THE OBSERVER'S HANDBOOK FOR 1920

PUBLISHED BY

The Royal Astronomical Society of Canada

EDITED BY C. A. CHANT.

TWELFTH YEAR OF PUBLICATION

TORONTO
198 COLLEGE STREET
PRINTED FOR THE SOCIETY
1920

1920 CALENDAR 1920

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

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

MARCH						
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	..	

APRIL						
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	..	

MAY						
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	..	

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

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

AUGUST						
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	..	

SEPTEMBER						
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	..	

OCTOBER						
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	..

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

DECEMBER						
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	..	

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CONTENTS

PREFACE

The HANDBOOK for 1920 contains twice the number of pages for the last two years, and it is hoped that it may prove useful to amateurs. Suggestions for improvements will be gladly received.

The brief descriptions of the constellations and the star-maps are not included, as fuller information is available in a better form and at a reasonable price in many publications, such as: Young's *Uranography* (about 35c.), Upton's *Star Atlas* (about $2.50) or McKready's *Beginner's Star Book* (about $3). Copies of the HANDBOOK for previous years containing the descriptions and maps mentioned are still on hand and may be obtained free by members by applying to the office of the Society.

To those mentioned in the body of the book; to Mr. J. P. Henderson, M.A., now of the Dominion Observatory, Ottawa, formerly assistant in astronomy at the University of Toronto; and to Major J. A. Pearce, thanks are offered for assistance.

THE EDITOR.

TORONTO, December 1919.

ANNIVERSARIES AND FESTIVALS, 1920

New Year's Day	Thur.,	Jan. 1	Victoria Day	Mon.,	May 24
Epiphany	Tues.,	Jan. 6	Trinity Sunday		May 30
Septuagesima Sunday		Feb. 1	Corpus Christi	Thur.,	June 3
Quinquagesima (Shrove Sunday)		Feb. 15	St. John Baptist	Thur.,	June 24
Ash Wednesday		Feb. 18	Dominion Day	Thur.,	July 1
St. David	Mon.,	Mar. 1	Labor Day	Mon.,	Sept. 6
St. Patrick	Wed.,	Mar. 17	St. Michael (Michaelmas Day)	Wed.,	Sept. 29
Palm Sunday		Mar. 28	All Saints Day	Mon.,	Nov. 1
Good Friday		Apr. 2	First Sunday in Advent		Nov. 28
Easter Sunday		Apr. 4	St. Andrew	Tues.,	Nov. 30
St. George	Fri.,	Apr. 23	Conception Day	Wed.,	Dec. 8
Rogation Sunday		May 9	St. Thomas Day	Tues.,	Dec. 21
Ascension Day (Holy Thursday)		May 13	Christmas Day	Sat.,	Dec. 25
Pentecost (Whit Sunday)		May 23			

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

SYMBOLS AND ABBREVIATIONS

SIGNS OF THE ZODIAC

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

SUN, MOON AND PLANETS

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

ASPECTS AND ABBREVIATIONS

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

THE GREEK ALPHABET

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

In the Configurations of Jupiter's Satellites (pages 25, 27, etc.), O represents the disc of the planet, ♃ signifies that the satellite is on the disc, * signifies that the satellite is behind the disc or in the shadow. Configurations are for an inverting telescope.

SOLAR AND SIDEREAL TIME

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

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

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

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

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

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

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

1920, EPHEMERIS OF SUN AT GREENWICH MEAN NOON.

Date	R.A.			Equation of Time			Declination			Date	R.A.			Equation of Time			Declination		
	h	m	s		m	s	°	′	″		h	m	s		m	s	°	′	″
Jan. 1	18	42	37	+	3	13.0	S 23	5	11	Apr. 3	0	49	26	FAST	4	22.7	5	18	12
" 4	18	55	51		4	37.3	22	49	38	" 6	1	0	23		2	29.8	6	26	39
" 7	19	9	1	FAST	5	58.1	22	30	0	" 9	1	11	21		1	38.7	7	34	6
" 10	19	22	7		7	14.8	22	6	23	" 12	1	22	22		0	50.1	8	40	26
" 13	19	35	9		8	26.7	21	38	51	" 15	1	33	26	+	0	4.3	9	45	28
" 16	19	48	5		9	35.2	21	7	33	" 18	1	44	33	−	0	38.2	10	49	4
" 19	20	0	56		10	33.8	20	32	35	" 21	1	55	44		1	17.1	11	51	3
" 22	20	13	39		11	28.0	19	54	8	" 24	2	6	59	SLOW	1	52.2	12	51	16
" 25	20	26	16		12	15.2	19	12	21	" 27	2	18	17		2	23.2	13	49	35
" 28	20	38	46		12	55.2	18	27	25	" 30	2	29	40		2	49.8	N14	45	51
" 31	20	51	8		13	27.7	17	39	28										
										May 3	2	41	8		3	11.7	N15	39	56
Feb. 3	21	3	23		13	52.6	16	48	43	" 6	2	52	41		3	28.8	16	31	40
" 6	21	15	30		14	10.2	15	55	20	" 9	3	4	18		3	40.6	17	20	57
" 9	21	27	30		14	20.6	14	59	28	" 12	3	16	2		3	47.1	18	7	38
" 12	21	39	23		14	23.9	14	1	20	" 15	3	37	50		3	48.3	18	51	35
" 15	21	51	9		14	20.5	13	1	5	" 18	3	39	44		4	44.3	19	19	18
" 18	22	2	49		14	10.6	11	58	57	" 21	3	51	42		3	35.3	20	10	47
" 21	22	14	22		13	54.4	10	55	5	" 24	4	3	46		3	21.6	20	45	47
" 24	22	25	50		13	32.2	9	49	43	" 27	4	15	54		3	3.5	21	17	34
" 27	22	37	12		13	4.4	8	43	1	" 30	4	28	5		2	41.3	21	46	3
Mar. 1	22	48	28		12	31.4	7	35	11										
" 4	22	59	40		11	53.6	6	26	22	June 2	4	40	21		2	15.3	22	11	8
" 7	23	10	48		11	11.8	5	16	45	" 5	4	52	40		1	45.8	22	32	44
" 10	23	21	52		10	26.4	4	6	30	" 8	5	5	3		1	13.2	22	50	48
" 13	23	32	54		9	38.2	2	55	46	" 11	5	17	27		0	38.1	23	5	15
" 16	23	43	53		8	47.7	1	44	44	" 14	5	29	54	−	0	0.8	23	16	2
" 19	23	54	50		7	55.3	S 0	33	35	" 17	5	42	23	+	0	37.8	23	23	8
" 22	0	5	46		7	1.6	N 0	37	32	" 20	5	54	51		1	17.0	23	26	32
" 25	0	16	41		6	7.0	1	48	25	" 23	6	7	20	FAST	1	56.0	23	26	12
" 28	0	27	36		5	12.0	2	58	56	" 26	6	19	48		2	34.3	23	22	10
" 31	0	38	30	+	4	17.0	4	8	55	" 29	6	32	51		3	11.1	23	14	27

WATCH FAST

WATCH SLOW

Date	R.A.	Equation of Time		Declination		Date	R.A.	Equation of Time		Declination	
	h m s		m s	° ′ ″			h m s		m s	° ′ ″	
July 2	6 44 39	+	3 46.0	23 3 3		Oct. 3	12 36 37	−	10 55.3	3 56 53	
" 5	6 57 1		4 18.6	22 48 2		" 6	12 47 33		11 49.5	5 6 19	
" 8	7 9 21		4 48.2	22 29 27		" 9	12 58 32		12 40.1	6 15 11	
" 11	7 21 37		5 14.4	22 7 21		" 12	13 9 35		13 26.6	7 23 18	
" 14	7 33 49		5 36.9	21 41 50		" 15	13 20 43		14 8.6	8 30 31	
" 17	7 45 57		5 55.1	21 12 59		" 18	13 31 55		14 45.6	9 36 39	
" 20	7 58 0		6 8.5	20 40 53		" 21	13 43 13		15 17.2	10 41 31	
" 23	8 9 58		6 16.8	20 5 41		" 24	13 54 37		15 43.1	11 44 56	
" 26	8 21 50		6 19.6	19 27 27		" 27	14 6 7		16 2.8	12 46 45	
" 29	8 33 37		6 17.1	18 46 20		" 30	14 17 44		16 15.8	13 46 46	
Aug. 1	8 45 19		6 9.0	18 2 26		Nov. 2	14 29 28		16 21.6	14 44 50	
" 4	8 56 55		5 55.6	17 15 53		" 5	14 41 19		16 20.0	15 40 45	
" 7	9 8 26		5 36.9	16 26 48		" 8	14 53 18		16 10.8	16 34 20	
" 10	9 19 52		5 13.1	15 35 18		" 11	15 5 24		15 54.0	17 25 25	
" 13	9 31 13		4 44.3	14 41 34		" 14	15 17 38		15 29.5	18 13 47	
" 16	9 42 29		4 10.6	13 45 43		" 17	15 30 0		14 57.5	18 59 16	
" 19	9 53 40		3 32.0	12 47 54		" 20	15 42 29		14 18.2	19 41 42	
" 22	10 4 46		2 49 0	11 48 16		" 23	15 55 5		13 31.8	20 20 55	
" 25	10 15 49		2 1.8	10 46 59		" 26	16 7 48		12 38.4	20 56 45	
" 28	10 26 48		1 10.8	9 44 9		" 29	16 20 38		11 38.4	21 29 3	
" 31	10 37 43	+	0 16.5	N 8 39 55							
Sept. 3	10 48 36	−	0 40.6	N 7 34 26		Dec. 2	16 33 34		10 32.0	21 57 41	
" 6	10 59 26		1 39.9	6 27 50		" 5	16 46 36		9 19.9	22 22 30	
" 9	11 10 14		2 40.9	5 20 15		" 8	16 59 43		8 2.7	22 43 26	
" 12	11 21 2		3 43.2	4 11 51		" 11	17 12 54		6 41.2	23 0 20	
" 15	11 31 48		4 46.3	3 2 48		" 14	17 26 8		5 16.3	23 13 8	
" 18	11 42 34		5 49.9	1 53 14		" 17	17 39 25		3 48.9	23 21 46	
" 21	11 53 21		6 53.4	N 0 43 19		" 20	17 52 44		2 20.0	23 26 12	
" 24	12 4 7		7 56.3	S 0 26 48		" 23	18 6 3	−	0 50.5	23 26 24	
" 27	12 14 55		8 58.0	1 36 59		" 26	18 19 20	+	0 38.8	23 22 22	
" 30	12 25 45		9 57.9	2 47 13		" 29	18 32 40	+	2 7.1	S23 14 6	

WATCH FAST

WATCH SLOW

WATCH SLOW

WATCH SLOW

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

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

OCCULTATION OF STARS BY THE MOON, 1920

PREPARED BY R. M. MOTHERWELL

The following predictions were prepared for Ottawa by the graphic method of W. F. Rigge and include all stars down to magnitude 4.6. Observers should bear in mind that the predictions were made only for Ottawa and that the times will vary according to the latitude and longitude of the observer.

It will be noticed that some occultations occurring in the day-time are given, the observation of which may prove interesting. Attention is also directed to the fact that the hours are numbered astronomically, that is, beginning at noon.

Date	Star	Mag.	*Immersion		Emerson*		Position Immer.	Angle Emer.
1920			h	m	h	m	°	°
Jan. 15	ω^1Scorpii	4.3	16	19.1	17	28.6	88	299
Jan. 15	ω^2Scorpii	4.6	16	29.9	17	34.6	32	259
Mar. 11	ξOphicuchi	4.4	21	02.4	....		82	..
Apr. 11	βCapricorni	3.2	19	38.7	20	27.7	12	302
Apr. 15	λPiscium	4.6	20	09.2	21	20.0	42	261
May 5	ξOphiuchi	4.4	10	30.1	11	08.1	155	218
June 10	δPiscium	4.6	23	19.7	00	07.7	112	209
June 23	χVirginis	4.8	06	55.6	08	01.6	79	332
July 2	βCapricorni	3.2	16	25.1	16	57.6	4	311
July 6	λPiscium	4.6	22	06.3	....		59	..
Sept. 21	ρSagittarii	4.0	06	53.7	08	08.2	50	280
Sept. 23	νAquarii	4.5	13	46.6	....		42	..
Oct. 4	λGeminorum	3.6	17	56.8	18	38.5	160	227
Oct. 15	ψOphiuchi	4.6	02	43.1	03	08.1	172	203
Nov. 7	αVirginis	1.2	22	09.7	23	30.4	113	282
Nov. 16	βCapriconri	3.2	04	36.8	05	57.3	49	270
Dec. 19	ϵPiscium	4.4	12	17.9	13	04.9	102	224
Dec. 25	λGeminorum	3.6	18	28.1	....		105	..

*Eastern Standard Time, the hours numbering from noon.

TIMES OF SUNRISE AND SUNSET

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

How the Tables are Constructed.

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

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

The Times for Any Station

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

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

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

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

JANUARY

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

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

FEBRURAY

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

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

MARCH

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

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

APRIL

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

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

MAY

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

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

JUNE

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

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

JULY

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

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

AUGUST

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

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

SEPTEMBER

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

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

OCTOBER

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

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

NOVEMBER

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

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

DECEMBER

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

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

THE PLANETS FOR THE YEAR

Mercury is a morning star at the first of January, then a good evening star the first week of March, a poor morning star the middle of April, an evening star ar the end of June, a good morning star the middle of August and a poor evening star towards the end of October and finally a good morning star the first week of December.

Venus is a morning star at the first of the year and remains such till May, becoming an evening star towards the end of August and improving in position up till the end of the year.

Mars improves during the first few months, when it is visible the latter part of the night, reaches its best in April when it is visible all night, then is to be seen in the evening sky up to the end of the year.

Jupiter is visible all night at the beginning of the year, in the evening heavens till July, and appears in the morning sky from September on. It is west of Regulus until its conjunction with the sun when it also passes Regulus moving eastward.

Saturn is visible nearly all night at the beginning of the year, in the evening sky till July, then in the morning sky from the end of September on. During the whole year Jupiter, Regulus and Saturn are nearly in line, at first Regulus being in the middle, then after September, Jupiter in the middle.

Uranus is in conjunction with the sun on February 11, a month or more after this date being seen in the morning before sunrise. It rises earlier each night until on August 27 it is in opposition with the sun and transits at midnight. It is far south of the equator and hence low in our sky. Towards the end of the year it may be seen only during the first part of the night.

When it is desired to locate either Uranus or Neptune their position should be charted on a star map, reference stars found, and then by either the naked eye or field glasses it may be picked up in the sky. Although the disc or an apparent diameter may be seen in the case of the other planets even with a very small telescope, it requires a fairly large one, generally much more than 3-in. aperture, to be able to discern any appreciable disc to either of these two outer planets.

Neptune is in opposition to the sun on January 31, when it transits at midnight, apparent time. For the first five months it is conveniently observed in the first half of the night, but during June and July it is getting too near the sun. It passes conjunction on August 3 and when the sun has moved far enough from it by about October it is to be seen in the latter part of the night. It is much higher in our sky than Uranus.

Minima of Algol.—These are calculated from Chandler's formula with Hartwig's correction of 1h 30m *earlier*. The times are given to the nearest ten minutes.

ECLIPSES IN 1920

PREPARED BY R. M. MOTHERWELL.

There will be four eclipses, two of the Sun and two of the Moon.

I. A Total Eclipse of the Moon, May 2, 1920; the beginning visible in Europe, western Asia, Africa, the Indian Ocean, except the eastern portion, the Atlantic Ocean, eastern North America and South America; the ending visible in western Europe, western Africa, the Atlantic Ocean, North America, except the extreme northwestern portion, South America and the eastern portion of the Pacific Ocean.

Circumstances of the eclipse:	d	h	m
Moon enters penumbra	May 2	5	49.3
Moon enters umbra	" 2	7	0.8
Total eclipse begins	" 2	8	14.7
Middle of the eclipse	" 2	8	50.9
Total eclipse ends	" 2	9	27.1
Moon leaves umbra	" 2	10	41.3
Moon leaves penumbra	" 2	11	53.2

Magnitude of the eclipse = 1.224 (Moon's diameter = 1.0).

II. A Partial Eclipse of the Sun, May 17, 1920, invisible in Canada. It is visible in the Indian Ocean and most of Australia. Magnitude of greatest eclipse = .973 (Sun's diameter = 1.0).

III. A Total Eclipse of the Moon, October 26, 1920, the beginning visible in western Canada. The beginning is visible generally in western North America, the Pacific Ocean, Australia, Asia except the western portion, and the eastern portion of the Indian Ocean. The ending is visible generally in the western portion of the Pacific Ocean, Asia, Australia, the Indian Ocean, Eastern Africa and Europe except the western portion.

Circumstances of the eclipse:	d	h	m
Moon enters penumbra	October 26	18	24.5
Moon enters umbra	" 26	19	25.6
Total eclipse begins	" 26	20	28.6
Middle of the eclipse	" 26	21	11.4
Total eclipse ends	" 26	21	54.3
Moon leaves umbra	" 26	22	57.5
Moon leaves penumbra	" 26	23	58.7

Magnitude of the eclipse = 1.404 (Moon's diameter = 1.0).

IV. A Partial Eclipse of the Sun, November 10, 1920, visible in North America, except the western and southwestern parts, the Atlantic Ocean, western Europe and the northwestern part of Africa. It is visible in all of Canada excepting British Columbia, northwestern Alberta and the Yukon and Northwestern Territory. The Moon's shadow first touches the Earth at a point east of Lake Winnipeg. On the western coast of Newfoundland the eclipse ends at noon; at Lake Superior it ends at 11 o'clock in the forenoon; at Lake Winnipeg it begins at sunrise and in southeastern British Columbia and northwestern Alberta it ends at sunrise.

(In all cases the time given is Eastern Standard Time.)

THE SKY FOR JANUARY

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R.A.	18h 48m	16h 48m	13h 29m	9h 13m	10h 53m	22h 8m	8h 52m
Decl.	24° 0′ S.	20° 18′ S.	7° 9′ S.°	16° 59′ N	9° 5′ N	12° 16′ S.	17° 34′ N
Transit	11.13	9.04	5.55	1.40	3.20	14.32	1.19

The position is given for Greenwich Mean Moon. The time of transit is in Local Mean Time, hours numbering from midnight.

The Sun.—During January the sun's R.A. increases from 18h 43m to 20h 51m and its Decl. changes from 23° 5′ to 17° 39′S. The equation of time (see page 6) increases from 3m 13s to 13m 28s, and on account of this rapid rise in value the time of mean moon appears to remain, for the first ten days, at the same distance from the time of sunrise, *i.e.*, the forenoons as indicated by our clocks are of the same length. The earth is nearest the sun on the 3rd at 5 p.m. E.S.T. when it is 91,340,000 miles distant.

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

On January 15 the moon occults two stars in Scorpio. See p. 8.

Mercury can be seen as a morning star for the first few days of the month but even then it is only 10° above the horizon at sunrise and about 18° south of where the sun will appear. If the horizon be clear it may be picked up easily with field glasses just before dawn.

Venus is a prominent morning star all month although far south and not high in the sky. It rises about 3 hours before the sun and at the same point in the sky reaching only about 20° altitude at sunrise because it is in the southern part of the ecliptic. Its phase is like our moon about half way between full and last quarter but requiring a good small telescope to show this as it is of small apparent diameter and far away from us. Its stellar magnitude is −3.6. On the 17th it will have a very close conjunction with the moon which will be visible as an occultation though not in eastern Canada. On that morning Venus will be below and not inside "the arms of the moon".

Mars on the 15th is 155 million miles from the earth and, rising about midnight, apparent time, is visible the rest of the night. On the 10th it is 4° north of the star Spica in Virgo, and is moving slowly eastward along north of the ecliptic towards the constellation Libra. Its stellar magnitude is +1.0.

Jupiter rises about 6.30 a.m. apparent time and travels across high up in the sky, visible all night. It is retrograding at present and moving eastward away from Regulus and towards Saturn. It is reaching its best for observation being of stellar magnitude −2.1 and so far north of the equator. For the configurations of its satellites see next page; for their eclipses, etc., see page 48.

Saturn rises about 8.30 p.m. A.T. or about 2 hours after Jupiter, and is visible the remainder of the night. The rings are inclined from our line of sight at present about 5° and we are looking at their southern face. This angle will increase to about 8° which will be their position in May. Its stellar magnitude is +0.8. It is quite a sight to see the three bright objects in line, Jupiter 10° to the west and about 22 times as bright and Saturn 12° to the east and about 1½ times as bright as Regulus.

JANUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configuration of Jupiter's Satellites at 1h 0m.
			h m	
Thur.	1			24O3*
Fri.	2			1O423
Sat.	3	17h ⊕ in Perihelion.	16 00	O2134
Sun.	4			241O4
♉ Mon.	5	16h 5m F.M.		3O14*
Tues.	6	12h ☿ in ♉.	12 50	31O24
Wed.	7	13h 36m ☌ ♆ ☾, ♆ 5° 11′ N.; 23h 38m ☌ ♃ ☾, ♃ 6° 12′ N.		32O14
Thur.	8			21O34
Fri.	9	20h 41m ☌ ♄ ☾, ♄ 7° 9′ N.	9 40	2413O2
Sat.	10			4O123
Sun.	11			421O3
☾ Mon.	12	17h 9m Moon L.Q.	6 30	43O1*
Tues.	13	0h 9m ☌ ♂ ☾, ♂ 4° 52′ N.; 22h □ ♂ ☉.		431O2
Wed.	14			432O1
Thur.	15		3 20	421O3
Fri.	16	18h ☿ in Aphelion.		4O123
Sat.	17	8h 37m ☌ ♀ ☾, ♀ 0° 3′ N.		4O123
Sun.	18		0 10	21O3*
Mon.	19			32O14
Tues.	20	3h 36m ☌ ☿ ☾, ☿ 5° 43′ S.	21 00	31O24
● Wed.	21	0h 27m N.M.		32O14
Thur.	22			21O34
Fri.	23	13h 40m ☌ ♁ ☾, ♁ 6° 4′ S.	17 50	O1234
Sat.	24			O234*
Sun.	25			21O34
Mon.	26		14 40	32O41
Tues.	27			341O2
☽ Wed.	28	10h 38m Moon F.Q.		243O1
Thur.	29		11 20	421O*
Fri.	30			4O213
Sat.	31	3h ☍ ♆ ☉.		41O23

Explanation of symbols and abbreviations on page 4.

THE SKY FOR FEBRUARY

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R.A.	22h 23m	19h 29m	14h 13m	8h 57m	10h 46m	22h 14m	8h 49m
Decl.	11° 46′ S.	21° 19′ S.	11° 0′ S.	18° 12′ N	9° 54′ N	11° 41′ S.	17° 49′ N
Transit	12.46	9.52	4.37	23.17	1.11	12.37	23.13

The position is given for Greenwich Mean Noon. The time of transit is in Local Mean Time, hours numbering from midnight.

The Sun.—During February the sun's R.A. increases from 20h 55m to 22h 45m and its Decl. changes from 17° 23′ to 7° 58′S. The equation of time reaches a maximum value 14m 24s on the 12th (see page 6).

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

Mercury is moving in the far side of its orbit passing, superior conjunction on the 5th. Towards the end of the month it becomes visible as an evening star, being at its best the first few days of March.

Venus is still a morning star but is only about 15° above the horizon at sunrise, and slightly south of the S.E. point of the horizon. Its disc is now about 4/5 full, being oriented like our moon past the full. Its stellar magnitude is −3.5 and it is moving towards superior conjunction, becoming smaller in apparent diameter as it recedes from us.

Mars on the 15th rises about 11 p.m. A.T. and is visible the remainder of the night. It is 94 million miles from the earth and its stellar magnitude is +0.3 increasing. It is entering the constellation Libra from Virgo and is nearly 2½° north of the ecliptic.

Jupiter on the 15th is about 12° above the eastern horizon at sunset remaining visible till about ¾ hour before sunrise when it sets. It is in the constellation Cancer and is still retrograding. The 2nd is the date of opposition to the sun, hence this is the best period to observe it. Its stellar magnitude is the same as last month, −2.1. Its position so far north of the equator brings it high in the sky and places it out of reach of ordinary horizon dust and haze difficulties, making it a splendid object for detailed surface study. The configurations of its satellites are given on the opposite page and their eclipses, etc., on page 48.

Saturn rises about 1 hour after sunset travelling across the vault of sky following Jupiter's lead. It is retrograding and approaching Regulus, while Jupiter is also retrograding and moving away, but they are all three still in line. Its stellar magnitude is +0.5 or about its greatest, and being in opposition to the sun on the 27th is at its best for observation. The rings are inclined 6° from our line of sight and we are looking at their southern face.

FEBRUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 0h 0m
			h	m	
Sun.	1		8	10	2 4 2 O 3
Mon.	2				4 2 3 O 1
♋ Tues.	3	1h ☌ ♃ ☉; 3h 42m F.M.; 23h 0m ☌ ♆ ☾, ♆ 5° 6′ N.			3 4 1 O 2
Wed.	4	4h 32m ☌ ♃ ☾, ♃ 6° 8′ N.	5	00	3 O 4 2 1
Thur.	5	15h ☌ ☿ ☉ Superior.			2 1 3 O 4
Fri.	6	3h ☿ Greatest Hel. Lat. S.; 4h 14m ☌ ♄ ☾, ♄ 7° 7′ N.			O 1 3 4*
Sat.	7		1	50	1 O 2 3 4
Sun.	8				2 O 1 3 4
Mon.	9		22	40	2 3 O 4*
☾ Tues.	10	5h 8m ☌ ♂ ☾, ♂ 3° 48′ N.; 15h 49m Moon L.Q.			3 1 O 2 4
Wed.	11				3 O 2 1 4
Thur.	12		19	30	2 4 2 1 3 O
Fri.	13				4 O 1 3*
Sat.	14	1h ☌ ☿ ♁, ☿ 1° 0′ S.			4 1 O 2 3
Sun.	15		16	20	4 2 O 1 3
Mon.	16	19h 5m ☌ ♀ ☾, ♀ 4° 4′ S.			4 2 3 O*
Tues.	17				4 3 1 O 2
Wed.	18		13	10	4 3 O 1 2
♍ Thur.	19	16h 35m N.M.; 23h 27m ☌ ♁ ☾, ♁ 5° 58′ S.			4 2 3 1 O
Fri.	20	20h 56m ☌ ☿ ☾, ☿ 5° 41′ S.			4 2 O 1 3
Sat.	21	9h ☌ ♁ ☉.	9	40	1 O 4 2 3
Sun.	22				2 O 1 3 4
Mon.	23				2 4 2 1 O 4
Tues.	24		6	40	2 4 3 O 2 4
Wed.	25	3h ☿ in ♌; 16h ♀ in ♍.			3 O 1 2 4
☽ Thur.	26	18h 49m Moon F.Q.			2 3 1 O 4
Fri.	27	23h ☌ ♄ ☉.	3	30	2 O 3 1 4
Sat.	28				1 O 4 2 3
Sun.	29	17h ☿ in Perihelion.			2 4 O 1 3

Explanation of symbols and abbreviations on page 4.

THE SKY FOR MARCH

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R.A.	0h 6m	21h 55m	14h 30m	8h 46m	10h 38m	22h 20m	8h 46m
Decl.	4° 33′ N	13° 37′ S	12° 22′ S	18° 58′ N	10° 47′ N	11° 5′ S	17° 59′ N
Transit	12.34	10.24	2.59	21.12	23.04	10.49	21.12

The position is given for Greenwich Mean Noon. The time of transit is in Local Mean Time, hours numbering from midnight.

The Sun.—On March 1st the sun's R.A. is 22h 48m and its Decl. is 7° 35′S. It reaches the equator on the 20th (see opposite page), and on the 31st its R.A. is 0h 39m, its Decl. 4° 9′ N. During the month the equation of time decreases from 12m 31s to 4m 17s (see page 6).

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

On March 11th the moon occults Xi Ophiuchi (see p. 8).

Mercury on the 3rd is at its best as an evening star. Although at this elongation only about 18° from the sun it is visible nearly 1¾ hours after sunset, being meantime only 5° south of vertically above the setting sun, and actually nearly 18° above it. Its stellar magnitude is about 0 and a small telescope should show it to be a crescent like our moon just before first quarter, which is rapidly narrowing during the week following the 3rd. If the horizon is clear it can be found with little difficulty with the naked eye for a week before and after this date. This is the best time of the year to observe the planets as evening stars because the ecliptic rises nearly vertically from the horizon at sunset.

Venus is approaching the sun and though still bright is very low in the sky at sunrise. On the 20th it is in close conjunction with Uranus but both are very poorly situated for observation.

Mars is now visible from about 9.30 p.m. A.T. on, and as it starts to retrograde on the 14th it will not move any farther into Libra at present. It is now only 71 million miles from us and this is a very suitable time to observe it as it approaches its best. Stellar magnitude −0.5 still increasing.

Jupiter is again in practically the same location among the stars and on the 15th is visible until 2 hours before sunrise when it sets. On the 12th it is in conjunction with Neptune, being 58′ to the north. This should assist greatly in locating Neptune which is usually somewhat difficult to distinguish from a small star. Its stellar magnitude is −2.0 and decreasing very slowly. For the configurations of its satellites, see next page; for their eclipses, etc., see page 48.

Saturn on the 15th is up 15° above the eastern horizon at sunset and visible all night. It is still retrograding slowly and apparently approaching Regulus while Jupiter is still moving away in a straight line on the other side of Regulus. It is of stellar magnitude +0.6 and the ring system is inclined slightly more, or at 7° with our line of sight, making the planet a magnificent spectacle when seen through a telescope.

MARCH

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 23h 15m.
			h	m	
Mon.	1		0	20	43 O12
Tues.	2	6h 34m ☌ ♆ ☾, ♆ 5° 10′ N.; 7h 44m ☌ ♃ ☾, ♃ 6° 9′ N.			43 O2*
Wed.	3	18h ☿ Greatest elong. E. 18° 12′.	21	10	4321 O
♉ Thur.	4	10h 5m ☌ ♄ ☾, ♄ 7° 10′ N.; 16h 13m F.M.			42 O31
Fri.	5				41 O23
Sat.	6		18	00	4 O213
Sun.	7				21 O3*
Mon.	8				3 O14*
Tues.	9	0h 26m ☌ ♂ ☾, ♂ 3° 7′ N.	14	50	3 O24*
Wed.	10	5h ☿ Stationary.			321 O4
Thur.	11	0h ☿ Greatest Hel. Lat. N.			2 O14*
☾ Fri.	12	12h 57m Moon L.Q.; 22h ☌ ♃ ♆, ♃ 0° 58′ N.	11	40	1 O234
Sat.	13				O2134
Sun.	14	19h ♂ Stationa y.			21 O34
Mon.	15		8	30	3 O41*
Tues.	16				341 O2
Wed.	17				♃ 432 O
Thur.	18	4h 57m ☌ ♀ ☾, ♀ 6° 18′ S.; 11h 2m ☌ ♁ ☾, ♁ 5° 59′ S.	5	20	42 O1*
Fri.	19				41 O23
♍ Sat.	20	3h ☌ ☿ ☉ Inferior; 5h 52m ☌ ☿ ☾, ☿ 0° 30′ S.; 5h 56m N.M.; 16h 59m ☉ enters Aries, Spring commences			4 O213
Sun.	21	0h ☌ ♀ ♁,, ♀ 0° 21′ S.	2	00	421 O3
Mon.	22				432 O1
Tues.	23		22	50	341 O2
Wed.	24				32 O1*
Thur.	25				23 O4*
Fri.	26		19	40	1 O234
☽ Sat.	27	1h 45m Moon F.Q.			O1234
Sun.	28				21 O34
Mon.	29	11h 18m ☌ ♃ ☾, ♃ 6° 16′ N.; 12h 9m ☌ ♆ ☾, ♆ 5° 20′ N.	16	30	23 O14
Tues.	30				31 O24
Wed.	31	3h ♀ in Aphelion; 14h 10m ☌ ♄ ☾, ♄ 7° 18′ N.			♃ 3 O14

Explanation of symbols and abbreviations on page 4.

THE SKY FOR APRIL

POSITION OF PLANETS ON THE 15TH.

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R.A.	23h 56m	0h 18m	14h 6m	8h 44m	10h 31m	22h 26m	8h 45m
Decl.	2° 49′ S.	0° 15′ N.	10° 54′ S.	19° 3′ N.	11° 26′ N	10° 34′ S.	18° 4′ N.
Transit	10.22	10.45	0.34	19.09	20.56	8.52	19.10

The position is given for Greenwich Mean Noon. The time of transit is in Local Mean Time, hours numbering from midnight.

The Sun.—During April the sun continues its rapid rise above the equator and the days fast increase in length. The sun's R.A. increases from 0h. 42 m on the 1st to 2h 30m on the 30th, and its Decl. from 4° 32′ to 14° 46′ N. For the equation of time see page 6.

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

On April 11th the moon occults Beta Capricorni and on April 15th Lambda Piscium. See p. 8.

Mercury on the 17th reaches its best as a morning star, but although 27½° away from the sun it is only 10° above the horizon at sunrise and 25° southward owing to the way the ecliptic slopes down along the horizon in the morning at this time of the year. Field glasses and a good horizon are very essential to locate it at this elongation.

Venus on the 15th is only about 8° above the horizon at sunrise and about 16° to the southward. Its disc is more than 9/10 full and its stellar magnitude is −3.3 which alone makes it visible in the early twilight.

Mars on the 15th is 56 million miles distant and reaches its best position for observation this month, being in opposition to the sun on the 21st and nearest us on the 28th, when it is 54 million miles distant. From the 15th of last month to the 15th of this month it has moved backward in the sky 6° towards Spica. It is now visible all night. Stellar magnitude −1.4, its greatest.

Jupiter on the 15th is ¾ hour east of the meridian at sunset and sets at 2 a.m. apparent time. It has not changed its position relatively to the stars being still in Cancer on the opposite side of Regulus from Saturn but it has just started to move forward again or eastward in the heavens. For the configurations of its satellites, see next page; for their eclipses, etc., see page 48.

Saturn on the 15th is a little more than half way to the meridian at sunset and is visible till an hour and a half before sunrise. Its relative position among the stars is also practically unchanged since last month but its stellar magnitude is +0.8 and decreasing and the rings are now inclined nearly 8°.

APRIL

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 22h 30m.
			h	m	
Thur.	1	14h ☿ Stationary	13	20	2 4 231 O
Fri.	2				2 4 4 O23
♑ Sat.	3	5h 55m F.M.; 11h ☿ in ♉; 23h 2 Stationary.			4 O123
Sun.	4	21h ♂ ☿ ♀ ☿ 1° 12′ N.	10	10	421 O3
Mon.	5	3h 35m ♂ ♂ ☾, ♂ 2° 58′ N.			2 4 42 O1
Tues.	6				431 O2
Wed.	7		7	00	43 O21
Thur.	8				4231 O
Fri.	9				2 4 4 O3*
Sat.	10		3	50	O423*
☾ Sun.	11	8h 24m Moon L.Q.			21 O34
Mon.	12	17h ☿ in Aphelion.			2 O314
Tues.	13		0	40	31 O24
Wed.	14	23h 5m ♂ ♎ ☾, ♎ 6° 4′ S.			3 O214
Thur.	15		21	20	231 O4
Fri.	16	19h 43m ♂ ☿ ☾, ☿ 6° 30′ S.			O134*
Sat.	17	1h ☿ Greatest elong. W. 27° 31′; 7h 26m ♂ ♀ ☾ ♀ 5° 8′ S.			O423*
♍ Sun.	18	16h 43m N.M.	18	10	241 O3
Mon.	19	6h Ψ Stationary; 23h ♂ 2 Ψ, 2 0° 55′ N.			42 O31
Tues.	20				431 O2
Wed.	21	4h ♌ ♂ ☉.	15	00	43 O21
Thur.	22	13h ♀ Greatest Hel. Lat. S.			4321 O
Fri.	23				42 O31
Sat.	24		11	50	41 O23
☽ Sun.	25	8h 27m Moon F.Q.; 17h 24m ♂ Ψ ☾, Ψ 5° 27′ N.; 17h 59m ♂ 2 ☾, 2 6° 21′ N.			2 4 42 O3
Mon.	26				24 O13
Tues.	27	18h 2m ♂ ♄ ☾, ♄ 7° 21′ N.	8	40	31 O24
Wed.	28	0h ♂ nearest ⊕.			3 O124
Thur.	29	5h □ Ψ ☉; 13h □ 2 ☉.			321 O4
Fri.	30		5	30	2 O14*

Explanation of symbols and abbreviations on page 4.

THE SKY FOR MAY

POSITION OF PLANETS ON THE 15TH.

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R.A.	2h 41m	2h 36m	13h 26m	3h 53m	10h 30m	22h 30m	8h 45m
Decl.	14° 14′ N	14° 0′ N	8° 29′ S.	18° 23′ N	11° 30′ N	10° 14′ S	18° 2′ N
Transit	11.09	11.04	21.52	17.20	18.57	6.58	17.13

The position is given for Greenwich Mean Noon. The time of transit is in Local Mean Time, hours numbering from midnight.

The Sun.—On the 1st the sun's R.A. is 2h 33m, Decl. 15° 4′ N.; on the 31st its R.A. is 4h 32m, Decl. 21° 55′. The equation of time is 2m 58s on the 1st, rises to a maximum 3m 49s on the 14th and then falls to 2m 33s on the 31st (see page 6). On the 18th there is a partial eclipse invisible in Canada (see p. 23).

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 2nd there is a total eclipse of the moon visible in Canada (see p. 23).

On May 5th the moon occults Xi Ophiuchi (see p. 8).

Mercury s again moving on the far side of its orbit and will not be suitably placed for observation this month.

Venus is getting rather too near the sun for convenient morning observation.

Mars on the 15th is 57 million miles from the earth and is visible most of the night setting about 1½ hours before sunrise. On the 1st it is in conjunction with the moon. It will continue to retrograde till the 1st of next month, passing 2½° north of Spica on the 22nd and practically on the ecliptic. Its stellar magnitude is −1.1.

Jupiter on the 15th is exactly as bright as our brightest fixed star Sirius, which is now close to the S.W. horizon at sunset. It has moved very slightly since last month but is now heading eastward towards Regulus and Saturn. It is a little more than 1½ hours west of the meridian at sunset and sets about 5½ hours later. The configurations of its satellites are given on the next page, and their eclipses, etc, on page 48.

Saturn is again to be found in the same relative position among the stars although it starts to move forward on the 7th; but the sun has moved forward along the ecliptic in the meantime which makes Saturn appear on the meridian at sunset and it sets about 1¾ hours after midnight apparent time. Saturn is north of the ecliptic and still practically in line eastward from Regulus and Jupiter. The ring system is inclined at its greatest this month, about 8° from our line of sight and we are looking at their southern face.

MAY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 21h 45m
			h	m	
Sat.	1	16h 54m ☌ ♂ ☾, ♂ 2° 55′ N.			1 O234
☉ Sun.	2	20h 47m F.M.; ☾ Total eclipse visible in Canada, see p. 23			2 4 O134
Mon.	3		2	20	2 O34*
Tues.	4	2h ☿ Greatest Hel. Lat. S.			3 1 O24
Wed.	5		23	10	3 4 O12
Thur.	6				4 3 2 1 O
Fri.	7	7h ♄ Stationary.			4 2 3 O1
Sat.	8		20	00	4 1 O23
Sun.	9				4 O213
Mon.	10				4 2 O3*
☾ Tues.	11	0h 51m Moon L.Q.	16	40	4 3 1 O*
Wed.	12	9h 46m ☌ ♁ ☾, ♁ 6° 5′ S.			3 4 O12
Thur.	13	12h ☌ ☿ ♀, ☿ 0° 22′ S.			3 2 1 O4
Fri.	14		13	30	2 3 O14
Sat.	15				1 O324
Sun.	16				O2134
Mon.	17	4h 2m ☌ ♀ ☾, ♀ 1° 23′ S.	10	20	2 1 O34
● Tues.	18	1h 25m N.M.; ☉ Partial eclipse invisible in Canada, see p. 23; 8h 43m ☌ ☿ ☾, ☿ 0° 56′ S.			) 4 4 (O4*
Wed.	19				3 O124
Thur.	20		7	10	3 1 2 O4
Fri.	21				2 3 O41
Sat.	22				4 1 O32
Sun.	23	0h 26m ☌ Ψ ☾, Ψ 5° 27′ N.; 2h ☿ in ♌; 5h 21m ☌ 4 ☾, 4 6° 21′ N.	4	00	4 O123
☽ Mon.	24	16h 7m Moon F.Q.			4 2 1 O3
Tues.	25	0h 2m ☌ ♄ ☾, ♄ 7° 16′ N.; 21h ☌ ☿ ☉ Superior.			4 2 O13
Wed.	26	13h □ ♄ ☉.	0	50	4 3 O2*
Thur.	27	0h □ ♁ ☉; 17h ☿ in Perihelion; 21h ♂ in ♉			4 3 1 2 O
Fri.	28	11h 12m ☌ ♂ ☾, ♂ 2° 14′ N.	21	40	4 3 2 O1
Sat.	29				4 1 O2*
Sun.	30				O4123
Mon.	31		18	30	2 1 O43

Explanation of symbols and abbreviations on page 4.

THE SKY FOR JUNE

POSITION OF PLANETS ON THE 15TH.

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R.A.	7h 6m	5h 12m	13h 23m	9h 11m	10h 34m	22h 31m	8h 48m
Decl.	24° 38′ N	22° 54′ N	9° 21′ S	17° 5′ N	10° 58′ N	10° 9′ S	17° 51′ N
Transit	13.33	11.39	19.47	15.37	16.59	4.57	15.13

The position is given for Greenwich Mean Noon. The time of transit is in Local Mean Time, hours numbering from midnight.

The Sun.—The sun's R.A. on the 1st is 4h 36m and on the 30th it is 6h 36m. During the month its declination slowly rises from 22° 3′ N. on the 1st to 23° 27′ on the 22nd, the summer solstice, when our days are longest. It then falls to 23° 11′ by the 30th. The equation of time reaches zero on the 14th and rises to 3m 23s on the 30th (see page 6). The increase in the equation of time taken with the decreasing length of the day causes the time of sunset, stated in mean time, to appear constant for several days at the end of June and the beginning of July.

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

On June 10th the moon occults Delta Piscium and on June 23rd Chi Virginis (see p. 8).

Mercury is at its best again as an evening star on the 29th. Although 23° south of the sunset point it is about 16° above the horizon due to its elongation being so much greater than in March. It sets about 1½ hours after the sun, and should be very easily picked up for a week before and after this date. Its half moon shaped disc constantly thinning day by day should again be easily observed in a small telescope; stellar magnitude +0.7 decreasing.

Venus is on the far side of its orbit and is now too close to the sun in the sky to be conveniently observed as a morning star.

Mars is 70 million miles from us on the 15th and has been moving forward in the sky since the 1st, again passing Spica on the 13th about 1½° to the north. It crosses the meridian a few minutes after sunset and sets about one a.m. apparent time. It has a close conjunction with the moon on the 24th. Stellar magnitude −0.4.

Jupiter is now visible for only about 3 hours in the evening after sunset and is 11° west and slightly to the north of Regulus on a line with Saturn. For the configurations of its satellites, see next page; for their eclipse, etc., see page 48.

Saturn is changing its position very little as yet but Jupiter has moved so that it is nearly as close to Regulus westward as Saturn is toward the east. Saturn is visible only about 4½ hours after sunset.

JUNE

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configuration of Jupiter's Satellites at 21h 0m.
			h m	
♍ Tues.	1	12h 18m F.M.; 20h ♂ Stationary.		2 O 1 3 4
Wed.	2	15h ♆ in ♌.		3 1 O 2 4
Thur.	3		15 20	2 1 2 1 3 O 4
Fri.	4			3 2 O 1 4
Sat.	5			1 O 2 4*
Sun.	6	23h ☿ Greatest Hel. Lat. N.	12 10	O 1 2 4 3
Mon.	7			2 1 O 4 3
Tues.	8	17h 50m ☌ ♁ ☾, ♁ 6° 0′ S.		4 2 O 1 3
☾ Wed.	9	13h 58m Moon L.Q.	8 50	4 3 1 O 2
Thur.	10	8h ♁ Stationary.		4 3 O 1 2
Fri.	11			4 3 2 O*
Sat.	12		5 40	4 1 3 O*
Sun.	13			4 O 1 2 3
Mon.	14			4 1 2 O 3
Tues.	15		2 30	2 4 O 1 3
♎ Wed.	16	0h 11m ☌ ♀ ☾, ♀ 2° 53′ N.; 8h 41m N.M.		1 3 O 2*
Thur.	17	19h ♀ in ♋.	23 20	3 O 1 2 4
Fri.	18	0h 18m ☌ ☿ ☾, ☿ 6° 32′ N.		3 2 O 4*
Sat.	19	10h 8m ☌ ♆ ☾, ♆ 5° 21′ N.; 21h 13m ☌ ♃ ☾ 6° 15′ N.		3 1 O 4*
Sun.	20		20 10	O 1 3 2 4
Mon.	21	9h 37m ☌ ♄ ☾, ♄ 7° 1′ N.; 12h 40m ☉ enters Cancer, Summer commences		1 2 O 3 4
Tues.	22			2 O 1 3 4
☽ Wed.	23	1h 49m Moon F.Q.	17 00	1 3 O 2 4
Thur.	24	22h 43m ☌ ♂ ☾, ♂ 0° 56′ N.		2 1 3 O 1 2
Fri.	25			3 4 2 1 O
Sat.	26		13 50	2 1 4 3 2 O
Sun.	27			4 O 1 3 2
Mon.	28			2 1 4 1 O 3
Tues.	29	9h ☿ Greatest elong. E. 25° 41′.	10 40	4 2 O 1 3
Wed.	30	10h ☿ in ♉.		4 1 O 3 2

Explanation of symbols and abbreviations on page 4.

THE SKY FOR JULY

POSITION OF PLANETS ON THE 15TH.

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R.A.	8h 47m	7h 52m	13h 57m	9h 34m	10h 44m	22h 29m	8h 52m
Decl.	14° 23′ N	21° 57′ N	13° 21′ S	15° 19′ N	9° 59′ N	10° 21′ S	17° 36′ N
Transit	13.13	12.20	18.24	14.01	3.10	2.58	13.19

The position is given for Greenwich Mean Noon. The time of transit is in Local Mean Time, hours numbering from midnight.

The Sun.—During the month the sun's R.A. changes from 6h 41m to 8h 41m, and its Decl. from 23° 7′ to 18° 17′ N. The earth is farthest from the sun on the 4th (see opposite page), when we are 94,450,000 miles distant.

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

On July 2nd the moon occults Beta Capricorni and on July 6th Lambda Piscium, see p. 8.

Mercury is in conjunction with the sun on the 26th and not well placed for observation after the first few days of July when it is an evening star (see June).

Venus is in superior conjunction with the sun on the 3rd, this being the day on which it changes from morning to evening star, although it will be too close to the sun to be obesrved till some time after the end of the month.

Mars on the 15th is 87 million miles from the earth and is about an hour past the meridian at sunset, being visible the first 4 hours of the night. It is moving forward in its path and eastward from Spica. Its stellar magnitude is 0 and decreasing. At its conjunction with the moon on the 23rd the moon is north of Mars whereas last month the moon was just south of it.

Jupiter is visible less than 1½ hours after sunset on the 15th and is much nearer to Regulus which it will pass next month when the sun is too close and will make it invisible. The configuration of its satellites are given on the next page up till the 27th the last day they are conveniently observed, their eclipses, etc., on page 48.

Saturn is moving forward and eastward away from Regulus. It is only visible in the evening sky for about 2¼ hours and its magnitude has decreased to +1.1 or only slightly brighter than Regulus. The ring system is inclined about 6° from our line of sight.

JULY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 20h 15m.
			h	m	
♋ Thur.	1	3h 41m F.M.			43 O12
Fri.	2		7	30	3214 O
Sat.	3	15h ☌ ☿ ☉ Superior.			32 O14
Sun.	4	7h ⊕ in Aphelion.			O324*
Mon.	5	23h 13m ☌ ♁ ☾, ♁ 5° 50′ S.	4	10	1 O234
Tues.	6				2 O134
Wed.	7				1 O234
Thur.	8		1	00	3 O124
☾ Fri.	9	0h 6m Moon L.Q.			321 O4
Sat.	10	16h ☿ in Aphelion.	21	50	32 O14
Sun.	11				31 O2*
Mon.	12	13h ☿ Stationary.			♃4 O23
Tues.	13		18	40	42 O13
Wed.	14				41 O3*
♌ Thur.	15	15h 25m N.M.; 23h 8m ☌ ☿ ☾, ☿ 5° 59′ N.			43 O12
Fri.	16	18h 49m ☌ ☿ ☾, ☿ 1° 18′ N.; 21h 49m ☌ ♆ ☾, ♆ 5° 15′ N.	15	30	4312 O
Sat.	17	16h 8m ☌ ♃ ☾, ♃ 6° 6′ N.			432 O1
Sun.	18	22h 40m ☌ ♄ ☾, ♄ 6° 41′ N.			413 O2
Mon.	19		12	20	♃4 O23
Tues.	20				2 O43*
Wed.	21	12h ☿ in Perihelion.			12 O34
☽ Thur.	22	14h 20m Moon F.Q.; 23h ☌ ☿ ☿, ☿ 6° 10′ S.	9	10	3 O124
Fri.	23	1h 5m ☌ ♂ ☾, ♂ 0° 48′ S.			312 O4
Sat.	24				32 O14
Sun.	25		6	00	13 O24
Mon.	26				O1234
Tues.	27	2h ☌ ☿ ☉ Inferior; 7h ☌ ☿ ♆, ☿ 1° 19′ N.			2 O43*
Wed.	28		2	50	
Thur.	29				
♍ Fri.	30	18h 19m F.M.	23	30	
Sat.	31	1h ☿ Greatest Hel. Lat. S.			

Explanation of symbols and abbreviations on page 4.

THE SKY FOR AUGUST

POSITION OF PLANETS ON THE 15TH.

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R.A.	8h 23m	10h 26m	14h 59m	10h 0m	10h 57m	22h 25m	8h 57m
Decl.	18° 26′ N	11° 22′ N	18° 40′ S	13° 9′ N	8° 39′ N	10°44′ S	17° 18′ N
Transit	10.49	12.52	17.24	12.25	13.21	0.52	11.22

The position is given for Greenwich Mean Noon. The time of transit is in Local Mean Time, hours numbering from midnight.

The Sun.—During August the sun's R.A. increases from 8h 45m to 10h 38m, and its Decl. changes from 18° 2′ to 8° 40′ N. The equation of time falls from 6m 9s on the 1st to 0m 16s on the 31st. For fuller details see page 7.

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

Mercury is 18¾° west of the sun on the 14th, hence a morning star. Although a small elongation it is worth most so far as we are concerned in the northern hemisphere as it places the planet 15° high and 9° southward at sunrise. It should be fairly easy to pick it up with the naked eye over a clear horizon for a week or so before and after this date. It is in conjunction with the moon on the 12th.

Venus is now an evening star but will be rather low down at sunset till towards the end of the month. Its brightness (−3.4) is always a great aid in finding it even though the sky is still bright with sunlight and the other stars are not yet visible.

Mars on the 15th is 104 million miles from the earth and is visible barely more than 3 hours after sunset. Its stellar magnitude is +0.4 and decreasing as it travels toward the opposite side of its orbit. It is now a little more than half way between Spica and Antares and slightly north of the line joining them.

Jupiter is in conjunction with the sun on the 22nd and too close for observation this month.

Saturn is also getting too close to the sun for convenient observation, setting on the 15th less than an hour after the sun.

AUGUST

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configuration of Jupiter's Satellites
			h m	
Sun.	1			
Mon.	2	3h 14m ☌ ♊ ☾, ♊ 5° 42′ S.	20 20	
Tues.	3	19h ☌ ♆ ☉; 20h □ ♂ ☉.		
Wed.	4			
Thur.	5		17 10	
Fri.	6	1h ☿ Stationary.		
☾ Sat.	7	7h 51m Moon L.Q.		
Sun.	8	13h ☌ ♀ ♌, ♀ 0° 39′ N.	14 00	
Mon.	9			
Tues.	10			
Wed.	11		10 50	
Thur.	12	7h ♀ Greatest Hel. Lat. N.; 16h 8m ☌ ☿ ☾, ☿ 3° 23′ N.		
♍ Fri.	13	9h 48m ☌ ♆ ☾, ♆ 5° 14′ N.; 22h 44m N.M.		
Sat.	14	12h 20m ☌ ♌ ☾, ♌ 5° 56′ N.; 20h ☿ Greatest elong. W. 18° 44′; 23h 28′ ☌ ♀ ☾, ♀ 6° 23′ N.	7 40	
Sun.	15	13h 51m ☌ ♄ ☾, ♄ 6° 22′ N.		
Mon.	16			
Tues.	17		4 30	
Wed.	18			
Thur.	19	1h ☿ in ☊.		
Fri.	20	13h 54m ☌ ♂ ☾, ♂ 2° 42′ S.	1 20	
☽ Sat.	21	5h 52m Moon F.Q.; 13h ☌ ☿ ♆, ☿, 0° 32′ N.		
Sun.	22	4h ☌ ♌ ☉; 15h ☌ ♀ ♄, ♀ 0° 23′ S.	22 10	
Mon.	23	16h ☿ in Perihelion.		
Tues.	24			
Wed.	25		18 50	
Thur.	26			
Fri.	27	2h ☍ ♊ ☉.		
Sat.	28		15 40	
♒ Sun.	29	7h 41m ☌ ♊ ☾, ♊ 5° 41′ S.; 8h 3m F.M.		
Mon.	30			
Tues.	31	23h ☌ ☿ ♌, ☿ 0° 57′ N.	12 30	

Invisible on account of proximity to sun.

Explanation of symbols and abbreviations on page 4.

THE SKY FOR SEPTEMBER

POSITION OF PLANETS ON THE 15TH.

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R.A.	11h 54m	12h 47m	16h 19m	10h 25m	11h 11m	22h 21m	9h 1m
Decl.	1 °57′ N	4° 3′ S	23° 13′ S	10° 48′ N	7° 11′ N	11° 10′ S	17° 0′ N
Transit	12.18	13.10	16.42	10.48	11.34	22.46	9.24

The position is given for Greenwich Mean Noon. The time of transit is in Local Mean Time, hours numbering from midnight.

The Sun.—The sun's R.A. increases during the month from 10h 41m to 12h 26m. On the 1st its Decl. is 8° 18′ N., which decreases till the 23rd when the sun crosses the equator, and by the 30th its Decl. is 2° 47′ S. The equation of time is given on page 7.

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

On September 21st the moon occults Rho Sagittarii and on September 23rd Nu Aquarii (see p. 8).

Mercury is in superior conjunction with the sun on the 8th and too close all month for observation.

Venus is constantly improving as an evening star, but again it is at a great disadvantage for at this time of the year in the northern hemisphere the ecliptic slopes down near the horizon towards the south and brings any planets on it very low in actual height although they may be a considerable distance from the sun. The reverse is true in the southern hemisphere—they are better placed evenings from August till October.

Mars on the 15th is 121 million miles from us and is visible the first three hours of the night although low in the southern sky in our latitude. It passes less than 3° north of Antares on the 17th.

Jupiter is now west of the sun and becomes a morning star being 15° above the horizon at sunrise on the 15th and well placed for observation by early risers in the northern hemisphere as it is so high in the sky and so far north. It is about 6° almost directly below Regulus and above Saturn. The configurations of its satellites are given on the next page from the 17th on, their eclipses, etc., on page 48.

Saturn is in conjunction with the sun on the 7th and too close for observation till near the end of the month when it is a morning star.

SEPTEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configuration of Jupiter's Satellites at 5h 0m.
			h m	
Wed.	1			
Thur.	2	22h ☿ Greatest Hel. Lat. N.		
Fri.	3		9 20	
Sat.	4			
☾ Sun.	5	14h 5m Moon L.Q.		
Mon.	6		6 10	
Tues.	7	19h ☌ ♄ ☉.		
Wed.	8	9h ☌ ☿ ♄, ☿ 0° 6′ S.; 21h ☌ ☿ ☉ Superior.		
Thur.	9	20h 23m ☌ Ψ ☾, Ψ 5° 19′ N.	3 00	
Fri.	10			
Sat.	11	8h 0m ☌ ♃ ☾, ♃ 5° 47′ N.	23 50	
● Sun.	12	5h 20m ☌ ♄ ☾, ♄ 6° 10′ N.; 7h 52m N.M.; 18h 7m ☌ ☿ ☾, ☿ 5° 17′ N.		
Mon.	13	23h 32m ☌ ♀ ☾, ♀ 3° 24′ N.		
Tues.	14		20 40	
Wed.	15			
Thur.	16			
Fri.	17		17 30	4 O 23*
Sat.	18	10h 31m ☌ ♂ ☾, ♂ 4° 30′ S.		4 3 1 O 2
☽ Sun.	19	23h 55m Moon F.Q.		4 3 2 O 1
Mon.	20		14 20	4 3 1 2 O
Tues.	21			4 3 O 1 2
Wed.	22			2 4 1 4 1 O 3
Thur.	23	3h 29m ☉ enters Libra, Autumn commences	11 00	4 2 O 1 3
Fri.	24			4 1 O 2 3
Sat.	25	13h 48m ☌ ♎ ☾, ♎ 5° 47′ S.		2 4 2 4 O 2
Sun.	26	10h ☿ in ♍.	7 50	3 2 O 1 4
○ Mon.	27	20h 57m F.M.		3 2 1 O 4
Tues.	28			3 O 1 2 4
Wed.	29		4 40	1 O 2 3 4
Thur.	30			2 O 1 3 4

Explanation of symbols and abbreviations on page 4.

THE SKY FOR OCTOBER

POSITION OF PLANETS ON THE 15TH.

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R.A.	14h 44m	15h 7m	17h 50m	10h 48m	11h 25m	22h 17m	9h 4m
Decl.	18° 8′ S	17° 55′ S	25° 10′ S	8° 36′ N	5° 49′ N	11° 29′ S	16° 48′ N
Transit	13.09	13.32	16.15	9.13	9.49	20.40	7.29

The position is given for Greenwich Mean Noon. The time of transit is in Local Mean Time, hours numbering from midnight.

The Sun.—The sun's R.A. increases during October from 12h 29m to 14h 22m, and its Decl. changes from 3° 10′ to 14° 6′ S. The equation of time rises from 10m 17s to 16m 19s, to be subtracted from apparent time. For fuller details see page 7.

The Moon.—For its phases and conjunctions with the planets see opposite page. On the 27th there is a total eclipse invisible in Canada.

On October 4th the moon occults Lambda Geminorum and on October 15th Psi Ophiuchi (see p. 8).

Mercury on the 15th is 24° east of the sun but is very unsuitably situated as an evening star, being only 8° above the horizon and 23° south of the sunset point. Field glasses and an extra good horizon will certainly be required to pick it up at this elongation.

Venus is still receding from the sun but is also moving southward along the ecliptic bringing it down along near the horizon to the southward of where the sun sets. On the 15th it is located 10° in altitude and 25° southward of the sun at sunset.

Mars is 136 million miles from the earth on the 15th and is visible slightly more than 3 hours after sunset but it is very far south in the sky in our latitude. It is because the sun has been moving southward, hence setting earlier, that for the last three months we have seen Mars for the same number of hours after sunset. It has been moving rapidly eastward and is now nearly 10° east of Antares.

Jupiter is visible for 3½ hours before sunrise on the 15th and is well placed as a morning star in our latitude being so high up from the horizon. It is about 10° east of Regulus. The configurations of its satellites are given on the next page; their eclipses, etc., on page 48. Its stellar magnitude is −1.4.

Saturn improves in position rapidly for observation as a morning star, during the month rising 2¾ hours before the sun on the 15th. Its stellar magnitude is only +1.3 and the rings are inclined at 5° from our line of sight. Jupiter and Saturn are again in line but this time Jupiter is the brilliant central one or rather slightly closer to Saturn which is the most easterly and only equal to Regulus in brightness.

OCTOBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 4h 30m.
			h	m	
Fri.	1				1 O 2 3 4
Sat.	2		1	30	O 1 3 2 4
Sun.	3				3 2 O 4*
☾ Mon.	4	19h 54m Moon L.Q.	22	20	3 2 1 4 O
Tues.	5				4 3 O 1 2
Wed.	6	15h ☿ in Aphelion.			4 1 O 3 2
Thur.	7	4h 30m ☌ Ψ ☾, Ψ 5° 26′ N.; 9h ♀ in ♉.	19	10	4 2 O 1 3
Fri..	8				4 1 O 3*
Sat.	9	1h 39m ☌ ♃ ☾, ♃ 5° 39′ N.; 19h 24m ☌ ♄ ☾, ♄ 6° 2′ N.			4 O 1 3 2
Sun.	10		16	00	4 3 2 O*
● Mon.	11	19h 50m N.M.			3 4 2 1 O
Tues.	12				3 4 O 1 2
Wed.	13	13h 55m ☌ ☿ ☾, ☿ 2° 32′ S.	12	50	1 O 2 4*
Thur.	14	2h 10m ☌ ♀ ☾, ♀ 1° 22′ S.			2 O 1 3 4
Fri.	15				1 2 O 3 4
Sat.	16		9	40	O 1 3 2 4
Sun.	17	13h 3m ☌ ♂ ☾, ♂ 5° 56′ S.			♃ 3 1 O 4
Mon.	18				♃ 3 2 O 4
☽ Tues.	19	19h 29m Moon F.Q.	6	20	3 O 1 2 4
Wed.	20				1 O 4 2*
Thur.	21				2 4 O 1 3
Fri.	22	21h 37m ☌ ♁ ☾, ♁ 5° 52′ S.	3	10	4 1 2 O 3
Sat.	23				4 O 1 3 2
Sun.	24				♃ 4 1 3 O
Mon.	25	5h ☿ Greatest elong. E. 24° 8′.	0	00	4 3 2 O 1
Tues.	26				4 3 O 2*
♍ Wed.	27	0h ☿ Greatest Hel. Lat. S.; 9h 9m F.M. (total eclipse invisible in Canada).	20	50	4 3 1 O 2
Thur.	28				4 2 O 1 3
Fri.	29				2 1 O 3*
Sat.	30		17	40	O 1 2 4 3
Sun.	31	19h ♂ Greatest Hel. Lat. S.			1 3 O 2 4

Explanation of symbols and abbreviations on page 4.

THE SKY FOR NOVEMBER

POSITION OF PLANETS ON THE 15TH.

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R.A.	15h 29m	17h 48m	19h 31m	11h 7m	11h 36m	22h 16m	9h 5m
Decl.	18° 51′S	25° 7′ S	23° 23′ S	6° 45′ N	4° 42′ N	11° 34′ S	16° 44′ N
Transit	11.50	14.11	15.54	7.30	7.59	18.37	5.28

The position is given for Greenwich Mean Noon. The time of transit is in Local Mean Time, hours numbering from midnight.

The Sun.—The sun's R.A. during the month increases from 14h 26m to 16h 25m and the Decl. changes from 14° 26′ to 21° 39′ S. The equation of time rises to a maximum on the 3rd when it is 16m 22s. The true sun crosses the meridian this much earlier than the mean sun (see page 7). On the 10th there is a partial eclipse visible in Eastern North America (see page 23).

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

On November 7th the moon occults Alpha Virginis and on November 16th Beta Capricorni (see p. 8).

Mercury on the 16th is in inferior conjunction with the sun and is not suitably placed for observation till near the end of the month, when it becomes a morning star.

Venus is improving for observation this month, being about 15° above the horizon at sunset on the 15th. Its disc is now about 4/5 full or like our moon before the full, and it is of stellar magnitude −3.4.

Mars is now 151 million miles from us and is visible for about the first 3½ hours of the night. It is interesting that for about four months it has remained in about the same relative position as regards the meridian, about ½ hour past or west of it, at sunset although moving actually quite rapidly among the stars, and from the constellation Sagittarius into Capricornus.

Jupiter on the 15th rises at 1.15 a.m. apparent time and is visible until sunrise. Its stellar magnitude is −1.5 or about 12 times as bright as Spica, Regulus or Saturn which are nearly all equal. For the configurations of its satellites, see next page; for their eclipses, etc., see page 48.

Saturn is the fainter star now, only about 7° east and slightly south of Jupiter, being visible from 1.45 a.m. A.T. on. Its stellar magnitude is at its lowest, +1.4, and the rings are inclined about 4½°.

NOVEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configuration of Jupiter's Satellites at 4h 30m.
			h m	
Mon.	1			32O14
Tues.	2		14 30	31O4*
☾ Wed.	3	2h 35m Moon L.Q.; 10h 38m ☌ ♆ ☾, ♆ 5° 29′ N.		2 3O24
Thur.	4			2O134
Fri.	5	13h ☿ Stationary; 16h 16m ☌ ♃ ☾, ♃ 5° 30′ N.	11 20	21O43
Sat.	6	6h □ ♆ ☉; 6h 55m ☌ ♄ ☾, ♄ 5h 57m.		O4123
Sun.	7			41O32
Mon.	8		8 10	432O1
Tues.	9			431O*
● Wed.	10	☉ Partial eclipse, visible in Canada except Western part, see p. 23; 11h 5m N.M.; 19h ♀ in Aphelion.		43O12
Thur.	11	7h 48m ☌ ☿ ☾, ☿ 3° 16′ S.; 9h ♁ Stationary.	5 00	42O13
Fri.	12			421O3
Sat.	13	11h 45m ☌ ♀ ☾, ♀ 5° 35′ S.		4O123
Sun.	14		1 40	41O32
Mon.	15	1h ☿ in ♌; 19h 0m ☌ ♂ ☾, ♂ 6° 44′ S.		32O41
Tues.	16	1h ☌ ☿ ☉ Inferior; 6h ♆ Stationary.	22 30	312O4
Wed.	17			3O124
☽ Thur.	18	15h 13m Moon F.Q.		2 O34*
Fri.	19	6h 13m ☌ ♁ ☾, ♁ 5° 49′ S.; 15h ☿ in Perihelion.	19 20	21O34
Sat.	20			O1234
Sun.	21			1O324
Mon.	22		16 10	23O14
Tues.	23			213O4
Wed.	24	4h □ ♁ ☉.		34O12
⑳ Thur.	25	5h ☿ Stationary; 11h ♂ in Perihelion; 20h 42m F.M.	13 00	41O2*
Fri.	26			2 42O3
Sat.	27			4O213
Sun.	28		5 90	41O32
Mon.	29	22h ☿ Greatest Hel. Lat. N.		423O1
Tues.	30	16h 46m ☌ ♆ ☾, ♆ 5° 24′ N.		4321O

Explanation of symbols and abbreviations on page 4.

THE SKY FOR DECEMBER

POSITION OF PLANETS ON THE 15TH.

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R.A.	16h 17m	20h 26m	21h 7m	11h 19m	11h 43m	22h 18m	9h 4m
Decl.	20° 19′ S	21° 25′ S	17° 54′ S	5° 41′ N	4° 6′ N	11° 23′ S	16° 48′ N
Transit	10.42	14.51	15.31	5.44	6.08	16.41	3.29

The position is given for Greenwich Mean Noon. The time of transit is in Local Mean Time, hours numbering from midnight.

The Sun.—During December the sun's R.A. increases from 16h 29m to 18h 42m. On the 1st the Decl. is 21° 49′ S., which increases slowly till the 21st, the winter solstice, when it is 23° 27′ S. By the 31st it has come back to 23° 6′ S. The equation of time is given on page 7.

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

On December 19th the moon occults Epsilon Piscium and on December 25th Lambda Geminorum (see p. 8).

Mercury is at greatest elongation west on the 3rd and is very suitably situated, being 16° above the horizon at sunrise and about 11° to the south of where the sun will appear. It should be quite easily picked up with the naked eye for a week or so before and after this date if a clear horizon is available.

Venus on the 15th is only about an hour and a quarter past the meridian at sunset, and though south of the most southerly part of the ecliptic is nevertheless fairly well placed for observation. Its phase is like our moon half way between first quarter and full which should be easily detected in a good small telescope. Its stellar magnitude is −3.6 and increasing.

Mars is 165 million miles from us on the 15th and is again just a ½ hour past our meridian when the sun sets. This makes it visible for the first 4 hours of the night—even longer than for the previous five months—ever since July it has been visible uniformly each night between 3 and 4 hours. It is moving through the constellation Capricornus.

Jupiter on the 15th rises at 11.15 p.m. apparent time and is visible the rest of the night. It is still moving forward in the sky and towards Saturn. The configurations of its satellites are given on the next page; their eclipses, etc., on page 48.

Saturn now rises just before midnight apparent time and is visible the remainder of the night. Jupiter is moving rapidly towards it and is only 6° to the west on the 15th. It is increasing in brightness, being of stellar magnitude +1.2, and the rings are inclined about 4½° from our line of sight.

DECEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configuration of Jupiter's Satellites at 3h 30m.
			h m	
Wed.	1		6 40	34O12
☾ Thur.	2	11h 29m Moon L.Q.		1O24*
Fri.	3	3h 49m ☌ ♃ ☾, ♃ 5° 19′ N.; 5h ☿ Greatest Hel. Lat. S.; 7h ☿ Greatest elong. W. 20° 30′; 15h 58m ☌ ♄ ☾, ♄ 5° 50′ N.	3 30	2O134 O34**
Sat.	4			1O234
Sun.	5			23O14
Mon.	6			321O4
Tues.	7		0 20	3O124
Wed.	8	10h 34m ☌ ☿ ☾, ☿ 0° 2′ N.		31O24
Thur.	9		21 10	2♃2O13
● Fri.	10	2h □ ♃ ☉; 5h 4m N.M.		4O3**
Sat.	11			41O23
Sun.	12		17 50	2♃42O1
Mon.	13			4321O
Tues.	14	1h 25m ☌ ♀ ☾, ♀ 7° 27′ S.		43O21
Wed.	15	1h 6m ☌ ♂ ☾, ♂ 6° 35′ S.	14 40	431O2
Thur.	16	12h □ ♄ ☉; 14h 36m ☌ ♁ ☾, ♁ 5° 36′ S.		42O13
Fri.	17			21O3*
☾ Sat.	18	9h 40m Moon F.Q.	11 30	2♃O423
Sun.	19			2♃O314
Mon.	20			321O4
Tues.	21	22h 17m ☉ enters Capricornus, Winter commences	8 20	3O214
Wed.	22			31O24
Thur.	23	9h ☿ in ♍.		2O314
Fri.	24		5 10	21O34
♋ Sat.	25	7h 38m F.M.		O1423
Sun.	26			4O23*
Mon.	27		2 00	4231O
Tues.	28	0h 49m ☌ ♆ ☾, ♆ 5° 15′ N.		43O21
Wed.	29		22 50	431O2
Thur.	30	13h 5m ☌ ♃ ☾, ♃ 5° 7′ N.; 23h 51m ☌ ♄ ☾, ♄ 5° 40′ N.		42O31
Fri	31	24h ⊕ in Perihelion.		

Explanation of symbols and abbreviations on page 4.

PHENOMENA OF JUPITER'S SATELLITES

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

JANUARY

d	h	m			d	h	m		
1	2	30	I	OR		1	1	I	TI
	4	36.4	IV	ED		2	53	I	Se
	20	48	I	SI		3	19	I	Te
	21	32	I	TI		21	42.2	I	ED
	23	5	I	Se	17	0	25	I	OR
	23	49	I	Te		19	27	I	TI
2	20	56	I	OR		21	21	I	Se
3	2	36	II	SI		21	45	I	Te
	4	1	II	TI		22	36.6	IV	ED
	5	27	II	Se	18	4	58	III	SI
	6	53	II	Te		6	32	III	TI
	21	2	III	SI	19	2	52.7	II	ED
	23	52	III	TI		6	30	II	OR
4	0	40	III	Se	20	21	2	II	SI
	3	29	III	Te		21	41	II	TI
	21	42.5	II	ED		23	54	II	Se
5	1	58	II	OR	21	0	33	II	Te
6	6	51.6	I	ED		23	37	III	OR
	20	2	II	Te	22	5	7.7	I	ED
7	4	13	I	SI		19	37	II	OR
	4	51	I	TI	23	2	29	I	SI
	6	30	I	Se		2	45	I	TI
8	1	20.0	I	ED		4	47	I	Se
	4	15	I	OR		5	3	I	Te
	22	41	I	SI		23	36.2	I	ED
	23	17	I	TI	24	2	9	I	OR
9	0	59	I	Se		20	57	I	SI
	1	34	I	Te		21	11	I	TI
	19	48.4	I	ED		23	15	I	Se
	22	41	I	OR		23	29	I	Te
	23	16	IV	Te	25	20	35	I	OR
10	5	10	II	SI	26	5	27.8	II	ED
	6	18	II	TI	27	23	37	II	SI
	20	1	I	Te		23	55	II	TI
11	1	0	III	SI	28	2	30	II	Se
	3	14	III	TI		2	48	II	Te
	4	38	III	Se		22	43.6	III	ED
	6	51	III	Te	29	2	53	III	OR
12	0	17.6	II	ED		18	45.2	II	ED
	4	15	II	OR		21	51	II	OR
13	19	26	II	TI	30	4	23	I	SI
	21	19	II	Se		4	29	I	TI
	22	18	II	Te		6	41	I	Se
14	6	7	I	SI		6	46	I	Te
	6	35	I	TI	31	1	30.3	I	ED
	20	19	III	OR		3	53	I	OR
15	3	13.8	I	ED		22	51	I	SI
	5	59	I	OR		22	55	I	TI
16	0	35	I	SI					

FEBRUARY

1	1	9	I	Se		6	17	I	SI
	1	12	I	Te	7	3	18	I	OD
	19	58.9	I	ED		5	42.8	I	ER
	22	19	I	OR		18	9	II	Te
2	19	38	I	Se		18	23	II	Se
	19	38	I	Te	8	0	38	I	TI
3	21	27.0	IV	ER		0	46	I	SI
4	2	9	II	TI		2	56	I	Te
	2	12	II	SI		3	3	I	Se
	5	2	II	Te		19	58	III	Te
	5	5	II	Se		20	33	III	Se
5	2	30	III	OD		21	44	I	OD
	6	22.1	III	ER	9	0	11.5	I	ER
	21	12	II	OD		19	4	I	TI
6	0	12.8	II	ER		19	14	I	SI
	6	12	I	TI		21	22	I	Te

FEBRUARY—*Continued.*

d	h	m			d	h	m		
	21	32	I	Se		5	22.7	II	ER
10	18	40.0	I	ER	21	19	47	II	TI
11	4	23	II	TI		20	43	II	SI
	4	48	II	SI		22	40	II	Te
	23	1	IV	TI		23	36	II	Se
12	1	6	IV	SI	22	4	6	I	TI
	3	45	IV	Te		4	34	I	SI
	5	45	III	OD		22	55	III	TI
	5	51	IV	Se	23	0	52	III	SI
	23	26	II	OD		1	13	I	OD
13	2	47.7	II	ER		2	33	III	Te
14	5	2	I	OD		4	0.7	I	ER
	20	24	II	Te		4	31	III	Se
	21	0	II	Se		18	40.2	II	ER
15	2	22	I	TI		22	33	I	TI
	2	40	I	SI		23	3	I	SI
	4	40	I	Te	24	0	50	I	Te
	4	58	I	Se		1	20	I	Se
	19	36	III	TI		19	39	I	OD
	20	53	III	SI		22	29.3	I	ER
	23	14	III	Te	25	19	16	I	Te
	23	28	I	OD		19	49	I	Se
16	0	32	III	Se	27	3	56	II	OD
	2	6.0	I	ER	28	19	5	IV	SI
	20	48	I	TI		22	4	II	TI
	21	8	I	SI		23	19	II	SI
	23	6	I	Te		23	51	IV	Se
	23	26	I	Se	29	0	57	II	Te
17	20	34.6	I	ER		2	12	II	Se
20	1	40	II	OD					

MARCH

1	2	17	III	TI	15	21	44	II	OD
	2	58	I	OD	16	2	24.9	II	ER
	4	51	III	SI		3	52	I	TI
	21	15.1	II	ER	17	0	59	I	OD
2	0	18	I	TI		18	49	II	Te
	0	57	I	SI		20	44	II	Se
	2	35	I	Te		22	19	I	TI
	3	15	I	Se		23	15	I	SI
	21	25	I	OD	18	0	36	I	Te
3	0	24.2	I	ER		1	32	I	Se
	18	45	I	TI		19	26	I	OD
	19	26	I	SI		22	43	III	OD
	21	2	I	Te		22	43.1	I	ER
	21	43	I	Se	19	2	22	III	OR
4	18	53.0	I	ER		2	38.5	III	ED
	22	18.4	III	ER		19	3	I	Te
7	0	24	II	TI		20	1	I	Se
	1	56	II	SI	22	20	26	III	Se
	3	16	II	Te	23	0	6	II	OD
	21	15	IV	OD	24	2	48	I	OD
8	2	4	IV	OR		20	28	II	SI
	19	23	II	OD		21	13	II	Te
	23	50.0	II	ER		22	44.1	IV	ED
9	2	5	I	TI		23	21	II	Se
	2	52	I	SI	25	0	8	I	TI
	4	22	I	Te		1	10	I	SI
	23	12	I	OD		2	24	I	Te
10	2	19.2	I	ER		21	16	I	OD
	20	31	I	TI	26	0	38.4	I	ER
	21	20	I	SI		2	18	III	OD
	22	48	I	Te		19	39	I	SI
	23	38	I	Se		20	52	I	Te
11	19	12	III	OD		21	55	I	Se
	20	48.0	I	ER	27	19	7.1	I	ER
12	2	18.1	III	ER	29	19	58	III	Te
14	2	45	II	TI					

MARCH—*Continued.*

d	h	m			d	h	m		
	20	49	III	SI	31	20	48	II	TI
30	0	26	III	Se		23	5	II	SI
	2	30	II	OD		23	41	II	Te

APRIL

1	1	58	I	TI	12	23	51	III	TI
	1	58	II	Se	15	1	50	II	TI
	20	30	IV	TI	16	20	42	II	OD
	23	6	I	OD		22	16.0	III	ER
2	1	12	IV	Te	17	0	9	I	TI
	2	33.6	I	ER		1	23	I	SI
	20	26	I	TI		21	19	I	OD
	20	52.0	II	ER	18	0	53.2	I	ER
	21	33	I	SI		19	52	I	SI
	22	42	I	Te		20	33	II	Se
	23	50	I	Se		20	54	I	Te
3	21	2.4	I	ER		22	8	I	Se
5	20	3	III	TI	19	1	7	IV	SI
	23	40	III	Te		19	22.1	I	ER
6	0	48	III	SI	23	21	6	III	OR
7	23	18	II	TI		22	37.0	III	ED
8	1	43	II	SI		23	14	II	OD
	2	10	II	Te	24	23	13	I	OD
9	0	58	I	OD	25	20	17	II	SI
	22	17	I	TI		20	31	I	TI
	23	26.8	II	ER		20	35	II	Te
	23	28	I	SI		21	46	I	SI
10	0	33	I	Te		22	48	I	Te
	1	44	I	Se		23	11	II	Se
19		26	I	OD	26	0	2	I	Se
	21	41.5	IV	ER		21	17.6	I	ER
	22	57.8	I	ER		22	36	IV	OD
11	20	13	I	Se	30	21	25	III	OD

MAY

2	20	20	II	TI	13	21	44	IV	OR
	22	26	I	TI	17	23	21	I	OD
	22	55	II	SI	18	19	48	III	TI
	23	12	II	Te		20	21	II	OD
	23	41	I	SI		20	47	I	TI
3	0	42	I	Te		21	59	I	SI
	19	37	I	OD		23	3	I	Te
	23	13.0	I	ER		23	25	III	Te
4	20	21	III	Se	19	21	32.6	I	ER
	20	26	I	Se	20	20	23	II	Se
	20	28.4	II	ER	25	22	44	I	TI
5	23	54	IV	Se		23	0	II	OD
9	22	59	II	TI	26	19	58	I	OD
10	0	22	I	TI	27	20	7	II	SI
	21	33	I	OD		20	37	II	Te
11	20	5	I	SI		20	39	I	Se
	20	45	III	SI		23	0	II	Se
	21	7	I	Te	29	22	14.7	III	ER
	22	21	I	Se	30	22	57.8	IV	ED
	23	3.1	II	ER					

JUNE

2	21	57	I	OD	11	21	47.4	I	ER
3	20	17	I	SI	16	20	17	III	Se
	20	29	II	TI		21	53.3	IV	ER
	21	28	I	Te	18	20	26	I	OD
	22	34	I	Se	19	20	29	II	OD
	22	44	II	SI		20	52	I	Se
5	20	4.6	II	ER	21	20	12	II	Se
	21	48	III	OR	23	20	41	III	Te
	22	36.1	III	ED		20	41	III	SI
7	21	9	IV	TI	24	21	42	IV	Te
10	21	10	I	TI	26	20	30	I	SI
	22	12	I	SI	28	21	8	II	Te

JULY

d	h	m			d	h	m		
5	21	2	II	TI	18	20	18	III	OD
12	20	26	I	Te	19	20	10	I	TI

SEPTEMBER

25	5	3	I	Se	25	5	9.9	IV	ED

OCTOBER

2	4	24	III	SI		5	13	I	Se
	4	40	I	SI	19	3	24	I	OR
	5	19	I	TI	20	5	44.9	III	ER
3	4	56	I	OR	24	4	30	II	TI
10	3	52.9	I	ED		5	29	II	Se
11	4	6	I	Te	25	4	50	I	SI
12	3	48.1	IV	ER		5	47		TI
13	5	3	III	OR	26	5	22	I	OR
15	5	0.6	II	ED	29	2	49	IV	OD
17	4	36	II	Te	31	3	48	III	Te
	5	46.2	I	ED		5	12	II	SI
18	3	48	I	TI					

NOVEMBER

2	4	0.8	I	ED		2	15.1	I	ED
	4	31	II	OR		2	25	II	Se
3	3	29	I	Se		4	41	II	Te
	4	31	I	Te		5	41	I	OR
6	5	30	IV	Se	19	1	44	I	Se
7	3	42	III	Se		2	54	I	Te
	4	40	III	TI	23	6	24	IV	TI
9	2	6.0	II	ED	25	1	31.1	III	ER
	5	53.9	I	ED		2	8	II	SI
10	3	6	I	SI		3	2	III	OD
	4	12	I	TI		4	8.0	I	ED
	5	22	I	Se		4	30	II	TI
	2	2	II	Te		4	57	II	Se
11	3	45	I	OR		6	20	III	OR
14	4	13	III	SI	26	1	21	I	SI
15	2	29	IV	OR		2	34	I	TI
16	4	41.8	II	ED		3	38	I	Se
17	4	59	I	SI		4	49	I	Te
	6	9	I	TI	27	1	58	II	OR
18	1	53	II	TI		2	5	I	OR
	2	14	III	OR					

DECEMBER

1	5	7.4	IV	ED	19	1	30	I	SI
2	2	1.4	III	ED		2	43	I	TI
	4	41	II	SI		3	46	I	Se
	5	27.8	III	ER		4	59	I	Te
	6	0.9	I	ED	20	0	3	III	SI
3	3	15	I	SI		1	27	II	TI
	4	29	I	TI		1	52	II	Se
	5	31	I	Se		2	12	I	OR
4	3	59	I	OR		3	25	III	Se
	4	36	II	OR		4	13	II	Te
5	1	13	I	Te		5	4	III	TI
9	5	58.5	III	ED	25	6	7.6	I	ED
10	0	49	IV	TI	26	3	24	I	SI
	4	34	IV	Te		4	35	I	TI
	5	8	I	SI		5	40	I	Se
	6	22	I	TI		6	50	I	Te
11	1	46.9	II	ED		6	54	IV	SI
	2	21.9	I	ED	27	0	35.8	I	ED
	5	52	I	OR		1	36	II	SI
12	0	51	I	TI		3	56	II	TI
	1	53	I	Se		4	1	III	SI
	3	6	I	Te		4	2	I	OR
13	0	20	I	OR		4	25	II	Se
	1	10	III	TI		6	42	II	Te
	1	43	II	Te	28	0	8	I	Se
	4	20	III	Te		1	18	I	Te
18	3	30.6	IV	ER	29	1	33	II	OR
	4	14.8	I	ED	31	1	50	III	OR
	4	22.8	II	ED					

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

SATELLITES OF THE SOLAR SYSTEM

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

DOUBLE STARS

Even with telescopes of small aperture it is possible to resolve a comparatively large number of double stars, and hence this kind of observation has much interest for the amateur. It permits one, also, to determine the optical value of the instrument he employs, as the power to separate the images is directly proportional to the diameter of the objective.

The usual test of excellence is that an objective of one-inch diameter should be able to separate star images at a distance of 4″·56 between their centres. This power should vary according to the following table:—

Diam. of Objective	1 in.	2 in.	3 in.	4 in.	5 in.	6 in.	10 in.	20 in.	40 in.
Limiting distance between stars	4″·56	2″·28	1″·52	1″·14	0″·91	0″·76	0″·45	0″·23	0″·11

In choosing a double-star for testing a telescope care should be taken that a binary, with varying distance between the components, be not selected.

I. THE MOST LUMINOUS PAIRS

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

II. THE FINEST COLORED PAIRS

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

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

A SHORT LIST OF VARIABLE STARS

PREPARED BY THE LATE J. MILLER BARR.

The brighter of the following stars can be found on any ordinary star map; for the others a good star-atlas will be required. The times of maxima and minima are given in *Popular Astronomy* (monthly) and in the "Companion" to the *Observatory*.

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

Several attempts have been made to classify the variable stars; but a scientific system of classification, in harmony with the chief deductions of theory as well as the facts of observation, is still wanting. The best

known system is that formulated by Professor E. C. Pickering in 1880, and reproduced (with slight additions) in his "Provisional Catalogue of Variable Stars" (1903). This includes five classes, two of which are subdivided, as follows:—

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

THE STARS

THEIR DISTANCES, VELOCITIES, SPECTRAL TYPES, ETC.

PREPARED BY W. E. HARPER.

The accompanying table contains the chief known facts regarding 276 stars and 13 nebulæ. The first 256 stars are those listed as brighter than 3.51 visual magnitude in Harvard *Annals,* Vol. L. The remaining number range in magnitude from 5 to 8.6, and they and the nebulæ are given here on account of their exceptionally high radial velocities.

In the case of visual double stars, the most important of which are preceded by a ‖, the magnitude of the components combined is given. The spectral type is also taken from the publication just named. (For a brief outline of the system of notation Campbell's *Stellar Motions,* p. 31, may be consulted.) The proper motion is from Boss's *Preliminary General Catalogue,* μ being the annual motion in R. A. and μ' that in Decl. The parallax is taken from many sources, principally Kapteyn's compilations. Those in brackets are least trustworthy. To obtain the distance in light-years, divide the number given in the column into 3.26, this being the number of light-year corresponding to a parallax of 1″. For example, the parallax of α Andromeda is ″.06; its distance is therefore $3.26 \div .06 = 54$ light-years. Where the parallax is negative, it indicates that the star is farther away than the faint comparison stars used. The radial velocities are taken from various Lick Observatory *Bulletins,* and the first decimal place is given only when the velocities are fairly well determined. A * placed after the velocity indicates that the star is a spectroscopic binary, and the velocity of the system is given. About 80 of these appear. The masses are given relative to the sun. These can be determined only for visual binaries or for spectroscopic binaries which show spectra of both components. In the latter case there is also uncertainty due to lack of knowledge of the inclination of the orbital plane to the line of sight.

Star	R.A. 1900	Decl. 1900	Mag.	Type	Proper Motion μ	Proper Motion μ'	Parallax	Rad. Vel. km./sec.	Mass
	h m	° ′			s	″	″		
α Andromedæ	0 3	+28 32	2·2	A	+·010	−·16	(·06)	−13·0*	
β Cassiopeiæ	4	+58 36	2·4	F5	+·068	−·18	·074	+12·8	
τ Pegasi	8	+14 38	2·9	B2	000	−·01		+6·5*	
β Hydri	20	−77 49	2·9	G	+·702	+·32	·143	+22·8	
α Phœnicis	21	−42 51	2·4	K	+·018	−·40		+76 *	
δ Andromedæ	34	+30 19	3·5	K	+·011	−·09		+5 *	
α Cassiopeiæ	35	+55 59	2·2-2·8	K	+·006	−·03	(·04)	−3·8	
β Ceti	39	−18 32	2·2	K	+·016	+·04		+14·6	
‖γ Cassiopeiæ	51	+60 11	2·2	Bp	+·004	00	(·01)	+3 *	
β Phœnicis	1 2	−47 15	3·4	K	−·004	−·01		−0·5	
β Andromedæ	4	+35 5	2·4	Ma	+·015	−·11	(·07)	+2 *	
δ Cassiopeiæ	19	+59 43	2·8	A5	+·040	−·05	(·01)	+9·0	
‖α Ursæ Majoris	23	+88 46	2·1	F8	+·138	00	·047	−17 *	
γ Phœnicis	24	−43 50	3·4	K5	−·003	−·22		*	
α Eridani	34	−57 45	0·6	B5	+·011	−·03	·051		
ε Cassiopeiæ	47	+63 11	3·4	B5	+·006	−·02		−9	
β Arietis	49	+20 19	2·7	A5	+·007	−·11		−1·0*	
α Hydri	56	−62 3	3·0	F	+·036	+·04		−5	
‖γ Andromedæ	58	+41 51	2·2	Kp	+·004	−.05	·007	−10·7	
α Arietis	2 2	+22 59	2·2	K2	+·014	−·15	·088	−14·0	
β Trianguli	4	+34 31	3·1	A5	+·012	−·05		−2 *	
ο Ceti	14	−3 26	1·7-9·6	Md	000	−·24	·142	+62·3	
‖θ Eridani	54	−40 42	3·0	A2	−·006	+·02		*	
α Ceti	57	+3 42	2·8	Ma	−·001	−·08		−25·1	
γ Persei	58	+53 7	3·1	Gp	000	−·01		+2 *	
ρ Persei	59	+38 27	3·4-4·2	Mb	+·012	−·11	·087	+28·6	
β Persei	3 2	+40 34	2·1-3·2	B8	+·001	00	·029	+4·1*	
α Persei	17	+49 30	1·9	F5	+·003	−·03	(·09)	−2·2	
δ Persei	36	+47 28	3·1	B5	+·003	−·03			
‖η Tauri	41	+23 48	3·0	B5	+·001	−·05		+15	
ζ Persei	48	+31 35	2·9	B1	+·001	−·02		+20·4	
γ Hydri	49	−74 33	3·2	Ma	+·011	−·12		+16	
‖ε Persei	51	+39 43	3·0	B	+·002	−·03		*	
γ Eridani	53	−13 47	3·2	K5	+·005	−·11		+62·5	
λ Tauri	55	+12 12	3·3-4·2	B3	000	−·01		+10 *	
α Reticuli	4 13	−62 43	3·4	G5	+·005	+·06		+35·4	
α Tauri	30	+16 18	1·1	K5	+·005	−·19	·073	+55·1	
α Doradus	32	−55 15	3·5	Ap	+·006	00		+26·0	
π³Orionis	44	+6 47	3·3	F8	+·032	+·02		+25·0	
ι Aurigæ	50	+33 0	2·9	K2	+·001	−·03		+18·0	
ε Aurigæ	55	+43 41	3·4-4·1	F5p	000	−·01		−9 *	
η Aurigæ	5 0	+41 6	3·3	B3	+·003	−·08		+3	
ε Leporis	1	−22 30	3·3	K5	+·002	−·07		+1·1	
β Eridani	3	−5 13	2·9	A2	−·006	−·08		−15·0	

Star	R.A. 1900	Decl. 1900	Mag.	Type	Proper Motion μ	Proper Motion μ'	Parallax	Rad. vel. km./sec.	Mass
	h m	° ′			s	″	″		
μ Leporis	5 8	− 16 19	3·3	Ap	+ ·003	− ·03		+ 28·0	
‖α Aurigæ	9	+ 45 54	0·2	G	+ ·008	− ·43	·066	+ 30·2*	2·0
‖β Orionis	10	− 8 19	0·3	B8p	000	00	·007	+ 22·6*	
‖η Orionis	19	− 2 29	3·4	B1	000	00		+ 35·5*	21·8 / sin³ i
γ Orionis	20	+ 6 16	1·7	B2	000	− ·02	− ·003	+ 18	
β Tauri	20	+ 28 31	1·8	B8	+ ·002	− ·18	(·06)	+ 11	
ζ Leporis	24	− 20 50	3·0	G	000	− ·09		− 13·7	
‖δ Orionis	27	− 0 22	2·4	B	000	00		+ 23·1*	
α Leporis	28	− 17 54	2·7	F	000	00		+ 24·9	
‖ι Orionis	31	− 5 59	2·9	Oe5	000	00		+ 21·3*	
ϵ Orionis	31	− 1 16	1·8	B	000	00		+ 24·5*	
ζ Tauri	32	+ 21 5	3·0	B3	000	− ·03		+ 16·4*	
‖ζ Orionis	36	− 2 0	1·8	B	000	− ·01		+ 2·0	
α Columbæ	36	− 34 8	2·8	B5p	000	− ·04			
κ Orionis	43	− 9 42	2·2	B	000	00		+ 2·2	
β Columbæ	47	− 35 48	3·2	K	+ ·004	+ ·39		+ 89·2	
α Orionis	50	+ 7 23	1·0-1·4	Ma	+ ·002	+ ·01	·030	+ 21 *	
β Aurigæ	52	+ 44 56	2·1	Ap	− ·004	00	·014	− 18·1*	4·4 / sin³ i
‖θ Aurigæ	53	+ 37 12	2·7	Ap	+ ·004	− ·09		+ 28·5*	
‖η Geminorum	6 9	+ 22 32	3·2-4·2	Ma	− ·004	− ·02	·044	*	
ζ Canis Majoris	17	− 30 1	3·1	B3	+ ·001	00		+ 24 *	
μ Geminorum	17	+ 22 34	3·2	Ma	+ ·004	− ·11		+ 54·6	
β Canis Majoris	18	− 17 54	2·0	B1	000	00		+ 33·7*	
α Carinæ	22	− 52 38	− 0·9	F	+ ·002	+ ·01	·007	+ 20·8	
γ Geminorum	32	+ 16 29	1·9	A	+ ·003	− ·05		− 11·0*	
ν Puppis	35	− 43 6	3·2	B8	000	− ·02		+ 26 *	
ϵ Geminorum	38	+ 25 14	3·2	G5	000	− ·02		+ 9·6	
ξ Geminorum	40	+ 13 0	3·4	F5	− ·008	− ·20		+ 27	
‖α Canis Majoris	41	− 16 35	− 1·6	A	− ·037	− 1·21	·376	− 7·4*	3·4
α Pictoris	47	− 61 50	3·3	A5	− ·011	+ ·26			
τ Puppis	47	− 50 30	2·8	K	+ ·003	− ·09		+ 37 *	
‖ϵ Canis Majoris	55	− 28 50	1·6	B1	000	00		+ 29·2	
ζ Geminorum	58	+ 20 43	3·7-4·3	G	000	− ·01		+ 6·8*	
o^2 Canis Majoris	59	− 23 41	3·1	B5p	000	− ·01		+ 49 *	
δ Canis Majoris	7 4	− 26 14	2·0	F8p	000	00		+ 35·5*	
L^2 Puppis	10	− 44 29	3·4-6·2	Md	+ ·009	+ ·32			
π Puppis	14	− 36 55	2·7	K5	− ·001	00		+ 16·4	
β Canis Minoris	22	+ 8 29	3·1	B8	− ·003	− ·04			
σ Puppis	26	− 43 6	3·3	K5	− ·006	+ ·18			
‖α Geminorum	28	+ 32 6	1·6	A	− ·014	− ·11	·069	− 1·0* + 6·2	4·8 ±
‖α Canis Minoris	34	+ 5 29	0·5	F5	− ·047	− 1·03	·324	− 0·5*	1·3
β Geminorum	39	+ 28 16	1·2	K	− ·047	− ·06	·064	+ 3·9	
ξ Puppis	45	− 24 37	3·5	G	000	00		+ 4·2	
ζ Puppis	8 0	− 39 43	2·3	Od	− ·003	+ ·01			
ρ Puppis	3	− 24 1	2·0	F5	− ·006	+ ·04		+ 4·6*	

Star	R.A. 1900	Decl. 1900	Mag.	Type	Proper Motion μ	Proper Motion μ'	Parallax	Rad. Vel. km./sec.	Mass
	h m	° ′			s	″	″		
‖γ Velorum	8 6	−47 3	2·2	Oap	000	00			
ϵ Carinæ	20	−59 11	1·7	Kp	−·004	+·01		+12	
o Urs. Majoris	22	+61 3	3·5	G	−·017	−·11	·087	+19·4	
‖ϵ Hydræ	41	+6 47	3·5	F8	−·013	−·05	(·25)	+37 *	3·3
δ Velorum	42	−54 20	2·0	A	+·003	−·09			
ζ Hydræ	50	+6 20	3·3	K	−·007	+·01		+23·1	
ι Urs. Majoris	52	+48 26	3·1	A5	−·044	−·25	·061	+6·0	
λ Velorum	9 4	−43 2	2·2	K5	−·002	00		+19·2	
β Carinæ	12	−69 18	1·8	A	−·031	+·10		−14·0	
ι Carinæ	14	−58 51	2·2	F	−·003	00		+13·3	
α Lyncis	15	+34 49	3·3	K5	−·018	+·01	−·057	+38·6	
κ Velorum	19	−54 35	2·6	B3	−·002	00		+21·9*	
α Hydræ	23	−8 14	2·2	K2	−·001	+·03		−3·5	
θ Urs. Majoris	26	+52 8	3·3	F8	−·103	−·55	·092	+15·7	
N Velorum	28	−56 36	3·0	K5	−·005	00		−13·5	
ϵ Leonis	40	+24 14	3·1	Gp	−·003	−·02		+5·0	
‖υ Carinæ	45	−64 36	3·1	F	−·003	+·01		+13·8	
α Leonis	10 3	+12 27	1·3	B8	−·017	00	·033		
q Carinæ	14	−60 50	3·4	K5	−·006	−·01		+8·3	
‖γ Leonis	14	+20 21	2·3	K	+·022	−·18	−·035	−35	
μ Urs. Majoris	16	+42 0	3·2	K5	−·007	+·02	·051	*	
θ Carinæ	39	−63 52	3·0	B	−·003	+·01		+16	
η Carinæ	41	−59 10	1·0–7·4	Pec.	000	00			
μ Velorum	42	−48 54	2·8	G5	+·005	−·06		+7·4	
ν Hydræ	45	−15 40	3·3	K	+·006	+·19		−1·1	
β Urs. Majoris	56	+56 55	2·4	A	+·010	+·03	(·08)	−16·8*	
α Urs. Maj.	58	+62 17	2·0	K	−·017	−·07		*	
ψ Urs. Majoris	11 4	+45 2	3·2	K	−·006	−·04		−3·4	
δ Leonis	9	+21 4	2·6	A2	+·011	−·14			
θ Leonis	9	+15 59	3·4	A	−·004	−·09		+7·7	
λ Centauri	31	−62 28	3·3	B9	−·006	−·02		+11	
β Leonis	44	+15 8	2·2	A2	−·034	−·12	·129	−4·0	
γ Urs. Majoris	49	+54 15	2·5	A	+·011	00		−9	
δ Centauri	12 3	−50 10	2·9	B3p	−·004	−·02			
ϵ Corvi	5	−22 4	3·2	K	−·005	+·01		+4·8	
δ Crucis	10	−58 12	3·1	B3	−·006	−·02		+25	
δ Urs. Majoris	10	+57 35	3·4	A2	+·014	00			
γ Corvi	11	−16 59	2·8	B8	−·011	+·01		−7 *	
α Crucis	21	−62 33	1·0	B1	−·007	−·02	·055	+7	
‖δ Corvi	25	−15 58	3·1	A	−·014	−·14			
γ Crucis	26	−56 33	1·5	Mb	+·002	−·27		+22	
β Corvi	29	−22 51	2·8	G5	000	−·06		−7·1	
α Muscæ	31	−68 35	2·9	B3	−·006	−·02		+13·5	
γ Centauri	36	−48 24	2·4	A	−·020	−·02		−7·0	
‖γ Virginis	36	−0 54	2·9	F	−·038	00	·058	−20·0	

Star	R.A. 1900	Decl. 1900	Mag.	Type	Proper Motion		Parallax	Rad. Vel. km./sec.	Mass
					μ	μ'			
	h m	° ′			s	″	″		
β Muscæ	12 40	− 67 34	3·3	B3	− ·005	− ·03			
β Crucis	42	− 59 9	1·5	B1	− ·006	− ·03	·008	+ 13	
ϵ Urs. Majoris	50	+ 56 30	1·7	Ap	+ ·014	− ·01	(·08)	− 10·0*	
‖α Can. Venat.	51	+ 38 51	2·8	Ap	− ·020	+ ·04		− 2·0	
ϵ Virginis.	57	+ 11 30	3·0	K	− ·018	+ ·02		− 13·2	
γ Hydræ	13 13	− 22 39	3·3	G5	+ ·005	− ·05		− 5·6	
ι Centauri	15	− 36 11	2·9	A2	− ·028	− ·09		+ 2·0	
‖ζ Urs. Majoris	20	+ 55 27	2·2	A	+ ·016	− ·04	·033	{ − 10·0* / − 12·5	
α Virginis	20	− 10 38	1·2	B2	− ·003	− ·04	− ·012	+ 1·6	15·4 / sin³ i
ζ Virginis	30	− 0 5	3·4	A2	− ·019	+ ·03			
ϵ Centauri	34	− 52 57	2·6	B1	− ·003	− ·03		+ 6	
η Urs. Majoris	44	+ 49 49	1·9	B3	− ·012	− ·02	(− ·05)	− 6	
μ Centauri	44	− 41 59	3·3	B2p	− ·002	− ·02		+ 12·6	
ζ Centauri	49	− 46 48	3·1	B2p	− ·006	− ·05			
η Boötis	50	+ 18 54	2·8	G	− ·004	− ·37		− 0·2*	
β Centauri	57	− 59 53	0·9	B1	− ·004	− ·03	·037	+ 12	
τ Hydræ	14 1	− 26 12	3·5	K	+ ·003	− ·16		+ 27·3	
θ Centauri	1	− 35 53	2·3	K	− ·044	− ·53		+ 1·5	
α Boötis	11	+ 19 42	0·2	K	− ·078	− 2·00	·075	− 3·9	
γ Boötis	28	+ 38 45	3·0	F	− ·010	+ ·14		− 35	
η Centauri	29	− 41 43	2·6	B3p	− ·003	− ·04		0	
‖α Centauri	33	− 60 25	0·0	{ G / K5	− ·487	+ ·73	·759	− 22·2	1·9
α Circini	34	− 64 32	3·4	F	− ·031	− ·24			
α Lupi	35	− 46 58	2·9	B2	− ·002	− ·03		+ 8 *	
‖ϵ Boötis	41	+ 27 30	2·6	K	− ·004	+ ·01		− 16·4	
‖α^2 Libræ	45	− 15 38	2·9	A2	− ·007	− ·08		*	
β Urs. Minoris	51	+ 74 34	2·2	K5	− ·007	00	(·02)	+ 17·2	
β Lupi	52	− 42 44	2·8	B2p	− ·004	− ·05		0 *	
κ Centauri	53	− 41 42	3·4	B3	− ·002	− ·03		+ 10	
σ Libræ	58	− 24 53	3·4	Mb	− ·006	− ·06		− 3·5	
ζ Lupi	15 5	− 51 43	3·5	K	− ·012	− ·07		− 9·4	
γ T Australis	10	− 68 19	3·1	A	− ·011	− ·02			
β Libræ	12	− 9 1	2·7	B8	− ·007	− ·03			
δ Lupi	15	− 40 17	3·4	B2	− ·001	− ·03			
γ Urs. Minoris	21	+ 72 11	3·1	A2	− ·003	+ ·01	(·04)	− 8	
ι Draconis	23	+ 59 19	3·5	A	− ·001	+ ·01		− 10·0	
γ Lupi	28	− 40 50	3·0	B3	− ·001	− ·04			
α Cor. Borealis	30	+ 27 3	2·3	A	+ ·009	− ·10	(− ·04)	+ 0·4*	
α Serpentis	39	+ 6 44	2·8	K	+ ·009	+ ·04		+ 3·4	
β T Australis	46	− 63 7	3·0	F	− ·030	− ·39			

Star	R.A. 1900	Decl. 1900	Mag.	Type	Proper Motion μ	Proper Motion μ'	Parallax	Rad. vel. km./sec.	Mass
	h m s	° ′ ″			s	″	″		
π Scorpii	15 53	−25 50	3·0	B2p	−·001	−·04		*	
δ Scorpii	54	−22 20	2·5	B	−·001	−·04		*	
‖β Scorpii	1 0	−19 32	2·8	B1	−·002	−·03		*	
δ Ophiuchi	9	− 3 26	3·0	Ma	−·003	−·15		−19·5	
ϵ Ophiuchi	13	− 4 27	3·3	K	+·005	+·03		− 9·2	
‖σ Scorpii	15	−25 21	3·1	B1	−·001	−·03		*	
‖η Draconis	23	+61 44	2·9	G5	−·002	+·06		−14·0	
‖α Scorpii	23	−26 12	1·2	Map	000	−·03	·029	− 3 *	
β Herculis	26	+21 42	2·8	K	−·008	−·02		−25·5*	
τ Scorpii	30	−28 1	2·9	B	−·001	−·04		+ 1·5	
ζ Ophiuchi	32	−10 22	2·7	B	+·001	+·02			
‖ζ Herculis	38	+31 47	3·0	G	−·036	+·38	·142	−70 *	
α T Australis	38	−68 51	1·9	K2	+·003	−·03		− 3·6	
ϵ Scorpii	44	−34 7	2·4	K	−·050	−·26		− 2·2	
μ' Scorpii	45	−37 53	3·1	B3p	−·001	−·03		*	
ζ Aræ	50	−55 50	3·1	Ma	−·003	−·04		− 6·6	
κ Ophiuchi	53	+ 9 32	3·4	K	−·020	−·01		−55·9	
‖η Ophiuchi	17 5	−15 36	2·6	A	+·002	+·09		− 1·0	
η Scorpii	5	−43 6	3·4	F2	+·002	−·29		−28	
ζ Draconis	8	+65 50	3·2	B5	−·002	+·02		−14·7	
‖α Herculis	10	+14 30	3·1–3·9	Mb	−·001	+·03		−32·2	
δ Herculis	11	+24 57	3·2	A	−·002	−·16	(·05)		
π Herculis	12	+36 55	3·4	K2	−·002	00	(·11)	−25·6	
θ Ophiuchi	16	−24 54	3·4	B3	000	−·03		− 0·9	
β Aræ	17	−55 26	2·8	K2	−·002	−·03		− 1·2	
υ Scorpii	24	−37 13	2·8	B3	000	−·04		+17 *	
α Aræ	24	−49 48	3·0	B3p	−·003	−·08		+ 2 *	
λ Scorpii	27	−37 2	1·7	B2	000	−·04		+ 3	
β Draconis	28	+52 23	3·0	G	−·002	+·01		−20·5	
θ Scorpii	30	−42 56	2·0	F	000	−·01		+ 5	
α Ophiuchi	30	+12 38	2·1	A5	+·008	−·24	·074	*	
κ Scorpii	36	−38 58	2·5	B2	−·001	−·03			
β Ophiuchi	39	+ 4 37	2·9	K	−·003	+·15		−11·8	
ι' Scorpii	41	−40 5	3·1	F5p	000	00			
‖μ Herculis	43	+27 47	3·5	G5	−·024	−·75	·106	−15·6	
G Scorpii	43	−37 1	3·2	K2	+·005	+·02		+24·5	
ν Ophiuchi	54	− 9 46	3·5	K	−·001	−·12		+12·9	
γ Draconis	54	+51 30	2·4	K5	−·001	−·03	·107	−27·0	
γ Sagittarii	59	−30 26	3·1	K				+22 *	
η Sagittarii	18 11	−36 48	3·2	Mb	−·012	−·17		0·0	
δ Sagittarii	15	−29 52	2·8	K	+·003	−·04		−20·2*	

Star	R.A. 1900	Decl. 1900	Mag.	Type	Proper Motion		Parallax	Rad. Vel. km./sec.	Mass
					μ	μ'			
	h m	° ′			s	″	″		
η Serpentis	18 16	− 2 55	3·4	K	− ·038	− ·70		+ 9·5	
ϵ Sagittarii	18	− 34 26	2·0	A	− ·004	− ·13		− 11·0	
λ Sagittarii	22	− 25 29	2·9	K	− ·004	− ·19		− 43·1	
‖α Lyræ	34	+ 38 41	0·1	A	+ ·017	+ ·28	·094	− 13·8	
φ Sagittarii	39	− 27 6	3·3	B8	+ ·004	00		*	
‖β Lyræ	46	+ 33 15	3·4–4·1	B2p	000	− ·01		− 7·8*	30·6
σ Sagittarii	49	− 26 25	2·1	B3	+ ·001	− ·07		− 1	
γ Lyræ	55	+ 32 33	3·3	A	000	− ·01		− 20 *	
‖ζ Sagittarii	56	− 30 1	2·7	A2	− ·002	00		+ 26·0	
τ Sagittarii	19 1	− 27 49	3·4	K	− ·004	− ·26		*	
ζ Aquilæ	1	+ 13 43	3·0	A	− ·001	− ·10			
π Sagittarii	4	− 21 11	3·0	F2	000	− ·04		− 10·5*	
δ Draconis	13	+ 67 29	3·2	K	+ ·017	+ ·09		+ 25·6	
δ Aquilæ	21	+ 2 55	3·4	F	+ ·017	+ ·08			
‖β Cygni	27	+ 27 45	3·1	Kp	000	− ·01	− ·021	− 24 *	
γ Aquilæ	42	+ 10 22	2·8	K2	+ ·001	00		− 1·9	
‖δ Cygni	42	+ 44 53	3·0	A	+ ·005	+ ·04			
α Aquilæ	46	+ 8 36	0·9	A5	+ ·036	+ ·38	·238	− 33·0	
θ Aquilæ	20 6	− 1 7	3·4	A	+ ·002	00		− 28·0*	0·6 / sin³ i
‖β Capricorni	15	− 15 6	3·2	Gp	+ ·002	00		− 18·8*	
α Pavonis	18	− 57 3	2·1	B3	000	− ·09		+ 2·0*	
γ Cygni	19	+ 39 56	2·3	F8p	000	00	− ·106	− 5·1	
α Indi	31	− 47 38	3·2	K	+ ·004	+ ·06		− 1·7	
α Cygni	38	+ 44 55	1·3	A2	000	00	− ·004	− 4·0	
ϵ Cygni	42	+ 33 36	2·6	K	+ ·020	+ ·32	− ·182	− 10 *	
ζ Cygni	21 9	+ 29 49	3·4	K	000	− ·06		+ 17 *	
α Cephei	16	+ 62 10	2·6	A5	+ ·022	+ ·05			
β Aquarii	26	− 6 1	3·1	G	+ ·001	− ·01		+ 6·9	
β Cephei	27	+ 70 7	3·3	B1	+ ·002	00		− 5 *	
ϵ Pegasi	39	+ 9 25	2·5	K	+ ·002	00		+ 5·0	
δ Capricorni	42	− 16 35	3·0	A5	+ ·018	− ·30		*	
γ Gruis	48	− 37 50	3·2	A	+ ·009	− ·02		− 3·0	
α Aquarii	22 1	− 0 48	3·2	G	+ ·001	− ·01		+ 7·5	
α Gruis	2	− 47 27	2·2	B5	+ ·012	− ·16	·024		
α Tucanæ	12	− 60 45	2·9	K2	− ·011	− ·03		+ 41 *	
β Gruis	37	− 47 24	2·2	Mb	+ ·012	− ·02		+ 1·2	
η Pegasi	38	+ 29 42	3·1	G	+ ·001	− ·04		+ 4·3*	
α P Australis	52	− 30 9	1·3	A3	+ ·025	− ·17	·138	+ 6·7	
β Pegasi	59	+ 27 32	2·2–2·4	Mb	+ ·014	+ ·13		+ 8·4	
α Pegasi	59	+ 14 40	2·6	A	+ ·004	− ·04		*	
γ Cephei	23 35	+ 77 4	3·4	K	− ·018	+ ·16		− 42·2	

SOME LARGE RADIAL VELOCITIES

Star	R.A. 1900	Decl. 1900	Mag.	Type	Annual Motion	Parallax	Rad. Vel. km./sec.	Mass
	h m	° ′			″	″		
Groom. 211	0 56	+44 55	7·0	G4	·10		− 71	
μ Cassiopeiæ	1 2	+54 26	5·3	G5	3·8	0·11	− 97	
Lalande 1966	1 3	+61 1	8·5	F3		0·08	− 325	
Lalande 4855	2 33	+30 28	7·2	G			− 120	
Lalande 5761	3 3	+26 0	8·0	F			− 153	
W. B. 3h·617	3 35	− 3 32	7·2	F5	·78		+ 114	
T Tauri	4 16	+19 18	var.				+ 86	
Groombridge 864	4 35	+41 58	7·3	G			+ 101	
C. Z. 5h·243	5 8	−44 59	8·3	G-K	8·7	0·32	+ 242	
A.G.C. 7195	5 59	−26 17	5·2	G			+ 185	
Lalande 15290	7 48	+30 54	8·2	G			− 242	
Boss 2847	9 47	+ 2 55	5·9	A2	·20		+ 96	
Groombridge 1830	11 47	+38 26	6·5	G-K	7·0	0·10	− 97	
11 Libræ	14 45	− 1 53	5·0	K			+ 83	
AOe 14320	15 5	−15 54	9·2	Go	3·76		+ 290	
Lalande 28607	15 38	−10 39	7·3	A			− 170	
Boss 4188	16 22	− 7 22	5·4	Ma p	·18		+ 97	
W. B. 17h·514	17 30	+ 6 4	8·6	F1	·58		− 148	
ω Pavonis	18 49	−60 20	5·1	K			+ 184	
ν^2 Sagittarii	18 49	−22 47	5·0	K			− 106	
31 δ Aquilæ	19 21	+11 45	5·2	G			− 96	
Boss 4976	19 24	+28 24	4·6	K5	·17		− 87	
Lalande 37120-1	19 30	+33 0	6·6	G			− 162	
A.G.C. 27600	20 5	−36 21	5·3	K5			− 132	
AOe 20452	20 18	−21 40	8·1	Go p	1·21		− 179	
NEBULÆ								
N.G.C. 224 (Andromeda)	0 37	+40 43		G			− 330	
N.G.C. 1644	1 6	−73 44					+ 158	
N.G.C. 1068	2 38	− 0 26					+ 765 } + 1100 }	
N.G.C. 1714	4 52	−67 06					+ 301	
N.G.C. 1743	4 55	−69 21					+ 254	
N.G.C. 2070	5 39	−69 09					+ 276	
N.G.C. 2111	5 53	−69 33					+ 268	
N.G.C. 4565	12 31	+26 32						
N.G.C. 4594 (Virgo)	12 35	−11 3					1000	
N.G.C. 5866	15 4	+56 9						
N.G.C. 5873	15 6	−37 43					− 136	
N.G.C. 6644	18 26	− 25 12					+ 191	
N.G.C. 6732	18 28	−22 43					− 148	
One in Lesser Magellanic							+ 160	
Four in Greater Magellanic							+ 275	

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