THE OBSERVER'S HANDBOOK FOR 1930

PUBLISHED BY

The Royal Astronomical Society of Canada

EDITED BY C. A. CHANT

TWENTY-SECOND YEAR OF PUBLICATION

TORONTO
198 COLLEGE STREET
PRINTED FOR THE SOCIETY
1930

1930 CALENDAR 1930

JANUARY						
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	..	

FEBRUARY						
Sun.	. .	2	9	16	23	
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	..	

MARCH						
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	..

APRIL						
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	..	
Fri.	. . 4	11	18	25	..	
Sat.	. 5	12	19	26	..	

MAY						
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	

JUNE						
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	..	

JULY						
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	..	

AUGUST						
Sun.	. 3	10	17	24	31	
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	..

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

OCTOBER						
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	..	

NOVEMBER						
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	..

DECEMBER						
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	..	

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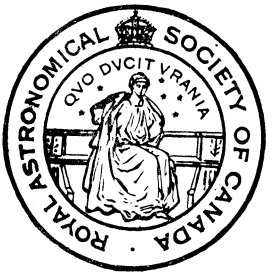

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CONTENTS

PREFACE

The present issue of the HANDBOOK is similar to those of recent past years. The chief improvement this year is a new table of "Distances of the Stars" (p. 61).

It may be stated that four circular star-maps, 9 inches in diameter, roughly for the four seasons, may be obtained from the Director of University Extension, University of Toronto, for one cent each; also a set of 12 circular maps, 5 inches in diameter, with brief explanation, is supplied by *Popular Astronomy*, Northfield, Minn., for 15 cents. Besides these may be mentioned Young's *Uranography*, containing four maps with R.A. and Decl. circles and excellent descriptions of the constellations, price 72 cents; Norton's *Star Atlas and Telescopic Handbook* (10*s.* 6*d.*); Olcott's *A Field-book of the Stars* ($1.50); McKready's *A Beginner's Star Book* ($5.00).

In the preparation of this HANDBOOK the Editor has received great assistance from Miss M. S. Burland, Mr. R. M. Motherwell and Dr. R. J. McDiarmid, of the Dominion Observatory, Ottawa; Mr. J. A. Pearce, of the Dominion Astrophysical Observatory, Victoria, B.C.; and his colleague, Dr. R. K. Young, of the University of Toronto.

The mimima of Algol have been computed from an observation by Stebbins (*Ap. J.*, vol. 53, 1921), J.D. 2422619.7866 with the period 2.86731077, given by Hellerick (*A.N.*, vol. 209, p. 227, 1919).

TORONTO, December, 1929. THE EDITOR.

ANNIVERSARIES AND FESTIVALS, 1930

New Year's Day	Wed.,	Jan. 1
Epiphany	Mon.,	Jan. 6
Septuagesima Sunday		Feb. 16
St. David	Sat.,	Mar. 1
Quinquagesima (Shrove Sunday)		Mar. 2
Ash Wednesday		Mar. 5
Quadragesima (First Sunday in Lent)		Mar. 9
St. Patrick	Mon.,	Mar. 17
Annunciation (Lady Day)	Tues.,	Mar. 25
Palm Sunday		Apr. 13
Good Friday		Apr. 18
Easter Sunday		Apr. 20
St. George	Wed.,	Apr. 23
Accession of King George V, (1910)		May 6
Empire (Victoria) Day	Sat.,	May 24
Rogation Sunday		May 25
Birthday of Queen Mary, (1867)		May 26
Ascension Day	Thur.,	May 29
Birthday of King George (1865)		June 3
Whit Sunday (Pentecost)		June 8
Trinity Sunday		June 15
Corpus Christi	Thur.,	June 19
Birthday of Prince of Wales (1894)		June 23
St. John Baptist (Mid-summer Day)		June 24
Dominion Day	Tues.,	July 1
Labour Day	Mon.,	Sept. 1
Hebrew New Year (Rosh Hashanah) (5691)	Tues.,	Sept. 23
St. Michael (Michaelmas Day)	Mon.,	Sept. 29
All Saints' Day	Sat.,	Nov. 1
Armistice Day (Thanks-giving)		Nov. 11
St. Andrew	Sun.,	Nov. 30
First Sunday in Advent	Sun.,	Nov. 30
Queen Alexandria (1844-1925)	Mon.,	Dec. 21
Christmas Day	Thur.,	Dec. 25

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.

1930 EPHEMERIS OF THE SUN AT 0h GREENWICH CIVIL TIME

Date	Apparent R.A.	Equation of Time	Apparent Decl.
	h m s	m s	° ′ ″
Jan. 1	18 42 54	+ 3 13.5	−23 05 02
" 4	18 56 08	+ 4 38.2	−22 49 22
" 7	19 09 19	+ 5 59.2	−22 29 38
" 10	19 22 26	+ 7 16.0	−22 05 54
" 13	19 35 27	+ 8 27.5	−21 38 17
" 16	19 48 22	+ 9 33.5	−21 06 55
" 19	20 01 12	+10 33.4	−20 31 55
" 22	20 13 55	+11 27.0	−19 53 25
" 25	20 26 32	+12 13.9	−19 11 35
" 28	20 39 01	+12 53.8	−18 26 33
" 31	20 51 24	+13 26.4	−17 38 32
Feb. 3	21 03 39	+13 51.7	−16 47 41
" 6	21 15 46	+14 09.4	−15 54 11
" 9	21 27 46	+14 19.7	−14 58 16
" 12	21 39 39	+14 22.7	−14 00 05
" 15	21 51 24	+14 18.7	−12 59 50
" 18	22 03 04	+14 08.2	−11 57 42
" 21	22 14 37	+13 51.6	−10 53 50
" 24	22 26 04	+13 29.2	− 9 48 26
" 27	22 37 26	+13 01.4	− 8 41 42
Mar. 2	22 48 43	+12 28.5	− 7 33 47
" 5	22 59 55	+11 51.1	− 6 24 54
" 8	23 11 03	+11 09.5	− 5 15 13
" 11	23 22 07	+10 24.2	− 4 04 56
" 14	23 33 08	+ 9 35.7	− 2 54 13
" 17	23 44 07	+ 8 44.8	− 1 43 14
" 20	23 55 04	+ 7 52.0	− 0 32 06
" 23	0 06 00	+ 6 58.0	+ 0 38 59
" 26	0 16 55	+ 6 03.3	+ 1 49 53
" 29	0 27 49	+ 5 08.4	+ 3 00 26

Date	Apparent R.A.	Equation of Time	Apparent Decl.
	h m s	m s	° ′ ″
Apr. 1	0 38 45	+ 4 13.9	+ 4 10 27
" 4	0 49 40	+ 3 20.2	+ 5 19 46
" 7	1 00 37	+ 2 27.6	+ 6 28 15
" 10	1 11 36	+ 1 36.6	+ 7 35 42
" 13	1 22 37	+ 0 47.9	+ 8 41 58
" 16	1 33 41	+ 0 01.9	+ 9 46 57
" 19	1 44 48	− 0 40.8	+10 50 29
" 22	1 55 58	− 1 19.9	+11 52 26
" 25	2 07 13	− 1 54.8	+12 52 38
" 28	2 18 32	− 2 25.4	+13 50 57
May 1	2 29 56	− 2 51.4	+14 47 13
" 4	2 41 24	− 3 12.7	+15 41 17
" 7	2 52 57	− 3 29.2	+16 33 00
" 10	3 04 35	− 3 40.8	+17 22 14
" 13	3 16 19	− 3 47.4	+18 08 50
" 16	3 28 07	− 3 48.7	+18 52 42
" 19	3 40 00	− 3 44.9	+19 33 43
" 22	3 51 59	− 3 35.9	+20 11 46
" 25	4 04 03	− 3 22.0	+20 46 43
" 28	4 16 11	− 3 03.4	+21 18 27
" 31	4 28 23	− 2 40.4	+21 46 52
June 3	4 40 40	− 2 13.8	+22 11 53
" 6	4 52 59	− 1 43.9	+22 33 24
" 9	5 05 22	− 1 11.1	+22 51 22
" 12	5 17 47	− 0 36.1	+23 05 43
" 15	5 30 13	+ 0 00.9	+23 16 25
" 18	5 42 41	+ 0 39.2	+23 23 26
" 21	5 55 10	+ 1 18.3	+23 26 44
" 24	6 07 39	+ 1 57.5	+23 26 20
" 27	6 20 07	+ 2 36.2	+23 22 12
" 30	6 32 34	+ 3 13.7	+23 14 21

1930 EPHEMERIS OF THE SUN AT 0h GREENWICH CIVIL TIME

Date	Apparent R.A.	Equation of Time	Apparent Decl.
	h m s	m s	° ′ ″
July 3	6 44 59	+ 3 49.0	+23 02 51
" 6	6 57 22	+ 4 21.7	+22 47 43
" 9	7 09 41	+ 4 51.2	+22 29 02
" 12	7 21 57	+ 5 17.2	+22 06 51
" 15	7 34 08	+ 5 39.2	+21 41 16
" 18	7 46 16	+ 5 56.9	+21 12 20
" 21	7 58 18	+ 6 10.0	+20 40 10
" 24	8 10 16	+ 6 18.4	+20 04 52
" 27	8 22 09	+ 6 21.5	+19 26 32
" 30	8 33 57	+ 6 19.3	+18 45 17
Aug. 2	8 45 39	+ 6 11.5	+18 01 17
" 5	8 57 15	+ 5 58.0	+17 14 38
" 8	9 08 45	+ 5 39.1	+16 25 29
" 11	9 20 11	+ 5 14.8	+15 33 58
" 14	9 31 31	+ 4 45.4	+14 40 12
" 17	9 42 47	+ 4 11.1	+13 44 19
" 20	9 53 57	+ 3 32.4	+12 46 28
" 23	10 05 04	+ 2 49.4	+11 46 46
" 26	10 16 07	+ 2 02.4	+10 45 22
" 29	10 27 06	+ 1 11.6	+ 9 42 27
Sept. 1	10 38 01	+ 0 17.5	+ 8 38 09
" 4	10 48 54	− 0 39.6	+ 7 32 38
" 7	10 59 44	− 1 39.2	+ 6 26 01
" 10	11 10 32	− 2 40.7	+ 5 18 27
" 13	11 21 19	− 3 43.5	+ 4 10 05
" 16	11 32 05	− 4 47.1	+ 3 01 02
" 19	11 42 51	− 5 50.8	+ 1 51 28
" 22	11 53 37	− 6 54.2	+ 0 41 30
" 25	12 04 24	− 7 56.8	− 0 28 40
" 28	12 15 13	− 8 58.2	− 1 38 53
Oct. 1	12 26 03	− 9 57.8	− 2 48 58
" 4	12 36 55	−10 55 2	− 3 58 47
" 7	12 47 50	−11 49.7	− 5 08 10
" 10	12 58 49	−12 40.7	− 6 16 58
" 13	13 09 51	−13 27.6	− 7 25 02
" 16	13 20 59	−14 09.8	− 8 32 12
" 19	13 32 12	−14 46.8	− 9 38 19
" 22	13 43 30	−15 18.2	−10 43 10
" 25	13 54 54	−15 43.6	−11 46 36
" 28	14 06 24	−16 02.8	−12 48 24
" 31	14 18 01	−16 15.5	−13 48 23
Nov. 3	14 29 45	−16 21.3	−14 46 23
" 6	14 41 36	−16 19.9	−15 42 13
" 9	14 53 35	−16 11.1	−16 35 43
" 12	15 05 41	−15 54.6	−17 26 42
" 15	15 17 55	−15 30.3	−18 15 00
" 18	15 30 17	−14 58.2	−19 00 26
" 21	15 42 46	−14 18.5	−19 42 49
" 24	15 55 23	−13 31.5	−20 21 58
" 27	16 08 06	−12 37.7	−20 57 44
" 30	16 20 56	−11 37.3	−21 29 57
Dec. 3	16 33 52	−10 30.9	−21 58 29
" 6	16 46 54	− 9 19.1	−22 23 13
" 9	17 00 00	− 8 02.3	−22 44 02
" 12	17 13 11	− 6 41.2	−23 00 51
" 15	17 26 26	− 5 16.5	−23 13 34
" 18	17 39 43	− 3 49.0	−23 22 07
" 21	17 53 02	− 2 19.8	−23 26 27
" 24	18 06 21	− 0 49.8	−23 26 33
" 27	18 19 41	+ 0 39.9	−23 22 24
" 30	18 32 59	+ 2 08.4	−23 14 02

To obtain the R.A. of Mean Sun, subtract the Equation of Time from the Right Ascension; adding 12h to this gives the Sidereal Time at 0h G.C.T.

In the Equation of Time the Sign + means the watch is faster than the Sun, − that it is slower. To obtain the 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, 1930

The following list of occultations was prepared for Ottawa and contains no stars fainter than magnitude 4.5. Anyone who has not observed an occultation or eclipse of a star by the moon should plan to do so. It is a striking phenomenon, especially when the immersion occurs at the dark limb of the moon, although an emersion at the dark limb is not without its thrill as the star suddenly pops into view apparently from out the depths of space. From new moon to full moon the immersion occurs at the dark limb and from full moon to new moon the emersion occurs at the dark limb. In the accompanying list the letter *d* after the position angle indicates that that particular phenomenon occurs at the dark limb.

The graphical method of the late Wm. F. Rigge has been used in these predictions and the time is correct within a minute for all central occultations, but in the case of a grazing occultation the error is likely to be quite large.

75th MERIDIAN CIVIL TIME

Date	Star	Mag.	Immersion*		Position Angle	Emersion*		Position Angle
1930			h	m	°	h	m	°
Jan. 8	*o* Piscium	4.5	20	29	356 d	21	05	293
June 10	σ Scorpii	3.0	0	48	158 d	1	36	228
July 23	136 Tauri	4.6	7	32	22	8	10	318 d
July 29	η Virginis	4.0	18	43	66 d	19	04	18
Sept. 7-8	ψ Aquarii	4.5	22	40	61	0	00	222
Sept. 13	δ Arietis	4.5	5	35	118	6	32	206 d
Sept. 16	136 Tauri	4.6	.....		.....	0	39	292 d
Oct. 13	136 Tauri	4.6	7	45	135	8	34	233 d
Oct. 24	α Scorpii	1.3	15	57	78 d	17	08	305
Nov. 16	η Virginis	4.0	7	57	76	8	37	2 d
Dec. 4	δ Arietis	4.5	3	27	118 d	4	13	213
Dec. 6	136 Tauri	4.6	18	55	43	19	38	296 d

*Eastern Standard Civil Time.

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 the 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 of 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.

FEBRUARY

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 20	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.

In the following notes on the planets a general account of the phenomena resulting from their motions is given. Fuller details regarding any particular phenomenon will be found on the pages headed "The Sky for the Month" (pages 28, 30,...).

MERCURY

Among the planets Mercury is notable in several respects. It is the smallest in diameter, the smallest in mass, the nearest to the sun and the swiftest in its orbital motion. It also has the most eccentric orbit, with the greatest inclination to the ecliptic

Its apparent separation from the sun is never great, its maximum values ranging from 18° to 28°. In the year 1930, it reaches greatest elongation seven times. At such times, when we search for it, in the west just after sunset, or in the east just before sunrise, it is never high above the horizon, and even with clear sky, the planet is not easily located although it is as bright as a first magnitude star.

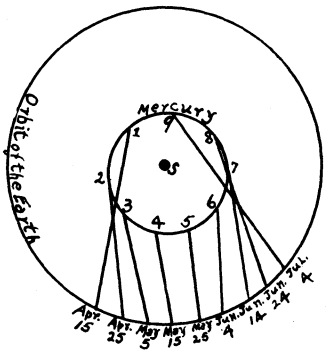

Fig. 1. ORBITS OF THE EARTH AND MERCURY. This diagram shows the relative positions of the earth and Mercury during the period April 15 to July 4, 1930. The planet reaches greatest elongation when the line from the earth to it is tangent to its orbits. This occurs on April 27 (eastern) and June 14 (western).

On account of the inclination of the ecliptic to the horizon, Mercury is usually best seen, in northern latitudes, as an evening star in the spring and as a morning star in the autumn.

The greatest eastern elongations in 1930 (Mercury, an evening star), are on January 5, 19° 15′, April 27, 20° 35′, August 25, 27° 20′, December 20, 20° 11′.

The greatest western elongations (Mercury, a morning star), are on February 15, 26° 14′, June 14, 23° 16′, October 7, 17° 58′.

The April elongation is the best of the year for evening observation, while the elongation of June is the most suitable for morning observation.

Venus

At the beginning of the year, Venus is seen as a morning star, slowly moving toward the sun, until February 6, when it is in superior conjunction with the sun. Shortly after conjunction, it is visible as an evening star and continues as an evening star throughout the summer and early fall. On September 13, it has its greatest elongation, east 46° 22′, and on October 18 it attains its greatest brilliancy, magnitude −4.3. At this time the telescope reveals its phase as nearly half moon (third Quarter) Following this, Venus gradually draws in toward the sun and reaches inferior conjunction November 22, after which it becomes a morning star. Venus, for the second time in the year, reaches its greatest brilliancy December 28, magnitude −4.4, fifteen times as bright as Sirius.

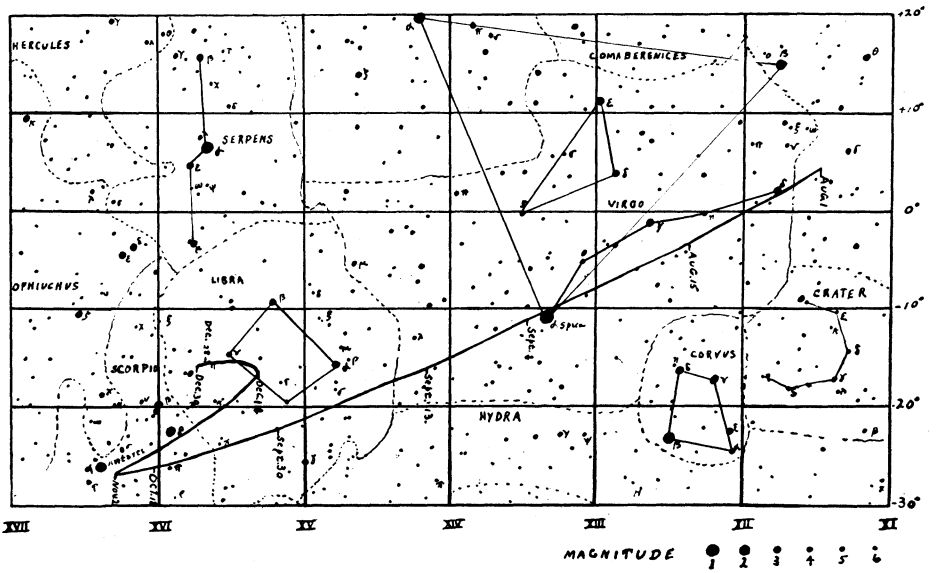

Fig. 2. Path of Venus among the Stars from August 1 to December 31, 1930.

Mars

Mars was in opposition on December 21, 1928, and as opposition occurs approximately every 780 days, next opposition will be in February 1931. At the beginning of the year Mars is in the constellation Sagittarius, and is not visible, on account of its proximity to the sun, until nearly the middle of the year, when it appears as a morning star about July 1. Its magnitude then is 1.3, slightly brighter than Polaris, and grows gradually brighter, reaching magnitude −0.6 at the end of the year. (See Fig. 3 on p. 3 of cover).

JUPITER

Jupiter, the next planet beyond Mars, is easily the largest and most massive of all the planets, and in brightness it is second only to Venus.

A small telescope will give a good view of the planet since a magnification of 60 diameters gives to it an apparent diameter equal to that of the moon as seen by the naked eye. Bands are seen on the planet's surface, parallel to the equator. They are believed to be clouds, though they are much more permanent than the cloud formations on the earth's surface.

Jupiter is known to possess nine moons. The four largest (two of them larger than Mercury) can be seen with field glasses, but the others are extremely faint bodies and require the most powerful instruments to detect them.

In January Jupiter crosses the meridian about 9.30 p.m., and for several months it can be seen in the evening. On June 20, it is in conjunction with the sun, after which it is a morning star.

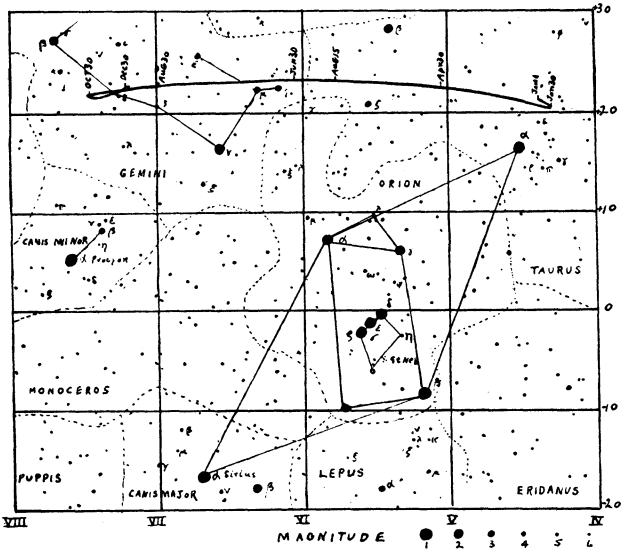

Fig. 4. PATH OF JUPITER AMONG THE STARS DURING 1930.

SATURN

Saturn possesses a remarkable set of rings and has nine satellites. It is considered to be one of the finest objects in the sky for the visual astronomer. During 1930, the rings of Saturn are still well placed for examination.

Saturn is a morning star in early spring, and gradually improves its position for observation. On June 30, it is in opposition to the sun and is visible the entire night. During the latter part of the year Saturn is an evening star but by December it is too close to the sun, being in conjunction with the sun January 5th, 1931.

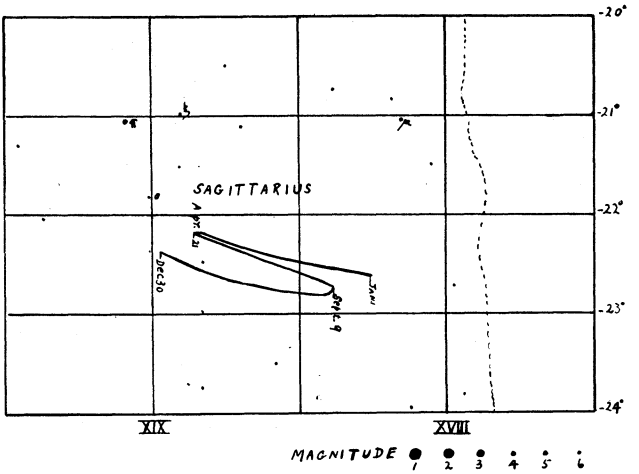

Fig. 5. Path of Saturn among the Stars during 1930.

Uranus

Uranus was discovered by Sir William Herschel in 1781. Before that time Saturn's path was considered the outermost boundary of the solar system, and when the planet was first seen by Herschel he thought it must be a comet. A year later its true nature was recognized.

The period of Uranus about the sun is 84 years, and consequently its motion in the heavens is slow. Its period of rotation is 10¾ hours. It is of the sixth magnitude and can be seen with the naked eye, but its motion is better observed by the aid of a field glass. A large telescope is necessary to show an appreciable disc. Uranus is in conjunction with the sun on April 1, some time later it is visible in the morning. On October 7, it is in opposition to the sun and is visible the entire night.

Neptune

Neptune was discovered in 1846 as the result of the mathematical discussion of the planet Uranus, which, for some unknown reason, was not following the path predicted for it. The story of the discovery is one of the most interesting romances in the history of astronomy.

Neptune is the most distant planet of the solar system, being 2,800 millions of miles from the sun and requiring 165 years to complete a revolution.

Neptune is in opposition with the sun February 21, and is visible all night at the beginning of the year. On August 27 it is in conjunction with the sun and is not visible. Neptune appears as an eighth magnitude star and hence can be seen only with a telescope. It has a single satellite.

ECLIPSES, 1930

In the year 1930 there will be four eclipses, two of the sun and two of the moon.

I. *A Partial Eclipse of the Moon*, April 12-13. This is a comparatively small eclipse, only one-ninth of the moon's diameter being covered. The beginning is visible in the southwestern part of Europe, the northwestern part of Africa, the Atlantic Ocean, North America, South America, and the Pacific Ocean except the western part; the ending is visible generally in the Atlantic Ocean, North America, South America, and the Pacific Ocean except the western part.

Circumstances of the Eclipse

Moon enters penumbra	April 13d	3h	42.9m	G.C.T.
Moon enters umbra	13	5	20.7	
Middle of eclipse	13	5	58.2	
Moon leaves umbra	13	6	35.6	
Moon leaves penumbra	13	8	13.8	

Magnitude of eclipse, 0.111 (Moon's diameter, 1.0)

II. *A Central Eclipse of the Sun*, April 28. Visible in all parts of North America as a total, annular or partial eclipse. The central path begins far out in the Pacific Ocean, enters California near San Francisco, passes near Boise City, Idaho, and Helena, Mont., enters Saskatchewan at Long. 106W., passes near Broadview, Sask., and Dauphin, Man., crosses Lake Winnipeg, reaching the eastern shore near the mouth of Berens River, enters Hudson Bay in Long. 85°, crosses the Belcher Islands and reaches the Atlantic Ocean near Nain, Labrador. The eclipse will be total for about 38 min. at the middle of its duration, the greatest duration of the total phase being 1.5 sec. For the rest of the time the eclipse will be annular.

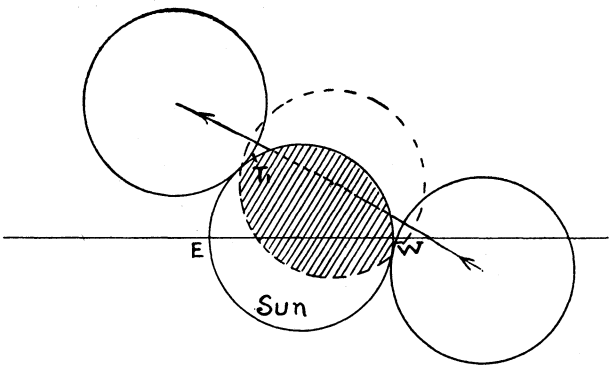

Fig. 6. THE SOLAR ECLIPSE OF APRIL 28. The appearance of the eclipse at Toronto. Greatest eclipse at 3.19 p.m., E.S.T., .64 per cent of the sun's diameter being covered.

In Toronto the eclipse begins at 2.00 and ends at 4.29 p.m., E.S.T. Sun's altitude at beginning 52°; at end, 28°. Greatest eclipse at 3.19 p.m., when 64% of the sun's diameter will be covered. See Fig. 6. (Further information will be published in the JOURNAL for February, 1930.)

III. *A Partial Eclipse of the Moon*, October 7, invisible in North and South America. The entire eclipse is visible generally in Asia, Australia, the Indian Ocean, Europe and Africa.

Circumstances of the Eclipse

Moon enters penumbra.....	Oct.	7d	16h 41.3m	G.C.T.
Moon enters umbra.....		7	18 46.2	
Middle of the eclipse.....		7	19 6.5	
Moon leaves umbra.....		7	19 27.0	
Moon leaves penumbra.....		7	21 31.9	

Magnitude of the eclipse, 0.029 (Moon's diameter, 1.0).

IV. *A Total Eclipse of the Sun*, Oct. 22. Invisible in North America. The path of totality lies in the Pacific Ocean. It begins north of New Guinea and ends at Patagonia. The only land on which the total eclipse is visible (excepting the mere dot of Nurakita, (179° 30′ E., 10° 45′ S.), is the island of Niuafou, about 250 miles from Samoa, in Long. 175° 41′ W., Lat. 15° 35′ S. Totality begins at this place at 9.09 a.m. (local time) and lasts 83 sec.; sun's altitude 52°.

THE SKY FOR JANUARY, 1930

The times of transit are given in Local Mean Time; to change to Standard Time, see p. 9. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During January the sun's R.A. increases from 18h 43m to 20h 55m, and its Decl. changes from 23° 5′ S. to 17° 22′ S. The equation of time (see p. 6) increases from 3m 13s to 13m 36s. Due to this rapid rise in value the time of mean noon appears, for the first ten days of the month, to remain 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 winter sign of the zodiac. On January 3rd, the earth is in perihelion.

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

Mercury on the 15th is in R.A. 20h 40m, Decl. 16° 54′ S, and transits at 13.00. It reaches its greatest elongation east on the 5th, but is not very favourably situated for observation. At sunset it is in the S.W. about 5° above the horizon. It sets about 40 minutes after the sun. On the 21st, it is in inferior conjunction with the sun, and is too close to it for observation.

Venus on the 15th is in R.A. 19h 21m, Decl. 22° 46′ S, and transits at 11.47. During the most of the month Venus is too close to the sun to be observed.

Mars on the 15th is in R.A. 18h 55m, Decl. 23° 39′ S, and transits at 11.19. It is a morning star in the constellation of Sagittarius, but too close to the sun for observation.

Jupiter on the 15th is in R.A. 4h 20m, Decl. 20° 50′ N, and transits at 20.41. It is an evening star in the constellation of Taurus. Its magnitude decreases from —2.3 to —2.1 during January. On the 15th the planet is about 35° above the eastern horizon at sunset and is well situated for observation. For the configurations of its satellites, see next page and for their eclipses, etc. see p. 52.

Saturn on the 15th is in R.A. 18h 23m, Decl. 22° 35′ S, and transits at 10.46. It is a morning star, but too close to the sun for observation. It is in the constellation of Sagittarius.

Uranus on the 15th is in R.A. 0h 30m, Decl. 2° 28′ N, and transits at 16.51.

Neptune on the 15th is in R.A. 10h 21m, Decl. 10° 57′ N, and transits at 2.45.

JANUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 22h 30m
			h	m	
Wed.	1	9h 54m ☌ ☿ ☾, ☿ 3° 23′ N			1304*
Thur.	2	12h☌♀♂, ♀ 0° 33′ N			01234
Fri.	3	2h☌ ♀ ♄, ♀ 0° 57′ S.; 7h ⊕ in	13	40	12034
		Perihelion, 91,347,000 miles; 13h☌ ♂ ♄, ♂ 1° 28′ S.			
Sat.	4				20134
Sun.	5	19h ☿ Greatest elong. E., 19° 15′			13024
Mon.	6		10	20	30124
☽ Tues.	7	2h 30m☌♁ ☾, ♁ 2° 14′ N.; 22h 10.8m			32104
		Moon F.Q.			
Wed.	8				d3420
Thur.	9	20h ☿ in ♌	7	10	40132
Fri.	10				41203
Sat.	11	15h 8m☌♃ ☾, ♃ 3° 4′ S.			42013
Sun.	12	11h ☿ Stationary	4	00	41302
Mon.	13				43012
☿ Tues.	14	11h ☿ in Perihelion; 17h 21.0m F.M.			43210
Wed.	15		0	50	43201
Thur.	16				0432*
Fri.	17	4h 28m☌♆ ☾, ♆ 4° 15′ S.	21	40	d1043
Sat.	18				20134
Sun.	19				d1024
Mon.	20		18	30	30124
☾ Tues.	21	11h 7.0m Moon L.Q.; 20h☌ ☿ ☉, Inferior			32104
Wed.	22	23h☌ ☿ ♀, ☿ 4° 25′ N			32014
Thur.	23		15	20	0324*
Fri.	24	18h ☿ Greatest Hel. Lat. N			10243
Sat.	25				24013
Sun.	26	19h 53m☌ ♄ ☾, ♄ 5° 1′ N	12	10	41032
Mon.	27				43012
Tues.	28	3h 33m☌♂ ☾, ♂ 3° 57′ N; 5h 0m☌ ☿ ☾, ☿ 8° 23′ N.;			
		16h☌ ☿♂, ☿ 4° 22′ N			43210
● Wed.	29	7h 29m☌♀ ☾, ♀ 4° 2′ N.; 14h 7.4m, N.M.	9	00	43201
Thur.	30				41032
Fri.	31	9h ♃ Stationary			d4023

Explanation of symbols and abbreviations on page 4

THE SKY FOR FEBRUARY, 1930

The times of transit are given in Local Mean Time; to change to Standard Time, see p. 9. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During February the sun's R.A. increases from 20h 55m to 22h 45m and its Decl. changes from 17° 22′ S. to 7° 56′ S. The equation of time reaches a maximum value of 14m 23s on the 12th (see p. 6). For the change in the length of the day see p. 11. On the 19th the sun enters the third winter zodiacal sign, Pisces.

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

Mercury on the 15th is in R.A. 20h 6m, Decl. 19° 54′ S, and transits at 10.29. In the 15th it reaches its greatest elongation west. On this date it rises about 1 hour before the sun.

Venus on the 15th is in R.A. 22h 1m, Decl. 13° 37′ S, and transits at 12.25. It is in superior conjunction with the sun on the 6th, and is not in good position for observation all month.

Mars on the 15th is in R.A. 20h 36m, Decl. 19° 40′ S, and transits at 10.59. On that date it rises about 50 minutes before the sun, and is in the constellation of Capricornus.

Jupiter on the 15th is in R.A. 4h 20m, Decl. 20° 56′ N, and transits at 18.39. Though its magnitude is decreasing, it is still a bright object in the sky, visible all night in the constellation of Taurus. On the 26th it is in quadrature with the sun. For the configurations of its satellites see next page, and for their eclipses etc., see p. 52.

Saturn on the 15th is in R.A. 18h 37m, Decl. 22° 26′ S, and transits at 8.58. It is in the constellation of Sagittarius and rises about 2½ hours before the sun on the 15th.

Uranus on the 15th is in R.A. 0h 34m, Decl. 2° 55′ N, and transits at 14.54.

Neptune on the 15th is in R.A. 10h 18m, Decl. 11° 15′ N, and transits at 0.41.

FEBRUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 22h 00m
			h m	
Sat.	1	.....	5 40	2403*
Sun.	2	7h ☿ Stationary; 9h ♀ in Aphelion		1043*
Mon.	3	10h 19m☌♁ ☾, ♁ 1° 54′ N		30124
Tues.	4	.....	2 30	31204
Wed.	5	.....		32014
☽ Thur.	6	12h☌♀ ☉, Superior; 12h 25.8m Moon, F.Q.	23 20	10324
Fri.	7	23h 17m☌♃ ☾, ♃ 3° 10′ S		01234
Sat.	8	.....		2034*
Sun.	9	.....	20 10	12034
Mon.	10	.....		30412
Tues.	11	.....		34120
Wed.	12	.....	17 00	43201
♋ Thur.	13	3h 38.6m F.M.; 14h 43m☌♆ ☾, ♆ 4° 9′ S		41302
Fri.	14	.....		40123
Sat.	15	4h ☿ Greatest elong. W., 26° 14′	13 50	42103
Sun.	16	.....		42103
Mon.	17	5h ☿ in ♉		43012
Tues.	18	.....	10 40	d3140
Wed.	19	.....		32014
☾ Thur.	20	3h 44.4m Moon L.Q.		13024
Fri.	21	8h☍♆ ☉	7 30	01234
Sat.	22	.....		21034
Sun.	23	7h 20m☌ ♄ ☾, ♄ 5° 19′ N		d2034
Mon.	24	17h ♀ Greatest Hel. Lat. S	4 20	3024*
Tues.	25	.....		31024
Wed.	26	1h 30m☌ ☿ ☾, ☿ 3° 58′ N.; 6h 25m☌♂ ☾, ♂ 4° 6′ N.; 15h □ ♃ ☉		32014
Thur.	27	11h ☿ in Aphelion	1 10	1340*
● Fri.	28	8h 32.7m N.M.; 17h 56m☌♀ ☾, ♀ 2° 40′ N		40132

Explanation of symbols and abbreviations on page 4

THE SKY FOR MARCH, 1930

The times of transit are given in Local Mean Time; to change to Standard Time, see p. 9. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During March the sun's R.A. increases from 22h 45m to 0h 39m. and its Decl. changes from 7° 56′ S to 4° 10′ N. The equation of time decreases from 12m 40s to 4m 14s (see p. 6). For changes in the length of the day see p. 12. On the 21st at 8h 30m (G.C.T.) the sun enters the first spring sign of the zodiac, Aries and Spring begins.

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

Mercury on the 15th is in R.A. 22h 43m, Decl. 10° 32′ S, and transits at 11.17. It is a morning star, and rises about 1¼ hours after the sun. By the end of the month it is too close to the sun for observation.

Venus on the 15th is in R.A. 0h 11m, Decl. 0° 9′ S, and transits at 12.44. It is now an evening star, setting about 50 minutes after the sun, on the 15th.

Mars on the 15th is in R.A. 22h 3m, Decl. 13° 10′ S, and transits at 10.35. About the middle of the month it enters the constellation of Aquarius. It is still a morning star, though not well placed for observation.

Jupiter on the 15th is in R.A. 4h 30m, Decl. 21° 25′ N, and transits at 17.00. It is in Taurus, and on the 15th sets about 5 hours after the sun. Its stellar magnitude drops to −1.7 at the end of the month. For the configurations of its satellites see next page, and for their eclipses etc., see p. 52.

Saturn on the 15th is in R.A. 18h 46m, Decl. 22° 17′ S, and transits at 7.17. It is in Sagittarius, and at sunrise on the 15th it is about 20° above the southern horizon.

Uranus on the 15th is in R.A. 0h 39m, Decl. 3° 29′ N, and transits at 13.10.

Neptune on the 15th is in R.A. 10h 16m, Decl. 11° 31′ N and transits at 22.44.

MARCH

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol h m	Configurations of Jupiter's Satellites at 21h 15m
Sat.	1	17h☌☿☍, ☿ 0° 31′ S.	21 50	42103
Sun.	2	18h 35m☌♁ ☾, ♁ 1° 37′ N.		42013
Mon.	3			d402*
Tues.	4		18 40	43102
Wed.	5			43201
Thur.	6			4310*
☽ Fri.	7	9h 4m☌♃ ☾, ♃ 3° 27′ S.; 23h 0.3m Moon, F.Q.	15 30	40312
Sat.	8			12043
Sun.	9			20134
Mon.	10		12 20	10324
Tues.	11			d3024
Wed.	12			32014
Thur.	13	0h 10m☌♆ ☾, ♆ 4° 13′ S.	9 10	31204
♋ Fri.	14	13h 58.4m F.M.		0124*
Sat.	15			12043
Sun.	16		6 00	24013
Mon.	17			41032
Tues.	18			43012
Wed.	19	19h ☿ Greatest Hel. Lat. S.	2 50	4320*
Thur.	20			43210
☾ Fri.	21	3h 30m ☉ enters ♈, Spring commences; 4h ☌♀♁, ♀ 0° 32′ S.; 22h 12.6m Moon L.Q.	23 40	4012*
Sat.	22	18h 6m☌ ♄ ☾, ♄ 5° 34′ N.		d4103
Sun.	23			24013
Mon.	24		20 30	10423
Tues.	25			30124
Wed.	26			3204*
Thur.	27	11h 1m☌☍ ☾, ☍ 3° 24′ N.	17 10	32104
Fri.	28	13h☍ Greatest Hel. Lat. S.		30124
Sat.	29	18h 25m☌ ☿ ☾, ☿ 1° 6′ N.		10234
♎ Sun.	30	0h 46.4m N.M.; 4h 15m☌♁ ☾, ♁ 1° 27′ N.	14 00	20134
Mon.	31	3h 6m☌♀ ☾, ♀ 0° 4′ N.		1034*

Explanation of symbols and abbreviations on page 4

THE SKY FOR APRIL, 1930

The times of transit are given in Local Mean Time; to change to Standard Time, see p. 9. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During April the sun's R.A. increases from 0h 39m to 2h 30m, and its Decl. from 4° 10′ N to 14° 47′ N. The equation of time changes from +4m 14s to −2m 51s (see p. 6). For changes in the length of the day see p. 13. On the 20th the sun enters Taurus, the second spring zodiacal sign. On the 28th there is a central eclipse of the sun, visible here as a partial eclipse.

The Moon—For its phases and conjunctions with the planets, see opp. page. On the 13th there is a partial eclipse of the moon, visible in North America.

Mercury on the 15th is in R.A. 2h 22m, Decl. 15° 32′ N, and transits at 12.55. On the 1st it is in superior conjunction with the sun. It reaches its greatest elongation east on the 27th, and is then about 20° above the horizon at sunset. It is in good position for observation in the N.W., settling about 2 hours after the sun.

Venus on the 15th is in R.A. 2h 34m, Decl. 14° 50′ N, and transits at 13.05. The planet is well in view all month, as an evening star. Its magnitude drops from −3.4 to −3.3. On the 15th it may be seen 15° above the western horizon at sunset.

Mars on the 15th is in R.A. 23h 34m, Decl. 4° 5′ S, and transits at 10.04. About the middle of the month it enters the constellation of Pisces. It may be seen in the south east shortly before sunrise.

Jupiter on the 15th is in R.A. 4h 51m, Decl. 22° 10′ N, and transits at 15.19. At sunset on the 15th, it is about 40° above the western horizon. It is in the constellation of Taurus. For the configurations of its satellites see next page, and for their eclipses etc., see p. 52.

Saturn on the 15th is in R.A. 18h 51m, Decl. 22° 11′ S, and transits at 5.20. It is a morning star in Sagittarius, and rises about 3¼ hours before the sun on the 15th. It is in quadrature with the sun on the 2nd.

Uranus on the 15th is in R.A. 0h 45m, Decl. 4° 11′ N, and transits at 11.13.

Neptune on the 15th is in R.A. 10h 13m, Decl. 11° 45′ N and transits at 20.40.

APRIL

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites 20h 45m
			h m	
Tues.	1	8h ☌ ☿ ☉, Superior; 9h ☌ ☿ ♁, ☿ 0° 26′ S.; 14h ☌ ♁ ☉; 20h □ ♄ ☉		30412
Wed.	2		10 50	34210
Thur.	3	21h 11m ☌ ♃ ☾, ♃ 3° 46′ S.		d4320
Fri.	4			4302*
Sat.	5		7 40	41023
☽ Sun.	6	6h 24.9m Moon F.Q.		42013
Mon.	7	20h ☿ in ♌		4103*
Tues.	8		4 30	43012
Wed.	9	7h 25m ☌ Ψ ☾, Ψ 4° 19′ S.		34120
Thur.	10			32014
Fri.	11		1 20	3024*
♍ Sat.	12	10h ☿ in Perihelion	22 10	20134
Sun.	13	0h 48.5m F.M.; Par. ecl. of ☾, visible at Toronto (see p. 26)		10234
Mon.	14			12034
Tues.	15			03124
Wed.	16		19 00	31204
Thur.	17			32014
Fri.	18			34012
Sat.	19	3h 36m ☌ ♄ ☾, ♄ 5° 41′ N.	15 50	d4032
☾ Sun.	20	17h 8.5m Moon L.Q.		42013
Mon.	21	10h ♄ Stationary		41203
Tues.	22	0h ♀ in ♌; 4h ☌ ☿ ♀, ☿ 2° 27′ N.; 8h ☌ ♂ in Perihelion; 17h ☿ Greatest Hel. Lat. N	12 40	40312
Wed.	23			d4310
Thur.	24			43201
Fri.	25	16h 29m ☌ ♂ ☾, ♂ 1° 51′ N.	9 20	43102
Sat.	26	15h 20m ☌ ♁ ☾, ♁ 1° 19′ N.		4012*
Sun.	27	3h ☌ ☿ ♀, ☿ 2° 34′ N.; 15h ☿ Greatest elong. E., 20° 33′		2043*
♎ Mon.	28	14h 8.4m N.M.; Cent. ecl. of ☉, visible as par. at Toronto (see p. 26)	6 10	21043
Tues.	29			01324
Wed.	30	4h 14m ☌ ☿ ☾, ☿ 0° 22′ N.; 6h 5m ☌ ♀ ☾, ♀ 2° 8′ S.		31024

Explanations of symbols and abbreviations on page 4

THE SKY FOR MAY, 1930

The times of transit are given in Local Mean Time; to change to Standard Time, see p. 9. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During May the sun's R.A. increases from 2h 30m to 4h 32m, and its Decl. from 14° 47′ N to 21° 56′ N. The equation of time increases from 2m 51s to a maximum of 3m 49s on the 15th, and then decreases to 2m 32s at the end of the month (see p. 6). For changes in the times of sunrise and sunset see p. 14. The sun enters Gemini, the third sign of the zodiac, on the 21st.

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

Mercury on the 15th is in R.A. 3h 56m, Decl. 20° 47′ N, and transits at 12.24. It is still an evening star at the beginning of the month, but is approaching the sun. On the 20th it is in inferior conjunction with the sun and not in a favourable position for observation during the latter part of the month.

Venus on the 15th is in R.A. 5h 6m, Decl. 23° 51′ N, and transits at 13.39. The planet is a brilliant object in the evening sky. On the 15th it sets about 2 hours after the sun.

Mars on the 15th is in R.A. 0h 59m, Decl. 5° 7′ N, and transits at 9.30. It is in Pisces, and at sunrise on the 15th is about 15° above the eastern horizon.

Jupiter on the 15th is in R.A. 5h 18m, Decl. 22° 49′ N, and transits at 13.48. It is in Taurus. The planet is approaching the sun, and on the 15th, sets about 2¼ hours after it. For the configurations of its satellites see next page, and for their eclipses etc., see p. 52.

Saturn on the 15th is in R.A. 18h 49m, Decl. 22° 14′ S, and transits at 3.20. At sunrise on the 15th it is about 20° above the southern horizon, in the constellation of Sagittarius.

Uranus on the 15th is in R.A. 0h 51m, Decl. 4° 47′ N and transits at 9.21.

Neptune on the 15th is in R.A. 10h 12m, Decl. 11° 49′ N and transits at 18.41.

MAY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 20h 15m
			h	m	
Thur.	1	12h 12m☌♃☾, ♃ 4° 3′ S.	3	00	32O14
Fri.	2				31O4*
Sat.	3		23	50	3O124
Sun.	4				2O43*
☽ Mon.	5	11h 53.1m Moon F.Q.			21O43
Tues.	6	12h 55m☌♆☾, ♆ 4° 20′ S.	20	40	4O123
Wed.	7				413O2
Thur.	8				432O1
Fri.	9	5h ☿ Stationary	17	30	4312O
Sat.	10				43O12
Sun.	11	20h☌♂♁, ♂ 0° 29′ S.; 10h ♆ Stationary			421O3
♋ Mon.	12	12h 29.3m F.M.	14	20	d42O3
Tues.	13				4O123
Wed.	14				13O42
Thur.	15		11	10	32O14
Fri.	16	4h ☿ in ♉; 11h 1m☌ ♄☾, ♄ 5° 37′ N			312O4
Sat.	17	13☌♀♃, ♀ 1° 21′ N			3O124
Sun.	18		8	00	d1O34
Mon.	19				2O134
☾ Tues.	20	0h☌ ☿ ☉, Inferior; 11h 21.6m Moon L.Q.			O234*
Wed.	21		4	40	d1O24
Thur.	22	11h □♆☉			324O1
Fri.	23				341O2
Sat.	24	2h 58m☌♁☾, ♁ 1° 7′ N.; 20h 58m☌♂☾, ♂ 0° 12′ S.	1	30	43O12
Sun.	25	16h ♀ in Perihelion			41O23
Mon.	26	10h ☿ in Aphelion	22	20	42O13
Tues.	27	7h 16m☌ ☿☾, ☿ 5° 11′ S.			41O23
● Wed.	28	0h 36.6m N.M.			41O32
Thur.	29	6h 0m☌♃☾, ♃ 4° 18′ S.	19	10	
Fri.	30	2h 22m☌♀☾, ♀ 3° 9′ S.			
Sat.	31				

Explanation of symbols and abbreviations on page 4

THE SKY FOR JUNE, 1930

The times of transit are given in Local Mean Time; to change to Standard Time, see p. 9. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During June the sun's R.A. increases from 4h 32m to 6h 37m, and its Decl. from 21° 56′ N to its maximum value of 23° 27′ N on the 21st, and then drops to 23° 11′ N at the end of the month. On the 22nd, the sun reaches summer solstice and enters Cancer, the first summer zodiacal sign, and Summer begins. The duration of daylight is now at its longest and does not change appreciably for some days, see p. 15. For changes in the equation of time see p. 6. The increase in this quantity at the end of the month, taken with the shortening of daylight causes the local mean time of sunset to appear almost 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 opp. page.

Mercury on the 15th is in R.A. 3h 55 m, Decl. 16° 44′ N, and transits at 10.25. On the 14th it reaches its greatest elongation west, and is not favourably situated for observation during the month.

Venus on the 15th is in R.A. 7h 49m, Decl. 22° 56′ N, and transits at 14.20. During the month it is well situated for observation. On the 1st, it is about 20° above the western horizon and sets about 2¼ hours after the sun.

Mars on the 15th is in R.A. 2h 27m, Decl. 13° 26′ N, and transits at 8.56. On that date it rises 2¼ hours before the sun. The planet is in the constellation of Aries.

Jupiter on the 15th is in R.A. 5h 48m, Decl. 23° 12′ N, and transits at 12.16. The planet is too close to the sun for observation during the month. It is in conjunction with that body on the 20th, after which time it becomes a morning star.

Saturn on the 15th is in R.A. 18h 42m, Decl. 22° 23′ S, and transits at 1.11. It rises about 1 hour after sunset on the 15th and is visible in the southern sky all night. On the 30th the planet is in opposition with the sun.

Uranus on the 15th is in R.A. 0h 56m, Decl. 5° 14′ N, and transits at 7.24.

Neptune on the 15th is in R.A. 10h 13m, Decl. 11° 41′ N, and transits at 16.40.

JUNE

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol h m
Sun.	1	5h ☿ Stationary	16 00
Mon.	2	18h 38m☌ ♆ ☾, ♆ 4° 13′ S.	
☽ Tues.	3	16h 56.3m Moon F.Q.	
Wed.	4		12 50
Thur.	5		
Fri.	6		
Sat.	7		9 40
Sun.	8		
Mon.	9		
Tues.	10		6 30
♋ Wed.	11	1h 11.7m F.M.	
Thur.	12	15h 54m☌ ♄ ☾, ♄ 5° 27′ N.	
Fri.	13		3 20
Sat.	14	21h ☿ Greatest elong. W., 23° 16′	
Sun.	15	19h ☿ Greatest Hel. Lat. S.	
Mon.	16	12h ♀ Greatest Hel.Lat. N	0 00
Tues.	17		
Wed.	18		20 50
☾ Thur.	19	4h 0.4m Moon L.Q.	
Fri.	20	11h☌ ♃☉; 13h 44m☌ ♁ ☾, ♁ 0° 51′ N.	
Sat.	21	22h 54m ☉ enters ♋, Summer commences	17 40
Sun.	22	22h 27m☌ ♂ ☾, ♂ 2° 9′ S.	
Mon.	23		
Tues.	24	22h 35m☌ ☿ ☾, ☿ 5° 25′ S.	14 30
Wed.	25		
♍ Thur.	26	1h 43m☌ ♃ ☾, ♃ 4° 32′ S.; 8h 46.7m N.M.	
Fri.	27		11 20
Sat.	28	19h 16m☌ ♀ ☾, ♀ 3° 16′ S.	
Sun.	29		
Mon.	30	2h 27m☌ ♆ ☾, ♆ 4° 0′ S.; 22h☍ ♄ ☉	8 10

Configurations of Jupiter's Satellites

By reason of the proximity of Jupiter to the Sun the configurations of the satellites are not given from May 29 to July 12.

Explanation of symbols and abbreviations on page 4

THE SKY FOR JULY, 1930

The times of transit are given in Local Mean Time; to change to Standard Time, see p. 9. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During July the sun's R.A. increases from 6h 37m to 8h 42m, and its Decl. decreases from 23° 11′ N to 18° 16′ N. The equation of time increases from 3m 26s on the 1st to 6m 22s on the 27th, and then falls to 6m 15s at the end of the month. On the 23rd, the sun enters Leo, the second summer sign of the zodiac. For changes in the length of the day, see p. 16. The earth is in aphelion on the 2nd.

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

Mercury on the 15th is in R.A. 7h 33m, Decl. 23° 13′ N, and transits at 12.08. On the 1st, Mercury rises about 1 hour before the sun, at a point 30° north of east. It is in superior conjunction with the sun on the 15th.

Venus on the 15th is in R.A. 10h 12m, Decl. 12° 45′ N, and transits at 14.44. Its magnitude increases from −3.4 on the 1st to −3.6 on the 31st. It is still to be seen as an evening star, setting about 2 hours after the sun on the 15th.

Mars on the 15th is in R.A. 3h 53m, Decl. 19° 41′ N, and transits at 8.24. It is in Taurus and on the 15th rises about 3¾ hours before the sun. Its stellar magnitude is then +1.3.

Jupiter on the 15th is in R.A. 6h 18m, Decl. 23° 13′ N, and transits at 10.48. It is a morning star in the constellation of Gemini and on the 15th rises about 1½ hours before the sun. For the configurations of its satellites see next page, and for their eclipses etc., see p. . 52

Saturn on the 15th is in R.A. 18h 33m, Decl. 22° 34′ S, and transits at 23.00. It is in the constellation of Sagittarius. At sunset on the 15th it is about 5° above the south-eastern horizon.

Uranus on the 15th is in R.A. 0h 58m, Decl. 5° 25′ N, and transits at 5.28.

Neptune on the 15th is in R.A. 10h 16m, Decl. 11° 26′ N, and transits at 14.45.

JULY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 4h 15m
			h m	
	Tues.	1		
☽	Wed.	2 19h ⊕ in Aphelion, 94,448,000 miles; 23h 3.1m Moon F.Q.		
	Thur.	3	5 00	
	Fri.	4 19h ☿ in ♌		
	Sat.	5 18h ☌ ☿ ♃, ☿ 0° 22′ N		
	Sun.	6	1 50	
	Mon.	7		
	Tues.	8 0h □ ♁ ☉	22 40	
	Wed.	9 10h ☿ in Perihelion; 18h 48m ☌ ♄ ☾, ♄ 5° 20′ N		
♋	Thur.	10 15h 1.1m F.M.		
	Fri.	11	19 20	
	Sat.	12		
	Sun.	13		34021
	Mon.	14	16 10	43102
	Tues.	15 5h ☍ ☿ ☉, Superior; 19h ☌ ♀ Ψ, ♀ 0° 52′ N		42031
	Wed.	16		41203
	Thur.	17 22h 23m ☌ ♁ ☾, ♁ 0° 31′ N	13 00	40123
☾	Fri.	18 18h 29.2m Moon L.Q.		41023
	Sat.	19 16h ☿ Greatest Hel. Lat. N		d4320
	Sun.	20	9 50	34021
	Mon.	21 16h ♁ Stationary; 19h 51m ☌ ♂ ☾, ♂ 3° 35′ S		31042
	Tues.	22		20314
	Wed.	23 21h 56m ☌ ♃ ☾, ♃ 4° 48′ S	6 40	21034
	Thur.	24		01234
♍	Fri.	25 15h 41.9m N.M.		10234
	Sat.	26 10h 22m ☌ ☿ ☾, ☿ 3° 15′ S	3 30	23014
	Sun.	27 12h 56m ☌ Ψ ☾, Ψ 3° 48′ S		3014*
	Mon.	28 11h 44m ☌ ♀ ☾, ♀ 2° 42′ S		31024
	Tues.	29	0 20	2041*
	Wed.	30		42103
	Thur.	31	21 10	40123

Explanation of symbols and abbreviations on page 4

THE SKY FOR AUGUST, 1930

The time of transits are given in Local Mean Time; to change to Standard Time, see p. 9. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During August the sun's R.A. increases from 8h 42m to 10h 38m and its Decl. decreases from 18° 16′ N to 8° 38′ N. The equation of time decreases from 6m 15s to 0m 17s. The sun enters Virgo, the third summer sign of the zodiac on the 23rd. See p. 17 for changes in the length of day.

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

Mercury on the 15th is in R.A. 11h 9m, Decl. 5° 0′ N, and transits at 13.39. It reaches its greatest elongation east on the 26th, and at that time sets about 1 hour after the sun, almost due west.

Venus on the 15th is in R.A. 12h 20m, Decl. 2° 24′ S, and transits at 14.49. It is still increasing in brightness, and by the end of the month its magnitude is −3.8. On the 1st it sets 1¾ hours after the sun, about 10° north of west, and on the 31st it sets about 1¼ hours after the sun, 10° south of west.

Mars on the 15th is in R.A. 5h 22m, Decl. 23° 2′ N, and transits at 7.51. It rises 5 hours before the sun on the 15th. Its magnitude increases to +1.1 at the end of the month. The planet is still in the constellation of Taurus.

Jupiter on the 15th is in R.A. 6h 46m, Decl. 22° 54′ N, and transits at 9.14. It is now a prominent object in the constellation of Gemini, and rises about 3½ hours before the sun on the 15th. For the configurations of its satellites see next page, and for their eclipses etc., see p. 52.

Saturn on the 15th is in R.A. 18h 25m, Decl. 22° 43′ S, and transits at 20.50. At sunset on the 15th the planet is about 20° above the southern horizon, in Sagittarius. It may be observed throughout the night, though it is rather low in the sky.

Uranus on the 15th is in R.A. 0h 57m, Decl. 5° 19′ N, and transits at 3.25.

Neptune on the 15th is in R.A. 10h 20m, Decl. 11° 4′ N, and transits at 12.47.

AUGUST

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 3h 45m
			h m	
☽	Fri.	1 7h 26.4m Moon F.Q.		41023
	Sat.	2		42301
	Sun.	3	18 00	4320*
	Mon.	4		43102
	Tues.	5 9h☌☿Ψ, ☿ 0° 15 N.; 21h 21m☌♄☾, ♄ 5° 19′ N		d4301
	Wed.	6	14 50	21403
	Thur.	7		02413
	Fri.	8		10234
♍	Sat.	9 5h 57.6m F.M.	11 30	23014
	Sun.	10		32104
	Mon.	11 13h♀ in ♉		d3024
	Tues.	12 3h ☿ in ♉	10 20	30214
	Wed.	13		21034
	Thur.	14 4h 28m☌♁☾, ♁ 0° 16′ N		02143
	Fri.	15	5 10	14023
	Sat.	16		d4201
☾	Sun.	17 6h 30.6m Moon L.Q.		43210
	Mon.	18	2 00	43012
	Tues.	19 12h 56m☌♂☾, ♂ 4° 25′ S.		4302*
	Wed.	20 16h 54m☌♃☾, ♃ 5° 4′ S.	22 50	42103
	Thur.	21		4013*
	Fri.	22 9h ☿ in Aphelion; 21h♂ in ☊		41023
♎	Sat.	23 22h 36.9m N.M.	19 40	24031
	Sun.	24 1h 10m☌Ψ☾, Ψ 3° 41′ S.		32104
	Mon.	25 17h 32m☌☿☾, ☿ 4° 56′ S.		30124
	Tues.	26 0h ☿ Greatest elong. E., 27° 20′	16 30	3024*
	Wed.	27 3h☌Ψ☉; 3h 47m☌♀☾, ♀ 2° 2′ S.		d2034
	Thur.	28		0134*
	Fri.	29	13 20	10234
☽	Sat.	30 18h 56.7m Moon F.Q.		20314
	Sun.	31		32104

Explanation of symbols and abbreviations on page 4

THE SKY FOR SEPTEMBER, 1930

The times of transit are given in Local Mean Time; to change to Standard Time, see p. 9. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During September the sun's R.A. increases from 10h 38m to 12h 26m, and its Decl. changes from 8° 38′ N to 2° 49′ S. At the beginning of the month, the equation of time is 0m 17s, it becomes zero on the 1st, and then increases to 9m 58s. For changes in the length of the day, see p. 19. On the 23rd the sun crosses the equator going south, and enters Libra, the first autumn zodiacal sign.

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

Mercury on the 15th is in R.A. 12h 10m, Decl. 5° 36′ S, and transits at 12.33. On the 21st it is in inferior conjunction with the sun. Toward the end of the month it becomes a morning star. On the 30th it is about 14° above the eastern horizon at sunrise.

Venus on the 15th is in R.A. 14h 17m, Decl. 16° 56′ S, and transits at 14.44. During the month, the planet increases in brightness from −3.8 to −4.2. On the 13th it reaches its greatest elongation east, but is rather far south. On that date it sets about 1¼ hours after the sun, at a point 20° south of west. At sunset it is 10° above the horizon.

Mars on the 15th is in R.A. 6h 47m, Decl. 23° 25′ N, and transits at 7.13. On the 15th it rises about 11.30 in the evening, and is well in view in Gemini during the early morning hours. It is becoming brighter and at the end of the month, its magnitude is +0.9.

Jupiter on the 15th is in R.A. 7h 10m, Decl 22° 24′ N, and transits at 7.35. It is in the constellation of Gemini, and rises about 5½ hours before the sun on the 15th. During the month its magnitude increases from −1.6 to −1.8. For the configurations of its satellites see next page, and for their eclipses etc., see p. 52.

Saturn on the 15th is in R.A. 18h 23m, Decl. 22° 48′ S, and transits at 18.46. It is a 1st magnitude star in Sagittarius. On the 15th it is on the meridian about 30 minutes after sunset. On the 29th it is in quadrature with the sun.

Uranus on the 15th is in R.A. 0h 53m, Decl. 4° 58′ N, and transits at 1.20.

Neptune on the 15th is in R.A. 10h 25m, Decl. 10° 38′ N, and transits at 10.50.

SEPTEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 3h 0m
			h	m	
Mon.	1		10	10	34O12
Tues.	2	1h 37m☌ ♄ ☾, ♄ 5° 25′ N			431O2
Wed.	3				42O1*
Thur.	4		6	50	42O3*
Fri.	5				41O23
Sat.	6				d4O13
☉ Sun.	7	21h 47.8m F.M.	3	40	4231O
Mon.	8	3h ☿ Stationary			34O21
Tues.	9	18h ♄ Stationary			314O2
Wed.	10	8h 45m☌♁ ☾, ♁ 0° 11′ N	0	30	23O14
Thur.	11	18h ☿ Greatest Hel. Lat. S.			2O34*
Fri.	12		21	20	1O234
Sat.	13	6h ♀ Greatest elong. E., 46° 22′			O2134
Sun.	14				213O4
☾ Mon.	15	2h ♀ in Aphelion; 16h 12.7m Moon L.Q.	18	10	3O214
Tues.	16				31O24
Wed.	17	1h 40m☌♂ ☾, ♂ 4° 40′ S.; 8h 48m☌ ♃ ☾, ♃ 5° 17′ S.			23O14
Thur.	18		15	00	241O3
Fri.	19				d4O23
Sat.	20	13h 20m☌ ♆ ☾, ♆ 3° 39′ S			4O123
Sun.	21	15h☌ ☿ ☉, Inferior	11	50	4213O
● Mon.	22	1h 17m☌ ☿ ☾, ☿ 5° 46′ S.; 6h 41.6m N.M.			43O1*
Tues.	23	13h 37m ☉ enters ♎, Autumn commences			431O2
Wed.	24		8	40	432O1
Thur.	25	15h 30m☌ ♀ ☾, ♀ 2° 3′ S			421O3
Fri.	26	20h☌♂ ♃, ♂ 0° 43′ N			O123*
Sat.	27		5	30	O243*
Sun.	28				21O34
☽ Mon.	29	6h □ ♄ ☉; 9h 11m ☌ ♄ ☾, ♄ 5° 30′ N.; 9h 57.8m, Moon F.Q.			3O14*
Tues.	30	0h ☿ Stationary; 18h ☿ in ♌	2	10	31O24

Explanation of symbols and abbreviations on page 4

THE SKY FOR OCTOBER, 1930

The times of transit are given in Local Mean Time; to change to Standard Time, see p. 9. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During October the sun's R.A. increases from 12h 26m to 14h 22m, and its Decl. from 2° 49′ S to 14° 8′ S. On the 24th the sun enters Scorpio, the second autumnal sign of the zodiac. The equation of time increases from 9m 58s to 16m 18s (see p. 7). For changes in the length of the day see p. 20. On the 21st there is a total eclipse of the sun, but it is not visible in the northern hemisphere.

The Moon—For its phases and conjunctions with the planets, see opp. page. On the 7th there is a partial eclipse of the moon, not visible in Canada.

Mercury on the 15th is in R.A. 12h 24m, Decl. 0° 24′ S, and transits at 10.54. On the 7th it reaches its greatest elongation west, and is then visible about 16° above the eastern horizon at sunrise.

Venus on the 15th is in R.A. 15h 54m, Decl. 25° 55′ S, and transits at 14.21. Although it attains greatest brilliancy, −4.3, on the 18th, it is not very favourably situated for observation. On the 18th it is only about 8° above the horizon and sets about 1 hour after the sun.

Mars on the 15th is in R.A. 7h 58m, Decl. 21° 45′ N, and transits at 6.26. About the middle of the month it enters the constellation of Cancer. It is in quadrature with the sun on the 27th and at that time rises about 11.00 o'clock in the evening. Its magnitude increases to +0.6 at the end of the month.

Jupiter on the 15th is in R.A. 7h 25m, Decl. 21° 59′ N, and transits at 5.52. On that date it rises about 11.00 o'clock at night, and may be seen in the constellation of Gemini. On the 13th it is in quadrature with the sun. For the configurations of its satellites see next page, and for their eclipses etc., see p. 53.

Saturn on the 15th is in R.A. 18h 27m, Decl. 22° 49′ S, and transits at 16.53. It sets about 4 hours after the sun on the 15th, but is not well placed for observation.

Uranus on the 15th is in R.A. 0h 49m, Decl. 4° 30′ N, and transits at 23.14.

Neptune on the 15th is in R.A. 10h 28m, Decl. 10° 19′ N, and transits at 8.55.

OCTOBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 2h 30m
			h m	
	Wed.	1		32O14
	Thur.	2	23 00	21O34
	Fri.	3		O1243
	Sat.	4		O423*
	Sun.	5 9h ☿ in Perihelion	19 50	d24O3
	Mon.	6		432O1
♉	Tues.	7 4h ♂☌♁☉; 6h ☿ Greatest elong. W., 17° 58′; 10h ♀ Greatest Hel. Lat. S.; 12h 56m ♂☌☾, ♁ 0° 16′ N.; 13h 55.6m F.M., Par. ecl. visible at Toronto (see p. 27)		431O2
	Wed.	8	16 40	d43O1
	Thur.	9		421O3
	Fri.	10		4O213
	Sat.	11	13 30	41O23
	Sun.	12		d42O3
	Mon.	13 8h □♃☉		32O14
	Tues.	14 20h 13m ♂♃☾, ♃ 5° 21′ S.	10 20	31O24
☾	Wed.	15 0h 11.9m Moon L.Q.; 9h 43m ♂♂☾, ♂ 4° 18′ S.; 16h ☿ Greatest Hel. Lat. N.		3O214
	Thur.	16		21O4*
	Fri.	17 23h 34m ♂♆☾, ♆ 3° 38′ S.	7 10	O2134
	Sat.	18 13h ♀ Greatest brilliancy		1O234
	Sun.	19		2O134
	Mon.	20 21h 17m ♂☿☾, ☿ 1° 11′ N.	4 00	23O4*
♏	Tues.	21 16h 47.6m N.M.; Tot. ecl. of ☉ (see p. 27)		31O42
	Wed.	22		34O21
	Thur.	23	0 50	421O*
	Fri.	24 10h 23m ♂♀☾, ♀ 2° 23′ S.		4O13*
	Sat.	25	21 40	41O23
	Sun.	26 20h 16m ♂♄☾, ♄ 5° 31′ N.		42O13
	Mon.	27 0h □♂☉		423O*
	Tues.	28	18 20	d43O2
☽	Wed.	29 4h 22.1m Moon F.Q.		3O12*
	Thur.	30 7h ♃ in ♌		213O4
	Fri.	31	15 10	O134*

Explanation of symbols and abbreviations on page 4

THE SKY FOR NOVEMBER, 1930

The times of transit are given in Local Mean Time; to change to Standard Time, see p. 9. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During November the sun's R.A. increases from 14h 22m to 16h 25m and its Decl. from 14° 8′ S to 21° 40′ S. The sun enters Sagittarius, the third autumn sign of the zodiac, on the 23rd. The equation of time rises from 16m 18s to a maximum value of 16m 22s on the 4th, and then drops to 11m 16s at the end of the month (see p. 7). For changes in the length of day see p. 20.

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

Mercury on the 15th is in R.A. 15h 36m, Decl. 20° 5′ S, and transits at 12.04. On the 7th it is in superior conjunction with the sun. It is too close to the sun to be seen this month.

Venus on the 15th is in R.A. 16h 5m, Decl. 25° 11′ S, and transits at 12.28. The planet decreases in magnitude from −4.2 to −3.2. It is not in good position for observation. On the 22nd, the planet is in inferior conjunction with the sun, after which it becomes a morning star.

Mars on the 15th is in R.A. 8h 54m, Decl. 19° 27′ N, and transits at 5.20. It is in Cancer, and rises about 10.00 o'clock in the evening, on the 15th. It attains a magnitude of +0.1 at the end of the month, and can easily be recognized by its ruddy colour.

Jupiter on the 15th is in R.A. 7h 28m, Decl. 21° 56′ N, and transits at 3.54. It rises about 9.00 o'clock at night on the 15th, and is a brilliant object in Gemini. Its magnitude increases to −2.2 at the end of the month. For the configurations of its satellites see next page, and for their eclipses etc., see p. 53.

Saturn on the 15th is in R.A. 18h 37m, Decl. 22° 45′ S, and transits at 15.01. It is in Sagittarius and sets about 2 hours after the sun on the 15th. It is not in good position for observation during November.

Uranus on the 15th is in R.A. 0h 45m, Decl. 4° 6′ N, and transits at 21.08.

Neptune on the 15th is in R.A. 10h 31m, Decl. 10° 5′ N, and transits at 6.56.

NOVEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 1h 45m
			h	m	
Sat.	1				10234
Sun.	2	4h ☿ Stationary			20134
Mon.	3	18h 27m ☌ ♁ ☾, ♁ 0° 23′ N	12	00	d2104
Tues.	4				30124
Wed.	5				3024*
♋ Thur.	6	5h 28.1m F.M.; 22h ☌ ☿ ☉, Superior	8	50	23104
Fri.	7				24013
Sat.	8	0h ♃ Stationary; 2h ☿ in ♉			41023
Sun.	9		5	40	d4013
Mon.	10				42103
Tues.	11	3h 8m ☌ ♃ ☾, ♃ 5° 15′ S			43012
Wed.	12	11h 49m ☌ ♂ ☾, ♂ 3° 19′ S	2	30	4302*
☾ Thur.	13	7h 27.3m Moon L.Q.			43210
Fri.	14	7h 0m ☌ ♆ ☾, ♆ 3° 31′ S	23	20	42013
Sat.	15				14023
Sun.	16				02143
Mon.	17		20	10	21034
Tues.	18	4h ☌ ☿ ☿, ☿ 2° 35′ N.; 9h ☿ in Aphelion			30214
Wed.	19				31024
● Thur.	20	5h 21.2m N.M.; 11h 47m ☌ ☿ ☾, ☿ 0° 5′ N.; 21h 28m ☌ ☿ ☾, ☿ 2° 14′ N	17	00	d3204
Fri.	21				20314
Sat.	22	13h ☌ ☿ ☉, Inferior			10234
Sun.	23	9h 44m ☌ ♄ ☾, ♄ 5° 26′ N	13	40	02413
Mon.	24				21403
Tues.	25				4301*
Wed.	26		10	30	43102
Thur.	27				43201
◗ Fri.	28	1h 17.6m Moon F.Q.; 12h □ ♆ ☉			4201*
Sat.	29		7	20	41023
Sun.	30				40213

Explanation of symbols and abbreviations on page 4

THE SKY FOR DECEMBER, 1930

The times of transit are given in Local Mean Time; to change to Standard Time, see p. 9. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During December the sun's R.A. increases from 16h 25m, to 18h 42m. On the 22nd the Decl. is at its maximum value of 23° 27′ S. It is then at winter solstice, the sun enters Capricornus and Winter begins. From this date on the sun moves slowly northward. The length of daylight is at its minimum and changes very slightly for several days (see p. 21). The equation of time is 11m 16s at the first of the month and drops to zero on the 25th (see p. 7).

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

Mercury on the 15th is in R.A. 18h 50m, Decl. 25° 6′ S, and transits at 13.20. On the 20th it is at its greatest elongation east and sets about 1½ hours after the sun.

Venus on the 15th is in R.A. 15h 21m, Decl. 15° 54′ S, and transits at 9.48. The planet reaches its greatest brilliancy of −4.4 on the 28th. It is a bright object in the morning sky. On the 15th it rises 2¾ hours before the sun, and is about 22° above the horizon at sunrise.

Mars on the 15th is in R.A. 9h 21m, Decl. 18° 45′ N, and transits at 3.48. The planet enters the constellation of Leo about the middle of the month. On the 15th it rises about 8.30 o'clock in the evening and is well in view all night. Its stellar magnitude increases during the month from +0.1 to −0.6.

Jupiter on the 15th is in R.A. 7h 20m, Decl. 22° 18′ N, and transits at 1.47. It rises about 2 hours after sunset on the 15th and is in good position for observation throughout the month. It is in the constellation of Gemini. For the configurations of its satellites see next page, and for their eclipses etc., see p. 53.

Saturn on the 15th is in R.A. 18h 51m, Decl. 22° 33′ S, and transits at 13.17. It is approaching the sun and on the 15th sets about 1½ hours after it.

Uranus on the 15th is in R.A. 0h 43m, Decl. 3° 55′ N, and transits at 19.08.

Neptune on the 15th is in R.A. 10h 31m, Decl. 10° 3′ N, and transits at 4.58.

DECEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 1h 0m
			h	m	
Mon.	1	1h 49m☌♁ ☾, ♁ 0° 22′ N.			42103
Tues.	2	16h ♀ in ♌	4	10	32041
Wed.	3				31024
Thur.	4				32014
Fri.	5	19h 39.9m F.M.	1	00	204**
Sat.	6				10234
Sun.	7		21	50	01234
Mon.	8	7h 21m☌♃ ☾, ♃ 5° 2′ S.; 17h ☿ Greatest Hel. Lat. S.; 23h Ψ Stationary			21034
Tues.	9				32014
Wed.	10	5h 16m☌♂ ☾, ♂ 1° 53′ S.	18	40	31042
Thur.	11	12h 46m☌Ψ ☾, Ψ 3° 17′ S.; 22h ♀ Stationary			d3401
☾ Fri.	12	15h 6.6m Moon L.Q.			42310
Sat.	13		15	30	d4023
Sun.	14	19h☌☿ ♄, ☿ 2° 33′ S.			40123
Mon.	15				42103
Tues.	16		12	20	42301
Wed.	17	6h 46m☌♀ ☾, ♀ 5° 43′ N.			43102
Thur.	18				34021
Fri.	19	10h♂ Stationary; 20h 23.7m N.M.	9	00	23104
Sat.	20	0h ☿ Greatest elong. E., 20° 11′; 23h 48m☌ ♄ ☾, ♄ 5° 21′ N.			01234
Sun.	21	12h 42m☌ ☿ ☾, ☿ 3° 39′ N.; 13h♁ Stationary			0234*
Mon.	22	8h 40m ☉ enters ♑, Winter commences	5	50	21034
Tues.	23				d2014
Wed.	24				31024
Thur.	25		2	40	30214
Fri.	26				23104
Sat.	27	13h ☿ Stationary; 18h ☿ in ♌; 22h 58.7m Moon F.Q.	23	30	4013*
Sun.	28	10h 24m☌♁ ☾, ♁ 0° 8′ N.; 11h ♀ Greatest brilliancy.			4023*
Mon.	29				42103
Tues.	30		20	20	42031
Wed.	31				43102

Explanation of symbols and abbreviations on page 4

PHENOMENA OF JUPITER'S SATELLITES, 1930

E — clipse, O—occultation, T—transit, S—shadow, D—disappearance, R—reappearance
I—ingress, e—egress. The Roman numerals denote the satellites.
75th Meridian Civil Time.

JANUARY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
0	22	36	I	OD	16	0	20	I	SI
1	1	29.5	I	ER		1	32	I	Te
	19	48	I	TI		2	02	II	OD
	20	30	I	SI		2	30	I	Se
	21	23	II	OD		20	37	I	OD
	21	58	I	Te		23	49.5	I	ER
	22	41	I	SE	17	17	49	I	TI
2	1	02	III	OD		18	49	I	SI
	1	13.2	II	ER		19	59	I	Te
	3	17	III	OR		20	51	II	TI
	3	52.6	III	ED		20	59	I	Se
	19	58.3	I	ER		22	54	II	SI
3	17	38	II	SI		23	16	II	Te
	18	30	II	Te	18	1	22	II	Se
	20	05	II	Se		18	18.4	I	ER
5	17	58	III	SI	19	19	42.7	II	ER
	20	23	III	Se		21	48	III	TI
7	3	07	I	TI	20	0	07	III	Te
	3	56	I	SI		1	59	III	SI
8	0	22	I	OD	23	1	11	I	TI
	3	25.0	I	ER		2	15	I	SI
	21	34	I	TI		18	23.4	III	ER
	22	25	I	SI		22	26	I	OD
	23	41	II	OD	24	1	45.1	I	ER
	23	44	I	Te		19	38	I	TI
9	0	35	I	Se		20	44	I	SI
	3	48.9	II	ER		21	48	I	Te
	18	48	I	OD		22	54	I	Se
	21	53.9	I	ER		23	17	II	TI
10	18	11	I	Te	25	1	32	II	SI
	18	28	II	TI		1	42	II	Te
	19	04	I	Se		20	14.1	I	ER
	20	16	II	Si	26	22	18.9	II	ER
	20	51	II	Te	27	1	25	III	TI
	22	43	II	Se	30	19	55.0	III	ED
12	18	16	III	TI		22	25.9	III	ER
	20	32	III	Te	31	0	17	I	OD
	21	58	III	SI		21	28	I	TI
13	0	24	III	Se		22	39	I	SI
15	2	10	I	OD		23	38	I	Te
	23	22	I	TI		24	49	I	Se

FEBRUARY

1	0	49	I	Se	15	1	13	I	TI
	1	45	II	TI		22	30	I	OD
	18	45	I	OD	16	19	41	I	TI
	22	9.8	I	ER		20	58	I	SI
2	18	06	I	Te		21	53	I	Te
	19	18	I	Se		23	08	I	SI
	20	03	II	OD	17	1	04	II	OD
3	0	55.1	II	ER		20	30.1	I	ER
4	19	57	II	Se		20	32	III	Se
6	18	56	III	OD	18	20	07	II	TI
	21	21	III	OR		22	33	II	Te
	23	56.0	III	ED		22	44	II	SI
7	23	20	I	TI	19	1	13	II	Se
8	0	34	I	SI	20	19	26.4	II	ER
	1	30	I	Te	23	0	25	I	OD
	20	37	I	OD		21	36	I	TI
9	0	05.5	I	ER		22	53	I	SI
	19	03	I	SI		23	46	I	Te
	19	58	I	Te	24	18	54	I	OD
	20	13	I	Se		19	10	II	Te
	22	32	II	OD		22	01	III	SI
10	0	59	II	OR		22	25.9	I	ER
	1	02.4	II	ED	25	0	34	III	Se
	18	34.4	I	ER		19	33	I	Se
11	19	59	II	Te		22	43	II	TI
	20	07	II	SI	27	19	24	II	OR
	22	35	II	Se		19	32.9	II	ED
13	22	46	III	OD		22	03.2	II	ER
14	1	13	III	OR					

MARCH

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
2	23	31	I	TI	15	19	51	II	Te
3	20	44	III	TI		19	56	II	SI
	20	50	I	OD		22	26	II	Se
	23	13	III	Te	18	21	54	I	TI
4	0	21.5	I	ER		23	08	I	SI
	19	17	I	SI	19	19	14	I	OD
	20	10	I	Te		22	41.7	I	ER
	21	28	I	Se	20	19	48	I	Se
5	18	50.5	I	ER	21	19	0	III	OD
6	19	33	II	OD		21	35	III	OR
	22	01	II	OR	22	20	05	II	TI
	22	09.3	II	ED		22	33	II	SI
8	19	49	II	Se		22	34	II	Te
10	22	46	I	OD	24	19	12.9	II	ER
11	19	56	I	TI	26	21	12	I	OD
	21	13	I	SI	27	19	32	I	SI
	22	07	I	Te		20	32	I	Te
	23	24	I	Se		21	44	I	Se
12	20	46.1	I	ER	28	19	05.9	I	ER
13	22	12	II	OD	29	22	49	II	TI
14	19	59.3	III	ED	31	21	50.2	II	ER
	22	37.3	III	ER					

APRIL

1	20	44	III	Se	15	22	02	III	TI
3	20	20	I	TI	16	19	41	II	SI
	21	28	I	SI		20	14	II	Te
	22	32	I	Te	18	21	42	I	OD
4	21	01.3	I	ER	19	19	47	I	SI
7	19	43	II	OD		21	02	I	Te
8	20	20	III	Te		21	59	I	Se
	22	05	III	SI	20	19	20.6	I	ER
9	19	37	II	Se	23	20	30	II	TI
10	22	20	I	TI	26	20	02.3	III	ED
11	19	41	I	OD		20	51	I	TI
12	20	04	I	Se	27	21	15.7	I	ER

MAY

3	20	27	III	OD	9	20	19	II	OD
4	20	13	I	OD	12	20	02	I	SI
5	19	35	I	Te	21	20	08	III	TI
5	20	19	I	Se					

JULY

19	4	27	I	Se	27	4	11	I	OD
26	4	08	I	SI					

AUGUST

3	14	25	I	ED	18	4	19	I	SI
4	3	28	I	Te	19	4	40	I	OR
5	3	46	II	Te		4	48	II	SI
	3	54.7	III	ED	21	4	19	II	OR
11	3	14	I	TI	26	3	23.6	I	ED
	4	39	I	Se	27	2	56	I	Se
12	3	51	II	TI		3	58	I	Te
15	3	19	IV	Te	28	2	15.8	II	ED
16	4	45	III	Te					

SEPTEMBER

3	2	36	I	SI		4	07	II	Te
	3	26	III	OR	10	2	54.2	III	ER
	3	42	I	TI		4	28	III	OD
	4	50	I	Se		4	30	I	SI
4	3	06	I	OR	11	1	38.8	I	ED
	4	52.0	II	ED		5	04	I	OR
6	1	52	II	Se	12	1	13	I	Se

SEPTEMBER—*Continued*

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
	2	23	I	Te	21	2	10	III	Te
13	1	47	II	SI	22	4	39	II	OR
	4	06	II	TI	25	5	25.6	I	ED
	4	26	II	Se	26	1	58	IV	OD
15	1	58	II	OR		2	47	I	SI
17	3	46.6	III	ED		4	02	I	TI
18	3	32.2	I	ED		4	17	IV	OR
19	0	53	I	SI		5	00	I	Se
	2	06	I	TI	27	3	26	I	OR
	3	06	I	Se	28	0	45	I	Te
	4	20	I	Te		1	04	III	Se
20	1	30	I	OR		3	05	III	TI
	4	21	II	SI	29	1	57.7	II	ED

OCTOBER

1	1	28	II	Te	17	1	50	II	OR
3	4	41	I	SI	18	5	34.1	I	ED
4	0	03	IV	SI	19	2	56	I	SI
	1	26	IV	Se		4	13	I	TI
	1	47.3	I	ED		5	10	I	Se
	5	21	I	OR	20	0	02.5	I	ED
5	0	26	I	TI		3	36	I	OR
5	1	22	I	Se		23	38	I	Se
	1	57	III	SI	21	0	55	I	Te
	2	40	I	Te		5	34	IV	TI
	5	03	III	Se	22	3	55	II	SI
	23	49	I	OR		23	39.4	III	ED
6	4	33.1	II	ED	23	2	50.7	III	ER
8	1	20	II	TI		4	49	III	OD
	1	27	II	Se		23	00.8	II	ED
	4	05	II	Te	24	4	22	II	OR
9	0	15	III	OR	26	4	50	I	SI
11	3	40.7	I	ED	27	1	56.0	I	ED
12	1	03	I	SI		5	28	I	OR
	2	20	I	TI		23	18	I	SI
	3	16	I	Se	28	0	33	I	TI
	4	34	I	Te		1	32	I	Se
13	1	43	I	OR		2	47	I	Te
15	1	20	II	SI		23	56	I	OR
	3	55	II	TI	29	2	06.8	IV	ED
	4	02	II	Se		3	58.8	IV	ER
16	0	55	III	OD	30	3	37.4	III	ED
	4	14	III	OR	31	1	35.7	II	ED

NOVEMBER

1	22	13	II	TI		5	43.0	I	ED
	22	30	II	Se		5	45	III	Te
2	0	59	II	Te		22	32	II	OR
	22	44	III	TI	11	3	05	I	SI
3	2	02	III	Te		4	13	I	TI
	3	49.5	I	ED		5	19	I	Se
4	1	12	I	SI	12	0	11.4	I	ED
	2	23	I	TI		3	36	I	OR
	3	25	I	Se		21	33	I	SI
	4	38	I	Te		22	40	I	TI
	22	17.8	I	ED		23	47	I	Se
5	1	46	I	OR	13	0	54	I	Te
	23	05	I	Te		22	03	I	OR
6	22	33	IV	TI	14	22	13.5	IV	ER
7	1	22	IV	Te	15	6	11	IV	OD
	4	10.4	II	ED	16	0	56	II	SI
8	22	21	II	SI		3	06	II	TI
9	0	41	II	TI		3	41	II	Se
	1	05	II	Se		5	53	II	Te
	3	27	II	Te	17	1	47	III	SI
	21	49	III	SI		5	00	III	Se
10	1	00	III	Se		6	04	III	TI
	2	25	III	TI	18	0	56	II	OR

NOVEMBER—*Coulinued*

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
	4	58	I	SI	25	3	18	II	OR
	6	01	I	TI	26	3	58.9	I	ED
19	2	05.1	I	ED		21	27	II	Te
	5	24	I	OR	27	1	20	I	SI
	19	26	I	SI		2	14	I	TI
20	0	28	I	TI		3	35	I	Se
	1	41	I	Se		4	29	I	Te
	2	42	I	Te		22	27.4	I	ED
	22	58	III	OR		22	47.1	III	ER
	23	51	I	OR		23	09	III	OD
21	21	09	I	Te	28	1	38	I	OR
23	3	31	II	SI		2	30	III	OR
	5	29	II	TI		20	41	I	TI
	5	44	IV	SI		22	03	I	Se
	6	16	II	Se		22	56	I	Te
24	5	46	III	SI	30	6	07	II	SI
	22	37.0	II	ED					

DECEMBER

1	21	46	IV	OD		3	23	II	Se
2	0	43	IV	OR		4	22	II	Te
	1	11.5	II	ED	19	4	09.6	I	ED
	5	37	II	OR		19	37.4	II	ED
3	5	52.8	I	ED		23	17	II	OR
	21	0	II	TI	20	1	29	I	SI
	22	10	II	Se		1	55	I	TI
	23	47	II	Te		3	45	I	Se
4	3	14	I	SI		4	11	I	Te
	5	00	I	TI		22	38.1	I	ED
	5	28	I	Se	21	1	20	I	OR
	6	15	I	Te		19	58	I	SI
	23	40.2	III	ED		20	21	I	TI
5	0	21.3	I	ED		22	13	I	Se
	3	24	I	OR		22	37	I	Te
	5	57	III	OR	22	19	46	I	OR
	21	42	I	SI		21	39	III	SI
	22	27	I	TI		23	08	III	TI
	23	57	I	Se	23	0	57	III	Se
6	0	42	I	Te		2	27	III	Te
	21	50	I	OR	25	3	12	II	SI
8	19	49	III	Te		3	50	II	TI
9	3	45.9	II	ED		6	00	II	Se
	23	40	IV	SI		6	38	II	Te
10	2	12	IV	Se	26	6	03.9	I	ED
	5	40	IV	TI		20	03	IV	TI
	22	0	II	SI		20	22	IV	Se
	23	18	II	TI		22	11.9	II	ED
11	0	46	II	Se		23	00	IV	Te
	2	06	II	Te	27	1	31	II	OR
	5	07	I	SI		3	23	I	SI
	5	45	I	TI		3	39	I	TI
12	2	15.4	I	ED		5	38	I	Se
	3	29.4	III	ED		5	54	I	Te
	5	09	I	OR	28	0	32.5	I	ED
	21	02	II	OR		3	03	I	OR
	23	36	I	SI		19	19	II	Se
13	0	11	I	TI		19	46	II	Te
	11	51	I	Se		21	52	I	SI
	2	27	I	Te		22	05	I	TI
	19	43.9	I	ED	29	0	07	I	Se
	23	35	I	OR		0	20	I	Te
14	20	19	I	Se		19	01.1	I	ED
	20	53	I	Te		21	29	I	OR
15	19	49	III	TI	30	1	38	III	SI
	20	57	III	Se	30	2	24	III	TI
	23	09	III	Te		4	57	III	Se
16	6	20.3	II	ED		5	43	III	Te
18	0	36	II	SI		18	35	I	Se
	1	34	II	TI		18	46	I	Te

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 Diameter 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	3009	0.0556	4.7(?)	0.055	88d
♀ Venus	0.723	67.2	224.70	0.62	7575	0.817	4.94	0.88	225d
⊕ Earth	1.000	92.9	365.26	1.00	7917.8	1.000	5.55	1.000	23h 56m 4s
♂ Mars	1.524	141.5	686.97	1.88	4216	0.108	3.92	0.151	24h 37m 23s
♃ Jupiter	5.203	483.3	4332.58	11.86	86728	318.4	1.32	1314	9h 55m ±
♄ Saturn	9.539	886.1	10759.2	29.46	72430	95.2	0.72	765	10h 14m ±
♅ Uranus	19.191	1782.8	30685.9	84.02	30878	14.6	1.22	59	10h 45m ±
♆ Neptune	30.071	2793.4	60187.6	164.79	32932	16.9	1.11	72	?
☉ Sun	....	....	....	....	864392	333400	1.39	1301100	25d 7h 48m±
☾ Moon	From ⊕ 238,857 mls.		27.32	0.075	2160	0.0123	3.39	0.020	27d 7h 43m 11.5s

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. Triton....	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 Canum Venat.	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.
o Cygni.....	4.3, 7.5, 5.5	337.8, 106.8	Yellow, Blue.
24 Coma Beren..	5.6, 7	21	Orange, Lilac.
o 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.
o 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.
o 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 Leon Campbell, Harvard Observatory, Cambridge, Mass., 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.....15[illegible]6
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 obervations, 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 to which, from his measurements, he assigned a parallax of 0″.78. Its brightness is only 1/20,000 that of Alpha Centauri. 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″.53. 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 SUN'S NEIGHBOURS—STARS NEARER THAN FIVE PARSECS

This table includes all stars known to be nearer than five Parsecs = 16.3 l−y. The apparent magnitudes m, and type are taken from Luyten's Study of the Nearby Stars, H.A. *85*, 73. The parallaxes, π, and proper motions, μ, are taken from Schlesinger's Catalogue of Parallaxes. M is the absolute magnitude and L the luminosity, the Sun being taken as unity. Sirius A, Procyon A and Altair are the only giant stars, the remainder being dwarfs. Wolf 359, the fifth star nearest the Sun, is intrinsically the faintest star known. It is also noteworthy that fifty per cent. of the stars are members of binary systems.

Name	(1900)α		(1900)δ		m	Type	π	μ	M	L
	h	m	°	′			″	″		
Sun					−26.7	Go			4.8	1.00
Prox. Cen.	14	22.8	−62	15	11.2	M(?)	0.765	3.76	15.6	.00005
αCen. A.	14	32.8	−60	25	0.3	G2	.758	3.68	4.7	1.10
αCen. B.	14	32.8	−60	25	1.7	K3	.760	3.68	6.1	0.30
Barnard	17	52.9	+ 4	25	9.7	Mb	.538	10.30	13.3	.0004
Wolf 359	10	51.6	+ 7	36	13.5	M4e	.404	.....	16.5	.00002
L1 21185	10	57.9	+36	38	7.6	Mb	.392	4.78	10.6	.005
Sirius A	6	40.7	−16	35	−1.6	A0	.371	1.32	1.2	28.
Sirius B	6	40.7	−16	35	8.4	F	.371	.....	11.2	.0028
B.D.−12.4523	16	24.8	−12	24	9.5	M5	.349	.....	12.2	.001
Innes	11	12.0	−57	02	12	.....	.340	2.69	14.7	.0001
C.Z.−5h243	5	7.7	−44	59	9.2	K2	.317	8.75	11.7	.002
τCet	1	39.4	−16	28	3.6	K0	.315	1.92	6.1	.30
Procyon A	7	34.1	+ 5	29	0.5	F5	.312	1.24	3.0	5.2
Procyon B	7	34.1	+ 5	29	12.5	.....	.312	.....	15.0	.00008
ϵEri	3	28.2	− 9	48	3.8	K0	.310	.97	6.3	.25
61 Cyg. A.	21	02.4	+38	15	5.6	K7	.300	5.20	8.0	.052
61 Cyg. B.	21	02.4	+38	15	6.3	K8	.300	5.20	8.7	.028
Lac 9352	22	59.4	−36	26	7.1	Ma	.292	6.90	9.4	.014
Bu 8798A	18	41.7	+59	29	9.3	Mb	.287	2.31	11.6	.002
Bu 8798B	18	41.7	59	29	10.0	Mb	.287	.....	12.3	.001
Grmb 34A	0	12.7	+43	27	8.1	Ma	.282	2.89	10.3	.006
Grmb 34B	0	12.7	+43	27	10.7	Mb	.282	.....	12.9	.0006
ϵ Indi	21	55.7	−57	12	4.7	K5	.281	4.70	6.9	.14
Kruger 60A	22	24.4	+57	12	9.6	Mb	.257	.87	11.6	.002
Kruger 60B	22	24.4	+57	12	11.3	.....	.....	.....	13.3	.0004
van Maanen	0	43.9	+ 4	55	12.3	Fo	.255	3.01	14.3	.0002
Lac 8760	21	11.4	−39	15	6.6	Ma	.253	3.53	8.6	.030
Anon	2	50.3	+52	05	9.2	.....	.239	0.49	11.1	.003
Gould 32416	23	59.5	−37	15	8.2	Ma	.220	6.11	9.9	.009
Oe. Arg. 17415	17	37.0	+68	26	9.1	Mb	.213	1.33	10.7	.004
+20.2465	10	14.2	+20	22	9.2	Ma	.207	.49	10.8	.004
Altair	19	45.9	+ 8	36	0.9	A5	.204	.66	2.4	9.1
o²Eri A	4	10.7	− 7	49	4.5	G5	.203	4.08	6.0	.33
o²Eri B	4	10.7	− 7	49	9.7	Ao	.203	4.08	11.2	.003
o²Eri C	4	10.7	− 7	49	10.8	Mb	.203	4.08	12.3	.001

THE BRIGHTEST STARS

Their Magnitudes, Types, Proper Motions, Distances and Radial Velocities

Prepared by W. E. HARPER

The accompanying table contains the chief known facts regarding 260 stars brighter than apparent magnitude 3.51 as listed in *Harvard Annals*, Volume 50. The position of the star for 1900 is given in the second and tnird columns. The fourth and fifth columns give the apparent visual magnitude and type taken from the same publication. In a few cases the type is changed to conform with a later determination.

The parallaxes are taken from Schlesinger's Advance Copy of Catalogue of Parallaxes, 1924 Edition, and for such stars the proper motions are copied from the same source. The remaining proper motions were computed using the abbreviated μ_α and μ_δ as they appeared in the HANDBOOK for 1915, where this table first appeared, and are not necessarily correct to the third decimal place. Three or four spectroscopic parallaxes have been added to those given in Schlesinger's catalogue. The small letter *s* following the parallax indicates a spectroscopic determination has also been made. The distance is also given in light years in the eighth column as to the lay mind that seems a fitting unit. The real parallax of a star cannot be a negative quantity, but in some cases the result of the calculation gives a negative quantity. In each such case the distance in light years is computed on the assumption that the parallax is positive and equal to $''.001$. The sign (:) after it indicates that the value is uncertain. The absolute magnitude or the magnitude the star would appear to have if it were at a distance of 32.6 light years is given in the ninth column. At that distance the sun would appear as a star of magnitude 5.5. The radial velocity, taken from Voûte's list supplemented from our observatory card catalogue, is given in the last column. Those starred indicate that the star is a spectroscopic binary for which the velocity of the system is given. Where only the whole number appears the velocity may be regarded as approximate. There are 74 starred out of 235 radial velocities set down or one in three of the bright stars is a spectroscopic binary. The sign || denotes a visual double and the combined magnitude is given.

The 20 first magnitude stars are printed in black face type.

NOTE.—Some of the parallaxes in this table differ slightly from those given in the previous table. The reader should be not surprised at this, and it has not been thought worth while to harmonize the two tables.—EDITOR.

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			k m./sec
α Andromedae	0 3	+28 32	2.2	Aop	.207	.....	.....	.....	−13.0*
β Cassiopeiae	4	+58 36	2.4	F5	.561	.071 s	46	1.7	+12.8
γ Pegasi	8	+14 38	2.9	B2	.010	.....	.....	.....	+ 7. *
β Hydri	20	−77 49	2.9	G0	2.243	.141	23	3.6	+22.2
α Phoenicis	21	−42 51	2.4	K0	.446	.....	.....	.....	+75.8*
δ Andromedae	34	+30 19	3.5	K2	.167	.026 s	125	0.6	− 5. *
α Cassiopeiae	35	+55 59	2.2–2.8	K0	.062	.016 s	204	−1.8	− 3.0
β Ceti	39	−18 32	2.2	K0	.230	.042 s	78	0.3	+13.5
||γ Cassiopeiae	51	+60 11	2.2	B0p	.031	.036	91	0.0	− 4.7
β Phoenicis	1 2	−47 15	3.4	K0	.042	.....	.....	.....	− 0.6
β Andromedae	4	+35 5	2.4	M0	.219	.045 s	72	0.7	− 2.
δ Cassiopeiae	19	+59 43	2.8	A5	.306	.....	.....	.....	+ 9.
||α Ursae Minoris	23	+88 46	2.1	F8	.043	.007 s	466	−3.7	−14.8*
γ Phoenicis	24	−43 50	3.4	K5	.222	.....	.....	.....	+26. *
α **Eridani**	34	−57 44	0.6	B5	.093	.049 s	67	−1.0	
ε Cassiopeiae	47	+63 11	3.4	B3	.043	.001 s	3260	−6.6	− 7.4
β Arietis	49	+20 19	2.7	A5	.150	.064 s	51	1.7	− 0.6*
α Hydri	56	−62 3	3.0	F0	.256	.....	.....	.....	− 5.
||γ Andromedae	58	+41 51	2.3	K0	.073	.007 s	466	−3.5	−10.9
α Arietis	2 2	+22 59	2.2	K2	.242	.033 s	99	−0.2	−14.3
β Trianguli	4	+34 31	3.1	A5	.161	.014	262	−1.2	.....*
o Ceti	14	− 3 26	1.7–9.6	M6e	.239	.062	53	0.7	+63.9
||θ Eridani	54	−40 42	3.4	A2	.071	.....	.....	.....	+20.
α Ceti	57	+ 3 42	2.8	M1	.080	.011 s	296	−2.0	−25.8
γ Persei	58	+53 7	3.1	Gp	.012	.012 s	272	−1.5	+ 2. *
ρ Persei	59	+38 27	3.4–4.2	M6	.176	.038 s	86	1.3	+28.6
β Persei	3 2	+40 34	2.1–3.2	B8	.011	.....	.....	.....	+ 5. *
α Persei	17	+49 30	1.9	F5	.041	.015 s	217	−2.2	− 2.4
δ Persei	36	+47 28	3.1	B5	.047	.005 s	652	−3.4	+ 0.7
||η Tauri	41	+23 48	3.0	B5p	.053	.007 s	466	−2.8	+15.
ζ Persei	48	+31 55	2.9	B1	.023	−.003 s	3260:	−7.1	+21.2
γ Hydri	49	−74 33	3.2	Ma	.128	.....	.....	.....	+16.8
||ε Persei	51	+39 43	3.0	B1	.041	−.012 s	3260:	−7.0	.....*
γ Eridani	53	−13 47	3.2	K5	.133	.018 s	181	−0.5	+62.2
λ Tauri	55	+12 12	3.3–4.2	B3	.015	−.008	3260:	−6.7	+13.6*
α Reticuli	4 13	−62 43	3.4	G5	.069	.....	.....	.....	+35.4

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′							km./sec.
α_2 **Tauri**	4 30	+16 18	1.1	K5	.205	.057 s	57	−0.1	+54.5
α Doradus	32	−55 15	3.5	A0p	.003	.....	.....	.....	+26.
π^3 Orionis	44	+ 6 47	3.3	F8	.474	.136 s	24	4.0	+24.7
ι Aurigae	50	+33 0	2.9	K2	.030	.018 s	181	−0.8	+18.5
ϵ Aurigae	55	+43 41	3.4–4.1	F5p	.015	.002 s	1630	−5.0	− 9. *
η Aurigae	5 0	+41 6	3.3	B3	.082	.014 s	233	−1.0	+ 3.0
ϵ Leporis	1	−22 30	3.3	K5	.074	.022 s	148	0.0	+ 1.1
β Eridani	3	− 5 13	2.9	A3	.117	.052 s	63	1.5	− 8.
μ Leporis	8	−16 19	3.3	A0p	.053	.....	.....	.....	+28.0
‖α **Aurigae**	9	+45 54	0.2	G0	.439	.075 s	43	−0.4	+30.2*
‖β **Orionis**	10	− 8 19	0.3	B8p	.005	.006	543	−5.8	+22.6*
‖η Orionis	19	− 2 29	3.4	B1	.000	.....	.....	.....	+35.5*
γ Orionis	20	+ 6 16	1.7	B2	.019	.019 s	172	−1.9	+19.
β Tauri	20	+28 31	1.8	B8	.180	.024 s	136	−1.3	+11.
β Leporis	24	−20 50	3.0	G0	.095	.004 s	815	−4.0	−13.7
‖δ Orionis	27	− 0 22	2.4	B0	.006	.009 s	362	−2.8	+17.6*
α Leporis	28	−17 54	2.7	F0	.006	.014 s	233	−1.6	+24.6
‖ι Orionis	31	− 5 59	2.9	Oe5	.000	.....	.....	.....	+21.3*
ϵ Orionis	31	− 1 16	1.8	B0	.004	.005 s	652	−3.7	+26.3
ζ Tauri	32	+21 5	3.0	B3p	.028	−.001 s	3260:	−7.2	+16.4*
‖ζ Orionis	36	− 2 0	1.8	B0	.012	−.019 s	3260:	−8.2	+17.9
α Columbae	36	−34 8	2.8	B5p	.040	.....	.....	.....	.....
κ Orionis	43	− 9 42	2.2	B0	.009	.029 s	112	2.5	+19.
β Columbae	47	−35 48	3.2	K0	.397	.....	.....	.....	+89.2
α **Orionis**	50	+ 7 23	1.0–1.4	M1	.032	.017 s	192	−2.8	+21.3*
β Aurigae	52	+44 56	2.1	A0p	.046	.034 s	96	−0.2	−19. *
‖θ Aurigae	53	+37 12	2.7	A0p	.106	.016 s	204	−1.3	+28.5
η Geminorum	6 9	+22 32	3.2–4.2	M2	.062	.014 s	233	−1.1	+20. *
μ Geminorum	17	+22 34	3.2	M3	.129	.016 s	204	−0.8	+55.2
β Can. Majoris	18	−17 54	2.0	B1	.003	.012 s	272	−2.6	+33. *
α **Carinae**	22	−52 38	−0.9	F0	.022	.005 s	652	−7.4	+20.2
γ Geminorum	32	+16 29	1.9	A0	.066	.043 s	76	0.1	−12.3*
ν Puppis	35	−43 6	3.2	B8	.020	.....	.....	.....	+26.0*
ϵ Geminorum	38	+25 14	3.2	G5	.020	.007 s	466	−2.6	+ 9.5
ξ Geminorum	40	+13 0	3.4	F5	.230	.048 s	68	1.8	+26.7
‖α **Can. Majoris**	41	−16 35	−1.6	A0	1.315	.371 s	9	1.2	− 7.4*
α Pictoris	47	−61 50	3.3	A5	.271	.....	.....	.....	.....
τ Puppis	47	−50 30	2.8	K0	.094	.....	.....	.....	+37. *

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
||ϵ Can. Majoris	6 55	−28 50	1.6	B1	.000	.....	.....	.....	+28.2
ζ Geminorum	58	20 43	3.7–4.3	G0p	.007	.005 s	652	−2.8	+ 6.8*
o^2 Can. Majoris	59	−23 41	3.1	B5p	.000	.....	.....	.....	.....
δ Can. Majoris	7 4	−26 14	2.0	G2p	.005	.010	326	−2.9	+34. *
L ^{2}Puppis	10	−44 29	3.4–6.2	Md	.334	.....	.....	.....	+52.6
π Puppis	14	−36 55	2.7	K5	.012	.....	.....	.....	+16.3
β Can. Minoris	22	+ 8 29	3.1	B8	.063	.020 s	163	−0.4	.....
σ Puppis	26	−43 6	3.3	K5	.192	.....	.....	.....	+87.3
||α_2 Geminorum	28	+32 6	2.0	A0	.201	.077 s	42	1.4	+ 6.2*
α_1 Geminorum	28	+32 6	2.8	A0	.209	.....	.....	.....	− 1.0*
α **Can. Minoris**	34	+ 5 29	0.5	F5	1.242	.312 s	10	3.0	− 4.3
β **Geminorum**	39	+28 16	1.2	K0	.623	.101 s	32	1.2	+ 3.6
ξ Puppis	45	−24 37	3.5	G6p	.007	.003 s	1087	−4.2	+ 4.2
ζ Puppis	8 0	−39 43	2.3	Od	.036	.....	.....	.....	.....
ρ Puppis	3	−24 1	2.9	F5	.097	.028 s	116	0.1	+46.
||γ Velorum	6	−47 3	2.2	Oap	.000	.....	.....	.....	.....
||ϵ Carinae	8 20	−59 11	1.7	K0	.032	.....	.....	.....	+11.7
o Urs. Majoris	22	+61 3	3.5	G0	.166	−.004 s	3260:	−6.5	+20.3
||ϵ Hydrae	41	+ 6 47	3.5	F8	.193	.015 s	217	−0.6	+37.2*
δ Velorum	42	−54 20	2.0	A0	.093	.....	.....	.....	.....
ζ Hydrae	50	+ 6 20	3.3	K0	.101	.014 s	233	−1.0	+23.0
ι Urs. Majoris	52	+48 26	3.1	A5	.500	.070 s	47	2.3	+ 8.
λ Velorum	9 4	−43 2	2.2	K5	.022	.....	.....	.....	+18.8
β Carinae	12	−69 18	1.8	A0	.192	.....	.....	.....	−16.0
ι Carinae	14	−58 51	2.2	F0	.023	.....	.....	.....	+13.1
α Lyncis	15	+34 49	3.3	K5	.214	.002 s	1630	−5.1	+38.5
κ Velorum	19	−54 35	2.6	B3	.017	.....	.....	.....	+21.9*
α Hydrae	23	− 8 14	2.2	K2	.036	.006 s	543	−3.9	− 4.0
θ Urs. Majoris	26	+52 8	3.3	F8p	1.096	.056 s	58	2.0	+15.8
N Velorum	28	−56 36	3.0	K5	.041	.....	.....	.....	−13.9
ϵ Leonis	40	+24 14	3.1	G0p	.045	−.001 s	3260:	−6.9	+ 5.1
||υ Carinae	45	−64 36	3.1	F0	.062	.....	.....	.....	+13.2
α **Leonis**	10 3	+12 27	1.3	B8	.244	.058 s	56	0.1	.....
q Carinae	14	−60 50	3.4	K5	.045	.....	.....	.....	+ 9.2
||γ Leonis	14	+20 21	2.3	K0	.347	.004 s	815	−4.7	−36.
μ Urs. Majoris	16	+42 0	3.2	K5	.082	.034 s	96	0.9	−22.

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
θ Carinae	10 39	−63 52	3.0	B0	.063	.....	.....	.....	+16.
η Carinae	41	−59 10	1.0-7.4	Pec	.000	.....	.....	.....	.....
μ Velorum	42	−48 54	2.8	G5	.084	.....	.....	.....	+ 7.1
ν Hydrae	45	−15 40	3.3	K0	.214	.035 s	93	1.0	− 0.7
β Urs. Majoris	56	+56 55	2.4	A0	.089	.047 s	69	0.8	−10.9*
α Urs. Majoris	58	+62 17	2.0	G5	.137	.074 s	44	1.4	− 8.
ψ Urs. Majoris	11 4	+45 2	3.2	K0	.067	.049 s	67	1.6	− 3.4
δ Leonis	9	+21 4	2.6	A3	.208	.078 s	42	2.1	−18.
θ Leonis	9	+15 59	3.4	A0	.103	.019 s	172	−0.2	+ 6.8
λ Centauri	31	−62 28	3.3	B9	.046	.....	.....	.....	+11.
β Leonis	44	+15 8	2.2	A2	.507	.101 s	32	2.2	+ 1.3
γ Urs. Majoris	49	+54 15	2.5	A0	.095	.004 s	815	−4.5	−10.0
δ Centauri	12 3	−50 10	2.9	B3p	.044	.....	.....	.....	.....
ε Corvi	5	−22 4	3.2	K0	.063	.025 s	130	0.2	+ 5.2
δ Crucis	10	−58 12	3.1	B3	.051	.....	.....	.....	+25.
δ Urs. Majoris	10	+57 35	3.4	A2	.113	.045 s	72	1.7	−10.7
γ Corvi	11	−16 59	2.8	B8	.159	.....	.....	.....	− 7. *
α **Crucis**	21	−62 33	1.0	B1	.048	.030	109	−1.6	+19.
‖δ Corvi	25	−15 58	3.1	A0	.249	.010 s	326	−1.9	−53.5
γ Crucis	26	−56 33	1.5	M6	.270	.....	.....	.....	+21.5
β Corvi	29	−22 51	2.8	G5	.061	.028	116	0.0	− 7.4
α Muscae	31	−68 35	2.9	B3	.038	.....	.....	.....	+13.5
γ Centauri	36	−48 24	2.4	A0	.200	.....	.....	.....	− 9.
γ Virginis	36	− 0 54	2.9	F0	.561	.073 s	45	2.2	−20.0
β Muscae	40	−67 34	3.3	B3	.041	.....	.....	.....	+35. *
β Crucis	42	−59 9	1.5	B1	.054	.008 s	408	−4.0	+13.
ε Urs. Majoris	50	+56 30	1.7	A0p	.117	.042	78	−0.2	−11.9*
‖α Can. Venat.	51	+38 51	2.8	A0p	.233	.015 s	217	−1.3	+ 1.0*
ε Virginis	57	+11 30	3.0	K0	.270	.048 s	68	1.4	−13.6
γ Hydrae	13 13	−22 39	3.3	G5	.085	.017 s	192	−0.5	− 5.1
ι Centauri	15	−36 11	2.9	A2	.111	.....	.....	.....	+ 2.0
‖ζ Urs. Majoris	20	+55 27	2.4	A2p	.131	.038 s	86	0.3	− 9.6*
α **Virginis**	20	−10 38	1.2	B2	.051	.009 s	362	−4.0	+ 1.6*
ζ Virginis	30	− 0 5	3.4	A2	.285	.038	86	1.3	.....
ε Centauri	34	−52 57	2.6	B1	.091	.....	.....	.....	+ 6.
η Urs. Majoris	44	+49 49	1.9	B3	.116	− .004 s	3260 :	−8.1	− 6.
μ Centauri	44	−41 59	3.3	B2p	.030	.....	.....	.....	+12.6

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
ζ Centauri	13 49	−46 48	3.1	B2p	.079	.....	.....	.....	.....
η Boötis	50	+18 54	2.8	G0	.370	.098 s	33	2.8	− 0.2*
β **Centauri**	57	−59 53	0.9	B1	.039	.036	91	−1.3	+12.0*
π Hydrae	14 1	−26 12	3.5	K0	.165	.....	.....	.....	+27.6
θ Centauri	1	−35 53	2.3	K0	.748	.....	.....	.....	+ 1.8
α **Boötis**	11	+19 42	0.2	K0	2.287	.080 s	41	−0.3	−5 .0
γ Boötis	28	+38 45	3.0	F0	.182	.058 s	56	1.8	−35.
η Centauri	29	−41 43	2.6	B3p	.052	.....	.....	.....	0.
||α **Centauri**	33	−60 25	0.3	G0	3.682	.758	4	4.7	+22.2
α Circini	34	−64 32	3.4	F0	.312	.....	.....	.....	+ 7.3
α Lupi	35	−46 58	2.9	B2	.036	.....	.....	.....	+ 8. *
||ε Boötis	41	+27 30	2.7	K0	.045	.016 s	204	−1.3	−16.4
||α² Librae	45	−15 38	2.9	K2	.129	.....	.....	.....	−17. *
β Urs. Minoris	51	+74 34	2.2	K5	.028	.011 s	296	−2.6	+17.0
β Lupi	52	−42 44	2.8	B2p	.066	.....	.....	.....	0. *
κ Centauri	53	−41 42	3.4	B3	.037	.....	.....	.....	+10. *
σ Librae	58	−24 53	3.4	M6	.094	.029 s	112	0.7	− 4.2
ζ Lupi	15 5	−51 43	3.5	K0	.132	.....	.....	.....	− 9.2
γT Australis	10	−68 19	3.1	A0	.064	.....	.....	.....	.....
β Librae	12	− 9 1	2.7	B8	.108	.....	.....	.....	−38. *
δ Lupi	15	−40 17	3.4	B2	.032	.....	.....	.....	.....
γ Urs. Minoris	21	+72 11	3.1	A2	.017	.....	.....	.....	− 8.
ι Draconis	23	+59 19	3.5	K0	.010	.034 s	96	1.2	−10.2
γ Lupi	28	−40 50	3.0	B3	.042	.....	.....	.....	.....
α Cor. Borealis	30	+27 3	2.3	A0	.160	.053 s	62	0.9	+ 0.4*
α Serpentis	39	+ 6 44	2.8	K0	.142	.046 s	71	1.1	+ 3.3
βT Australis	46	−63 7	3.0	F0	.440	.....	.....	.....	.....
π Scorpii	53	−25 50	3.0	B2p	.042	.....	.....	.....	*
δ Scorpii	54	−22 20	2.5	B0	.042	.....	.....	.....	*
||β Scorpii	16 0	−19 32	2.8	B1	.041	.....	.....	.....	− 9.5*
δ Ophiuchi	9	− 3 26	3.0	K8	.159	.040 s	82	1.0	−19.0
ε Ophiuchi	13	− 4 27	3.3	K0	.088	.046 s	71	1.6	− 9.2
||σ Scorpii	15	−25 21	3.1	B1	.033	.....	.....	.....	+ 2.0*
||η Draconis	23	+61 44	2.9	G5	.062	.042 s	78	1.0	−13.9
||α **Scorpii**	23	−26 12	1.2	M2p	.032	.026 s	126	−1.7	− 3.1*
β Herculis	26	+21 42	2.8	K0	.104	.030 s	109	0.2	−25.5*
τ Scorpii	30	−28 1	2.9	B0	.042	.....	.....	.....	+ 1.5

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
ζ Ophiuchi	16 32	−10 22	2.7	B0	.024	.....	.....	.....	−15.0
||ζ Herculis	38	+31 47	3.0	G0	.601	.111 s	29	3.2	−70. *
α T Australis	38	−68 51	1.9	K2	.034	.....	.....	.....	− 3.7
ε Scorpii	44	−34 7	2.4	K0	.668	.....	.....	.....	− 2.0
μ^1 Scorpii	45	−37 53	3.1	B3p	.032	.....	.....	.....	.....
ζ Arae	50	−55 50	3.1	Ma	.047	.....	.....	.....	− 6.1
κ Ophiuchi	53	+ 9 32	3.4	K0	.296	.208 s	116	0.6	−55.3
||η Ophiuchi	17 5	−15 36	2.6	A0	.094	.....	.....	.....	− 1.1
η Scorpii	5	−43 6	3.4	F2	.291	.....	.....	.....	−28.
ζ Draconis	8	+65 50	3.2	B5	.023	.019 s	172	−0.4	−14.6
||α Herculis	10	+14 30	3.1–3.9	M7	.030	− .002 s	3260 :	−6.9	−32.4
δ Herculis	11	+24 57	3.2	A2	.164	.029 s	112	0.5	−42. *
π Herculis	12	+36 55	3.4	K2	.021	.019 s	172	−0.2	−25.1
θ Ophiuchi	16	−24 54	3.4	B3	.030	.....	.....	.....	− 0.9
β Arae	17	−55 26	2.8	K2	.035	.....	.....	.....	− 1.0
υ Scorpii	24	−37 13	2.8	B3	.040	.....	.....	.....	.....
α Arae	24	−49 48	3.0	B3p	.085	.....	.....	.....	.....
λ Scorpii	27	−37 2	1.7	B2	.040	.....	.....	.....	− 1. *
β Draconis	28	+52 23	3.0	G0	.012	.004 s	815	−4.0	−19.7
θ Scorpii	30	−42 56	2.0	F0	.010	.....	.....	.....	+ 5.
α Ophiuchi	30	+12 38	2.1	A5	.264	.049 s	67	0.5	.....
κ Scorpii	36	−38 58	2.5	B2	.032	.....	.....	.....	.....
β Ophiuchi	39	+ 4 37	2.9	K0	.157	.024 s	136	−0.2	−11.5
ι^1 Scorpii	41	−40 5	3.1	F5p	.000	.....	.....	.....	−27.8
||μ Herculis	43	+27 47	3.5	G5	.817	.111 s	29	3.7	−15.7
G Scorpii	43	−37 1	3.2	K2	.062	.....	.....	.....	+24.7
ν Ophiuchi	54	− 9 46	3.5	K0	.118	.026 s	126	0.6	+12.6
γ Draconis	54	+51 30	2.4	K5	.026	.017 s	192	−1.4	−27.0
γ Sagittarii	59	−30 26	3.1	K0	.206	.....	.....	.....	+22. *
η Sagittarii	18 11	−36 48	3.2	M6	.223	.....	.....	.....	0.0
δ Sagittarii	15	−29 52	2.8	K0	.042	.....	.....	.....	−20.2
η Serpentis	16	− 2 55	3.4	K0	.898	.065 s	50	2.5	+ 9.5
ε Sagittarii	18	−34 26	2.0	A0	.139	.....	.....	.....	−11.0
λ Sagittarii	22	−25 29	2.9	K0	.197	.....	.....	.....	−43.2
||α **Lyrae**	34	+38 41	0.1	A0	.348	.124 s	26	0.6	−13.8
φ Sagittarii	39	−27 6	3.3	B8	.053	.....	.....	.....	+26. *
||β Lyrae	46	+33 15	3.4–4.1	B2p	.011	− .014 s	3260 :	−6.6	*
σ Sagittarii	49	−26 25	2.1	B3	.081	.....	.....	.....	− 1.

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec
γ Lyrae	18 55	+32 33	3.3	A0	.010	.....	.....	.....	−20. *
||ζ Sagittarii	56	−30 1	2.7	A2	.026	.....	.....	.....	+22.
τ Sagittarii	19 1	−27 49	3.4	K0	.265	.....	.....	.....	+42. *
ζ Aquilae	1	+13 43	3.0	A0	.103	.040 s	82	1.0	−38.6
π Sagittarii	4	−21 11	3.0	F2	.041	.016 s	204	−1.0	−10.3
δ Draconis	13	+67 29	3.2	K0	.135	.038 s	86	1.1	+25.1
δ Aquilae	21	+ 2 55	3.4	F0	.267	.057 s	57	2.2	−32. *
||β Cygni	27	+27 45	3.2	K0p	.010	.003 s	1087	−4.4	−23. *
γ Aquilae	42	+10 22	2.8	K2	.018	.018 s	181	−0.9	− 2.1
||δ Cygni	42	+44 53	3.0	A0	.067	.038 s	86	0.9	−37.
α **Aquilae**	46	+ 8 36	0.9	A5	.659	.204 s	16	2.4	−33.
θ Aquilae	20 6	− 1 7	3.4	A0	.035	.015 s	217	−0.7	−29.2*
||β Capricorni	15	−15 6	3.2	G0p	.042	.005 s	652	−3.3	−18.8*
α Pavonis	18	−57 3	2.1	B3	.090	.....	.....	.....	+ 2.0*
γ Cygni	19	+39 56	2.3	F8p	.006	−.002 s	3260:	−7.7	− 5.6
α Indi	31	−47 38	3.2	K0	.072	.....	.....	.....	− 0.8
α **Cygni**	38	+44 55	1.3	A2p	.004	.005	652	−5.2	− 4.
ϵ Cygni	42	+33 36	2.6	K0	.485	.041 s	80	0.7	−10. *
ζ Cygni	21 9	+29 49	3.4	K0	.061	.024 s	136	0.3	+17. *
α Cephei	16	+62 10	2.6	A5	.163	.083 s	39	2.2	−30.7
β Aquarii	26	− 6 1	3.1	G0	.020	−.003 s	3260:	−6.9	+ 6.4
β Cephei	27	+70 7	3.3	B1	.013	.007 s	466	−2.5	−14.1*
ϵ Pegasi	39	+ 9 25	2.5	K0	.028	.002 s	1630	−5.9	+ 5.3
δ Capricorni	42	−16 35	3.0	A5	.395	.114 s	29	3.3	*
γ Gruis	48	−37 50	3.2	A0	.108	.....	.....	.....	− 3.
α Aquarii	22 1	− 0 48	3.2	G0	.009	.009 s	362	−2.0	+ 7.1
α Gruis	2	−47 27	2.2	B5	.200				
α Tucanae	12	−60 45	2.9	K2	.085	.....	.....	.....	+41.
β Gruis	37	−47 24	2.2	M6	.122	.....	.....	.....	+ 1.2
η Pegasi	38	+29 42	3.1	G0	.039	−.001 s	3260:	−6.9	+ 4.3*
α **P. Australis**	52	−30 9	1.3	A3	.367	.137	24	2.0	+ 6.7
β Pegasi	59	+27 32	2.6	M3	.235	.016 s	204	−1.4	+ 8.6
α Pegasi	59	+14 40	2.6	A0	.077	.038 s	86	0.5	+ 4. *
γ Cephei	23 35	+77 4	3.4	K1	.167	.069 s	47	2.6	−41.6

ASTRONOMICAL CONSTANTS

Solar Parallax, 8″.80

Mass of the sun, 1.983×10^{33} grams = 332000 times the mass of the earth

Temperature of the sun's surface, 5740° C.

Solar Constant, 1.925 calories per sq. cm. per min.

Obliquity of the ecliptic, 23° 27′ 8″.26 − 0.4684 $(t-1900)$

Mean Distance Earth to Sun, 149,504,201 km. = 92,897,416 statute miles

Mean Distance Earth to Moon, 384,403 km. = 238,857 statute miles

Equatorial Horizontal Parallax of Moon, 57′ 2″.70

Gaussian constant of gravitation, $\kappa = .017202099$

Newtonian constant of gravitation, $\kappa = 6.658\times10^{-8}$ c.g.s.

Acceleration in one second due to gravity, $g = 9.8060$ meters $- .0260 \cos 2\phi - \frac{2h}{R}g$

Reduction from geographic latitude ϕ to geocentric latitude ϕ',

$$\phi' - \phi = -11' 35''.66 \sin 2\phi + 1''.17 \sin 4\phi.$$

Dimensions of the earth:

Equatorial radius, $a = 6378.388$ km. = 3963.34 statute miles

Polar radius, $b = 6356.909$ km. = 3949.99 statute miles

Mass of the earth, 5.974×10^{27} grams

Density of the earth, 5.515 grams per cubic cm.

Velocity of light, 299,796 km. or 186,285 miles per sec.

Length of the year:

Tropical	$365^d.24219879$	$-0000000614\ (t-1900)$
Sidereal	$365\ .25636042$	$+000000011\ (t-1900)$
Anomalistic	$365\ .25964134$	$+0000000304\ (t-1900)$
Eclipse	$346\ .620031$	$+00000032\ (t-1900)$

Length of the day:

Sidereal	$23^h56^m\ 4^s.091$ of mean solar time
Mean Solar	$24\ 3\ 56\ .555$ of sidereal time

Length of the month:

Synodical	$29^d.530588 = 29^d12^h44^m\ 2^s.8$
Tropical	$27\ .321582 = 27\ 7\ 43\ 4\ .7$
Sidereal	$27\ .321661 = 27\ 7\ 43\ 11\ .5$
Anomalistic	$27\ .554550 = 27\ 13\ 18\ 33\ .1$
Nodical	$27\ .212220 = 27\ 5\ 5\ 35\ .8$

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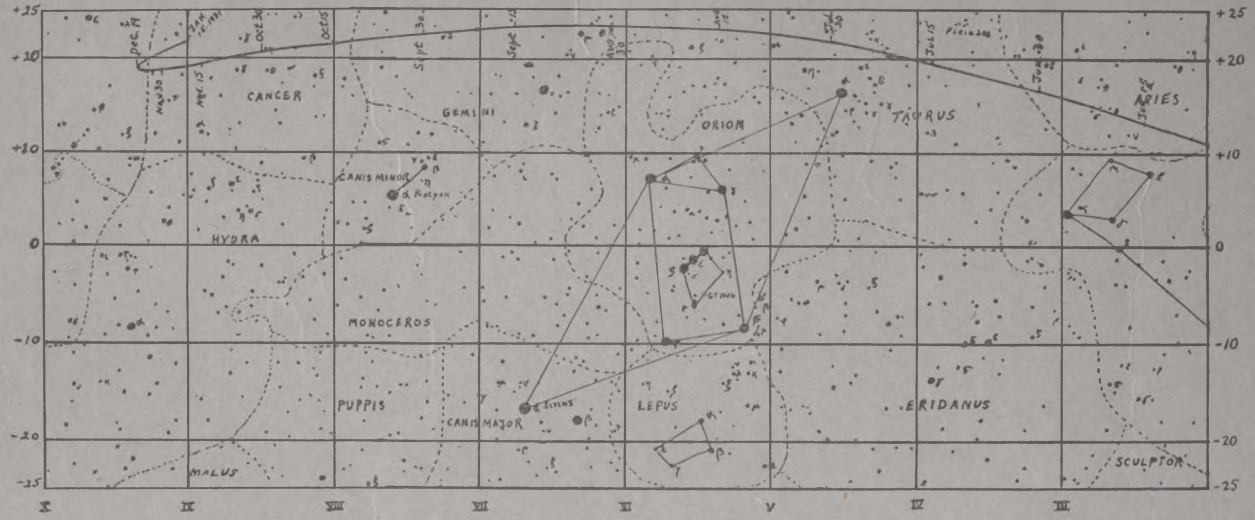

Fig. 3. Path of Mars among the Stars from June 7, 1930 to January 75, 1931.

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