Dr. J. Satterly
with compliments of
C. A. C.

THE OBSERVER'S HANDBOOK FOR 1915

PUBLISHED BY

The Royal Astronomical Society of Canada

EDITED BY C. A. CHANT

SEVENTH YEAR OF PUBLICATION

TORONTO
198 COLLEGE STREET
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1915

CALENDAR 1915

JANUARY

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

FEBRUARY

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

MARCH

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

APRIL

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

MAY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

JUNE

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

JULY

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

AUGUST

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

SEPTEMBER

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

OCTOBER

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

NOVEMBER

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

DECEMBER

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

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CONTENTS

PREFACE

The HANDBOOK for 1915 differs from that for last year chiefly in the omission of the brief review of astronomical progress, and the addition of (1) a table of double stars, (2) a table of variable stars, and (3) a table containing 272 stars and 5 nebulæ. This last table was prepared by Mr. W. E. Harper, M.A., and gives in a concise form a mass of useful and interesting information regarding the brighter stars. It will be found a valuable feature. Other minor alterations and corrections have been made which will render the work more usable.

The Editor is indebted to those whose names are mentioned in the body of the book, to Mr. R. M. Stewart, M.A., and to some of his assistants at the University of Toronto.

THE EDITOR.

TORONTO, December, 1914.

ANNIVERSARIES AND FESTIVALS, 1915

New's Year's Day	Fri.,	Jan. 1	Victoria Day	Mon.,	May 24
Epiphany	Wed.,	Jan. 6	Trinity Sunday		May 30
Septuagesima Sunday		Jan. 31	Corpus Christi	Thur.,	June 3
Quinquagesima (Shrove Sunday)		Feb. 14	St. John Baptist	Thur.,	June 24
Ash Wednesday		Feb. 17	Dominion Day	Thur.,	July 1
St. David	Mon.,	Mch. 1	Labour Day	Mon.,	Sept. 6
St. Patrick	Wed.	Mch. 17	St. Michael (Michaelmas Day)	Wed.,	Sept. 29
Palm Sunday		Mch. 28			
Good Friday		Apl. 2	All Saints Day	Mon.,	Nov. 1
Easter Sunday		Apl. 4	First Sunday in Advent		Nov. 28
St. George	Fri.,	Apl. 23	St. Andrew	Tues.,	Nov. 30
Rogation Sunday		May 9	Conception Day	Wed.,	Dec. 8
Ascension Day (Holy Thursday)		May 13	St Thomas Day	Tues.,	Dec. 21
Pentecost (Whit Sunday)		May 23	Christmas Day	Sat.,	Dec. 25

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.
$^{\circ}$ ′ ″, 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.

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.

1915, EPHEMERIS OF SUN. AT GREENWICH MEAN NOON.

Date			Right Ascension			Declination				Equation of Time +, add to −, subt. from Apparent Time			Sidereal Time or R.A. of Mean Sun		
			h	m	s		°	′	″		m	s	h	m	s
Fri.	Jan.	1	18	43	32	S.	23	4	30	+	3	18·8	18	40	13·2
Wed.	"	6	19	5	33		22	35	50		5	37·1	18	59	56·0
Mon.	"	11	19	27	24		21	55	59		7	44·7	19	19	38·8
Sat.	"	16	19	49	0		21	5	26		9	38·4	19	39	21·6
Thur.	"	21	20	10	19		20	4	48		11	15·1	19	59	4·4
Tues.	"	26	20	31	20		18	54	48		12	32·5	20	18	47·2
Sun.	"	31	20	52	0		17	36	13		13	29·6	20	38	30·0
Fri.	Feb.	5	21	12	19		16	9	49		14	6·4	20	58	12·7
Wed.	"	10	21	32	19		14	36	26		14	23·2	21	17	55·5
Mon.	"	15	21	51	59		12	56	53		14	20·9	21	37	38·3
Sat.	"	20	22	11	21		11	12	8		14	0·0	21	57	21·1
Thurs.	"	25	22	30	26		9	23	2		13	22·1	22	17	3·8
Tues.	Mar.	2	22	49	16		7	30	28		12	29·0	22	36	46·6
Sun.	"	7	23	7	53		5	35	12		11	23·4	22	56	29·4
Fri.	"	12	23	26	20		3	38	0		10	8·0	23	16	12·1
Wed.	"	17	23	44	40	S.	1	39	41		8	45·0	23	35	54·9
Mon.	"	22	0	2	54	N.	0	18	55		7	16·6	23	55	37·7
Sat.	"	27	0	21	6		2	17	1		5	45.2	0	15	20·5
Thur.	Apr.	1	0	39	17		4	13	52		4	13·4	0	35	3·2
Tues.	"	6	0	57	30		6	8	50		2	44·0	0	54	46·0
Sun.	"	11	1	15	48		8	1	11		1	19·6	1	14	28·8
Fri.	"	16	1	34	14		9	50	12	+	0	2·3	1	34	11·5
Wed.	"	21	1	52	48		11	35	8	−	1	6·3	1	53	54·3
Mon.	"	26	2	11	33		13	15	16		2	4·6	2	13	37·1
Sat.	May	1	2	30	29		14	49	56		2	51·1	2	33	19·9
Thur.	"	6	2	49	39		16	18	32		3	24·1	2	53	2·6
Tues.	"	11	3	9	3		17	40	24		3	42·7	3	12	45·4
Sun.	"	16	3	28	41		18	54	53		3	46·8	3	32	28·2
Fri.	"	21	3	48	34		20	1	22		3	36·9	3	52	11·0
Wed.	"	26	4	8	40		20	59	18		3	13·9	4	11	53·8
Mon.	"	31	4	28	58		21	48	12		2	38·9	4	31	36·6
Sat.	June	5	4	49	26		22	27	41		1	52·9	4	51	19·4
Thur.	"	10	5	10	4		22	57	22	−	0	57·9	5	11	2·1
Tues.	"	15	5	30	48		23	16	57	+	0	3·5	5	30	44·9
Sun.	"	20	5	51	36		23	26	17		1	8·1	5	50	27·7
Fri.	"	25	6	12	23		23	25	17		2	12·6	6	10	10·5
Wed.	"	30	6	33	8	N.	23	14	1	+	3	14·5	6	29	53·3

Observe that the sum of the 4th and 5th columns equals the 2nd.

1915, EPHEMERIS OF SUN. AT GREENWICH MEAN NOON.

Date			Right Ascension			Declination				Equation of Time +, add to −, subt. from Apparent Time			Sidereal Time or R.A. of Mean Sun		
			h	m	s		°	′	″		m	s	h	m	s
Mon.	July	5	6	53	48	N.	22	52	34	+	4	11·4	6	49	36·1
Sat.	"	10	7	14	20		22	21	10		5	0·8	7	9	18·9
Thur.	"	15	7	34	42		21	40	6		5	40·0	7	29	1·7
Tues.	"	20	7	54	51		20	49	49		6	6·8	7	48	44·5
Sun.	"	25	8	14	47		19	50	47		6	19·5	8	8	27·3
Fri.	"	30	8	34	27		18	43	31		6	17·4	8	28	10·0
Wed.	Aug.	4	8	53	54		17	28	31		6	0·7	8	47	52·8
Mon.	"	9	9	13	5		16	6	24		5	29·3	9	7	35·6
Sat.	"	14	9	32	2		14	37	46		4	43·4	9	27	18·4
Thur.	"	19	9	50	45		13	3	21		3	43·6	9	47	1·2
Tues.	"	24	10	9	15		11	23	49		2	31·0	10	6	43·9
Sun.	"	29	10	27	34		9	39	45	+	1	7·5	10	26	26·7
Fri.	Sept.	3	10	45	45		7	51	48	−	0	24·7	10	46	9·5
Wed.	"	8	11	3	49		6	0	38		2	3·4	11	5	52·2
Mon.	"	13	11	21	48		4	6	58		3	46·7	11	25	35·0
Sat.	"	18	11	39	45		2	11	31		5	32·7	11	45	17·8
Thur.	"	23	11	57	42	N.	0	15	0		7	18·9	12	5	0·6
Tues.	"	28	12	15	41	S.	1	41	56		9	2·3	12	24	43·3
Sun.	Oct.	3	12	33	46		3	38	38		10	40·2	12	44	26·1
Fri.	"	8	12	51	59		5	34	19		12	9·9	13	4	8·9
Wed.	"	13	13	10	22		7	28	14		13	29·3	13	23	51·6
Mon.	"	18	13	28	58		9	19	31		14	36·3	13	43	34·4
Sat.	"	23	13	47	48		11	7	25		15	28·8	14	3	17·2
Thur.	"	28	14	6	56		12	51	10		16	4·3	14	22	59·9
Tues.	Nov.	2	14	26	22		14	29	57		16	20·8	14	42	42·7
Sun.	"	7	14	46	8		16	2	54		16	17·0	15	2	25·5
Fri.	"	12	15	6	16		17	29	9		15	52·4	15	22	8·3
Wed.	"	17	15	26	44		18	47	49		15	7·0	15	41	51·1
Mon.	"	22	15	47	33		19	58	8		14	1·0	16	1	33·8
Sat.	"	27	16	8	42		20	59	22		12	35·0	16	21	16·6
Thur.	Dec.	2	16	30	9		21	46	37		10	50·3	16	40	59·4
Tues.	"	7	16	51	53		22	31	42		8	49·2	17	0	42·2
Sun.	"	12	17	13	50		23	1	38		6	35·3	17	20	25·0
Fri.	"	17	17	35	55		23	20	10		4	12·4	17	40	7·8
Wed.	"	22	17	58	6		23	27	3	−	1	44·6	17	59	50·6
Mon.	"	27	18	20	18	S.	23	22	11	+	0	44·5	18	19	33·4

Notice that the sum of the 4th and 5th columns equals the 2nd.

OCCULATIONS OF STARS BY THE MOON, 1915

PREPARED BY R. M. MOTHERWELL

The following predictions were prepared for Ottawa, and so it will be necessary for observers at other places to allow for differences in longitude and latitude. All stars down to magnitude 4·5 have been included.

Star	Mag.	Date	*Immersion		*Emersion		Position Angle	
							Immer.	Emer.
			h	m	h	m		
τ Scorpii	2·9	January 11	19	15·1	20	9·6	145	243
q Tauri	4·3	February 21	0	23·1	1	15·1	103	212
ν Leonis	4·5	March 29	9	43·6	10	53·6	132	295
τ Scorpii	2·9	April 3	14	4·7	14	22·2	180	208
ι Capricorni	4·3	May 5	14	53·2	16	00·2	42	269
π Scorpii	3·0	June 24	6	08·8	6	34·3	44	352
θ Capricorni	4·2	October 16	11	34·3			45	
ε Geminorum	3·2	November 24	8	35·6	9	27·6	123	235
17 Tauri	3·8	December 18	5	04·7	6	06·2	90	228
q Tauri	4·3	December 18	5	47·0	6	18·0	3	310
20 Tauri	4·1	December 18	5	42·6	6	49·6	52	266
ε Geminorum	3·2	December 21	17	09·2	18	08·2	88	305

* Eastern Standard Astronomical Time (Hours numbered from noon).

TIMES OF SUNRISE AND SUNSET

In the tables on pages 10 to 21 are given the times of sunrise and sunset fo 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 SKY FOR JANUARY

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	20h 13m	16h 35m	19h 21m	21h 52m	5h 47m	20h 53m	8h 5m
Decl.	22° 6′ S.	17° 30′ S.	23° 4′ S.	13° 52′ S.	22° 20′ N.	18° 9′ S.	19° 58′ N.
Transit	12·38	9·00	11·46	14·17	22·09	13·21	0·32

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 44m to 20h 52m and its Decl. changes from 23° 4′ S. to 17° 36′ S. The equation of time (see p. 6) increases from 3m 19s to 13m 30s, and on account of this rapid rise in value the time of mean noon 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 (see p. 10). The earth is nearest the sun at 1 p.m. on January 2 (see opp. page).

The Moon.— For its phases and conjunctions with the planets, see opposite page. On the 12th at 7 a.m. the moon occults τ Scorpii, (see page 8).

Mercury is in superior conjunction with the sun on the 5th, and is too close to the sun to be seen during the month.

Venus, is still a beautiful morning star and, as will be seen from the above table, crosses the meridian about 3 hours before the sun. It attains maximum brilliancy on the 2nd, at which time its stellar magnitude is − 4·4, and in a telescope magnifying 45 times it appears exactly like the moon four days old and of the same size if the latter is seen by the naked eye. (See *Young*, General Astronomy, Art. 567).

Mars, as will be seen from the above table, is still near the sun having been in conjunction with it on December 24, 1914. On the 15th it is 223 millions of miles from the earth.

Jupiter can still be seen in the S.W. as an evening star, but it is not well-placed for observation. On the opposite page is given the configuration of the satellites until the 23rd and their eclipses, etc., are given on page 46.

Saturn is still a beautiful object all night long, its stellar magnitude being about − 0·1. The rings are wide open, the southern face being visible. The planet is retrograding, and by applying the position given above to Map II. of the Constellations it will be seen that it is near the eastern boundary of Tausus.

The positions of *Uranus* and *Neptune* are given above. By referring to Maps IV. and II. of the Constellations their positions with respect to the stars can be obtained.

For the minima of Algol, see next page.

JANUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 6h 25m
			h	m	
☽Fri.	1	7h 20m·5 Full Moon; 14h ☌ ☿ ♂, ☿ 0° 48′ S.			1○324
Sat.	2	7h ♀ Greatest Brilliancy; 13h ⊕ in Perihelion;			23○14
Sun.	3	[19h 13m ☌ Ψ ☾, Ψ 2° 53′ S	5	54	312○4
Mon.	4				3○124
Tues.	5	11h ☌ ☿ ☉ Superior.			2|4○4●●
Wed.	6		2	43	21○34
Thur.	7	2h ♀ in Perihelion.			○2143
☾Fri.	8	16h 12m·6 Moon's Last Quarter.	23	32	2|1○32
Sat.	9				423○1
Sun.	10				4321○
Mon.	11		20	21	43○12
Tues.	12	6h 21m ☌ ♀ ☾, ♀ 9° 42′ N.; 9h·1 ☾ in Perigee.			4312○
Wed.	13				2|42○3
Thur.	14	22h 52m ☌ ♂ ☾, ♂ 2° 23′ N.	17	10	4○13●
●Fri.	15	9h 41m·9 New Moon; 18h ☿ Greatest Hel. Lat. S.;			41○23
Sat.	16	13h 26m ☌ ♅ ☾, ♅ 0° 52′ N. [21h 57m ☌ ☿ ☾,			243○1
Sun.	17	17h 37m ☌ 2|4 ☾, 2|4 0° 54′ S. [☿ 0° 7′ N.	13	59	321○4
Mon.	18				3○124
Tues.	19				31○24
Wed.	20	0h ☍ Ψ ☉.	10	48	2○134
Thur.	21	5h ☌ ☿ ♅, ☿ 1° 20′ S.			○3|4●●
Fri.	22				1○234
☽Sat.	23	0h 32m·3 Moon's First Quarter.	7	37	2|12○14
Sun.	24	3h·7 Moon in Apogee.			
Mon.	25				
Tues.	26		4	26	
Wed.	27	12h 59m ☌ ♄ ☾, ♄ 5° 37′ S.			
Thur.	28				
Fri.	29	0h ♀ Greatest Hel. Lat. N.	1	15	
☽Sat.	30	1h 34m ☌ Ψ ☾, Ψ 2° 56′ S.; 23h 41m·3 Full Moon.			
Sun.	31		22	3	

Invisible on account of proximity to sun.

Key to Symbols.—☌ Conjunction; ☍ Opposition; □ Quadrature; ☊ Ascending Node; ☋ Descending Node; ☉ Sun; ☿ Mercury; ♀ Venus; ⊕ Earth; ♂ Mars; 2|4 Jupiter; ♄ Saturn; ♅ Uranus; Ψ Neptune. For Jupiter's satellites the circle ○ represents the disc of the planet; 2|4 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.

THE SKY FOR FEBRUARY

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	22h 32m	18h 39m	21h 2m	22h 20m	5h 40m	21h 0m	8h 2m
Decl.	6° 1′ S.	20° 13′ S.	18° 2′ S.	11° 20′ S.	22°23′ N.	17° 40′ S.	20° 8′ N.
Transit	12·54	9·01	11·24	12·42	20·01	11·23	22·22

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

The Sun. — During February the sun's R.A. increases from 20h 56m to 22h 42m, and the Decl. changes from 17° 20′ S. to 8° 16′ S. The equation of time reaches its maximum value 14m 25s on the 12th. See table on page 6. On the 13th there is an annular eclipse, invisible in Canada. (See page 53).

The Moon.— For its phases and conjunctions with the planets, see opposite page. The moon occults q Tauri on 21st (see page 8).

Mercury reaches greatest elongation, 18° 14′ E., on the 6th, and as this is a good time of the year to observe an eastern elongation the planet should be visible in the west just after sunset for some days before and after the date given. It will appear like a first-magnitude star. It reaches inferior conjunction on the 21st (see opposite page).

Venus continues a prominent morning star and on the 15th has still a stellar magnitude − 4·0. See remarks on Venus for January. On the 13th it attains its greatest elongation west (see opposite page).

Mars is slowly separating from the sun and at the same time approaching the earth from which on the 15th it is distant 218 millions of miles. It will be months before it will be suitably placed for observation.

Jupiter during the month is too near the sun for observation. It reaches conjunction on the 24th (see opposite page).

Saturn, as seen in the above table, is on the meridian at about 8 p.m. and hence is well-placed for observation. From the R.A. and Decl. there given, it is seen to be slightly west of its position last month. It continues retrograding until the 26th when it becomes stationary and after that it will move eastward.

The positions of *Uranus* and *Neptune* are given in the above table. See note for January.

The minima of Algol are given on the opposite page.

FEBRUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites
			h	m	
Mon.	1	9h ☌ ☊ ☉.			
Tues.	2	2h ☌ ☿ ♃, ☿ 0° 33′ N.			
Wed.	3	18h ☿ in ♌.	18	52	
Thur.	4				
Fri.	5	[W. 46° 54′.			
Sat.	6	1h ☿ Greatest Elong. E. 18° 14′; 13h ♀ Greatest Elong.	15	41	
☾Sun.	7	0h 10m·9 Moon's Last Quarter; 8h·3 ☾ in Perigee.			
Mon.	8	9h ☿ in Perihelion.			
Tues.	9		12	30	
Wed.	10	6h 42m ☌ ♀ ☾, ♀ 7° 30′ N.			
Thur.	11	23h ☿ Stationary. [in Canada.			
Fri.	12	23h 5m ☌ ♂ ☾, ♂ 0° 24′ N. [Annular Eclipse invis.	9	19	
●Sat.	13	1h 29m ☌ ☊ ☾, ☊ 0° 43′ N.; 23h 31m New Moon; ☉			
Sun.	14	15h 27m ☌ ♃ ☾, ♃ 1° 37′ S.; 19h ☌ ♂ ☊, ♂ 0° 27′ S.;			
Mon.	15	[22h 15m ☌ ☿ ☾, ☿ 2° 4′ N.	6	8	
Tues.	16				
Wed.	17				
Thur.	18	11h ☌ ☿ ♃, ☿ 4° 44′ N.; 16h ☿ Greatest Hel. Lat. N.	2	57	
Fri.	19				
Sat.	20		23	46	
☽Sun.	21	0h·9 ☾ in Apogee; 7h ♄ in Perihelion; 13h ☌ ☿ ☉			
Mon.	22	[Inferior; 21h 58m·3 Moon's First Quarter.			
Tues.	23	20h 14m ☌ ♄ ☾, ♄ 5° 35′ S.	20	35	
Wed.	24	10h ☌ ♃ ☉.			
Thur.	25				
Fri.	26	0h ♄ Stationary; ☌ ♆ ☾, ♆ 3° 0′ S.	17	24	
Sat.	27				
Sun.	28				

Invisible on account of proximity to sun.

Key to Symbols.—☌ Conjunction; ☍ Opposition; □ Quadrature; ☊ Ascending Node; ☋ Descending Node; ☉ Sun; ☿ Mercury; ♀ Venus; ⊕ Earth; ♂ Mars; ♃ Jupiter; ♄ Saturn; ♅ Uranus; ♆ Neptune. For Jupiter's satellites the circle ○ 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.

THE SKY FOR MARCH

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	21h 56m	20h 50m	22h 28m	22h 46m	5h 41m	21h 6m	7h 59m
Decl.	12° 49′ S.	16° 58′ S.	10° 50′ S.	8° 53′ S.	22° 29′ N.	17° 16′ S.	20° 15′ N.
Transit	10·28	9·21	11·00	11·13	18·12	9·39	20·30

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 46m and its Decl. 7° 53′ S. It reaches the equator on the 21st (see opposite page) and on the 31st its R.A. is 0h 36m, Decl. 3° 51′ N. During the month the equation of time changes from 12m 41s to 4m 32s. See table on page 6.

The Moon.— For its phases and conjunctions with the planets, see opposite page. On the 29th the moon occults ν Leonis, (see page 8).

Mercury is stationary on the 5th and reaches greatest elongation, 27° 44′ W., on the 20th. About this time it should be visible as a morning star as it rises about an hour and a half before the sun.

Venus is still a prominent morning star. By marking on Map IV. of the Constellations the positions of Mercury and Venus as given for the 15th in the above table it will be seen that they are both in the constellation Capricornus, Venus being about 16° west and south of Mercury. On the 20th the stellar magnitude of Mercury is 0·4 and that of Venus −3·7. They should both be seen as morning stars for some days before and after the 20th.

Mars, on the 15th is 212 millions of miles from the earth, and the above table shows that it is in Aquarius (Map IV. of the Constellations) but it is still unfavorably placed for observation.

Jupiter during the month is not well placed for observation.

Saturn, is on the meridian at about 6 p.m. and so can still be seen during the evening. It is now moving eastward, is still in Taurus, and its stellar magnitude is 0·2, the same as Arcturus.

The positions of *Uranus* and *Neptune* are given in the above table. See note for January.

The minima of Algol are given on the opposite page.

MARCH

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 5h 15m
			h	m	
♋Mon.	1	2h ☌ ☿ ♂, ☿ 4° 14′ N.; 13h 32m·6 Full Moon.	14	13	
Tues.	2				
Wed.	3				
Thur.	4	22h·0 ☾ in Perigee.	11	2	
Fri.	5	19h ☿ Stationary.			
Sat.	6				
Sun.	7		7	51	
☾Mon.	8	7h 27m·6 Moon's Last Quarter.			
Tues.	9				
Wed.	10	[Lat. S.	4	40	
Thur.	11	20h 32m ☌ ♀ ☾, ♀ 3° 0′ N.; 21h ☍ Greatest Hel.			
Fri.	12	11h 15m ☌ ♁ ☾, ♁ 0° 33′ N.			
Sat.	13	8h 44m ☌ ☿ ☾, ☿ 0° 16′ N.	1	29	
Sun.	14	1h 32m ☌ ♂ ☾, ♂ 1° 59′ S.; 3h ☿ in ♉; 12h 13m			
♎Mon.	15	14h 42m·3 New Moon. [☌ ♃ ☾, ♃ 2° 20′ S.	22	18	
Tues.	16				
Wed.	17	4h □ ♄ ☉.			
Thur.	18		19	7	
Fri.	19	1h ☌ ♀ ♁, ♀ 1° 10′ N.			
Sat.	20	10h ☿ Greatest Elong. W. 27° 44′; 20h·2 ☾ in Apogee.			
Sun.	21	11h 51m ☉ enters Aries, Spring commences.	15	56	
Mon.	22				
☽Tues.	23	5h 38m ☌ ♄ ☾, ♄ 5° 22′ S.; 17h 48m Moon's First			
Wed.	24	8h ☿ in Aphelion. [Quarter.	12	45	
Thur.	25	18h 12m ☌ ♆ ☾, ♆ 2° 55′ S.			
Fri.	26	2h ♀ in ♉.			
Sat.	27		9	33	○234●
Sun.	28				21○34
Mon.	29	20h ☌ ☿ ♃, ☿ 1° 18′ S.			32○14
Tues.	30		6	22	31○24
♋Wed.	31	0h 37m·7 Full Moon.			♃3○14

Invisible on account of proximity to sun.

Key to Symbols.—☌ Conjunction; ☍ Opposition; □ Quadrature; ☊ Ascending Node; ☋ Descending Node; ☉ Sun; ☿ Mercury; ♀ Venus; ⊕ Earth; ♂ Mars; ♃ Jupiter; ♄ Saturn; ♁ Uranus; ♆ Neptune. For Jupiter's satellites the circle ○ 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.

THE SKY FOR APRIL

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	0h 33m	23h 11m	23h 58m	23h 12m	5h 49m	21h 11m	7h 59m
Decl.	1° 8′ N.	6° 26′ S.	1° 24′ S.	6° 14′ S.	22° 37′ N.	16° 55′ S.	20° 18′ N.
Transit	11·03	9·41	10·28	9·42	16·18	7·42	18·27

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 rapidly increase in length. On the 1st the R. A. 0h 39m, Decl. 4° 14′ N.; on the 30th the R. A. is 2h 27m, Decl. 14° 31′ N. For the equation of time see page 6.

The Moon—For its phases and conjunctions with the planets, see opposite page. On the 4th at about 2 a.m. the moon occults τ Scorpii.

Mercury during the month continually moves in towards the sun, reaching superior conjunction on May 1. Hence it cannot be well observed during April.

Venus still rises about two and a half hours before the sun and hence is well seen as a morning star. Its stellar magnitude is about − 3·5.

Mars, as seen from the above table, crosses the meridian about an hour and a half before the sun and so is a morning star. From the table its position (on Map IV. of the Constellations) can be marked, and it will be found to be in Pisces. But the planet is still (on the 15th) 206 millions of miles from the earth, and hence is a faint object.

Jupiter is now well seen as a morning star. It is very near Venus, the two being in conjunction on the 15th (see opposite page). As the stellar magnitude of Jupiter is − 2·4, the appearance of the two bodies at this time of the month should be very beautiful. For the configuration of the satellites, see opposite page and for their eclipses, etc., see page 46.

Saturn, now crosses the meridian soon after 4 p.m. (see above table) and sets rather too early for good evening observations.

The positions of *Uranus* and *Neptune* are given in the above table. See note for January.

The minima of Algol are given on the opposite page.

APRIL

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 4h 53m
			h	m	
Thur.	1	18h·6 ☾ in Perigee.			21C34
Fri.	2		3	11	24O123
Sat.	3	21h ☌ ☿ ♂, ☿ 1° 25′ S.			41O23
Sun.	4				24O23
Mon.	5	11h ♂ in Perihelion.	0	0	432O1
☾Tues.	6	15h 12m·4 Moon's Last Quarter.			431O2
Wed.	7		20	49	43O21
Thur.	8	19h ☌ ♅ ☾, ♅ 0° 18′ N.; 19h ♆ Stationary.			421O●
Fri.	9				4O213
Sat.	10	22h 6m ☌ ♀ ☾, ♀ 2° 36′ S.	17	38	1O23●
Sun.	11	7h 9m ☌ 24 ☾, 24 3° 6′ S.			2O143
Mon.	12	5h 4m ☌ ♂ ☾, ♂ 4° 12′ S.; 20h 48m ☌ ☿ ☾, ☿ 6° 14′ S.			23O4●
Tues.	13	17h ☿ Greatest Hel. Lat. S.	14	27	31O24
●Wed.	14	6h 35m·7 New Moon.			3O214
Thur.	15	11h ☌ ♀ 24, ♀ 0° 9′ S.			213O4
Fri.	16		11	16	O134●
Sat.	17	10h·6 ☾ in Apogee.			1O234
Sun.	18	15h □ ♆ ◍.			2C143
Mon.	19	16h 23m ☌ ♄ ☾, ♄ 5° 0′ S.	8	5	243O●
Tues.	20				341C2
Wed.	21				43O12
☽Thur.	22	2h 25m ☌ ♆ ☾, ♆ 2° 41′ S.; 10h 39m·1 Moon's First	4	54	4213O
Fri.	23	[Quarter.			42O13
Sat.	24				41O23
Sun.	25		1	43	42O13
Mon.	26				24421O
Tues.	27		22	32	2434O2
Wed.	28				3O124
☉Thur.	29	8h ☿ in Aphelion; 9h 19m·3 Full Moon.			231O4
Fri.	30	2h·2 ☾ in Perigee.	19	21	2O134

Key to Symbols.—☌ Conjunction; ☍ Opposition; □ Quadrature; ☊ Ascending Node; ☋ Descending Node; ◍ Sun; ☿ Mercury; ♀ Venus; ⊕ Earth; ♂ Mars; 24 Jupiter; ♄ Saturn; ♅ Uranus; ♆ Neptune. For Jupiter's satellites the circle O represents the disc of the planet; 24 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.

THE SKY FOR MAY

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	4h 27m	1h 24m	1h 23m	23h 34m	6h 2m	21h 13m	8h 0m
Decl.	23° 41′ N.	6° 56′ N.	7° 44′ N.	4° 1′ S.	22° 43′ N.	16° 47′ S.	20° 14′ N.
Transit	12 59	9·56	9·54	8·06	14·33	5·46	16·31

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 30m, Decl. 14° 50′ N.; on the 31st the R. A. is 4h 29m, Decl. 21° 48′ N. The equation of time is 2m 51s on the 1st, rises to 3m 47s on the 15th (a maximum) and then falls to 2m 39s on the 31st. See page 6.

The Moon—For its phases and conjunctions with the planets, see opposite page. It occults ι Capricorni on the 6th at about 3 a.m., (see page 8).

Mercury is in superior conjunction with the sun on the 1st and so will be invisible during much of the month, but on the 31st it attains greatest elongation 23° 18′ E. For several days on each side of this date the planet should be easily seen. As soon as possible after sunset examine the sky above the sunset point, and the planet will appear like a first magnitude star. Its stellar magnitude at this time is 0·7; almost the same as Procyon. If any difficulty is experienced in locating the planet with the naked eye use an opera glass at first.

Venus, as will be seen from the above table, is about two hours ahead of the sun, and so can easily be seen as a morning star. Its stellar magnitude is − 3·3. About 88 per cent. of its disc is now illuminated.

Mars, is also a morning star, close to Venus in the sky, as will be seen from the above table. Its stellar magnitude is about 1·5. On the 15th it is 200 millions of miles from the earth.

Jupiter is in Pisces, of stellar magnitude − 1·8, and is a prominent morning star.

Saturn, sets about 2½ hours after the sun and is still an evening star.

The positions of *Uranus* and *Neptune* are given in the above table. See note for January.

The minima of Algol are given on the opposite page.

MAY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 3h 38m
			h	m	
Sat.	1	13h ☌ ☿ ☉ Superior.			1○234
Sun.	2	17h ☿ in ☊.			○2134
Mon.	3		16	10	21C34
Tues.	4				3○124
Wed.	5	[2′ S.			3○42●
☾Thur.	6	0h 22m·6 Moon's Last Quarter; 2h 8m ☌ ♅ ☾, ♅ 0°	12	59	3241○
Fri.	7	0h □ ♅ ☉; 8h ☿ in Perihelion.			42○31
Sat.	8				41○23
Sun.	9	0h 9m ☌ ♃ ☾, ♃ 3° 54′ S.	9	48	4C213
Mon.	10				421○3
Tues.	11	4h 57m ☌ ♀ ☾, ♀ 6° 28′ S.; 7h 54m ☌ ♂ ☾, ♂ 5°			43○1●
Wed.	12	[38′ S.	6	37	431○2
●Thur.	13	22h 31m New Moon.			♃342○
Fri.	14	8h ☌ ♀ ♂, ♀ 0° 56′ S.; 16h·4 ☾ in Apogee.			24○1●
Sat.	15	9h 26m ☌ ☿ ☾, ☿ 2° 51′ S.	3	26	1○243
Sun.	16				○2134
Mon.	17	4h 0m ☌ ♄ ☾, ♄ 4° 36′ S.; 15h ☿ Greatest Hel. Lat. N.			21○34
Tues.	18		0	15	3○14●
Wed.	19	9h 51m ☌ ♆ ☾, ♆ 2° 23′ S.			31○24
Thur.	20		21	4	32○14
☽Fri.	21	12h ♅ Stationary; 22h ♀ Greatest Hel. Lat. S.; 23h			2○4●●
Sat.	22	[50m·0 Moon's First Quarter.			1○423
Sun.	23		17	52	4○123
Mon.	24				421○3
Tues.	25				432○1
Wed.	26		14	41	431C2
Thur.	27				♃43○1
♋Fri.	28	12h·6 ☾ in Perigee; 16h 32m·9 Full Moon.			423○●
Sat.	29		11	30	♃4○23
Sun.	30				4○123
Mon.	31	9h ☌ ☿ ♄, ☿ 2° 29′ N.; 16h ☿ Greatest Elong. E.			21○43
		[23° 18′.			

Key to Symbols.—☌ Conjunction; ☍ Opposition; □ Quadrature; ☊ Ascending Node; ☋ Descending Node; ☉ Sun; ☿ Mercury; ♀ Venus; ⊕ Earth; ♂ Mars; ♃ Jupiter; ♄ Saturn; ♅ Uranus; ♆ Neptune. For Jupiter's satellites the circle ○ 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.

THE SKY FOR JUNE

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	6h 40m	3h 50m	2h 51m	23h 50m	6h 18m	21h 12m	8h 3m
Decl.	21° 46′ N.	18° 48′ N.	15° 45′ N.	2° 25′ S.	22° 43′ N.	16° 53′ S.	20° 5′ N
Transit	13·09	10·19	9·21	6·20	12·47	3·43	14·32

The position is given for Greenwich Mean Moon. 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 33m, and on the 30th it is 6h 33m. During the month the declination slowly rises from 21° 57′ on the 1st to 23° 27′ on the 22nd, which is the winter solstice, at which time our days are longest. It then falls to 23° 14′ on the 30th. The equation of time is zero on the 15th. It then rises to 3m 14s 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. (See table on pages 15 and 16).

The Moon.— For its phases and conjunctions with the planets, see opposite page. On the 24th it occults π Scorpii, (see page 8).

Mercury is at greatest elongation east on May 31st and should be well seen as an evening star for some days at the beginning of June (see note for last month). Then it closes in towards the sun and reaches inferior conjunction on the 27th, (see opposite page).

Venus, is still more than 1½ hours before the sun, and can be seen as a morning star. Its stellar magnitude is still − 3·3, and 91 per cent. of its disc is now illuminated.

Mars as will be seen from the above table, is on the meridian between 9.00 and 9.30 a.m., and hence is a morning star. It is in Aries and its stellar magnitude is about 1·4. On the 15th it is 192 millions of miles from the earth.

Jupiter crosses the meridian soon after 6 a.m., and reaches quadrature with the sun on the 19th (See opposite page). Its stellar magnitude is − 2·0 and hence it is a prominent morning star, rising almost exactly at the east point at about midnight.

Saturn is too near the sun to be observed. It comes into conjunction on the 28th (see opposite page), after which it becomes a morning star.

The positions of *Uranus* and *Neptune* are given in the above table. See note for January.

For the minima of Algol, see opposite page.

JUNE

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol h m	Configuration of Jupiter's Satellites at 2h 23m
Tues.	1		8 19	♃2O14
Wed.	2	9h 55m ☌ ♅ ☾, ♅ 0° 20′ S.		31C24
Thur.	3			3O214
☾Fri.	4	11h 32m·1 Moon's Last Quarter.	5 8	231O4
Sat.	5	15h 8m ☌ ♃ ☾, ♃ 4° 38′ S.		O1234
Sun.	6			O234●
Mon.	7		1 57	21O43
Tues.	8			2O341
Wed.	9	8h 55m ☌ ♂ ☾, ♂ 6° 1′ S.	22 46	341O2
Thur.	10	2h ☿ in ♈; 10h 17m ☌ ♀ ☾, ♀ 6° 38′ S.; 19h·4 ☾		43C21
Fri.	11	(Northern Lights) [in Apogee		4231C
●Sat.	12	13h 57m·3 New Moon. λ Seen 9–10 pm. Rays	19 35	4O13●
Sun.	13	16h 22m ☌ ♄ ☾, ♄ 4° 16′ S.; 23h ☿ Stationary.		4O23●
Mon.	14	2h 42m ☌ ☿ ☾, ☿ 4° 18′ S.		421O3
Tues.	15	17h 2m ☌ ♆ ☾, ♆ 2° 8′ S.	16 24	42O31
Wed.	16	Northern Lights Flickering		341O2
Thur.	17	Northern Lights Flickering Clouds.		3C421
Fri.	18		13 13	321O4
Sat.	19	6h □ ♃ ♍.		O314●
☽Sun.	20	8h ☿ in Aphelion; 9h 24m·3 Moon's First Quarter.		1O234
Mon.	21		10 2	♃2O34
Tues.	22	7h 29m ♍ enters Cancer, Summer commences.		2O134
Wed.	23			31O24
Thur.	24		6 51	3C214
Fri.	25	2h ☌ ☿ ♄, ☿ 3° 14′ S.; 21h·1 ☾ in Perigee.		321O4
☉Sat.	26	23h 27m·4 Full Moon.		423O1
Sun.	27	0h ☌ ☿ ♍ Inferior.	3 40	11C23
Mon.	28	12h ☌ ♄ ♍.		♃4O13
Tues.	29	18h 30m ☌ ♅ ☾, ♅ 0° 28′ S.		42O3●
Wed.	30		0 29	431C2

Key to Symbols.—☌ Conjunction; ☍ Opposition; □ Quadrature; ☊ Ascending Node; ☋ Descending Node; ♍ Sun; ☿ Mercury; ♀ Venus; ⊕ Earth; ♂ Mars; ♃ Jupiter; ♄ Saturn; ♅ Uranus; ♆ Neptune. For Jupiter's satellites the circle 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.

THE SKY FOR JULY

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	6h 10m	6h 25m	4h 19m	23h 57m	6h 35m	21h 9m	8h 8m
Decl.	20° 8′ N.	23° 15′ N.	21° 7′ N.	1° 50′ S.	22° 34′ N.	17° 8′ S.	19° 53′ N.
Transit	10·41	10·56	8·50	4·29	11·06	1·43	12·39

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 37m, to 8h 38m, and the Decl. from 23° 11′ N. to 18° 29′ N. The earth is farthest from the sun on the 5th (see opposite page).

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

Mercury on the 18th reaches greatest elongation, 20° 23′ W., and the planet should be seen without difficulty for some days before and after this date, though the dawn may somewhat interfere. Use an opera glass and search the sky just above the point where the sun will rise.

Venus, is still a morning star, but as it rises only about an hour before the sun it cannot be observed so easily as for several months past. Its stellar magnitude is − 3·3, and 96 per cent. of its disc is now illuminated.

Mars, can be seen during the latter half of the night. On the 15th it is about 4° north and slightly west of Aldebaran, and slightly fainter than that star. At that date it is 183 millions of miles from the earth.

Jupiter rises at about 10.30 p.m. and is visible all the rest of the night, reaching the meridian, on the 15th, at 4.29 a.m. (see above table). Stellar magnitude − 2·2. For the configuration of Jupiter's satellites see next page and for their eclipses, etc., see page 46.

Saturn, is a morning star, but too close to the sun to be well observed.

The positions of *Uranus* and *Neptune* are given in the above table. See note for January.

The minima of Algol are given on the opposite page.

JULY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 1h 38m
			h	m	
Thur.	1				43○12
Fri.	2		21	18	4321○
Sat.	3	3h 42m ☌ ♃ ☾, ♃ 5° 12′ S.			2○1●●
☾Sun.	4	0h 54m·2 Moon's Last Quarter.			1○423
Mon.	5	16h ⊕ in Aphelion.	18	7	○2143
Tues.	6				2○34●
Wed.	7	[Stationary.			♃3○24
Thur.	8	5h·8 ☾ in Apogee; 8h 0m ☌ ♂ ☾, ♂ 5° 30′ S.; 8h ☿	14	56	3○124
Fri.	9	[16h ☿ Greatest Hel. Lat. S.; 23h ☌ ☿ ♀, ☿ 3° 50′ S.			312○4
Sat.	10	15h 13m ☌ ♀ ☾, ♀ 4° 7′ S.; 15h 50m ☌ ☿ ☾, ☿ 7° 57′ S.;			23○14
Sun.	11	5h 33m ☌ ♄ ☾, ♄ 4° 0′ S.	11	45	1○324
●Mon.	12	4h 30m·8 New Moon.			4○213
Tues.	13	0h 51m ☌ ♆ ☾, ♆ 1° 59′ S.			421○3
Wed.	14		8	34	♃4○1●
Thur.	15				43○12
Fri.	16				4312○
Sat.	17	5h ☿ in ☊; 8h ☌ ☿ ♄, ☿ 0° 38′ N.	5	23	423○1
Sun.	18	22h ☿ Greatest Elong. W. 20° 23′.			41○32
☽Mon.	19	16h 8m·8 Moon's First Quarter; 21h ♃ Stationary.			4○123
Tues.	20		2	1	214○3
Wed.	21				○314●
Thur.	22	14h ☌ ☿ ♄, ☿ 1° 0′ S.	23	0	3○24●
Fri.	23	23h ☌ ♆ ☉.			312○4
Sat.	24	0h·4 ☾ in Perigee.			32○14
Sun.	25		19	49	1○324
☽Mon.	26	7h 11m·0 Full Moon.			○1234
Tues.	27	3h 1m ☌ ♅ ☾, ♅ 0° 27′ S.			21○34
Wed.	28		16	38	2○314
Thur.	29	17h ☿ in ☊.			34○2●
Fri.	30	13h 0m ☌ ♃ ☾, ♃ 5° 29′ S.			♃♃34○
Sat.	31		13	27	432○1

Key to Symbols.—☌ Conjunction; ☍ Opposition; □ Quadrature; ☊ Ascending Node; ☋ Descending Node; ☉ Sun; ☿ Mercury; ♀ Venus; ⊕ Earth; ♂ Mars; ♃ Jupiter; ♄ Saturn; ♅ Uranus; ♆ Neptune. For Jupiter's satellites the circle ○ 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.

THE SKY FOR AUGUST

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	9h 43m	9h 7m	5h 49m	23h 53m	6h 51m	21h 4m	8h 13m
Decl.	15° 37′ N.	17° 40′ N.	23° 34′ N.	2° 26′ S.	22° 19′ N.	17° 30′ S.	19° 38′ N.
Transit	12·11	11·35	8·18	2·23	9·20	23·31	10·42

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 42m to 10h 35m and the Decl. changes from 18° 14′ N. to 8° 57′ N. The equation of time falls from 6m 12s on the 1st to 0m 31s on the 31st. For fuller details see page 7. On the 10th is an annular eclipse of the sun, invisible, however, in Canada. (See page 50).

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

Mercury during the month is too near the sun for observation. It reaches superior conjuction on the 14th (see opposite page).

Venus is also too near the sun for observation.

Mars, as will be seen from the above table, is on the meridian on the 15th at 8.18 a.m., that is, it is about four hours ahead of the sun and so can be seen as a morning star. By marking on Map II. of the Constellations the position given in the above table, it will be seen that on the 15th the planet is near the boundary between Taurus and Gemini, and about midway between Aldebaran and Castor. Its stellar magnitude then is 1·4 and its distance from the earth is 170 millions of miles.

Jupiter on the 15th rises at about 8.30 and is visible all the rest of the night. Stellar magnitude – 2·4. For the configuration of the satellites, see opposite page; and for their eclipses, etc., see page 46.

Saturn, as will be seen from the above table, crosses the meridian on the 15th at 9.20 a.m. and so can be seen as a morning star. Saturn's stellar magnitude, 0·4.

The positions of *Uranus* and *Neptune* are given in the above table. See note for January.

The minima of Algol are given on the opposite page.

AUGUST

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 0h 53m
			h	m	
Sun.	1				41○32
☾Mon.	2	16h 27m·3 Moon's Last Quarter.			4○123
Tues.	3	7h ☿ in Perihelion.	10	16	421○3
Wed.	4	7h ☌ ☿ ♀, ☿ 0° 18′ N.; 7h ☌ ☿ ♆, ☿ 1° 21′ N.;			42○13
Thur.	5	[8h ☌ ♀ ♆, ♀ 1° 3′ N.; 21h·6 ☾ in Apogee.			431○2
Fri.	6	5h ♂ in ☊; 5h 38m ☌ ☍ ☽, ☍ 4° 22′ S.	7	53	3○142
Sat.	7	2h ☍ ☉ (◍); 19h 23m ☌ ♄ ☽, ♄ 3° 47′ S.			32○4●
Sun.	8	[♀ 0° 2′ S.			13○24
Mon.	9	9h 49m ☌ ♆ ☾, ♆ 1° 54′ S.; 23h 6m ☌ ♀ ☾,	3	54	○1234
(◍)Tues.	10	10h 14m ☌ ☿ ☾, ☿ 1° 18′ N.; 17h 52m·4 New Moon;			12○34
Wed.	11	[(◍) Annular Eclipse invisible in Canada.			2○134
Thur.	12		0	43	31○24
Fri.	13	14h ☿ Greatest Hel. Lat. N.			3○124
Sat.	14	5h ☌ ☿ (◍) Superior.	21	32	32○4●
Sun.	15				413○●
Mon.	16				4○123
☽Tues.	17	21h 17m·4 Moon's First Quarter.	18	21	412○3
Wed.	18				42○13
Thur.	19	18h ♀ in Perihelion.			413○2
Fri.	20	9h·2 ☾ in Perigee.	15	10	43○12
Sat.	21				4321○
Sun.	22				♃43○●
Mon.	23	10h 26m ☌ ☉ ☾, ☉ 0° 20′ S.	11	59	○1423
☺Tues.	24	16h 40m·5 Full Moon.			12○43
Wed.	25				2○134
Thur.	26	18h 22m ☌ ♃ ☾, ♃ 5° 27′ S	8	48	413○2
Fri.	27				13○24
Sat.	28				3○124
Sun.	29		5	37	321○4
Mon.	30				○1432
Tues.	31				♃14○3

Key to Symbols.—☌ Conjunction; ☍ Opposition; □ Quadrature; ☊ Ascending Node; ☋ Descending Node; (◍) Sun; ☿ Mercury; ♀ Venus; ⊕ Earth; ♂ Mars; ♃ Jupiter; ♄ Saturn; ♅ Uranus; ♆ Neptune. For Jupiter's satellites the circle ○ 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.

THE SKY FOR SEPTEMBER

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	12h 53m	11h 34m	7h 14m	23h 40m	7h 4m	21h 0m	8h 17m
Decl.	6° 58′ S.	4° 21′ N.	22° 59′ N.	3° 55′ S.	22° 3′ N.	17° 48′ S.	19° 26′ N.
Transit	13·19	12·01	7·41	0·08	7·31	21·25	8·44

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 38m to 12h 23m. On the 1st the declination is 8° 35′ N., the sun reaches the equator on the 23rd (the autumn equinox), and on the 30th its declination is 2° 29′ S. (For fuller details, see p. 7.)

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

Mercury during the early part of the month is near the sun, but on the 28th it attains greatest elongation, 26° 2′ E. It is pretty low in the south-western sky and so is not well placed for observation.

Venus reaches superior conjunction with the sun on the 12th and cannot be observed all month. After this date it becomes an evening star, but it will be some time before the planet will be far enough from the sun for convenient observation.

Mars rises at about midnight and so can be seen all the rest of the night. On the 15th it is 154 millions of miles from the earth, its stellar magnitude is 1·3 and it is about 5° S. and slightly W. of Pollux.

Jupiter is in opposition to the sun on the 17th (see opposite page) and hence can be seen all night long. Its stellar magnitude is now − 2·5 For the configuration of the satellites, see opposite page; and for their eclipses, etc., see page 46.

Saturn is now near Mars in the sky and hence can be seen during the latter half of the night. The two planets are in conjunction on the 10th (see next page) Stellar magnitude 0·4.

The positions of *Uranus* and *Neptune* are given in the above table. See note for January.

The minima of Algol are given on the opposite page.

SEPTEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol h	Minima of Algol m	Configuration of Jupiter's Satellites at 0h 8m
☾ Wed.	1	9h 56m·6 Moon's Last Quarter; 16h·2 ☾ in Apogee.	2	26	42○13
Thur.	2				41○32
Fri.	3		23	15	43○12
Sat.	4	2h 3m ☌ ♂ ☾, ♂ 2° 45′ S.; 9h 6m ☌ ♄ ☾, ♄ 3° 31′ S.			4321○
Sun.	5	19h 54m ☌ ♆ ☾, ♆ 1° 48′ S.			432○1
Mon.	6	1h ☿ in ☊.	20	4	4○32●
Tues.	7				41○23
Wed.	8				24○13
● Thur.	9	5h 52m·7 New Moon; 7h 23m ☌ ♀ ☾, ♀ 4° 19′ N.	16	53	1○324
Fri.	10	17h ♀ Greatest Hel. Lat. N.; 18h ☌ ♂ ♄, ♂ 1° 8′ N.			3○124
Sat.	11	0h 51m ☌ ☿ ☾, ☿ 3° 50′ N.			321○4
Sun.	12	13h ☌ ♀ ☉ Superior.	13	41	32○14
Mon.	13				1○324
Tues.	14	10h·3 ☾ in Perigee.			24○234
Wed.	15		10	30	2○143
☽ Thur.	16	2h 21m·3 Moon's First Quarter; 7h ☿ in Aphelion.			1○43●
Fri.	17	7h ☍ 24 ☉.			34○12
Sat.	18		7	19	4312○
Sun.	19	16h 11m ☌ ♅ ☾, ♅ 0° 18′ S.			432○1
Mon.	20				41○2●
Tues.	21		4	8	4○123
Wed.	22	20h 23m ☌ 24 ☾, 24 5° 11′ S.			12○3●
○ Thur.	23	4h 35m·2 Full Moon; 22h 24m ☉ enters ♎, Autumn			41○3●
Fri.	24	[commences.	0	57	43○12
Sat.	25				312○4
Sun.	26		21	46	32○14
Mon.	27				13○24
Tues.	28	0h ☿ Greatest Elong. E., 26° 2′.			○1234
Wed.	29	11h·8 ☾ in Apogee.	18	35	2○34●
☾ Thur	30	23h 39m·8 Moon's Last Quarter.			21○34

Key to Symbols.— ☌ Conjunction; ☍ Opposition; □ Quadrature; ☊ Ascending Node; ☋ Descending Node; ☉ Sun; ☿ Mercury; ♀ Venus; ⊕ Earth; ♂ Mars; 24 Jupiter; ♄ Saturn; ♅ Uranus; ♆ Neptune. For Jupiter's satellites the circle ○ represents the disc of the planet; 24 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.

THE SKY FOR OCTOBER

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	14h 9m	13h 52m	8h 27m	23h 26m	7h 10m	20h 58m	8h 19m
Decl.	16° 9′ S.	10° 37′ S.	20° 24′ N.	5° 20′ S.	21° 53′ N.	17° 56′ S.	19° 18′ N.
Transit	12·37	12·20	6·56	21·53	5·40	19·25	6·48

The position is given for Greenwich Mean Moon. 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 27m to 14h 19m and the Decl. changes from 2° 52′ to 13° 51′ S. The equation of time rises from 10m 2s to 16m 17s, to be subtracted from apparent time. For fuller details, see page 7.

The Moon.— For the phases of the moon and its conjunctions with the planets, see opposite page. On the 16th the moon occults θ Capricorni (see page 8).

Mercury comes to inferior conjunction with the sun on the 22nd, after which it becomes a morning star, but it does not get far enough from the sun to be observed conveniently until about the 6th of the next month.

Venus is still too near the sun for observation.

Mars rises an hour or less before midnight and so is visible all the latter half of the night. On the 15th it is 135 millions of miles from the earth, its stellar magnitude is 1·1, and it is very near the cluster Praesepe in Cancer.

Jupiter is well placed for observation during the month. Its stellar magnitude is − 2·4. The planet is in Pisces and is retrograding. For the configuration of its satellites, see next page; and for their eclipses, etc., see page 46.

Saturn is in quadrature to the west of the sun on the 10th, that is, it is 6h ahead of the sun then. It rises about 10 o'clock and hence can be observed much of the night. Its stellar magnitude is 0·3. It begins to retrograde on the 29th.

The positions of *Uranus* and *Neptune* are given in the above table. See note for January.

For the minima of Algol, see opposite page.

OCTOBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 22h 38m
			h	m	
Fri.	1	21h 23m ☌ ♄ ☾, ♄ 3° 13′ S.			3○124
Sat.	2	20h 40m ☌ ♂ ☾, ♂ 0° 43′ S.	15	24	2431○4
Sun.	3	6h 7m ☌ ♆ ☾, ♆ 1° 36′ S.			32○41
Mon.	4				413○2
Tues.	5		12	13	4○123
Wed.	6	16h ☿ Greatest Hel. Lat. S.			421○3
Thur.	7				42○13
Fri.	8	16h 42m·1 New Moon.	9	2	43○2●
Sat.	9	9h 30m ☌ ♀ ☾, ♀ 6° 10′ N. [Stationary.			431○2
Sun.	10	6h 40m ☌ ☿ ☾, ☿ 1° 41′ N.; 8h □ ♄ ☍; 15h ☿			342○1
Mon.	11	7h·1 ☾ in Perigee; 14h ☌ ♂ ♆, ♂ 1° 28′ N.	5	51	134○2
Tues.	12				○1432
Wed.	13				21○34
Thur.	14		2	40	2○134
Fri.	15	8h 51m·5 Moon's First Quarter.			2431○4●
Sat.	16	21h 8m ☌ ♁ ☾, ♁ 0° 26′ S.	23	29	31○24
Sun.	17	12h ☌ ☿ ♀, ☿ 3° 30′ S.			32○14
Mon.	18				13○4●
Tues.	19	21h 24m ☌ 2 ☾, 2 4° 57′ S.	20	18	○1432
Wed.	20				214○3
Thur.	21				42○13
Fri.	22	9h ☌ ☿ ☍ Inferior; 16h ♁ Stationary; 19h 15m·5	17	7	41○32
Sat.	23	[Full Moon.			2431○2
Sun.	24				432○1
Mon.	25	16h ☿ in ☊.	13	56	431○●
Tues.	26	22h □ ♆ ☍.			4○312
Wed.	27	6h·1 ☾ in Apogee.			412○3
Thur.	28		10	45	2○13●
Fri.	29	6h 40m ☌ ♄ ☾, ♄ 2° 53′ S. 19h ♄ Stationary.			1○324
Sat.	30	7h ☿ in Perihelion; 15h 9m ☌ ♆ ☾, ♆ 1° 18′ S.;			2431○4
Sun.	31	11h 37m ☌ ♂ ☾, ♂ 1° 34′ N. [21h ☿ Stationary; 23h	7	34	32○4●
		[39m·8 Moon's Last Quarter.			

Key to Symbols.—☌ Conjunction; ☍ Opposition; □ Quadrature; ☊ Ascending Node; ☋ Descending Node; ☍ Sun; ☿ Mercury; ♀ Venus; ⊕ Earth; ♂ Mars; 2 Jupiter; ♄ Saturn; ♁ Uranus; ♆ Neptune. For Jupiter's satellites the circle ○ represents the disc of the planet; 2 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.

THE SKY FOR NOVEMBER

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	14h 15m	16h 26m	9h 28m	23h 20m	7h 10m	20h 59m	8h 19m
Decl.	11° 31′ S.	22° 7′ S.	17° 0′ N.	5° 50′ S.	21°55′ N.	17° 51′ S.	19° 16′ N.
Transit	10·41	12·53	5·55	19·45	3·38	17·24	4·47

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 22m to 16h 22m, and the Decl. changes from 14° 11′ to 21° 31′ S. The equation of time rises to a maximum on the 4th, at which time it is 16m 22s. The true sun crosses the meridian this much earlier than the mean sun.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 24th the moon occults ε Geminorum (see page 8).

Mercury reaches greatest elongation, 18° 57′ W., on the 7th, at which time it is well-placed for observation as a morning star. For the greater part of the month the planet should be easily seen just above the sunrise point. If an opera glass is convenient use it first to locate the planet, after which it will be easily 'picked up' with the naked eye.

Venus is slowly separating from the sun, and as it rises about an hour after the sun it can be seen as an evening star. It is still too near the sun, however, for convenient observation.

Mars is continually improving its position for observation. During the month it passes from Cancer into Leo and at the end of the the month is about 4½° N.W. of Regulus. On the 15th its stellar magnitude is 0·7 (Regulus is 1·3), its distance from the earth is 112 millions of miles. It is visible from about 11 p.m. on during the night.

Jupiter is still well-placed for observation during the evening. It continues to retrograde until the 15th. For the configuration of the satellites, see next page; and for their eclipses, etc., see page 46.

Saturn is on the meridian on the 15th at 3.38 (see above table) and hence can be observed during the most of the night. It is in Gemini, about 7° S.W. of Pollux (on the 15th), and its stellar magnitude 0·1.

The positions of *Uranus* and *Neptune* are given in the above table. See note for January.

The minima of Algol are given on the opposite page.

NOVEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 21h 8m
			h	m	
Mon.	1				3 1 2 ○ 4
Tues.	2				○ 3 1 2 4
Wed.	3				
Thur.	4		4	23	2 1 ○ 3 4
Fri.	5	3h □ ♅ ☉; 18h ☿ in ♍; 19h ♆ Stationary; 23h 14m			2 ○ 1 4 3
Sat.	6	☌ ☿ ☾, ☿ 7° 31′ N.	1	12	1 ○ 4 2 3
☉ Sun.	7	2h 52m·3 New Moon; 5h ☿ Greatest Elong. W. 18° 57′.			3 4 1 ○ 2
Mon.	8	5h 36m ☌ ♀ ☾, ♀ 4° 46′ N.; 9h·3 ☾ in Perigee.	22	0	4 3 2 1 ○
Tues.	9	13h ☿ Greatest Hel. Lat. N.; 22h □ ♂ ☉.			4 ○ 1 2 ●
Wed.	10				4 1 ○ 2 3
Thur.	11				
Fri.	12		18	49	4 2 ○ 1 3
☽ Sat.	13	3h 20m ☌ ♅ ☾, ♅ 0° 43′ S.; 18h 3m·0 Moon's First			4 1 ○ 3 ●
Sun.	14	[Quarter.			4 3 ○ 1 2
Mon.	15	3h ♃ Stationary.	15	38	3 2 1 ○ 4
Tues.	16	0h 54m ☌ ♃ ☾, ♃ 4° 59′ S.			♃ 3 2 ○ 4
Wed.	17				3 ○ 2 4 ●
Thur.	18		12	27	1 ○ 2 3 4
Fri.	19				2 ○ 1 3 4
Sat.	20				1 ○ 3 4 ●
☽ Sun.	21	12h 36m·4 Full Moon.	9	16	3 ○ 1 2 4
Mon.	22				3 2 1 ○ 4
Tues.	23	18h·7 ☾ in Apogee.			3 2 ○ 4 1
Wed.	24		6	5	4 3 ○ 2 ●
Thur.	25	12h 8m ☌ ♄ ☾, ♄ 2° 41′ S.			4 1 ○ 2 3
Fri.	26	22h 2m ☌ ♆ ☾, ♆ 1° 3′ S			4 2 ○ 1 3
Sat.	27		2	54	4 1 2 ○ 3
Sun.	28	19h 17m ☌ ♂ ☾, ♂ 3° 52′ N.			♃ 4 ○ 1 2
☾ Mon.	29	17h 10m·5 Moon's Last Quarter.	23	43	4 3 1 2 ○
Tues.	30				3 4 2 ○ 1
					3 4 1 ○ 2

Key to Symbols.—☌ Conjunction; ☍ Opposition; □ Quadrature; ☊ Ascending Node; ☋ Descending Node; ☉ Sun; ☿ Mercury; ♀ Venus; ⊕ Earth; ♂ Mars; ♃ Jupiter; ♄ Saturn; ♅ Uranus; ♆ Neptune. For Jupiter's satellites the circle ○ 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.

THE SKY FOR DECEMBER

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	17h 25m	19h 10m	10h 6m	23h 26m	7h 3m	21h 2m	8h 18m
Decl.	24° 29′ S.	23° 57′ S.	14° 48′ N.	5° 6′ S.	22° 8′ N.	17° 35′ S.	19° 22′ N.
Transit	11·53	13·38	4·35	17·53	1·33	15·30	2·47

The position is given for Greenwich Mean Moon. 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 26m to 18h 38m. On the 1st the Decl. is 21° 41′ S.; this slowly changes until it becomes 23° 27′ on the 22nd, (the winter solstice, see next page); and by the 31st it has come back to 23° 10′.

The Moon.— For its phases and conjunctions with the planets, see opposite page. On December 18 the moon occults three of the Pleiades, and on the 21st, ε Geminorum (see page 8).

Mercury is in superior conjunction with the sun on the 15th, and is not suitably placed for observation during the month.

Venus, is now far enough from the sun to be seen as an evening star and its position is improving every day.

Mars, can now be seen from about 10 o'clock on through the night. On the 15th it is 89 millions of miles from the earth and its stellar magnitude is + 0·2, the same at Capella. On the 31st the magnitude is − 0·2. On the 13th the planet is in conjunction with Regulus from which it is 2½° north.

Jupiter on the 12th is in quadrature with the sun, and so can be seen during the first half of the night. For the configuration of the satellites, see next page; and for their eclipses, etc., see page 46.

Saturn now rises at about 6.30 p.m. and is visible during the entire night. It continues to retrograde during the month. Stellar magnitude − 0·1.

The positions of *Uranus* and *Neptune* are given in the above table. See note for January.

For the minima of Algol, see next page.

DECEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 20h 8m
			h	m	
Wed.	1		20	32	2 ○ 4 2 3
Thur.	2				2 ○ 1 4 3
Fri.	3	0h ☿ in ♍.			1 2 ○ 3 4
Sat.	4		17	21	○ 3 1 2 4
Sun.	5				2 4 3 1 ○ 4
(New) Mon.	6	5h 16m ☌ ☿ ☾, ☿ 4° 9′ N.; 13h 3m·7 New Moon;			3 2 ○ 1 4
Tues.	7	[20h·3 ☾ in Perigee.	14	10	3 1 ○ 2 4
Wed.	8	1h 36m ☌ ♀ ☾, ♀ 1° 31′ N.			○ 1 2 4 ●
Thur.	9				2 4 2 ○ 3 ●
Fri.	10	0h ♀ in Aphelion; 12h 42m ☌ ♅ ☾, ♅ 1° 2′ S.	10	59	4 2 1 ○ 3
Sat.	11				4 ○ 3 1 2
Sun.	12	20h □ 2 4 (Sun).			4 3 1 ○ 2
(1st Q.) Mon.	13	6h ☿ in Aphelion; 6h 38m·4 Moon's First Quarter;	7	48	4 3 2 ○ 1
Tues.	14	[9h 43m ☌ 2 4 ☾, 2 4 5° 14′ S.			4 3 1 ○ ●
Wed.	15	19h ☌ ☿ (Sun) Superior.			4 ○ 3 1 2
Thur.	16		4	37	4 2 ○ 3 ●
Fri.	17				2 4 1 ○ 3
Sat.	18				○ 1 3 4 2
Sun.	19		1	26	3 1 ○ 2 4
Mon.	20	19h·6 ☾ in Apogee.			3 2 ○ 1 4
(Full) Tues.	21	7h 52m·3 Full Moon.	22	15	3 1 ○ 4 ●
Wed.	22	14h 42m ☌ ♄ ☾, ♄ 2° 41′ S.; 17h 16m Sun enters			3 ○ 1 2 4
Thur.	23	[Capricornus, Winter commences.			2 1 ○ 3 4
Fri.	24	3h 6m ☌ ♆ ☾, ♆ 0° 56′ S.	19	4	2 4 2 ○ 3 4
Sat.	25				○ 1 4 2 3
Sun.	26	14h 9m ☌ ♂ ☾, ♂ 5° 45′ N.			3 1 4 ○ 2
Mon.	27		15	53	3 4 2 ○ 1
Tues.	28				4 3 1 2 ○
(Last Q.) Wed.	29	7h 58m·8 Moon's Last Quarter.			4 3 ○ 1 2
Thur.	30		12	42	4 1 2 ○ 3
Fri.	31				4 2 ○ 1 3

Key to Symbols.—☌ Conjunction; ☍ Opposition; □ Quadrature; ☊ Ascending Node; ☋ Descending Node; (Sun) Sun; ☿ Mercury; ♀ Venus; ⊕ Earth; ♂ Mars; 2 4 Jupiter; ♄ Saturn; ♅ Uranus; ♆ Neptune. For Jupiter's satellites the circle ○ represents the disc of the planet; 2 4 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.

PHENOMENA OF JUPITER'S SATELLITES

E = eclipse, O = occultation, T = transit, S = shadow, D = disappearance, R = re-appearance, I = ingress, e = egress. The numbers in the fifth column denote the satellites.
Eastern Standard Time, Hours numbering from Midnight.

JANUARY

d	h	m	s			d	h	m	s		
5	18	50		II	SI	16	18	16		III	Se
6	17	44		I	Se	20	18	38		I	TI
13	18	56		I	Te	21	18	44	08	I	ER
14	19	07	57	II	ER	23	18	42		III	SI

APRIL

21	4	52		I	Te	29	4	01		I	OR
28	4	34		I	TI						

MAY

3	3	50		II	TI	21	3	43		I	SI
	4	34		II	Se	22	4	20	06	III	ER
10	4	16		II	SI	23	3	17		IV	SI
14	3	01		I	TI	29	2	48	05	I	ED
	4	08		I	Se	30	2	24		I	Se
15	4	24		IV	OD		3	42		I	Te

JUNE

1	3	15		IV	OR	21	2	58	57	I	ED
2	3	43		III	Te	22	1	38		II	Te
4	4	10		II	TI		1	38		I	TI
6	1	58		I	SI		2	33		I	Se
	1	59		II	OR		3	55		I	Te
	3	21		I	TI	23	1	06		I	OR
7	2	48		I	OR	27	0	19	51	III	ER
9	1	32		IV	Se		2	53		III	OD
	2	23		III	Se		4	12	08	II	ED
11	4	00		II	SI	29	1	24		II	TI
13	3	52		I	SI		1	27		II	Se
15	2	02		I	Te		2	08		I	SI
16	3	04		III	SI		3	31		I	TI
20	1	37	37	II	ED		4	14		II	Te
	1	53		III	OR	30	2	59		I	OR

JULY

1	0	16		I	Te	16	1	10		I	OR
4	1	13	22	III	ED	21	23	08		III	SI
	3	12	09	IV	ER	22	1	12	35	II	ED
6	1	11		II	SI		2	17		I	SI
	3	58		II	TI		2	21		III	Se
	4	02		I	SI		3	30		I	TI
	4	04		II	Se		4	11		III	TI
7	1	15	57	I	ED		23	33	05	I	ED
	23	51		I	TI	23	3	00		I	OR
8	0	48		I	Se		22	36		II	Se
	1	29		II	OR		23	04		I	Se
	2	07		I	Te	24	0	14		I	Te
13	1	23		IV	Te		0	59		II	Te
	3	48		II	SI	29	3	08		III	SI
14	3	10	13	I	ED		3	47	02	II	ED
15	0	24		I	SI		4	11		I	SI
	0	28		III	TI		4	22		IV	SI
	1	41		I	TI	30	1	27	29	I	ED
	2	42		I	Se	30	22	22		II	SI
	3	20		III	Te		22	40		I	SI
15	3	56		I	OR		23	45		I	TI
	3	58		II	Te	31	0	36		II	TI

JULY (*Continued*)

d	h	m	s			d	h	m	s		
31	0	57		I	Se	31	3	24		II	Te
	1	14		II	Se		23	15		I	OR
	2	02		I	Te						

AUGUST

2	0	28		III	OR	16	21	15		I	OR
6	3	21	57	I	ED	17	21	18		II	Te
	22	03		IV	OD	19	21	01		III	Te
	23	42		IV	OR	21	4	21		I	SI
7	0	33		I	SI	22	1	39	53	I	ED
	0	59		II	SI		4	34		I	OR
	1	32		I	TI		22	50		I	SI
	2	51		I	Se		23	29		I	TI
	2	59		II	TI	23	0	48	13	II	ED
	3	48		I	Te		1	08		I	Se
	3	51		II	Se		1	45		I	Te
	21	50	39	I	ED		4	50		II	OR
8	1	02		I	OR		23	00		I	OR
	22	15		I	Te	24	20	49		II	TI
9	0	15		II	OR		22	26		II	Se
	0	19	40	III	ER		23	36		II	Te
	1	11		III	OD	26	21	36		III	TI
	3	58		III	OR		22	20		III	Se
14	2	27		I	SI	27	0	22		III	Te
	3	18		I	TI	29	3	34	40	I	ED
	3	37		II	SI	30	0	44		I	SI
	4	45		I	Se		1	13		I	TI
	22	40		IV	SI		3	01		I	Se
	23	45	13	I	ED		3	23	08	II	ED
15	2	07		IV	Se		3	29		I	Te
	2	48		I	OR		22	03	18	I	ED
	21	44		I	TI	31	0	45		I	OR
	22	13	27	II	ED		20	15		IV	Se
	23	14		I	Se		21	30		I	Se
16	0	00		I	Te		21	55		I	Te
	1	20	40	III	ED		21	55		IV	TI
	2	33		II	OR		22	12		II	SI
	4	19	53	III	ER		23	06		II	TI
	4	38		III	OD		23	25		IV	Te

SEPTEMBER

1	1	03		II	Se	7	23	38		I	Te
	1	53		II	Te	8	0	50		II	SI
2	20	12		II	OR		1	21		II	TI
	23	14		III	SI		3	41		II	Se
3	0	53		III	TI		4	09		II	Te
	2	21		III	Se		20	55		I	OR
	3	41		III	Te	9	0	46	35	IV	ED
6	2	38		I	SI		5	05		IV	OR
	2	56		I	TI		22	25		II	OR
	4	56		I	Se	10	3	15		III	SI
	23	58	12	I	ED		4	09		III	TI
7	2	29		I	OR	13	4	33		I	SI
	21	07		I	SI		4	40		I	TI
	21	22		I	TI		20	41		III	OR
	23	24		I	Se	14	1	53	13	I	ED

SEPTEMBER—(*Continued*)

d	h	m	s			d	h	m	s		
14	4	13		I	OR	23	0	30	07		ER
	23	01		I	SI			19	14	I	TI
	23	05		I	TI			19	24	I	SI
15	1	19		I	Se			21	31	I	Te
	1	22		I	Te			21	42	I	Se
	3	28		II	SI	24	0	03		II	OD
	3	36		II	TI			3	11	31	II ER
	20	22	02	I	ED			18	58	51	I ER
	22	39		I	OR	25	18	58		II	TI
16	19	47		I	Se			19	24	II	SI
	19	47		I	Te			21	46	04	IV ER
	21	50		II	OD			21	46	II	Te
17	0	38		II	OR			22	15	II	Se
18	19	31		II	Te	28	0	22		III	OD
	19	37		II	Se			4	23	16	III ER
20	21	06		III	OD	29	2	32		I	TI
21	0	22	27	III	ER			2	51	I	SI
	3	40		I	OD			23	50	I	OD
22	0	49		I	TI	30	2	25	14	I	ER
	0	56		I	SI			20	58	I	TI
	3	05		I	Te			21	19	I	SI
	3	13		I	Se			23	15	I	Te
	22	06		I	OD			23	36	I	Se

OCTOBER

1	2	17		II	OD	16	0	44	32	I	ER
	18	22		III	Se			2	24	III	Se
	20	53	59	I	ER			18	54	I	TI
2	21	13		II	TI			19	38	I	SI
	22	02		II	SI			21	11	I	Te
3	0	02		II	Te			21	55	I	Se
	0	53		II	Se	17	1	49		II	TI
4	1	50		IV	TI			19	13	26	I ER
	4	05		IV	Te	18	19	58		II	OD
	19	05	13	II	ER	19	0	17	42	II	ER
5	3	39		III	OD	20	18	57		IV	Te
7	1	35		I	OD			19	27	II	Se
	22	43		I	TI	21	0	03		IV	SI
	23	14		I	SI			2	43	IV	Se
8	0	59		I	Te	22	2	14		I	TI
	1	31		I	Se			23	33	I	OD
	19	22		III	SI			23	58	III	TI
	20	01		I	OD	23	2	39	56	I	ER
	20	07		III	Te			20	41	I	TI
	22	23		III	Se			21	33	I	SI
	22	49	13	I	ER			22	58	I	Te
9	19	26		I	Te			23	50	I	Se
	20	00		I	Se	24	18	00		I	OD
	23	30		II	TI			21	08	51	I ER
10	0	40		II	SI	25	18	19		I	Se
	2	20		II	Te			22	17	II	OD
	3	30		II	Se	26	20	27	02	III	ER
11	21	41	20	II	ER	27	19	15		II	SI
14	3	20		I	OD		20	10		II	Te
15	0	28		I	TI			22	05	II	Se
	1	09		I	SI	28	22	22		IV	OD
	2	45		I	Te	29	1	13		IV	OR
	20	32		III	TI	30	1	21		I	OD
	21	47		I	OD			22	29	I	TI
	23	25		III	SI			23	29	I	SI
	23	30		III	Te	31	0	46		I	Te

OCTOBER—(*Continued*)

31	1	46		I	Se	31	23	04	19	I	ER
	19	48		I	OD						

NOVEMBER

1	17	58		I	SI	15	20	36		I	TI
	19	13		I	Te			21	49	I	SI
	20	15		I	Se			22	53	I	Te
2	0	39		II	OD	16	0	06		I	Se
	17	33	09	I	ER			17	56	I	OD
	20	22		III	OR			21	24	15	I ER
	21	43	06	III	ED	17	0	39		III	OD
3	0	28	21	III	ER			18	34	I	Se
	19	44		II	TI	18	0	38		II	TI
	21	53		II	SI		19	18	45	II	OD
	22	34		II	Te	20	0	04	01	II	ER
4	0	42		II	Se			17	30	III	Te
5	18	49	31	II	ER			19	38	III	SI
6	18	27		IV	SI			22	31	III	Se
	20	52		IV	Se	21	19	16		II	Se
7	0	18		I	TI	22	22	27		I	TI
7	1	24		I	SI	22	23	45		I	SI
	21	37		I	OD	23	0	08		IV	TI
8	0	59	51	I	ER			19	48	I	OD
	18	45		I	TI			23	19	49	I ER
	19	53		I	SI	24	18	14		I	SI
	21	02		I	Te			19	13	I	Te
	22	10		I	Se			20	30	I	Se
9	19	28	41	I	ER	25	17	48	44	I	ER
	20	57		III	OD	26	21	16		II	OD
10	0	00		III	OR	27	18	14		III	TI
	22	10		II	TI			21	21	III	Te
11	0	31		II	SI			23	41	III	SI
	1	00		II	Te	28	19	04		II	SI
12	21	26	40	II	ER			19	16	II	Te
13	18	29		III	Se			21	53	II	Se
14	23	28		I	OD	30	21	41		I	OD

DECEMBER

1	18	49		I	TI	12	21	36		II	TI
	20	09		I	SI	14	21	16	32	II	ER
	20	39	12	IV	ED	15	19	24		III	OR
	21	06		I	Te	15	21	59	48	III	ED
	22	13	28	IV	ER			22	40	I	TI
	22	26		I	Se	16	22	00		I	OD
2	19	44	19	I	ER			17	18	30	I SI
3	23	49		II	OD			19	26	I	Te
4	22	10		III	TI			20	46	I	Se
5	18	59		II	TI	18	18	04	17	I	ER
	21	42		II	SI	21	18	24		II	OD
	21	51		II	Te	22	20	23		III	OD
7	18	38	32	II	ER	23	19	02		II	Se
	23	35		I	OD		21	57		I	OD
8	17	56	50	III	ED	24	19	06		I	TI
	20	35	15	III	ER		20	26		I	SI
	20	44		I	TI		21	23		I	Te
	22	05		I	SI		22	42		I	Se
	23	01		I	Te	25	19	59	47	I	ER
9	17	44		IV	TI	26	18	39		III	Se
	18	04		I	OD	28	21	06		II	OD
	21	00		IV	Te	30	18	51		II	SI
	21	39	53	I	ER		19	06		II	Te
10	17	30		I	Te		21	38		II	Se
	18	50		I	Se	31	21	04		I	TI

EPHEMERIS FOR PHYSICAL OBSERVATIONS OF THE SUN.

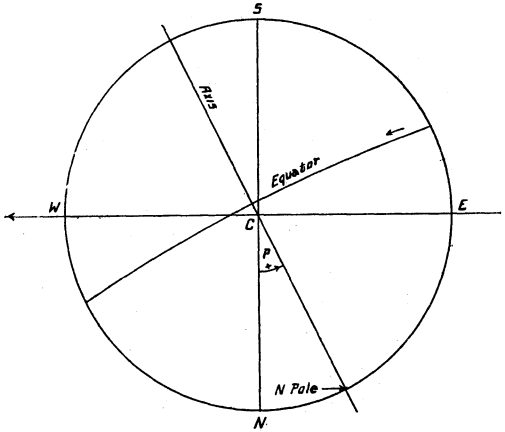
By Ralph E. DeLury.

In the ephemeris for Physical Observations of the Sun, P is the position angle of the N end of the Sun's axis measured E from N point of the disc, *i. e.*, in direction $N\ E\ S\ W$ around the edge of the disc. P will therefore be positive when the N point of the Sun's axis is E of the N point of the disc and negative when it is W of this point.

"*Lat.*" is the heliographical latitude of the centre of the Sun's disc, *i.e.*, the angle measured on the surface of the Sun in a direction N of the Sun's equator. "*Lat.*" will therefore be positive when the centre of the Sun's disc is N of the Sun's equator and negative when the centre of the disc is S of it.

"*Long.*" is the heliographical longitude of the centre of the Sun's disc referred to the meridian which passed through the ascending node on January 1, 1854, Greenwich Mean Noon, as zero meridian.

In preparing this ephemeris it has been assumed that the inclination of the Sun's axis to the ecliptic is 82°·750, the longitude of the ascending node for 1914·0 is 74°·560 and the period of the Sun's sidereal rotation is 25·38 days (according to the deductions of Carrington from his sun-spot measurements).



The accompanying Figure shows the relative positions of various points for a selected time, October 9, 12:00 noon, "Eastern" Time, *i. e.*, 5:00 Greenwich Mean Time, when $P = +\ 26°{\cdot}41$, "*Lat.*" $= +\ 6°{\cdot}23$ and "*Long.*" $= 337°{\cdot}97$. In the Figure, $N\ E\ S\ W$ are the North, South, East and West points on the disc of the Sun. These points are determined on an image of the Sun by allowing it to drift due to the Earth's rotation, from East to West tangentially to a line which will therefore give the "*East and West*" line, thus fixing the diameters, $E\ W$ parallel to it and $N\ S$ perpendicular to it. The axis is shown making an angle of $+\ 26°{\cdot}41$ with $N\ S$ and having the *North Pole* on the positive side of it, *i.e.*, eastward from N; and the equator is shown intersecting the edge of the disc at points the same angle from E and W, and passing S of the centre of the disc, C which is at "*Lat.*" $+\ 6°{\cdot}23$ and "*Long.*" $337°{\cdot}97$.

If the ephemeris is to be used frequently it will be found very convenient to have the values plotted on a large scale on section-paper so that the angles for any particular hour may be read of quickly, care being taken to use the hour corresponding to Greenwich Mean Noon, *e. g.* in "Eastern" Time 7 a.m.

EPHEMERIS FOR PHYSICAL OBSERVATIONS OF THE SUN*

Greenwich Mean Noon		*P*	Lat.	Long.	Greenwich Mean Noon		*P*	Lat.	Long.
		°	°	°			°	°	°
Jan. 1	+	2·25	− 3·11	91·07	July 5	−	1·11	+ 3·38	169·30
6	−	0·20	3·68	25·21	10	+	1·16	3·90	103·12
11		2·62	4·22	319·37	15		3·41	4·39	36·96
16		4·99	4·72	253·54	20		5·63	4·85	330·80
21		7·30	5·19	187·70	25		7·78	5·28	264·65
26		9·54	5·62	121·87	30		9·86	5·68	198·51
31	−	11·67	− 6·00	56·04	Aug. 4	+	11·87	+ 6·04	132·39
Feb. 5		13·70	6·34	350·20	9		13·77	6·35	66·28
10		15·60	6·63	284·37	14		15·57	6·62	0.18
15		17·37	6·86	218·53	19		17·26	6·84	294·09
20		18·99	7·04	152·69	24		18·83	7·02	228·02
25		20·48	7·17	86·84	29		20·26	7·15	161·96
Mar. 2	−	21·81	− 7·24	20·98	Sept. 3	+	21·57	+ 7·23	95·91
7		22·97	7·25	315·10	8		22·73	7·25	29·88
12		23·98	7·20	249·21	13		23·75	7·22	323·86
17		24·82	7·10	183·31	18		24·61	7·14	257·85
22		25·49	6·96	117·40	23		25·31	7·02	191·85
27		25·97	6·76	51·46	28		25·85	6·83	125·85
Apr. 1	−	26·29	− 6·51	345·50	Oct. 3	+	26·22	+ 6·59	59 88
6		26·43	6·21	279·52	8		26·41	6·30	353·91
11		26·38	5·87	213·54	13		26·41	5·98	287·95
16		26·14	5·48	147·52	18		26·23	5·60	222·00
21		25·73	5·05	81·49	23		25·86	5·17	156·05
26		25·14	4·59	15·43	28		25·30	4·71	90·11
May 1	−	24·36	− 4·10	309·35	Nov. 2	+	24·54	+ 4·21	24·18
6		23·40	3·58	243·26	7		23·59	3·68	318·26
11		22·25	3·04	177·15	12		22·43	3·13	252·34
16		20·94	2·47	111·02	17		21·08	2·54	186·43
21		19·47	1·90	44·88	22		19·55	1·93	120·52
26		17·84	1·31	338·73	27		17·84	1·31	54·62
31	−	16·07	− 0·71	272·56	Dec. 2	+	15·96	+ 0·68	348·72
June 5		14·17	− 0·11	206·39	7		13·94	+ 0·04	282·84
10		12·17	+ 0·49	140·21	12		11·79	− 0·60	216·96
15		10·06	1·09	74·03	17		9·54	1·24	151·08
20		7·89	1·68	7·85	22		7·19	1·87	85·21
25		5·66	2·27	301·66	27		4·79	2·48	19·35
30	−	3·39	+ 2·83	235·48	32	+	2·36	− 3·07	313·50

* Taken from *The Nautical Almanac.*

METEORS AND SHOOTING STARS

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

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

Name of Shower	Duration	Greatest Display	Radiant Point R.A.		Decl.
			h	m	°
Quadrantids	Dec. 28-Jan. 9	Jan. 3	15	20	+ 53
Aurigids	Feb. 7-23	Feb. 10	5	0	+ 41
Lyrids	April 16-22	April 21	18	4	+ 33
η Aquarids	April 29-May 8	May 4-6	22	32	− 2
Herculids	May 13-29	May 24	16	36	+ 30
Scorpiids	May-June Ju'y	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
Draconids	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

ECLIPSES IN 1915.

There will be two Eclipses in 1915, both of the Sun, but neither will be visible in Canada.

I. An Annular Eclipse of the Sun, February 13, 1915. The path of the central eclipse begins in the Indian Ocean directly south of Madagascar Island and, crossing the north-west part of Australia and New Guinea, ends in the Pacific Ocean in Longitude 174° 48′ east and Latitude 13° 12′ north.

II. An Annular Eclipse of the Sun, August 10, 1915. The path of the central eclipse begins east of Formosa Island and, extending across the Pacific Ocean, ends in Longitude 106° 36′ west and Latitude 22° 00′ south.

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	υ 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 the star maps in this volume; for the others a good star-atlas be will required. The times of maxima and minima are given in *Popular Astronomy* (monthy) 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
p 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 formu-

lated by Prof. 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 sub-divided, 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 Lyræ.
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 272 stars and 5 nebulæ. The first 256 stars are those listed as brighter than 3·51 visual magnitude in Harvard *Annals*, Vol. 50. The remaining 16 range in magnitude from 5 to 8·3, and they and the 5 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 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-years corresponding to a parallax of 1″. For example, the parallax of α Andromeda is ″·06; its distance is therefore 3·26 ÷ ·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		Parallax	Rad. Vel. km./sec.	Mass
					μ	μ'			
	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	−·094	−·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 Minoris	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 *	
o 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	
π^3Orionis	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		Parallax	Rad. Vel. km./sec.	Mass
					μ	μ'			
	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	·056	+ 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	
β 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*	
o² 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*	
L² 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	2·9	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	·00c	·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 2c	2·0	A	+ ·003	− ·09			
ζ Hydræ	50	+ 6 2c	3·3	K	− ·007	+ ·01		+ 23·1	
ι Urs. Majoris	52	+ 48 2c	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	− ·c03	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	+ ·c06	+ ·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	·c0			
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	+ ·c02	− ·27		+ 22	
β Corvi	29	− 22 51	2·8	G5	000	− ·06		− 7·1	
$\grave{a}$ 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 μ	Proper Motion μ'	Parallax	Rad. Vel. km./sec.	Mass
	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	
π 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		Parallax	Rad. Vel. km./sec.	Mass
					μ	μ'			
	h m	° ′			s	″	″		
π Scorpii	15 53	− 25 50	3·0	B2p	− ·001	− ·04			*
δ Scorpii	54	− 22 20	2·5	B	− ·001	− ·04			*
β Scorpii	16 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	+ ·029	+ ·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	13 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	° ′			″	″		
μ Cassiopeiæ	1 2	+54 26	5·3	G5	3·8	0·11	− 97	
Lalande 1966	1 3			F3		0·08	−325	
Cordoba Zones 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	
1830 Groombridge	11 47	+38 26	6·5	G-K	7·0	0·10	− 97	
11 Libræ	14 45	− 1 53	5·0	K			+ 83	
ω Pavonis	18 49	−60 20	5·1	K			+184	
ν^2 Sagittarii	18 49	−22 47	5·0	K			−106	
A.G.C. 27600	20 5	−36 21	5·3	K5			−132	
Lalande 4855	2 33	+30 28	7·2	G			−120	
Lalande 5761	3 3	+26 0	8·0	F			−153	
Groombridge 864	4 35	+41 58	7·3	G			+101	
Lalande 15290	7 48	+30 54	8·2	G			−242	
Lalande 28607	15 38	−10 39	7·3	A			−170	
31 *b* Aquilæ	19 21	+11 45	5·2	G			− 96	
Lalande 37120-1	19 30	+33 0	6·6	G			−162	
NEBULÆ								
Andromedæ	0 37	+40 43		G			−300	
N.G.C. 5873	15 6	−37 43					−136	
N.G.C. 6644	18 26	−25 12					+191	
N.G.C 4732	18 28	−22 45					−148	
N.G.C. 4594 (Virgo)							1000	

THE CONSTELLATIONS

The accompanying maps, which contain the stars down to the fifth magnitude, are intended primarily for beginners ; but as the right ascension and declination lines are drawn in, the position of any other object, (such as a comet, a planet or a fainter star) if its R.A. and Decl. are known, can be located with respect to the brighter stars.

The constellations are arranged according to months. Those given for any month are on the meridian at approximately 9 p.m. on the 15th of that month ; but, of course, these constellations can be seen in the same position during the month before or that after by looking two hours later or earlier, respectively.

The double-stars and other objects given below are suitable for a small telescope (say, of aperture 3 inches) or sometimes for an opera glass.

For the positions of the sun and the planets consult pages 22, 24, 26, etc.

JANUARY

Camelopardalis (The Giraffe) is a large circumpolar constellation, north of Auriga and Perseus and extending almost to the pole by a long lane which constitutes the neck and head of the animal. The constellation contains no stars brighter than the fourth magnitude.

Auriga (The Charioteer) may readily be recognised by Capella, its brightest star, which crosses the meridian not far from the zenith at 9 p.m. on January 24. Capella, Vega and Arcturus are the three brightest stars of the northern hemisphere, each being approximately of magnitude 0·2. Sirius, which is slightly south of the celestial equator, and which is the brightest star in the entire sky, is the only other star visible in our latitudes which rivals these three. In the mythological drawing of this constellation the charioteer holds in his left arm a goat (Capella) and two kids, represented by the three faint stars 4° or 5° S. W. of Capella. The south-western half of the constellation is traversed by the Milky Way and contains many fine star clusters.

Capella is 30 light years distant and is receding from us at the rate of 21 miles per second.

Clusters. (1) M. 37; R.A. 5h 44m, Decl. 32° 31′, nearly on the line from θ Aurigæ to ζ Tauri. A fine cluster, resolvable into about 500 stars from the tenth to the fourteenth magnitude. "Even in smaller instruments extremely beautiful, one of the finest of its class. Gaze at it well and long."—*Webb.* (2) M. 38, R.A. 5h 21m, Decl. 35° 47′. A fine cluster described by Admiral Smyth as "an oblique cross, with a pair of large stars in each arm, and a conspicuous one in the centre, the whole followed by a bright individual of the seventh magnitude." The whole region is very beautiful.

Taurus (The Bull), directly S. W. of Auriga. It is most easily recognised by the little dipper-shaped group called the Pleiades, which crosses the meridian about 9 p.m. on January 1. In this group six stars are easily visible, but on a dark night a good eye will see nine. It is a beautiful sight in an opera glass, and with a 3-inch telescope 100 stars are visible. Aldebaran, the brightest star, of a ruddy color, is at one end of a group of stars forming a V and well-known as the Hyades. The only other conspicuous star is β or Nath, to the N. E. of Aldebaran and almost south of Capella: it is of the second magnitude. The brightest of the Pleiades is called Alcyone.

Nebula. M. 1, R.A. 5h 27m, Decl. 21° 56′, about 1° west and a little north of ζ, the so-called Crab Nebula. Its accidental discovery by Messier when following a comet in 1758 led to the formation of his catalogue of nebulæ, in which it is number one.

Orion, which is named from a giant of mythological history is one of the few constellations really suggesting the figure of the object it is supposed to represent. It is also the most beautiful and brilliant constellation of all, being studded with stars of the first, second and third magnitudes. The three stars of second magnitude in a close row form the belt; the upper one of these is on the celestial equator. From these depend three others, known as the Sword of Orion; the centre one, θ, appears slightly hazy to a good eye; when examined with a telescope it is seen to be quadruple, and to be surrounded by a nebula, the Great Nebula of Orion. The left foot of the giant is marked by Rigel, of the first magnitude, the right knee by κ, of the second; the two shoulders by Betelgeuse and Bellatrix, of the first and second magnitudes respectively; the head is a small triangle formed by one star of the fourth and two of the fifth magnitude.

Double Stars. (1) β (Rigel), mags. 1 and 8; distance 9″·1; both white; the brilliancy of the primary renders the companion more difficult. (2) δ (the

westernmost star in the belt), mags. 2 and 7; distance 53″. (3) ζ (the easterly star of the belt), triple; mags. 2, 6, 9; distances 2″·2, 57″; colors, yellow, purplish, grey. (4) ι, triple; mags. $3\frac{1}{2}$, $8\frac{1}{2}$, 11; the lowest star in the sword, just below the nebula. (5) θ, multiple, the trapezium situated in the densest part of the great nebula; mags. 6, 7, $7\frac{1}{2}$, 8. (6) σ, triple, a beautiful star of the fourth magnitude. In most ordinary telescopes it presents an appearance described by Sir Wm. Herschel as "a double-treble star, or two sets of treble stars almost similarly situated." In larger instruments both sets are seen to be quadruple.

Nebula. M. 42; the finest in the sky. The fainter portions extend over an immense space; shown by photography to cover a large part of the constellation.

FEBRUARY

Canis Major (The Great Dog), lies to the south-east of Orion. It is marked by Sirius, the Dog Star, which is by far the brightest of the fixed stars, forming a magnitude by itself. It is at a distance of about nine light-years; hence it must be of stupendous magnitude and brilliancy. From irregularities in its proper motion it was shown that it must have a dark companion revolving about it. This was confirmed by Alvan Clark's discovery in 1862 of a companion of the tenth magnitude. The period of revolution is about fifty years, the companion having about one-half the mass of Sirius, and about equal to that of our sun. About five or six degrees west of Sirius is β, of the second magnitude; further to the south are δ and ϵ, of the second magnitude, and two other stars of the third, all in the same constellation.

Cluster. M. 41, 4° S. of Sirius; a fine group with a red star near the centre.

Canis Minor (The Lessor Dog) is to the east of Orion and slightly higher. The name of its brightest star, Procyon, signifies "Before the Dog," being given to it because it rises shortly before Sirius; it forms an equilateral triangle with Sirius and Betelgeuse. From the proper motion of Procyon it was shown theoretically by Bessel that it must, like Sirius, have a companion revolving around it. This companion was discovered at the Lick Observatory by Professor Schaeberle in 1896, very nearly in the predicted position.

Gemini (The Twins) is the third sign and the fourth constellation of the zodiac. It derives its name from the Twin Stars, Castor and Pollux, of the first magnitude; they are separated by about four and a half degrees, and lie to the south-east of Capella, and some distance directly to the north of Procyon.

Castor is a double star, the components revolving about one another in about 1000 years. Some distance to the south-west is γ, of the second magnitude; the constellation also includes several third and fourth magnitude stars.

Double Stars. (1) α (Castor), mags. $2\frac{1}{2}$, $3\frac{1}{2}$; distance 5″·5. A beautiful object in a small telescope. The larger of the pair has been shown to be a spectroscopic binary of period about 3 days. (2) δ, about half-way between β and γ, and just south of the ecliptic. Mags. 3 and 8; distance 7″. (3) μ, mags, 3, 11; distance 80″.

MARCH

Lynx, a modern constellation just east of Auriga. It contains no stars above magnitude 4.

Double Star. ρ Lyncis, R. A. 9h 11m; Decl. 37° 21′; mags. 4 and $7\frac{1}{2}$; distance 2″·9; white and lilac.

Cancer (The Crab), south of the Lynx and east of Gemini. This does not contain any star brighter than the fourth magnitude.

Double Star. ι, R.A. 8h 40m, Decl. 29°: mags. 4, $6\frac{1}{2}$; distance 30′; orange and blue.

Cluster. Præsepe ("Beehive") a well-known coarse cluster, easily recognised by the naked eye and resolvable by an opera glass. The line from Castor to Pollux produced about 12° passes near it.

APRIL

Ursa Major (The Great Bear). This is the most familiar of the circumpolar constellations and in our latitudes is always above the horizon. In April it is above the pole. The best known feature is the "Big Dipper," but this is but a small part of the constellation. The stars α and β are known as the "Pointers" because a line from β through α, and produced about five times the distance between them passes near the Pole Star.

The Plough or Charles' wain

Double Stars. (1) ζ (Mizar, at the bend in the handle). Near it is a little star Alcor, the "rider on his horse," easily observed by the naked eye. Mizar in a small telescope is seen to be double. Mags. 3 and 5; distance 14″·5. The large star of this pair is also a spectroscopic binary—the first one discovered. (2) ξ, R.A. 11h 13m, Decl. 32° 6′; mags. 4 and 5; distance about 3″ (rapidly changing). A binary having a period of 61 years. Discovered by Sir W. Herschel in 1780. The first binary whose orbit was computed.

Nebulæ. M. 81 and M. 82. R.A. 9h 45m, Decl. 69° 44′. Two nebulæ about half a degree apart, one pretty bright.

Leo (The Lion). East of Cancer. Regulus, its brightest star, is of the first magnitude, and it is on the ecliptic. The well-known configuration "The Sickle," in which Regulus is at the end of the handle, is easily recognisable.

Double Stars. (1) γ, the third star in the Sickle. Mags. 2, $3\frac{1}{2}$; distance 3″·4; a binary with a period of about 400 years. (2) ι (about 5° S. W. from β); mags. 4 and 7; distance 2″·5; yellow and bluish.

MAY

Canes Venatici (The Hunting Dogs). With these dogs Boötes pursues the Great Bear around the pole. Most of the stars are small but α (which is known as Cor Caroli — the heart of Charles II. of England) is of magnitude $2\frac{1}{2}$.

Double Star. α (Cor Caroli); mags. 3 and 5; distance 20″; white.

Nebulæ. (1) M. 51; R.A. 13h 25m, Decl. 47° 49′. Faint in small telescopes, but the wonderful spiral, in modern photographs. (2) M. 3; about 12° N. W. from Arcturus; a bright cluster, discovered in 1895 to be variable.

Coma Berenices (The Hair of Berenice). A little constellation, containing many 5 and 6 mag. stars.

Virgo (The Virgin), east of Leo and south of Coma Berenices. Its brightest star is α or Spica, mag. $1\frac{1}{2}$, a fine white star forming with Denebola (β Leonis) and Arcturus an almost equilateral triangle.

Double Stars. (1) γ; mags. 3 and 8; distance 6″·2; a binary with period 185 years. Yellowish. (2) θ (two-fifths of the way from Spica to δ, just north of ecliptic); mags. $4\frac{1}{2}$, 9, 10.

JUNE

Ursa Minor (The Lesser Bear). This small constellation is, of course, always high above the horizon, and it has the high distinction of containing our Pole Star. This star is of the second magnitude and is easily located by means of the Pointers of the "Big Dipper." There are seven stars forming the "Little Dipper," the Pole Star being at the end of the handle. The stars β and γ are known as the "Guardians of the Pole."

Double Star. Polaris has a companion; mag. $9\frac{1}{2}$; distance 18″·6.

Boötes (The Herdsman). A fine and large constellation, extending from the celestial equator to within 30° of the pole. Its principal star Arcturus may be easily located by prolonging the sweep of the handle of the Dipper. It is second only to

Sirius in brilliancy and has been seen *with the naked eye* 24^{m} before sunset. Its distance is about 140 light-years. The spectroscope shows that it is approaching us at the rate of 4 miles a second, but its velocity at right angles to the line drawn from the star to us is probably 250 miles a second. Arcturus, Spica and Denebola form a great triangle, as already remarked.

Double Stars. (1) ϵ, mags. 3 and 6; distance 3″·1; orange and greenish blue. (2) ζ (about 9° S. E. from Arcturus); mags. 3·5, 4; distance 0″·8; requires a good 4-inch telescope to separate this.

Corona Borealis (Northern Crown) is a pretty half-circle of stars about 20° N. E. of Arcturus. Its principal star, Alphecca, is of the second magnitude. It was in this constellation that a *Nova* of the second magnitude suddenly appeared on May 10, 1866. In a short time it faded to the ninth magnitude, in which condition it still remains. Its position is 1½° S. E. of ϵ, the most easterly star in the semi-circle.

Libra (The Balance). This is a large but inconspicuous constellation, there being no stars of the first or second magnitude and only two, α and β, of the third. The star δ is a remarkable variable, usually being of the 4½ or 5 magnitude, but at times running down nearly two magnitudes.

JULY

Hercules, a large constellation, is bounded on the north by Draco and on the south by Ophiuchus, and extends east and west nearly from Arcturus to Vega. It has no very conspicuous stars, but contains many good telescopic objects. It is interesting as marking that part of the heavens towards which the solar system is at present travelling.

Double Stars. (1) α, mags. 3 and 6; distance 4″·5; colors, yellow and intense blue; one of the finest objects in the heavens. (2) ζ, at the S. W. corner of the "Keystone" (see Map); mags. 3, 6½; distance 1″·5 (1905); a binary of period 34 years. (3) ρ, (2½° east of π); mags. 4 and 5; distance 4″; white, emerald green (4) δ, mags. 3 and 8; distance 18″; white, light blue.

Clusters. (1) M. 13, R.A. 16h 37m, Decl. 36° 41′. The finest of all the clusters, containing 25,000 stars. (2) M. 92, R.A. 17h 13m, Decl. 43° 16′. Fine but not equal to M. 13.

Ophiuchus (The Serpent-Bearer) is south of Hercules, and though occupying a considerable space in the sky, is not a very conspicuous constellation. The highest part of this constellation is marked by the star α, of the second magnitude, about

half-way between Antares and Vega, and forming with Vega and Altair a nearly equilateral triangle.

Serpens (The Serpent) is a divided constellation, the principal part being to the north-west of Ophiuchus ; with one corner to the south-east of the latter. The ancients probably considered it to consist of a trail of stars stretching across, or, perhaps, coiled around, Ophiuchus, whence arose the name of the latter. It contains no stars brighter than the third magnitude.

Double Stars. (1) λ Ophiuchi, R.A. 16h 28m, Decl. 2° 20′ N.; mags. 4 and 6; distance 1″·2. (2) 70 Ophiuchi, R.A. 18h 1m, Decl. 2° 32′ N.; mags. 4½, 6; distance (1905) 2″; a well-known binary of period 93 years. (3) δ Serpentis, R.A. 15h 30m, Decl. 10° 51′; mags. 4 and 5; distance 4″. (4) θ Serpentis, R.A. 18h 51m, Decl. 4° 4′ N.; mags. 4 and 4½; distance 21″; yellowish and white; a fine wide pair.

Cluster. M. 23, R.A. 17h 50m, Decl. 19° 0′ S.; a fine low-power field.

Scorpio (The Scorpion), south of Ophiuchus, the ninth constellation of the zodiac, is of irregular shape. It is only by virtue of two long projections to the north that it is ranked as a zodiac constellation at all, as nearly all the stars belonging to it are some distance south of the ecliptic. The sun spends only nine days out of twenty-five in Scorpio, the other sixteen being occupied in passing through Ophiuchus, which, however, is not counted among the zodiac constellations. Scorpio's principal star is Antares, of the first magnitude, color a decided red. Viewed through the telescope Antares' color appears interspersed with intermittent flashes of green, which is explained by the presence of a close green companion. Under ordinary atmospheric conditions this companion can not be separated from the rays of Antares itself.

Double Stars. (1) α, mags. 1 and 7; distance 3″·5 (see above). (2) β, triple; mags. 2, 4, 10; distances 13″, 0″·9. (3) ν (2° E. of β), quadruple; mags. 4, 5, 7, 8.

Clusters. (1) M. 80, half-way between α and β; a very fine cluster. (2) M. 4, 1½° W. of α; not so fine as the preceding.

AUGUST

Draco (The Dragon), a very large and winding constellation, is in the neighborhood of the pole. Draco contains several second magnitude stars between Vega and the pole, and extends westward in a wide curve around Ursa Minor. The star α, of

magnitude 3½, 4700 years ago was the pole-star, being much nearer to the pole than Polaris now is.

Lyra (The Lyre), though a small constellation, contains several fairly bright stars. The principal of these is Vega, which rank second or third in the heavens in brightness. Vega is of a brilliant bluish-white color and cannot fail to be easily identified. It crosses the meridian at 9 p.m. on August 15, when it is only a few degrees south of the zenith. This star is always visible in our latitudes at some hour of the night throughout the year. Twelve thousand years from now it will be the pole star, though not so near the pole as Polaris now is.

Double Stars. (1) Vega has a companion, of mag. 11. 48″ from it. (2) β has three small stars near it, a pretty object with low power. (3) ϵ, the well-known "double-double," about 2° east of Vega. Visible in an opera glass as a double and to some with the naked eye. Each is again double; mags. 5, 6, 5, 5.

Nebula. M. 57, the Ring Nebula; between β and γ, one-third of the way from β.

Sagittarius (The Archer), the tenth constellation of the zodiac, passes low in the south when Vega is on the meridian. It contains a group of seven fairly bright stars, about 30° to the east of Antares and at about the same altitude. The sun passes through Sagittarius in December and January.

Clusters. (1) M. 22 (3° N. W. of λ). (2) M. 25 (7° N. and 1° E. of λ); visible to naked eye. (3) The Trifid Nebula, R.A. $17^h\ 55^m$, Decl. 23° 2′ S., a well-known and beautiful object.

SEPTEMBER

Cygnus (The Swan) is marked by five stars forming a conspicuous cross in the heavens, which may, without unduly stretching the imagination, be likened to the outline of a flying swan. It is in the Milky Way, which here begins to separate into two streams, and contains telescopic fields of great magnificence. Its brightest star α, sometimes known as Arided or Deneb, crosses the meridian two hours and five minutes after Vega and a few degrees higher, almost exactly in the zenith; it is between the first and second magnitudes, but has no appreciable parallax or proper motion, being, therefore, at an immense distance, and possibly surpassing Vega or even Sirius in size; it is approaching us at the rate of about forty miles per second. About 15° east of α there suddenly appeared, in 1876, a Nova of the 3rd magnitude, which later faded irregularly to the 14th magnitude.

Double Stars. (1) β, mags. $3\frac{1}{2}$, 7; distance 35″; orange and blue; the finest of colored pairs for a small telescope. (2) 61 Cygni, at one corner of a parallelogram, of which α, γ and ε form the other corners; mags. $5\frac{1}{2}$, 6; distance 22″; our *second nearest* neighbor, its distance having been first determined by Bessel in 1838.

Clusters. The Milky Way in Cygnus affords fine views for a low power.

Vulpecula (The Fox) and **Sagitta** (The Arrow) are two small constellations immediately south of Cygnus, between it and Aquila. Neither of them contains any bright stars, but as both are traversed by the Galaxy the telescopic fields are good. Vulpecula, in particular, contains one of the prettiest of telescopic objects, the well-known Dumb-Bell Nebula. M. 27, R. A. 19^h 54^m, Decl. 22° 23′.

Delphinus (The Dolphin), otherwise known as Job's Coffin, is another small constellation to the immediate north-east of Aquila, containing a little group of five stars of the third magnitude.

Double Star. γ (at the N. E. angle of quadrilateral); mags. 4 and 7; distance 11″·3

Aquila (The Eagle) is on the meridian about nine o'clock at the beginning of September, being then about half-way from the horizon to the zenith. It is conspicuously marked by Altair, a fine star of the first magnitude, which crosses the meridian seventy minutes after Vega. Though Aquila is a large constellation it contains only three other moderately bright stars, all of the third magnitude.

OCTOBER

Cepheus one of the polar constellations, extends northward to the pole between Draco and Cassiopeia, and southward as far as Cygnus. Though a large constellation, it contains only three stars of the third magnitude and four of the fourth; however, it atones for this by the comparatively large number of interesting double and variable stars, several of the latter being of quite short period.

Double Stars. (1) β, mags. 3 and 8; distance 14″. (2) δ, mags. 3·7 to 5 (larger star variable) and 7; distance 41″.

Pegasus, the winged horse of Grecian mythology, lies S. E. of Cygnus; three bright stars in it form with Alpherat, in Andromeda, a large and conspicuous figure known as the Square of Pegasus, each side of the square being about 14° in length.

The boundaries of the constellation extend a considerable distance to the west and south-west, taking in the bright star ϵ, which lies west and a little south of the star in the right-hand lower corner of the square.

Aquarius (The Waterman), a large and irregularly shaped constellation, lies to the east and north of Capricornus. It is the eleventh sign and twelfth constellation of the zodiac, and is occupied by the sun from the middle of February till the middle of March; it contains seven third magnitude and eight fourth magnitude stars. It is not conspicuous, but if attentively examined the stars in the south-eastern part of it will be found to have a trend downwards, which, doubtless, gave occasion to the idea of water flowing from a jar.

Piscis Australis (The Southern Fish), which is not to be confounded with the zodiac constellation of Pisces, lies to the south of Aquarius and Capricornus. Its brightest star, Fomalhaut, is the most southerly of the first magnitude stars visible in these latitudes; it is on the meridian at nine o'clock on the 20th of October, when it is only about 15° above the southern horizon.

Capricornus (The Goat), the eleventh constellation of the zodiac, contains four stars of the third magnitude and four of the fourth. It may be readily recognised by two stars pointing directly to Altair, which pass the meridian twenty-seven minutes after it, about 20° lower.

Double Stars. (1) α, mags. 3 and 4; distance 6′ 13″; use a very low power. (2) β, mags. $3\frac{1}{2}$ and 7; distance 3′ 25″.

NOVEMBER

Cassiopeia, one of the two bright circumpolar constellations, is named from a queen of Grecian mythology; and sometimes known by the name of *The Lady in her Chair*. During November it is on the meridian, directly above the pole and opposite the Dipper, about nine o'clock. The constellation is very easily recognised by five bright stars arranged in a zigzag figure like a wide inverted W, which in certain positions is said to resemble the outline of a chair. Lying as it does, in the galaxy, it contains many fine telescopic fields.

Double Star. η, about half-way between α and γ, a little off the line; mags. 4 and $7\frac{1}{2}$; distance 5″·5; orange and purple.

Andromeda is directly to the south of Cassiopeia, and passes the meridian slightly south of the zenith. Its brightest star Alpherat, passes the meridian at the same time as the most westerly of the five bright stars in Cassiopeia, β passes the meridian an hour after Alpherat, and about 7° nearer to the zenith.

Double Stars. (1) γ, mags. 3 and 5; distance 11″; orange and greenish-blue; very fine. (2) π (2° N. and a little W. of δ); mags. 4 and 9; distance 36″; white and blue.

Nebula. M. 31; the Great Nebula, visible to the naked eye; prolong the line from β to μ its own length beyond μ.

Pisces (The Fishes), is to the southeast and east of Pegasus and south of Andromeda. It is the first constellation of the zodiac; although containing quite a large number of stars, none of them are brighter than the fourth magnitude, and it is a quite inconspicuous constellation.

Double Star. α, mags. 4 and 5½; distance 3″.

Cetus (The Whale), is a fairly large constellation lying to the southeast of Pisces. It contains two stars, α and β, of the second magnitude, and eight of the third. β may be identified by prolonging the eastern side of the Square of Pegasus about two and a half times its own length to the south: α lies about 40° towards the northeast. About one-third of the way from α to β, in a direct line between them, lies Mira (The Wonderful), a variable star, having a period of about eleven months; at its maximum brilliancy this star is somewhat brighter than the second magnitude, though it does not attain this degree of brightness in every period; its minimum is about the ninth magnitude.

Double Star. γ, mags. 3½, 7; distance 2″·5; yellow and blue.

DECEMBER

Perseus, named after a hero of Grecian mythology, lies to the east of Andromeda. Its brightest star, α, is known by the name of Mirfak; it is of the second magnitude, and crosses the meridian slightly north of the zenith at nine o'clock (local time) on December 26. About ten degrees a little west of south from it is Algol (The Demon), the best known variable star in the heavens. Ordinarily of the second magnitude, but once in every period of two days and nearly twenty-one hours it is partially

eclipsed by a companion which revolves around it; the eclipse occupies eight or ten hours, during about half an hour of which the star is only of the fourth magnitude. It is easily located by noting that it is a little less than half way from the Pleiades to Cassiopeia. Another interesting feature of this constellation is the double cluster, lying about half way between Mirfak and Cassiopeia.

Double Star.· ε, mags. $3\frac{1}{2}$ and 9; distance 8″·4.

Aries (The Ram), lies immediately to the north-east of Pisces. Its brightest star α, otherwise known as Hamal, is of the second magnitude; it is situated directly east from the centre of the Square of Pegasus, at a distance of about double the diameter of the latter; near it, to the south-west, is β, of the third magnitude; the constellation contains no other stars brighter than the fifth magnitude.

Triangulum (The Triangle), is a small constellation marked by a right-angled triangle of three stars of the third magnitude. The centre of the triangle lies about ten degrees directly north of Hamal.

COMETS OF 1914

The most conspicuous comet during 1914 was discovered by Delavan at La Plata, Argentine, on December 17, 1913, and which was known as Comet 1913*f*. It was about the eleventh magnitude when discovered and increased steadily in brightness until by August 1914, it was visible to the naked eye. During September and October it was a conspicuous object in the morning and evening sky, a tail of about 8° being visible at its maximum brightness. It reached perihelion on October 26, and moving southward, steadily decreased in brightness. The most striking feature was the presence of a long narrow tail of sharp structure, and a short diffuse one, the former being much more active photographically, than the latter.

Kritzinger of Bothkamp, Germany, discovered the first comet of 1914, on March 29 in the constellation of Scorpio. It was a faint object when discovered and never became very bright. Perihelion was reached May 31 and it was soon invisible except to the larger telescopes.

Comet 1914*b*, discovered by Zlatinsky at Mitau, Russia, about May 15, was quite bright at first, being visible to the naked eye until near the end of May. Photographs by Professor Barnard showed a tail of 12°. However, it had passed perihelion on May 8 and soon became a telescopic object.

Neujmin discovered Comet 1914*c* at Simeis, Crimea, on June 27. Perihelion passage was on July 24, but the comet was visible only in large telescopes and decreased in brightness very rapidly.

The fourth comet to be discovered in 1914 was Encke's, which was photographed on September 17 by Professor Barnard. Its magnitude as given by Backlund from an observation on September 20, was fourteen. This comet has a period of 3·315 years, being first discovered by Méchain, Paris, in 1786, and observed on several returns. It is called Encke's because Encke first discovered its periodicity in 1818.

1914*e* was discovered by Campbell at Arequipa, Peru, on September 18, an independent discovery being made by Haggerty at State College, New Mexico, on September 25. It was a naked eye object when discovered but soon became faint.

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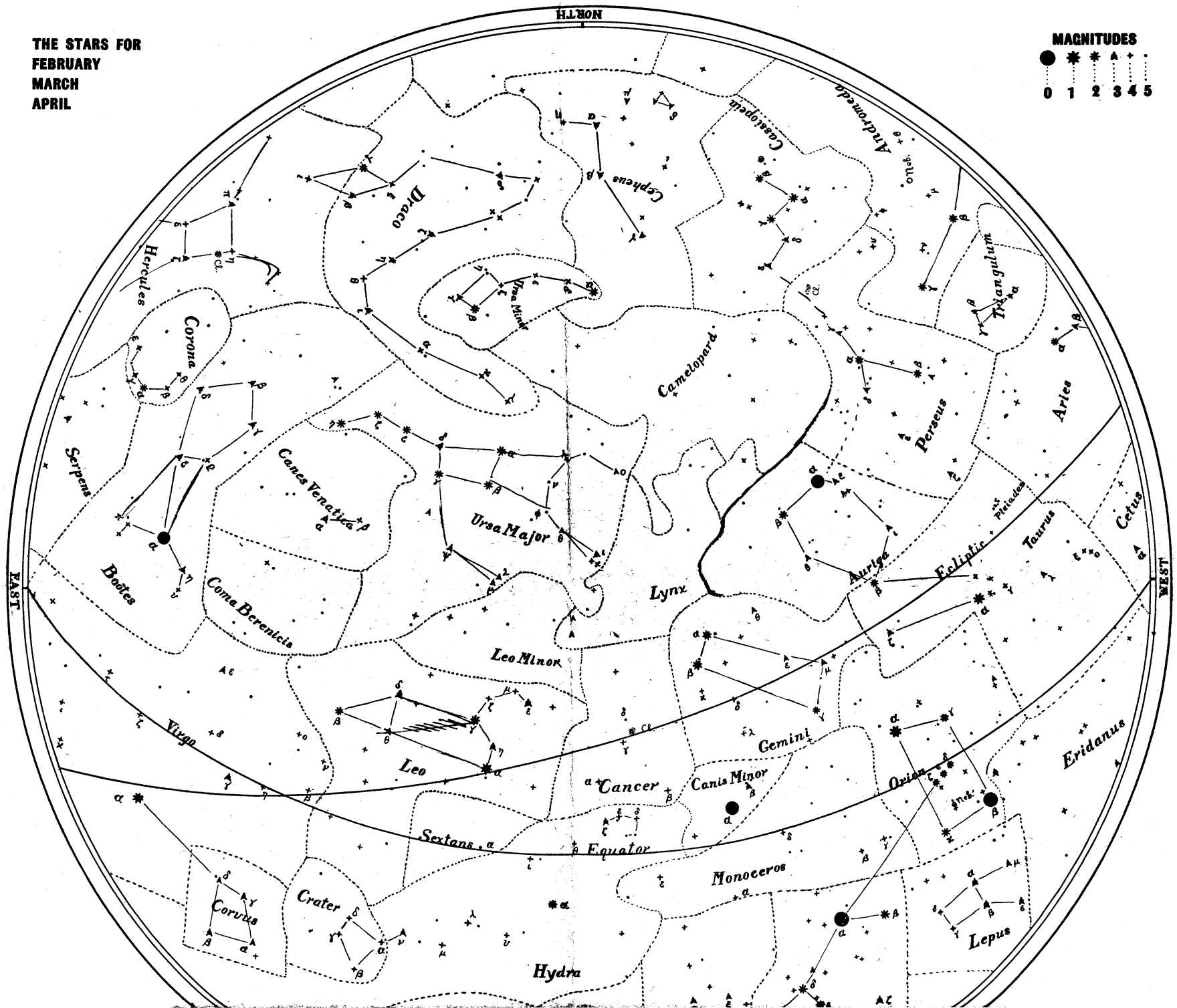
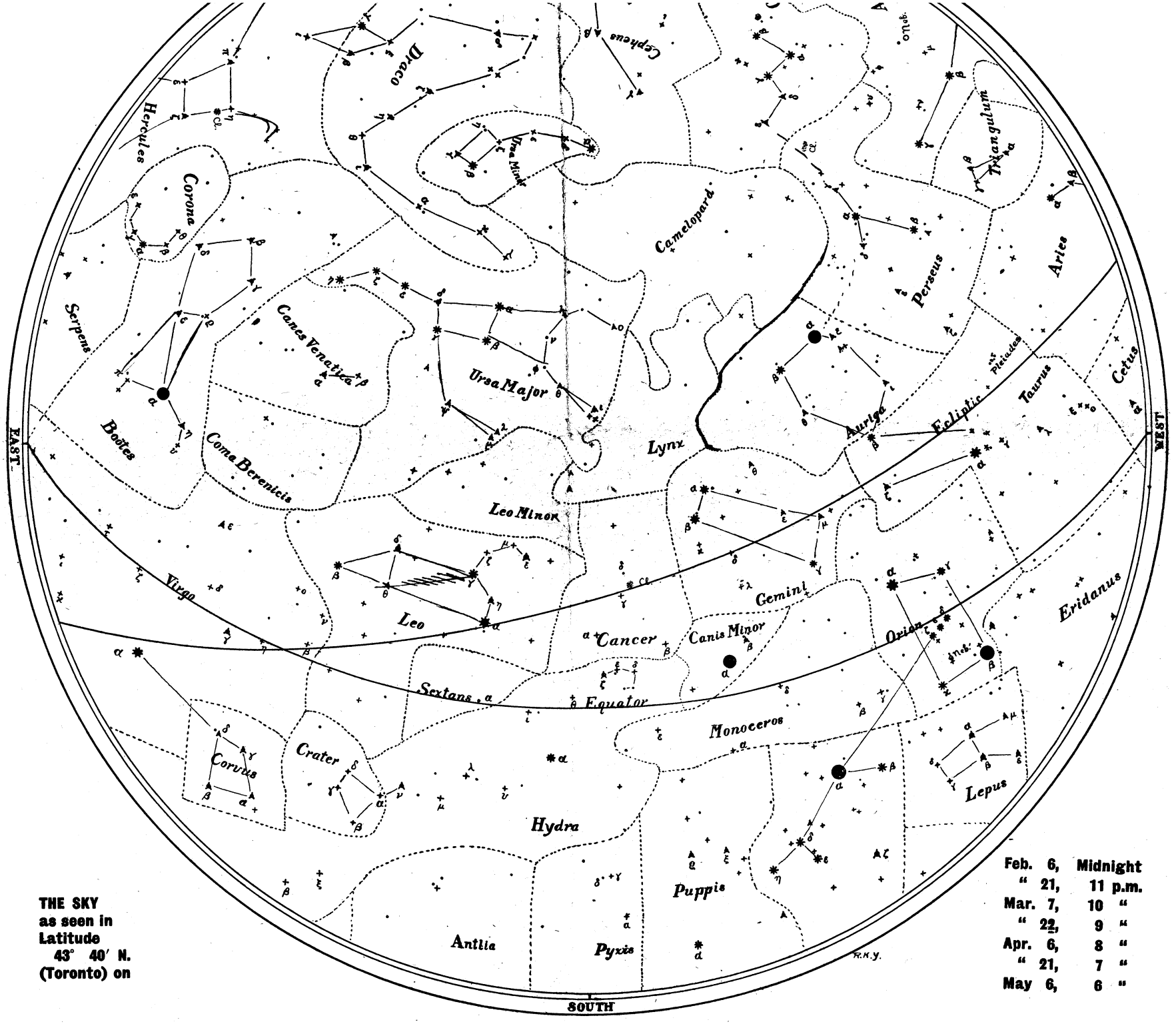
THE STARS FOR
FEBRUARY
MARCH
APRIL





THE SKY as seen in Latitude 43° 40′ N. (Toronto) on

Feb. 6,	Midnight
" 21,	11 p.m.
Mar. 7,	10 "
" 22,	9 "
Apr. 6,	8 "
" 21,	7 "
May 6,	6 "