THE OBSERVER'S HANDBOOK FOR 1933

PUBLISHED BY

The Royal Astronomical Society of Canada

EDITED BY C. A. CHANT

TWENTY-FIFTH YEAR OF PUBLICATION

TORONTO
198 COLLEGE STREET
PRINTED FOR THE SOCIETY
1933

1933 CALENDAR 1933

JANUARY					
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	....

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

MARCH					
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	....

APRIL					
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 ....

MAY					
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	....

JUNE					
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	....

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

AUGUST					
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	....

SEPTEMBER					
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

OCTOBER					
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	....

NOVEMBER					
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	....
Sat.	4	11	18	25	....

DECEMBER					
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 ....

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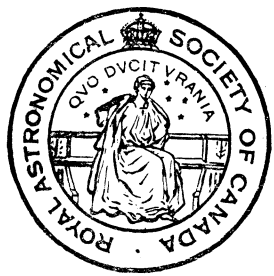

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CONTENTS

PREFACE

In the present issue of the HANDBOOK the list of stars occulted by the moon has been reduced as the observations reported did not warrant the great labour of computation—Those given (see p. 8) are for Ottawa—Others will be supplied when there is a demand for them.

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* (10s. 6*d*.); Olcott's *A Field-book of the Stars* ($1.50), and *A Firld-book of the Skies* ($3.50); McKready's *A Beginner's Star Book* ($5.00).

In the preparation of this HANDBOOK the Editor has been assisted by Miss M. S. Burland and Dr. R. J. McDiarmid, of the Dominion Observatory, Ottawa; Mr. H. Boyd, Brydon, Victoria; Mr. W. S. Armstrong 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, 1932. THE EDITOR.

ANNIVERSARIES AND FESTIVALS, 1933

New Year's Day	Sun.,	Jan. 1
Epiphany	Fri.,	Jan. 6
Septuagesima Sunday		Feb. 12
Quinquagesima (Shrove Sunday)		Feb. 26
Ash Wednesday		Mar. 1
St. David	Wed.,	Mar. 1
Quadragesima (First Sunday in Lent)		Mar. 5
St. Patrick	Fri.,	Mar. 17
Annunciation (Lady Day)	Sat.,	Mar. 25
Palm Sunday		Apr. 9
Good Friday		Apr. 14
Easter Sunday		Apr. 16
St. George	Sun.,	Apr. 23
Accession of King George V. (1910)	Sat.,	May 6
Rogation Sunday		May 21
Empire (Victoria) Day	Wed.,	May 24
Ascension Day	Thur.,	May 25
Birthday of Queen Mary (1867)	Fri.,	May 26
Birthday of King George V (1865)	Sat.,	June 3
Pentecost (Whit Sunday)		June 4
Corpus Christi	Thur.,	June 15
Birthday of Prince of Wales (1894)	Fri.,	June 23
St. John Baptist (Mid-Summer Day)	Sat.,	June 24
Dominion Day	Sat.,	July 1
Labour Day	Mon.,	Sept. 4
Hebrew New Year (Rosh Hashanah (5693)	Thu.,	Sept. 21
St. Michael (Michaelmas Day)	Fri.,	Sept. 29
All Saints' Day	Wed.,	Nov. 1
Remembrance Day	Sat.,	Nov. 11
St. Andrew	Thu.,	Nov. 30
First Sunday in Advent		Dec. 3
Christmas Day	Mon.,	Dec. 25

Thanksgiving Day, date set by Proclamation

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.

1933 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 44 08	+ 3 21.6	−23 03 45
" 4	18 57 22	+ 4 45.8	−22 47 43
" 7	19 10 32	+ 6 06.4	−22 27 36
" 10	19 23 38	+ 7 22.5	−22 03 31
" 13	19 36 39	+ 8 33.6	−21 35 34
" 16	19 49 34	+ 9 39.2	−21 03 51
" 19	20 02 23	+10 38.7	−20 28 31
" 22	20 15 06	+11 31.9	−19 49 41
" 25	20 27 42	+12 18.3	−19 07 32
" 28	20 40 11	+12 57.7	−18 22 12
" 31	20 52 33	+13 29.6	−17 33 54
Feb. 3	21 04 47	+13 54.0	−16 42 48
" 6	21 16 53	+14 10.9	−15 49 06
" 9	21 28 52	+14 20.5	−14 52 58
" 12	21 40 45	+14 22.8	−13 54 36
" 15	21 52 30	+14 18.4	−12 54 09
" 18	22 04 08	+14 07.5	−11 51 50
" 21	22 15 41	+13 50.5	−10 47 47
" 24	22 27 08	+13 27.7	− 9 42 14
" 27	22 38 29	+12 59.5	− 8 35 21
Mar. 1	22 46 01	+12 37.8	− 7 50 07
" 4	22 57 14	+12 01.4	− 6 41 28
" 7	23 08 23	+11 20.6	− 5 31 59
" 10	23 19 28	+10 36.1	− 4 21 51
" 13	23 30 30	+ 9 48.3	− 3 11 13
" 16	23 41 29	+ 8 58.0	− 2 00 16
" 19	23 52 27	+ 8 05.7	− 0 49 09
" 22	0 03 23	+ 7 12.1	+ 0 22 00
" 25	0 14 18	+ 6 17.7	+ 1 32 59
" 28	0 25 13	+ 5 23.0	+ 2 43 38
" 31	0 36 08	+ 4 28.3	+ 3 53 47
Apr. 3	0 47 04	+ 3 34.2	+ 5 03 17
" 6	0 58 00	+ 2 41.1	+ 6 11 57
" 9	1 08 58	+ 1 49.7	+ 7 19 38
" 12	1 19 59	+ 1 00.3	+ 8 26 12
" 15	1 31 02	+ 0 13.7	+ 9 31 31
" 18	1 42 08	− 0 29.8	+10 35 26
" 21	1 53 18	− 1 09.6	+11 37 47
" 24	2 04 32	− 1 45.4	+12 38 26
" 27	2 15 50	− 2 17.1	+13 37 13
" 30	2 27 12	− 2 44.3	+14 33 58
May 3	2 38 39	− 3 06.9	+15 28 33
" 6	2 50 11	− 3 24.8	+16 20 49
" 9	3 01 48	− 3 37.7	+17 10 39
" 12	3 13 29	− 3 45.6	+17 57 53
" 15	3 25 16	− 3 48.2	+18 42 26
" 18	3 37 09	− 3 45.5	+19 24 10
" 21	3 49 06	− 3 37.6	+20 02 56
" 24	4 01 09	− 3 24.8	+20 38 38
" 27	4 13 16	− 3 07.3	+21 11 08
" 30	4 25 27	− 2 45.6	+21 40 21
June 2	4 37 43	− 2 20.0	+22 06 10
" 5	4 50 01	− 1 51.0	+22 28 32
" 8	5 02 23	− 1 19.2	+22 47 21
" 11	5 14 47	− 0 44.7	+23 04 35
" 14	5 27 13	− 0 08.2	+23 14 10
" 17	5 39 41	+ 0 29.9	+23 22 03
" 20	5 52 10	+ 1 09.0	+23 26 17
" 23	6 04 39	+ 1 48.3	+23 26 45
" 26	6 17 07	+ 2 27.1	+23 23 31
" 29	6 29 35	+ 3 04.7	+23 16 33

1933 EPHEMERIS OF THE SUN AT 0h GREENWICH CIVIL TIME

Date	Apparent R.A.	Equation of Tine	Apparent Decl.
	h m s	m s	° ′ ″
July 2	6 42 00	+ 3 40.4	+23 05 56
" 5	6 54 23	+ 4 13.5	+22 51 41
" 8	7 06 42	+ 4 43.7	+22 33 52
" 11	7 18 59	+ 5 10.4	+22 12 32
" 14	7 31 12	+ 5 33.4	+21 47 46
" 17	7 43 20	+ 5 52.3	+21 19 38
" 20	7 55 24	+ 6 06.7	+20 48 14
" 23	8 07 23	+ 6 16.2	+20 13 39
" 26	8 19 17	+ 6 20.6	+19 36 02
" 29	8 31 06	+ 6 19.5	+18 55 30
Aug. 1	8 42 49	+ 6 12.9	+18 12 10
" 4	8 54 26	+ 6 00.6	+17 26 10
" 7	9 05 58	+ 5 42.8	+16 37 38
" 10	9 17 25	+ 5 19.8	+15 46 41
" 13	9 28 47	+ 4 51.7	+14 53 26
" 16	9 40 03	+ 4 18.8	+13 58 03
" 19	9 51 15	+ 3 41.2	+13 00 38
" 22	10 02 23	+ 2 59.2	+12 01 21
" 25	10 13 27	+ 2 13.1	+11 00 22
" 28	10 24 26	+ 1 23.1	+ 9 57 49
" 31	10 35 23	+ 0 29.6	+ 8 53 52
Sept. 3	10 46 16	− 0 26.9	+ 7 48 39
" 6	10 57 06	− 1 26.0	+ 6 42 18
" 9	11 07 55	− 2 27.0	+ 5 34 57
" 12	11 18 42	− 3 29.4	+ 4 26 44
" 15	11 29 29	− 4 32.7	+ 3 17 49
" 18	11 40 15	− 5 36.3	+ 2 08 20
" 21	11 51 01	− 6 39.7	+ 0 58 27
" 24	12 01 48	− 7 42.5	− 0 11 41
" 27	12 12 35	− 8 44.3	− 1 21 53
" 30	12 23 25	− 9 44.6	− 2 32 00

Date	Apparent R.A.	Equation of Time	Apparent Decl.
	h m s	m s	° ′ ″
Oct. 3	12 34 17	−10 42.6	− 3 41 53
" 6	12 45 11	−11 37.8	− 4 51 23
" 9	12 56 09	−12 29.6	− 6 00 21
" 12	13 07 11	−13 17.4	− 7 08 38
" 15	13 18 17	−14 00.6	− 8 16 04
" 18	13 29 29	−14 38.8	− 9 22 28
" 21	13 40 46	−15 11.4	−10 27 39
" 24	13 52 08	−15 38.4	−11 31 25
" 27	14 03 37	−15 59.2	−12 33 37
" 30	14 15 13	−16 13.6	−13 34 02
Nov. 2	14 26 55	−16 21.1	−14 32 32
" 5	14 38 44	−16 21.5	−15 28 55
" 8	14 50 41	−16 14.3	−16 23 00
" 11	15 02 45	−15 59.5	−17 14 38
" 14	15 14 58	−15 36.9	−18 03 37
" 17	15 27 18	−15 06.5	−18 49 46
" 20	15 39 45	−14 28.5	−19 32 53
" 23	15 52 20	−13 43.3	−20 12 49
" 26	16 05 02	−12 51.1	−20 49 24
" 29	16 17 50	−11 52.4	−21 22 28
Dec. 2	16 30 45	−10 47.6	−21 51 55
" 5	16 43 45	− 9 37.0	−22 17 35
" 8	16 56 51	− 8 21.3	−22 39 21
" 11	17 10 01	− 7 01.0	−22 37 09
" 14	17 23 14	− 5 36.9	−23 10 52
" 17	17 36 31	− 4 09.8	−23 20 25
" 20	17 49 50	− 2 40.9	−23 25 45
" 23	18 03 09	− 1 11.1	−23 26 52
" 26	18 16 28	+ 0 18.6	−23 23 44
" 29	18 29 47	+ 1 47.2	−23 16 23

To obtain the R.A. of Mean Sun, subtract the Equation of Time from the Apparent R.A.; 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, 1933

Prepared by R. M. MOTHERWELL

The following predictions of occultations for 1933 were computed for Ottawa and include all stars down to magnitude 4.5. The time given is Eastern Standard Time.

Date 1933	Star	Mag.	Immersion		Emersion	
			E. S. T.	P	E. S. T.	P
			h m	°	h m	°
Jan. 3	δ Piscium	4.5	11 11	3	11 40	301
9	136 Tauri	4.6	15 48	96	16 43	246
11	κ Geminorum	3.6	16 43	116	17 33	255
28	λ Aquarii	3.8	6 43	7	7 10	307
Feb. 3	q Tauri	4.3	13 50	77	14 54	236
3	20 Tauri	4.1	14 13	118	14 55	195
6	136 Tauri	4.6	2 28	146	3 08	233
8	κ Geminorum	3.6	2 57	110	3 58	294
18	τ Scorpii	2.8	4 03	64	5 15	285
Mar. 10	ρ Leonis	3.8	16 42	44	17 01	3
29	ϵ Arietis	4.6	7 57	53	8 52	258
Apr. 3	κ Geminorum	3.6	20 05	154	21 06	252
6	α Leonis	1.3	14 32	105	15 29	299
15-16	τ Sagittarii	3.5	23 58	139	0 36	218
20	λ Aquarii	3.8	5 54	36	7 04	256
26	q Tauri	4.3	14 59	142	15 32	189
May 11	τ Scorpii	2.8	3 14	130	4 11	239
20	δ Piscium	4.5	1 22	77	2 08	327
June 19	ϵ Arietis	4.6	2 58	66	3 56	245
20	q Tauri	4.3	1 14	54	2 19	260
20	20 Tauri	4.1	1 46	35	2 27	288
July 5	τ Scorpii	2.8	0 34	129	1 28	236
26	υ Leonis	4.5	20 00	96	20 57	323
Aug. 28	τ Scorpii	2.8	13 56	187	14 06	206
Sept. 9	q Tauri	4.3	22 49	88	23 48	229
9	20 Tauri	4.1	23 17	133	23 44	185
Oct. 7	q Tauri	4.3	9 40	104	10 31	246
7	20 Tauri	4.1	10 03	130	10 37	214
26	ι Capricorni	4.3	19 19	355	19 55	299
Nov. 30	q Tauri	4.3	22 39	109	23 48	215
Dec. 20	ι Capricorni	4.3	7 56	119	8 32	208

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 1933

MERCURY

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

Its apparent separation from the sun is never great, its maximum value ranging from 18° to 28°. In the year 1933 it reaches elongation six times. At such times when we search for it, in the west just after sunset, or in the east just before sunrise, it is never high above the horizon, and even with clear sky the planet is not easily located, although it is as bright as a first magnitude star.

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

The greatest eastern elongations in 1933 (Mercury, an evening star) are on March 6, 18° 14′, July 2, 25° 53′, and October 28, 23° 57′.

The greatest western elongations (Mercury, a morning star) are on April 20, 27° 25′, August 17, 18° 37′, and December 6, 20° 41′.

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

VENUS

The next planet in order from the Sun is Venus, by far the brightest and most conspicuous of all in our skies. It is nearly the earth's twin in respect to magnitude, density and general constitution, if not in other physical conditions.

Venus comes closest to the earth of any body except Eros, the moon, and an occasional comet. Its mean distance from the sun is 67 millions of miles, and its distance from the earth ranges from 26 million to 160 million miles.

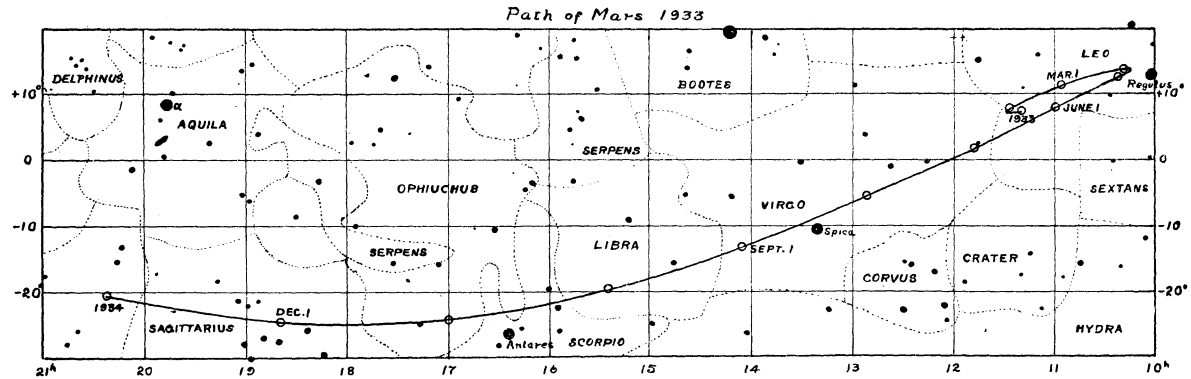
It is so brilliant that it is easily seen with the naked eye in the daytime for several weeks when near its greatest elongation. At the beginning of the year Venus is seen as a morning star (in the constellation Ophiuchus) and continues to be such till early spring. On April 21 the planet is in superior conjunction with the sun, and about May 20 it may be observed as an evening star and continues to be such the rest of the year. Venus reaches its greatest eastern elongation November 25, when it is 47° east of the sun. The planet has its greatest brilliancy December 31, magnitude −4.4, 15 times as bright as Sirius. A beautiful object for observation.

Observations

February 14. Conjunction of Venus and Saturn, 12′ separation, visible in morning.

August 17. Conjunction of Venus and Jupiter, 6′ separation, visible in evening.

December 21. Conjunction of Venus and Saturn, 20′ separation, visible in evening.



PATH OF MARS AMONG THE STARS DURING 1933

The position of the planet on the first of each month is shown by open circles.

MARS

Mars is in the constellation Leo at the beginning of 1933, and is visible as a morning star. January 1 the planet has the same brightness as Beta Orionis (Rigel), Mag. +0.3, and gradually increases to a maximum of Mag. −1.0 (nearly as bright as Sirius) on March 3, when it again grows gradually fainter due to its increasing distance from the earth.

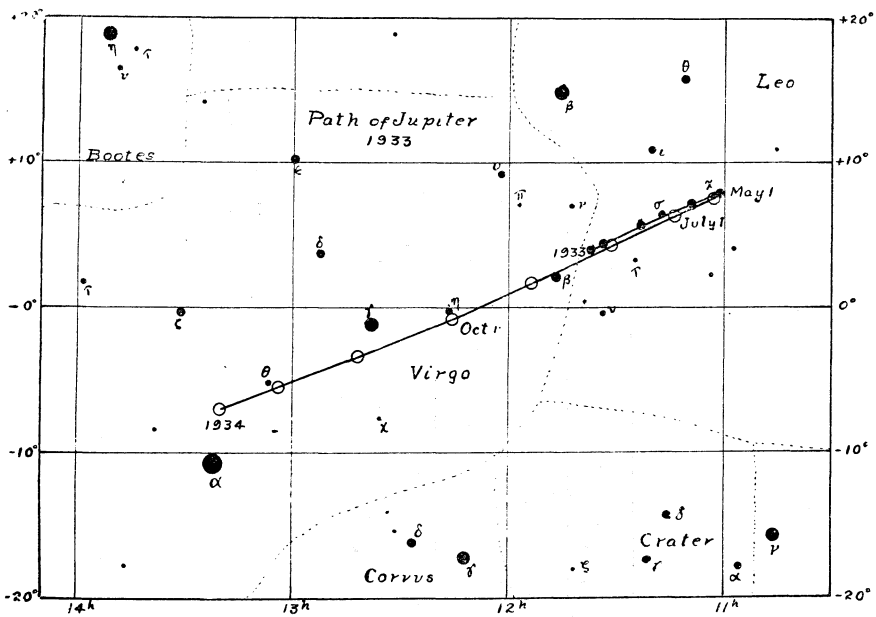
Mars is in opposition with the Sun March 1, and is visible all night. March 3 it is nearest the earth.

The opposition of March is not a suitable one for observation.

The planet's average distance from the earth at opposition is 48.6 million miles. When opposition occurs near the planet's perihelion, this distance may be reduced to 34.5 millions of miles, while near aphelion it can be as great as 62.9 millions of miles. As Mars passes aphelion February 16, its distace from the earth on March 3 is 62.7 millions of miles, hence this opposition is not a good one to observe the planet.

Mars and Jupiter are of interest to observers as they are in conjunction June 4; 16′ separation, visible in the evening.

JUPITER



PATH OF JUPITER AMONG THE STARS DURING 1933

The position of the planet is shown on the first of each month. When its motion is direct its position is shown by open circles; when retrograde, by filled circles.

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

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

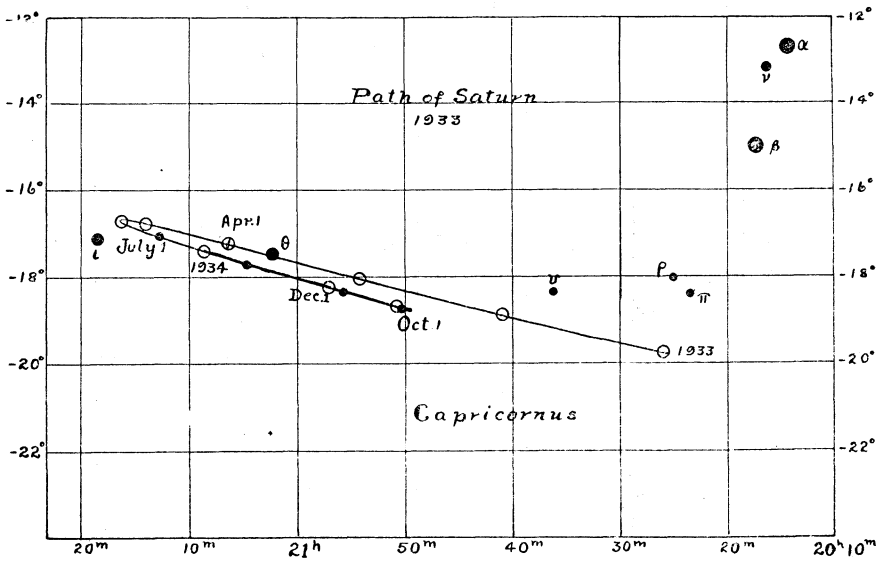
Jupiter is known to possess nine moons. The four largest (two of them larger than Mercury) can be seen with field glasses, but the others are extremely faint bodies and require the most powerful instruments to detect them.

Jupiter is in Leo at the beginning of the year and is visible after midnight and as a morning star, magnitude -1.7, equalling Sirius in brightness. On March 9, it is in opposition with the sun, and is visible all night. September 27 the planet is in conjunction with the sun and for some time is not visible, appearing again in late autumn as a morning star (magnitude -1.2).

Jupiter and Mars are in conjunction June 4; 16′ separation; visible in evening.

Jupiter and Venus are in conjunction August 17; 6′ separation; visible in evening.

SATURN



PATH OF SATURN AMONG THE STARS DURING 1933

The position of the planet is shown on the first of each month. When its motion is direct its position is shown by open circles; when retrograde, by filled circles.

Saturn possesses a remarkable set of rings and has ten satellites. It is considered to be one of the finest objects in the sky for the visual astronomer.

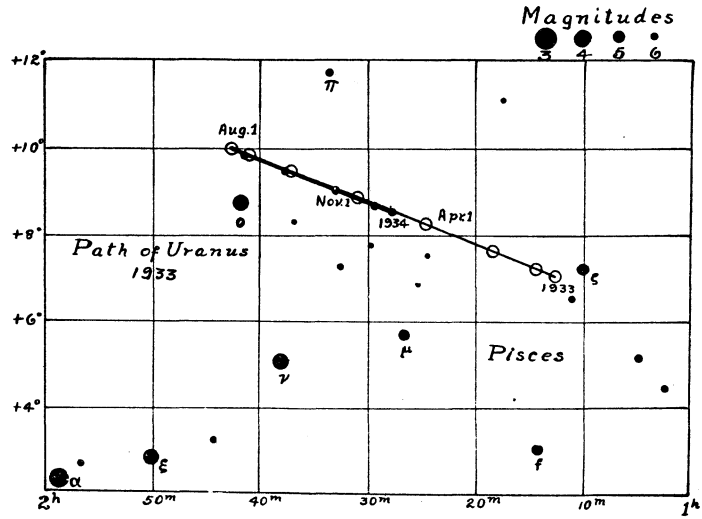
During 1933, although the planet is 18° south of the equator, the rings of Saturn are quite well placed for examination.

Saturn is an evening star in Capricornus for a short time at the beginning of 1933 (mag. +0.8). It is in conjunction with the sun January 27; a month later it appears again as a morning star. On August 5 Saturn is in opposition with the sun, crossing the meridian at midnight, and is therefore visible all night. Magnitude +0.3. During the autumn it is an evening star.

Saturn and Venus are in conjunction February 14; 12′ separation and visible just before sunrise; and again on December 21 in the evening, there is a conjunction with 20′ separation.

URANUS

Uranus was discovered by Sir William Herschel in 1781. Before that time Saturn's path was considered the outermost boundary of the solar system, and when the planet was first seen by Herschel he thought it must be a comet. A year later its true nature was recognized. The planet has four satellites, two discovered by Herschel a few years after his discovery of Uranus. In 1851, Lassell rediscovered and observed these two satellites, Oberon and Titania, and independently discovered and observed the two fainter satellites, Ariel and Umbriel. The satellites are very faint, about magnitude 14.



PATH OF URANUS AMONG THE STARS DURING 1933

The position of the planet is shown on the first of each month. When its motion is direct its position is shown by open circles; when retrograde, by filled circles.

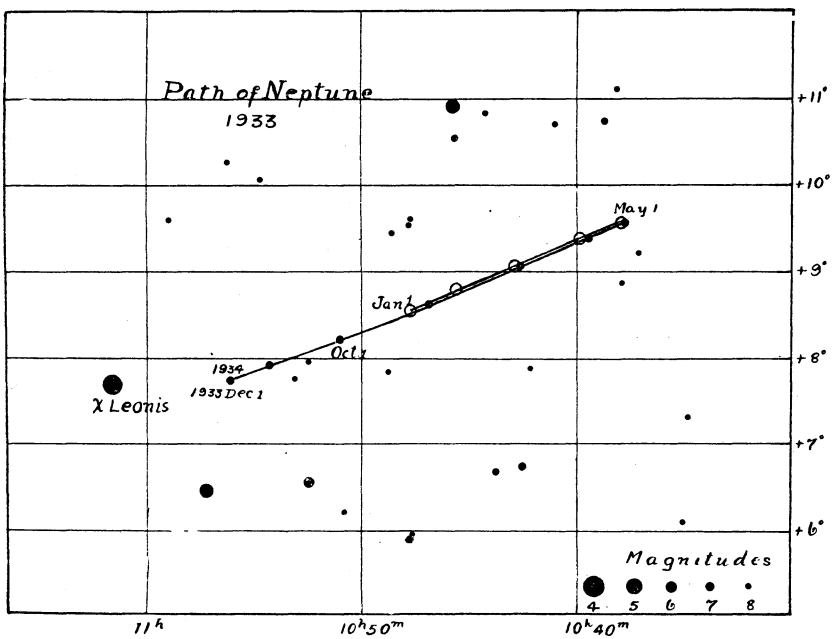
The period of Uranus about the sun is 84 years, and consequently its motion in the heavens is slow. Its period of rotation is 10¾ hours. It is of the sixth magnitude, and can be seen with the naked eye, but its motion is better observed by the aid of a field glass. A large telescope is necessary to show an appreciable disc.

Uranus is in the constellation Pisces in 1933. It is in conjunction with the sun April 13, some time later it is visible in the morning. On October 19, it is in opposition to the sun and is visible the entire night.

NEPTUNE

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

Neptune, until two years ago, was considered the most distant planet of the solar system, being 2,800 millions of miles from the sun, and requiring 165 years to complete a revolution. The discovery of a new member of the solar system,



PATH OF NEPTUNE AMONG THE STARS DURING 1933

The position of the planet on its path at the beginning of each month is marked. The open circles show the time when the planet is retrograding and the filled circles the time when the motion is direct. The positions of the stars are for the epoch 1933.

Pluto, at Flagstaff observatory, Arizona, in 1930, has robbed Neptune of this distinction.

Neptune is in opposition to the sun on February 27, and is visible all night at the beginning of the year. On September 3 it is in conjunction with the sun and is not visible.

Neptune appears as an eighth magnitude star and hence can be seen only with a telescope. It has a single satellite, with a magnitude of about 13. The satellite was discovered by Lassell a few months following the discovery of the planet.

PLUTO

Percival Lowell, founder and late Director of the Lowell Observatory, Flagstaff, Arizona, through his researches on the motions of the planets Uranus and Neptune, was led to predict the position of a body beyond Neptune which was producing small perturbations of these planets. From his extensive mathematical investigations, he gave its position in the heavens within about five degrees.

In the discovery of this planet history seems to have repeated itself closely, except in one tragic detail—Percival Lowell did not live to see his prediction confirmed.

The body was discovered by the staff of the Lowell Observatory at Flagstaff about the beginning of the year 1930. Since its discovery many observations have been recorded from photographs dating back to 1919. The discussion of these observations confirms, to a certain degree, Lowell's prediction. The period of revolution of the new planet about the sun is 248 years, one and a half times the period of Neptune; the estimated mass based on certain assumptions is nearly that of the earth, while the distance from the sun is approximately 900 millions of miles farther than Neptune.

The stellar magnitude of the new planet is about 14. Its computed position is given for January 1, 1933, as R.A. 7^h36^m, declination $+22°32'$ (*Lick Bulletin* No. 444).

In connection with the discovery of the planet Pluto as a member of the solar system, reference should be made to the extensive investigations of W. H. Pickering (formerly on the staff of Harvard Observatory, and now living in Jamaica), of all the apparent planetary perturbations that may indicate unknown planets in the solar system, dealing particularly with Jupiter and Saturn. His conclusion is that there are still three unknown planets, P, S, and U, yet to be discovered. (*Popular Astronomy*, Vol. XL, No. 2, 1932).

ECLIPSES, 1933

In the year 1933 there will be two eclipses, both of the sun, both invisible in North America.

I. An Annular Eclipse of the Sun, February 24, 1933.

Path of the annular eclipse begins at sunrise on the Pacific Ocean off Valdivia, Chile, passes eastward across S. America, thence north eastward entering Africa in the French Kongo thence more easterly to Aden and ends at sunset off the S. coast of Arabia.

Circumstances of the Eclipse
75th Meridian Civil Time

		d	h	m	Long. °	′		Lat. °	′	
Eclipse begins	Feb.	24	04	56	62	61	W.	34	56	S.
Central eclipse begins	"	24	05	58	79	09	W.	39	25	S.
Central eclipse ends	"	24	09	34	52	18	E.	14	28	N.
Eclipse ends	"	24	10	37	35	51	E.	19	00	N.

II. An Annular Eclipse of the Sun, August 21, 1933.

Path of the annular eclipse begins at sunrise in the Sahara Desert, passes eastward near Bagdad, thence across Afghanistan, past Delhi, thence southeastwardly through Burma and Borneo, thence across N. Australia and ends at sunset off the E. coast of Queensland.

Circumstances of the Eclipse
75th Meridian Civil Time

		d	h	m	Long. °	′		Lat. °	′	
Eclipse begins	Aug.	20	21	52	41	00	E.	28	26	N.
Central eclipse begins	"	20	22	56	24	38	E.	30	11	N.
Central eclipse ends	"	21	02	42	150	38	E.	20	31	S.
Eclipse ends	"	21	03	45	134	21	E.	22	16	S.

THE SKY FOR JANUARY, 1933

Prepared by MIRIAM S. BURLAND

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 57m, and its Decl. changes from 23° 4′ S. to 17° 17′ S. The equation of time (see p. 6) increases from 3m to 22s to 13m 39s. Due to this rapid rise in value the time of mean noon appears, for the first ten days of the month, to remain at the same distance from the time of sunrise, that is, the forenoons as indicated by our clocks are of the same length. On the 20th the sun enters the sign Aquarius, the second winter zodiacal sign. On the 3rd the earth is in perihelion.

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

Mercury on the 15th is in R.A. 18h 42m, Decl. 23° 55′ S., and transits at 11.08. It is a morning star and on the 1st rises in the southeast about 1½ hours before the sun. During the latter part of the month it is too close to the sun for observation.

Venus on the 15th is in R.A. 18h 3m, Decl. 22° 56′ S., and transits at 10.28. It is a morning star of −3.4 magnitude. On the 15th it rises about 1½ hours before the sun.

Mars on the 15th is in R.A. 11h 29m, Decl. 7° 6′ N., and transits at 3.52. On the 15th it rises about 9.15 p.m. During the month its magnitude increases from +0.3 to −0.4. It is in the constellation of Leo.

Jupiter on the 15th is in R.A. 11h 37m, Decl. 3° 55′ N., and transits at 4.00. On the 15th it rises about 10 p.m. and may be seen in Virgo. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 54.

Saturn on the 15th is in R.A. 20h 33m, Decl. 19° 23′ S., and transits at 12.55. It is too close to the sun for observation. On the 27th it is in conjunction with the sun.

Uranus on the 15th is in R.A. 1h 13m, Decl. 7° 6′ N., and transits at 17.34.

Neptune on the 15th is in R.A. 10h 47m, Decl. 8° 39′ N., and transits at 3.10.

JANUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 3h 45m
			h	m	
	Sun.	1			30124
	Mon.	2	21	10	31042
☽	Tues.	3 11h 23.6m F.Q.			24013
		14h ⊕ in Perihelion.			
	Wed.	4 3h 44m☌♁☾, ♁ 4° 19′ S.			403**
	Thur.	5	17	50	41023
	Fri.	6			42031
	Sat..	7 20h ☿ in♉			42310
	Sun.	8 12h ♃ Stationary	14	40	43021
	Mon.	9 23h □♁☉			43102
	Tues.	10 19h ♂ Greatest Hel. Lat. N.			2031*
♋	Wed.	11 15h 35.6m F.M.	11	30	2043*
	Thur.	12			10234
	Fri.	13			d0134
	Sat.	14	8	20	23104
	Sun.	15 11h 33m☌♆☾, ♆ 1° 05′ N.			30214
	Mon.	16 9h 05m☌♂☾, ♂ 5° 08′ N.			31024
		12h 56m☌♃☾, ♃ 3° 00′ N.			
	Tues.	17	5	10	2014*
	Wed.	18 2h ☿ in Aphelion.			21043
☾	Thur.	19 1h 15.4m L.Q.			d4023
	Fri.	20	2	00	40123
	Sat.	21 21h ♂ Stationary			42310
	Sun.	22	22	50	43021
	Mon.	23			43102
	Tues.	24 2h 59m☌♀☾, ♀ 4° 25′ N.			4201*
●	Wed.	25 1h 04m☌☿☾, ☿ 1° 51′ N.	19	40	42103
		18h 19.7m N.M.			
		19h 43m☌♄☾, ♄ 2° 15′ N.			
	Thur.	26 8h ♀ in♉			40123
	Fri.	27 8h☌♄☉			4023*
	Sat.	28	16	40	23104
	Sun.	29			3014*
	Mon.	30			31024
	Tues.	31 13h 08m☌♁☾, ♁ 4° 33′ S.			32014

Explanation of symbols and abbreviations on page 4

THE SKY FOR FEBRUARY, 1933

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

The Sun—During February the sun's R.A. increases from 20h 57m to 22h 46m, and its Decl. changes from 17° 17′ S. to 7° 50′ S. The equation of time reaches a maximum value of 14m 23s on the 12th (see p. 6). For changes in the length of day see p. 11. On the 19th the sun enters Pisces, the third winter sign of the zodiac. On the 24th there is an annular eclipse, visible mostly in the southern hemisphere. See p. 29.

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

Mercury on the 15th is in R.A. 22h 16m, Decl. 12° 33′ S., and transits at 12.40. It is approaching the sun and on the 8th is in superior conjunction, after that date it becomes an evening star.

Venus on the 15th is in R.A. 20h 48m, Decl. 18° 39′ S., and transits at 11.10. It is approaching superior conjunction and is not favourably situated for observation.

Mars on the 15th is in R.A. 11h 16m, Decl. 9° 18′ N., and transits at 1.38. It rises about 7 p.m. on the 15th and may be seen in Leo all month. By the end of the month its magnitude has increased to −1.0.

Jupiter on the 15th is in R.A. 11h 30m, Decl. 4° 52′ N., and transits at 1.51. On the 15th it rises about 2 hours after sunset. Its magnitude, −2.0, is at a maximum for this year. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 54.

Saturn on the 15th is in R.A. 20h 48m, Decl. 18° 29′ S., and transits at 11.08. It is now a morning star, though rather close to the sun for observation.

Uranus on the 15th is in R.A. 1h 16m, Decl. 7° 26′ N., and transits at 15.36.

Neptune on the 15th is in R.A. 10h 44m, Decl. 8° 55′ N., and transits at 1.06.

FEBRUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 2h 15m
			h	m	
Wed.	1	4h ☌☿♄, ☿ 1° 32′ S.			21O34
☽ Thur.	2	8h 16.3m F.Q.			O1234
Fri.	3		10	00	1O234
Sat.	4				d23O4
Sun.	5				342O1
Mon.	6		6	50	341O2
Tues.	7	10h ☿ Greatest Hel. Lat. S.; 19h ☌☿☉ Superior.			432O1
Wed.	8				421O3
Thur.	9		3	40	4O213
♋ Fri.	10	8h 00.5m F.M.			41O23
Sat.	11	17h 06m ☌Ψ☾, Ψ 1° 07′ N.			d42O1
Sun.	12	10h 02m ☌♂☾, ♂ 5° 41′ N. 15h 50m ☌♃☾, ♃ 3° 02′ N.	0	30	342O*
Mon.	13				31O42
Tues.	14	16h ☌♀♄, ♀ 0° 12′ S.	21	20	d3O14
Wed.	15	22h ♂ in Aphelion.			21O34
Thur.	16				O2134
☾ Fri.	17	9h 08.4m L.Q.	18	10	1O234
Sat.	18				2O314
Sun.	19				32O4*
Mon.	20		14	00	31O24
Tues.	21				3O421
Wed.	22	10h 12m ☌♄☾, ♄ 1° 59′ N.			241O3
Thur.	23	3h 40m ☌♀☾, ♀ 0° 38′ N.	11	50	4O213
● Fri.	24	7h 43.9m N.M. ☉ Annular Eclipse, invisible at Toronto.			41O23
Sat.	25	13h 22m ☌☿☾, ☿ 1° 35′ S.			42O13
Sun.	26	11h ☿ in ♌	8	40	4321O
Mon.	27	15h ☍Ψ☉			d43O2
Tues.	28	0h 05m ☌♁☾, ♁ 4° 39′ S.			43O12

Explanation of symbols and abbreviations on page 4

THE SKY FOR MARCH, 1933

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° 50′ S. to 4° 17′ N. The equation of time decreases from 12m 38s to 4m 10s (see p. 6). For changes in the length of the day see p. 12. On the 21st at 1h 43m (G.C.T.) the sun enters the first spring sign of the zodiac, Aries and Spring begins. On that day the sun crosses the equator going north.

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

Mercury on the 15th is in R.A. 0h 22m, Decl. 5° 59′ N., and transits at 12.50. It is an evening star and on the 6th reaches its greatest elongation east, it is then favourably situated for observation and may be seen at sunset about 15° above the western horizon. Its magnitude is about −0.1. After this date the planet approaches the sun and on the 23rd is in inferior conjunction with it.

Venus on the 15th is in R.A. 23h 5m, Decl. 7° 28′ S., and transits at 11.36. It is too close to the sun for observation.

Mars on the 15th is in R.A. 10h 37m, Decl. 13° 3′ N., and transits at 23.03. On the 1st it is in opposition with the sun and on that date rises at sunset, and is visible throughout the night. On the 3rd it is nearest to the earth. It is still in Leo.

Jupiter on the 15th is in R.A. 11h 17m, Decl. 6° 16′ N., and transits at 23.44. On the 9th it is in opposition with the sun and rises at sunset. It is in Leo and well situated for observation throughout the night. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 54.

Saturn on the 15th is in R.A. 21h 0m, Decl. 17° 41′ S., and transits at 9.30. At sunrise on the 15th it is about 12° above the southeastern horizon. Its magnitude is +1.0.

Uranus on the 15th is in R.A. 1h 21m, Decl. 7° 56′ N., and transits at 13.50.

Neptune on the 15th is in R.A. 10h 41m, Decl. 9° 13′ N., and transits at 23.09.

MARCH

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 1h 0m
			h m	
	Wed. 1	15h ☌☌☉	5 20	2410*
		22h ☿ in Aphelion.		
	Thur. 2			0143*
	Fri. 3	2h ☿ in Perihelion		10243
		8h ♂ nearest ⊕.		
☽	Sat. 4	5h 23.3m F.Q	2 10	20134
	Sun. 5			23104
	Mon. 6	15h ☿ Greatest elong. E. 18° 14′	23 00	30124
	Tues. 7			3024*
	Wed. 8			21304
	Thur. 9	3h ☌☌	19 50	20143
	Fri. 10			14023
♒	Sat. 11	0h ☌♂Ψ, ♂ 3° 28′ N		42013
		0h 29m ☌♂☾, ♂ 4° 30′ N.		
		0h 30m ☌Ψ☾, Ψ 1° 02′ N.		
		18h 17m ☌☌☾, ☌ 2° 45′ N.		
		21h 45.7m F.M.		
	Sun. 12		16 40	42310
	Mon. 13	4h ☿ Stationary		43012
	Tues. 14			43102
	Wed. 15		13 30	d4230
	Thur. 16			42013
	Fri. 17			41023
☾	Sat. 18	16h 04.8m L.Q	10 20	d4013
	Sun. 19			21304
	Mon. 20	20h 43m ☉ enters ♈, Spring commences		30214
	Tues. 21	21h 56m ☌♄☾, ♄ 1° 40′ N	7 10	31024
	Wed. 22			d2304
	Thur. 23	3h ☌☿☉ Inferior		20134
	Fri. 24	5h ♀ Greatest Hel. Lat. S	3 00	10234
♍	Sat. 25	11h 05m ☌♀☾, ♀ 3° 39′ S		02134
		12h 25m ☌☿☾, ☿ 0° 56′ N.		
		20h ☌☿♀, ☿ 4° 35′ N.		
		22h 20.3m N.M.		
	Sun. 26			21304
	Mon. 27	11h 04m ☌♁☾, ♁ 4° 41′ S	0 40	34021
	Tues. 28			43102
	Wed. 29		21 30	43201
	Thur. 30			4203*
	Fri. 31			41023

Explanation of symbols and abbreviations on page 4

THE SKY FOR APRIL, 1933

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

The Sun—During April the sun's R.A. increases from 0h 40m to 2h 31m, and its Decl. changes from 4° 17′ N. to 14° 52′ N. The equation of time changes from +4m 10s to −2m 52s (see p. 6). For changes in the length of day see p. 13. On the 20th the sun enters Taurus, the second spring zodiacal sign.

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

Mercury on the 15th is in R.A. 23h 55m, Decl. 2° 28′ S., and transits at 10.24. It is a morning star, and on the 20th reaches its greatest elongation west.

Venus on the 15th is in R.A. 1h 26m, Decl. 7° 48′ N., and transits at 11.56. It is too close to the sun for observation and on the 21st is in superior conjunction with it.

Mars on the 15th is in R.A. 10h 16m, Decl. 13° 42′ N., and transits at 20.42. At sunset on the 15th the planet may be seen about 45° above the southeastern horizon, in the constellation of Leo. Its magnitude is decreasing and at the end of the month is +0.2.

Jupiter on the 15th is in R.A. 11h 4m, Decl. 7° 32′ N., and transits at 21.30. At sunset on the 15th it is about 35° above the southeastern horizon. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 21h 11m, Decl. 17° 0′ S., and transits at 7.39. Its position for morning observation is improving. On the 15th it rises about 3 hours before the sun. It is in Capricornus and its magnitude is +1.0.

Uranus on the 15th is in R.A. 1h 28m, Decl. 8° 34′ N., and transits at 11.55.

Neptune on the 15th is in R.A. 10h 39m, Decl. 9° 29′ N., and transits at 21.04

APRIL

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 0h 0m
			h	m	
	Sat.	1	18	20	4O213
	Sun.	2			421O3
☽	Mon.	3 0h 56.4m F.Q.			34O1*
	Tues.	4 14h ☿ Stationary	15	10	31O2*
	Wed.	5 19h ☿ in ♉			32O14
	Thur.	6 22h 11m ☌♂☾, ♂ 2° 46′ N.			21O34
	Fri.	7 9h 18m ☌♆☾, ♆ 1° 01′ N.	12	00	dO234
		22h 36m ☌♃☾, ♃ 2° 26′ N.			
	Sat.	8			O1234
	Sun.	9			21O34
♉	Mon.	10 8h 37.6m F.M.	8	50	32O14
	Tues.	11			31O24
	Wed.	12			d32O1
	Thur.	13 5h ♂ Stationary	5	40	421O*
		13h ☌☉.			
	Fri.	14			4O123
	Sat.	15 2h ☌♀☉, ♀ 0° 39′ S.			4O23*
☾	Sun.	16 1h ☿ in Aphelion	2	30	421O3
		23h 17.4m L.Q.			
	Mon.	17			432O1
	Tues.	18 7h 18m ☌♄☾, ♄ 1° 16′ N.	23	20	431O2
	Wed.	19			d43O1
	Thur.	20 2h ☿ Greatest elong. W. 27° 25′			214O*
	Fri.	21 11h ☌♀☉ Superior	20	10	O1243
	Sat.	22 8h 47m ☌☿☾, ☿ 5° 41′ S.			O234*
	Sun.	23 21h 03m ☌♉☾, ♉ 4° 45′ S.			21O34
♌	Mon.	24 13h 38.3m N.M.	16	50	32O14
		19h 35m ☌♀☾, ♀ 5° 40′ S.			
	Tues.	25			31O24
	Wed.	26			3O214
	Thur.	27	13	40	213O4
	Fri.	28			O2143
	Sat.	29			41O23
	Sun.	30	10	30	d42O3

Explanation of symbols and abbreviations on page 4

THE SKY FOR MAY, 1933

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

The Sun—During May the sun's R.A. increases from 2h 31m to 4h 34m, and its Decl. changes from 14° 52′ N. to 21° 58′ N. The equation of time decreases from −2m 52s, to a minimum of −3m 48s on the 15th, and then increases to −2m 29s at the end of the month (see p. 6). For changes in the times of sunrise and sunset see p. 14. On the 21st the sun enters Gemini, the third sign of the zodiac.

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

Mercury on the 15th is in R.A. 2h 26m, Decl. 12° 40′ N., and transits at 10.59. It is a morning star at the beginning of the month, but rather close to the sun for observation. On the 28th it is in superior conjunction with the sun, after which it becomes an evening star.

Venus on the 15th is in R.A. 3h 51m, Decl. 19° 57′ N., and transits at 12.22. It is now an evening star though rather close to the sun for observation.

Mars on the 15th is in R.A. 10h 36m, Decl. 10° 38′ N., and transits at 19.04. At sunset on the 15th it is near the meridian, about 55° above the southern horizon. By the end of the month its magnitude has decreased to +0.7.

Jupiter on the 15th is in R.A. 11h 1m, Decl. 7° 49′ N., and transits at 19.28. It is approaching quadrature and at sunset on the 15th is close to the meridian. Its magnitude is decreasing and by the end of the month is −1.7. For the configurations of its satellites, see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 21h 16m, Decl. 16° 42′ S., and transits at 5.46. On the 7th it is in quadrature with the sun, and on that date it rises shortly after midnight.

Uranus on the 15th is in R.A. 1h 34m, Decl. 9° 11′ N., and transits at 10.03.

Neptune on the 15th is in R.A. 10h 38m, Decl. 9° 35′ N., and transits at 19.05.

MAY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 23h 15m
			h m	
	Mon.	1		43102
☽	Tues.	2 17h 39.1m F.Q.		43021
	Wed.	3		42130
	Thur.	4 11h 51m ☌♂☾, ♂ 2° 02′ N.	7 20	4013*
		18h 11m ☌♆☾, ♆ 1° 10′ N.		
	Fri.	5 5h 39m ☌♃☾, ♃ 2° 22′ N.		41023
	Sat.	6 10h ☿ Greatest Hel. Lat. S.	4 10	2013*
		10h ☌☿♎, ☿ 2° 12′ S.		
		21h □♄☉.		
	Sun.	7		2304*
	Mon.	8		31024
♋	Tues.	9 17h 04.4m F.M.	1 00	30124
	Wed.	10 17h ♃ Stationary.		23104
	Thur.	11	21 50	20134
	Fri.	12		10234
	Sat.	13		20134
	Sun.	14	18 40	d204*
	Mon.	15 15h 31m ☌♄☾, ♄ 0° 51′ N.		34102
☾	Tues.	16 7h 50.4m L.Q.		43012
		16h ☌♂♆, ♂ 0° 46′ N.		
	Wed.	17	15 30	42310
	Thur.	18		42031
	Fri.	19 1h ♆ Stationary.		41023
		12h ♀ in ♌.		
	Sat.	20	12 10	d4013
	Sun.	21 5h 54m ☌♎☾, ♎ 4° 56′ S.		42103
	Mon.	22		d3402
	Tues.	23 19h 08m ☌☿☾, ☿ 5° 24′ S.	9 00	30142
●	Wed.	24 5h 06.9m N.M.		32104
	Thur.	25 2h 03m ☌♀☾, ♀ 4° 44′ S.		2014*
		10h ☿ in ♉.		
	Fri.	26	5 50	10234
	Sat.	27 9h ♄ Stationary.		02134
	Sun.	28 14h ☌☿☉ Superior.		21034
	Mon.	29 1h □♆☉.	2 40	3014*
	Tues.	30 1h ☿ in Perihelion.		3024*
	Wed.	31	23 30	d3012

Explanation of symbols and abbreviations on page 4

THE SKY FOR JUNE, 1933

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

The Sun—During June the sun's R.A. increases from 4h 34m to 6h 38m, and its Decl. from 21° 58′ N. to its maximum value of 23° 27′ N. on the 21st and then drops to 23° 10′ N., at the end of the month. On that date the sun reaches summer solstice and enters Cancer, the first summer zodiacal sign, and Summer commences. The duration of daylight is now at its longest and does not change appreciably for some days, see p. 15. For changes in the equation of time see p. 6. The increase in this quantity at the end of the month, taken with the shortening of daylight causes the local mean time of sunset to appear almost constant for several days at the end of June and the beginning of July.

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

Mercury on the 15th is in R.A. 6h 53m, Decl. 24° 56′ N., and transits at 13.24. It is too close to the sun to observe at the beginning of the month. On the 15th it sets about 1¼ hours after the sun.

Venus on the 15th is in R.A. 6h 35m, Decl. 24° 13′ N., and transits at 13.04. It is an evening star of magnitude −3.3. On the 15th it sets about 1 hour after the sun.

Mars on the 15th is in R.A. 11h 20m, Decl. 5° 8′ N., and transits at 17.48. On the 6th it is in quadrature with the sun. It is in Leo at the beginning of the month, but about the 20th crosses into Virgo. It may be observed during the first half of the night only.

Jupiter on the 15th is in R.A. 11h 8m, Decl. 7° 2′ N., and transits at 17.33. On the 5th it is in quadrature with the sun. Its magnitude is still decreasing and is −1.5 at the end of the month. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 21h 15m, Decl. 16° 49′ S., and transits at 3.43. On the 15th it rises about 10.45 p.m. and may be seen in the constellation of Capricornus. Its magnitude is now +0.7.

Uranus on the 15th is in R.A. 1h 39m, Decl. 9° 41′ N., and transits at 8.06.

Neptune on the 15th is in R.A. 10h 38m, Decl. 9° 30′ N., and transits at 17.04.

JUNE

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 22h 30m
			h m	
☽	Thur.	1 2h 10m ☌ ♆☾, ♆ 1° 27′ N.		42O1*
		6h 52.9m F.Q.		
		13h 11m ☌ ♂☾, ♂ 2° 19′ N.		
		15h 15m ☌ ♃☾, ♃ 2° 37′ N.		
	Fri.	2		41O23
	Sat.	3	20 20	4O213
	Sun.	4 17h ☌ ♂♃, ♂ 0° 16′ S.		421O3
	Mon.	5 5h □ ♃☉		43O1*
		19h □ ♂☉.		
	Tues.	6	17 10	431O2
	Wed.	7		d432O
♋	Thur.	8 0h 04.7m F.M.		243O1
		11h ☌ ☿♀, ☿ 1° 06′ N.		
	Fri.	9 7h ☿ Greatest Hel. Lat. N.	14 00	1O23*
	Sat.	10		O2143
	Sun.	11 19h 31m ☌ ♄☾, ♄ 0° 31′ N.		21O34
	Mon.	12	10 50	32O14
	Tues.	13		31O24
☾	Wed.	14 18h 25.5m L.Q.		d32O4
	Thur.	15	7 30	23O4*
	Fri.	16		1O234
	Sat.	17 14h 08m ☌ ♁☾, ♁ 5° 11′ S.		4O123
	Sun.	18	4 20	421O3
	Mon.	19		423O1
	Tues.	20		431O2
	Wed.	21 16h 12m ☉ enters ♋, Summer commences	1 10	d43O1
♍	Thur.	22 7h ♀ in Perihelion		423O*
		20h 22.3m N.M.		
	Fri.	23	22 00	41O23
	Sat.	24 9h 01m ☌ ♀☾, ♀ 2° 04′ S.		4O123
	Sun.	25 1h 08m ☌ ☿☾, ☿ 1° 30′ S.		214O3
	Mon.	26	18 50	d2O14
	Tues.	27		31O24
	Wed.	28 9h 13m ☌ ♆☾, ♆ 1° 44′ N.		3O214
	Thur.	29 3h 01m ☌ ♃☾, ♃ 3° 03′ N.	15 40	231O4
		20h 51m ☌ ♂☾, ♂ 3° 08′ N.		
☽	Fri.	30 16h 40.5m F.Q.		dO34*

Explanation of symbols and abbreviations on page 4

THE SKY FOR JULY, 1933

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

The Sun—During July the sun's R.A. increases from 6h 38m to 8h 43m, and its Decl. changes from 23° 10′ N. to 18° 12′ N. The equation of time increases from 3m 29s on the 1st to 6m 21s on the 27th and then drops to 6m 13s at the end of the month. On the 23rd, the sun enters Leo, the second summer sign of the zodiac. For changes in the length of day, see p. 16. On the 2nd the earth is in aphelion.

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

Mercury on the 15th is in R.A. 9h 0m, Decl. 14° 14′ N., and transits at 13.28. On the 2nd it reaches its greatest elongation east and may then be seen at sunset about 10° above the western horizon. On the 30th it is in inferior conjunction with the sun.

Venus on the 15th is in R.A. 9h 10m, Decl. 17° 59′ N., and transits at 13.41. At sunset on the 15th it may be seen about 10° above the western horizon.

Mars on the 15th is in R.A. 12h 17m, Decl. 1° 34′ S., and transits at 16.46. It is an evening star in Virgo and on the 15th sets about 3 hours after the sun.

Jupiter on the 15th is in R.A. 11h 22m, Decl. 5° 25′ N., and transits at 15.50. It is now approaching the sun and at sunset on the 15th may be seen about 25° above the western horizon. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 21h 9m, Decl. 17° 20′ S., and transits at 1.40. On the 15th it rises about 1 hour after sunset and is in good position for observation. It is still in Capricornus.

Uranus on the 15th is in R.A. 1h 42m, Decl. 9° 58′ N., and transits at 6.11.

Neptune on the 15th is in R.A. 10h 41m, Decl. 9° 15′ N., and transits at 15.09.

JULY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 21h 30m
			h m	
Sat.	1	.....		O1234
Sun.	2	11h ☿ Greatest elong. E. 25° 53′.....	12 30	21O34
		16h ⊕ in Aphelion.		
		18h ☿ in ♉.		
Mon.	3	.....		2O314
Tuse.	4	.....		314O2
Wed.	5	.....	9 20	34O21
Thur.	6	.....		4321O
♈ Fri.	7	6h 50.6m F.M.....		4O1**
Sat.	8	.....	6 10	4O23*
Sun.	9	7h 24m ☌ ♄ ☾, ♄ 0° 24′ N.....		421O3
Mon.	10	.....		42O13
Tues.	11	.....	2 00	431O2
Wed.	12	8h ☌ ☿ ♀, ♀ 3° 52′ S.....		34O21
Thur.	13	1h ☿ in Aphelion.....	23 40	321O4
☾ Fri.	14	0h ♀ Greatest Hel. Lat. N.....		2O14*
		7h 23.6m L.Q.		
		22h 18m ☌ ♁ ☾, ♁ 5° 26′ S.		
Sat.	15	15h ☿ Stationary.....		1O234
Sun.	16	.....	20 30	d2O34
Mon.	17	.....		2O134
Tues.	18	.....		13O24
Wed.	19	.....	17 20	3O124
Thur.	20	8h □ ♁ ☉.....		321O4
Fri.	21	.....		423O1
♍ Sat.	22	11h 03.1m N.M.....	14 10	41O23
Sun.	23	7h 28m ☌ ☿ ☾, ☿ 6° 26′ S.....		dd4O3
Mon.	24	17h 08m ☌ ♀ ☾, ♀ 1° 31′ N.....		42O3*
Tues.	25	16h 13m ☌ ♆ ☾, ♆ 1° 56′ N.....	11 00	413O2
Wed.	26	16h 47m ☌ ♃ ☾, ♃ 3° 33′ N.....		43O12
Thur.	27	13h ♂ in ♉.....		4321O
Fri.	28	7h 44m ☌ ♂ ☾, ♂ 4° 02′ N.....	7 59	423O1
☽ Sat.	29	23h 43.6m F.Q.....		1O32*
Sun.	30	6h ☌ ☿ ☉ Inferior.....		O1243
Mon.	31	.....	4 40	2O34*

Explanation of symbols and abbreviations on page 4

THE SKY FOR AUGUST, 1933

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 August the sun's R.A. increases from 8h 43m to 10h 39m, and its Decl. decreases from 18° 12′ N. to 8° 32′ N. The equation of time decreases from 6m 13s to 0m 11s. The sun enters Virgo, the third summer zodiacal sign on the 23rd. For changes in the length of day see p. 17. On the 21st there is an annular eclipse of the sun, invisible in North America. See p. 29.

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

Mercury on the 15th is in R.A. 8h 22m, Decl. 17° 39′ N., and transits at 10.50. It is not favourably situated for observation at the beginning of the month. On the 17th it reaches its greatest elongation west and is most favourably situated for morning observation, being about 15° above the eastern horizon at sunrise.

Venus on the 15th is in R.A. 11h 33m, Decl. 4° 8′ N., and transits at 14.01. It is an evening star of magnitude −3.4.

Mars on the 15th is in R.A. 13h 24m, Decl. 9° 8′ S., and transits at 15.51. At sunset it is about 18° above the southwestern horizon. The planet is in Virgo and is approaching the sun.

Jupiter on the 15th is in R.A. 11h 42m, Decl. 3° 11′ N., and transits at 14.08. It is an evening star and sets about 1¼ hours after the sun. Its magnitude is −1.2. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 21h 0m, Decl. 18° 1′ S., and transits at 23.24. On the 5th it is in opposition with the sun, and on that date rises at sunset. It is visible all night in Capricornus. On the 2nd it reaches its greatest brilliancy for the year, when its magnitude is +0.4.

Uranus on the 15th is in R.A. 1h 42m, Decl. 9° 59′ N., and transits at 4.10.

Neptune on the 15th is in R.A. 10h 45m, Decl. 8° 53′ N., and transits at 13.10.

AUGUST

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 20h 45m
			h m	
	Tues.	1		d1O4*
	Wed.	2 9h ☿ Greatest Hel. Lat. S.		3O124
		18h ♁ Stationary.		
	Thur.	3 14h ☌♀Ψ, ♀ 0° 38′ N.	1 30	312O4
	Fri.	4		23O14
♋	Sat.	5 14h 31.6m F.M.	22 00	1O324
		14h 33m ☌♄☾, ♄ 0° 30′ N.		
		18h ☍♄☉.		
	Sun.	6		O4213
	Mon.	7		241O3
	Tues.	8	19 00	d42O3
	Wed.	9 2h ☿ Stationary.		43O12
	Thur.	10		4312O
	Fri.	11 6h 34m ☌♁☾, ♁ 5° 34′ S.	15 50	432O1
☾	Sat.	12 22h 49.3m L.Q.		41O32
	Sun.	13		4O123
	Mon.	14	12 40	24O13
	Tues.	15		2O143
	Wed.	16		
	Thur.	17 6h ☌♀♃, ♀ 0° 6′ S.	9 30	
		18h ☿ Greatest elong. W. 18° 37′.		
	Fri.	18		
	Sat.	19 9h 04m ☌☿☾, ☿ 2° 31′ S.		
	Sun.	20	6 20	
♍	Mon.	21 ☉ Annular Eclipse.		
		0h 47.9m N.M.		
		9h ☿ in ♌.		
	Tues.	22 0h 20m ☌Ψ☾, Ψ 2° 03′ N.		
	Wed.	23 8h 43m ☌♃☾, ♃ 4° 02′ N.	3 10	
		21h 06m ☌♀ ☾, ♀ 4° 14′ N.		
	Thur.	24		
	Fri.	25 20h 20m ☌♂☾, ♂ 4° 36′ N.	24 00	
	Sat.	26 0h ☿ in Perihelion.		
	Sun.	27		
☽	Mon.	28 5h 13.3m F.Q.	20 50	
	Tues.	29		
	Wed.	30		
	Thur.	31	17 40	

Explanation of symbols and abbreviations on page 4

THE SKY FOR SEPTEMBER, 1933

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

The Sun—During September the sun's R.A. increases from 10h 39m to 12h 27m, and its Decl. decreases from 8° 32′ N. to 2° 55′ S. On the 1st the equation of time is +0m 11s, it becomes zero on that day and decreases to −10m 4s at the end of the month. For changes in the length of day, see p. 18. On the 23rd the sun crosses the equator going south and enters Libra, the first autumn sign of the zodiac.

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

Mercury on the 15th is in R.A. 11h 41m, Decl. 3° 34′ N., and transits at 12.09. The planet is still a morning star but is approaching the sun and on the 12th is in superior conjunction with it.

Venus on the 15th is in R.A. 13h 48m, Decl. 11° 35′ S., and transits at 14.14. It is an evening star and on the 15th sets in the southwest about 1 hour after the sun.

Mars on the 15th is in R.A. 14h 41m, Decl. 16° 22′ S., and transits at 15.06. It is about 15° above the southwestern horizon at sunset. It crosses into Libra about the 6th.

Jupiter on the 15th is in R.A. 12h 6m, Decl. 0° 36′ N., and transits at 12.30. It is approaching the sun and is not favourably situated for observation. On the 27th it is in conjunction with the sun. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 20h 53m, Decl. 18° 34′ S., and transits at 21.15. At sunset on the 15th it is about 14° above the southeastern horizon. By the end of the month its magnitude has decreased to +0.7.

Uranus on the 15th is in R.A. 1h 40m, Decl. 9° 44′ N., and transits at 2.06.

Neptune on the 15th is in R.A. 10h 49m, Decl. 8° 27′ N., and transits at 11.13.

SEPTEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	
			h	m
	Fri.	1 20h 23m ☌ ♄☾, ♄ 0° 39′ N.		
	Sat.	2 17h ☌ ♆☉		
	Sun.	3	14	20
♋	Mon.	4 0h 04.4m F.M.		
	Tues.	5 7h ☿ Greatest Hel. Lat. N.		
	Wed.	6	11	10
	Thur.	7 1h ☌ ☿♆, ♆ 1° 02′ N.		
		14h 31m ☌ ♁☾, ♁ 5° 33′ S.		
	Fri.	8 1h ♀ in ♉		
	Sat..	9	8	00
	Sun.	10		
☾	Mon.	11 16h 30.0m L.Q.		
		19h ☌ ☿☉ Superior		
	Tues.	12	4	50
	Wed.	13		
	Thur.	14		
	Fri.	15	1	40
	Sat.	16		
	Sun.	17	22	30
	Mon.	18 10h 12m ☌ ♆☾, ♆ 2° 10′ N.		
♍	Tues.	19 2h ☌ ☿♃, ☿ 0° 03′ S.		
		13h 20.9m N.M.		
	Wed.	20 2h 52m ☌ ♃☾, ♃ 4° 30′ N.	19	20
		6h 07m ☌ ☿☾, ☿ 4° 29′ N.		
	Thur.	21		
	Fri.	22 17h 04m ☌ ♀☾, ♀ 4° 18′ N.		
	Sat.	23 7h 01m ☉ enters ♎, Autumn commences	16	10
		10h 16m ☌ ♂☾, ♂ 4° 36′ N.		
	Sun.	24		
	Mon.	25		
♐	Tues.	26 10h 36.3m F.Q.	13	10
	Wed.	27 1h ☌ ♃☉		
	Thur.	28 18h ☿ in ♉		
	Fri.	29 1h 11m ☌ ♄☾, ♄ 0° 42′ N.	9	50
	Sat.	30		

Configurations of Jupiter's Satellites.

By reason of the proximity of Jupiter to the Sun the phenomena of the satellites are not given from August 16 to October 12.

Explanation of symbols and abbreviations on page 4

THE SKY FOR OCTOBER, 1933

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

The Sun—During October the sun's R.A. increases from 12h 27m to 14h 23m and its Decl. changes from 2° 55′ S. to 14° 13′ S. On the 23rd the sun enters Scorpio, the second autumnal sign of the zodiac. The equation of time decreases from −10m 4s to −16m 19s. For changes in the length of day see p. 19.

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

Mercury on the 15th is in R.A. 14h 36m, Decl. 17° 13′ S., and transits at 13.04. It is an evening star and on the 28th reaches its greatest elongation east. Due to its southerly declination, the planet is not in good position for observation.

Venus on the 15th is in R.A. 16h 8m, Decl. 23° 8′ S., and transits at 14.36. It is approaching greatest elongation east, but due to its southerly declination, is not very high above the horizon. On the 15th its altitude at sunset is about 14°.

Mars on the 15th is in R.A. 16h 7m, Decl. 21° 50′ S., and transits at 14.34. It is still an evening star and on the 15th sets about 2 hours after the sun. It is in Libra at the beginning of the month, but crosses Scorpio and about the 17th enters Ophiuchus.

Jupiter on the 15th is in R.A. 12h 29m, Decl. 1° 57′ S., and transits at 10.56. It is now a morning star though rather close to the sun for observation. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 20h 50m, Decl. 18° 46′ S., and transits at 19.14. At sunset on the 15th it is about 20° above the southwestern horizon and is in the constellation of Capricornus.

Uranus on the 15th is in R.A. 1h 36m, Decl. 9° 20′ N., and transits at 0.03 and 23.59.

Neptune on the 15th is in R.A. 10h 53m, Decl. 8° 5′ N., and transits at 9.19.

OCTOBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 6h 45m
			h m	
	Sun.	1		
	Mon.	2	6 30	
♋	Tues.	3 12h 07.6m F.M		
	Wed.	4 21h 27m ☌♁☾, ♁ 5° 26′ S		
	Thur.	5	3 20	
	Fri.	6		
	Sat.	7		
	Sun.	8	0 10	
	Mon.	9 0h ☿ in Aphelion		
	Tues.	10	21 00	
☾	Wed.	11 11h 45.5m L.Q		
	Thur.	12 15h ♀ in Aphelion		
	Fri.	13	17 50	3O142
	Sat.	14 7h ☌♀♂, ♀ 1° 15′ S		324O*
		13h ♄ Stationary.		
	Sun.	15 21h 21m ☌♆☾, ♆ 2° 21′ N		43210
	Mon.	16	14 40	4O12*
	Tues.	17 22h 47m ☌♃☾, ♃ 4° 59′ N		41023
	Wed.	18		42013
♍	Thur.	19 0h 44.7m N.M	11 30	41023
		1h ☍♁☉.		
	Fri.	20 18h 29m ☌☿☾, ☿ 2° 43′ N		43012
	Sat.	21		34210
	Sun.	22 1h 59m ☌♂☾, ♂ 4° 01′ N	8 20	d32O4
		7h 44m ☌♀☾, ♀ 2° 21′ N.		
	Mon.	23		3O124
	Tues.	24		1O234
♎	Wed.	25 17h 20.7m F.Q	5 10	2O134
	Thur.	26 6h 34m ☌♄☾, ♄ 0° 30′ N		1O234
	Fri.	27		3O124
	Sat.	28 5h ☿ Greatest elong. E. 23° 57′	1 50	321O4
	Sun.	29 8h ☿ Greatest Hel. Lat. S		32O14
	Mon.	30	22 40	3O412
	Tues.	31		41023

Explanation of symbols and abbreviations on page 4

THE SKY FOR NOVEMBER, 1933

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

The Sun—During November the sun's R.A. increases from 14h 23m to 16h 26m, and its Decl. decreases from 14° 13′ S. to 21° 42′ S. On the 22nd the sun enters Sagittarius, the third autumn zodiacal sign. The equation of time decreases from −16m 19s to a minimum value of −16m 22s on the 3rd and then increases to −11m 10s at the end of the month (see p. 7). For changes in the length of day see p. 20.

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

Mercury on the 15th is in R.A. 15h 56m, Decl. 21° 15′ S., and transits at 12.17. The planet is not favourably situated for observation during the month. On the 19th it is in inferior conjunction with the sun.

Venus on the 15th is in R.A. 18h 40m, Decl. 26° 17′ S., and transits at 15.06. Its magnitude is increasing and by the end of the month is −4.1. On the 25th it reaches its greatest elongation east, and at sunset on that date may be seen about 20° above the southwestern horizon.

Mars on the 15th is in R.A. 17h 46m, Decl. 24° 30′ S., and transits at 14.11. It is in the constellation of Ophiuchus till about the 13th when it enters Sagittarius. On the 15th it sets about 2 hours after the sun.

Jupiter on the 15th is in R.A. 12h 53m, Decl. 4° 24′ S., and transits at 9.17. It is a morning star in Virgo. At sunrise on the 15th it is about 25° above the southeastern horizon. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 20h 53m, Decl. 18° 32′ S., and transits at 17.16. On the 2nd it is in quadrature with the sun. Its magnitude is decreasing and by the end of the month is +0.9.

Uranus on the 15th is in R.A. 1h 31m, Decl. 8° 54′ N., and transits at 21.53.

Neptune on the 15th is in R.A. 10h 55m, Decl. 7° 49′ N., and transits at 7.20.

NOVEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 6h 30m
			h	m	
	Wed. 1	2h 54m ☌♁☾, ♁ 5° 22′ S.			42O13
●	Thur. 2	2h 59.2m F.M.	19	30	41O3*
		17h □♄ ☉.			
	Fri. 3	21h ♀ Greatest Hel. Lat. S.			d4O12
	Sat. 4				4312O
	Sun. 5		16	20	432O1
	Mon. 6				43O2*
	Tues. 7				41O32
	Wed. 8	9h ☿ Stationary	13	10	2O413
	Thur. 9				12O43
☾	Fri. 10	7h 17.8m L.Q.			O3124
	Sat. 11		10	00	d31O4
	Sun. 12	8h 19m ☌♆☾, ♆ 2° 40′ N.			32O14
	Mon. 13				31O24
	Tues. 14	19h 10m ☌☊☾, ☊ 5° 31′ N.	6	50	dO324
	Wed. 15				2O143
	Thur. 16				21O43
○	Fri. 17	9h ☿ in ♌	3	30	4O312
		11h 23.8m N.M.			
		17h 41m ☌☿☾, ☿ 5° 15′ N.			
	Sat. 18	19h ☌☿ ☉ Inferior			431O2
	Sun. 19	20h 17m ☌♂☾, ♂ 2° 54′ N.			432O1
	Mon. 20	20h 19m ☌♀☾, ♀ 0° 02′ S.	0	20	431O2
	Tues. 21	23h ☿ in Perihelion			4O12*
	Wed. 22	14h 48m ☌♄☾, ♄ 0° 07′ N.	21	10	42O3*
	Thur. 23				421O3
◑	Fri. 24	2h 38.4m F.Q.			4O132
	Sat. 25	10h ♀ Greatest elong. E. 47° 17′.	18	00	31O24
	Sun. 26				32O14
	Mon. 27				31O4*
	Tues. 28	0h ☿ Stationary	14	50	O124*
		7h 17m ☌♁☾, ♁ 5° 27′ S.			
	Wed. 29				2O34*
	Thur. 30				21O34

Explanation of symbols and abbreviations on page 4

THE SKY FOR DECEMBER, 1933

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

The Sun—During December the sun's R.A. increases from 16h 26m to 18h 43m, and its Decl. changes from 21° 42′ S. to its maximum southerly value of 23° 27′ S. on the 22nd. The sun is then at the winter solstice, it enters Capricornus and Winter begins. From this date the sun moves slowly northward. The length of daylight is at its minimum and changes very slightly for several days (see p. 21). The equation of time is −11m 10s at the beginning of the month and increases to zero on the 25th (see p. 7).

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

Mercury on the 15th is in R.A. 16h 8m, Decl. 19° 34′ S., and transits at 10.36. It is a morning star all month and on the 6th reaches its greatest elongation west. At sunrise on that date it is about 14° above the southeastern horizon.

Venus on the 15th is in R.A. 20h 45m, Decl. 20° 7′ S., and transits at 15.11. It is a brilliant object in the evening sky, reaching its greatest brilliancy, −4.4, on the 31st. On that date it sets about 3 hours after the sun.

Mars on the 15th is in R.A. 19h 26m, Decl. 23° 9′ S., and transits at 13.53. On the 26th the planet crosses into Capricornus. At sunset on the 15th it is about 15° above the southwestern horizon.

Jupiter on the 15th is in R.A. 13h 12m, Decl. 6° 17′ S., and transits at 7.38. At sunrise on the 15th it is near the meridian. Its magnitude is increasing and by the end of the month is −1.5. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 21h 2m, Decl. 17° 55′ S., and transits at 15.27. At sunset on the 15th it is about 25° above the southern horizon. It may now be observed during only the early part of the night.

Uranus on the 15th is in R.A. 1h 28m, Decl. 8° 37′ N., and transits at 19.52.

Neptune on the 15th is in R.A. 10h 56m, Decl. 7° 44′ N., and transits at 5.23.

DECEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satallites at 6h 0m
			h m	
♍ Fri.	1	20h 30.9m F.M.	11 40	O1234
Sat.	2	6h ☿ Greatest Hel. Lat. N.		13O24
Sun.	3			324O1
Mon.	4	18h □♆☉	8 30	341O*
Tues.	5			43O21
Wed.	6	5h ☿ Greatest elong. W. 20° 41′		412O3
Thur.	7		5 20	d42O3
Fri.	8			4O123
Sat.	9	17h 20m ☌♆☾, ♆ 3° 01′ N.		413O2
☾ Sun.	10	1h 23.6m L.Q.	2 10	342O1
Mon.	11			3124O
Tues.	12	13h 47m ☌♃☾, ♃ 6° 03′ N.	23 00	3O142
Wed.	13			d1O34
Thur.	14	19h ♃ Greatest Hel. Lat. N.		2O134
Fri.	15	8h ♆ Stationary	19 50	O234*
		16h 37m ☌☿☾, ☿ 6° 16′ N.		
♎ Sat.	16	21h 52.7m N.M.		1O324
Sun.	17			32O14
Mon.	18	17h 45m ☌♂☾, ♂ 1° 16′ N.	16 30	312O4
Tues.	19			3O142
Wed.	20	2h 04m ☌♀☾, ♀ 0° 43′ S.		14O23
		3h 15m ☌♄☾, ♄ 0° 19′ S.		
Thur.	21	5h ☌♀♄, ♀ 0° 20′ S.	13 20	42O13
Fri.	22	1h 58m ☉ enters ♑, Winter commences		4O23*
☽ Sat.	23	15h 08.8m F.Q.		d4O32
Sun.	24		10 10	432O1
Mon.	25	12h 11m ☌♁☾, ♁ 5° 38′ S.		4321O
		17h ☿ in ♑.		
Tues.	26			43O12
Wed.	27		7 00	41O32
Thur.	28			24O13
Fri.	29			1O43*
Sat.	30	4h ♀ in ♌	3 50	O1324
♑ Sun.	31	6h ♀ Greatest Brilliancy		32O14
		13h ♂ Greatest Hel. Lat. S.		
		15h 53.9m F.M.		

Explanation of smybols and abbreviations on page 4

PHENOMENA OF JUPITER'S SATELLITES, 1933

E—Eclipse, 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.
2	4	29	IV	TI	19	2	11	I	SI
	6	39	I	ED		3	11	I	TI
3	3	56	I	SI		4	27	I	Se
	5	06	I	TI		5	26	I	Te
	6	12	I	Se		23	21	I	ED
4	1	07	I	ED	20	2	35	I	OR
	3	39	II	ED		3	15	II	SI
	4	31	I	OR		5	14	II	TI
	23	33	I	TI		5	56	II	Se
5	0	40	I	Se		22	55	I	Se
	1	48	I	Te		23	53	I	Te
6	0	26	II	TI	21	22	09	II	ED
	0	51	II	Se	22	2	48	II	OR
	3	02	II	Te	24	1	30	III	ED
	3	47	III	SI		4	46	III	ER
10	1	13	III	OR		5	23	III	OD
	3	11	IV	ED	25	6	46	I	ED
	5	49	I	SI	26	4	05	I	SI
	6	56	I	TI		4	49	I	TI
11	3	00	I	ED		6	21	I	Se
	6	15	II	ED	27	1	01	IV	ER
	6	20	I	OR		1	14	I	ED
12	0	18	I	SI		4	22	I	OR
	1	23	I	TI		5	48	II	SI
	2	33	I	Se		6	12	IV	OD
	3	37	I	Te		22	16	III	Te
13	0	42	II	SI		22	33	I	SI
	0	47	I	OR		23	25	I	TI
	2	51	II	TI	28	0	49	I	Se
	3	23	II	Se		1	40	I	Te
	5	27	II	Te		22	48	I	OR
15	0	24	II	OR	29	0	45	II	ED
17	0	49	III	ER		5	09	II	OR
	1	49	III	OD	30	21	46	II	Se
	4	50	III	OR		23	20	II	Te
18	4	53	I	ED	31	5	28	III	ED
	23	37	IV	Te					

FEBRUARY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
2	5	58	I	SI	11	2	09	III	TI
3	3	07	I	ED		2	20	I	SI
	6	08	I	OR		2	49	III	Se
	22	46	III	TI		2	57	I	TI
	22	52	III	Se		4	36	I	Se
4	0	27	I	SI		5	07	III	Te
	1	12	I	TI		5	11	I	Te
	1	43	III	Te		23	29	I	ED
	2	42	I	Se	12	2	19	I	OR
	3	26	I	Te		5	56	II	ED
	4	59	IV	SI		20	49	I	SI
	21	36	I	ED		21	10	IV	OD
5	0	34	I	OR		21	23	I	TI
	3	21	II	ED		23	05	I	Se
	21	11	I	Se		23	38	I	Te
	21	52	I	Te		23	43	IV	OR
6	21	38	II	SI	13	20	45	I	OR
	23	02	II	TI	14	0	12	II	SI
7	0	19	II	Se		1	19	II	TI
	1	38	II	Te	14	2	53	II	Se
8	20	38	II	OR		3	54	II	Te
10	5	01	I	ED	15	22	55	II	OR
	23	35	III	SI	18	3	34	III	SI

FEBRUARY—*Continued*

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
	4	14	I	SI		19	48	I	Te
	4	42	I	TI		21	58	III	OR
	5	30	III	TI	22	21	50	II	ED
19	1	23	I	ED	23	1	11	II	OR
	4	03	I	OR	25	6	08	I	SI
	22	43	I	SI	26	3	16	I	ED
	23	08	I	TI		5	47	I	OR
20	0	58	I	Se	27	0	37	I	SI
	1	22	I	Te		0	52	I	TI
	19	51	I	ED		2	52	I	Se
	22	29	I	OR		3	06	I	Te
	22	57	IV	SI		21	45	I	ED
21	2	34	IV	Se	28	0	13	I	OR
	2	46	II	SI		5	20	II	SI
	3	02	IV	TI		5	48	II	TI
	3	34	II	TI		19	18	I	TI
	5	27	II	Se		21	20	III	ED
	5	36	IV	Te		21	21	I	Se
	6	10	II	Te		21	32	I	Te

MARCH

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	1	15	III	OR	16	19	38	I	Se
2	0	25	II	ED	17	23	22	II	TI
	3	26	II	OR		23	47	II	SI
3	21	18	II	Se	18	1	27	IV	OD
	21	31	II	Te		2	00	II	Te
5	5	10	I	ED		2	28	II	Se
6	2	31	I	SI		19	28	III	SI
	2	35	I	TI		21	37	III	Te
	4	46	I	Se		22	38	III	Se
	4	50	I	Te	19	21	36	II	ER
	23	38	I	ED	21	3	10	I	OD
7	1	57	I	OR	22	0	29	I	TI
	20	59	I	SI		0	48	I	SI
	21	01	I	TI		2	44	I	Te
	23	15	I	Se		3	03	I	Se
	23	16	I	Te		21	36	I	OD
8	1	18	III	ED	23	0	11	I	ER
	4	31	III	OR		18	55	I	TI
	20	23	I	OR		19	16	I	SI
9	3	01	II	ED		21	10	I	Te
	4	43	II	ER		21	32	I	Se
	19	55	IV	Te	25	1	37	II	TI
	20	27	IV	Se		2	22	II	SI
10	21	08	II	TI		4	15	II	Te
	21	12	II	SI		21	52	III	TI
	23	45	II	Te		23	26	III	SI
	23	53	II	Se	26	0	55	III	Te
12	19	01	II	ER		2	35	III	Se
13	4	19	I	TI		20	40	II	OD
	4	25	I	SI	27	0	11	II	ER
14	1	26	I	OD	29	2	14	I	TI
	3	48	I	ER		2	42	I	SI
	22	45	I	TI		4	29	I	Te
	22	53	I	SI		23	20	I	OD
15	1	00	I	Te	30	2	05	I	ER
	1	09	I	Se		20	40	I	TI
	4	45	III	OD		21	11	I	SI
	19	52	I	OD		22	55	I	Te
	22	17	I	ER		23	26	I	Se
16	5	17	II	OD	31	20	34	I	ER
	19	26	I	Te					

APRIL

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	3	53	II	TI	14	21	18	I	OD
2	1	11	III	TI	15	0	23	I	ER
	3	25	III	SI		19	28	I	SI
	4	16	III	Te		20	54	I	Te
	22	57	II	OD		21	43	I	Se
3	2	46	II	ER	18	21	41	II	TI
	21	18	IV	ED		23	27	II	SI
4	0	38	IV	ER	19	0	21	II	Te
	19	41	II	Te		2	07	II	Se
	20	55	II	Se		21	33	III	OD
5	3	59	I	TI	20	0	42	III	OR
	20	24	III	ER		1	13	III	ED
6	1	06	I	OD		21	14	II	ER
	4	00	I	ER	21	2	00	I	TI
	22	26	I	TI		2	54	I	SI
	23	05	I	SI		23	06	I	OD
7	0	41	I	Te	22	2	18	I	ER
	1	20	I	Se		20	27	I	TI
	19	32	I	OD		21	23	I	SI
	22	28	I	ER		22	42	I	Te
8	19	49	I	Se		23	37	I	Se
10	1	15	II	OD	23	20	46	I	ER
11	19	20	II	TI	26	0	04	II	TI
	20	51	II	SI		2	04	II	SI
	21	53	IV	TI		2	44	II	Te
	22	00	II	Te	27	1	05	III	OD
	23	31	II	Se		23	49	II	ER
12	1	07	IV	Te	28	23	01	IV	SI
	21	13	III	OR	29	0	55	I	OD
	21	14	III	ED		2	05	IV	Se
13	0	22	III	ER		22	16	I	TI
	2	52	I	OD		23	18	I	SI
14	0	12	I	TI	30	0	31	I	Te
	1	00	I	SI		1	32	I	Se
	2	27	I	Te		22	26	III	Se
	3	14	I	Se		22	41	I	ER

MAY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	20	00	I	Se	15	22	39	I	Te
4	21	32	II	OD		23	50	I	Se
6	20	37	II	Se	16	21	00	I	ER
	22	26	IV	OD	18	20	15	III	ER
7	0	06	I	TI	20	20	43	II	TI
	1	13	I	SI		23	13	II	SI
	2	00	IV	OR		23	24	II	Te
	21	12	I	OD	22	0	56	I	OD
	21	55	III	Te		20	51	II	ER
	23	21	III	SI		22	17	I	TI
8	0	36	I	ER		23	31	I	SI
	19	41	I	SI	23	0	32	I	Te
	20	48	I	Te		22	55	I	ER
	21	55	I	Se	24	20	13	I	Se
11	23	59	II	OD	25	21	11	III	ED
13	20	36	II	SI	26	0	13	III	ER
	20	53	II	Te	27	23	16	II	TI
	23	14	II	Se	29	23	25	II	ER
14	22	29	III	TI	30	0	11	I	TI
	23	04	I	OD		21	18	I	OD
15	19	58	IV	Se	31	20	54	I	Te
	20	25	I	TI		22	07	I	Se
	21	36	I	SI		23	52	IV	TI

JUNE

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	23	10	III	OR	7	20	23	II	Se
5	20	50	II	OD		20	34	I	TI
6	23	13	I	OD		21	49	I	SI

JUNE—*Continued*

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
	22	48	I	Te	17	20	39	IV	Te
8	21	15	I	ER	19	21	23	III	Te
	23	54	III	OD	21	20	29	II	TI
9	21	37	IV	ED		23	01	II	SI
12	22	16	III	Se	22	21	35	I	OD
	23	26	II	OD	23	20	07	I	SI
14	20	23	II	SI		20	26	II	ER
	20	30	II	Te		21	09	I	Te
	22	29	I	TI		22	20	I	Se
14	23	00	II	Se	26	22	19	III	TI
15	23	10	I	ER	30	20	52	I	TI
16	20	25	I	Se		22	02	I	SI

JULY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	21	29	I	ER	16	20	19	I	SI
7	20	43	II	OD		20	44	II	Te
	21	09	III	ED		21	32	I	Te
9	20	11	II	Se	23	20	49	II	TI
	20	38	I	Se	25	20	00	II	ER
14	20	42	III	OD	31	20	30	I	OD
16	20	13	II	SI					

AUGUST

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	20	00	I	Te	10	19	58	II	Se
8	19	45	I	TI	12	19	58	III	ER
9	20	02	I	ER					

NOVEMBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
2	5	26	II	ED	18	5	46	II	SI
3	5	18	III	TI	20	4	05	II	OR
	5	33	III	Se	21	4	15	III	OD
6	5	36	I	ED	22	3	51	I	ED
7	4	57	I	Se	23	4	04	I	Te
	5	36	I	Te	28	4	44	III	ED
11	4	36	II	TI	29	5	44	I	ED
	5	42	II	Se	30	3	50	I	TI
14	4	37	I	SI		5	05	I	Se
	5	22	I	TI		6	02	I	Te
15	4	57	I	OR					

DECEMBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen
1	3	23	I	OR	20	5	18	II	SI
4	5	03	II	ED	22	4	20	II	OR
6	4	40	II	Te		5	52	I	ED
7	4	46	I	SI	23	3	02	I	SI
	5	48	I	TI		4	11	I	TI
8	5	20	I	OR		5	14	I	Se
9	3	02	III	TI		6	22	I	Te
	5	26	III	Te		6	39	III	SI
13	2	45	II	SI	24	3	41	I	OR
	4	54	II	TI	27	3	47	III	OR
	5	13	II	SI	29	2	06	II	ED
14	6	40	I	SI	30	4	55	I	SI
15	3	59	I	ED		6	07	I	TI
16	2	41	III	SI	31	1	55	II	Te
	3	20	I	Se		2	13	I	ED
	4	26	I	Te		5	36	I	OR
	5	14	III	Se					

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. h	m	Decl. °
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	30d (?)
⊕ 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	16 h
PL Pluto	39.60	3700	....	247.7	....	1 (?)	....	....	.....
☉ Sun	....	....	....	....	864392	333400	1.39	1301100	25d 7h 48m±
☾ Moon	From ⊕238,857 mls.		27.32	0.075	2160	0.0123	3.39	0.020	27d 7h 43m 11.5s

SATELLITES OF THE SOLAR SYSTEM

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

DOUBLE STARS

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

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

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

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

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

I. THE MOST LUMINOUS PAIRS

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

II. THE FINEST COLORED PAIRS

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

By FRANK S. HOGG

Of the naked eye stars visible to a northern observer, nearly a hundred are known to undergo variations in their light. With field glasses or a small telescope the number of variables is enormously increased. Thus there is no dearth of material with which an inquisitive amateur may satisfy himself as to the reality and nature of the fluctuations of the light of stars. Further this curiosity may be turned to real scientific value, in that the study of variable stars is one of the best organized and most fruitful fields of research for amateur observers For years the professional astronomer has entrusted the visual observation of many of the most important variable stars entirely to amateurs, as organized into societies in England in 1890, America in 1911, and France in 1921. The American Association of Variable Star Observers has charts of the fields of 350 of these stars, and in general supervises the work of amateur observers. The Recorder is Mr. Leon Campbell, at the Harvard Observatory, Cambridge, Massachusetts. New observers are welcomed, and supplied with charts.

In our galaxy there are already known about 5,000 variables, while in globular clusters and outside systems there are some 3,000 more. Almost all those which have been sufficiently studied may be conveniently classified, according to their light variation into ten groups, by Ludendorff's classification. His classes, with their typical stars, are listed as follows:

I. New or temporary stars: Nova Aquilae 3, 1918.
II. Nova-like variables: T Pyxidis.
III. R Coronae stars: R Coronae Borealis. Usually at constant maximum, with occasional sharp minima.
IV. U Geminorum stars: U Geminorum. Usually at constant minimum, with occasional sharp maxima.
V. Mira stars: oCeti. Range of several magnitudes, fairly regular period of from 100 to 600 days.
VI. μCephei stars: μCephei. Red stars with irregular variations of a few tenths of a magnitude.
VII. RV Tauri stars: RV Tauri. Usually a secondary minimum occurs between successive primary minima.
VIII. Long period Cepheids: δCephei. Regular periods of one to forty-five days. Range about 1.5 magnitudes.
IX. Short period Cepheids: RR Lyrae. Regular periods less than one day. Range about a magnitude.
X. Eclipsing stars: βPersei. Very regular periods. Variations due to covering of one star by companion.

REPRESENTATIVE BRIGHT VARIABLE STARS

Name	Design.	Max.	Min.	Sp.	Period	Type	Date	Discoverer
η Aql	194700	3.7	4.3	G4	7.17668	VIII	1784	Pigott
N Aql	184300	−0.2	10.9	Q	Irr.	I	1918	Bower
ϵ Aur	045443	3.3	4.1	F5p	9900.	X	1821	Fritsch
δ Cep	222557	3.6	4.3	G0	5.36640	VIII	1784	Goodricke
U Cep	005381	6.8	9.2	A0	2.49293	X	1880	W. Ceraski
o Cet[1]	0214*o3*	2.0	9.6	M5e	329.5	V	1596	Fabricius
RR Cet	012700	8.4	9.0	F0	0.55304	IX	1906	Oppolzer
R CrB	154428	5.8	13.8	G0e	Irr.	III	1795	Pigott
χ Cyg	194632	4.2	13.4	M7e	408.3	V	1686	Kirch
P Cyg	201437a	3.5	6.0	B1qk	Irr.	II	1600	Blaeu
SS Cyg	213843	8.1	12.0	Pec.	Irr.	IV	1896	Wells
XX Cyg	200158	11.4	12.1	A	0.13486	IX	1904	L. Ceraski
ζ Gem	065820	3.7	4.1	cG1	10.15353	VIII	1847	Schmidt
η Gem	060822	3.3	4.2	M2	235.15	V	1865	Schmidt
R Gem	070122a	6.5	13.5	Se	370.1	V	1848	Hind
U Gem	074922	8.8	13.8	Pec.	Irr.	IV	1855	Hind
α Her	171014	3.1	3.9	M5	Irr.	VI	1795	W. Herschel
R Hya	1324*22*	3.5	10.1	M7e	413.6	V	1670	Montanari
R Leo	094211	5.0	10.5	M7e	310.3	V	1782	Koch
Lyr	184633	3.5	4.1	B5e	12.90801	X	1784	Goodricke
RR Lyr	192242	7.1	7.8	A5	0.56684	IX	1901	Fleming
α Ori[2]	054907	0.2	1.2	M2	Irr.	VI	1840	J. Herschel
U Ori	054920	5.4	12.2	M7e	376.1	V	1885	Gore
β Per[3]	030140	2.3	3.5	B8	2.86731	X	1669	Montanari
ρ Per	025838	3.3	4.1	M4	Irr.	VI	1854	Schmidt
R Sge	200916	8.4	10.4	cG7	70.84	VII	1859	Baxendell
R Sct	1842*o5*	4.5	9.0	K5e	141.5	VII	1795	Pigott
λ Tau	035512	3.8	4.2	B3	3.95294	X	1848	Baxendell
RV Tau	044126	8.7	11.8	K0	78.60	VII	1905	L. Ceraski
SU Tau	054319	9.5	15.4	G0e	Irr.	III	1908	Cannon
α UMi[4]	012288	2.3	2.4	cF7	3.96815	VIII	1911	Hertzsprung

[1]*o*Cet (Mira); [2]αOri (Betelgeuse); [3]βPer (Algol); [4]αUMi (Polaris).

Most of the data in this Table are from Prager's 1931 *Katalog und Ephemeriden Veränderlicher Sterne*. The stars are arranged alphabetically in order of constellations. The second column, the Harvard designation, gives the 1900 position of the star. The first four figures of the designation give the hour and minute of right ascension, the last two the declination in degrees, italicised for stars south of the equator. Thus the position of the fourth star of the list, δCephei, is R.A. 22h 25m, Dec. +57°, (222557). The remaining columns give the maximum and minimum magnitudes, spectral class, the period in days and decimals of a day, the classification on Ludendorff's system, and the discoverer and date. In the case of eclipsing stars, the spectrum is that of the brighter component.

THE DISTANCES OF THE STARS

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

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

For many years attempts were made to measure stellar parallaxes, but without success. The angle to be measured is so exceedingly small that it was lost in the unavoidable instrumental and other errors of observation. The first satisfactory results were obtained by Bessel, who in 1838, by means of a heliometer, succeeded in determining the parallax of 61 Cygni, a 6th magnitude star with a proper motion of 5″ a year. On account of this large motion the star was thought to be comparatively near to us, and such proved to be the case. At about the same time Henderson, at the Cape of Good Hope, from meridian-circle obervations, deduced the parallax of Alpha Centauri to be 0″.75. For a long time this was considered to be the nearest of all the stars in the sky, but in 1913 Innes, director of the Union Observatory, Johannesburg, South Africa, discovered a small 11th mag. star, 2° 13′ from Alpha Centauri, with a large proper motion and to which, from his measurements, he assigned a parallax of 0″.78. Its brightness is only 1/20,000 that of Alpha Centauri. In 1916 Barnard discovered an 11th mag. star in Ophiuchus with a proper motion of 10″ per year, the greatest on record, and its parallax is about 0″.53. It is believed to be next to Alpha Centauri in distance from us.

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

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

THE SUN'S NEIGHBOURS—STARS NEARER THAN FIVE PARSECS

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

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

THE BRIGHTEST STARS

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

Prepared by W. E. HARPER

The accompanying table contains the chief known facts regarding 260 stars brighter than apparent magnitude 3.51 as listed in *Harvard Annals*, Volume 50. The position of the star for 1900 is given in the second and third 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.—The revision of this table has been postponed until 1934.—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 Hydrii	49	−74 33	3.2	Ma	.128	.....	.....	.....	+16.8
||ε Persei	51	+39 43	3.0	B1	.041	−.012 s	3260:	−7.0	..... *
γ Eridan	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*
o^2 Can. Majoris	59	−23 41	3.1	B5p	.000	.....	.....	.....	.....
δ Can. Majoris	7 4	−26 14	2.0	G2p	.005	.010	326	−2.9	+34. *
L ^{2}Puppis	10	−44 29	3.4–6.2	Md	.334	.....	.....	.....	+52.6
π Puppis	14	−36 55	2.7	K5	.012	.....	.....	.....	+16.3
β Can. Minoris	22	+ 8 29	3.1	B8	.063	.020 s	163	−0.4	.....
σ Puppis	26	−43 6	3.3	K5	.192	.....	.....	.....	+87.3
||α_2 Geminorum	28	+32 6	2.0	A0	.201	.077 s	42	1.4	+ 6.2*
α_1 Geminorum	28	+32 6	2.8	A0	.209	.....	.....	.....	− 1.0*
α **Can. Minoris**	34	+ 5 29	0.5	F5	1.242	.312 s	10	3.0	− 4.3
β **Geminorum**	39	+28 16	1.2	K0	.623	.101 s	32	1.2	+ 3.6
ξ Puppis	45	−24 37	3.5	G6p	.007	.003 s	1087	−4.2	+ 4.2
ζ Puppis	8 0	−39 43	2.3	Od	.036	.....	.....	.....	.....
ρ Puppis	3	−24 1	2.9	F5	.097	.028 s	116	0.1	+46.
||γ Velorum	6	−47 3	2.2	Oap	.000	.....	.....	.....	.....
||ϵ Carinae	8 20	−59 11	1.7	K0	.032	.....	.....	.....	+11.7
o Urs. Majoris	22	+61 3	3.5	G0	.166	−.004 s	3260:	−6.5	+20.3
||ϵ Hydrae	41	+ 6 47	3.5	F8	.193	.015 s	217	−0.6	+37.2*
δ Velorum	42	−54 20	2.0	A0	.093	.....	.....	.....	.....
ζ Hydrae	50	+ 6 20	3.3	K0	.101	.014 s	233	−1.0	+23.0
ι Urs. Majoris	52	+48 26	3.1	A5	.500	.070 s	47	2.3	+ 8.
λ Velorum	9 4	−43 2	2.2	K5	.022	.....	.....	.....	+18.8
β Carinae	12	−69 18	1.8	A0	.192	.....	.....	.....	−16.0
ι Carinae	14	−58 51	2.2	F0	.023	.....	.....	.....	+13.1
α Lyncis	15	+34 49	3.3	K5	.214	.002 s	1630	−5.1	+38.5
κ Velorum	19	−54 35	2.6	B3	.017	.....	.....	.....	+21.9*
α Hydrae	23	− 8 14	2.2	K2	.036	.006 s	543	−3.9	− 4.0
θ Urs. Majoris	26	+52 8	3.3	F8p	1.096	.056 s	58	2.0	+15.8
N Velorum	28	−56 36	3.0	K5	.041	.....	.....	.....	−13.9
ϵ Leonis	40	+24 14	3.1	G0p	.045	−.001 s	3260:	−6.9	+ 5.1
||υ Carinae	45	−64 36	3.1	F0	.062	.....	.....	.....	+13.2
α **Leonis**	10 3	+12 27	1.3	B8	.244	.058 s	56	0.1	.....
q Carinae	14	−60 50	3.4	K5	.045	.....	.....	.....	+ 9.2
||γ Leonis	14	+20 21	2.3	K0	.347	.004 s	815	−4.7	−36.
μ Urs. Majoris	16	+42 0	3.2	K5	.082	.034 s	96	0.9	−22.

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

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
ζ Centauri	13 49	−46 48	3.1	B2p	.079	.....	.....	.....	.....
η Boötis	50	+18 54	2.8	G0	.370	.098 s	33	2.8	− 0.2*
β **Centauri**	57	−59 53	0.9	B1	.039	.036	91	−1.3	+12.0*
π Hydrae	14 1	−26 12	3.5	K0	.165	.....	.....	.....	+27.6
θ Centauri	1	−35 53	2.3	K0	.748	.....	.....	.....	+ 1.8
α **Boötis**	11	+19 42	0.2	K0	2.287	.080 s	41	−0.3	−5 .0
γ Boötis	28	+38 45	3.0	F0	.182	.058 s	56	1.8	−35.
η Centauri	29	−41 43	2.6	B3p	.052	.....	.....	.....	0.
‖α **Centauri**	33	−60 25	0.3	G0	3.682	.758	4	4.7	+22.2
α Circini	34	−64 32	3.4	F0	.312	.....	.....	.....	+ 7.3
α Lupi	35	−46 58	2.9	B2	.036	.....	.....	.....	+ 8. *
‖ε Boötis	41	+27 30	2.7	K0	.045	.016 s	204	−1.3	−16.4
‖a^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
ι^1 Scorpii	41	−40 5	3.1	F5p	.000	.....	.....	.....	−27.8
||μ Herculis	43	+27 47	3.5	G5	.817	.111 s	29	3.7	−15.7
G Scorpii	43	−37 1	3.2	K2	.062	.....	.....	.....	+24.7
ν Ophiuchi	54	− 9 46	3.5	K0	.118	.026 s	126	0.6	+12.6
γ Draconis	54	+51 30	2.4	K5	.026	.017 s	192	−1.4	−27.0
γ Sagittarii	59	−30 26	3.1	K0	.206	.....	.....	.....	+22. *
η Sagittarii	18 11	−36 48	3.2	M6	.223	.....	.....	.....	0.0
δ Sagittarii	15	−29 52	2.8	K0	.042	.....	.....	.....	−20.2
η Serpentis	16	− 2 55	3.4	K0	.898	.065 s	50	2.5	+ 9.5
ϵ Sagittarii	18	−34 26	2.0	A0	.139	.....	.....	.....	−11.0
λ Sagittarii	22	−25 29	2.9	K0	.197	.....	.....	.....	−43.2
||α **Lyrae**	34	+38 41	0.1	A0	.348	.124 s	26	0.6	−13.8
φ Sagittarii	39	−27 6	3.3	B8	.053	.....	.....	.....	+26. *
||β Lyrae	46	+33 15	3.4-4.1	B2p	.011	−.014 s	3260:	−6.6	
σ Sagittarii	49	−26 25	2.1	B3	.081	.....	.....	.....	− 1. *

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

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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."

For many years the Toronto organization existed alone, but now the Society is national in extent, having active Centres in Montreal, P.Q.; Ottawa, Ont.; Toronto, London, Hamilton, Ont.; Winnipeg, Man.; Vancouver and Victoria, B.C. Among its 800 members are a number of the leading astronomers and scientists of the world, many amateurs, and in addition, many laymen who are interested in the culture of the science.

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