THE OBSERVER'S HANDBOOK FOR 1929

PUBLISHED BY

The Royal Astronomical Society of Canada

EDITED BY C. A. CHANT

TWENTY-FIRST YEAR OF PUBLICATION

TORONTO
198 COLLEGE STREET
PRINTED FOR THE SOCIETY
1929

1929 CALENDAR 1929

JANUARY						
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	..

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

MARCH						
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	..

APRIL						
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	..

MAY						
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	..

JUNE						
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	..

JULY						
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	..

AUGUST						
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

SEPTEMBER						
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	..

OCTOBER						
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	..

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

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

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CONTENTS

PREFACE

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 been assisted by Mr. R. M. Motherwell. Dominion Observatory, Ottawa, who computed the occultations of the stars by the moon; Mr. P. Millman, University of Toronto; and especially by 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 minima 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, 1928. THE EDITOR.

ANNIVERSARIES AND FESTIVALS, 1928

New Year's Day	Tues., Jan. 1	Birthday Queen Mary, 1867	May 26
Epiphany	Sun., Jan. 6	Corpus Christi	Thur., May 30
Septuagesima Sunday	Jan. 27	Birthday King George V., 1865	June 3
Quinquagesima (Shrove Sunday)	Feb. 10	Birthday Prince of Wales, 1894	June 23
Ash Wednesday	Feb. 13	St. John Baptist	Mon., June 24
Quadragesima (First Sunday in Lent	Feb. 17	Dominion Day	Mon., July 1
St. David	Fri., Mar. 1	Labour Day	Mon., Sept. 2
St. Patrick	Sun., Mar. 17	Hebrew New Year (Rosh Hashanah)	Sat., Oct. 5
Palm Sunday	Mar. 24	St. Michael (Michaelmas Day)	Tues., Oct. 29
Annunciation (Lady Day)	Mon., Mar. 25	All Saints' Day	Fri., Nov. 1
Good Friday	Mar. 29	Armistice Day	Mon., Nov. 11
Easter Sunday	Mar. 31	Thanksgiving Day	Mon., Nov. 11
St. George	Tues., Apr. 23	St. Andrew's	Sat., Nov. 30
Rogation Sunday	May 5	Queen Alexandra (1844-1925), born	Sun., Dec. 1
Accession King George V., 1910	May 6	First Sunday in Advent	Dec. 1
Ascension Day	Thur., May 9	Conception Day	Sun., Dec. 8
Pentecost (Whit Sunday)	May 19	St. Thomas	Sat., Dec. 21
Victoria Day	Fri., May 24	Christmas Day	Wed., Dec. 25
Trinity Sunday	May 26		

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.

1929 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 43 57	+ 3 19.4	−23 03 54
" 4	18 57 11	+ 4 43.6	−22 47 56
" 7	19 10 21	+ 6 04.4	−22 27 52
" 10	19 23 28	+ 7 21.1	−22 03 50
" 13	19 36 29	+ 8 32.8	−21 35 55
" 16	19 49 25	+ 9 38.8	−21 04 13
" 19	20 02 14	+10 38.6	−20 28 54
" 22	20 14 57	+11 31.6	−19 50 07
" 25	20 27 33	+12 17.6	−19 08 02
" 28	20 40 01	+12 56.4	−18 22 47
" 31	20 52 22	+13 28.1	−17 34 33
Feb. 3	21 04 37	+13 52.5	−16 43 31
" 6	21 16 43	+14 09.8	−15 49 50
" 9	21 28 43	+14 19.8	−14 53 42
" 12	21 40 36	+14 22.8	−13 55 19
" 15	21 52 21	+14 18.8	−12 54 52
" 18	22 04 00	+14 08.0	−11 52 32
" 21	22 15 33	+13 50.8	−10 48 32
" 24	22 26 59	+13 27.6	− 9 43 03
" 27	22 38 20	+12 58.9	− 8 36 15
Mar. 2	22 49 36	+12 25.4	− 7 28 18
" 5	23 00 48	+11 47.5	− 6 19 22
" 8	23 11 56	+11 05.7	− 5 09 38
" 11	23 23 00	+10 20.4	− 3 59 17
" 14	23 34 02	+ 9 32.2	− 2 48 29
" 17	23 45 01	+ 8 41.5	− 1 37 25
" 20	23 55 58	+ 7 48.8	− 0 26 16
" 23	0 06 53	+ 6 54.6	+ 0 44 49
" 26	0 17 48	+ 5 59.6	+ 1 55 39
" 29	0 28 42	+ 5 04.4	+ 3 06 06

Date	Apparent R.A.	Equation of Time	Apparent Decl.
	h m s	m s	° ′ ″
Apr. 1	0 39 37	+ 4 09.5	+ 4 16 02
" 4	0 50 33	+ 3 15.7	+ 5 25 16
" 7	1 01 30	+ 2 23.4	+ 6 33 40
" 10	1 12 30	+ 1 33.0	+ 7 41 04
" 13	1 23 31	+ 0 44.9	+ 8 47 19
" 16	1 34 35	− 0 00.4	+ 9 52 14
" 19	1 45 43	− 0 42.8	+10 55 39
" 22	1 56 54	− 1 21.6	+11 57 26
" 25	2 08 08	− 1 56.6	+12 57 27
" 28	2 19 27	− 2 27.2	+13 55 34
May 1	2 30 51	− 2 53.2	+14 51 37
" 4	2 42 20	− 3 14.3	+15 45 29
" 7	2 53 53	− 3 30.3	+16 37 01
" 10	3 05 32	− 3 41.0	+17 26 05
" 13	3 17 16	− 3 46.7	+18 12 31
" 16	3 29 05	− 3 47.3	+18 56 11
" 19	3 40 59	− 3 43.0	+19 36 58
" 22	3 52 58	− 3 33.8	+20 14 44
" 25	4 05 02	− 3 19.9	+20 49 23
" 28	4 17 10	− 3 01.4	+21 20 49
" 31	4 29 22	− 2 38.6	+21 48 57
June 3	4 41 39	− 2 11.7	+22 13 42
" 6	4 53 59	− 1 41.3	+22 34 57
" 9	5 06 22	− 1 07.9	+22 52 38
" 12	5 18 47	− 0 32.2	+23 06 43
" 15	5 31 15	+ 0 05.2	+23 17 07
" 18	5 43 43	+ 0 43.6	+23 23 49
" 21	5 56 11	+ 1 22.4	+23 26 49
" 24	6 08 40	+ 2 01.2	+23 26 05
" 27	6 21 07	+ 2 39.3	+23 21 39
" 30	6 33 34	+ 3 16.2	+23 13 32

1929 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 45 59	+ 3 51.3	+23 01 44
" 6	6 58 21	+ 4 24.1	+22 46 20
" 9	7 10 41	+ 4 53.8	+22 27 22
" 12	7 22 56	+ 5 19.9	+22 04 53
" 15	7 35 08	+ 5 41.8	+21 39 00
" 18	7 47 15	+ 5 59.0	+21 09 48
" 21	7 59 17	+ 6 11.5	+20 37 23
" 24	8 11 14	+ 6 18.9	+20 01 51
" 27	8 23 06	+ 6 21.2	+19 23 18
" 30	8 34 53	+ 6 18.2	+18 41 52
Aug. 2	8 46 34	+ 6 10.0	+17 57 40
" 5	8 58 10	+ 5 56.4	+17 10 48
" 8	9 09 41	+ 5 37.5	+16 21 25
" 11	9 21 06	+ 5 13.1	+15 29 40
" 14	9 32 26	+ 4 43.5	+14 35 42
" 17	9 43 41	+ 4 08.8	+13 39 40
" 20	9 54 51	+ 3 2.94	+12 41 40
" 23	10 05 57	+ 2 45.5	+11 41 53
" 26	10 16 59	+ 1 57.8	+10 40 25
" 29	10 27 58	+ 1 06.6	+ 9 37 25
Sept. 1	10 38 53	+ 0 12.3	+ 8 33 00
" 4	10 49 46	− 0 44.6	+ 7 27 21
" 7	11 00 36	− 1 44.0	+ 6 20 37
" 10	11 11 24	− 2 45.2	+ 5 12 56
" 13	11 12 11	− 3 48.0	+ 4 04 29
" 16	11 32 57	− 4 51.7	+ 2 55 24
" 19	11 43 43	− 5 55.7	+ 1 45 49
" 22	11 54 29	− 6 59.5	+ 0 35 54
" 25	12 05 16	− 8 02.4	− 0 34 13
" 28	12 16 04	− 9 03.8	− 1 44 25
Oct. 1	12 26 54	−10 03.0	− 2 54 30
" 4	12 37 47	−10 59.8	− 4 04 21
" 7	12 48 43	−11 53.6	− 5 13 45
" 10	12 59 42	−12 43.9	− 6 22 32
" 13	13 10 46	−13 30.3	− 7 30 34
" 16	13 21 53	−14 12.3	− 8 37 38
" 19	13 33 06	−14 49.2	− 9 43 36
" 22	13 44 24	−15 20.6	−10 48 17
" 25	13 55 49	−15 45.9	−11 51 33
" 28	14 07 20	−16 04.6	−12 53 12
" 31	14 18 58	−16 16.5	−13 53 04
Nov. 3	14 30 42	−16 21.3	−14 50 57
" 6	14 42 35	−16 18.8	−15 46 39
" 9	14 54 34	−16 09.0	−16 39 59
" 12	15 06 41	−15 51.7	−17 30 46
" 15	15 18 55	−15 27.0	−18 18 49
" 18	15 31 17	−14 54.7	−19 03 58
" 21	15 43 47	−14 14.9	−19 46 03
" 24	15 56 24	−13 27.6	−20 24 56
" 27	16 09 08	−12 33.2	−21 00 25
" 30	16 21 59	−11 32.1	−21 32 22
Dec. 3	16 34 56	−10 24.8	−22 00 37
" 6	16 47 58	− 9 12.0	−22 25 04
" 9	17 01 05	− 7 54.5	−22 45 34
" 12	17 14 16	− 6 33.0	−23 02 02
" 15	17 27 31	− 5 08.3	−23 14 24
" 18	17 40 48	− 3 41.2	−23 22 36
" 21	17 54 06	− 2 12.4	−23 26 35
" 24	18 07 25	− 0 42.7	−23 26 21
" 27	18 20 45	+ 0 46.9	−23 21 52
" 30	18 34 03	+ 2 15.5	−23 13 10
" 32	18 42 54	+ 3 13.5	−23 05 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, 1929

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
1929			h m	°	h m	°
Jan. 1	ν Virginis	4.2	0 33.2	82	1 27.1	334 d
Jan. 14	τ Aquarii	4.4	14 41.9	33 d	15 32.4	266
Feb. 17	τ Tauri	4.3	17 22.4	127 d	18 02.6	192
Feb. 26	γ Virginis	2.9	1 57.6	164	2 59.8	272 d
Mar. 16	κ Tauri	4.1	16 33.1	153 d	16 42.9	167
Mar. 16	υ Tauri	4.2	16 58.9	38 d	18 03.6	284
Apr. 2	τ Sagittarii	3.5	5 49.8	149	6 30.2	205 d
May 15	η Leonis	3.6	19 46.8	85 d	20 46.1	336
May 19	γ Virginis	2.9	1 05.3	93 d	2 01.8	326
May 21	α Librae	2.7	18 30.8	87 d	19 25.3	336
May 31	τ Aquarii	4.4	7 47.6	66	9 00.5	224 d
June 23	τ Sagittarii	3.5	3 23.1	129	4 13.0	207 d
July 4	κ Tauri	4.1	3 34.8	93	4 24.3	228 d
July 9	η Leonis	3.6	10 34.5	82 d	11 30.1	319
July 12	γ Virginis	2.9	11 36.8	163 d	12 17.7	252
July 16	δ Scorpii	2.7	18 02.7	177 d	18 41.7	238
Oct. 8	X Sagittarii	4.4	19 40.4	86 d	.....	.....
Oct. 14	τ Aquarii	4.4	.....	.....	17 16.3	238
Oct. 20-1	A Tauri	4.5	22 58.3	72	0 04.6	238 d
Nov. 23	η Leonis	3.6	2 38.0	94	3 45.4	313 d
Dec. 14	A Tauri	4.5	18 40.6	58 d	19 43.6	252
Dec. 24	θ Virginis	4.4	1 17.7	120	2 16.5	297 d

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

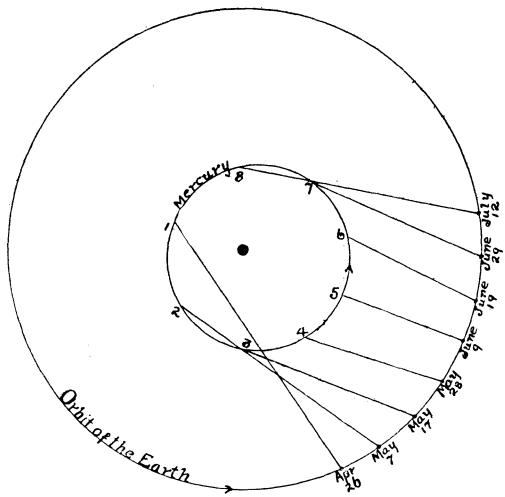
For an explanation of this table and its use at various places, see pages 8 and 9.

THE PLANETS DURING 1929

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, the swiftest in its orbital motion; also it has the most eccentric orbit, with the greatest inclination to the ecliptic.



ORBITS OF THE EARTH AND MERCURY

This diagram shows the relative positions of the earth, Mercury and the sun during the period April 26 to July 12. The planet reaches greatest elongation when the line joining it to the earth is tangent to its orbit. This occurs on May 15 (eastern) and July 3 (western).

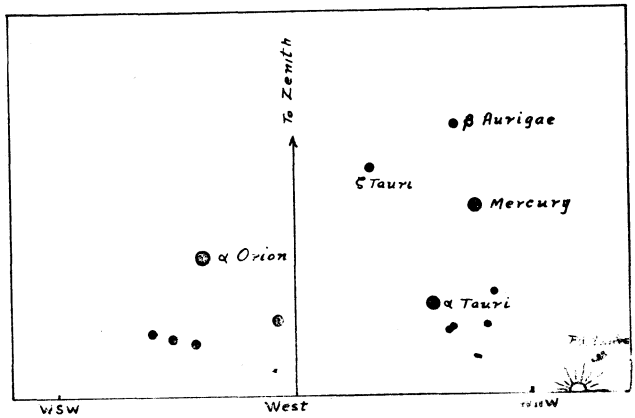
Its apparent separation from the sun is never very great, its maximum values ranging from 18° to 28°. It reaches its greatest elongation six times during the year. At such times, when we search for it, in the west just after sunset, or in the east just before sunrise, it is never high above the horizon, and in the usually bright sky it is not easy to locate, even though the planet is as bright as a first-magnitude star.

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

Greatest eastern elongations in 1929 (Mercury an evening star):
Jan. 22, 18° 35′; May 15, 21° 57′; Sept. 12, 26° 48′.

Greatest western elongations (Mercury a morning star):
Mar. 4, 27° 14′; July 3, 21° 37′; Oct. 23, 18° 23′.

The May elongation is the best of the year for evening observation. In the accompanying diagram the position of the planet among the stars at this elongation is shown. Use a field glass for the fainter stars. In the other diagram are shown the relative positions of the earth and Mercury during a revolution of the planet.



MERCURY AT GREATEST EASTERN ELONGATION ON MAY 15.

Chart showing the stars about Mercury when at its greatest elongation in May.

VENUS

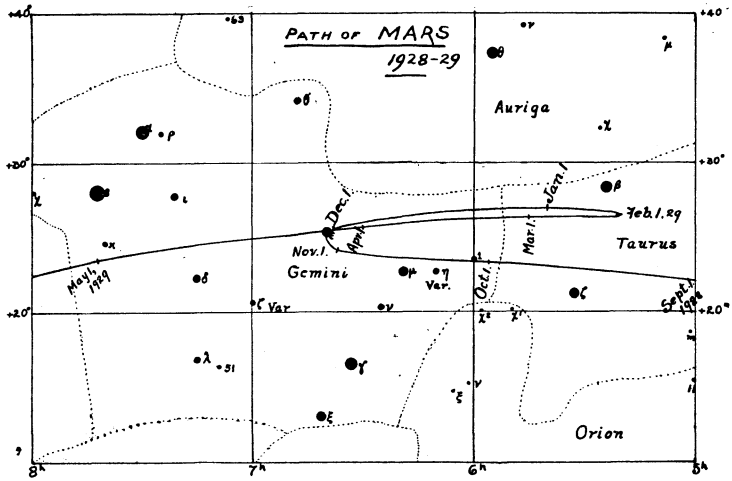
Venus is a twin-sister to the earth, its diameter being only 3% shorter and its physical condition presumably being similar. Its distance from the sun is nearly twice that of Mercury and at its greatest elongations its angular separation from the sun is about 48°. It has a characteristic silvery brilliance, which, along with its great brightness, renders it easy to recognize.

At the beginning of the year Venus is a fine evening star. It continues to separate from the sun until its greatest elongation is reached on Feb. 7. It is still increasing in brightness and reaches maximum brilliancy on March 14 (see page 32). It then moves in towards the sun and reaches inferior conjunction on April 20, after which date it is a morning star. It reaches greatest brilliancy again on May 26. Greatest western elongation is attained on June 29 and the planet remains a morning star all the rest of the year. It comes into superior conjunction with the sun on Feb. 6, 1930.

The path of Venus among the stars is shown on page 3 of the cover.

MARS

Mars was in opposition to the sun on Dec. 21, 1928; and at the beginning of 1929 is a bright object in Taurus, visible almost all night. Its stellar magnitude then is −1.2 (not quite as bright as Sirius). It gradually recedes from the earth and becomes inconspicuous. Its path among the stars until May 9 is shown on the accompanying map. On May 9 its stellar magnitude is 1.5. It becomes fainter as it gets farther away and on Nov. 15 it is about as bright as Polaris. After that date the planet, as it moves in its orbit, becomes nearer the earth and its brightness increases slowly. It is in Sagittarius on Dec. 31.



PATH OF MARS AMONG THE STARS DURING THE INTERVAL, Sept. 1, 1928, to May 9, 1929.
The position of the planet is shown for the first of each month.

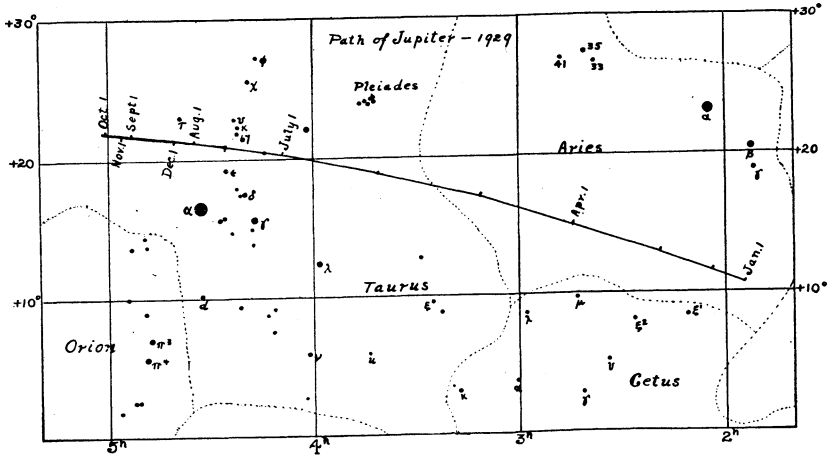
JUPITER

Jupiter is the next planet beyond Mars. It 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 its 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.

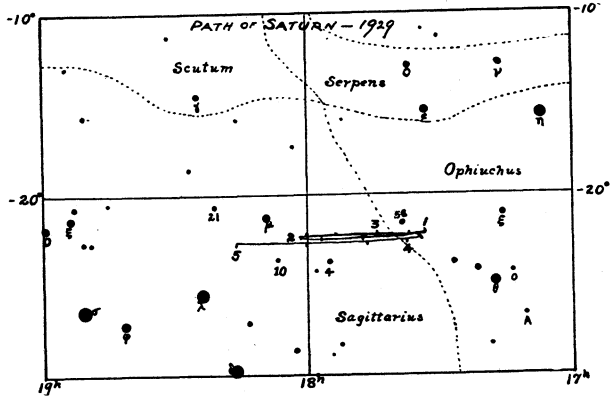
In January Jupiter comes to the meridian at about 7 p.m. and for several months it is a brilliant evening star. It is in conjunction with the sun on May 14, after which it is a morning star. Its path among the stars is shown on the accompanying chart.



PATH OF JUPITER AMONG THE STARS DURING 1929
The marks indicate the position on the first of each month.

SATURN

Saturn possesses a remarkable set of rings as well as a numerous company of moons, and by many persons it is considered the finest object in the sky for



PATH OF SATURN AMONG THE STARS DURING 1929.
The marks on the path show the positions at the beginning of each month, as follows:—1, Jan. 1; 2, April 1; 3, July 1; 4, Oct. 1; 5, Jan. 1, 1930.

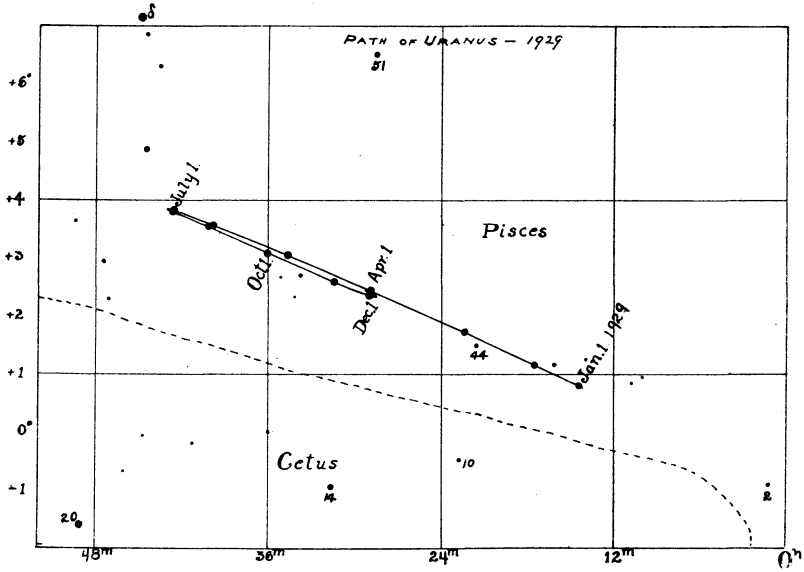
the visual observer. During 1928 the rings appeared the farthest opened out and of course they are still well placed for examination.

During the first part of the year Saturn is a morning star, constantly improving its position for observation. On June 19 it is in opposition to the sun and is visible the entire night. During the latter part of the year it is an evening star, but by Nov. 15 it is too near the sun for observation. It is in conjunction with the sun on Dec. 25.

URANUS

Uranus was discovered in 1781 by Sir William Herschel. 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. Its true nature was not recognized until about a year later.

Its period about the sun is 84 years and hence its motion on the sky is very slow. It appears like a star of the 6th magnitude, and while the planet can be seen with the naked eye it is best to observe its motion with a field glass. A large telescope is necessary to show an appreciable disc.



PATH OF URANUS AMONG THE STARS DURING 1929
Its positions on the first of each month are indicated.

NEPTUNE

Neptune was discovered in 1846 as the result of mathematical discussions of the motion or Uranus, which, for some unknown reason, did not follow precisely the path predicted for it. The story of the discovery is one of the most interesting romances in the history of science.

Its revolution period is 165 years. It appears as a star of the 8th magnitude and hence can be seen only with a telescope. It has a single satellite.

ECLIPSES, 1929

During 1929 there will be only two eclipses, both of the sun. This is the minimum number possible in any one year.

I. A total eclipse of the sun, May. 9, 1929, invisible in North America. The path of totality crosses the Indian Ocean and the Pacific Ocean north of Australia. The greatest duration of totality will be 5m. 7sec. The only land areas where the eclipse will be total are the Malay Peninsula, Northern End of Sumatra and some of the smaller islands of the South Seas. On the Malay Peninsula and Sumatra the eclipse will occur early in the afternoon and the duration of totality will be just under 5 min. It will be visible as a partial eclipse in Southern Asia, and Africa, and in Australia.

Central Eclipse begins.....	May	9d	4h	30.2m G.C.T.
Central Eclipse at local apparent noon.....		9	5	58.0
Central Eclipse ends.....		9	7	50.1

II. An annular eclipse of the sun, Nov. 1st, 1929. The path of the annular eclipse crosses Central Africa and the Atlantic Ocean. The end of the partial phase will be just visible in the Maritime Provinces and Newfoundland at sunrise. The partial phase will be seen generally in Africa, Europe and the Southwest of Asia.

Eclipse begins.....	Nov.	1d	9h	12.3m G.C.T.
Eclipse central at local apparent noon.....		1	11	46.5
Eclipse ends.....		1	14	57.2

THE SKY FOR JANUARY, 1929

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 44m to 20h 56m, and its Decl. changes from 23° 4′S to 17° 18′ S. The equation of time (see page 6) increases from 3m 19s to 13m 37s. On account of this rapid rise in value the time of mean noon appears to remain, for the first ten days of the month, at the same distance from the time of sunrise, that is, the forenoons as indicated by our clocks are of the same length. On the 20th the sun enters the sign Aquarius, the second of the winter signs of the zodiac. On January 1 the earth is in perihelion (see opp. page for distance).

The Moon—For its phases and conjunctions with the planets, see opp. page. The moon occults a star in Virgo on the 1st, and one in Aquarius on the 14th (see page 8).

Mercury on the 15th is in R.A. 20h 54m, Decl. 19° 1′ S, and transits at 13.20. It reaches its greatest elongation east on the 22nd. On this date it will be well in view in the S.W. at sunset, being about 14° above the horizon. It sets about 1½ hours after the sun and should be visible for about a week before and after the 22nd.

Venus on the 15th is in R.A. 22h 47m, Decl. 8° 51′ S, and transits at 15h 11m. The planet is a prominent object in the evening sky, setting about 4 hours after the sun. Its magnitude increases from −3.7 to −4.0 during the month.

Mars on the 15th is in R.A. 5h 24m, Decl. 26° 39′ N, and transits at 21.43. It is in the constellation of Taurus throughout the month and visible all night. It is of stellar mag. −1.2 on the 1st and −0.4 on the 31st.

Jupiter on the 15th is in R.A. 1h 58m, Decl. 10° 47′ N and transits at 18.18. It is in the constellation of Aries and sets about 8½ hours after the sun on the 15th. For the configuration of its satellites, see next page, and for their eclipses, etc., see page 52.

Saturn on the 15th. is in R.A. 17h 40m, Decl. 22° 12′ S, and transits at 10.02 It is a morning star in Scorpio but not well placed for observation. It rises about 2 hours before the sun on the 15th.

Uranus on the 15th is in R.A. 0h 16m, Decl. 0° 55′ N, and transits at 16.37.

Neptune on the 15th is in R.A. 10h 13m, Decl. 11° 42′ N, and transits at 2.36.

For further information regarding the planets, with maps of their paths, see pages 22 to 26.

JANUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 21h 00m
			h m	
	Tues.	1 3h ⊕ in Perihelion, 91,343,000 miles	13 10	O3124
☾	Wed.	2 13h 44m Moon L.Q.		21O34
	Thur.	3 23h ☿ Greatest Hel. Lat. S.		2O143
	Fri.	4	10 00	4O32*
	Sat.	5		431O2
	Sun.	6		432O1
	Mon.	7	6 50	431O*
	Tues.	8 16h 12m ☌♄☾, ♄ 3° 21′ N.		4O12*
	Wed.	9		412O3
●	Thur.	10 19h 28m N.M.	3 40	42O13
	Fri.	11		41O32
	Sat.	12 1h 30m ☌☿☾, ☿ 2° 59′ N.		d34O2
	Sun.	13	0 30	32O14
	Mon.	14 15h 13m ☌♀☾, ♀ 4° 21′ N.		312O4
	Tues.	15	21 20	O3124
	Wed.	16 12h 34m ☌♁☾, ♁ 3° 51′ N.		12O34
	Thur.	17		2O134
☽	Fri.	18 10h 15m Moon F.Q.; 15h 16m ☌♃☾, ♃ 1° 19′ N.	18 10	1O234
	Sat.	19		3O124
	Sun.	20		32O4*
	Mon.	21 23h □♃☉	15 00	3421O
	Tues.	22 3h 23m ☌☌☾, ☌ 1° 26′ N.; 10h ☿ Greatest elong. E., 18° 35′; 23h ☿ in ♌		43O12
	Wed.	23		d41O3
	Thur.	24	11 40	42O13
♓	Fri.	25 2h 9m F.M.		41O23
	Sat.	26 18h 0m ☌Ψ☾, Ψ 4° 46′ S.		43O12
	Sun.	27 5h ♂ Stationary; 14h ♀ in ♌; 14h ☿ in Perihelion.	8 30	432O*
	Mon.	28 12h ☿ Stationary		3421O
	Tues.	29		3O412
	Wed.	30	5 20	1O234
	Thur.	31		2O134

Explanation of symbols and abbreviations on page 4

THE SKY FOR FEBRUARY, 1929

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

The Sun—During February the sun's R.A. increases from 20h 56m to 22h 46m and its Decl. changes from 17° 18′ S to 7° 51′ S. The equation of time reaches a maximum value of 14m 23s on the 12th (see page 6). For the change in the length of the day see page 11. On the 19th the sun enters the third winter sign of the zodiac, Pisces.

The Moon—For its phases and conjunctions with the planets, see opp. page. The moon occults a star in Taurus on the 17th and one in Virgo on the 26th (see page 8).

Mercury on the 15th is in R.A. 20h 47m, Decl. 14° 41′ S, and transits at 11.05. It is in inferior conjunction with the sun on the 7th and is not well placed for observation during the month.

Venus on the 15th is in R.A. 0h 43m, Decl. 6° 38′ N, and transits at 15.04. The planet is still growing brighter in the evening sky, its mag. being −4.0 on the 1st and −4.2 on the 28th. It reaches its greatest elongation E on the 7th, when it sets about 4 hours after the sun.

Mars on the 15th is in R.A. 5h 29m, Decl. 26° 16′ N, and transits at 19.47. It is a bright red star of zero mag. in the constellation of Taurus. It sets about 3.00 in the morning in the middle of the month and is in view for most of the night.

Jupiter on the 15th is in R.A. 2h 11m, Decl. 12° 6′ N and transits at 16.30. It is well in view in the evening sky in Aries, and sets about 11 o'clock on the 15th. For the configurations of its satellites, see next page, and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 17h 52m, Decl. 22° 16′ S and transits at 8.13. Its position for observation is slightly better than last month. It rises about 3 hours before the sun on the 15th, but at sunrise is only 20° above the horizon.

Uranus on the 15th is in R.A. 0h 20m, Decl. 1° 24′ N, and transits at 14.40.

Neptune on the 15th is in R.A. 10h 10m, Decl. 12° 0′ N, and transits at 0.31.

For further information regarding the planets, with maps of their paths, see pages 22 to 26.

FEBRUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 20h 30m
			h m	
☾	Fri. 1	9h 10m Moon L.Q.		1O34*
	Sat. 2		2 10	3O124
	Sun. 3			321O4
	Mon. 4		23 00	d32O4
	Tues. 5	4h 56m ☌♄☾, ♄ 3° 43′ N.		3O24*
	Wed. 6	21h ☿ Greatest Hel. Lat. N.; 23h ☌☿☉, Inferior		1O423
	Thur. 7	13h ♀ Greatest elong. E., 46° 48′; 20h ☌♀♁, ♀ 1° 57′ N.	19 50	24O13
	Fri. 8	22h 29m ☌☿☾, ☿ 8° 56′ N.		41O3*
●	Sat. 9	12h 55m N.M.		d4O12
	Sun. 10		16 40	4312O
	Mon. 11			432O1
	Tues. 12	20h 10m ☌♁☾, ♁ 3° 34′ N.		43O2*
	Wed. 13	5h 8m ☌♀☾, ♀ 5° 50′ N.	13 30	41O32
	Thur. 14			24O13
	Fri. 15	2h 40m ☌♃☾, ♃ 0° 52′ N.		12O43
◑	Sat. 16	19h 22m Moon F.Q.	10 20	O3124
	Sun. 17			d31O4
	Mon. 18	15h 20m ☌♂☾, ♂ 0° 33′ N.; 21h ☿ Stationary; 22h ☌♇☉		32O14
	Tues. 19		7 00	31O24
	Wed. 20			dO24*
	Thur. 21			2O134
	Fri. 22		3 50	12O43
	Sat. 23	2h 58m ☌♆☾, ♆ 4° 42′ S, 13h 59m F.M.		O4312
♋	Sun. 24			431O2
	Mon. 25		0 40	432O1
	Tues. 26			431O2
	Wed. 27		21 30	d4O2*
	Thur. 28			42O3*

Explanation of symbols and abbreviations on page 4

THE SKY FOR MARCH, 1929

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 46m to 0h 40m, and its Decl. changes from 7° 51′ S to 4° 16′ N. The equation of time decreases from 12m 37s to 4m 10s (see page 6). For changes in the length of the day, see page 12. On the 21st at 2.35 a.m. the sun enters the first spring sign of the zodiac, Aries (see opp. page).

The Moon—For its phases and conjunctions with the planets, see opp. page. The moon occults two stars in Taurus on the 16th (see page 8).

Mercury on the 15th is in R.A. 22h 5m, Decl. 13° 35′ S, and transits at 10.38. It reaches its greatest western elongation, 27° 14′, on the 5th but will not be particularly well placed for observation. It rises about fifty minutes before the sun on the 5th but is only 10° above the horizon at sunrise.

Venus on the 15th is in R.A. 1h 59m, Decl. 17° 53′ N, and transits at 14.29. It attains its greatest brilliancy of mag. −4.3 on the 15th of the month and throughout the whole month is brighter than any other heavenly body with the exception of the sun or moon or an occasional fireball or comet. It throws a very noticeable shadow on a moonless night. It sets 3½ hours after the sun on the 15th.

Mars on the 15th is in R.A. 6h 7m, Decl. 25° 58′ N, and transits at 18.36 During the month Mars is an evening star in Gemini, setting about 2.15 in the morning on the 15th. It is in quadrature with the sun on the 28th.

Jupiter on the 15th is in R.A. 2h 30m, Decl. 13° 49′ N, and transits at15.00. It is in the evening sky, setting about 4 hours after the sun on the 15th. Its stellar mag. is −1.7. For the configurations of its satellites, see next page, and for their eclipses, see page 52.

Saturn on the 15th is in R.A. 18h 0m, Decl. 22° 16′ S, and transits at 6.30. It is a morning star in the southern sky and reaches the meridian about 30 minutes after sunrise. When in this part of its orbit Saturn is poorly placed for observation from the northern hemisphere, since it never rises very high above the southern horizon.

Uranus on the 15th is in R.A. 0h 25m, Decl. 2° 0′ N, and transits at 12.55.

Neptune on the 15th is in R.A. 10h 7m, Decl. 12° 16′ N, and transits at 22.34.

For further information regarding the planets, with maps of their paths, see pages 22 to 26.

MARCH

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 20h 00m
			h	m	
	Fri.	1			42103
	Sat.	2 8h ☿ in ♉; 8h ♀ in Perihelion	18	20	40132
☾	Sun.	3 6h 9m Moon L.Q			41302
	Mon.	4 16h 54m ☌♄☾, ♄ 4° 7′ N.; 19h ☿ Greatest elong. W., 27° 14′			32041
	Tues.	5	15	10	3104*
	Wed.	6			30124
	Thur.	7			2034*
	Fri.	8 19h 32m ☌☿☾, ☿ 4° 14′ N	12	00	21034
	Sat.	9			01234
	Sun.	10			13024
●	Mon.	11 3h 37m N.M	8	50	32041
	Tues.	12 5h 51m ☌♁☾, ♁ 3° 22′ N.; 14h ☿ in Aphelion			31204
	Wed.	13			43012
	Thur.	14 2h 38m ☌♀☾, ♀ 7° 41′ N.; 17h 21m ☌♃☾, ♃ 0° 17′ N.; 20h ♀ Greatest brilliancy	5	40	42103
	Fri.	15			d4203
	Sat.	16			40123
	Sun.	17	2	30	d4102
☽	Mon.	18 2h 42m Moon F.Q.; 12h 29m ☌♂☾, ♂ 0° 50′ S			43201
	Tues.	19	23	10	34120
	Wed.	20 21h 35m ☉ enters ♈, Spring commences			34012
	Thur.	21 3h □♄☉			d1043
	Fri.	22 9h 45m ☌♆☾, ♆ 4° 47′ S	20	00	20134
	Sat.	23			0234*
	Sun.	24 2h ♀ Greatest Hel. Lat. N			10324
♋	Mon.	25 2h 46m F.M	16	50	32014
	Tues.	26			31204
	Wed.	27			30124
	Thur.	28 0h □♂☉; 7h ☌♁☉	13	40	10234
	Fri.	29 5h ♀ Stationary			24013
	Sat.	30			41023
	Sun.	31	10	30	d4032

Explanation of symbols and abbreviations on page 4

THE SKY FOR APRIL, 1929

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

The Sun—During April the sun's R.A. increases from 0h 40m to 2h 31m, and its Decl. from 4° 16′ N to 14° 52′ N. The equation of time changes from +4m 10s to −2m 53s (see page 6). For the length of daylight in various latitudes, consult page 13. On the 20th the sun enters the second spring sign, Taurus.

The Moon—For its phases and conjunctions with the planets, see opp. page. The moon occults a star in Sagittarius on the 2nd.

Mercury on the 15th is in R.A. 1h 21m, Decl. 7° 28′ N, and transits at 11.53. It is in superior conjunction with the sun on the 17th and too near the sun for observation during April.

Venus on the 15th is in R.A. 1h 54m, Decl. 19° 4′ N, and transits at 12.18. During most of this month Venus is too near the sun to be well observed. It is in inferior conjunction with the sun on the 20th, after which date it becomes a morning star.

Mars on the 15th is in R.A. 7h 8m, Decl. 24° 36′ N, and transits at 17.36. It is an evening star in the constellation of Gemini, setting about 1.30 a.m. in the middle of the month. Its stellar magnitude is 1.2.

Jupiter on the 15th is in R.A. 2h 56m, Decl. 15° 55′ N, and transits at 13.24. It sets about 1 hour and 45 minutes after the sun on the 15th. For the configurations of its satellites, see next page, and for their eclipses, etc. see page 52. These are not given after the 30th.

Saturn on the 15th is in R.A. 18h 2m, Decl. 22° 14′ S, and transits at 4.30. It is a morning star in Sagittarius and rises about midnight. It is stationary on the 9th and then retrogrades.

Uranus on the 15th is in R.A. 0h 32m, Decl. 2° 41′ N, and transits at 10.59.

Neptune on the 15th is in R.A. 10h 4m, Decl. 12° 28′ N, and transits at 20.30.

For further information regarding the planets, with maps of their paths, see pages 22 to 26.

APRIL

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol h m	Configurations of Jupiter's Satellites 19h 30m
	Mon.	1 2h 57m ☌ ♄ ☾, ♄ 4° 26′ N.; 22h ☿ Greatest Hel. Lat. S.		43201
☾	Tues.	2 2h 29m Moon L.Q.		43210
	Wed.	3	7 20	43012
	Thur.	4		41032
	Fri.	5		42013
	Sat.	6	4 10	4103*
	Sun.	7 16h ☌☿♁, ☿ 1° 18′ S.		d0432
	Mon.	8 1h ♂ Greatest Hel. Lat. N.; 17h 38m ☌♁☾, ♁ 3° 16′ N.; 21h 37m ☌☿☾, ☿ 1° 56′ N.		3204*
♍	Tues.	9 12h ♄ Stationary; 15h 33m N.M.	1 00	32104
	Wed.	10 12h 41m ☌♀☾, ♀ 9° 34′ N.		30124
	Thur.	11 11h 23m ☌♃☾, ♃ 0° 20′ S.	21 50	13024
	Fri.	12		20134
	Sat.	13		12034
	Sun.	14	18 30	01432
	Mon.	15 15h 12m ☌♂☾, ♂ 2° 13′ S.		3420*
◑	Tues.	16 9h 9m Moon F.Q.		34210
	Wed.	17 11h ☌☿☉, Superior	15 20	43012
	Thur.	18 2h ☌☿♀, ☿ 7° 33′ S.; 14h 46m ☌♆☾, ♆ 4° 56′ S.		41302
	Fri.	19		42013
	Sat.	20 4h ☌♀☉, Inferior; 23h ☿ in ♌	12 10	41203
	Sun.	21		40123
	Mon.	22		d4130
♋	Tues.	23 16h 47m F.M.	9 00	d3240
	Wed.	24		30124
	Thur.	25 13h ☿ in Perihelion		31024
	Fri.	26	5 50	20134
	Sat.	27		12034
	Sun.	28 9h ☌☿♃, ☿ 2° 12′ N.; 10h 10m ☌♄☾, ♄ 4° 33′ N.		01234
	Mon.	29	2 40	10324
	Tues.	30		Invisible

Explanations of symbols and abbreviations on page 4

THE SKY FOR MAY, 1929

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

The Sun—During May the sun's R.A. increases from 2h 31m to 4h 33m, and its Decl. from 14° 52′ N to 21° 58′ N. The equation of time increases from 2m 53s to a maximum of 3m 48s on the 15th, and then falls to 2m 30s at the end of the month (see page 6). For changes in the length of the day, see page 14. On the 21st the sun enters Gemini, the third sign of the zodiac. On May 9 there is a total eclipse of the sun visible in South Africa, the Indian Ocean and the Malay Archipeligo, not visible in Canada.

The Moon—For its phases and conjunctions with the planets, see opp. page. The moon occults stars on the 15th, 19th, 21st and 31st (see page 8).

Mercury on the 15th is in R.A. 4h 56m, Decl. 25° 3′ N, and transits at 13.27. It reaches its greatest elongation east on the 15th and is particularly well placed for observation in the evening sky for a week before and after this date. It sets about 2 hours after the sun and is 20° above the western horizon at sunset on the 15th.

Venus on the 15th is in R.A. 1h 20m, Decl. 9° 16′ N, and transits at 9.49. The plant advances steadily into the morning sky during this month and on the 15th rises about 1½ hours before the sun. It attains its greatest brilliancy, −4.2 mag., on the 26th of the month.

Mars on the 15th is in R.A. 8h 15m, Decl. 21° 34′ N, and transits at 16.45. It is well in view for the first half of the night in Cancer, and sets about midnight on the 15th.

Jupiter on the 15th is in R.A. 3h 25m, Decl. 17° 51′ N, and transits at 11.54. It is in conjunction with the sun on the 14th and becomes a morning star. During the whole month it will be too near the sun for observation.

Saturn on the 15th is in R.A. 17h 58m, Decl. 22° 13′ S, and transits at 2.28. It rises about 10 o'clock in the evening and is a pale yellow star of 1st mag. between Scorpio and Sagittarius.

Uranus on the 15th is in R.A. 0h 37m, Decl. 3° 17′ N, and transits at 9.07.

Neptune on the 15th is in R.A. 10h 4m, Decl. 12° 32′ N, and transits at 18.32.

For further information regarding the planets, with maps of their paths, see pages 22 to 26.

MAY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites
			h m	
☾	Wed.	1 20h 26m Moon L.Q.	23 30	
	Thur.	2		
	Fri.	3		
	Sat.	4	20 20	
	Sun.	5 20h ☿ Greatest Hel. Lat. N.		
	Mon.	6 6h 14m ☌♁☾, ♁ 3° 12′ N.		
	Tues.	7 2h 19m ☌♀☾, ♀ 5° 39′ N.	17 10	
	Wed.	8		
●	Thur.	9 1h 7m N.M.; ☉ Total eclipse invisible in Canada (see page 27); 3h ♀ Stationary; 7h 52m ☌♃☾, ♃ 0° 55′ S.; 22h Ψ Stationary.		
	Fri.	10 13h 8m ☌☿☾, ☿ 0° 45′ N.	13 50	
	Sat.	11		
	Sun.	12		
	Mon.	13 21h ♂ in Aphelion; 21h 45m ☌♂☾, ♂ 3° 19′ S.	10 40	
	Tues.	14 8h ☌♃☉		
◑	Wed.	15 13h ☿ Greatest elong. E., 21° 57′; 15h 56m Moon F.Q.; 20h 3m ☌Ψ☾, Ψ 4° 59′ S.		
	Thur.	16	7 30	
	Fri.	17		
	Sat.	18		
	Sun.	19 3h ♀ in ♉; 22h □Ψ☉	4 20	
	Mon.	20		
	Tues.	21		
	Wed.	22	1 10	
♋	Thur.	23 7h 50m F.M.		
	Fri.	24	22 00	
	Sat.	25 14h 28m ☌♄☾, ♄ 4° 27′ N.		
	Sun.	26 4h ♀ Greatest brilliancy.		
	Mon.	27	18 50	
	Tues.	28 9h ☿ Stationary.		
	Wed.	29 7h ☿ in ♉		
	Thur.	30	15 40	
☾	Fri.	31 11h 13m Moon L.Q.		

Invisible by reason of the proximity of Jupiter to the Sun, from April 30 to June 14.

Explanation of symbols and abbreviations on page 4

THE SKY FOR JUNE, 1929

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

The Sun—During June the sun's R.A. increases from 4h 33m to 6h 38m, and its Decl. rises from 21° 58′ N on the 1st to its maximum 23° 27′ on the 21st On the 21st the sun reaches the summer solstice and enters the first summer sign of the zodiac, Cancer. The duration of daylight is then longest, but it does not change appreciably for several days, before and after this date, see page 15. The Decl. falls to 23° 10′ at the end of the month. The increase in the equation of time (for which see page 6), taken with the decreasing length of daylight, causes the local mean time of sunset to appear unchanged 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. The moon occults a star in Sagittarius on the 23rd.

Mercury on the 15th is in R.A. 4h 58m, Decl. 18° 35′ N, and transits at 11.23. It is in inferior conjunction with the sun on the 9th, when it becomes a morning star. Towards the end of the month it will be approaching western elongation but is unfavourably situated for observation.

Venus on the 15th is in R.A. 2h 29m, Decl. 11° 43′ N, and transits at 8.57. It is a brilliant object in the morning sky, rising about 2½ hours before the sun. During the month the mag. falls from −4.2 to −3.9.

Mars on the 15th is in R.A. 9h 26m, Decl. 16° 32′ N, and transits at 15.53. It enters the constellation of Leo about the middle of the month and sets about 3½ hours after the sun. Its stellar mag. is still decreasing being 1.8 on the 15th.

Jupiter on the 15th is in R.A. 3h 54m, Decl. 19° 32′ N, and transits at 10.22. During the first half of the month it is too near the sun for observation. It is a morning star in the constellation of Taurus and rises about 1½ hours before the sun on the 15th. For the configurations of its satellites see next page, and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 17h 49m, Decl. 22° 13′ S, and transits at 0.17. It is in conjunction with the sun on the 19th and well in view all night in Scorpio.

Uranus on the 15th is in R.A. 0h 41m, Decl. 3° 42′ N, and transits at 7.09.

Neptune on the 15th is in R.A. 10h 5m, Decl. 12° 24′ N, and transits at 16.31.

For further information regarding the planets, with maps of their paths, see pages 22 to 26.

JUNE

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 4h 00m
			h m	
	Sat.	1		
	Sun.	2 17h 52m ☌ ♁ ☾, ♁ 3° 4′ N	12 30	
	Mon.	3		Invisible
	Tues.	4 6h 58m ☌ ☿ ☾, ☿ 0° 17′ S		
	Wed.	5	9 20	
	Thur.	6 5h 14m ☌ ♃ ☾, ♃ 1° 31′ S		
●	Fri.	7 8h 56m N.M.; 13h 55m ☌ ☿ ☾, ☿ 5° 7′ S		
	Sat.	8 13h ☿ in Aphelion	6 00	
	Sun.	9 6h ☌ ☿ ☉ Inferior		
	Mon.	10		
	Tues.	11 7h 31m ☌ ♂ ☾, ♂ 4° 1′ S	2 50	
	Wed.	12 3h 30m ♂ Ψ ☾, Ψ 4° 54′ S		
	Thur.	13	23 40	
☽	Fri.	14 0h 14m Moon F.Q.		
	Sat.	15		3O214
	Sun.	16	20 30	21O34
	Mon.	17		O2134
	Tues.	18 19h ☍ ♄ ☉		1O234
	Wed.	19	17 20	2O314
	Thur.	20		321O4
♋	Fri.	21 4h ☿ Stationary; 16h 52m ☌ ♁ ☾, ♄ 4° 16′ N.; 17h 1m ☉ enters ♋, Summer commences; 23h 15m F.M.		3O124
	Sat.	22 16h ☿ in Aphelion	14 10	34O2*
	Sun.	23		421O3
	Mon.	24		4O13*
	Tues.	25	11 00	41O23
	Wed.	26		42O31
	Thur.	27		4321O
	Fri.	28 21h ☿ Greatest Hel. Lat. S.	7 50	43O12
☾	Sat.	29 4h ☿ Greatest elong. W., 45° 45′; 22h 54m Moon L.Q.		43O2*
	Sun.	30 3h 5m ☌ ♁ ☾, ♁ 2° 50 ♁ ′N		241O3

Explanation of symbols and abbreviations on page 4

THE SKY FOR JULY, 1929

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

The Sun—During July the sun's R.A. increases from 6h 38m to 8h 43m, and its Decl. decreases from 23° 10′ N to 18° 13′ N. The equation of time increases from 3m 28s on the 1st to 6m 21s on the 27th and then falls to 6m 13s on the 31st. On the 23rd the sun enters Leo, the second summer sign of the zodiac. For changes in the length of the day, see page 16. The earth is in aphelion on the 4th (see opp. page for distance).

The Moon—For its phases and conjunctions with the planets, see opp. page. The moon occults stars on the 4th, 9th, 12th and 16th (see page 8).

Mercury on the 15th is in R.A. 6h 22m, Decl. 22° 42′ N, and transits at 10.55. It reaches greatest western elongation on the 3rd but is not particularly well placed for observation. It rises about 1¼ hours before the sun on the 3rd and is 12° above the horizon at sunrise at a point about 20° north of east. It is in superior conjunction with the sun on the 31st.

Venus on the 15th is in R.A. 4h 23m, Decl. 18° 34′ N, and transits at 8.54. The planet is a morning star, rising about 3 hours before the sun throughout the month. Its mag. is −3.9 at the beginning of the month and drops to −3.7 at the end of the month.

Mars on the 15th is in R.A. 10h 34m, Decl. 10° 7′ N, and transits at 15.04. It is in the constellation of Leo during the month and sets about 2 hours after the sun on the 15th.

Jupiter on the 15th is in R.A. 4h 21m, Decl. 20° 44′ N, and transits at 8.51. It is rapidly coming into prominence in the morning sky and rises about 3¼ hours before the sun on the 15th. For the configurations of its satellites, see next page, and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 17h 40m, Decl. 22° 13′ S, and transits at 22.06. It is a first mag. star in the tail of the Scorpion and is well in view most of the night.

Uranus on the 15th is in R.A. 0h 43m, Decl. 3° 51′ N, and transits at 5.13.

Neptune on the 15th is in R.A. 10h 8m, Decl. 12° 8′ N, and transits at 14.36.

For further information regarding the planets, with maps of their paths, see pages 22 to 26.

JULY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 3h 30m
			h m	
	Mon.	1	4 40	20143
	Tues.	2 19h ☌♂Ψ, ♂ 0° 35′ N		10234
	Wed.	3 2h ☿ Greatest elong. W., 21° 37′; 11h 31m ☌♀☾, ♀ 3° 51′ S.; 14h □♁☉		20314
	Thur.	4 1h 40m ☌♃☾, ♃ 2° 8′ S.; 17h ⊕ in Aphelion, 94,452,000 miles	1 20	23104
	Fri.	5 4h 31m ☌☿☾, ☿ 5° 25′ S		30124
●	Sat.	6 15h 47m N.M	22 10	31024
	Sun.	7		d204*
	Mon.	8		20143
	Tues.	9 13h 37m ☌Ψ☾, Ψ 4° 45′ S.; 20h 16m ☌♂☾, ♂ 4° 12′ S	19 00	14023
	Wed.	10		d4013
	Thur.	11		42130
	Fri.	12	15 50	43021
☽	Sat.	13 11h 5m Moon F.Q		43102
	Sun.	14 5h ☌♀♃, ♀ 2° 16′ S		42301
	Mon.	15 0h ♀ Greatest Hel. Lat. S	12 40	4203*
	Tues.	16		41023
	Wed.	17 8h ♁ Stationary; 22h ☿ in ♌		40213
	Thur.	18 19h 17m ☌♄☾, ♄ 4° 8′ N	9 30	21304
	Fri.	19		30214
	Sat.	20		31024
○	Sun.	21 14h 21m F.M	6 20	32014
	Mon.	22 13h ☿ in Perihelion		2034*
	Tues.	23		d0234
	Wed.	24	3 10	01234
	Thur.	25		d2104
	Fri.	26		3401*
	Sat.	27 9h 32m ☌♁☾, ♁ 2° 34′ N		34102
	Sun.	28		43201
☾	Mon.	29 7h 56m Moon L.Q	20 40	42103
	Tues.	30 23h ☌☿☉, Superior		40123
	Wed.	31 19h 24m ☌♃☾, ♃ 2° 45′ S		40123

Explanation of symbols and abbreviations on page 4

THE SKY FOR AUGUST, 1929

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

The Sun—During August the sun's R.A. increases from 8h 43m to 10h 39m, and its Decl. decreases from 18° 13′ N to 8° 33′ N. The equation of time falls from 6m 13s to 0m 12s see page 7. For changes in the length of daylight, see page 17. On the 23rd the sun enters the third summer sign of the zodiac, Virgo.

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

Mercury on the 15th is in R.A. 10h 33m, Decl. 10° 25′ N, and transits at 13.03. It is an evening star during August but too near the sun to be observed.

Venus on the 15th is in R.A. 6h 47m, Decl. 21° 29′ N, and transits at 9.16. It is a brilliant morning star, rising about 3½ hours before the sun on the 15th.

Mars on the 15th is in R.A. 11h 45m, Decl. 2° 23′ N, and transits at 14.12. During the first half of the month it enters the constellation of Virgo. It is steadily approaching the sun, setting about an hour after sunset on the 15th.

Jupiter on the 15th is in R.A. 4h 44m, Decl. 21° 32′ N, and transits at 7.11. It is in the constellation of Taurus and rises about 5½ hours before the sun on the 15th. For the configurations of its satellites, see next page, and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 17h 34m, Decl. 22° 14′ S, and transits at 19.58. It is an evening star in Scorpio and sets about midnight.

Uranus on the 15th is in R.A. 0h 42m, Decl. 3° 43′ N, and transits at 3.09.

Neptune on the 15th is in R.A. 10h 12m, Decl. 11° 46′ N, and transits at 12.38.

For further information regarding the planets, with maps of their paths, see pages 22 to 26.

AUGUST

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 2h 45m
			h	m	
Thur.	1	19h ☿ Greatest Hel. Lat. N.; 21h 53m ☌♀☾, ♀ 5° 24′ S.	17	30	42103
Fri.	2				43201
Sat.	3				31402
● Sun.	4	22h 40m N.M.	14	20	32014
Mon.	5	6h 41m ☌☿☾, ☿ 3° 25′ S.			21034
Tues.	6	1h 25m ☌♆☾, ♆ 4° 37′ S.			01234
Wed.	7	11h 54m ☌♂☾, ♂ 3° 45′ S.	11	10	0234*
Thur.	8				21034
Fri.	9				32014
Sat.	10		8	00	31024
Sun.	11	14h ☌☿♆, ☿ 0° 57′ N.			d3041
☽ Mon.	12	1h 1m Moon F.Q.			2140*
Tues.	13		4	50	40213
Wed.	14	23h 38m ☌♄☾, ♄ 4° 10′ N.			41023
Thur.	15				d4203
Fri.	16		1	40	42301
Sat.	17				43102
Sun.	18		22	30	43021
Mon.	19				24130
♍ Tues.	20	4h 42m F.M.			0413*
Wed.	21		19	20	10243
Thur.	22				20134
Fri.	23	14h 13m ☌♁☾, ♁ 2° 22′ N.			2304*
Sat.	24	15h ☌♆☉	16	10	31024
Sun.	25	6h ☿ in ♍			30214
Mon.	26				21304
☾ Tues.	27	15h 2m Moon L.Q.	12	50	20134
Wed.	28	9h 0m ☌♃☾, ♃ 3° 18′ S.; 22h ♄ Stationary			10423
Thur.	29				42013
Fri.	30		9	40	4230*
Sat.	31	10h 53m ☌♀☾, ♀ 5° 30′ S.			d4302

Explanation of symbols and abbreviations on page 4

THE SKY FOR SEPTEMBER, 1929

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

The Sun—During September the sun's R.A. increases from 10h 39m to 12h 27m, and its Decl. changes from 8° 33′ N to 2° 55′ S. The equation of time is 0m 12s at the beginning of the month, becomes zero on the first and then increases to 10m 3s. For the change in the length of daylight, see page 18. On the 23rd the sun crosses the equator going southward and enters the first autumn sign of the zodiac, Libra.

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

Mercury on the 15th is in R.A. 13h 3m, Decl. 9° 48′ S, and transits at 13.28. It reaches its greatest eastern elongation on the 12th of the month but is not well placed for observation, due to the small angle which the ecliptic makes with the horizon at sunset. On the 12th the planet is 7° above the horizon at sunset and sets about 40 minutes after the sun.

Venus on the 15th is in R.A. 9h 19m, Decl. 15° 59′ N, and transits at 9.45. It is a bright morning star, rising about 3 hours before the sun on the 15th.

Mars on the 15th is in R.A. 12h 58m, Decl. 5° 48′ S, and transits at 13.23. It is in the evening sky in the constellation of Virgo, but too near the sun to be well observed.

Jupiter on the 15th is in R.A. 4h 58m, Decl. 21° 54′ N, and transits at 5.23. It is a fine object in the morning sky in Taurus and is on the meridian at sunrise on the 15th. For the configurations of its satellites, see next page, and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 17h 35m, Decl. 22° 20′ S, and transits at 17.57. It is on the meridian, in the south at sunset, and sets about 4½ hours after the sun on the 15th.

Uranus on the 15th is in R.A. 0h 38m, Decl. 3° 20′ N, and transits at 1.03.

Neptune on the 15th is in R.A. 10h 16m, Decl. 11° 22′ N, and transits at 10.41.

For further information regarding the planets, with maps of their paths, see pages 22 to 26).

SEPTEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 2h 00m
			h m	
Sun.	1			43O12
Mon.	2	13h 8m ☌♆☾, ♆ 4° 35′ S.	6 30	4231O
● Tues.	3	6h 48m N.M.		42O13
Wed.	4	12h ☿ in Aphelion		41O23
Thur.	5	2h 6m ☌☿☾, ☿ 5° 5′ S.; 6h 19m ☌♂☾, ♂ 2° 42′ S.	3 20	d4O13
Fri.	6			21O34
Sat.	7			3O124
Sun.	8	4h □♃☉	0 10	3O124
Mon.	9	7h ♀ in ♌		321O4
☽ Tues.	10	3h ☌☿♂, ☿ 2° 55′ S.; 17h 57m Moon F.Q.	21 00	2O314
Wed.	11	7h 5m ☌♄☾, ♄ 4° 19′ N.		1O234
Thur.	12	12h ☿ Greatest elong. E., 26° 48′		O2134
Fri.	13		17 50	21O34
Sat.	14			3O421
Sun.	15			34O2*
Mon.	16		14 40	4321O
Tues.	17	9h □♄☉		42O31
◎ Wed.	18	18h 16m F.M.		41O23
Thur.	19	18h 59m ☌♁☾, ♁ 2° 20′ N.	11 30	4O213
Fri.	20			421O3
Sat.	21			43O1*
Sun.	22		8 10	341O2
Mon.	23	7h 53m ☉ enters ♎, Autumn commences; 18h ☌☿♂, ☿ 4° 20′ S.		d32O4
Tues.	24	18h 1m ☌♃☾, ♃ 3° 42′ S.; 20h ☿ Greatest Hel. Lat. S.		2O14*
☾ Wed.	25	12h ☿ Stationary; 21h 7m Moon L.Q.	5 00	1O234
Thur.	26			O2134
Fri.	27	7h ☌♀♆, ♀ 0° 18′ N.		21O34
Sat.	28		1 50	3O14*
Sun.	29	23h 6m ☌♆☾, ♆ 4° 38′ S.		31O24
Mon.	30	5h 0m ☌♀☾, ♀ 4° 6′ S.	22 40	32O14

Explanation of symbols and abbreviations on page 4

THE SKY FOR OCTOBER, 1929

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

The Sun—During October the sun's R.A. increases from 12h 27m to 14h 23m, and its Decl. increases from 2° 55′ S to 14° 13′ S. On the 23rd the sun enters the second autumnal sign of the zodiac, Scorpio. The equation of time rises from 10m 3s to 16m 19s (see page 7). For the change in length of daylight, see page 19.

The Moon—For its phases and conjunctions with the planets, see opp. page The moon occults stars on the 8th, 14th and 20th (see page 8).

Mercury on the 15th is in R.A. 12h 32m, Decl. 3° 7′ S, and transits at 10.56. It is in inferior conjunction with the sun on the 8th and becomes a morning star. On the 23rd it reaches its greatest elongation west and rises about 1¾ hours before the sun. At sunrise it is 17° above the horizon and 20° south of the east point.

Venus on the 15th is in R.A. 11h 39m, Decl. 3° 52′ N, and transits at 10.07. The planet is a bright morning star, still well in view in the morning sky, but gradually nearing the sun as it approaches superior conjunction. Its mag. is steady at −3.4. It rises about 2½ hours before the sun on the 1st and 2 hours before the sun on the 30th.

Mars on the 15th is in R.A. 14h 14m, Decl. 13° 23′ S, and transits at 12.41. It is approaching conjunction with the sun and too near that body to be observed.

Jupiter on the 15th is in R.A. 5h 1m, Decl. 21° 56′ N, and transits at 3.27. It rises about 8 o'clock in the evening and is well in view all night in Taurus. For the configurations of its satellites, see next page, and for their eclipses, etc., see page 53.

Saturn on the 15th is in R.A. 17h 41m, Decl. 22° 28′ S, and transits at 16.06. It sets about 3 hours after the sun on the 15th, but is low in the southwest and not well placed for observation.

Uranus on the 15th is in R.A. 0h 34m, Decl. 2° 52′ N, and transits at 22.57.

Neptune on the 15th is in R.A. 10h 20m, Decl. 11° 2′ N, and transits at 8.47.

For further information regarding the planets, with maps of their paths, see pages 22 to 26.

OCTOBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 1h 15m
			h m	
	Tues.	1		24O**
●	Wed.	2 17h 19m N.M.; 21h ☍ ☌ ☉		41O23
	Thur.	3 8h 0m ☌ ☿ ☾, ☿ 5° 48′ S	19 30	4O123
	Fri.	4 3h 12m ☌ ♂ ☾ ♂ 1° 11′ S		421O3
	Sat.	5 6h ♃ Stationary		432O1
	Sun.	6	16 20	431O2
	Mon.	7		d43O1
	Tues.	8 1h ☌ ☿ ☉ Inferior; 17h 32m ☌ ♄ ☾, ♄ 4° 30′ N		423O*
	Wed.	9	13 10	41O23
◗	Thur.	10 13h 5m Moon F.Q		O1243
	Fri.	11		21O34
	Sat.	12 23h ♀ in Perihelion	10 00	23O14
	Sun.	13 21h ☿ in ♌		31O24
	Mon.	14		3O214
	Tues.	15	6 50	231O4
	Wed.	16 10h ☿ Stationary		dO234
	Thur.	17 1h 19m ☌ ☌ ☾, ☌ 2° 26′ N		O1423
♍	Fri.	18 7h 6m F.M.; 12h ☿ in Perihelion	3 30	241O3
	Sat.	19		42O31
	Sun.	20		431O2
	Mon.	21 23h 27m ☌ ♃ ☾, ♃ 3° 48′ S	0 20	43O21
	Tues.	22 15h ♂ in ♉		4231O
	Wed.	23 14h ☿ Greatest elong. W., 18° 23′	21 10	4O13*
	Thur.	24		4O23*
☾	Fri.	25 3h 21m Moon L.Q		421O3
	Sat.	26	18 00	2O431
	Sun.	27 6h 38m ☌ ♆ ☾, ♆ 4° 41′ S		31O24
	Mon.	28 19h ☿ Greatest Hel. Lat. N		3O214
	Tues.	29	14 50	321O4
	Wed.	30 6h 39m ☌ ♀ ☾, ♀ 1° 7′ S.; 22h 56m ☌ ☿ ☾, ☿ 0 11′ N.		O314*
	Thur.	31		O234*

Explanation of symbols and abbreviations on page 4

THE SKY FOR NOVEMBER, 1929

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

The Sun—During November the sun's R.A. increases from 14h 23m to 16h 26m, and its Decl. increases from 14° 13′ S to 21° 42′ S. On the 22nd the sun enters Sagittarius, the third autumnal sign of the zodiac. The equation of time on the 3rd rises to a maximum of 16m 21s, to be subtracted from apparent time —that is, the sun dial is that amount ahead of the mean time clock (see page 7). For the changes in the length of daylight, see page 20. On November 1 there is an annular eclipse visible in Africa, Western Europe, Asia and the Atlantic Ocean. The end is just visible in the extreme east of Canada, see page 27.

The Moon—For its phases and conjunctions with the planets, see opp. page. The moon occults a star in Leo on the 23rd (see page 8).

Mercury on the 15th is in R.A. 14h 50m, Decl. 15° 36′ S, and transits at 11.18. It is in superior conjunction with the sun on the 27th when it becomes an evening star. It is too near the sun to be seen this month.

Venus on the 15th is in R.A. 14h 2m, Decl. 10° 48′ S, and transits at 10.28. It is a bright morning star rising about 2 hours before the sun on the 15th.

Mars on the 15th is in R.A. 15h 40m, Decl. 19° 50′ S, and transits at 12.06. It is too near the sun to be observed this month.

Jupiter on the 15th is in R.A. 4h 50m, Decl. 21° 40′ N, and transits at 1.15. It rises about 5.30 on the 15th and is well in view all night in Taurus. For the configurations of its satellites, see next page, and for their eclipses, etc., see page 53.

Saturn on the 15th is in R.A. 17h 53m, Decl. 22° 36′ S, and transits at 14.17. It sets about 2 hours after the sun on the 15th and is too near the sun to be well observed.

Uranus on the 15th is in R.A. 0h 30m, Decl. 2° 28′ N, and transits at 20.51.

Neptune on the 15th is in R.A. 10h 22m, Decl. 10° 49′ N, and transits at 6.46.

For further information regarding the planets, with maps of their paths, see pages 22 to 26.

NOVEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 0h 30m
			h	m	
● Fri.	1	7h 1m N.M.; ⊙ Annular eclipse invisible in Canada (see page 27)	11	40	d2O34
Sat.	2	1h 55m ☌☌☾, ♂ 0° 31′ N			2O134
Sun.	3	19h ♀ Greatest Hel. Lat. N			31O42
Mon.	4		8	30	34O21
Tues.	5	5h 58m ☌♄☾, ♄ 4° 38′ N			4321O
Wed.	6				42O1*
Thur.	7		5	20	41O23
Fri.	8				d42O3
☽ Sat.	9	9h 10m Moon F.Q			42O13
Sun.	10		2	10	431O2
Mon.	11	♄ in Aphelion			34O12
Tues.	12		23	00	321O4
Wed.	13	9h 23m ☌♁☾, ♁ 2° 33 N			2O14*
Thur.	14				1O234
Fri.	15		19	40	dO134
♋ Sat.	16	19h 14m F.M			2O34*
Sun.	17				31O24
Mon.	18	3h 34m ☌♃☾, ♃ 3° 36′ S	16	30	3O124
Tues.	19				321O4
Wed.	20				234O1
Thur.	21	5h ☿ in ♍	13	20	41O23
Fri.	22				4O213
☾ Sat.	23	11h 4m Moon L.Q.; 12h 43m ☌♆☾, ♆ 4 39′ S			421O3
Sun.	24		10	10	431O2
Mon.	25				43O12
Tues.	26	2h □♆☉			4321O
Wed.	27	9h ☌☿☉, Superior	7	00	423O1
Thur.	28				14O32
Fri.	29	10h ☌☿♂, ☿ 0° 31′ S.; 13h 54m ☌♀☾, ♀ 2° 2′ N			O2143
● Sat.	30	23h 48m N.M	3	50	21O34

Explanation of symbols and abbreviations on page 4

THE SKY FOR DECEMBER, 1929

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

The Sun—During December the sun's R.A. increases from 16h 26m to 18h 43m, and its Decl. reaches a maximum value 23° 27′ S on the 22nd. This is the time of the winter solstice, and the sun enters the first of the winter signs of the zodiac, Capricornus. It is then vertical to points on the tropic of Capricorn on the earth. From this time it slowly moves northward, the daylight period being the shortest and changing very little for several days before and after the solstice (see page 21). The equation of time changes from 11m 10s watch slow to 3m 13s watch fast (see page 7).

The Moon—For its phases and conjunctions with the planets, see opp. page. The moon occults a star in Taurus on the 14th and one in Virgo on the 24th (see page 8).

Mercury on the 15th is in R.A. 18h 10m, Decl. 25° 30′ S, and transits at 12.39. It is an evening star during the month, but too near the sun to be observed.

Venus on the 15th is in R.A. 16h 32m, Decl. 21° 19′ S, and transits at 11.01. It is now fast approaching superior conjunction and during the latter half of the month too near the sun to be well observed. It rises about an hour before the sun on the 15th.

Mars on the 15th is in R.A. 17h 13m, Decl. 23° 32′ S, and transits at 11.40. It is in conjunction with the sun on the 3rd, when it becomes a morning star. It is too near the sun for observation during the month.

Jupiter on the 15th is in R.A. 4h 33m, Decl. 21° 12′ N, and transits at 22.55. It is in opposition with the sun on the 3rd and a brilliant object of stellar mag. −2.4: It is in view all night. For the configurations of its satellites, see next page and for their eclipses, etc., see page 53.

Saturn on the 15th is in R.A. 18h 7m, Decl. 22° 39′ S, and transits at 12.33. It is in conjunction with the sun on the 25th and too near the sun for observation during December.

Uranus on the 15th is in R.A. 0h 28m, Decl. 2° 19′ N, and transits at 18.52.

Neptune on the 15th is in R.A. 10h 23m, Decl. 10° 48′ N, and transits at 4.49.

For further information regarding the planets, with maps of their paths, see pages 22 to 26.

DECEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satallites at 23h 30m
			h m	
♍	Sat.	0 23h 48m N.M.	3 50	dO14*
	Sun.	1 1h 43m ☌♂☾, ♂ 2° 2′ N.; 4h 50m ☌☿☾, ☿ 1° 30′ N.; 12h ☿ in Aphelion		3O124
	Mon.	2 19h 2m ☌♄☾, ♄ 4° 42′ N.		312O4
	Tues.	3 3h ☌♂☉; 18h ☍♃☉	0 40	23O14
	Wed.	4		1O324
	Thur.	5	21 30	O4213
	Fri.	6 11h Ψ Stationary		241O3
	Sat.	7		42O31
	Sun.	8	18 20	43O2*
♎	Mon.	9 4h 42m Moon F.Q.		4312O
	Tues.	10 18h 10m ☌♁☾, ♁ 2 29′ N.		423O1
	Wed.	11	15 00	41O32
	Thur.	12		4O123
	Fri.	13		241O3
	Sat.	14 11h ☌☿♄, ☿ 2° 50′ S.	11 50	2O431
	Sun.	15 8h 31m ☌♃☾, ♃ 3° 16′ S.		31O24
♏	Mon.	16 6h 38m F.M.		dd3O4
	Tues.	17 9h ♁ Stationary	8 40	32O14
	Wed.	18		1O324
	Thur.	19		O1234
	Fri.	20 19h 33m ☌Ψ☾, Ψ 4° 28′ S.	5 30	21O34
	Sat.	21 20h ☿ Greatest Hel. Lat. S.		2O134
☾	Sun.	22 2h 53m ☉ enters ♑, Winter commences; 21h 27m Moon L.Q.		314O2
	Mon.	23	2 20	34O12
	Tues.	24 23h ☌♄☉		432O*
	Wed.	25	23 10	41O2*
	Thur.	26		4O123
	Fri.	27		412O3
	Sat.	28	20 00	42O13
	Sun.	29 12h □♁☉; 20h ☿ in♉; 22h 27m ☌♀☾, ♀ 3 46′ N.		431O2
♍	Mon.	30 2h 11m ☌♂☾, ♂ 3° 13′ N.; 7h 47m ☌♄☾, ♄ 4° 49′ N.; 18h 42m N.M.		34O12
	Tues.	31	16 50	321O4

Explanation of symbols and abbreviations on page 4

PHENOMENA OF JUPITER'S SATELLITES, 1929

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	17	58	II	OD	14	23	02	II	OD
	20	16	II	OR	15	18	03	III	OD
	20	29.7	II	ED		20	08	III	OR
	22	45.9	II	ER		23	34.7	III	ED
2	17	54	II	Se	16	18	12	II	TI
3	23	16	I	TI		20	31	II	Te
4	0	33	I	SI		20	55	II	SI
	20	35	I	OD		23	09	II	Se
5	0	03.5	I	ER	19	21	33	I	TI
	0	12	III	TI		22	53	I	SI
	17	45	I	TI		23	42	I	Te
	19	01	I	SI	20	18	53	I	OD
	19	54	I	Te		22	23.8	I	ER
	21	10	I	Se	21	18	11	I	Te
6	18	32.4	I	ER		19	30	I	Se
7	20	28	II	OD	22	22	03	III	OD
	22	48	II	OR	23	20	49	II	TI
	23	07.0	II	ED		23	08	II	TI
8	19	32.7	III	ED		23	32	II	Se
	21	23.4	III	ER	25	19	56.9	II	ER
9	17	55	II	Te	26	19	24	III	Se
	18	17	II	SI		23	29	I	TI
	20	32	II	Se	27	20	49	I	OD
11	22	29	I	OD	28	17	58	I	TI
12	19	38	I	TI		19	17	I	SI
	20	57	I	SI		20	07	I	Te
	21	47	I	Te		21	26	I	Se
	23	06	I	Se	29	18	48.7	I	ER
13	20	28.2	I	ER	30	23	28	II	TI

FEBRUARY

1	19	57	II	OR		22	39.5	I	ER
	20	18.4	II	ED	13	18	32	I	Te
	22	34.7	II	ER		19	47	I	Se
2	18	14	III	Te	17	20	32	II	Te
	21	39	III	SI		20	42	II	SI
	23	27	III	Se	19	21	12	I	OD
3	22	46	I	OD	20	18	21	I	TI
4	19	55	I	TI		19	34	I	SI
	21	13	I	SI		19	44.0	III	ED
	22	05	I	Te		20	31	I	Te
	23	22	I	Se		21	34.8	III	ER
5	20	43.9	I	ER		21	43	I	Se
8	20	17	II	OD	21	19	03.8	I	ER
	22	38	II	OR	24	20	57	II	TI
	22	56.4	II	ED	26	19	48.3	II	ER
9	20	18	III	TI	27	18	59	III	OD
	22	26	III	Te		20	21	I	TI
10	20	19	II	Se		21	11	III	OR
11	21	53	I	TI		21	29	I	SI
12	19	13	I	OD	28	20	59.1	I	ER

MARCH

7	19	41	I	OD	16	19	18.4	I	ER
8	19	02	I	Te	17	20	04	III	Te
	20	03	I	Se	21	20	25	II	SI
10	19	38	III	Se		20	59	II	Te
12	20	45	II	OD	22	20	54	I	TI
14	20	04	II	Se	30	19	40.7	II	ER
15	18	52	I	TI		20	14	I	OD
	19	50	I	SI	31	19	37	I	Te
	21	03	I	Te		20	20	I	Se

APRIL

4	19	14	III	OR		20	06	I	SI
	19	52.7	III	ED	8	19	32.2	I	ER
7	19	28	I	TI	15	19	45	II	Se

JUNE

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
19	4	03	III	Se	29	3	18.2	I	ED
22	4	13	I	OR	30	3	34	I	Te

JULY

1	3	35.2	II	ED	22	3	28.4	I	ED
7	3	24	I	TI	23	1	53	I	TI
	3	25	III	OD		2	59	I	Se
8	2	44	I	OR		4	03	I	Te
10	2	46	II	Se	25	2	30	III	TI
14	3	58.1	III	ED	30	2	44	I	SI
17	3	03	II	SI		3	52	I	TI
19	2	33	II	OR	31	3	11	I	OR

AUGUST

1	2	07	III	SI	1	2	41	II	SI
	4	08	III	Se	19	2	01.3	III	ER
2	3	19.2	II	ED	20	0	25	II	OD
4	2	13	II	Te		2	48	II	OR
6	4	38	I	SI	22	2	54	I	SI
7	1	44.5	I	ED		4	13	I	TI
8	1	15	I	Se	23	3	31	I	OR
	2	29	I	Te	24	0	51	I	Te
11	2	24	II	Se	26	3	55.0	III	ED
	2	35	II	TI	27	0	23.4	II	ED
12	1	01	III	OD		2	44.2	II	ER
	3	11	III	OR	27	3	04	II	OD
14	3	38.3	I	ED	29	4	48	I	SI
15	1	00	I	SI	30	1	41	III	Te
	2	16	I	TI		1	54.4	I	ED
	3	09	I	Se	31	0	37	I	TI
	4	25	I	Te		1	26	I	Se
16	1	35	I	OR		2	46	I	Te
						23	55	I	OR

SEPTEMBER

3	2	58.5	II	ED	19	2	21	II	SI
4	23	30	II	Se		4	42	II	Se
	23	53	II	TI		5	02	II	TI
5	2	14	II	Te	20	23	47.4	II	ER
6	0	11	III	Se	21	0	04	II	OD
	3	35	III	TI		2	26	II	OR
	3	48.2	I	ED		4	58	I	SI
7	1	10	I	SI	22	2	04.4	I	ED
	2	31	I	TI		23	26	I	SI
	3	19	I	Se	23	0	44	I	TI
	4	40	I	Te		1	35	I	Se
8	1	49	I	OR		2	52	I	Te
	23	08	I	Te	24	0	03	I	OR
11	23	46	II	SI		1	12	III	OD
12	2	06	II	Se		3	22	III	OR
	2	29	II	TI	26	4	57	II	SI
	4	50	II	Te	28	0	00.2	II	ED
13	2	05	III	SI		2	22.2	II	ER
	4	11	III	Se		2	33	II	OD
	23	55	II	OR		4	55	II	OR
14	3	04	I	SI	29	3	58.3	I	ED
	4	24	I	TI		23	10	II	Te
	5	13	I	Se	30	1	20	I	SI
15	0	10.5	I	ED		2	34	I	TI
	3	43	I	OR		3	29	I	Se
	22	52	I	TI		4	43	I	Te
	23	41	I	Se		22	26.9	I	ED
16	1	01	I	Te		23	52.6	III	ED
	23	31	III	OR					

OCTOBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	1	54	I	OR		23	59	I	OR
	2	04.1	III	ER	17	21	15	I	Te
	4	59	III	OD	18	22	01	III	SI
	21	57	I	Se	19	0	13	III	Se
	23	11	I	Te		2	15	III	TI
5	2	34.8	II	ED		4	22	III	Te
	4	57.0	II	ER	21	2	03	II	SI
	5	00	II	OD		4	06	II	TI
6	23	13	II	Se		4	27	II	Se
	23	17	II	TI	22	4	09.2	I	ED
7	1	38	II	Te		21	00.7	II	ED
	3	13	I	SI	23	1	19	II	OR
	4	24	I	TI		1	29	I	SI
	5	22	I	Se		2	26	I	TI
8	0	20.9	I	ED		3	38	I	Se
	3	44	I	OR		4	35	I	Te
	3	51.5	III	ED		22	37.7	I	ED
	21	42	I	SI	24	1	46	I	OR
	22	51	I	TI		20	53	I	TI
	23	51	I	Se		22	07	I	Se
9	1	00	I	Te		23	02	I	Te
	22	11	I	OR	25	20	13	I	OR
11	22	41	III	TI	26	2	00	III	SI
12	0	47	III	Te		4	14	III	Se
	5	09.4	II	ED		5	45	III	TI
13	23	27	II	SI	28	4	40	II	SI
14	1	43	II	TI	29	21	28	III	OR
	1	50	II	Se		23	35.0	II	ED
	4	04	II	Te	30	3	22	I	SI
	5	07	I	SI		3	37	II	OR
15	2	15.0	I	ED		4	12	I	TI
	5	32	I	OR		5	32	I	Se
	22	58	II	OR	31	0	32.0	I	ED
	23	35	I	SI		3	33	I	OR
16	0	39	I	TI		20	23	II	Se
	1	45	I	Se		21	51	I	SI
	2	48	I	Te		22	00	II	Te
	20	43.5	I	ED		22	38	I	TI

NOVEMBER

1	0	01	I	Se		20	23	I	Se
	0	47	I	Te		20	58	I	Te
	21	59	I	OR	12	23	50.6	III	ED
2	5	59	III	SI	13	4	12	III	OR
5	19	50.9	III	ED		4	43.6	II	ED
	22	07.8	III	ER	14	4	20.9	I	ED
	22	44	III	OD		23	13	II	SI
6	0	52	III	OR	15	0	14	II	TI
6	2	09.3	II	ED		1	38	I	SI
	5	16	I	SI		1	33	II	Se
	5	54	II	OR		2	07	I	TI
	5	57	I	TI		2	36	II	Te
7	2	26.4	I	ED		3	48	I	Se
	5	18	I	OR		4	16	I	Te
	20	36	II	SI		22	49.7	I	ED
	21	57	II	TI	16	1	29	I	OR
	23	00	II	Se		20	07	I	SI
	23	44	I	SI		20	33	II	TI
8	0	19	II	Te		21	16	II	OR
	0	23	I	TI		22	17	I	Se
	1	54	I	Se		22	42	I	Te
	2	32	I	Te	17	19	55	I	OR
	20	55.1	I	ED	20	3	50.2	III	ED
	23	44	I	OR	21	6	15.6	I	ED
9	19	01	II	OR	22	1	50	II	SI

NOVEMBER—*Continued*

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
	2	30	II	TI		0	26	I	Te
	3	32	I	SI		19	13.0	I	ED
	3	50	I	TI		21	38	I	OR
	4	16	II	Se	25	17	59	II	Te
	4	52	II	Te		18	40	I	Se
	5	43	II	Se		18	52	I	Te
	6	00	I	Te	29	4	28	II	SI
23	0	44.4	I	ED		4	44	II	TI
	3	13		OR		5	26	I	SI
	19	07	III	TI		5	34	I	TI
	20	16	III	Se	30	2	39.2	I	ED
	20	35.3	II	ED		4	56	I	OR
	21	13	III	Te		21	58	III	SI
	22	01	I	SI		22	22	III	TI
	22	16	I	TI		23	09.8	II	ED
	23	29	II	OR		23	55	I	SI
24	0	11	I	Se		23	59	I	TI

DECEMBER

1	0	17	III	Se		3	09.9	I	ER
	0	29	III	Te		21	52	I	TI
	1	42	II	OR		22	12	I	SI
	2	05		Se		22	22	II	TI
	2	09	I	Te		23	02	II	SI
	21	07.9	I	ED	17	0	02	I	Te
	23	22	I	OR		0	23	I	Se
2	17	46	II	SI		0	45	II	Te
	17	51	II	TI		1	29	II	Se
	18	23	I	SI		19	05	I	OD
	18	25	I	TI		21	38.7	I	ER
	20	12	II	Se	18	18	22	III	OD
	20	14	II	Te		18	28	I	Te
	20	34	I	Se		18	51	I	Se
	20	35	I	Te		20	02.3	II	ER
3	17	48.4	I	ER		22	14.8	III	ER
7	4	29	I	OD	22	5	10	I	TI
8	1	33	II	OD	23	2	24	I	OD
	1	35	III	TI		5	05.2	I	ER
	1	43	I	TI		23	36	I	TI
	1	49	I	SI	24	0	07	I	SI
	1	57	III	SI		0	38	II	TI
	3	44	III	Te		1	40	II	SI
	3	52	I	Te		1	46	I	Te
	4	00	I	Se		2	17	I	Se
	4	09.6	II	ER		3	01	II	Te
	4	18	III	Se		4	07	II	Se
	22	55	I	OD		20	50	I	OD
9	1	14.6	I	ER		23	34.1	I	ER
	20	06	II	TI	25	18	03	I	TI
	20	08	I	TI		18	35	I	SI
	20	18	I	SI		19	07	II	OD
	20	24	II	SI		20	12	I	Te
	22	18	I	Te		20	46	I	Se
	22	28	I	Se		21	41	III	OD
	22	29	II	Te		22	37.7	II	ER
	22	51	II	Se	26	2	17.1	III	ER
10	17	21	I	OD		18	02.9	I	ER
	19	43.5	I	ER	27	17	27	II	Se
11	17	27.1	II	ER	30	4	09	I	OD
	18	13.1	III	ER	31	1	21	I	TI
15	3	26	I	TI		2	01	I	SI
	3	43	I	SI		2	56	II	TI
	3	45	II	OD		3	31	I	Te
	4	50	III	TI		4	12	I	Se
	5	36	I	Te		4	18	II	SI
16	0	39	I	OD		22	36	I	OD

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	44i Boötis....	5.0, 6.0	4.8
ζ Aquarii..	3.5, 4.4	3.5	π Boötis....	4.3, 6.0	6.0

II. THE FINEST COLORED PAIRS

Star	Magnitudes	Distance ″	Colors
γ Andromedæ..	2.2, 5.5	10	Orange, Green.
α CanumVenat.	3.2, 5.7	20	Golden, Lilac.
β Cygni.....	3.3, 5.5	34	Golden, Sapphire.
ε Boötis.....	2.4, 6.5	2.9	Golden, Sapphire.
95 Herculis.....	5.5, 5.8	6	Golden, Azure.
α Herculis.....	4, 5.5	4.7	Ruby, Emerald.
γ Delphini.....	3.4, 5	11	Golden, Bluish Green.
32 Eridani.....	4.7, 7	6.7	Topaz, Bright Green.
ε Hydræ.....	3.5, 7.5	3.5	Yellow, Blue.
ζ Lyræ.....	4.5, 5.5	44	Yellow, Green.
i 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 ncludes five classes, two of which are subdivided, as follows:—

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

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

THE DISTANCES OF THE STARS

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

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

For many years attempts were made to measure stellar parallaxes, but without success. The angle to be measured is so exceedingly small that it was lost in the unavoidable instrumental and other errors of observation. The first satisfactory results were obtained by Bessel, who in 1838, by means of a heliometer, succeeded in determining the parallax of 61 Cygni, a 6th magnitude star with a proper motion of 5″ a year. On account of this large motion the star was thought to be comparatively near to us, and such proved to be the case. At about the same time Henderson, at the Cape of Good Hope, from meridian-circle 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 following list, prepared by Mr. J. A. Pearce, gives some of the latest values obtained.

Name	R.A. (1900) h	m	Decl. (1900) °	′	Vis. Mag. Harvard	Parallax ″	Distance Light Years
Prox. Cen	14	22.9	−62	15	11.2	0.765	4.26
* αCentauri	14	32.8	−60	25	0.33	.759	4.30
Barnard	17	52.9	+ 4	28	9.67	.533	6.12
Lal. 21185	10	57.9	+36	38	7.60	.403	8.09
* αCan. Maj	6	40.7	−16	35	−1.58	.376	8.67
Innes	11	12.0	−57	2	(12)	.339	9.62
C.Z. 5h 243	5	7.7	−44	59	8.3	.319	10.22
τCeti	1	39.4	−16	28	3.65	.318	10.25
* αCan. Min	7	34.1	+ 5	29	0.48	.312	10.45
εErid	3	28.2	− 9	48	3.81	.311	10.48
*61 Cygni	21	2.4	+38	15	5.57	.306	10.65
Lac. 9352	22	59.4	−36	26	7.44	.292	11.16
* Σ2398	18	41.8	+59	29	9.33	.287	11.36
εIndi	21	55.7	−57	12	4.74	.284	11.48
* Groom. 34	0	12.5	+43	27	7.98	.281	11.60
* Krüger 60	22	24.5	+57	12	9.64	.262	12.44
Lac. 8760	21	11.4	−39	15	6.65	.251	12.99
Oe. Arg. 17415-6	17	37.0	+68	26	9.2	.247	13.20
Van Maanen	0	43.9	+ 4	55	12.3	.246	13.25
Gould 32416	23	59.5	−37	51	8.5	.203	15.87
αAquilae	19	45.9	+ 8	36	0.89	.200	16.30
O² Erid	4	10.7	− 7	49	4.48	.198	16.5
*70 Oph	18	10.4	+ 2	31	4.28	.192	17.0
Cordoba 32416	23	59.5	−37	51	8.3	.191	17.1
+HR 7703	20	4.6	−36	21	5.34	.190	17.2
* ηCassiop	0	43.0	+57	17	3.64	.184	17.7
Alb. 8164	23	44.0	+ 1	52	8.7	.183	17.8
σDrac	19	32.6	+69	29	4.78	.182	17.9
HR 8832	23	8.5	+56	37	5.65	.177	18.4
* HR 6416	17	11.5	−46	32	5.58	.175	18.6
* A Oph	17	9.2	−26	27	5.29	.174	18.7
* HR 6426	17	12.1	−34	53	5.89	.170	19.2
eErid	3	15.9	−43	27	4.30	.152	21.5
* ξUrs. Maj	11	12.9	+32	6	4.41	.150	21.7
δErid	3	38.5	−10	6	3.72	.142	23.0
* αLyrae	18	33.6	+38	41	0.14	.134	24.3
βHydri	0	20.5	−77	49	2.90	.133	24.5
αPis. Aus	22	52.1	−30	9	1.29	.128	25.5
χDrac	18	22.9	+72	41	3.69	.127	25.7
* ζHerc	16	37.5	+31	47	3.00	.116	28.1
* μHerc	17	42.5	+27	47	3.48	.116	28.1
βLeonis	11	44.0	+15	8	2.23	.109	29.9
αBootis	14	11.1	+19	42	0.24	.105	31.1
βVirg	11	45.5	+ 2	20	3.80	.105	31.1
βCan. Ven	12	29.0	+41	54	4.32	.104	31.4
* 85 Peg	23	56.8	+26	34	5.85	.101	32.3
βGemin	7	39.2	+28	16	1.21	.095	34.3
αTauri	4	30.2	+16	18	1.06	.064	50.9
αAurigae	5	9.3	+45	54	0.21	.063	51.8
αLeonis	10	3.0	+12	27	1.34	.045	72.5
αErid	1	34.0	−57	45	0.60	.041	79.5
* αUrs. Min	1	22.6	+88	46	2.12	.041	79.5
βCentauri	13	56.8	−59	53	0.86	.027	120.7
αOrionis	5	49.8	+ 7	23	0.92	.022	148.2
αScorp	16	23.3	−26	13	1.22	.019	171.6
σCygni	20	38.0	+44	35	1.33	.012	271.7
αCarinae	6	21.7	−52	38	−0.86	.007	465.7

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

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	° ′			″	″			km./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 **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*
σ^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
||α^2 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
ν^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	45	−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	$29^d.530588 = 29^d 12^h 44^m\ 2^s.8$
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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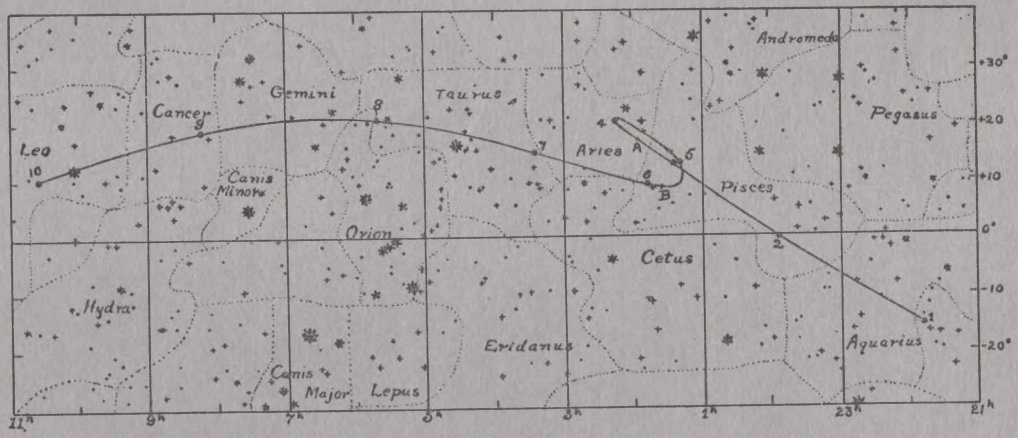

PATH OF VENUS AMONG THE STARS DURING 1929

The positions of the planet are shown for the first of each month. 1, Jan. 1; 2, Feb. 1; 4, April 1; 5, May 1; 6, June 1; 7, July 1; 8, Aug. 1; 9, Sept. 1; 10, Oct. 1. A, position when at greatest brilliancy as an evening star; B, greatest brilliancy as a morning star.

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

The objects of the Society, incorporated in 1890, are:

(*a*) "To study Astronomy, Astrophysics and such cognate subjects as shall be approved of by the Society and as shall, in its opinion, tend to the better consideration and elucidation of Astronomical and Astrophysical problems; and to diffuse theoretical and practical knowledge with respect to such subjects.

(*b*) To publish from time to time the results of the work of the Society; and,

(*c*) To acquire and maintain a Library, and such apparatus and real and personal property as may be necessary and convenient for the carrying into effect of the objects of the Society."

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