	6 0	5 39	6 1	5 38	6 2	5 37	6 3	5 37
3	6 0	5 38	6 1	5 37	6 2	5 36	6 3	5 35	6 5	5 35
4	6 1	5 36	6 2	5 35	6 4	5 34	6 5	5 33	6 6	5 32
5	6 2	5 34	6 4	5 33	6 5	5 32	6 6	5 31	6 8	5 30
6	6 4	5 32	6 5	5 31	6 7	5 30	6 8	5 28	6 10	5 28
7	6 5	5 31	6 6	5 30	6 8	5 28	6 10	5 26	6 11	5 25
8	6 6	5 29	6 8	5 28	6 9	5 26	6 11	5 24	6 13	5 23
9	6 8	5 27	6 9	5 26	6 11	5 24	6 12	5 22	6 15	5 21
10	6 9	5 25	6 10	5 24	6 12	5 22	6 14	5 20	6 16	5 19
11	6 10	5 24	6 12	5 22	6 14	5 20	6 16	5 18	6 18	5 17
12	6 11	5 22	6 13	5 20	6 15	5 18	6 17	5 16	6 19	5 15
13	6 12	5 20	6 14	5 18	6 17	5 16	6 19	5 14	6 21	5 13
14	6 13	5 19	6 16	5 16	6 18	5 14	6 21	5 12	6 23	5 10
15	6 15	5 17	6 17	5 14	6 20	5 12	6 22	5 10	6 24	5 8
16	6 16	5 15	6 18	5 13	6 21	5 10	6 24	5 7	6 26	5 6
17	6 17	5 13	6 20	5 11	6 22	5 8	6 26	5 5	6 27	5 4
18	6 19	5 12	6 21	5 9	6 24	5 6	6 27	5 3	6 29	5 1
19	6 20	5 10	6 22	5 8	6 25	5 5	6 28	5 2	6 31	4 59
20	6 21	5 9	6 24	5 6	6 27	5 3	6 30	5 0	6 33	4 57
21	6 22	5 7	6 25	5 4	6 28	5 1	6 32	4 57	6 35	4 55
22	6 24	5 6	6 27	5 2	6 30	4 59	6 34	4 56	6 37	4 53
23	6 25	5 4	6 28	5 1	6 31	4 58	6 35	4 54	6 39	4 51
24	6 26	5 2	6 30	4 59	6 33	4 56	6 37	4 52	6 40	4 48
25	6 28	5 1	6 31	4 57	6 34	4 54	6 38	4 50	6 42	4 46
26	6 29	4 59	6 32	4 56	6 36	4 52	6 40	4 48	6 44	4 44
27	6 30	4 57	6 34	4 54	6 38	4 50	6 42	4 46	6 46	4 42
28	6 32	4 56	6 35	4 52	6 39	4 48	6 43	4 44	6 48	4 40
29	6 33	4 55	6 37	4 51	6 41	4 47	6 45	4 42	6 50	4 38
30	6 34	4 54	6 38	4 49	6 42	4 45	6 47	4 41	6 52	4 36
31	6 35	4 52	6 40	4 48	6 44	4 44	6 48	4 39	6 53	4 35

For an explanation of this table and its use at various places, see pages 8 and 9.

NOVEMBER

Day of Month	Latitude 44°		Latitude 46°		Latitude 48°		Latitude 50°		Latitude 52°	
	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	6 37	4 51	6 41	4 46	6 45	4 42	6 50	4 37	6 55	4 33
2	6 38	4 49	6 42	4 45	6 47	4 41	6 52	4 36	6 57	4 31
3	6 40	4 48	6 44	4 44	6 48	4 39	6 53	4 34	6 59	4 29
4	6 41	4 47	6 45	4 42	6 50	4 38	6 55	4 32	7 1	4 27
5	6 42	4 45	6 47	4 41	6 51	4 36	6 57	4 31	7 2	4 26
6	6 43	4 44	6 48	4 39	6 53	4 35	6 58	4 29	7 4	4 24
7	6 44	4 43	6 49	4 38	6 54	4 33	7 0	4 28	7 6	4 22
8	6 46	4 42	6 51	4 37	6 56	4 32	7 2	4 26	7 8	4 21
9	6 47	4 41	6 52	4 36	6 58	4 30	7 3	4 25	7 9	4 19
10	6 49	4 40	6 54	4 35	6 59	4 29	7 5	4 23	7 11	4 18
11	6 50	4 38	6 55	4 33	7 1	4 28	7 7	4 22	7 13	4 16
12	6 51	4 37	6 56	4 32	7 2	4 26	7 8	4 20	7 15	4 15
13	6 53	4 36	6 58	4 31	7 4	4 25	7 10	4 19	7 16	4 13
14	6 54	4 35	6 59	4 30	7 5	4 24	7 11	4 18	7 18	4 12
15	6 55	4 34	7 1	4 29	7 7	4 23	7 13	4 16	7 20	4 10
16	6 57	4 33	7 2	4 28	7 8	4 21	7 15	4 15	7 21	4 9
17	6 58	4 32	7 4	4 27	7 10	4 20	7 16	4 14	7 23	4 7
18	6 59	4 32	7 5	4 26	7 12	4 19	7 18	4 13	7 25	4 6
19	7 0	4 31	7 6	4 25	7 13	4 18	7 20	4 11	7 26	4 5
20	7 2	4 30	7 8	4 24	7 14	4 17	7 21	4 10	7 28	4 4
21	7 3	4 29	7 9	4 23	7 15	4 17	7 23	4 9	7 30	4 3
22	7 4	4 28	7 10	4 22	7 17	4 16	7 24	4 8	7 32	4 2
23	7 6	4 28	7 12	4 22	7 19	4 15	7 26	4 7	7 33	4 0
24	7 7	4 27	7 13	4 21	7 20	4 14	7 28	4 6	7 35	3 59
25	7 8	4 26	7 14	4 20	7 21	4 13	7 29	4 5	7 37	3 58
26	7 9	4 26	7 16	4 19	7 23	4 12	7 31	4 4	7 38	3 57
27	7 10	4 25	7 17	4 19	7 24	4 12	7 32	4 4	7 40	3 56
28	7 12	4 25	7 18	4 18	7 25	4 11	7 33	4 3	7 41	3 55
29	7 13	4 24	7 19	4 18	7 27	4 10	7 35	4 2	7 43	3 55
30	7 14	4 24	7 21	4 17	7 28	4 10	7 36	4 2	7 44	3 54

For an explanation of this table and its use at various places, see pages 8 and 9.

DECEMBER

Day of Month	Latitude 44°		Latitude 46°		Latitude 48°		Latitude 50°		Latitude 52°	
	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
1	7 15	4 23	7 22	4 16	7 29	4 9	7 37	4 1	7 46	3 54
2	7 16	4 23	7 23	4 16	7 31	4 9	7 39	4 1	7 47	3 53
3	7 17	4 23	7 24	4 16	7 32	4 8	7 40	4 0	7 48	3 52
4	7 18	4 23	7 25	4 16	7 33	4 8	7 41	4 0	7 50	3 52
5	7 19	4 22	7 26	4 15	7 34	4 8	7 42	3 59	7 51	3 51
6	7 20	4 22	7 27	4 15	7 35	4 8	7 43	3 59	7 53	3 51
7	7 21	4 22	7 29	4 15	7 36	4 7	7 45	3 59	7 54	3 50
8	7 22	4 22	7 30	4 15	7 37	4 7	7 46	3 59	7 55	3 50
9	7 23	4 22	7 30	4 15	7 37	4 7	7 47	3 58	7 56	3 50
10	7 24	4 22	7 31	4 15	7 38	4 7	7 48	3 58	7 57	3 50
11	7 25	4 22	7 32	4 15	7 40	4 7	7 49	3 58	7 58	3 50
12	7 26	4 22	7 33	4 15	7 41	4 7	7 50	3 58	7 59	3 50
13	7 26	4 22	7 34	4 15	7 42	4 7	7 51	3 58	7 59	3 49
14	7 27	4 22	7 35	4 15	7 43	4 7	7 52	3 58	8 0	3 49
15	7 28	4 23	7 36	4 15	7 44	4 7	7 53	3 58	8 1	3 49
16	7 29	4 23	7 36	4 15	7 44	4 7	7 53	3 58	8 2	3 49
17	7 30	4 23	7 37	4 16	7 45	4 8	7 54	3 59	8 3	3 49
18	7 30	4 24	7 38	4 16	7 46	4 8	7 55	3 59	8 4	3 50
19	7 31	4 24	7 38	4 16	7 46	4 8	7 55	3 59	8 4	3 50
20	7 31	4 24	7 39	4 17	7 47	4 9	7 56	4 0	8 5	3 51
21	7 32	4 25	7 39	4 17	7 47	4 9	7 56	4 0	8 5	3 51
22	7 32	4 25	7 40	4 18	7 48	4 10	7 57	4 1	8 6	3 52
23	7 33	4 26	7 40	4 18	7 48	4 10	7 57	4 1	8 6	3 52
24	7 33	4 27	7 41	4 19	7 49	4 11	7 58	4 2	8 7	3 53
25	7 34	4 27	7 41	4 20	7 49	4 12	7 58	4 3	8 7	3 53
26	7 34	4 28	7 42	4 20	7 50	4 12	7 58	4 3	8 8	3 54
27	7 34	4 28	7 42	4 21	7 50	4 13	7 59	4 4	8 8	3 54
28	7 34	4 29	7 42	4 22	7 50	4 14	7 59	4 5	8 8	3 55
29	7 35	4 30	7 42	4 22	7 50	4 15	7 59	4 6	8 8	3 56
30	7 35	4 31	7 42	4 23	7 50	4 16	7 59	4 7	8 8	3 57
31	7 35	4 32	7 42	4 24	7 50	4 17	7 59	4 8	8 8	3 58

For an explanation of this table and its use at various places, see pages 8 and 9.

THE PLANETS DURING 1923

In the following notes on the planets a general account of the phenomena connected with their motions is given. Fuller details will be found on the pages headed *The Sky for the Month* (pages 28, 30, . .).

MERCURY ☿

Mercury's apparent separation from the sun is never great, and consequently the planet is comparatively seldom seen with the naked eye; but when near its greatest elongation, or angular distance from the sun, it is easily visible as a star of the first magnitude. It can often be seen for about a fortnight at such time, but some of these occasions are much more favourable than others. For instance, on January 13, the planet is 19° east of the sun, while on September 2 it is 27° east. Yet the former is the better time to look for the planet, since it is then higher in the horizon after the sun has set. On December 27 Mercury is 20° east of the sun. In general the planet can best be seen at an eastern elongation (that is as an evening star) in the autumn.

By reference to the Planetary Phenomena, on pages 29, 37, 47, it will be seen that maximum eastern elongations occur on January 13 and May 5, near which dates the planet should be well seen as an evening star; a favourable western elongation occurs on October 14, when it should be a good morning star. The planet can probably be seen at the other elongations too, but those named are especially favourable.

VENUS ♀

From December 28, 1922, till January 3, 1923, Venus has its greatest brightness; from this latter date the brightness decreases very rapidly, so that on March 12 it is just 50 per cent. of the brilliancy on January 1. The decrease in brightness from March 12 is more gradual, the minimum being reached about September 15. Venus has its greatest phase September 10, when it is in superior conjunction with the sun. Venus is a morning star at the beginning of the year and remains so until September 10, when it is in conjunction, disappearing for a short time and then appearing as an evening star for the remainder of the year.

MARS ♂

At the beginning of the year Mars is an evening star and is an interesting object, as it is well placed for observation for the early part of 1923. August 8 the planet is in conjunction with the sun, following this it will become a morning star. Mars is in aphelion September 22. January 1 magnitude of Mars is +1.0 and it gradually becomes fainter till near the end of the year, when it is nearly the second magnitude. A map showing the path of Mars amongst the stars is given on the third page of the cover, having been crowded out here.

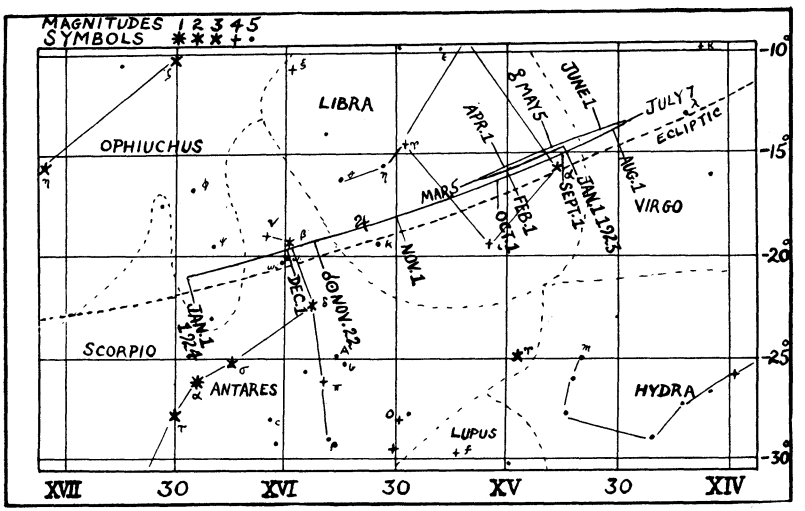
Jupiter ♃

Jupiter is the greatest of all the planets. Its brightness exceeds that of any of the fixed stars, and though at times Mars rivals it, Venus only distinctly outshines it. Jupiter is always a conspicuous object in the sky but it reaches its best in March and April, when it is visible all night long. After that it apparently drifts steadily to the western sky and it is a brilliant evening star until it becomes lost in the sun's rays. It reaches conjunction with the sun on November 22, and a few weeks later it will be a bright morning star.

Jupiter is a fine object for a small telescope. Even a field-glass will reveal its disc and also its four large moons. These were discovered by Galileo in 1610, but since then five more have been discovered—all very faint objects (see page 56).

The paths of Jupiter and Saturn are shown in the accompanying maps.

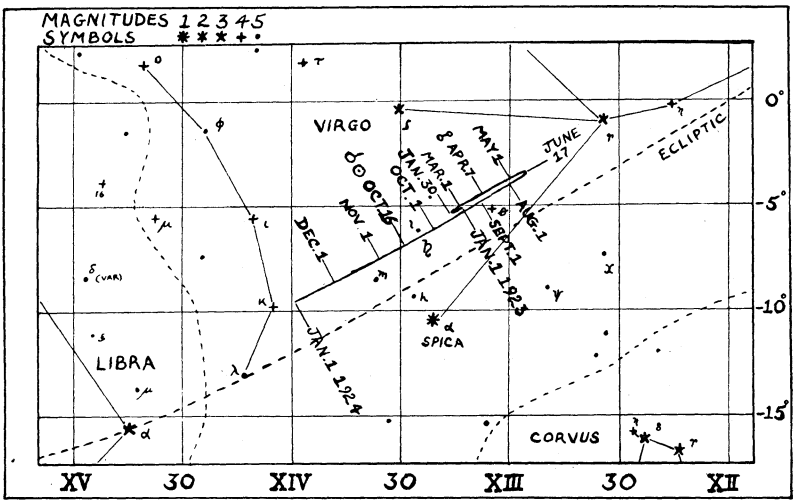
Jupiter passed Saturn on September 22, 1921, and on January 1, 1923, is about 22° east of it.



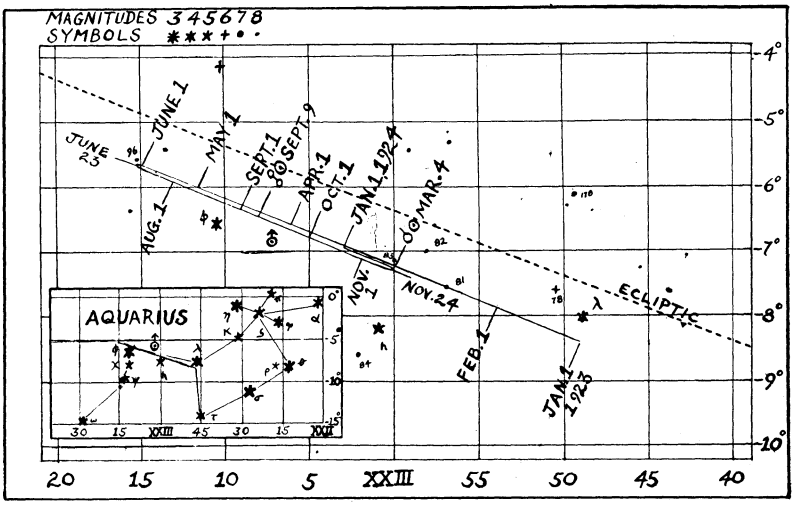
Path of Jupiter amongst the Stars in 1923

Saturn ♄

At the beginning of the year Saturn is a morning star, moving slowly eastward and it becomes stationary on January 31. It then retrogrades until June 17. It is in opposition to the sun on April 7 and is then visible all night. Saturn is in the constellation Virgo all year, about 5° north of Spica. October 17 Saturn is in conjunction with the sun, after which it becomes a morning star.



Path of Saturn amongst the Stars in 1923



Path of Uranus amongst the Stars in 1923

By many observers Saturn, with its unique ring system and its numerous satellites, is considered the finest object in the sky. During some months in 1921 the rings were invisible (as explained in the HANDBOOK for 1921) and we now see their north face. In the year 1923 Saturn is in good position to see the ring formation. For about seven years the rings will appear to open out and then they will close in again.

URANUS ♅

This planet was discovered by Sir William Herschel in 1781, and it appears to the naked eye on a dark night as a small star of the sixth magnitude. It is in the constellation Pisces. It moves eastward until July 3, when it begins to retrograde, continuing to do so until November 24. It is in opposition on September 4, when it will be visible all night. For some weeks before and after this date the planet can be best observed, and its position and motion can be followed with a field glass.

NEPTUNE ♆

The planet Neptune is the most distant member of the solar system, being 2,800 millions of miles from the sun and requiring 165 years to complete a revolution. During the year it moves in Leo, and is in opposition to the sun on February 6 (see page 31). It appears as a star of the eighth magnitude and so cannot be seen with the naked eye.

ALGOL

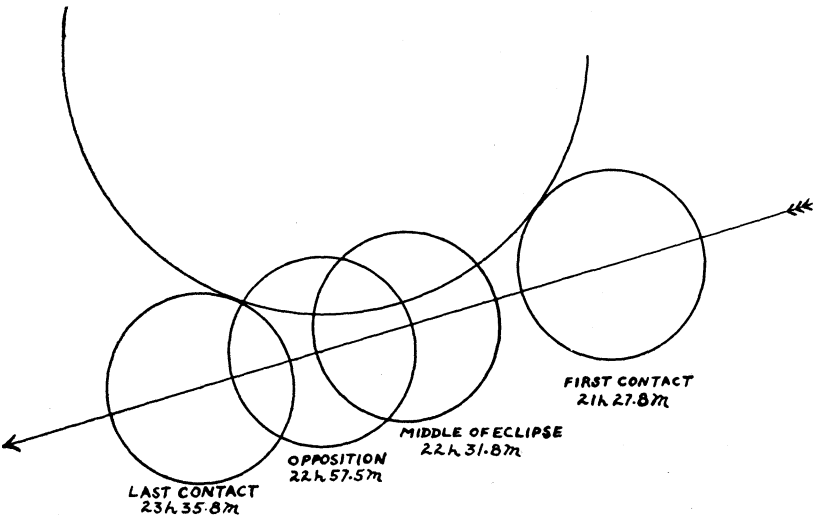
The minima of Algol have been calculated from Chandler's formula, with Hartwig's correction of 1h 30m earlier; but recent observations indicate that another correction of 1h 20m *earlier* should be made. This will be allowed for in 1924.

In the year 1923 there will be four eclipses, two of the sun and two of the moon.

I. *A Partial Eclipse of the Moon*, March 2, 1923; the beginning visible generally in Western Asia, Europe, Africa, the Atlantic Ocean, South America, North America, except the extreme northwestern part, and the eastern part of the Pacific Ocean; the ending visible generally in Europe, Africa, except the eastern part, the Atlantic Ocean, North America, South America, and the eastern part of the Pacific Ocean.

	d	h	m	
Moon enters shadow.....March	2	21	28	E.S.T.
Middle of the eclipse..... "	2	22	32	"
Moon leaves shadow..... "	2	23	36	"

Magnitude of the eclipse = 0.376 (Moon's diameter = 1.0).



Apparent path of moon across shadow during Eclipse of Mar. 2

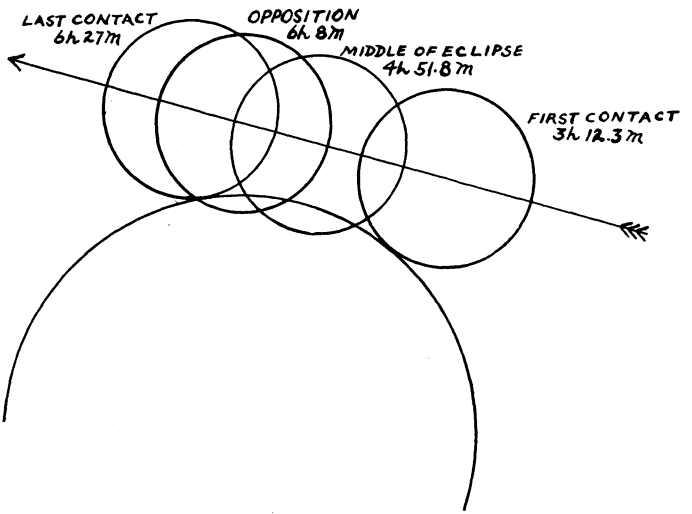
II. *An Annular Eclipse of the Sun*, March 16-17, 1923; invisible in Canada. The path of the annulus crosses the extreme southern portion of South America at latitude 49°S. Thence it crosses the Atlantic Ocean, entering Africa at latitude 24°S. It leaves Africa at latitude 15°S., crossing the north end of Madagascar and terminating just east of that island.

	d	h	m	
Central Eclipse begins.....March	16	3	6	G.M.T.
Central Eclipse at L.A. Noon..... "	17	0	24	"
Central Eclipse ends..... "	17	2	24	"

III. *A Partial Eclipse of the Moon*, August 26, 1923; the beginning visible generally in North America, except the extreme northeastern part, the western part of South America, the Pacific Ocean, Australia, except the extreme southwestern part, and the extreme northeastern part of Asia; the ending visible generally in North America, except the northeastern part, the extreme northwestern part of South America, the Pacific Ocean, Australia, and the eastern part of Asia.

		d	h	m	
Moon enters shadow	August	26	4	52	E.S.T.
Middle of the eclipse	"	26	5	40	"
Moon leaves shadow	"	26	6	27	"

Magnitude of the eclipse = 0.168 (Moon's diameter = 1.0).



Apparent path of moon during Eclipse of Aug. 26

IV. *A Total Eclipse of the Sun*, September 10, 1923; visible throughout Canada as a partial eclipse. The path of totality begins south of Kamchatka and crosses the Pacific Ocean, entering North America just south of California. It crosses Mexico about one hundred and fifty miles north of Mexico City and terminates in the Atlantic Ocean at longitude 64° and somewhat north of South America. At Toronto the eclipse begins at about 15.26 and ends at 17.18 (E.S.T.).

		d	h	m	
Total Eclipse begins	September	10	14	17	E.S.T.
Total Eclipse at L.A. Noon	"	10	15	30	"
Total Eclipse ends	"	10	17	17	"

Greatest duration of total phase, 3m 37s.

The Sun.—During January the sun's R.A. increases from 18h 44m to 20h 56m, and its Decl. changes from 23° 4′ S to 17° 18′ S. The equation of time (see page 6) increases from 3m 21s to 13m 39s, and, on account of this rapid rise in value, the time of mean noon appears to remain, for the first ten days of the month, at the same distance from the time of sunrise, that is, the forenoons, as indicated by our clocks, are of the same length. On the 20th the sun enters the sign Aquarius, the second of the winter signs of the zodiac. The change in the length of the day for any latitude may be found on page 10. On January 2nd the earth is in perihelion, at a distance of 91,339,200 miles.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On January 27th the moon occults three stars in Taurus, including Aldebaran (see page 8).

Mercury on the 15th is in R.A. 21h 2m, Decl. 17° 1′ S, and transits at 13.26 (L.M.T.). It was in superior conjunction with the sun on December 6th, 1922. It slowly separates from the sun, and on January 13th it attains greatest elongation east, 18° 56′. This is not a very good time to see the planet as an evening star. Field glasses are necessary to locate it. It will be found about 14° south of the setting sun, and about 14° above the horizon; its stellar magnitude is −0.3. The planet then draws in towards the sun, and reaches inferior conjunction on the 28th.

Venus on the 15th is in R.A. 16h 33m, Decl. 17° 32′ S, and transits at 8.58 (L.M.T.). The planet appears as a brilliant morning star in the southeastern sky during the entire month. It rises more than 3 hours before the sun, and can be seen about 7° north of Antares. The stellar magnitude on the 15th is −4.3.

Mars on the 15th is in R.A. 23h 45m, Decl. 2° 9′ S, and transits at 16.09 (L.M.T.). The planet is moving through the constellation Pisces, and is visible as an evening star, stellar magnitude +1.1, for 5 hours after sunset. On the 15th it is 150,775,000 miles from the earth, which distance is increasing.

Jupiter on the 15th is in R.A. 14h 53m, Decl. 15° 23′ S, and transits at 7.18 (L.M.T.). It rises 5h before the sun and is seen half way between Spica and Antares. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 13h 17m, Decl. 5° 29′ S, and transits at 5.43 (L.M.T.). It is in Virgo about 5° north of Spica. It is a good morning star and during the month improves its position for observation. It reaches a stationary point on the 30th after which it begins to retrograde (see map, page 24). Its stellar magnitude is +0.9.

Uranus on the 15th is in R.A. 22h 51m, Decl. 8° 8′ S, and transits at 15.15 (L.M.T.).

Neptune on the 15th is in R.A. 9h 20m, Decl. 15° 48′ N, and transits at 1.46 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

JANUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configurations of Jupiter's Satellites at 4h 45m
			h	m	
	Mon.	1			O1324
(29)	Tues.	2 18h ⊕ in Perihelion, 91,339,100 miles distant; 21h 33m F.M.	23	40	21O43
	Wed.	3			d24O3
	Thur.	4			4O132
	Fri.	5 13h 34m ☌ Ψ ☾, Ψ 3° 11′ N.	20	30	431O2
	Sat.	6 3h ♀ in Perihelion			432O1
	Sun.	7			431O*
	Mon.	8 7h Moon in Perigee	17	20	4O312
☾	Tues.	9 19h 54m Moon L.Q.; 21h 43m ☌ ♄ ☾, ♄ 0° 10′ N.			412O3
	Wed.	10 20h □ ♄ ☉			42O13
	Thur.	11 15h 2m ☌ ♃☾, ♃ 2° 59′ S.	14	10	O432*
	Fri.	12			31O24
	Sat.	13 5h ☿ Greatest Elong. E. 18° 56′; 7h 49m ☌ ♀ ☾, ♀ 0° 31′ S.			32O14
	Sun.	14	11	00	31O4*
	Mon.	15 18h ♀ in ♌			O124*
(30)	Tues.	16 21h 41m N.M.			12O34
	Wed.	17	7	50	2O134
	Thur.	18 10h 1m ☌ ☿ ☾, ☿ 2° 24′ S.			O234*
	Fri.	19 13h ☿ Stationary			d3O42
	Sat.	20 8h ☿ in Perihelion; 13h 18m ☌ ♁ ☾, ♁ 1° 45′ S.	4	30	324O1
	Sun.	21			4312O
	Mon.	22 2h 33m ☌ ♂ ☾, ♂ 0° 29′ N.			4O12*
	Tues.	23 8h Moon in Apogee	1	20	d41O3
☽	Wed.	24 22h 59m Moon F.Q.			42O13
	Thur.	25	22	10	41O23
	Fri.	26			43O12
	Sat.	27			321O4
	Sun.	28 2h ♀ Greatest Hel. Lat. N.; 23h ☌ ☿ ☉ Inferior.	19	00	321O4
	Mon.	29			3O124
	Tues.	30 15h ☿ Greatest Hel. Lat. N.; 15 h ♄ Stationary			1O234
	Wed.	31	15	50	2O134

Explanation of symbols and abbreviations on page 4.

THE SKY FOR FEBRUARY, 1923

The Sun.—During February the sun's R.A. increases from 20h 56m to 22h 46m, and its Decl. changes from 17° 18′ S to 7° 52′ S. On the 19th the sun enters the third winter sign, Pisces. For the change in the length of the day, see page 11. The equation of time reaches a maximum value of 14m 24s on the 12th (see page 6).

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 6th the moon occults a star in Virgo and on the 23rd one in Taurus (see page 8).

Mercury on the 15th is in R.A. 20h 10m, Decl. 18° 35′ S, and transits at 10.33 (L.M.T.). On the 22nd the planet reaches greatest elongation west, 26° 42′, but although this distance from the sun, to an observer in middle north latitude, it is only 11° above the horizon at sunrise, and 24° southward from the sun. This is owing to the small inclination of the ecliptic to the eastern horizon at sunrise at this time of year. Field glasses and a clear sky are essential to locate the planet at this elongation. Stellar magnitude +0.3, brightness increasing.

Venus on the 15th is in R.A. 18h 40m, Decl. 20° 19′ S, and transits at 9.03 (L.M.T.). On the 4th the planet reaches greatest elongation west, 46° 55′. Throughout the month it continues to be a brilliant morning star. It rises nearly 3 hours before the sun, and at sunrise is 20° above the horizon and 40° south of the sun. Stellar magnitude decreases slightly during the month, and is on the 15th −4.0.

Mars on the 15th is in R.A. 1h 7m, Decl. 7° 10′ N, and transits at 15.29 (L.M.T.). The planet is still an evening star, stellar magnitude +1.4, setting 4 hours after sunset. On the 15th it is 172,248,000 miles distant from the earth.

Jupiter on the 15th is in R.A. 15h 5m, Decl. 16° 10′ S, and transits at 5.28 (L.M.T.). It is a conspicuous morning star of magnitude −1.6. During the month it continues to rise earlier and thus improves its position for observation. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 13h 17m, Decl. 5° 20′ S, and transits at 3.41 (L.M.T.). The planet's position for observation is continually improving and, on the 15th, it rises about 4h 30m after sunset. Its stellar magnitude is +0.7.

Uranus on the 15th is in R.A. 22h 57m, Decl. 7° 32′ S, and transits at 13.18 (L.M.T.).

Neptune on the 15th is in R.A. 9h 16m, Decl. 16° 4′ N, and transits at 23.36 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

FEBRUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 3h 45m
			h m	
♒ Thur.	1	10h 53m F.M.; 21h 6m ☌ ♆ ☾, ♆ 3° 10′ N.		10234
Fri.	2			d0124
Sat.	3		12 40	3204*
Sun.	4	2h Moon in Perigee; 3h ☿ Greatest Elong. W. 46° 55′		3210 4
Mon.	5			30412
Tues.	6	3h 58m ☌ ♄ ☾, ♄ 0° 3′ N.; 9h ☍ ♆ ☉	9 30	41023
Wed.	7	12h □ ♃ ☉		42013
☾ Thur.	8	1h 34m ☌ ♃ ☾, ♃ 3° 17′ S.; 4h 16m Moon L.Q.		4103*
Fri.	9	15h ☿ Stationary	6 20	40312
Sat.	10			43120
Sun.	11	15h 7m ☌ ☿ ☾, ☿ 1° 59′ S.		d4320
Mon.	12		3 10	43012
Tues.	13	1h ♂ in ♌; 13h 2m ☌ ☿ ☾, ☿ 2° 16′ S.		41032
Wed.	14			20413
● Thur.	15	14h 7m N.M.	0 0	1034*
Fri.	16	23h 46m ☌ ♁ ☾, ♁ 1° 32′ S.		03124
Sat.	17		20 40	31204
Sun.	18			32014
Mon.	19,			3024*
Tues.	20	3h Moon in Apogee; 3h 2m ☌ ♂ ☾, ♂ 2° 57′ N.	17 30	10324
Wed.	21			20143
Thur.	22			12403
☽ Fri.	23	0h ☿ Greatest Elong. W. 26° 42′; 2h ☿ in ♉; 19h 6m Moon F.Q.	14 20	40312
Sat.	24			d4310
Sun.	25			43201
Mon.	26		11 10	4302*
Tues.	27			41302
Wed.	28			42013

Explanation of symbols and abbreviations on page 4.

THE SKY FOR MARCH, 1923

The Sun.—During March the sun's R.A. increases from 22h 46m to 0h 39m, and its Decl. changes from 7° 52′ S to 4° 15′ N. On the 21st the sun enters the first sign of spring, Aries (see opp. page). The equation of time decreases from 12m 40s to 4m 12s (see page 6). For changes in the length of the day, see page 12.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 19th the moon occults a star in Cetus (see page 8).

Mercury on the 15th is in R.A. 22h 26m, Decl. 12° 10′ S, and transits at 10.57 (L.M.T.). At no time during the month is the planet suitably placed for observation.

Venus on the 15th is in R.A. 20h 51m, Decl. 16° 56′ S, and transits at 9.24 (L.M.T.). The planet still continues to be a splendid morning star, rising 2 hours before the sun, and being at sunrise 18° above the horizon and 38° south of the sun. Stellar magnitude is −3.7 on the 15th, slightly less than a month ago.

Mars on the 15th is in R.A. 2h 22m, Decl. 14° 35′ N, and transits at 14.54 (L.M.T.). The planet is now moving through the constellation Aries, and sets about 3 hours after the sun. On the 15th it is 191,055,000 miles distant.

Jupiter on the 15th is in R.A. 15h 7m, Decl. 16° 11′ S, and transits at 3.40 (L.M.T.). It began to retrograde on the 6th and is steadily becoming better placed for observation and getting brighter, attaining the magnitude −2.0 by the end of the month. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 13h 12m, Decl. 4° 43′ S, and transits at 1.46 (L.M.T.). The planet is still retrograding and improving its position for observation. Stellar magnitude +0.6.

Uranus on the 15th is in R.A. 23h 3m, Decl. 6° 55′ S, and transits at 11.34 (L.M.T.).

Neptune on the 15th is in R.A. 9h 13m, Decl. 16° 16′ N, and transits at 21.44 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

MARCH

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 2h 30m
			h m	
	Thur.	1	8 00	42103
♋	Fri.	2 23h F.M.; Partial Eclipse Visible in Canada (see page 27)		40123
	Sat.	3		13024
	Sun.	4 6h Moon in Perigee; 23h ☌♁ ☉	4 50	32014
	Mon.	5 8 h☿ in Aphelion; 10h 43m ☌♄ ☾, ♄ 0° 11′ N.; 20h ♃ Stationary		31024
	Tues.	6		30124
	Wed.	7 9h 55m ☌♃ ☾, ♃ 3° 20′ S.	1 40	2034*
	Thur.	8		21034
☾	Fri.	9 13h 31m Moon L.Q.	22 30	01234
	Sat.	10		13024
	Sun.	11		32401
	Mon.	12	19 20	3410*
	Tues.	13 11h 38m ☌ ♀ ☾ 2° 47′ S.		43012
	Wed.	14		4203*
	Thur.	15 ♁ Greatest Hel. Lat. S.; 15h 14m ☌☿ ☾, ☿ 3° 49′ S.	16 00	42103
	Fri.	16 9h 24m ☌♁ ☾, ♁ 1° 23′ S.		40123
●	Sat.	17 7h 51m N.M.; Ann. Eclipse invis. in Canada (see page 27)		d4102
	Sun.	18	12 50	34201
	Mon.	19 15h Moon in Perigee		31204
	Tues.	20		30124
	Wed.	21 2h 46m ☌♂ ☾, ♂ 4° 45′ N.; 10h 29m ☉ enters ♈ Spring commences; 13h ☌☿ ♁, ☿ 1° 40′ S.	9 40	12034
	Thur.	22		d2034
	Fri.	23		01234
	Sat.	24	6 30	10324
☽	Sun.	25 4h ♀ in ♉; 11h 42m Moon F.Q.; 17h ☿ Greatest Hel. Lat. S.		32014
	Mon.	26		31204
	Tues.	27	3 20	30412
	Wed.	28 16h 4m ☌♆ ☾, ♆ 3° 18′ N.		d4103
	Thur.	29		42013
	Fri.	30	0 10	4023*
	Sat.	31		41032

Explanation of symbols and abbreviations on page 4.

THE SKY FOR APRIL, 1923

The Sun.—During April the sun's R.A. increases from 0h 39m to 2h 31m, and its Decl. increases from 4° 15′ N to 14° 50′ N. On the 20th it enters the second spring sign, Taurus. The equation of time changes from +4m 12s to −2m 51s (see page 6). For the length of the day in various latitudes, consult page 13.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 19th the moon occults two stars in Taurus, one of these being Aldebaran (see page 8).

Mercury on the 15th is in R.A. 1h 59m, Decl. 12° 27′ N, and transits at 12.29 (L.M.T.). On the 8th it reaches superior conjunction, after which it is an evening star; but not until the end of the month is it suitably placed for observation.

Venus on the 15th is in R.A. 23h 13m, Decl. 6° 15′ S, and transits at 9.43 (L.M.T.). Its stellar magnitude is −3.5, and its position as a morning star is not quite so good as a month ago.

Mars on the 15th is in R.A. 3h 49m, Decl. 20° 44′ N, and transits at 14.18 (L.M.T.). The planet is now moving through the constellation Taurus, and should be visible for a short time after sunset.

Jupiter on the 15th is in R.A. 14h 58m, Decl. 15° 30′ S, and transits at 1.29 (L.M.T.). It rises at about 20.00 (L.M.T.) and so is well placed for observation. Its stellar magnitude is −2.0. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 13h 4m, Decl. 3° 49′ S, and transits at 23.31 (L.M.T.). On the 7th the planet is in opposition with the sun and is visible all night. Stellar magnitude +0.6. For its position among the stars, see page 24.

Uranus on the 15th is in R.A. 23h 9m, Decl. 6° 17′ S, and transits at 9.39 (L.M.T.).

Neptune on the 15th is in R.A. 9h 12m, Decl. 16° 24′ N, and transits at 19.40 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

APRIL

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 1h 0m
			h m	
♒ Sun.	1	8h 10m F.M.; 16h Moon in Perigee; 18h 32m ☌ ♄ ☾, ♄ 0° 24′ N.	21 00	43201
Mon.	2			43210
Tues.	3	17h 5m ☌ ♃ ☾, ♃ 3° 11′ S.		43012
Wed.	4		17 50	41032
Thur.	5			20413
Fri.	6			1043*
Sat.	7	10h ☍ ♄ ☉	14 40	d0324
☾ Sun.	8	0h 22m Moon L.Q.; 13h ☌ ☿ ☉ Superior		32014
Mon.	9			32104
Tues.	10		11 20	30124
Wed.	11			13024
Thur.	12	14h 27m ☌ ♀☾, ♀ 1° 43′ S.; 18h 6m ☌ ♁ ☾, ♁ 1° 14′ S.		20143
Fri.	13	17h ☿ in ♌	8 10	1403*
Sat.	14	5h ☌ ♀ ♁, ♀ 0° 23′ S.		40132
Sun.	15	18h Moon in Apogee		43201
♍ Mon.	16	1h 28m N.M.; 18h 25m ☌ ☿ ☾, ☿ 4° 23′ N.	5 00	43210
Tues.	17			43012
Wed.	18	7h ☿ in Perihelion		41302
Thur.	19	1h 34m ☌ ♂ ☾, ♂ 5° 43′ N.	1 50	42013
Fri.	20			41203
Sat.	21		22 40	40132
Sun.	22			3204*
Mon.	23			32104
☽ Tues.	24	0h 20m Moon F.Q.	19 30	30124
Wed.	25	0h 10m ☌ ♆ ☾, ♆ 3° 11′ N.		13024
Thur.	26	20h ♆ Stationary		20134
Fri.	27		16 20	12034
Sat.	28	12h ♀ in Aphelion; 15h ☿ Greatest Hel. Lat. N.		01234
Sun.	29	2h 27m ☌ ♄ ☾, ♄ 0° 33′ N.		d3104
♒ Mon.	30	3h Moon in Perigee; 16h 30m F.M.; 23h 13m ☌ ♃ ☾, ♃ 2° 58′ S.	13 10	d3240

Explanation of symbols and abbreviations on page 4.

THE SKY FOR MAY, 1923

The Sun,—During May the sun's R.A. increases from 2h 31m to 4h 33m, and its Decl. increases from 14° 51′ to 21° 57′ N. On the 21st the sun enters Gemini, the third spring sign of the zodiac. The equation of time increases from 2m 51s to a maximum of 3m 47s on the 15th, and then falls to 2m 38s on the 31st (see page 6). For changes in the length of the day, see page 14.

The Moon,—For its phases and conjunctions with the planets, see opposite page.

Mercury on the 15th is in R.A. 4h 36m, Decl. 23° 40′ N, and transits at 13.07 (L.M.T.). On the 5th the planet reaches greatest elongation east, 21° 7′. This is the most favourable time of this year to see Mercury as an evening star. At sunset it will be about 10° south of the sun and 19° above the horizon. When observed in a telescope the phase of the planet will resemble the moon at first quarter. Its stellar magnitude will be +0.5, the same as Procyon. The planet then draws in towards the sun, and reaches inferior conjunction on the 28th, after which it is a morning star.

Venus on the 15th is in R.A. 1h 26m, Decl. 7° 10′ N, and transits at 9.58 (L.M.T.). It rises about 1h before the sun and its stellar magnitude is −3.4.

Mars on the 15th is in R.A. 5h 15m, Decl. 23° 56′, and transits at 13.47 (L.M.T.). The planet is still moving through the constellation Taurus, setting earlier each night, as the sun is slowly overtaking it.

Jupiter on the 15th is in R.A. 14h 43m, Decl. 14° 27′ S, and transits at 23.12 (L.M.T.). It is in opposition with the sun on the 5th and so can be seen all night. Its stellar magnitude is −2.0. For its path among the stars, see page 24; for the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 12h 56m, Decl. 3° 7′ S, and transits at 21.26 (L.M.T.). It is in excellent position for observation. Stellar magnitude +0.8, slightly fainter than a month ago. For its position among the stars, see page 24.

Uranus on the 15th is in R.A. 23h 13m, Decl. 5° 51′ S, and transits at 7.45 (L.M.T.).

Neptune on the 15th is in R.A. 9h 12m, Decl. 16° 23′ N, and transits at 17.42 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

MAY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 0h 0m
			h m	
Tues.	1			34O12
Wed.	2			431O2
Thur.	3		10 00	42O13
Fri.	4			421O3
Sat.	5	9h ☌ ♃ ☉; 12h ☿ Greatest Elong. E. 21° 7′		4O123
Sun.	6	19h □♆☉	6 50	41O32
☾ Mon.	7	13h 18m Moon L.Q.		324O1
Tues.	8			3O42*
Wed.	9		3 30	31O24
Thur.	10	2h 17m ☌♁☾, ♁ 0° 59′ S.		2O314
Fri.	11			21O34
Sat.	12	19h 36m ☌♀☾, ♀ 0° 53′ N.	0 20	O1234
Sun.	13	0h Moon in Apogee		1O324
Mon.	14		21 10	32O14
● Tues.	15	17h 38m N.M.		3O4**
Wed.	16			31O42
Thur.	17	1h 11m ☌☿☾, ☿ 6° 19′ N.; 17h ☿ Stationary; 23h 4m ☌♂☾, ♂ 5° 57′ N.	18 00	42O31
Fri.	18			421O3
Sat.	19			4O123
Sun.	20		14 50	41O32
Mon.	21	0h ♀ Greatest Hel. Lat. S.		423O1
Tues.	22	2h ☿ in ♈; 6h 42m ☌♆☾, ♆ 2° 56′ N.		4312O
☽ Wed.	23	9h 25m Moon F.Q.	11 40	d43O2
Thur.	24			42O1*
Fri.	25			21O43
Sat.	26	9h 26m ☌♄☾, ♄ 0° 27′ N.	8 30	O2143
Sun.	27			1O324
Mon.	28	4h 20m ☌♃☾, ♃ 2° 54′ S.; 11h Moon in Perigee; 22h ☌☿☉ Inferior		23O14
Tues.	29		5 20	312O4
Wed.	30	0h 7m F.M.		3O124
Thur.	31			d3O4*

Explanation of symbols and abbreviations on page 4.

THE SKY FOR JUNE, 1923

The Sun.—During June the sun's R.A. increases from 4h 33m to 6h 38m, and its Decl. increases to the maximum 23° 27′, on the 22nd. On that date the sun enters the first summer sign, Cancer, and our days are longest (see page 15). The declination falls to 23° 13′ on the 30th. The equation of time becomes zero on the 15th, and rises to 3m 16s on the 30th (see page 6). The increase in the equation of time taken with the decreasing length of the day causes the local mean time of sunset to appear constant for several days at the end of June and the beginning of July.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 9th the moon occults a star in Cetus and on the 22nd one in Virgo.

Mercury on the 15th is in R.A. 4h 8m, Decl. 16° 45′ N, and transits at 10.38 (L.M.T.). The planet reaches greatest elongation west on the 22nd, its distance from the sun then being 22° 33′. At sunrise it is about 18° south of the sun and 10° above the horizon. On account of the brightness of the sky, a field glass will be necessary to "pick up" the planet. Stellar magnitude +0.8.

Venus on the 15th is in R.A. 3h 52m, Decl. 18° 58′ N, and transits at 10.22 (L.M.T.). It rises 1h before the sun and at sunrise is 12° above the horizon and about 19° south of the sun. Its stellar magnitude is −3.3 throughout the month.

Mars on the 15th is in R.A. 6h 45m, Decl. 24° 5′, and transits at 13.14 (L.M.T.). The planet is now too close to the sun for observation.

Jupiter on the 15th is in R.A. 14h 31m, Decl. 13° 36′ S, and transits at 20.59 (L.M.T.). Since May 15 it has retrograded about 4°, and is now about 17° east of Spica (see page 24). Its stellar magnitude is −2.0. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 12h 53m, Decl. 2° 53′ S, and transits at 19.21 (L.M.T.). On the 17th the planet reaches a stationary point, after which it begins to move eastward again. It is a good evening star. Stellar magnitude +1.0, slightly fainter than a month ago, but still somewhat brighter than Spica. For its position among the stars, see page 24.

Uranus on the 15th is in R.A. 23h 15m, Decl. 5° 39′ S, and transits at 5.45 (L.M.T.).

Neptune on the 15th is in R.A. 9h 14m, Decl. 16° 14′ N, and transits at 15.43 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

JUNE

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 23h 0m
			h m	
Fri.	1	7h ☿ in Aphelion	2 10	40213
Sat.	2			41023
Sun.	3		22 50	42301
Mon	4			43210
Tues.	5			43012
☾ Wed.	6	4h 19m Moon L.Q.; 10h 25m ☌ ♁ ☾, ♁ 0° 42′ S.	19 40	43102
Thur.	7			42103
Fri.	8			4013*
Sat.	9	3h □ ♁ ☉; 13h Moon in Apogee	16 30	14023
Sun.	10			23014
Mon.	11			32104
Tues.	12	2h 53m ☌ ♀ ☾, ♀ 3° 28′ N.; 16h 48m ☌ ☿ ☾, ☿ 0° 41′ N.	13 20	30124
Wed.	13			31024
● Thur.	14	7h 42m N.M.		d2034
Fri.	15	18h 56m ☌ ♂ ☾, ♂ 5° 33′ N.	10 10	0134*
Sat.	16			10234
Sun.	17	18h ♄ Stationary		23041
Mon.	18	12h 57m ☌ ♆ ☾, ♆ 2° 40′ N.	7 00	32140
Tues.	19			34012
Wed.	20			43102
☽ Thur.	21	11h ☌ ☿ ♀, ☿ 2° 38′ S.; 15h 46m Moon F.Q.; 16h ☿ Greatest Hel. Lat. S.	3 50	42013
Fri.	22	6h 3m ☉ enters ♋, Summer commences; 15h 36m ☌ ♄ ☾, ♄ 0° 5′ N.		4203*
Sat.	23	0h ☿ Greatest Elong. W. 22° 33′; 6h ♁ Stationary		41023
Sun.	24	9h 9m ☌ ♃ ☾, ♃ 3° 4′ S.	0 40	42031
Mon.	25	9h Moon in Perigee		32410
Tues.	26		21 30	30421
Wed.	27			31024
♋ Thur.	28	8h 4m F.M.		20134
Fri.	29		18 10	21034
Sat.	30			10234

Explanation of symbols and abbreviations on page 4.

THE SKY FOR JULY, 1923

The Sun.—During July the sun's R.A. increases from 6h 38m to 8h 42m, and its Decl. decreases from 23° 10′ to 18° 13′ N. On the 23rd it enters Leo, the second summer sign of the zodiac. The equation of time increases from 3m 28s on the 1st to a maximum of 6m 21s on the 27th, and then falls to 6m 15s on the 31st (see page 7). For changes in the length of the day, see page 16. The earth in in aphelion on July 5th, being 94,454,500 miles distant.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 2nd the moon occults a star in Aquarius, on the 9th two stars in Taurus, on the 10th Aldebaran in Taurus, on the 18th a star in Virgo and on the 30th one in Virgo (see page 8).

Mercury on the 15th is in R.A. 7h 1m, Decl. 23° 32′ N, and transits at 11.31 (L.M.T.). The planet reaches superior conjunction on the 22nd, and during the entire month it is too close to the sun for observation.

Venus on the 15th is in R.A. 6h 28m, Decl. 23° 15′ N, and transits at 10.59 (L.M.T.). Although the planet still rises about 1h before the sun it is much nearer to it than last month, being, at sunrise, only 10° above the horizon and 10° south of the sun. Its stellar magnitude is still −3.3.

Mars on the 15th is in R.A. 8h 8m, Decl. 21° 19′ N, and transits at 12.39 (L.M.T.). During the entire month the planet is not in a suitable position for observation.

Jupiter on the 15th is in R.A. 14h 28m, Decl. 13° 32′ S, and transits at 18.58 (L.M.T.). Its position in the sky is nearly the same as last month as it reached a stationary point on the 7th (see opposite page); after this date it moves eastward again. Stellar magnitude −1.8. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 12h 55m, Decl. 3° 16′ S, and transits at 17.25 (L.M.T.). The planet is still a prominent evening star, setting 3h 30m after the sun. Its stellar magnitude is +1.0.

Uranus on the 15th is in R.A. 23h 15m, Decl. 5° 44′ S, and transits at 3.47 (L.M.T.).

Neptune on the 15th is in R.A. 9h 18m, Decl. 15° 58′ N, and transits at 13.48 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

JULY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 22h 0m
			h m	
Sun.	1			dO134
Mon.	2		15 00	231O4
Tues.	3	18h 29m ☌ ♁ ☾, ♁ 0° 27′ S.		3O214
Wed.	4	10h ☌ ☿ ♀, ☿ 0° 47′ S.		31O42
☾ Thur.	5	19h ⊕ in Aphelion, 94,455,600 miles distant; 20h 56m Moon L.Q.	11 50	42O31
Fri.	6	15h □ ♄ ☉		421O3
Sat.	7	0h Moon in Apogee; 15h ♃ Stationary		4O123
Sun.	8		8 40	4O23*
Mon.	9			4231O
Tues.	10	16h ☿ in ♌		43O1*
Wed.	11		5 30	431O2
Thur.	12	11h 30m ☌ ♀ ☾, ♀ 4° 37′ N.; 23h 8m ☌ ☿ ☾, ☿ 5° 0′ N.		42O1*
● Fri.	13	19h 45m N.M.		21O43
Sat.	14	13h 8m ☌ ♂ ☾, ♂ 4° 40′ N.	2 20	O1243
Sun.	15	7h ☿ in Perihelion; 20h 31m ☌ Ψ ☾, Ψ 2° 28′ N.		O234*
Mon.	16	7h ♀ in ♌	23 10	231O4
Tues.	17			3O14*
Wed.	18			31O24
Thur.	19	22h 15m ☌ ♄ ☾, ♄ 0° 18′ S.	20 00	23O14
☽ Fri.	20	20h 32m Moon F.Q.		21O43
Sat.	21	15h 9m ☌ ♃ ☾, ♃ 3° 24′ S.; 21h Moon in Perigee.		4O123
Sun.	22	4h ☌ ☿ ☉ Superior	16 50	41O23
Mon.	23			d423O
Tues.	24			432O1
Wed.	25	14h ☿ Greatest Hel. Lat. N.; 21h ☌ ☿ ♂, ☿ 0° 39′ N.	13 40	431O2
Thur.	26			432O1
♋ Fri.	27	17h 33m F.M.		421O3
Sat.	28		10 20	4O123
Sun.	29			14O23
Mon.	30			23O14
Tues.	31	2h 2m ☌ ♁ ☾, ♁ 0° 21′ S.; 6h ☌ ☿ Ψ, ☿ 1° 35′ N.	7 10	32O4*

Explanation of symbols and abbreviations on page 4.

THE SKY FOR AUGUST, 1923

The Sun.—During August the sun's R.A. increases from 8h 42m to 10h 39m, and its Decl. decreases from 18° 13′ to 8° 34′ N. On the 23rd it enters the third summer sign, Virgo. The equation of time falls from 6m 12s to 0m 12s (see page 7), and for the change in the length of the day, see page 17.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 14th the moon occults a star in Virgo (see page 8).

Mercury on the 15th is in R.A. 10h 58m, Decl. 7° 2′ N, and transits at 13.27 (L.M.T.). At no time during the month is the planet suitably placed for observation.

Venus on the 15th is in R.A. 9h 9m, Decl. 17° 30′ N, and transits at 11.38 (L.M.T.). The planet has now closed in on the sun and is not in a suitable position for observation during the latter part of the month.

Mars on the 15th is in R.A. 9h 29m, Decl. 16° 5′ N, and transits at 11.58 (L.M.T.). On the 8th the planet comes into conjunction with the sun, after which it is a morning star. During the entire month the planet is too close to the sun for observation.

Jupiter on the 15th is in R.A. 14h 37m, Decl. 14° 18′ S, and transits at 17.04 (L.M.T.). The planet is now moving eastward again, but it is only about 2° east of its place a month ago. Its stellar magnitude is −1.6,—still a prominent evening star. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52).

Saturn on the 15th is in R.A. 13h 3m, Decl. 4° 10′ S, and transits at 15.31 (L.M.T.) The planet sets about 2h after the sun. Stellar magnitude +1.1. For its position among the stars, see page 24.

Uranus on the 15th is in R.A. 23h 12m, Decl. 6° 4′ S, and transits at 1.42 (L.M.T.)

Neptune on the 15th is in R.A. 9h 22m, Decl. 15° 37′ N, and transits at 11.51 (L.M.T.)

For information regarding *Uranus* and *Neptune*, see page 25.

AUGUST

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 20h 45m
			h m	
Wed.	1			31O24
Thur.	2			d3O14
Fri.	3	8h □ ♃ ☉	4 00	21O34
☾ Sat.	4	1h Moon in Apogee; 14h 22m Moon L.Q.		O2134
Sun.	5			1O234
Mon.	6		0 50	2O314
Tues.	7			3241O
Wed.	8	15h ☌ ♂ ☉	21 40	d34O2
Thur.	9			43O21
Fri.	10			421O3
Sat.	11	10h ☌ ♆ ☉; 17h 4m ☌ ☿ ☾, ☿ 3° 46′ N.	18 30	4O13*
● Sun.	12	6h 1m ☌ ♂ ☾, ♂ 3° 22′ N.; 6h 12m ☌ ♆ ☾, ♆ 2° 22′ N.; 6h 17m N.M.; 10h ☌ ♂ ♆, ♂ 0° 59′ N.		41O23
Mon.	13	20h 27m ☌ ☿ ☾, ☿ 0° 39′ N.		42O31
Tues.	14		15 20	4321O
Wed.	15	5h Moon in Perigee; 7h 8m ☌ ♄ ☾ 0° 41′ S.		34O12
Thur.	16			3O24*
Fri.	17	1h ♂ Greatest Hel. Lat. N.; 23h ☌ ☿ ♆, ☿ 0° 58′ N.	12 10	21O34
Sat.	18	0h 6m ☌ ♃ ☾, ♃ 3° 45′ S.; 1h ☿ in ♉		O134*
◑ Sun.	19	1h 7m Moon F.Q.		1O234
Mon.	20		9 00	2O134
Tues.	21			231O4
Wed.	22			3O124
Thur.	23	11h ☌ ☿ ♂, ☿ 0° 6′ N.	5 40	3O42*
Fri.	24			2413O
Sat.	25			42O13
♍ Sun.	26	5h 29m F.M.; Partial Eclipse visible in Canada (see page 27)	2 30	41O23
Mon.	27	8h 24m ☌ ♁ ☾, ♁ 0° 24′ S.		42O13
Tues.	28	7h ☿ in Aphelion	23 20	4213O
Wed.	29			43O12
Thur.	30			431O2
Fri.	31	20h Moon in Apogee	20 10	d423O

Explanation of symbols and abbreviations on page 4.

THE SKY FOR SEPTEMBER, 1923

The Sun.—During September the sun's R.A. increases from 10h 39m to 12h 27m, and its Decl. changes from 8° 34′ N to 2° 53′ S. On the 23rd the sun crosses the equator and enters Libra, the first autumn sign of the zodiac. The equation of time becomes zero on the 2nd, and then increases to 10m 4s. For the change in the length of the day, see page 18.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 2nd the moon occults two stars in Taurus and on the 29th one star in Taurus (see page 8).

Mercury on the 15th is in R.A. 12h 45m, Decl. 9° 1′ S, and transits at 13.10 (L.M.T.). On the 2nd the planet reaches greatest elongation east, and though it is 27° from the sun it is only 8° above the horizon, and cannot be conveniently observed. It then draws in towards the sun, and reaches inferior conjunction on the 28th.

Venus on the 15th is in R.A. 11h 36m, Decl. 4° 5′ N, and transits at 12.03 (L.M.T.). On the 10th it comes into superior conjunction with the sun, after which it is an evening star.

Mars on the 15th is in R.A. 10h 45m, Decl. 9° 11′ N, and transits at 11.11 (L.M.T.). At no time during the month is the planet suitably placed for observation.

Jupiter on the 15th is in R.A. 14h 54m, Decl. 15° 42′ S, and transits at 15.20 (L.M.T.). Its stellar magnitude is −1.4. On the 15th it sets about 2h after the sun. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 13h 15m, Decl. 5° 26′ S, and transits at 13.41 (L.M.T.). The sun is rapidly overtaking Saturn, which, on the 15th, sets 1h after sunset. On the 30th it is in conjunction with Spica, being about 4° N. Stellar magnitude +1.0.

Uranus on the 15th is in R.A. 23h 7m, Decl. 6° 32′ S, and transits at 23.31 (L.M.T.).

Neptune on the 15th is in R.A. 9h 27m, Decl. 15° 16′ N, and transits at 9.53 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

SEPTEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 19h 30m
			h m	
Sat.	1			2043*
Sun.	2	17h ☿ Greatest Elong. E. 27° 9′		10243
☾ Mon.	3	7h 47m Moon L.Q.	17 00	02134
Tues.	4			21304
Wed.	5			3014*
Thur.	6		13 50	31024
Fri.	7			32014
Sat.	8	17h 34m ☌ ♆ ☾, ♆ 2° 18′ N.		2034*
Sun.	9	2h ☍ ♁ ☉; 19h ♀ Greatest Hel. Lat. N.; 22h 6m ☌ ♂ ☾, ♂ 1° 44′ N.	10 40	10423
● Mon.	10	6h ☌ ♀ ☉ Superior; 15h 53m N.M. Total Eclipse, Visible as Partial in Canada (see page 27); 16h 44m ☌ ♀ ☾, ♀ 0° 56′ N.		40213
Tues.	11			42103
Wed.	12	6h 1m ☌ ☿ ☾, ☿ 6° 44′ S.; 17h Moon in Perigee; 19h 17m ☌ ♄ ☾, ♄ 0° 59′ S.	7 30	43O1*
Thur.	13			43102
Fri.	14	13h 9m ☌ ♃ ☾, ♃ 4° 1′ S.		43201
Sat.	15	21h ☿ Stationary	4 20	42103
Sun.	16			d4023
☽ Mon.	17	7h 4m Moon F.Q.; 15h ☿ Greatest Hel. Lat. S.		40123
Tues.	18		1 00	21043
Wed.	19			32014
Thur.	20		21 50	31024
Fri.	21			32014
Sat.	22	0h ♂ in Aphelion		2104*
Sun.	23	13h 22m ☌ ♁ ☾, ♁ 0° 31′ S.; 21h 4m ☉ enters ♎, Autumn commences	18 40	01234
♍ Mon.	24	20h 16m F.M.		0234*
Tues.	25			21034
Wed.	26	0h ☌ ☿ ♀, ☿ 4° 57′ S.	15 30	32041
Thur.	27			34102
Fri.	28	12h Moon in Apogee; 23h ☌ ☿ ☉ Inferior		d4301
Sat.	29		12 20	4210*
Sun.	30			40123

Explanation of symbols and abbreviations on page 4.

THE SKY FOR OCTOBER, 1923

The Sun.—During October the sun's R.A. increases from 12h 27m to 14h 23m, and its Decl. increases from 2° 53′ S to 14° 11m S. On the 24th the sun enters the second autumnal sign, Scorpio. The equation of time rises from 10m 4s to 16m 20s, to be subtracted from apparent time (see page 7). For the change in the length of the day, see page 19.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 12th the moon occults a star in Libra and on the 20th a star in Aquarius (see page 8).

Mercury on the 15th is in R.A. 12h 14m, Decl. 0° 24′ N, and transits at 10.42 (L.M.T.). On the 14th the planet reaches greatest elongation west, 18° 7′. At sunrise it is about 17° above the horizon and 6° south of the sun. This is a favourable time to see the planet. It should be visible for some days before and after the 14th.

Venus on the 15th is in R.A. 13h 54m, Decl. 10° 52′ S, and transits at 12.22 (L.M.T.). It is now an evening star but is not in a favourable position for observation.

Mars on the 15th is in R.A. 11h 55m, Decl. 1° 41′ N, and transits at 10.24 (L.M.T.). The planet has now separated from the sun and is visible for a short time before sunrise.

Jupiter on the 15th is in R.A. 15h 16m, Decl. 17° 20′ S, and transits at 13.44 (L.M.T.). The sun is rapidly overtaking the planet which on the 15th sets about 1h after sunset. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 13h 28m, Decl. 6° 47′ S, and transits at 11.56 (L.M.T.). It is in conjunction with the sun on the 4th and therefore too near for observation.

Uranus on the 15th is in R.A. 23h 3m, Decl. 6° 56′ S, and transits at 21.30 (L.M.T.).

Neptune on the 15th is in R.A. 9h 30m, Decl. 15° 3′ N, and transits at 7.59 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

OCTOBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 18h 15m
			h m	
	Mon.	1		41023
	Tues.	2	9 10	d4203
☾	Wed.	3 0h 29m Moon L.Q.		42301
	Thur.	4		34102
	Fri.	5	6 00	30241
	Sat.	6 5h 5m ☌ ♆ ☾, ♆ 2° 11′ N.; 15h ☿ in ♌		21304
	Sun.	7 7h ☿ Stationary		0134*
	Mon.	8 13h 49m ☌ ♂ ☾, ♂ 0° 3′ S.; 21h 6m ☌ ☿ ☾, ☿ 1° 0′ S.	2 50	10234
	Tues.	9 1h ☌ ♀ ♄, ♀ 1° 22′ S.		d2034
●	Wed.	10 1h 6m N.M.; 10h 24m ☌ ♄ ☾, ♄ 1° 13′ S.; 13h 2m ☌ ♀ ☾, ♀ 2° 45′ S.; 23h Moon in Perigee	23 40	23014
	Thur.	11 7h ☿ in Perihelion		31024
	Fri.	12 6h 24m ☌ ♃ ☾, ♃ 4° 11′ S.		30214
	Sat.	13	20 30	21304
	Sun.	14 11h ☿ Greatest Elong. W. 18° 7′		42013
	Mon.	15 ♄ Greatest Hel. Lat. N.		41023
☽	Tues.	16 15h 54m Moon F.Q.	17 10	42013
	Wed.	17 6h ☌ ♄ ☉		d420*
	Thur.	18		43102
	Fri.	19	14 00	43012
	Sat.	20 17h 31m ☌ ♁ ☾, ♁ 0° 31′ S.		42310
	Sun.	21 13h ☿ Greatest Hel. Lat. N.		42031
	Mon.	22	10 50	10423
	Tues.	23		20134
○	Wed.	24 13h 26m F.M.		21034
	Thur.	25 22h Moon in Apogee	7 40	d3024
	Fri.	26		30124
	Sat.	27		32104
	Sun.	28	4 30	20314
	Mon.	29 19h ☌ ☿ ♄, ☿ 0° 42′ S.		10423
	Tues.	30		....
	Wed.	31	1 20	....

Explanation of symbols and abbreviations on page 4.

THE SKY FOR NOVEMBER, 1923

The Sun.—During November the sun's R.A. increases from 14h 23m to 16h 26m, and its Decl. changes from 14° 11′ to 21° 41′ S. On the 23rd the sun enters Sagittarius, the third autumn sign of the zodiac. The equation of time rises to a maximum of 16m 23s on the 4th (see page 7). For the change in the length of the day, see page 20.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 2nd the moon occults a star in Leo, on the 20th a star in Cetus, and on the 23rd two stars in Taurus, one of these being Aldebaran (see page 8).

Mercury on the 15th is in R.A. 15h 17m, Decl. 18° 22′ S, and transits at 11.43 (L.M.T.). The planet reaches superior conjunction on the 15th, and is too close to the sun for observation during the entire month.

Venus on the 15th is in R.A. 16h 29m, Decl. 22° 15′ S, and transits at 12.55 (L.M.T.). At sunset it is about 7° above the horizon and 15° south of the setting sun. Its stellar magnitude is −3.3 and, setting nearly an hour after the sun, it should be easily seen.

Mars on the 15th is in R.A. 13h 8m, Decl. 6° 11′ S, and transits at 9.34 (L.M.T.). It rises about three hours before the sun and is 30° above the horizon and 15° south of the sun at sunrise. It is in the constellation Virgo, about 5° north of Spica. On the 15th it is distant 220,693,000 miles from the earth.

Jupiter on the 15th is in R.A. 15h 43m, Decl. 19° 0′ S, and transits at 12.09 (L.M.T.). It is too near the sun this month for observation, conjunction occurring on the 22nd, after which date it becomes a morning star.

Saturn on the 15th is in R.A. 13h 42m, Decl. 8° 6′ S, and transits at 10.08 (L.M.T.). It is now a morning star rising about 2h before the sun on the 15th. Stellar magnitude +0.9.

Uranus on the 15th is in R.A. 23h 1m, Decl. 7° 9′ S, and transits at 19.26 (L.M.T.).

Neptune on the 15th is in R.A. 9h 31m, Decl. 14° 55′ N, and transits at 5.58 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

NOVEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

Minima of Algol

			h	m
☾ Thur.	1	15h 49m Moon L.Q.		
Fri.	2	14h 47m ☌ Ψ ☾, Ψ 1° 58′ N.	22	10
Sat.	3			
Sun.	4	15h ☌ ☿ ♃, ☿ 0° 45′ S; 21h ☿ in ♉		
Mon.	5		19	00
Tues.	6	5h 17m ☌ ♂ ☾, ♂ 1° 49′ S.		
Wed.	7	2h 47m ☌ ♄ ☾, ♄ 1° 27′ S.		
● Thur.	8	0h 31m ☌ ☿ ☾, ☿ 3° 53′ S.; 10h Moon in Perigee; 10h 27m N.M.	15	50
Fri.	9	2h 42m ☌ ♃ ☾, ♃ 4° 18′ S.; 10h 45m ☌ ☿ ☾, ☿ 5° 17′ S.		
Sat.	10			
Sun.	11		12	30
Mon.	12			
Tues.	13	14h □ Ψ ☉		
Wed.	14	0h ☿ in ♉	9	20
☽ Thur.	15	4h 41m Moon F.Q.; 19h ☌ ☿ ☉ Superior		
Fri.	16	22h 22m ☌ ♁ ☾, ♁ 0° 21′ S.		
Sat.	17		6	10
Sun.	18			
Mon.	19			
Tues.	20	1h ☌ ☿ ♃, ☿ 1° 25′ S.	3	00
Wed.	21	22h Moon in Apogee		
Thur.	22	17h ☌ ♃ ☉	23	50
♋ Fri.	23	7h 58m F.M.; 16h Ψ Stationary		
Sat.	24	3h ♁ Stationary; 6h ☿ in Aphelion		
Sun.	25		20	40
Mon.	26			
Tues.	27			
Wed.	28		17	30
Thur.	29	21h 34m ☌ Ψ ☾, Ψ 1° 41′ N.		
Fri.	30			

By reason of the proximity of Jupiter to the Sun the phenomena of the Satellites are not given from October 30 to December 17.

Explanation of symbols and abbreviations on page 4.

THE SKY FOR DECEMBER, 1923

The Sun.—During December the sun's R.A. increases from 16h 26m to 18h 43m, and its Decl. reaches the maximum value of 23° 27′ S on the 22nd. On that date the sun enters the first zodiacal sign of winter, Capricornus; and it is vertical to points on the Tropic of Capricorn on the earth. From this time it slowly moves northward. The equation of time changes from 11m 12s "watch slow" to 3m 13s "watch fast" (see page 7). For the change in the length of the day, see page 21.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 2nd the moon occults a star in Virgo (see page 8).

Mercury on the 15th is in R.A. 18h 37m, Decl. 27° 27′ S, and transits at 13.05 (L.M.T.). On the 27th the planet reaches greatest elongation east, 19° 46′, and is about 14° south of the sun and 12° above the horizon. Field glasses are necessary to locate the planet. Stellar magnitude −0.3, brightness decreasing.

Venus on the 15th is in R.A. 19h 12m, Decl. 23° 53′ S, and transits at 13.40 (L.M.T.). It is daily improving its position as an evening star and at sunset on the 15th is 14° above the horizon and 22° south of the setting sun. It sets 2h after the sun and its stellar magnitude is −3.4. During the month it is a fine evening star.

Mars on the 15th is in R.A. 14h 21m, Decl. 13° 10′ S, and transits at 8.49 (L.M.T.). It is still in the constellation Virgo and rises four hours before the sun. Its stellar magnitude is now +1.8 and its distance from the earth is 201,439,000 miles.

Jupiter on the 15th is in R.A. 16h 11m, Decl. 20° 23′ S, and transits at 10.38 (L.M.T.). It is a morning star rising about 1h 30m before the sun. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 13h 53m, Decl. 9° 8′ S, and transits at 8.22 (L.M.T.). It is a better morning star this month than last, rising, on the 15th, about 4h 30m before the sun. Stellar magnitude +0.9.

Uranus on the 15th is in R.A. 23h 2m, Decl. 7° 4′ S, and transits at 17.28 (L.M.T.).

Neptune on the 15th is in R.A. 9h 31m, Decl. 14° 58′ N, and transits at 4.00 (L.M.T.)

For information regarding *Uranus* and *Neptune*, see page 25.

DECEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 6h 30m
			h m	
☾	Sat.	1 5h 9m Moon L.Q.	14 20	
	Sun.	2 3h ☌ ♂ ♄, ♂ 1° 30′ S.		
	Mon.	3		
	Tues.	4 18h 0m ☌ ♄ ☾, ♄ 1° 43′ S.; 20h 22m ☌ ♂ ☾, ♂ 3° 19′ S.	11 10	
	Wed.	5		
	Thur.	6 16h □♁☉; 22h Moon in Perigee; 23h 59m ☌ ♃ ☾, ♃ 4° 23′ S.		
●	Fri.	7 20h 30m N.M.	7 50	
	Sat.	8 17h 45m ☌ ☿ ☾, ☿ 6° 47′ S.		
	Sun.	9 3h ♀ in Aphelion; 12h 14m ☌ ♀ ☾, ♀ 5° 30′ S.		
	Mon.	10	4 40	
	Tues.	11		
	Wed.	12		
	Thur.	13	1 30	
	Fri.	14 5h 38m ☌♁☾, ♁ 0° 1′ S.; 15h ☿ Greatest Hel. Lat. S.; 21h 38m Moon F.Q.		
☽	Sat.	15	22 20	
	Sun.	16		
	Mon.	17		
	Tues.	18	19 10	10324
	Wed.	19 6h Moon in Apogee		02143
	Thur.	20		21403
	Fri.	21	16 00	42031
	Sat.	22 15h 54m ☉ enters ♑, Winter commences		4302*
♋	Sun.	23 2h 33m F.M.		43120
	Mon.	24	12 50	43201
	Tues.	25		41032
	Wed.	26		40123
	Thur.	27 2h 22m ☌ Ψ ☾, Ψ 1° 29′ N.; 11h ☿ Greatest Elong. E. 19° 46′	9 40	42103
	Fri.	28		24013
	Sat.	29		31042
☾	Sun.	30 16h 7m Moon L.Q.	6 30	d3024
	Mon.	31 17h ♀ Greatest Hel. Lat. S.		32014

See page 47

Explanation of symbols and abbreviations on page 4.

E—eclipse, O—occultation, T—transit, S—shadow, D—disappearance, R—reappearance, I—ingress, e—egress. The Roman numerals denote the satellites. Eastern Standard Time, hours numbering from Midnight.

JANUARY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
2	6	30	I	ED	19	3	3	I	TI
3	3	38	I	SI		4	2	I	Se
	4	41	I	TI		5	11	I	Te
	5	47	I	Se	20	2	33	I	OR
	6	49	I	Te	21	6	14	II	ED
4	4	11	I	OR	22	3	35	III	ED
	5	35	III	SI		5	22	III	ER
5	6	57	II	SI	23	3	46	II	Se
7	5	39	II	OR		3	49	II	TI
10	5	32	I	SI		6	7	II	Te
	6	38	I	TI	25	6	38	I	ED
11	6	8	I	OR	26	3	46	I	SI
12	3	15	I	Te		4	58	I	TI
14	3	40	II	ED		5	55	I	Se
15	4	22	III	OD	27	4	28	I	OR
	6	0	III	OR	30	3	58	II	SI
16	3	28	II	Te		6	20	II	Se
18	4	44	I	ED		6	27	II	TI

FEBRUARY

1	2	55	II	OR	16	5	19	III	SI
2	2	30	III	TI	17	3	6	II	Te
	3	58	III	Te	18	3	54	I	SI
	5	40	I	SI		5	7	I	TI
3	2	59	I	ED		6	3	I	Se
	6	22	I	OR	19	1	14	I	ED
4	2	17	I	Se		4	35	I	OR
	3	29	I	Te	20	1	43	I	Te
6	6	33	II	SI		1	52	III	OR
8	3	3	II	ER	22	5	49	II	ED
	3	13	II	OD	24	0	57	II	SI
	5	30	II	OR		3	18	II	Se
9	1	22	III	SI		3	22	II	TI
	3	7	III	Se		5	35	II	Te
	6	31	III	TI	25	5	47	I	SI
10	4	52	I	ED	26	3	7	I	ED
11	2	1	I	SI	27	0	16	I	SI
	3	15	I	TI		1	7	III	ER
	4	10	I	Se		1	26	I	TI
	5	22	I	Te		2	25	I	Se
12	2	44	I	OR		3	34	I	Te
15	3	14	II	ED		4	22	III	OD
	5	37	II	ER		5	39	III	OR
	5	47	II	OD	28	0	54	I	OR

MARCH

3	3	31	II	SI	13	4	2	I	SI
	5	49	II	TI		5	5	I	TI
	5	51	II	Se		23	39	II	Te
5	2	18	II	OR	14	1	21	I	ED
	5	0	I	ED		4	31	I	OR
6	2	9	I	SI		23	32	I	TI
	3	16	I	TI	15	0	40	I	Se
	3	18	III	ED		1	40	I	Te
	4	18	I	Se	17	1	27	III	TI
	5	4	III	ER		2	35	III	Te
	5	24	I	Te	19	2	53	II	ED
7	2	43	I	OR	20	23	49	II	TI
	23	51	I	Te	21	0	14	II	Se
12	0	17	II	ED		2	1	II	Te
	4	45	II	OR		3	14	I	ED

MARCH—*Continued*

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
22	0	24	I	SI	28	4	21	II	Te
	1	20	I	TI		5	7	I	ED
	2	33	I	Se	29	2	17	I	SI
	3	28	I	Te		3	7	I	TI
23	0	45	I	OR		4	27	I	Se
24	1	6	III	SI		5	14	I	Te
	2	50	III	Se		22	41	II	OR
	5	2	III	TI		23	36	I	ED
26	5	28	II	ED	30	2	31	I	OR
28	0	27	II	SI		22	55	I	Se
	2	9	II	TI		23	41	I	Te
	2	47	II	Se	31	5	4	III	SI

APRIL

3	22	21	III	OD	20	2	34	II	ED
	23	25	III	OR	21	2	27	I	SI
4	3	1	II	SI		2	48	I	TI
	4	27	II	TI		4	37	I	Se
	5	21	II	Se		21	24	II	SI
5	4	11	I	SI		22	5	II	TI
	4	53	I	TI		23	44	I	ED
6	1	1	II	OR		23	44	II	Se
	1	29	I	ED	22	0	18	II	Te
	4	17	I	OR		2	10	I	OR
	22	39	I	SI		20	56	I	SI
	23	19	I	TI		21	14	I	TI
7	0	49	I	Se		23	6	I	Se
	1	27	I	Te		23	23	I	Te
	22	43	I	OR	23	20	37	I	OR
10	23	6	III	ED	28	4	21	I	SI
11	0	51	III	ER		4	32	I	TI
	1	43	III	OD		20	55	III	SI
	2	47	III	OR		21	52	III	TI
12	23	58	II	ED		22	39	III	Se
13	3	19	II	OR		22	58	III	Te
	3	22	I	ED		23	58	II	SI
14	0	33	I	SI	29	0	19	II	TI
	1	4	I	TI		1	37	I	ED
	2	43	I	Se		2	17	II	Se
	3	12	I	Te		2	32	II	Te
	21	11	II	Se		3	55	I	OR
	21	50	I	ED		22	50	I	SI
	22	3	II	Te		22	58	I	TI
15	0	27	I	OR	30	1	0	I	Se
	21	12	I	Se		1	7	I	Te
	21	38	I	Te		20	6	I	ED
18	3	4	III	ED		21	1	II	OR
	4	49	III	ER		22	21	I	OR

MAY

6	0	53	III	SI	7	2	54	I	Se
	1	7	III	TI		21	2	II	OD
	2	16	III	Te		21	57	I	OD
	2	31	II	SI		23	27	II	ER
	2	32	II	TI	8	0	9	I	ER
	2	38	III	Se		21	17	I	Te
	3	31	I	OD		21	23	I	Se
7	0	42	I	TI	14	2	27	I	TI
	0	44	I	SI		2	39	I	SI
	2	51	I	Te		23	17	II	OD

MAY—*Continued*

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
14	23	40	I	OD	23	21	20	III	OD
15	2	3	I	ER		22	22	II	Te
	2	4	II	ER		22	25	I	ER
	20	53	I	TI		22	42	III	OR
	21	7	I	SI		22	54	III	ED
	23	1	I	Te		23	15	II	Se
	23	17	I	Se	24	0	40	III	ER
16	20	7	II	Te	30	0	23	I	TI
	20	31	I	ER		0	57	I	SI
	20	41	II	Se		2	32	I	Te
	20	42	III	ER		21	35	I	OD
22	1	24	I	OD		22	22	II	TI
	1	34	II	OD		23	30	II	SI
	22	37	I	TI	31	0	19	I	ER
	23	2	I	SI		0	38	II	Te
23	0	46	I	Te		0	38	III	OD
	1	12	I	Se		1	49	II	Se
	19	50	I	OD		2	4	III	OR
	20	6	II	TI		2	52	III	ED
	20	56	II	SI		20	58	I	Te
						21	35	I	Se

JUNE

1	20	36	II	ER	17	20	14	II	Se
6	2	9	I	TI		21	7	III	TI
	23	21	I	OD		22	43	III	Te
7	0	39	II	TI	18	0	46	III	SI
	2	4	II	SI	22	0	12	I	TI
	2	13	I	ER		1	10	I	SI
	20	36	I	TI		21	22	I	OD
	21	20	I	SI	23	0	5	II	OD
	22	45	I	Te		0	31	I	ER
	23	30	I	Se		20	48	I	Te
8	20	42	I	ER		21	48	I	Se
	23	14	II	ER	24	20	31	II	SI
10	20	47	III	SI		20	49	II	Te
	22	32	III	Se		22	49	II	Se
14	1	8	I	OD	25	0	38	III	TI
	22	23	I	TI	28	20	34	III	ER
	23	15	I	SI	29	23	11	I	OD
15	0	32	I	Te	30	20	29	I	TI
	1	25	I	Se		21	34	I	SI
	21	41	II	OD		22	38	I	Te
	22	36	I	ER		23	43	I	Se
16	1	51	II	ER					

JULY

1	20	54	I	ER	3	20	24	II	ER
	20	54	II	TI	5	22	46	III	ED
	23	5	II	SI	7	22	20	I	TI
	23	14	II	Te		23	29	I	SI

JULY—*Continued*

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
8	22	49	I	ER	16	23	18	II	ED
	23	20	II	TI	22	23	13	I	OD
9	20	7	I	Se	23	20	33	I	TI
10	20	37	II	OR		20	42	III	SI
	20	41	II	ED		21	48	I	SI
	23	1	II	ER		22	28	III	Se
12	21	49	III	OD		22	42	I	Te
	23	40	III	OR	24	21	7	I	ER
15	21	21	I	OD	26	19	58	II	Te
16	20	49	I	Te		20	8	II	SI
	22	2	I	Se		22	26	II	Se
	20	45	II	OD	30	21	23	III	Te
	23	9	II	OR		22	27	I	TI

AUGUST

1	20	21	I	Se	15	20	48	I	TI
2	20	10	II	TI	16	21	20	I	ER
	22	32	II	Te	17	19	33	III	OR
	22	44	II	SI	18	20	31	II	OD
4	20	10	II	ER	20	19	31	II	Se
7	21	30	I	OD	23	19	52	I	OD
8	20	8	I	SI	24	19	24	I	Te
	21	1	I	Te		20	35	I	Se
	22	16	I	Se	27	19	47	II	Te
10	13	30	III	ER		19	49	II	SI
11	20	16	II	OR	31	19	12	I	TI
	20	27	II	ED		20	21	I	SI

SEPTEMBER

1	19	39	I	ER	16	19	50	I	Te
3	20	7	II	TI	21	19	14	II	Se
4	20	36	III	SI	23	19	39	I	TI
5	19	54	II	ER	29	18	59	III	OD
11	20	11	III	TI					

OCTOBER

1	18	47	I	OD	10	18	11	I	ER
2	19	7	I	Se		18	22	III	Se
9	18	10	I	TI					

DECEMBER

23	6	13	II	Te	30	6	51	I	Se
30	6	41	II	TI					

METEORS AND SHOOTING STARS

On almost any clear night any one observing the sky for a few minutes will see one or more shooting stars. They are particularly numerous during the autumn months and on account of the rotation of the earth are better seen during the early morning hours than in the evening.

At certain times there are striking displays, located in particular portions of the sky. These are considered to be due to *meteor swarms*. The principal ones are given in the following table.

Name of Shower	Duration	Greatest Display	Radiant Point R.A.		Decl.	
			h	m	°	
Quadrantids	Dec. 28-Jan. 9	Jan. 3	15	20	+	53
Aurigids	Feb. 7-23	Feb. 10	5	0	+	41
Lyrids	April 16-22	April 21	18	4	+	33
η Aquarids	April 29-May 8	May 4-6	22	32	-	2
Herculids	May 13-29	May 24	16	36	+	30
Scorpiids	May-June-July	June 4	16	48	-	21
Sagittids	June-July	July 28	20	12	+	24
Capricornids	July-Aug.	July 22	20	20	-	12
δ Aquarids	July 18-Aug. 12	July 28-31	22	36	-	11
α β Perseids	July-Aug.-Sept.	Aug. 16	3	12	+	43
Perseids	July 8-Aug. 25	Aug. 11-12	3	4	+	57
Draconis	Aug. 18-25	Aug. 23	19	24	+	61
ϵ Perseids	Aug.-Sept.	Sept. 15	4	8	+	35
Arietids	Aug.-Sept.-Oct.	Sept. 21	2	4	+	19
	Sept.-Oct.	Oct. 15	2	4	+	9
Orionids	Oct. 9-29	Oct. 19	6	8	+	15
μ Ursids Maj.	Oct.-Nov.-Dec.	Nov. 16-25	10	16	+	41
Taurids	November	Nov. 21	4	12	+	23
Leonids	Nov. 9 20	Nov. 14-15	10	0	+	23
Andromedes	Nov. 20-30	Nov. 20-23	1	40	+	43
Geminids	Dec. 1-14	Dec. 11	7	12	+	33

Of these the chief ones are the Perseids, the Leonids and the Andromedes.

The Perseids furnish an annual display of considerable strength, and are perhaps the best known of all. The swarm appears to have an orbit identical with that of the great Comet 1862 III., the period of which is 120 years.

The Leonids follow in the orbit of Tempel's Comet of 1866, of period 33 years.

The Andromedes are thought to be remnants of Biela's Comet. They were especially numerous in 1872, 1885, 1898, but in recent years have not been so prominent.

The above table was prepared for the HANDBOOK by Mr. W. F. Denning, F.R.A.S., of Bristol, England; and for further interesting information regarding this subject (and almost any other subject in which the amateur is interested) reference may be made to his *Telescopic Work for Starlight Evenings*.

PRINCIPAL ELEMENTS OF THE SOLAR SYSTEM

Name	Mean Distance from Sun		Sidereal Period		Mean Diam't'r Miles	Mass	Density	Volume	Axial Rotation
	⊕ = 1	Millions of Miles	Mean Solar Days	Years		⊕ = 1	Water = 1	⊕ = 1	
☿ Mercury...	0.387	36.0	87.97	0.24	3030	0.0476	4.7(?)	0.056	88d
♀ Venus.....	0.723	67.2	224.70	0.62	7700	0.82	4.94	0.92	225d
⊕ Earth.....	1.000	92.9	365.26	1.00	7917.6	1.00	5.55	1.00	23h 56m 4s
♂ Mars.....	1.524	141.5	686.95	1.88	4230	0.108	3.92	0.152	24h 37m 23s
♃ Jupiter....	5.203	483.3	4332.58	11.86	86500	317.7	1.32	1309	9h 55m ±
♄ Saturn.....	9.539	886.0	10759.2	29.46	73000	94.8	0.72	760	10h 14m ±
♅ Uranus....	19.183	1781.9	30686.8	84.02	31900	14.6	1.22	65	10h 45m ±
♆ Neptune...	30.055	2971.6	60181.1	164.78	34800	17.0	1.11	85	?
☉ Sun.....	....	....	....	....	866400	332000	1.39	1300000	25d 7h 48m ±
☾ Moon.....	From ⊕ 238,840 mls		27.32	0.075	2163	1/81.5	3.39	0.020	27d 7h 43m

SATELLITES OF THE SOLAR SYSTEM

Name	Stellar Magnitude.	Mean Distance in Miles	Sidereal Period d. h. m. s.	Discoverer	Date
THE EARTH					
The Moon..	..	238,840	27 7 43 11		
MARS					
1. Phobos.....	14	5,850	7 39 15	Asaph Hall....	Aug. 17, 1877
2. Deimos....	13	14,650	1 6 17 54	Asaph Hall....	Aug. 11, 1877
JUPITER					
5. (Nameless).	13	112,500	11 57 23	Barnard.....	Sept. 9, 1892
1. Io.....	6½	261,000	1 18 27 33	Galileo.....	Jan. 7, 1610
2. Europa....	6½	415,000	3 13 13 42	Galileo.....	Jan. 8, 1610
3. Ganymede.	6	664,000	7 3 42 33	Galileo.....	Jan. 7, 1610
4. Callisto....	7	1,167,000	16 16 32 11	Galileo.....	Jan. 7, 1610
6. (Nameless).	14	7,372,000	266·00 d.	Perrine	Dec. 1904
7. (Nameless).	16	7,567,900	276·67 d.	Perrine	Jan. 1905
8. (Nameless).	17	15,600,000	789 d.	Melotte.....	Jan. 1908
9. (Nameless).	19	18,900,000	3 years	Nicholson.....	July 1914
SATURN					
1. Mimas.....	15	117,000	22 37 6	W. Herschel...	July 18, 1789
2. Enceladus..	14	157,000	1 8 53 7	W. Herschel...	Aug. 29, 1789
3. Tethys.....	11	186,000	1 21 18 26	J. D. Cassini...	Mar. 21, 1684
4. Dione.....	11	238,000	2 17 41 9	J. D. Cassini...	Mar. 21, 1684
5. Rhea.....	10	332,000	4 12 25 12	J. D. Cassini...	Dec. 23, 1672
6. Titan.....	9	771,000	15 22 41 23	Huygens.....	Mar. 25, 1655
7. Hyperion...	16	934,000	21 6 39 27	G. P. Bond....	Sept. 16, 1848
8. Iapetus....	11	2,225,000	79 7 54 17	J. D. Cassini...	Oct. 25, 1671
9. Phoebe.....	17	8,000,000	546.5 d.	W.H.Pickering	1898
10. Themis.....	17	906,000	20 20 24 0	W.H.Pickering	1905
URANUS					
1. Ariel.....	15	120,000	2 12 29 21	Lassell.....	Oct. 24, 1851
2. Umbriel....	16	167,000	4 3 27 37	Lassell.....	Oct 24, 1851
3. Titania.....	13	273,000	8 16 56 29	W. Herschel...	Jan 11, 1787
4. Oberon.....	14	365,000	13 11 7 6	W. Herschel...	Jan. 11, 1787
NEPTUNE					
1. (Nameless).	13	221,500	5 21 2 44	Lassell.....	Oct. 10, 1846

DOUBLE STARS

Close scrutiny of the sky reveals the fact that many of the stars are composed of two or more components, that is, they are *double* or *multiple* stars. Over 15,000 such objects have been discovered.

A star may appear double in two ways. First, one may just happen to be nearly in line with the other as seen from the earth. Second, the two bodies may be physically connected, each revolving about their common centre of gravity. The former are called *optical doubles*, the latter *binary stars*. In the course of time the binaries exhibit a change in the distance between the components and also in the direction of the line joining them, that is, in the position angle.

While the close pairs require a large instrument for their detection, there are many within the range of small instruments. Such observations also allow one to determine the quality of the instrument employed. It has been found that a telescope having an objective 1 inch in diameter should be able to distinguish two stars 4″.56 apart, and the resolving power is inversely proportional to the diameter of the objective. Thus a telescope of 3-inch aperture should separate stars 1/3 of 4″.56, or 1″.52 apart; for one of aperture 10 inches, stars 1/10 of 4″.56, or 0″.45 apart should be seen separate; and so on. With the Yerkes refractor, of aperture 40 inches, a double star with distance 0″.11 can be detected.

In choosing a double star for testing a telescope care should be taken not to select a binary, with varying distance between its components.

The stars in the following short lists can be identified from almost any star atlas, and observation of them will prove of great interest to the amateur.

I. THE MOST LUMINOUS PAIRS

Star	Mags.	Dist. ″	Star	Mags.	Dist. ″
Mizar....	2.4, 4.0	14.5	γ Leonis....	2.5, 4.0	3.0
Castor...	2.5, 3.0	5.6	β Scorpii...	2.5, 5.5	13.0
γ Virginis.	3.0, 3.2	5.0	θ Serpentis.	4.4, 6.0	21.0
γ Arietis...	4.2, 4.5	8.9	44*i* Boötis....	5.0, 6.0	4.8
ζ Aquarii..	3.5, 4.4	3.5	π Boötis....	4.3, 6.0	6.0

II. THE FINEST COLORED PAIRS

Star	Magnitudes	Distance ″	Colors
γ Andromedæ..	2.2, 5.5	10	Orange, Green.
α CanumVenat.	3.2, 5.7	20	Golden, Lilac.
β Cygni.....	3.3, 5.5	34	Golden, Sapphire.
ε Boötis.....	2.4, 6.5	2.9	Golden, Sapphire.
95 Herculis.....	5.5, 5.8	6	Golden, Azure.
α Herculis.....	4, 5.5	4.7	Ruby, Emerald.
γ Delphini.....	3.4, 5	11	Golden, Bluish Green.
32 Eridani.....	4.7, 7	6.7	Topaz, Bright Green.
ε Hydræ.....	3.5, 7.5	3.5	Yellow, Blue.
ζ Lyræ.....	4.5, 5.5	44	Yellow, Green.
ι Cancri.....	4.5, 5	30	Pale Orange, Blue.
ο Cygni.....	4.3, 7.5, 5.5	337.8, 106.8	Yellow, Blue.
24 Coma Beren..	5.6, 7	21	Orange, Lilac.
ο Cephei.....	5.4, 8	2.5	Golden, Azure.
94 Aquarii.....	5.5, 7.5	11	Rose, Greenish.
39 Ophiuchi.....	5.7, 7.5	12	Yellow, Blue.
41 Aquarii.....	5.8, 8.5	4.8	Yellow Topaz, Blue.
2 Canum Venat	6, 9	11	Golden, Azure
52 Cygni.....	4.6, 9	7	Orange, Blue.
55 Piscium.....	6, 9	6	Orange, Blue.
κ Geminorum..	3.8, 9	9	Orange, Blue.
ρ Orionis.....	5.1, 9	6.8	Orange, Blue.
54 Hydræ.....	5.2, 8	9	Yellow, Violet.
η Persei.....	4.2, 8.5	28	Yellow, Blue.
φ Draconis.....	4.8, 6	31	Yellow, Lilac.
ο Draconis.....	4.7, 8.5	32	Golden, Lilac.
η Cassiopeiæ...	4.7, 7	5.7	Golden, Purple.
23 Orionis.....	5.4, 7	32	White, Blue.
δ Herculis.....	3.6, 8	18	White, Violet.
ο Capricorni...	6.3, 7	22	Bluish.
17 Virginis.....	6.5, 7	20	Rose.
ξ Boötis.....	4.5, 6.5	4.2	Reddish Yellow.

The colors given above are according to Flammarion. For slight variations and also for a much longer list consult Webb's "Celestial Objects."

VARIABLE STARS

The study of variable stars is especially suited to amateur observers. In it they can make observations of permanent scientific value, since all the brighter and more interesting objects are within the range of modest instruments. An ordinary field glass or a small telescope is all that is required.

In recent years there has been organized the American Association of Variable Star Observers, with a working membership of about 70, and reports of observations are published monthly in *Popular Astronomy*. The recording secretary is Howard O. Eaton, 428 Lake St., Madison, Wis., and additional observers are desired.

The *novae* or "new" stars comprise one class of variables, and all the recent brighter objects of this sort have been discovered by amateurs. The long-period variable Omicron Ceti, or *Mira*, was discovered by Fabricius in 1596, while Algol, the best-known variable of short-period, was discovered by Goodricke, a deaf mute, in 1783.

Several attempts have been made to classify the variable stars; but a scientific system of classification, in harmony with the chief deductions of theory as well as the facts of observation, is still wanting. The best known system is that formulated by Professor E. C. Pickering in 1880, and reproduced (with slight additions) in his "Provisional Catalogue of Variable Stars" (1903). This includes five classes, two of which are subdivided, as follows:—

	EXAMPLES
I. New or temporary stars	Nova, 1572
II. Variables of long period:	
a. Ordinary stars of this class ... *o*	Ceti
b. Stars subject to "occasional sudden and irregular outbursts of light which gradually diminishes"	U Geminorum
III. "Variables of small range or irregular variation, according to laws as yet unknown" ... *a*	Orionis
IV. Variables of short period:	
a. "Ordinary" cases ... δ	Cephei
b. Stars with "minima successively bright and faint" ... β	Lyræ
V. Stars of the Algol type ... β	Persei

Name	Limiting Mags.	Period			Class	Discoverer	
		d.	h.	m.			
U Cephei	7.0– 9.2	2	11	49.6	V.	W. Ceraski	1880
o Ceti	1.7– 9.5	331.7			II.	Fabricius	1596
ρ Persei	3.4– 4.2		Irr.		III.	Schmidt	1854
6.1904 Cephei	8.6– 9.1	32.3			V.	Blajko	1904
β Persei (Algol)	2.1– 3.2	2	20	48.9	V.	Montanari	1669
λ Tauri	3.3– 4.2	3	22	52.2	V.	Baxendell	1848
W Eridani	8.1–<12.5	369			II.	Fleming	1898
RW Tauri	8–11	2	18	27.2	V.	Fleming	1905
R Leporis	6–8 ?	436.1			II.	Schmidt	1855
α Orionis	1– 1.4		Irr.		III.	J. Herschel	1840
U Orionis	5.8–12.3	375			II.	Gore	1885
η Geminorum	3.2– 4.2	231.4			III.	Schmidt	1865
T Monocerotis	5.7– 6.8	27.0			IV.	Gould	1871
ζ Geminorum	3.8– 4.3	10	3	41.5	IV.	Schmidt	1847
R Geminorum	6.6–13.3	370.2			II.	Hind	1848
R Canis Maj	5.7– 6.3	1	3	15.8	V.	Sawyer	1887
S Cancri	8.0–10.2	9	11	37.8	V.	Hind	1848
S Antliæ	6.3– 6.8	0	7	46.8	IV.	Paul	1888
W Ursæ Maj	7.9– 8.6	0	4	0.2	V.?	Müller & Kempf	1903
R Leonis	4.6–10.5	312.8			II.	Koch	1782
R Hydræ	3.5– 9.7	425.1			II.	Montanari	1670
δ Libræ	5.0– 6.2	2	7	51.4	V.	Schmidt	1859
α Herculis	3.1– 3.9		Irr.		III.	W. Herschel	1795
U Ophiuchi	6.0– 6.7	0	20	7.7	V.	Gould	1871
X Sagittarii	4.4– 5.4	7	0	17.1	IV.	Schmidt	1866
R Scuti	4.8– 7.8	Irr.			III.	Pigott	1795
β Lyræ	3.4– 4.1	12	21	59.2	IV.	Goodricke	1784
χ Cygni	4.5–13.5	406.0			II.	Kirch	1686
η Aquilæ	3.7– 4.5	7	4	14.0	IV.	Pigott	1784
S Sagittæ	5.5– 6.1	8	9	11.8	IV.	Gore	1885
14.1904 Cygni	10.7–11.6	0	3	14.2	IV.	Ceraski	1904
Y Cygni	7.1– 7.9	1	11	57.5	V.	Chandler	1886
δ Cephei	3.7– 4.6	5	8	47.7	IV.	Goodricke	1784
U Pegasi	9.3– 9.9	0	8	59.7	IV.	Chandler	1894

THE DISTANCES OF THE STARS

The measurement of the distances of the stars is one of the most important problems in astronomy. Without such information it is impossible to form any idea as to the magnitude of our universe or the distribution of the various bodies in it.

The parallax of a star is the apparent change of position in the sky which the star would exhibit as one would pass from the sun to the earth at a time when the line joining earth to sun is at right angles to the line drawn to the star; or, more accurately, it is the angle subtended by the semi-major axis of the earth's orbit when viewed perpendicularly from the star. Knowing the parallax, the distance can be deduced at once.

For many years attempts were made to measure stellar parallaxes, but without success. The angle to be measured is so exceedingly small that it was lost in the unavoidable instrumental and other errors of observation. The first satisfactory results were obtained by Bessel, who in 1838, by means of a heliometer, succeeded in determining the parallax of 61 Cygni, a 6th magnitude star with a proper motion of 5″ a year. On account of this large motion the star was thought to be comparatively near to us, and such proved to be the case. At about the same time Henderson, at the Cape of Good Hope, from meridian-circle observations, deduced the parallax of Alpha Centauri to be 0″.75. For a long time this was considered to be the nearest of all the stars in the sky, but in 1913 Innes, director of the Union Observatory, Johannesburg, South Africa, discovered a small 11th mag. star, 2° 13′ from Alpha Centauri, with a large proper motion, and which proved to have a parallax of 0″.78. Its brightness is only 1/20,000 that of Alpha Centauri and the mass of the body is the least known. In 1916 Barnard discovered an 11th mag. star in Ophiuchus with a proper motion of 10″ per year, the greatest on record, and its parallax is about 0″.6. It is believed to be next to Alpha Centauri in distance from us.

The distances of the stars are so enormous that a very large unit has to be chosen to express them. The one generally used is the light-year, that is, the distance travelled by light in a year, or 186,000x60x60x24x365¼ miles. A star whose parallax is 1″ is distant 3.26 light years; if the parallax is 0″.1, the distance is 32.6 l.-y.; if the parallax is 0″.27 the distance is 3.26÷.27 = 12 l.-y. In other words, the distance is inversely proportional to the parallax. In recent years the word *parsec* has been introduced to express the distances of the stars. A star whose distance is 1 parsec is such that its *par*-allax is 1 *sec*-ond. Thus 1 parsec is equivalent to 3.26 l.-y., 10 parsecs = 32.6 l.-y., etc.

In later times much attention has been given to the determination of parallaxes, chiefly by means of photography, and now several hundred are known with tolerable accuracy.

The following list, prepared by Mr. J. A. Pearce, gives some of the latest values obtained.

Name	R.A. (1900)		Decl. (1900)		Vis. Mag. Harvard	Parallax	Distance Light Years
	h	m	′	″		″	
Prox. Cen	14	22.9	−62	15	10.5	0.802	4.06
* αCentauri	14	32.8	−60	25	0.33	.759	4.30
Barnard	17	52.9	+ 4	28	9.67	.533	6.12
Lal. 21185	10	57.9	+36	38	7.60	.403	8.09
* αCan. Maj	6	40.7	−16	35	−1.58	.376	8.67
Innes	11	12.0	−57	2	(12)	.339	9.62
C.Z. 5h 243	5	7.7	−44	59	8.3	.319	10.22
τCeti	1	39.4	−16	28	3.65	.318	10.25
* αCan. Min	7	34.1	+ 5	29	0.48	.312	10.45
εErid	3	28.2	− 9	48	3.81	.311	10.48
*61 Cygni	21	2.4	+38	15	5.57	.306	10.65
Lac. 9352	22	59.4	−36	26	7.44	.292	11.16
* Σ2398	18	41.8	+59	29	9.33	.287	11.36
εIndi	21	55.7	−57	12	4.74	.284	11.48
* Groom. 34	0	12.5	+43	27	7.98	.281	11.60
* Krüger 60	22	24.5	+57	12	9.64	.262	12.44
Lac. 8760	21	11.4	−39	15	6.65	.251	12.99
Oe. Arg. 17415-6	17	37.0	+68	26	9.2	.247	13.20
Van Maanen	0	43.9	+ 4	55	12.3	.246	13.25
Gould 32416	23	59.5	−37	51	8.5	.203	15.87
αAquilae	19	45.9	+ 8	36	0.89	.200	16.30
O^2 Erid	4	10.7	− 7	49	4.48	.198	16.5
*70 Oph	18	10.4	+ 2	31	4.28	.192	17.0
Cordoba 32416	23	59.5	−37	51	8.3	.191	17.1
+HR 7703	20	4.6	−36	21	5.34	.190	17.2
* ηCassiop	0	43.0	+57	17	3.64	.184	17.7
Alb. 8164	23	44.0	+ 1	52	8.7	.183	17.8
σDrac	19	32.6	+69	29	4.78	.182	17.9
HR 8832	23	8.5	+56	37	5.65	.177	18.4
* HR 6416	17	11.5	−46	32	5.58	.175	18.6
* A Oph	17	9.2	−26	27	5.29	.174	18.7
* HR 6426	17	12.1	−34	53	5.89	.170	19.2
*e*Erid	3	15.9	−43	27	4.30	.152	21.5
* ξUrs. Maj	11	12.9	+32	6	4.41	.150	21.7
δErid	3	38.5	−10	6	3.72	.142	23.0
* αLyrae	18	33.6	+38	41	0.14	.134	24.3
βHydri	0	20.5	−77	49	2.90	.133	24.5
αPis. Aus	22	52.1	−30	9	1.29	.128	25.5
χDrac	18	22.9	+72	41	3.69	.127	25.7
* ζHerc	16	37.5	+31	47	3.00	.116	28.1
* μHerc	17	42.5	+27	47	3.48	.116	28.1
βLeonis	11	44.0	+15	8	2.23	.109	29.9
αBootis	14	11.1	+19	42	0.24	.105	31.1
βVirg	11	45.5	+ 2	20	3.80	.105	31.1
βCan. Ven	12	29.0	+41	54	4.32	.104	31.4
* 85 Peg	23	56.8	+26	34	5.85	.101	32.3
βGemin	7	39.2	+28	16	1.21	.095	34.3
αTauri	4	30.2	+16	18	1.06	.064	50.9
* αAurigae	5	9.3	+45	54	0.21	.063	51.8
αLeonis	10	3.0	+12	27	1.34	.045	72.5
αErid	1	34.0	−57	45	0.60	.041	79.5
* αUrs. Min	1	22.6	+88	46	2.12	.041	79.5
βCentauri	13	56.8	−59	53	0.86	.027	120.7
αOrionis	5	49.8	+ 7	23	0.92	.022	148.2
αScorp	16	23.3	−26	13	1.22	.019	171.6
αCygni	20	38.0	+44	35	1.33	.012	271.7
αCarinae	6	21.7	−52	38	−0.86	.007	465.7

*Double or multiple star; magnitude of brighter component given.

GEOGRAPHICAL POSITIONS OF SOME POINTS IN CANADA

Name	Latitude N.			Longitude W.			Feet above Sea Level
	°	′	″	°	′	″	
Banff, Alta	51	10		115	35		4542
Barrie, Ont	44	23		79	41		839
Battleford, Sask	52	41		108	20		1620
Brandon, Man	49	51		99	57		1176
Calgary, Alta	51	02	39.21	7	36	15.1	3428
Charlottetown, P.E.I	46	14		63	10		38
Collingwood, Ont	44	30		80	15		595
Edmonton, Alta	53	31	58.81	113	30	27.0	2188
Father Point, Que	48	31		68	19		20
Fort Churchill	58	51		94	11		....
Fort Simpson	61	52		121	43		....
Fredericton, N.B	45	57		66	36		164
Golden, B.C	51	16		116	55		2550
Gravenhurst, Ont	44	54		79	20		770
Guelph, Ont	43	32	43.7	80	15	09.0	1063
Halifax, N.S	44	39		63	36		97
Hamilton, Ont	43	16		79	54		303
Herschel Is	69	30		139.	15		....
Kingston, Ont	44	13		76	29		285
London, Ont	42	59		81	13		808
Medicine Hat	50	1		110	37		2161
Moncton, N.B	46	9		64	45		50
Montreal Que	45	30	17.0	73	34	39.45	187
New Westminster, B.C	49	13		122	54		330
No. West River, Ungava	53	31	31.45	60	10	17.85	....
Ottawa, Ont	45	23	38	75	42	58.20	273.4
Owen Sound, Ont	44	33	56.42	80	56	40.5	585
Peterborough, Ont	44	17		78	19		722
Portage la Prairie, Man	49	58		98	17		830
Port Simpson, B.C	54	34		130	26		26
Prince Albert, Sask	53	10		106	0		1432
Quebec, Que	46	48		71	13		296
Regina, Sask	50	27		104	37		1885
Revelstoke, B.C	51	00	11.25	7	52	49.8	1503
Rose Point, Ont	45	19	00.73	80	02	28.5	602
St. Catharines, Ont	43	10		79	17		347
St. John, N.B	45	17		66	4		70
St. Johns, Nfd	47	34		52	42		125
Stratford, Ont	43	23		81	00		1191
Toronto, Ont	43	39	35.9	79	23	39.75	350
Vancouver, B.C	49	17	48.0	123	07	05.52	11
Victoria, B.C	48	25	31.38	123	21	42.0	55
Windsor, Ont	42	20		83	4		625
Winnipeg, Man	49	53	51.53	97	08	28.53	751
York Factory	57	00		92	28		55

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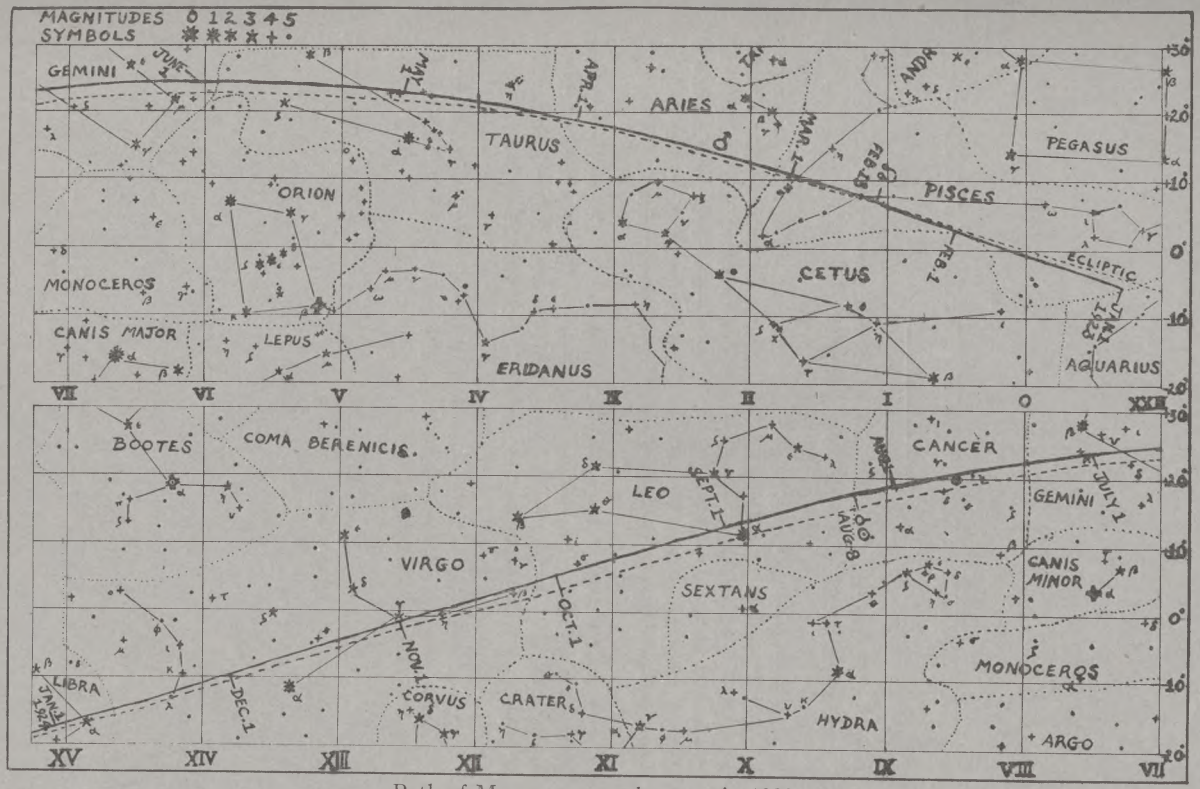

Path of Mars amongst the stars in 1923

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

The Library and the offices of the General Secretary and the General Treasurer are at 198 College Street, Toronto.

Ordinary meetings are held in Toronto in the Physics Building on alternate Tuesdays, beginning in September and continuing to the end of May. In addition, ordinary meetings are at present held at Montreal, Ottawa, Winnipeg and Victoria. The Society also has organizations at Guelph, Hamilton, Peterborough and Regina, but during the war the meetings were discontinued and have not yet been revived.

The Society publishes a monthly JOURNAL, containing each year about 500 pages of interesting articles, and a yearly HANDBOOK of 64 pages, containing information for the amateur observer. Subscription, $2.00 a year; single copies of the JOURNAL or HANDBOOK, 25 cents.

Membership in the Society is open to anyone interested in Astronomy and many more members are desired. The annual fee of $2.00 includes subscription to the publications.

For further information apply to the General Secretary, Mr. A. F. Hunter, M.A., at the above address.