THE OBSERVER'S HANDBOOK FOR 1916

PUBLISHED BY

The Royal Astronomical Society of Canada

EDITED BY C. A. CHANT

EIGHTH YEAR OF PUBLICATION

TORONTO
198 COLLEGE STREET
PRINTED FOR THE SOCIETY
1916

CALENDAR 1916

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	29				

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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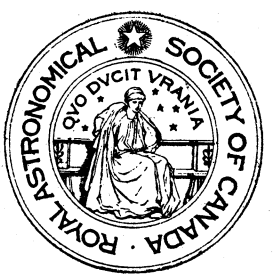

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CONTENTS

PREFACE

The HANDBOOK for 1916 follows the same plan as that for last year, no new suggestions regarding desirable improvements having been received. The Editor would be glad to consider any proposals for making the book more usable by amateurs.

Besides those mentioned in the body of the book, Mr. R. M. Stewart has supplied the phenomena of Jupiter's satellites and Dr. R. K. Young has furnished the times of the Minima of Algol. For the latter, Hartwig's correction of $1^h\ 30^m$ *earlier* has been applied to Chandler's formula:

$$m = \text{J.D. } 2410640{\cdot}34111 + 2{\cdot}8673102\,E + 0^d{\cdot}1021\,(0^\circ{\cdot}024\,E + 226^\circ) + 0^d{\cdot}0153\,(\sin E/13 + 216^\circ).$$

THE EDITOR.

TORONTO, December, 1915.

ANNIVERSARIES AND FESTIVALS. 1916

New Year's Day	Sat., Jan. 1	Pentecost (Whit Sunday)	June 11
Epiphany	Thurs., Jan. 6	Trinity Sunday	June 18
Septuagesima Sunday	Feb. 20	Corpus Christi	Thur., June 22
St. David	Wed. Mch. 1	St. John Baptist	Sat., June 24
Quinquagesima (Shrove Sunday)	Mch. 5	Dominion Day	Sat., July 1
Ash Wednesday	Mch. 8	Labor Day	Mon., Sept. 4
St. Patrick	Fri. Mch. 17	St. Michael (Michaelmas Day)	Fri., Sept. 29
Palm Sunday	Apr. 16	All Saints Day	Wed., Nov. 1
Good Friday	Apr. 21	St. Andrew	Thur. Nov. 30
Easter Sunday	Apr. 23	First Sunday in Advent	Dec. 3
St. George	Sun., Apr. 23	Conception Day	Fri., Dec. 8
Victoria Day	Wed., May 24	St. Thomas Day	Thur., Dec. 21
Rogation Sunday	May 28	Christmas Day	Mon., Dec. 25
Ascension Day (Holy Thursday)	June 1		

King George V., born June 3, 1865; began to reign May 6, 1910.

Queen Mary, born May 26, 1867.

Prince of Wales, born June 23, 1894.

SYMBOLS AND ABBREVIATIONS

SIGNS OF THE ZODIAC

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

SUN, MOON AND PLANETS

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

ASPECTS AND ABBREVIATIONS

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

THE GREEK ALPHABET

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

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.

1916, 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
Sat.	Jan.	1	18	42	27	S.	23	5	35	+	3	11·0	18	39	16·2
Thur.	"	6	19	4	30		22	37	26		5	30·6	18	58	59·0
Tues.	"	11	19	26	21		21	58	6		7	39·0	19	18	41·8
Sun.	"	16	19	47	57		21	8	5		9	32·8	19	38	24·6
Fri.	"	21	20	9	17		20	7	59		11	9·6	19	58	7·4
Wed.	"	26	20	30	18		18	58	28		12	27·7	20	17	50·1
Mon.	"	31	20	50	59		17	40	14		13	26·3	20	37	32·9
Sat.	Feb.	5	21	11	21		16	14	8		14	4·8	20	57	15·7
Thur.	"	10	21	31	21		14	41	2		14	22·8	21	16	58·5
Tues.	"	15	21	51	2		13	1	51		14	20·8	21	36	41·3
Sun.	"	20	22	10	24		11	17	24		14	0·1	21	56	24·0
Fri.	"	25	22	29	30		9	28	32		13	22 7	22	16	6·8
Wed.	Mar.	1	22	48	20		7	36	3		12	30·9	22	35	49·6
Mon.	"	6	23	6	59		5	40	48		11	26·5	22	55	32·3
Sat.	"	11	23	25	27		3	43	40		10	11·6	23	15	15·1
Thur.	"	16	23	43	46	S.	1	45	29		8	48·5	23	34	57·9
Tues.	"	21	0	2	0	N.	0	13	2		7	19·7	23	54	40·6
Sun.	"	26	0	20	12		2	11	10		5	48·2	0	14	23·4
Fri.	"	31	0	38	23		4	8	11		4	16·9	0	34	6·2
Wed.	Apr.	5	0	56	37		6	3	20		2	48·0	0	53	49·0
Mon.	"	10	1	14	55		7	55	49		1	23·4	1	13	31·7
Sat.	"	15	1	33	20		9	44	56	+	0	5·2	1	33	14·5
Thur.	"	20	1	51	53		11	30	1	−	1	4·4	1	52	57·3
Tues.	"	25	2	10	37		13	10	25		2	3·4	2	12	40·0
Sun.	"	30	2	29	33		14	45	26		2	49·8	2	32	22·8
Fri.	May	5	2	48	43		16	14	23		3	22·8	2	52	5·6
Wed.	"	10	3	8	6		17	36	34		3	42·1	3	11	48·4
Mon.	"	15	3	27	44		18	51	23		3	47·5	3	31	31·2
Sat.	"	20	3	47	35		19	58	14		3	38·9	3	51	13·9
Thur.	"	25	4	7	40		20	56	37		3	16·6	4	10	56·7
Tues.	"	30	4	27	58		21	46	1		2	41·3	4	30	39·5
Sun.	June	4	4	48	27		22	25	58		1	55·1	4	50	22·3
Fri.	"	9	5	9	5		22	56	6		1	0·5	5	10	5·1
Wed.	"	14	5	29	48		23	16	10	−	0	0·1	5	29	47·9
Mon.	"	19	5	50	34		23	26	1	+	1	3·6	5	49	30·7
Sat.	"	24	6	11	22		23	25	33		2	8·4	6	9	13·5
Thur.	"	29	6	32	8	N.	23	14	45	+	3	11·3	6	28	56·2

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

1916, 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
Tues.	July	4	6	52	48	N.	22	53	46	+	4	9·0	6	48	39·0
Sun.	"	9	7	13	20		22	22	50		4	58·7	7	8	21·8
Fri.	"	14	7	33	42		21	42	17		5	37·7	7	28	4·6
Wed.	"	19	7	53	52		20	52	29		6	4·5	7	47	47·4
Mon.	"	24	8	13	48		19	53	52		6	18·1	8	7	30·2
Sat.	"	29	8	33	31		18	46	55		6	17·5	8	27	13·0
Thur.	Aug.	3	8	52	58		17	32	14		6	2·0	8	46	55·8
Tues.	"	8	9	12	10		16	10	28		5	31·0	9	6	38·5
Sun.	"	13	9	31	6		14	42	14		4	45·1	9	26	21·3
Fri.	"	18	9	49	50		13	8	8		3	45·5	9	46	4·1
Wed.	"	23	10	8	21		11	28	47		2	33·8	10	5	46·9
Mon.	"	28	10	26	41		9	44	51	+	1	11·5	10	25	29·6
Sat.	Sept.	2	10	44	53		7	57	2	−	0	19·9	10	45	12·4
Thur.	"	7	11	2	57		6	6	3		1	58·6	11	4	55·2
Tues.	"	12	11	20	56		4	12	35		3	42·4	11	24	37·9
Sun.	"	17	11	38	52		2	17	15		5	28·6	11	44	20·7
Fri.	"	22	11	56	49	N.	0	20	43		7	14·4	12	4	3·5
Wed.	"	27	12	14	49	S.	1	36	19		8	57·4	12	23	46·2
Mon.	Oct.	2	12	32	54		3	33	4		10	35·1	12	43	29·0
Sat.	"	7	12	51	6		5	28	46		12	5·6	13	3	11·8
Thur.	"	12	13	9	28		7	22	42		13	26·2	13	22	54·5
Tues.	"	17	13	28	3		9	14	7		14	34·1	13	42	37·3
Sun.	"	22	13	46	53		11	2	16		15	26·8	14	2	20·1
Fri.	"	27	14	6	0		12	46	18		16	2·4	14	22	2·8
Wed.	Nov.	1	14	25	26		14	25	21		16	19·4	14	41	45·6
Mon.	"	6	14	45	11		15	58	34		16	17·0	15	1	28·4
Sat.	"	11	15	5	17		17	25	6		15	54·0	15	21	11·2
Thur.	"	16	15	25	44		18	44	10		15	9·8	15	40	54·0
Tues.	"	21	15	46	33		19	54	57		14	4·2	16	0	36·8
Sun.	"	26	16	7	41		20	56	38		12	38·2	16	20	19·5
Fri.	Dec.	1	16	29	8		21	48	31		10	54·0	16	40	2·3
Wed.	"	6	16	50	51		22	29	56		8	54·2	16	59	45·1
Mon.	"	11	17	12	46		23	0	24		6	41·6	17	19	27·9
Sat.	"	16	17	34	51		23	19	30		4	19·3	17	39	10·7
Thur.	"	21	17	57	3		23	26	57	−	1	51·0	17	58	53·5
Tues.	"	26	18	19	15		23	22	37	+	0	39·0	18	18	36·3
Sun.	"	31	18	41	25	S.	23	6	33	+	3	5·9	18	38	19·1

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

OCCULTATIONS OF FIXED STARS AND PLANETS BY THE MOON, 1916

PREPARED BY R. M. MOTHERWELL

The following predictions were prepared for Ottawa, and observers at other stations should bear this in mind when preparing to observe. All stars down to magnitude 4·6 are included. The occultation of α Scorpii on September 4 is not given, as ahe grazing nature of the occultation prevents an accurate determination by the graphic method.

Date	Star	Mag.	*Immersion		*Emersion		Position Angle	
							Immer.	Emer.
			h	m	h	m	°	°
January 14	q Tauri	4·3	14	06·5			75	
January 30	χ Sagittarii	4·4			17	51·7		270
February 14	ϵ Geminorum	3·2	3	19·1	5	15·6	128	234
March 9	q Tauri	4·3	4	06·0	5	33·6	72	257
March 9	20 Tauri	4·1	4	31·6	5	44·3	105	224
March 23	π Scorpii	3·0	12	14·0	13	12·5	137	262
May 8	Neptune	7·7			0	03·7		267
July 23	17 Tauri	3·8	13	58·3	14	24·5	12	313
July 23	23 Tauri	4·3	14	09·6	15	16·1	86	257
July 23	η Tauri	3·0	14	51·2	15	57·2	65	253
July 23	27 Tauri	3·7	15	43·7	16	35·9	110	211
August 20	17 Tauri	3·8	23	00·2			68	
August 24	Saturn	0·4			16	22·0		290
October 13	23 Tauri	4·3	16	11·9	17	22·9	57	285
October 13	η Tauri	3·0	17	12·0	17	46·0	20	327
October 13	27 Tauri	3·7	17	52·9	18	48·4	50	302
December 6	ϵ Arietis	4·6	10	50·9	12	01·9	103	225
December 28	θ Aquarii	4·3	2	58·4	4	04·9	78	214

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

How the Tables are Constructed

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

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

The Times for Any Station

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

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

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

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

JANUARY

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

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

FEBRURAY

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

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 57m	21h 49m	10h 8m	23h 42m	6h 53m	21h 8m	8h 15m
Decl.	18° 34′ S.	14° 58′ S.	15° 50′ N.	3° 17′ S.	22° 26′ N.	17° 7′ S.	19° 32′ N.
Transit	13·23	14·15	2·36	16·07	23·16	13·34	0·42

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

The Sun.—During January the sun's R.A. increases from 18h 42m to 20h 51m and its Decl. changes from 23° 6′ to 17° 57′ S. The equation of time (see page 6) increases from 3m 11s to 13m 26s, 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 page 10). The earth is nearest the sun at 6 p.m., January 2 (see opposite page).

The Moon.—For its phases and conjunctions with the planets, see opposite page. There is an eclipse of the moon on January 19 (see page 53). On the 14th the moon occults q Tauri and on the 30th, χ Sagittarii (see page 8).

Mercury attains greatest elongation 18° 40′ E. on the 20th. This is not the very best time of the year to observe an eastern elongation of Mercury, a month or two later being better, but it is moderately favorable and for some days before and after the 20th the planet should be seen just after sunset. Examine the sky about 25° south of the west point of the horizon. Use, if convenient, a field glass to locate the planet; having once found it, it will likely be visible to the naked eye.

Venus on the 15th crosses the meridian at 2.15 p.m. (see above table) and can be seen as an evening star. Its position will continually improve during the month.

Mars on the 15th is on the meridian at 2.36 a.m., rising about 7 hours before this time. It is consequently visible most of the night. The planet is stationary on the 2nd and retrogrades until March 22. On the 15th it is 69 millions of miles from the earth and as its stellar magnitude is − 0·6 it is a prominent object.

Jupiter is about 4h behind the sun and hence is easily seen as an eveuing star. Its stellar magnitude is − 1·8, a little brighter than Sirius. For the configuration of its satellites, see next page; and for the eclipses, etc., see page 46.

Saturn rises at about 4 p.m. and can be seen all night. It is in opposition to the sun on the 4th (see opposite page). Taking its R.A. and Decl. from the above table, and referring to Map II. of the Constellations, it will be seen that the planet is between δ and ζ of Gemini. Its stellar magnitude is − 0·1, and it continues to retrograde during the month (until March 11).

The positions of *Uranus* and *Neptune* are given in the above table. 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 18h 55m.
			h	m	
Sat.	1	15h ♀ Greatest Hel. Lat. S.; 21h ♂ Stationary.			4○23●
Sun.	2	8h ⊕ in Perihelion; 15h ☿ Greatest Hel. Lat. S.	8	01	413○2
Mon.	3				32○41
(●) Tues.	4	9h·3 Moon in Perigee: 12h ☍ ♄ (◍); 23h 45m·4 New			312○4
Wed.	5	20h 48m ☌ ☿ ☾, ☿ 1° 1′ S. [Moon.	4	50	3○124
Thur.	6	15h ☌ ♀ ♁, ♀ 1° 7′ S.			12○34
Fri.	7	1h 18m ☌ ♁ ☾, ♁ 1° 17′ S.; 2h 13m ☌ ♀ ☾, ♀ 2° 27′ S.			2○134
Sat.	8		1	39	1○234
Sun.	9				23○24
Mon.	10	0h 33m ☌ ♃ ☾, ♃ 5° 34′ S.	22	28	32○14
(☽) Tues.	11	22h 37m·6 Moon's First Quarter.			321○4
Wed.	12				34○12
Thur.	13		19	17	41○23
Fri.	14				42○13
Sat.	15				41○3●
Sun.	16		16	06	41○32
Mon.	17	0h·1 Moon in Apogee; 13h ☌ ☿ ♁, ☿ 0° 15′ S.			432○●
Tues.	18	16h 39m ☌ ♄ ☾, ♄ 2° 49′ S.			4321○
Wed.	19	☾ Partial Eclipse visible in Canada. (See p. 53).	12	55	34○12
(☍) Thur.	20	3h 29m Full Moon; 7h 48m ☌ ♆ ☾, ♆ 0° 58′ S.;			1○2●●
Fri.	21	15h ☿ in ♌. [13h ☿ Greatest Elong. E. 18° 40′.			2○143
Sat.	22	10h ☍ ♆ (◍); 14h 28m ☌ ♂ ☾, ♂ 6° 35′ N.	9	44	1○34●
Sun.	23				○1324
Mon.	24				32○14
Tues.	25		6	33	321○4
Wed.	26	6h ☿ in Perihelion; 17h ☿ Stationary.			3○124
(☾) Thur.	27	19h 35m·1 Moon's Last Quarter..			1○24●
Fri.	28		3	22	2○413
Sat.	29				412○3
Sun.	30				4○132
Mon.	31		0	10	23431○

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 FEBRUARY

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	20h 33m	0h 9m	9h 27m	0h 4m	6h 44m	21h 16m	8h 11m
Decl.	16° 0′ S.	0° 18′ N.	19° 46′ N.	0° 46′ S.	22° 40′ N.	16° 36′ S.	19° 43′ N.
Transit	10·56	14·33	23·48	14·27	21·06	11·39	22·41

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

The Sun.—During February the sun's R.A. increases from 20h 55m to 22h 45m and the Decl. changes from 17° 24′ to 7° 59′ S. The equation of time reaches its maximum value 14m 24s on the 12th. See table on page 6. On the 3rd there is an eclipse of the sun, visible in Canada as a partial eclipse (see page 53).

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 14th the moon occults ϵ Geminorum (see page 8).

Mercury reaches inferior conjunction on the 5th (see opposite page) and is not well placed for observation during the month,

Venus is now about 2½ hours after the sun and hence is an evening star. It is slowly separating from the sun, and will continue to do so until April 24th. Its stellar magnitude is - 3·5, and so is about six times as bright as Sirius, the brightest of the fixed stars.

Mars is in oppposition to the sun on the 9th at 9 p.m., but is nearest the earth 15 hours earlier. This, however, is not a close opposition, the distance between the earth and Mars being 62,690,000 miles, while at some oppositions it may be less than 36,000,000 miles. However, the stellar magnitude is - 1·0, and so it is a prominent object. By taking the planet's R.A. and Decl. from the above table and referring to Map III. of the Constellations it will be seen that it is in Leo, about 6° west of Regulus. It is still retrograding, of course.

Jupiter is now only about 2½ hours after the sun, and is still an evening star. For the configuration of its satellites, see opposite page ; and for their eclipses, etc., see page 46.

Saturn is visible practically all night, being on the meridian, on the 15th, at 9.06 p.m. (see above table). See note on Saturn for last month.

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

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 at 16h 40m.
			h	m	
Tues.	1	19h·1 Moon in Perigee. [19h ☌ ♀ ☉, ♀ 4° 15′ N.			♃4320
Wed	2	[24m ☌ ♀ ☾, ♀ 2° 47′ N.; ◍ Eclipse vis. in Canada;	20	59	4320
●Thur.	3	11h 5m·6 New Moon; 15h 8m ☌ ♁ ☾, ♁ 1° 27′ S.; 15h			4132
Fri.	4	[19h ☌ ♁ ◍.			4201
Sat.	5	3h ☌ ☿ ◍ Inferior; 13h ☿ Greatest Hel. Lat. N.;	17	48	4120
Sun.	6	6h 6m ☌ ♀ ☾, ♀ 5°.16′ S.; 19h 55m ☌ ♃ ☾, ♃ 5° 52′ S.			0413
Mon.	7	7h ♂ Greatest Hel. Lat. N.			3124
Tues.	8		14	37	3204
Wed.	9	5h ☿ nearest ⊕; 21h ☍ ♂ ◍.			3024●
☽Thur.	10	17h 20m·4 Moon's First Quarter.			3102
Fri.	11		11	26	2013
Sat.	12				1203
Sun.	13	16h·4 Moon in Apogee; 22h ☌ ♀ ♃, ♀ 0° 27′ N.			0123
Mon.	14	20h 20m ☌ ♄ ☾, ♄ 2° 54′ S.	8	15	♃1042
Tues.	15				3240
Wed.	16	13h 24m ☌ ♆ ☾, ♆ 1° 2′ S.			4301●
Thur.	17	1h ☿ Stationary.	5	04	♃4302
♍Fri.	18	1h 16m ☌ ♂ ☾, ♂ 5° 44′ N.; 21h 28m·6 Full Moon.			4203
Sat.	19				4210
Sun.	20		1	53	4012
Mon.	21				4103
Tues.	22		22	42	3240
Wed.	23				3102
Thur.	24				3102
Fri.	25		19	31	2034●
☾Sat.	26	4h 23m·8 Moon's Last Quarter; 22h ♀ in ☊.			2103
Sun.	27				0123
Mon.	28		16	20	1032
Tues.	29	0h ☿ in ☋; 15h·7 Moon in Perigee.			3201

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.	22h 14m	2h 15m	8h 56m	0h 29m	6h 42m	21h 22m	8h 9m
Decl.	13° 2′ S.	14° 45′ N.	21° 9′ N.	1° 56′ N.	22° 47′ N.	16° 8′ S.	19° 52′ N.
Transit	10·43	14·44	21·24	12·58	19·09	9·51	20·36

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

The Sun.—On March 1st the sun's R.A. is 22h 48m and its Decl. is 7° 36′ S. It reaches the equator on the 20th (see opposite page), and on the 31st its R.A. is 0h 38m, Decl. 4° 8′ N. During the month the equation of time changes from 12m 31s to 4m 17s. See table on page 6.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 9th the moon occults *q* Tauri and 20 Tauri (Pleiades), and on the 23rd π Scorpii (see page 8).

Mercury reaches greatest elongation 27° 6′ W. on the 1st. This is quite a large distance from the sun, but as the ecliptic makes a small angle with the horizon in the east at sunrise, the planet is near the horizon and cannot be easily seen.

Venus is now well seen as an evening star. Its stellar magnitude is − 3·7, or nearly 6½ times as bright as Sirius.

Mars on the 15th is on the meridian at 9.24 p.m. and so is well seen almost all night. On that date its distance from the earth is 74 millions of miles. The planet retrogrades until the 22nd, and during the month the stellar magnitude falls from − 0·7 to + 0·1.

Jupiter is too close to the sun for convenient observation. It reaches conjunction with the sun on April 1.

Saturn is on the meridian on the 15th, at 7.09 p.m. and so can still be seen most of the night. It is in quadrature with the sun on the 30th (see opposite page).

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

The minima of Algol are given on the next page.

MARCH

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites.
		[☿ 0° 58′ S.	h	m	
Wed.	1	19h ☿ Greatest Elong. W. 27° 6′; 22h 17m ☌ ♅ ☾,			
Thur.	2	3h 40m ☌ ♅ ☾, ♅ 1° 37′ S.	13	09	
(New) Fri.	3	22h 57m·6 New Moon.			
Sat.	4	20h ☌ ☿ ♅. ☿ 0° 8′ S.			
Sun.	5	17h 16m ☌ ♃ ☾, ♃ 6° 5′ S.	9	58	
Mon.	6				
Tues.	7	8h 17m ☌ ♀ ☾, ♀ 4° 50′ S.			
Wed.	8		6	47	
Thur.	9				
Fri.	10	6h ☿ in Aphelion.			
(☽) Sat.	11	7h ♄ Stationary; 7h ♃ Greatest Hel. Lat. S.; 13h	3	36	
Sun.	12	12h·4 Moon in Apogee. [32m·9 Moon's First Quarter.			
Mon.	13	3h 3m ☌ ♄ ☾, ♄ 2° 45′ S.; 22h ♂ in Aphelion.			
Tues.	14	20h 24m ☌ ♆ ☾, ♆ 0° 58′ S.	0	25	
Wed.	15	19h 51m ☌ ♂ ☾, ♂ 4° 15′ N.			
Thur.	16		21	14	
Fri.	17				
Sat.	18				
(☉) Sun.	19	12h 26m·7 Full Moon.	18	03	
Mon.	20	17h 47m ♈ enters Aries, Spring commences.			
Tues.	21				
Wed.	22	8h ♂ Stationary.	14	52	
Thur.	23				
Fri.	24				
Sat.	25		11	41	
(☾) Sun.	26	8h·2 Moon in Perigee; 11h 22m·4 Moon's Last Quarter.			
Mon.	27				
Tues.	28		8	29	
Wed.	29	13h 25m ☌ ♅ ☾, ♅ 1° 53′ S.			
Thur.	30	14h ☿ Greatest Hel. Lat. S.; 17h □ ♄ (New).			
Fri.	31	11h ♀ in Perihelion.	5	18	

Invisible on account of proximity to sun.

Key to Symbols.—☌ Conjunction; ☍ Opposition; □ Quadrature; ☊ Ascending Node; ☋ Descending Node; (New) 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.	1h 37m	4h 34m	9h 8m	0h 56m	6h 46m	21h 27m	8h 8m
Decl.	9° 28′ N.	25° 3′ N.	19° 11′ N.	4° 52′ N.	22° 46′ N.	15° 45′ S.	19° 55′ N.
Transit	12 04	15·00	19·34	11·23	17·12	7·54	18·34

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. is 0h 42m, Decl. 4° 31′ N.; on the 30th the R.A. is 2h 30m, Decl. 14° 45′ N. For the equation of time, see page 6.

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

Mercury on the 14th is in superior conjunction with the sun (see opposite page) and consequently the planet is not well placed for observation during the month.

Venus on the 15th transits the meridian at 3 p.m. (see above table) and is well seen as an evening star. On the 24th it reaches its greatest elongation 45° 39′ E. On April 15th its stellar magnitude is − 3·9, and it is a beautiful object. On the 6th when in conjunction with the moon the two bodies should present a pleasing spectacle.

Mars is rapidly increasing its distance from the earth, being, on the 15th, 97 millions of miles away. Its stellar magnitude is then 0·4, and as it is on the meridian at 7.34, it can be seen much of the night. The planet is near the western edge of Leo, about 10° N.-W. of Regulus.

Jupiter is still too close to the sun for observation.

Saturn is on the meridian, on the 15th, at 5.12 p.m., and so can be well seen during the evening.

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.
			h	m	
Sat.	1	9h ☌ ♃ ☉; 15h 45m ☌ ☿.☾, ☿ 6° 52′ S.			
(31) Sun.	2	11h 21m·2 New Moon; 14h 23m ☌ ♃ ☾, ♃ 6° 17′ S.			
Mon.	3		2	07	
Tues.	4				
Wed.	5		22	56	
Thur.	6	7h 8m ☌ ♀ ☾, ♀ 2° 0′ S.			
Fri.	7				
Sat.	8	[12h 46m ☌ ♄ ☾, ♄ 2° 24′ S.	19	45	
Sun.	9	4h ☌ ☿ ♃, ☿ 0° 24′ S.; 8h·7 Moon in Apogee;			
(7) Mon.	10	6h ♆ Stationary; 9h 35m·7 Moon's First Quarter.			
Tues.	11	4h 27m ☌ ♆ ☾, ♆ 0° 45′ S.	16	34	
Wed.	12	9h ☌ ♂ ☾, ♂ 3° 37′ N.			
Thur.	13				
Fri.	14	16h ☌ ☿ ☉ Superior.	13	23	
Sat.	15				
Sun.	16				
Mon.	17	20h ♃ in Perihelion.	10	12	
(26) Tues.	18	0h 7m·5 Full Moon; 15h ☿ in ☊.			
Wed.	19				
Thur.	20	2h □ ♆ ☉.	7	01	
Fri.	21	6h·6 Moon in Perigee.			
Sat.	22	10h ♀ Greatest Hel. Lat. N.			
Sun.	23	5h ☿ in Perihelion.	3	50	
☾ Mon.	24	5h ♀ Greatest Elong. E. 45° 39′; 17h 38m·3 Moon's			
Tues.	25	20h 43m ☌ ♁ ☾, ♁ 2° 14′ S. [Last Quarter.			
Wed.	26		0	39	
Thur.	27				
Fri.	28		21	28	
Sat.	29				
Sun.	30	9h 54m ☌ ♃ ☾, ♃ 6° 29′ S.			

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 MAY

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	4h 57m	6h 35m	9h 48m	1h 22m	6h 57m	21h 29m	8h 9m
Decl.	24° 53′ N.	26° 48′ N.	15° 7′ N.	7° 29′ N.	22° 36′ N.	15° 35′ S.	19° 51′ N.
Transit	13 25	15·03	18·16	9·51	15·25	5·59	16·37

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

The Sun—On the 1st the sun's R.A. is 2h 33m, Decl. 15° 4′ N.; on the 31st the R.A. is 4h 32m, Decl. 21° 55′ N. The equation of time is 2m 57s on the 1st, rises to 3m 47s (a maximum) on the 14th and then falls to 2m 33s on the 31st. See page 6.

The Moon—For its phases and conjunction with the planets, see opposite page. On the 8th the moon occults Neptune (see page 8).

Mercury on the 12th reaches greatest elongation 21° 43′ E. This is a favorable time to see the planet at an eastern elongation and for several days before and after the 12th it should be easily visible to the naked eye. Just after sunset examine the sky in the region about 15° N. of W.. and about 15° above the horizon, using a field glass if convenient. After the planet has once been located it will be seen by the unaided eye, appearing like a first magnitude star.

Venus is a magnificent evening star all month. On the 27th it attains its greatest brilliancy, at which time its stellar magnitude is −4·2. Its close conjunction with the moon on the 6th is a fine spectacle (see opposite page). When at greatest brilliancy the planet shows, in a telescope, a disc like the moon about five days old.

Mars on the 15th is 121 million miles away from the earth and has stellar magnitnde 0·9. It is in Leo, not far from Regulus, on the 25th being about 1° N. of this star.

Jupiter on the 15th crosses the meridian at 9·51 a.m., and hence can be seen as a morning star, though it is still rather close to the sun for convenient observation. The configurations of its satellites are given on the opposite page, and their eclipses, etc., will be found on page 46.

Saturn on the 15th transits the meridian at 3.25 p.m., and can be seen some time after sunset.

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

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 40m.
			h	m	
Mon.	1		18	17	♃○243
♉Tues.	2	0h 28m·9 New Moon.			○2134
Wed	3	12h ☿ Greatest Hel. Lat. N.; 16h 56m ☌ ☿ ☾, [☿ 2°6′ S.	15	06	3○214
Thur.	4				31○24
Fri.	5				23○14
Sat.	6	0h 33m ☌ ♀ ☾, ♀ 1° 1′ N.			21○34
Sun.	7	0h 31m ☌ ♄ ☾, ♄ 1° 56′ S.; 2h·7 Moon in Apogee.	12	55	1○423
Mon.	8	12h 51m ☌ ♆ ☾, ♆ 0° 27′ S.			4○123
Tues.	9				4213○
☽Wed.	10	3h 47m·1 Moon's First Quarter; 10h □ ♁ ☉; [11h 41m ☌ ♂ ☾, ♂ 3° 54′ N.	9	44	43○1●
Thur.	11				431○2
Fri.	12	11h ☿ Greatest Elong. E. 21° 43′.			432○1
Sat.	13		6	33	421○3
Sun.	14	9h □ ♂ ☉.			4○123
Mon.	15				4○23●
Tues.	16		3	22	213○4
♋Wed.	17	9h 11m·3 Full Moon.			32○14
Thur.	18				31○24
Fri.	19	3h Moon in Perigee.	0	11	32○14
Sat.	20				21○34
Sun.	21		20	59	○1234
Mon.	22				1○234
Tues.	23	3h 11m ☌ ♁ ♄, ♁ 2° 33′ S.			♃2○34
☾Wed.	24	0h 16m·4 Moon's Last Quarter; 3h ☌ ♀ ♄, ♀ 3° 25′ N.;	17	48	324○1
Thur.	25	4h ☿ Stationary. [22h ♁ Stationary.			341○2
Fri.	26	23h ☿ in ♉.			43○1
Sat.	27	9h ♀ Greatest brilliancy.	14	37	♃421○3
Sun.	28	3h 20m ☌ ♃ ☾, ♃ 6° 41′ S.			4○213
Mon.	29				41○23
Tues.	30		11	26	42○13
♍Wed.	31	14h 37m·3 New Moon.			

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.	4h 40m	7h 25m	10h 43m	1h 46m	7h 12m	21h 29m	8h 13m
Decl.	17° 50′ N.	22° 28′ N.	9° 14′ N.	9° 44′ N.	22° 16′ N.	15° 39′ S.	19° 42′ N.
Transit	11·07	13·51	17·09	8·13	13·38	3·56	14·38

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

The Sun.—The sun's R.A. on the 1st is 4h 36m, and on the 30th it is 6h 36m. During the month the declination slowly rises from 22° 3′ on the 1st to 23° 27′ on the 21st, which is the summer solstice, at which time our days are longest. It then falls to 23° 11′ on the 30th. The equation of time is zero on the 14th. It then rises to 3m 23s on the 30th. See page 6. The increase in the equation of time, taken with the decreasing length of the day, causes the time of sunset, stated in mean time, to appear constant for several days at the end of June and the beginning of July. (See table on pages 15 and 16).

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

Mercury is in inferior conjunction with the sun on the 5th (see opposite page), and on the 30th reaches greatest elongation 21° 52′ W. This is not the most favorable time of the year to see the planet at western elongation, but a careful search of the sky near the horizon about 25° N. of E. about this date or a few days later would probably reveal it. See note on Mercury for last month.

Venus can still be seen as an evening star during the early part of the month. It is in conjunction with the moon on the 3rd and becomes stationary on the 11th.

Mars on the 15th is 145 million miles from the earth and its stellar magnitude has fallen to 1·3.

Jupiter on the 15th crosses the meridian at 8.13 a.m., and hence can be well seen as a morning star. For the configurations of its satellites, see next page, and for their eclipses, etc., see page 46.

Saturn on the 15th crosses the meridian at 1.38 p.m. and hence is too close to the sun to be *well* observed, though it can still be seen as an evening 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		Configuration of Jupiter's Satellites at 2h 55m.
			h	m	
Thur.	1	6h 22m ☌ ☿ ☾, ☿ 4° 58′ S.			432O●
Fri.	2	[20h 38m ☌ ♀ ☾, ♀ 1° 16′ N.	8	15	341O2
Sat.	3	13h 18m ☌ ♄ ☾, ♄ 1° 29′ S.; 16h·5 Moon in Apogee;			3O214
Sun.	4	21h 5m ☌ ♆ ☾, ♆ 0° 10′ S.			21O34
Mon.	5	20h ☌ ☿ (☉) Inferior.	5	04	○134●
Tues.	6	5h ☿ in Aphelion.			1O234
Wed.	7	21h 32m ☌ ♂ ☾, ♂ 4° 38′ N.			2O134
☽Thur.	8	18h 59m Moon's First Quarter.	1	53	23O4●
Fri.	9				4O23
Sat.	10		22	42	3O124
Sun.	11	11h ♀ Stationary.			214O●
Mon.	12				4O13●
Tues.	13		19	31	41○23
Wed.	14				42O13
☺Thur.	15	16h 41m·7 Full Moon.			4213○
Fri.	16	9h·6 Moon in Perigee.	16	20	431O2
Sat.	17	11h ♀ in ♉; 20h ☿ Stationary.			43O12
Sun.	18				4231O
Mon.	19	10h 25m ☌ ♅ ☾, ♅ 2° 44′ S.	13	09	42O13
Tues.	20				1O423
Wed.	21	13h 24m Sun enters Cancer, Summer commences.			4O134
☾Thur.	22	8h 16m·3 Moon's Last Quarter; 10h ☌ ♀ ♄, ♀ 0° 57′ S.	9	58	4O21○4
Fri.	23				3O124
Sat.	24	18h 42m ☌ ♃ ☾, ♃ 6° 52′ S.			3○24●
Sun.	25		6	47	231O4
Mon.	26	14h ☿ Greatest Hel. Lat. S.			2○134
Tues.	27				1O423
Wed.	28	8h 11m ☌ ☿ ☾, ☿ 7° 7′ S.	3	36	42O13
Thur.	29				421O3
(☉)Fri.	30	1h ☿ Greatest Elong. W. 21° 52′; 5h 43m·4 New Moon;			43O21
		[15h 10m ☌ ♀ ☾, ♀ 4° 30′ S.; 23h·2 Moon in Apogee.			

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 JULY

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	6h 36m	6h 22m	11h 44m	2h 4m	7h 28m	21h 26m	8h 17m
Decl.	23° 8′ N.	17° 49′ N.	2° 18′ N.	11° 16′ N.	21° 47′ N.	15° 55′ S.	19° 28′ N.
Transit	11·04	10·50	16·12	6·33	11·56	1·55	12·45

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 40m to 8h 41m, and the Decl. from 23° 8′ to 18° 33′ N. The earth is farthest from the sun on the 3rd (see opposite page). On the 29th is an annular eclipse of the sun, invisible in Canada (see page 53).

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 14th is a partial eclipse of the moon, visible in Canada (see page 53). On the 23rd the moon occults four of the Pleiades (see page 8).

Mercury attains superior conjunction with the sun on the 28th, and is not well placed for observation, except for a few days at the beginning of the month (see note for June).

Venus comes into inferior conjunction with the sun on the 3rd, and as it rapidly separates from the sun it will be seen as a morning star towards the end of the month.

Mars on the 15th is 165 million miles from the earth, and as it crosses the meridian at 4.12 p.m. it is visible as an evening star, but its brightness has so diminished that it is not a suitable object for observation.

Jupiter is now a prominent morning star near the s. w. corner of Aries. It is in quadrature with the sun on the 27th, *i. e.*, it is 6 hours before the sun then. For the configurations of its satellites, see next page, and for their eclipses, etc., see page 46.

Saturn is in conjunction with the sun on the 12th, and is not well placed for observation during the month.

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

For the minima of Algol, see opposite page.

JULY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 2h 10m.
			h	m	
Sat.	1		0	25	43102
Sun.	2	5h 5m ☌ ♆ ☾, ♆ 0° 6′ N.			24320
Mon.	3	1h ⊕ in Aphelion; 15h ☌ ☿ ☉ Inferior.	21	14	42013
Tues.	4				41023
Wed	5				40213
Thur.	6	10h 41m ☌ ♂ ☾, ♂ 5° 22′ N.	18	03	21403
Fri.	7				3014●
☽Sat.	8	6h 55m Moon's First Quarter.			31024
Sun.	9		14	52	32014
Mon.	10				2044●
Tues.	11				10234
Wed.	12	15h ☌ ♄ ☉.	11	41	02134
Thur.	13	19h ☌ ☿ ☿, ☿ 5° 1′ N.			21034
☉Fri.	14	19h·3 Moon in Perigee; 23h 40m Full Moon; ☾ Partial			3014●
Sat.	15	14h ☿ in ♌. [Eclipse visible in Canada.	8	30	34102
Sun.	16	18h 54m ☌ ♁ ☾, ♁ 2° 44′ S.			43201
Mon.	17				4203●
Tues.	18		4	19	41023
Wed.	19				40123
Thur.	20	5h ☿ in Perihelion.			42103
☾Fri.	21	16h ☌ ☿ ♄, ☿ 1° 9′ N.; 18h 33m Moon's Last Quarter;	1	08	43201
Sat.	22	7h 57m ☌ ♃ ☾, ♃ 6° 57′ S. [23h ☿ in Aphelion.			34102
Sun.	23		21	56	24301
Mon.	24				23104
Tues.	25	6h ☿ Stationary; 12h ☌ ♆ ☉.			24023
Wed.	26	19h ☌ ☿ ♆, ☿ 1° 53′ N.	18	45	01234
Thur.	27	1h 8m ☌ ☿ ☾, ☿ 8° 21′ S.; 6h □ ♃ ☉. [♄ ☾, ♄ 0° 44′ S.			21034
Fri.	28	2h·5 Moon in Apogee; 5h ☌ ☿ ☉ Superior; 15h 47m ☌			23014
●Sat.	29	13h 8m ☌ ♆ ☾, ♆ 0° 5′ N.; 21h 15m·4 New Moon; [☉ Annular eclipse invisible in Canada.	15	34	31024
Sun.	30	3h 41m ☌ ☿ ☾, ☿ 2° 50′ N.; 11h ☿ Greatest Hel.			30214
Mon.	31	[Lat. N.			23104

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 AUUGST

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	10h 45m	6h 44m	12h 53m	2h 14m	7h 45m	21h 21m	8h 22m
Decl.	8° 58′ N.	18° 2′ N.	5° 33′ S.	11° 59′ N.	21° 12′ N.	16° 17′ S.	19° 13′ N.
Transit	13·11	9·10	15·18	4·41	10·11	23·45	10·47

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

The Sun—During August the sun's R.A. increases from 8h 45m to 10h 38m, and the Decl. changes from 18° 3′ to 9° 2′ N. The equation of time falls from 6m 13s on the 1st to 0m 18s on the 31st. For fuller details, see page 7.

The Moon—For its phases and conjunction with the planets, see opposite page. On the 20th the moon occults 17 Tauri, and on the 24th Saturn (see page 8).

Mercury during the month is not well placed for observation.

Venus attains greatest brilliancy on the 9th and is a prominent morning star. See note on Venus for May.

Mars on the 15th is 183 million miles from the earth and though still an evening star is not a suitable object for observations. Its position amongst the stars can be determined by using the above table and Map III. of the Constellations.

Jupiter is a prominent morning star, crossing the meridian, on the 15th, at 4·41 a.m. Its stellar magnitude is – 2·2. For the configurations of the satellites, see opposite page, and for their eclipses, etc., see page 46.

Saturn on the 15th crossses the meridian at 10.11 a.m. It is thus a morning star, but rather close to the sun for convenient observation. See note on the moon above.

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

For the minima of Algol, see opposite page.

AUGUST

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 1h 25m.
			h	m	
Tues.	1		12	23	4○123
Wed.	2.				4○23●
Thur.	3				421○3
Fri.	4	1h 2m ☌ ♂ ☾, ♂ 5° 42′ N.	9	12	423○1
Sat.	5				431○2
☽Sun.	6	16h 5m·6 Moon's First Quarter.			43○21
Mon.	7		6	01	4231○
Tues.	8				4○13●
Wed.	9	10h ☿ Greatest brilliancy.			1○423
Thur.	10	12h ☍ ♅ ☉.	2	50	②2○43
Fri.	11				2○314
Sat.	12	4h·3 Moon in Perigee.	23	39	31○24
♒Sun.	13	3h 53m ☌ ♅ ☾, ♅ 2° 37′ S.; 7h 0m·3 Full Moon;			3○214
Mon.	14	[8h ☿ Greatest Hel. Lat. S.			321○4
Tues.	15		20	28	☾314●
Wed.	16				1○243
Thur.	17				214☉3
Fri.	18	18h 51m ☌ ② ☾, ② 6° 58′ S.	17	17	42○13
Sat.	19				431○2
☾Sun.	20	7h 52m·8 Moon's Last Quarter.			43○12
Mon.	21		14	06	4321○
Tues.	22	22h ♂ in ♉; 22h ☿ in ♉.			42○1●
Wed.	23				41○23
Thur.	24	10h 12m ☌ ☿ ☾, ☿ 5° 23′ S.; 12h Moon in Apogee.	10	55	②4○13
Fri.	25	5h 11m ☌ ♄ ☾, ♄ 0° 21′ S.; 14h ② Stationary;			24○3●
Sat.	26	[21h 37m ☌ ♆ ☾, ♆ 0° 12′ N.			31○24
Sun.	27		7	44	3○124
♍Mon.	28	12h 24m·7 New Moon.			321○4
Tues.	29				2○314
Wed.	30	20h 7m ☌ ☿ ☾, ☿ 3° 54′ N.	4	33	1○234
Thur.	31				○2134

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 SEPTEMBER

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	13h 2m	8h 33m	14h 9m	2h 12m	7h 59m	21h 16m	8h 26m
Decl.	10° 9′ S.	16° 42′ N.	13° 18′ S.	11° 41′ N.	20° 37′ N.	16° 37′ S.	19° 0′ N.
Transit	13·25	8·56	14·32	2·37	8·23	21·38	8·50

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 26m. On the 1st the Decl. is 8° 19′ N., the sun reaches the equator on the 23rd (the autumn equinox), and on the 30th its declination is 2° 46′ S. For fuller details, see page 7.

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

Mercury on the 9th reaches greatest elongation 26° 54′ E., but as the autumn is not a favorable time for seeing Mercury at eastern elongation, it is not well placed for observation.

Venus reaches greatest elongation 46° 1′ W. on the 12th, and is a prominent morning star all month. At greatest elongation the phase shown, when viewed in a telescope, is a half-moon.

Mars on the 15th is 196 million miles from the earth. See note for last month.

Jupiter is on the meridian, on the 15th, at 2·37 a.m. and as it rises about 7¾ hours before this, it is visible practically all night. For the configurations of the satellites, see opposite page, and for their eclipses, etc., see page 46.

Saturn on the 15th crosses the meridian at 8.23 a.m. and hence is well placed to be seen as 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.

SEPTEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satel. lites at 0h 40m.
			h	m	
Fri.	1	15h 43m ☌ ♂ ☾, ♂ 5° 25′ N.			21○34
Sat.	2	4h ☿ in Aphelion.	1	22	2143○24
Sun.	3				34○12
☽Mon.	4	23h 26m·5 Moon's First Quarter.	22	10	3421○
Tues.	5	21h ☌ ☿ ♄, ☿ 3° 0′ S.			423○1
Wed	6				41○23
Thur.	7		19	00	4○213
Fri.	8				421○3
Sat.	9	8h·4 Moon in Perigee; 12h 5m ☌ ♅ ☾, ♅ 2° 33′ S.;			43○1●
Sun.	10	[12h ☿ Greatest Elong. E. 26° 54′.	15	49	34○2●
☍Mon.	11	15h 30m·9 Full Moon.			321○4
Tues.	12	9h ☿ Greatest Elong. W. 46° 1′.			23○14
Wed.	13	12h ☌ ☿ ♆, ☿ 2° 3′ S.	12	38	1○234
Thur.	14				○2134
Fri.	15	2h 45m ☌ ♃ ☾, ♃ 6° 55′ S.			21○34
Sat.	16		9	26	3○14●
Sun.	17				3○24●
Mon.	18				321○4
☾Tues.	19	0h 35m·3 Moon's Last Quarter.	6	16	23○14
Wed.	20				14○32
Thur.	21	4h·6 Moon in Apogee; 18h 15m ☌ ♄ ☾, ♄ 0° 6′ N.			4○123
Fri.	22	6h 38m ☌ ♆ ☾, ♆ 0° 25′ N.; 13h ☿ Greatest Hel.	3	04	421○3
		[Lat. S.; 13h ☿ Stationary.			
Sat.	23	2h 41m ☌ ☿ ☾, ☿ 0° 12′ N.; 4h 14m Sun enters			42○31
Sun.	24	[Libra, Autmun commences.	23	53	431○2
Mon.	25				2143○
Tues.	26				432○1
●Wed.	27	2h 34m·1 New Moon; 11h ♄ in ☊.	20	42	41○32
Thur.	28	7h 11m ☌ ☿ ☾, ☿ 1° 30′ N.			○4123
Fri.	29				21○43
Sat.	30		17	31	2○314

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 OCTOBER

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	12h 22m	10h 41m	15h 31m	2h 0m	8h 8m	21h 14m	8h 28m
Decl.	1° 16′ S.	8° 50′ N.	19° 40′ S.	10° 34′ N.	20° 13′ N.	16° 47′ S.	18° 51′ N.
Transit	10·48	9·06	13·56	0·27	6·34	19·38	6·54

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

The Sun.—The sun's R.A. increases during October from 12h 29m to 14h 22m, and the Decl. changes from 3° 10′ to 14° 6′ S. The equation of time rises from 10m 16s to 16m 18s, 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 13th the moon occults three of the Pleiades (see page 8).

Mercury is at inferior conjunction with the sun on October 5th,, and on the 20th it reaches greatest elongation 18° 17′ W. This is a good time to see the planet at a western elongation. For a few days before and after the 20th it should be seen just before sunrise at a point about 15° S. of E. See note for June.

Venus is a beautiful morning star all month. On the 15th its stellar magnitude is − 3·7, and 65 per cent. of its apparent disc is illuminated.

Mars on the 15th is 205 million miles from the earth, and sets about 2 hours after the sun. It is faint and is not well placed for observation.

Jupiter is in opposition to the sun on the 23rd, that is, at midnight Jupiter is on the meridian. It can be well observed all night long. For the configurations of its satellites, see next page, and for their eclipses, etc., see page 46.

Saturn on the 15th crosses the meridian at 6.34 a.m., and is a prominent morning star. On the 23rd it is in quadrature with the sun, *i. e.*, it crosses the meridian 6 hours after the sun then.

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 23h 40m
			h	m	
Sun.	1				31○24
Mon.	2				3○214
Tues.	3				32○4●
☽Wed.	4	6h 0m·5 Moon's First Quarter.	14	20	1○324
Thur.	5	6h ☌ ☿ ☉ Inferior.			○1243
Fri.	6	17h·5 Moon in Perigee; 18h 40m ☌ ♅ ☾, ♅ 2° 39′ S.	11	09	12○43
Sat.	7				42○13
Sun.	8	15h ♀ in ☊			431○2
Mon.	9		7	59	43○21
Tues.	10				432○1
☺Wed.	11	2h 1m·1 Full Moon; 13h ☿ in ♋.			2|4○●●
Thur.	12	7h 21m ☌ ♃ ☾, ♃ 6° 54′ S.	4	48	4○123
Fri.	13	14h ☿ Stationary.			412○3
Sat.	14				24○13
Sun.	15		1	37	13○42
Mon.	16	4h ☿ in Perihelion.			3○124
Tues.	17		22	26	321C 4
☾Wed.	18	20h 8m·7 Moon's Last Quarter.			2|3○24
Thur.	19	0h·2 Moon in Apogee; 6h 5m ☌ ♄ ☾, ♄ 0° 34′ N.;			○1234
Fri.	20	17h ☿ Greatest Elong. W. 18° 17′. [15h 46m ☌ ♆ ☾,	19	15	12○34
Sat.	21	[♆ 0° 42′ N.			2○134
Sun.	22				13○24
Mon.	23	8h 47m ☌ ♀ ☾, ♀ 5° 35′ N.; 20h □ ♄ ☉;	16	03	34○12
Tues.	24	[21h ☍ ♃ ☉.			3421C
Wed.	25	12h 24m ☌ ☿ ☾, ☿ 7° 40′ N.			432○1
☉Thur.	26	3h ♅ Stationary; 10h ☿ Greatest Hel. Lat. N.;	12	53	4C32●
Fri.	27	[15h 37m New Moon.			2|41○3
Sat.	28	10h □ ♆ ☉; 23h 46m ☌ ♂ ☾, ♂ 3° 3′ N.			42○13
Sun.	29		9	41	413○2
Mon.	30				34○12
Tues.	31	13h·8 Moon in Perigee.			3214○

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 NOVEMBER

POSITION OF PLANETS ON THE 15TH

	☿ Mercury	♀ Venus	♂ Mars	♃ Jupiter	♄ Saturn	♅ Uranus	♆ Neptune
R. A.	15h 2m	12h 58m	17h 7m	1h 44m	8h 11m	21h 15m	8h 29m
Decl.	16° 45′ S.	4° 10′ S.	23° 44′ S.	9° 13′ N.	20° 7′ N.	16° 44′ S.	18° 49′ N.
Transit	11·25	9·21	13·30	22·06	4·36	17·36	4·53

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 25m to 16h 25m, and the Decl. changes from 14° 25′ to 21° 39′ S. The equation of time rises to a maximum on the 3rd, at which time it is 16m 21s. 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.

Mercury is in superior conjunction with the sun on the 23rd and it is not well placed for observation during the month.

Venus is still well separated from the sun and is a prominent morning star. On the 15th its stellar magnitude is − 3·5 and 77 per cent. of its disc is illuminated.

Mars on the 15th is 212 million miles from the earth, and sets soon after the sun.

Jupiter is visible now all night long. It is in the easterly portion of the constellation Pisces. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 46.

Saturn rises at about 9 p.m. and can be seen all the rest of the night.

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

For the minima of Algol, see opposite page.

NOVEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 22h 25m.
			h	m	
Wed.	1		6	30	32○14
☽ Thur.	2	12h 50m·6 Moon's First Quarter.			1○324
Fri.	3	0h 14m ☌ ♊ ☾, ♊ 2° 53′ S.			♃2○34
Sat.	4		3	19	2○134
Sun.	5				13○24
Mon.	6				3○124
Tues.	7	7h ♆ Stationary.	0	08	312○4
Wed.	8	9h □ ♊ ☉; 9h 31m ☌ ♃ ☾, ♃ 6° 56′ S.			32○41
♍ Thur.	9	15h 18m·0 Full Moon.	20	57	41○32
Fri.	10				4○123
Sat.	11	9h ☿ in Perihelion.			42○3●
Sun.	12	5h ♄ Stationary.	17	45	41○3●
Mon.	13				43○12
Tues.	14				4312○
Wed.	15	15h 22m ☌ ♄ ☾, ♄ 0° 56′ N.; 21h Moon in Apogee.	14	34	432○1
Thur.	16	0h 9m ☌ ♆ ☾, ♆ 1° 0′ N.			41○32
☾ Fri.	17	17h 0m·5 Moon's Last Quarter..			○1423
Sat.	18	21h ☿ in ♌.	11	23	2○43●
Sun.	19				1○234
Mon.	20				3○124
Tues.	21		8	12	312○4
Wed.	22	13h 32m ☌ ☿ ☾, ☿ 7° 33′ N.			32○14
Thur.	23	21h ☌ ☿ ☉ Superior.			1○324
Fri..	24		5	01	○1243
♎ Sat.	25	3h 50m·4 New Moon ; 6h 17m ☌ ☿ ☾, ☿ 3° 5′ N.			214○3
Sun.	26	18h 57m ☌ ♂ ☾, ♂ 1° 12′ N.			♃42○3
Mon.	27	14h·7 Moon in Perigee.	1	50	43○12
Tues.	28				4312○
Wed.	29	3h ☿ in Aphelion.	22	39	432○1
Thur.	30	6h 54m ☌ ♊ ☾, ♊ 3° 10′ S.			41○32

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.	18h 22m	15h 18m	18h 46m	1h 36m	8h 7m	21h 18m	8h 27m
Decl.	25° 32′ S.	16° 30′ S.	24° 2′ S.	8° 36′ N.	20° 23′ N.	16° 27′ S.	18° 55′ N.
Transit	12·47	9·43	13·11	20·00	2·34	15·42	2·53

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

The Sun.—During December the sun's R.A. increases from 16h 29m to 18h 41m. On the 1st the Decl. is 21° 49′ S., this slowly changes and it becomes 23° 27′ on the 22nd (the winter solstice, see next page); and by the 31st it has come back to 23° 7′. On the 24th there is a partial eclipse of the sun invisible in Canada (see page 53)..

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 6th the moon occults ε Arietis, and on the 28th θ Aquarii (see page 8).

Mercury during the month is too near the sun for convenient observation, but on the 31st it sets about 1h 15m after the sun. It reaches greatest elongation 19° 22′ E. on January 2, 1917.

Venus on the 15th crosses the meridian at 9.43 a.m., and is well seen as a morning star all month.

Mars on the 15th is 216 million miles from the earth, and sets soon after the sun.

Jupiter on the 15th is on the meridian at 8 p.m., and is a prominent object almost all night. For the configurations of its satellites, see opposite page; and for their eclipses, etc., see page 46.

Saturn is now visible all night long. It is retrograding, having begun to do so on November 11th. From the table above and Map II. of the Constellations its position amongst the stars can be found.

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.

DECEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configuration of Jupiter's Satellites at 21h 10m,
			h	m	
☽Fri.	1	20h 55m·5 Moon's First Quarter.			4○123
Sat.	2		19	28	421○3
Sun.	3	3h ☿ Greatest Hel. Lat. N.			24○13
Mon.	4				3○42●
Tues.	5	11h 36m ☌ ♃ ☾, ♃ 7° 0′ S.	16	17	312○4
Wed.	6				32○14
Thur.	7				13○24
Fri.	8		13	06	○1234
☽Sat.	9	7h 43m·9 Full Moon.			21○34
Sun.	10				2○134
Mon.	11		9	55	3○142
Tues.	12	21h 13m ☌ ♄ ☾, ♄ 1° 4′ N.			♃34○2
Wed.	13	7h 5m ☌ ♆ ☾, ♆ 1° 8′ N.; 15h·8 Moon in Apogee.			342○1
Thur.	14		6	44	413○●
Fri.	15				4○132
Sat.	16				412○3
☾Sun.	17	13h 6m·4 Moon's Last Quarter.	3	33	42○13
Mon.	18				♃41○2
Tues.	19	12h ☿ Greatest Hel. Lat. S.			♃34○2
Wed.	20	[Winter commences.	0	22	32○4●
Thur.	21	8h ♃ Stationary; 22h 59m Sun enters Capricornus,			31○24
Fri.	22	6h ☌ ☿ ♂, ☿ 1° 10′ S.; 12h 46m ☌ ♀ ☾, ♀ 5° 34′ N.	21	11	○3124
Sat.	23	[Canada.			12○34
♑Sun.	24	15h 31m·2 New Moon; ◍ Partial eclipse invisible in			2○134
Mon.	25	17h 4m ☌ ♂ ☾, ♂ 0° 57′ S.; 19h·5 Moon in Perigee;	18	00	1○324
Tues.	26	[21h 36m ☌ ☿ ☾, ☿ 2° 13′ S.			3○124
Wed.	27	16h 42m ☌ ♅ ☾, ♅ 3° 22′ S.			32○4●
Thur.	28		14	49	312○4
Fri.	29				4○12●
Sat.	30				♃41○3
☽Sun.	31	7h 7m·2 Moon's First Quarter.	11	38	42○13

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.

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		
1	18	26	11	I	OD	12	21	13	48	IV	Se
	21	57	09	I	ER	15	21	10	47	II	ER
2	17	40	15	III	Te	16	19	34	54	I	TI
	17	50	24	I	Te		20	44	33	I	SI
	19	05	28	I	Se	17	20	16	43	I	ER
	19	59	18	III	SI	18	17	26	21	I	Se
3	20	20	26	IV	OD	20	18	07	59	III	ED
6	19	00	48	II	TI		19	12	59	IV	OR
	21	30	09	II	SI		20	47	17	III	ER
	21	47	01	II	Te	22	18	48	27	II	OD
8	18	32	19	II	ER	24	18	42	49	II	Se
	20	24	52	I	OD		18	54	19	I	OD
9	17	35	09	I	TI	25	18	19	54	I	Te
	18	48	38	I	SI		19	22	19	I	Se
	18	53	56	III	TI	27	17	48	46	III	OD
	19	49	29	I	Te		20	49	16	III	OR
	21	01	27	I	Se	31	18	37	19	II	SI
10	18	21	25	I	ER		19	24	58	II	Te
12	20	22	38	IV	SI						

FEBRUARY

1	18	06	30	I	TI	14	19	50	13	III	Te
	19	05	13	I	SI	16	19	27	40	I	OD
	20	21	04	I	Te	17	18	55	15	I	Te
2	18	35	58	I	ER		19	38	56	I	Se
7	18	49	39	III	Se	23	19	37	45	II	OD
	19	26	37	II	TI	24	18	43	00	I	TI
8	20	08	05	I	TI		19	21	29	I	SI
9	18	26	14	II	ER	25	18	23	46	II	Se
10	17	43	08	I	Se		18	49	44	I	ER

MAY

9	4	10	02	I	TI	28	3	14	11	II	TI
18	4	00	15	III	TI		4	01	24	II	Se
25	4	00	45	I	Se						

JUNE

1	3	43	50	I	SI	18	2	30	20	I	OR
4	3	58	45	II	SI	22	3	31	12	II	Te
5	2	59	16	III	OD	23	2	03	57	III	TI
6	3	51	12	II	OR		3	56	16	III	Te
9	2	45	25	I	ED	24	3	55	29	I	SI
10	2	17	45	I	Se	26	1	47	57	I	Te
	3	22	20	I	Te	29	3	40	19	II	TI
12	2	45	44	III	ED		3	41	56	II	Se
17	2	01	14	I	SI	30	3	04	31	III	Se
	3	11	07	I	TI						

JULY

1	1	24	13	II	OR	8	1	30	29	II	OD
2	2	56	07	I	ED		4	04	23	II	OR
3	1	36	04	I	TI	10	2	12	09	I	SI
	2	28	08	I	Se		3	32	36	I	TI
	3	44	52	I	Te	11	0	31	46	III	OD
4	0	55	00	I	OR		2	14	27	III	OR
6	3	41	03	II	SI		2	51	26	I	OR
8	1	25	53	II	ER	15	1	23	19	II	ED
15	4	00	57	II	ER	25	2	52	54	III	ED
	4	09	47	II	OD		3	06	55	I	ED
17	0	55	57	II	Te	26	0	28	28	I	SI
	4	06	06	I	SI		1	51	22	I	TI
18	0	57	27	III	ER		2	37	55	I	Se
	1	12	48	I	ED		3	59	06	I	Te
19	0	44	12	I	Se	27	1	10	13	I	OR
	2	04	57	I	Te	29	0	25	07	III	Te
22	3	58	35	II	ED	31	0	48	22	II	SI
24	0	48	12	II	Se		3	24	40	II	Se
	1	02	34	II	TI		3	39	26	II	TI
	3	33	54	II	Te						

AUGUST

2	1	10	23	II	OR	18	0	32	14	II	Te
	2	22	15	I	SI		0	38	04	I	SI
	3	44	48	I	TI		1	55	59	I	TI
	4	31	36	I	Se		2	47	20	I	Se
	23	29	30	I	ED		4	03	08	I	Te
3	3	03	47	I	OR	19	1	15	25	I	OR
4	0	20	24	I	Te		22	30	41	I	Te
	23	02	53	III	Se	23	0	27	55	III	OD
5	2	58	02	III	TI		1	39	20	III	OR
	4	19	24	III	Te		3	35	45	II	ED
7	3	25	05	II	SI	24	21	57	39	II	SI
9	1	02	39	II	ER	25	0	32	30	II	TI
	1	11	30	II	OD		0	33	50	II	Se
	3	41	44	II	OR		2	31	43	I	SI
	4	15	59	I	SI		3	01	23	II	Te
10	1	23	39	I	ED		3	45	47	I	TI
	22	44	24	I	SI		4	41	00	I	Se
11	0	05	01	I	TI		23	40	47	I	ED
	0	53	40	I	Se	26	3	05	27	I	OR
	2	12	17	I	Te		21	50	11	II	OR
	23	24	16	I	OR		22	13	03	I	TI
12	1	04	56	III	SI		23	09	25	I	Se
	3	03	18	III	Se	27	0	20	09	I	Te
16	1	01	00	II	ED		21	32	45	I	OR
	3	37	12	II	ER	29	22	58	30	III	ED
	3	41	21	II	OD	30	0	56	33	III	ER
17	3	17	52	I	ED		4	11	22	III	OD

SEPTEMBER

1	0	34	49	II	SI	8	3	12	06	II	SI
	2	59	29	II	TI	9	3	29	34	I	ED
	3	10	56	II	Se		21	45	00	III	TI
	4	25	23	I	SI		22	02	30	II	ED
2	1	35	08	I	ED		22	41	56	III	Te
	4	54	22	I	OR	10	0	47	28	I	SI
	22	53	47	I	SI		1	48	40	I	TI
3	0	01	25	I	TI		2	34	45	II	OR
	0	13	36	II	OR		2	56	55	I	Se
	1	03	08	I	Se		3	55	51	I	Te
	2	08	31	I	Te		21	58	08	I	ED
	23	21	23	I	OR	11	1	08	56	I	OR
6	3	00	13	III	ED		21	03	31	II	Te
	4	57	09	III	ER		21	25	20	I	Se

SEPTEMBER—(*Continued*)

d	h	m	s			d	h	m	s		
11	22	22	28	I	Te	24	3	02	03	III	Se
16	21	08	45	III	SI		3	11	58	II	ED
	23	01	57	III	Se		4	35	01	I	SI
17	0	37	14	II	ED		4	41	02	III	TI
	1	15	39	III	TI		5	20	04	I	TI
	2	09	35	III	Te	25	1	47	20	I	ED
	2	41	12	I	SI		4	41	03	I	OR
	3	34	52	I	TI		21	45	28	II	SI
	4	50	45	I	Se		23	03	29	I	SI
	4	53	51	II	OR		23	15	40	II	TI
	23	52	41	I	ED		23	46	13	I	TI
18	2	55	27	I	OR	26	0	21	38	II	Se
	20	56	26	II	T		1	13	08	I	Se
	21	09	38	I	SI		1	44	08	II	Te
	21	43	59	II	Se		1	53	39	I	Te
	22	01	15	I	TI		20	16	03	I	ED
	23	19	12	I	Se		23	07	23	I	OR
	23	24	46	II	Te	27	19	41	40	I	Se
19	0	08	32	I	Te		20	18	57	II	OR
	21	21	59	I	OR		20	19	50	I	Te
24	1	09	47	III	SI						

OCTOBER

1	5	11	30	III	SI	17	4	57	16	I	TI
2	3	42	05	I	ED		5	39	20	II	SI
3	0	23	14	II	SI	18	2	00	47	I	ED
	0	57	26	I	SI		4	19	59	I	OR
	1	30	26	I	TI		23	14	24	I	SI
	1	33	05	II	TI		23	23	03	I	TI
	2	59	22	II	Se	19	0	14	21	II	ED
	3	07	11	I	Se		1	24	14	I	Se
	3	38	02	I	Te		1	31	05	I	Te
	4	01	48	II	Te		3	00	41	II	OR
	22	10	51	I	ED		3	09	16	III	ED
4	0	52	02	I	OR		5	07	06	III	OR
	19	04	16	II	ED		20	29	29	I	ED
	19	05	05	III	ED		22	45	50	I	OR
	19	25	59	I	SI	20	18	58	56	II	SI
	19	56	24	I	TI		19	12	03	II	TI
	20	57	43	III	ER		19	52	51	I	Se
	21	32	45	III	OD		19	56	55	I	Te
	21	35	44	I	Se		21	34	45	II	Se
	22	04	03	I	Te		21	41	53	II	Te
	22	30	08	III	OR	22	17	44	57	III	TI
	22	33	47	II	OR		18	48	35	III	Te
5	19	18	02	I	OR		19	03	36	III	Se
9	5	36	57	I	ED	25	3	54	29	I	OD
10	2	51	32	I	SI	26	1	06	10	I	TI
	3	01	13	II	SI		1	08	53	I	SI
	3	14	02	I	TI		2	44	48	II	OD
	3	49	08	II	TI		3	14	22	I	Te
	5	01	22	I	Se		3	18	40	I	Se
	5	21	50	I	Te		5	23	28	II	ER
	5	37	16	II	Se		22	20	20	I	OD
11	0	05	45	I	ED	27	0	35	32	I	ER
	2	36	10	I	OR		19	31	59	I	TI
	21	20	06	I	SI		19	37	32	I	SI
	21	39	14	II	ED		21	26	43	II	TI
	21	39	53	I	TI		21	37	19	II	SI
	23	07	20	III	ED		21	40	15	I	Te
	23	29	55	I	Se		21	47	19	I	Se
	23	47	43	I	Te		23	57	10	II	Te
12	0	47	32	II	OR	28	0	12	54	II	Se
	1	49	16	III	OR		19	04	23	I	ER
	18	34	25	I	ED	29	18	41	07	II	ER
	21	02	04	I	OR		20	56	25	III	TI
13	18	56	42	II	Se		21	16	22	III	SI
	19	26	34	II	Te		22	05	53	III	Te
17	4	45	48	I	SI		23	03	57	III	Se

NOVEMBER

2	2	49	31	I	TI	3	23	23	52	I	Te
	3	03	30	I	SI		23	41	48	II	TI
	4	57	34	II	OD		23	41	54	I	Se
	4	57	54	I	Te	4	0	15	45	II	SI
	5	13	13	I	Se		2	12	52	II	Te
3	0	04	10	I	OD		2	51	02	II	Se
	2	30	46	I	ER		18	30	15	I	OD
	21	15	27	I	TI		20	59	38	I	ER
	21	32	11	I	SI	5	17	49	50	I	Te

NOVEMBER—(*Continued*)

d	h	m	s			d	h	m	s		
5	18	04	15	II	OD	18	3	31	21	I	Se
	18	10	32	I	Se		4	15	25	II	TI
	21	16	30	II	ER		22	00	03	I	OD
6	0	09	25	III	TI	19	0	50	27	I	ER
	1	18	25	III	SI		19	10	40	I	TI
	1	25	08	III	Te		19	50	38	I	SI
	3	05	00	III	Se		21	19	23	I	Te
9	4	33	23	I	TI		22	00	02	I	Se
	4	58	14	I	SI		22	34	08	II	OD
	17	02	58	III	ER	20	2	27	50	II	ER
10	1	48	31	I	OD		19	19	18	I	ER
	4	26	06	I	ER	21	17	24	26	II	TI
	22	59	29	I	TI		18	51	43	II	SI
	23	26	59	I	SI		19	57	02	II	Te
11	1	08	03	I	Te		21	25	59	II	Se
	1	36	35	I	Se	23	20	18	29	III	OD
	1	57	53	II	TI		21	52	25	III	OR
	2	54	17	II	SI		23	19	05	III	ED
	4	29	35	II	Te	24	1	05	24	III	ER
	20	14	45	I	OD	25	2	30	09	I	TI
	22	55	00	I	ER		3	16	57	I	SI
12	17	25	36	I	TI		23	46	18	I	OD
	17	55	41	I	SI	26	2	46	00	I	ER
	19	34	12	I	Te		20	56	46	I	TI
	20	05	14	I	Se		21	45	43	I	SI
	20	18	25	II	OD		23	05	35	I	Te
	23	52	03	II	ER		23	54	57	I	Se
13	3	24	17	III	TI	27	0	51	46	II	OD
	17	23	49	I	ER		18	13	00	I	OD
14	17	38	03	II	Te		21	14	52	I	ER
	18	47	52	II	Se	28	17	32	18	I	Te
16	16	58	17	III	OD		18	23	42	I	Se
	18	26	13	III	OR		19	44	51	II	TI
	19	16	54	III	ED		21	30	20	II	SI
	21	04	00	III	ER		22	18	01	II	Te
17	3	33	35	I	OD	29	0	04	08	II	Se
18	0	44	20	I	TI	30	18	21	53	II	ER
	1	21	54	I	SI		23	43	35	III	OD
	2	53	01	I	Te						

DECEMBER

1	1	23	08	III	OR	16	18	39	37	II	Se
	3	21	59	III	ED	18	20	39	46	III	TI
3	1	33	42	I	OD		22	28	38	III	Te
	22	44	02	I	TI		23	39	51	I	OD
	23	40	55	I	SI	19	1	30	53	III	SI
4	0	52	56	I	Te		20	49	57	I	TI
	1	49	59	I	Se		22	00	29	I	SI
	17	26	58	III	SI		22	59	04	I	Te
	19	09	52	III	Se	20	0	09	13	I	Se
	20	00	41	I	OD		18	07	40	I	OD
	23	10	30	I	ER		21	30	56	I	ER
5	18	09	44	I	SI	21	17	26	48	I	Te
	19	19	58	I	Te		18	38	02	I	Se
	20	18	45	I	Se		21	12	28	II	OD
	22	07	32	II	TI	22	17	12	53	III	ER
6	0	08	52	II	SI	23	18	45	18	II	SI
	0	41	13	II	Te		18	50	09	II	Te
	2	42	13	II	Se		21	17	32	II	Se
	17	39	29	I	ER	26	0	22	44	III	TI
7	20	58	12	II	ER		1	31	22	I	OD
11	0	32	31	I	TI		22	41	21	I	TI
	1	36	13	I	SI		23	55	59	I	SI
	2	41	31	I	Te	27	0	50	34	I	Te
	17	03	03	III	TI		19	59	31	I	OD
	18	47	39	III	Te		23	26	41	I	ER
	21	28	53	III	SI	28	17	09	24	I	TI
	21	49	37	I	OD		18	24	51	I	SI
	23	10	54	III	Se		19	18	37	I	Te
12	1	06	12	I	ER		20	33	28	I	Se
	18	59	50	I	TI		23	41	26	II	OD
	20	05	03	I	SI	29	17	55	33	I	ER
	21	08	52	I	Te		19	31	20	III	ED
	22	13	56	I	Se		21	14	20	III	ER
13	0	32	42	II	TI	30	18	46	35	II	TI
	19	35	11	I	ER		21	21	37	II	Te
14	16	42	44	I	Se		21	23	35	II	SI
	18	46	11	II	OD		23	55	24	II	Se
	23	34	41	II	ER						

EPHEMERIS FOR PHYSICAL OBSERVATIONS OF THE SUN

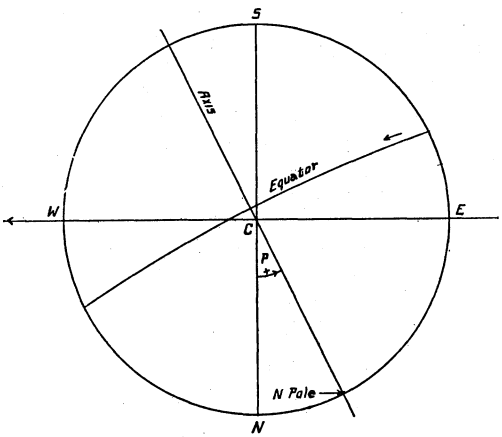
By Ralph E. DeLury

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 the 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 1916·0 is 74°·588 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.*" $= +\ 6°{\cdot}18$ and "*Long.*" $= 187°{\cdot}22$. 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.*" $+\ 6°{\cdot}18$ and "*Long.*" $187°{\cdot}22$.

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 off 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	+ 2·37	− 3·08	313·50	July	4	− 1·22	+ 3·35	31·75
	6	− 0·07	3·65	247·65		9	+ 1·05	3·87	325·58
	11	2·49	4·19	181·81		14	3·31	4·36	259·41
	16	4·87	4·70	115·97		19	5·52	4·83	193·25
	21	7·19	5·17	50·13		24	7·68	5·26	127·10
	26	9·43	5·60	344·30		29	9·77	5 66	60·96
	31	− 11·57	− 5·98	278·47	Aug.	3	+ 11·77	+ 6·02	344·84
Feb.	5	13·60	6·32	212·64		8	13·68	6·34	288·72
	10	15·51	6·61	146·80		13	15·49	6·61	222·62
	15	17·28	6·85	80·96		18	17·18	6·84	156·53
	20	18·92	7·03	15·12		23	18·75	7·02	90·46
	25	20·41	7·16	309·27		28	20·20	7·14	24·40
Mar.	1	− 21·74	− 7·23	243·41	Sept.	2	+ 21·51	+ 7·22	318·35
	6	22·92	7·25	177·54		7	22·68	7·25	252·32
	11	23 93	7·21	111·65		12	23·70	7·22	186·30
	16	24·78	7·12	45·75		17	24·57	7·15	120·28
	21	25·45	6·97	339·83		22	25·28	7·02	54·29
	26	25·95	6·77	273·89		27	25·82	6·84	348·30
	31	− 26·28	− 6·52	207·94	Oct.	2	+ 26·20	+ 6·60	282·32
Apr.	5	26·42	6·22	241·97		7	26·40	6·32	216·36
	10	26·39	5·88	75·98		12	26·42	5·99	150·39
	15	26·16	5·50	9·96		17	26·25	5·61	84·44
	20	25·76	5·08	303·93		22	25·89	5·20	18·50
	25	25·17	4·62	237·87		27	25·33	4·74	312·56
	30	− 24·40	− 4·13	171·80	Nov.	1	+ 24·58	+ 4·24	246·63
May	5	23·44	3·61	105·71		6	23·63	3·71	180·70
	10	22·31	3·07	39·60		11	22·49	3·15	114·78
	15	21·01	2·51	333·47		16	21·15	2·57	48·86
	20	19·54	1·93	267·33		21	19·62	1·96	342·96
	25	17·92	1·34	201·18		26	17·92	1·34	277·06
	30	− 16·16	− 0·74	135·02	Dec.	1	+ 16·06	+ 0·71	211·17
June	4	14·27	− 0·14	68·84		6	14·04	+ 0·07	145·28
	9	12·27	+ 0·47	2·67		11	11·90	− 0·57	79·39
	14	10·17	1·06	296·48		16	9·65	1·21	13·52
	19	8·00	1·66	230·30		21	7·31	1·84	307·65
	24	5·77	2·24	164·11		26	4·91	2·45	241·79
	29	− 3·50	+ 2·80	97·93		31	+ 2·48	− 3·05	175·94

*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-July	June 4	16	48	−	21
Sagittids	June-July	July 28	20	12	+	24
Capricornids	July-Aug.	July 22	20	20	−	12
δ Aquarids	July 18-Aug. 12	July 28-31	22	36	−	11
α β Perseids	July-Aug.-Sept.	Aug. 16	3	12	+	43
Perseids	July 8-Aug. 25	Aug. 11-12	3	4	+	57
Draconis	Aug. 18-25	Aug. 23	19	24	+	61
ϵ Perseids	Aug.-Sept.	Sept. 15	4	8	+	35
Arietids	Aug.-Sept.-Oct.	Sept. 21	2	4	+	19
	Sept.-Oct.	Oct. 15	2	4	+	9
Orionids	Oct. 9-29	Oct. 19	6	8	+	15
μ Ursids Maj.	Oct.-Nov.-Dec.	Nov. 16-25	10	16	+	41
Taurids	November	Nov. 21	4	12	+	23
Leonids	Nov. 9 20	Nov. 14-15	10	0	+	23
Andromedes	Nov. 20-30	Nov. 20-23	1	40	+	43
Geminids	Dec. 1-14	Dec. 11	7	12	+	33

Of these the chief ones are the Perseids, the Leonids and the Andromedes.

The Perseids furnish an annual display of considerable strength, and are perhaps the best known of all. The swarm appears to have an orbit identical with that of the great Comet 1862 III., the period of which is 120 years.

The Leonids follow in the orbit of Tempel's Comet of 1866, of period 33 years.

The Andromedes are thought to be remnants of Biela's Comet. They were especially numerous in 1872, 1885, 1898, but in recent years have not been so prominent.

The above table was prepared for the HANDBOOK by Mr. W. F. Denning, F.R.A.S., of Bristol, England; and for further interesting information regarding this subject (and almost any other subject in which the amateur is interested) reference may be made to his *Telescopic Work for Starlight Evenings*.

PRINCIPAL ELEMENTS OF THE SOLAR SYSTEM

Name	Mean Distance from Sun		Sidereal Period		Mean Diam'tr 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	265 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 1916

PREPARED BY R. M. MOTHERWELL

In the year 1916 there will be five Eclipses, three of the Sun and two of the Moon.

I. A Partial Eclipse of the Moon, January 19th, 1916, the beginning visible in extreme western Europe, the North Atlantic Ocean, North and South America and the Pacific Ocean; the ending visible in North America, the North Atlantic Ocean, Northwestern South America, Northeast Asia and the Pacific Ocean.

Moon enters shadow	January	19d	14h	55·0m
Middle of the eclipse	"	19	15	39·5
Moon leaves shadow	"	19	16	24·0

Magnitude of the eclipse = 0·137 (Moon's diameter = 1·0).

II. A Total Eclipse of the Sun, February 3rd, 1916, visible in Canada as a partial eclipse, except on the Pacific Coast where it ends at sunrise. It begins at sunrise along a line running northeast through Central Southern Alberta and across the eastern end of Lake Athabaska. At Ottawa it begins about twenty minutes after ten in the morning. The path of totality extends from a point in the Pacific Ocean about seven degrees north of the equator and eight hours west of Greenwich, eastward across the northwest corner of South America, then in a northeasterly direction across the Atlantic Ocean to a point southwest of the British Isles.

III. A Partial Eclipse of the Moon, July 14th, 1916, the beginning visible in Africa, southwestern Europe, the Atlantic Ocean, North America except the most western portions, South America, and the South Pacific Ocean, the ending visible in the Atlantic Ocean, North and South America, and the South Pacific Ocean.

Moon enters shadow	July	14d	10h	19·3m
Middle of the eclipse	"	14	11	45·9
Moon leaves shadow	"	14	13	12·5

Magnitude of the ecilpse = 0·800 (Moon's diameter = 1·0).

IV. An Annular Eclipse of the Sun, July 29th, 1916, invisible in Canada but visible in the South Pacific and Indian Oceans, Australia, New Zealand, New Guinea, Borneo, Java, Sumatra, the Malay Peninsula and part of the Philippine Islands.

V. A Partial Eclipse of the Sun, December 24th 1916, invisible in Canada.

Magnitude of greatest eclipse = 0·011 (Sun's diameter = 1·0).

(Eastern Standard Astronomical Time used, hours numbering from noon).

DOUBLE STARS

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

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

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

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

I. THE MOST LUMINOUS PAIRS

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

II. THE FINEST COLORED PAIRS

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

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

A SHORT LIST OF VARIABLE STARS

PREPARED BY THE LATE J. MILLER BARR

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

NAME	LIMITING MAGS.	PERIOD	CLASS	DISCOVERER
		d. h. m.		
U Cephei	7.0– 9.2	2 11 49.6	V.	W. Ceraski....1880
o Ceti	1.7– 9.5	331.7	II.	Fabricius....1596
ρ Persei	3.4– 4.2	Irr.	III.	Schmidt....1854
6.1904 Cephei	8.6– 9.1	32.3	V.	Blajko....1904
β Persei (Algol)	2.1– 3.2	2 20 48.9	V.	Montanari....1669
λ Tauri	3.3– 4.2	3 22 52.2	V.	Baxendell....1848
W Eridani	8.1–<12.5	369	II.	Fleming....1898
RW Tauri	8–11	2 18 27.2	V.	Fleming....1905
R Leporis	6–8 ?	436.1	II.	Schmidt....1855
α Orionis	1– 1.4	Irr.	III.	J. Herschel....1840
U Orionis	5.8–12.3	375	II.	Gore....1885
η Geminorum	3.2– 4.2	231.4	III.	Schmidt....1865
T Monocerotis	5.7– 6.8	27.0	IV.	Gould....1871
ζ Geminorum	3.8– 4.3	10 3 41.5	IV.	Schmidt....1847
R Geminorum	6.6–13.3	370.2	II.	Hind....1848
R Canis Maj	5.7– 6.3	1 3 15.8	V.	Sawyer....1887
S Caneri	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 Professor E. C. Pickering in 1880, and reproduced (with slight additions) in his "Provisional Catalogue of Variable Stars" (1903). This includes five classes, two of which are 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 276 stars and 13 nebulæ. The first 256 stars are those listed as brighter than 3·51 visual magnitude in Harvard *Annals*, Vol. L. The remaining number range in magnitude from 5 to 8·6, and they and the nebulæ are given here on account of their exceptionally high radial velocities.

In the case of visual double stars, the most important of which are preceded by a ||, the magnitude of the components combined is given. The spectral type is also taken from the publication just named. (For a brief outline of the system of notation Campbell's *Stellar Motions*, p. 31, may be consulted). The proper motion is from Boss's *Preliminary General Catalogue*, μ being the annual motion in R.A. and μ' that in Decl. The parallax is taken from many sources, principally Kapteyn's compilations. Those in brackets are least trustworthy. To obtain the distance in light-years, divide the number given in the column into 3·26, this being the number of light-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	−·004	−·01		−0·5	
β Andromedæ	4	+35 5	2·4	Ma	+·015	−·11	(·07)	+2 *	
δ Cassiopeiæ	19	+59 43	2·8	A5	+·040	−·05	(·01)	+9·0	
‖α Ursæ 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	
‖ Andromedæ	58	+41 51	2·2	Kp	+·004	−·05	·007	−10·7	
α Arietis	2 2	+22 59	2·2	K2	+·014	−·15	·088	−14·0	
β Trianguli	4	+34 31	3·1	A5	+·012	−·05		−2 *	
ο Ceti	14	−3 26	1·7–9·6	Md	000	−·24	·142	+62·3	
‖θ Eridani	54	−40 42	3·0	A2	−·006	+·02		*	
α Ceti	57	+3 42	2·8	Ma	−·001	−·08		−25·1	
γ Persei	58	+53 7	3·1	Gp	000	−·01		+2 *	
ρ Persei	59	+38 27	3·4–4·2	Mb	+·012	−·11	·087	+28·6	
β Persei	3 2	+40 34	2·1–3·2	B8	+·001	00	·029	+4·1*	
α Persei	17	+49 30	1·9	F5	+·003	−·03	(·09)	−2·2	
δ Persei	36	+47 28	3·1	B5	+·003	−·03			
‖η Tauri	41	+23 48	3·0	B5	+·001	−·05		+15	
ζ Persei	48	+31 35	2·9	B1	+·001	−·02		+20·4	
γ Hydri	49	−74 33	3·2	Ma	+·011	−·12		+16	
‖ε Persei	51	+39 43	3·0	B	+·002	−·03		*	
γ Eridani	53	−13 47	3·2	K5	+·005	−·11		+62·5	
λ Tauri	55	+12 12	3·3–4·2	B3	000	−·01		+10 *	
α Reticuli	4 13	−62 43	3·4	G5	+·005	+·06		+35·4	
α Tauri	30	+16 18	1·1	K5	+·005	−·19	·073	+55·1	
α Doradus	32	−55 15	3·5	Ap	+·006	00		+26·0	
π³Orionis	44	+6 47	3 3	F8	+·032	+·02		+25·0	
ι Aurigæ	50	+33 0	2·9	K2	+·001	−·03		+18·0	
ε Aurigæ	55	+43 41	3·4–4·1	F5p	000	−·01		−9 *	
η Aurigæ	5 0	+41 6	3·3	B3	+·003	−·08		+3	
ε Leporis	1	−22 30	3·3	K5	+·002	−·07		+1·1	
β Eridani	3	−5 13	2·9	A2	−·006	−·08		−15·0	

Star	R.A. 1900	Decl. 1900	Mag.	Type	Proper Motion μ	Proper Motion μ'	Parallax	Rad. Vel. km./sec.	Mass
	h m	° ′			s	″	″		
μ Leporis	5 8	−16 19	3·3	Ap	+·003	−·03		+28·0	
‖α Aurigæ	9	+45 54	0·2	G	+·005	−·43	·066	+30·2*	2·0
‖ζ 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*	
o^2 Canis Majoris	59	−23 41	3·1	B5p	000	−·01		+49 *	
δ Canis Majoris	7 4	−26 14	2 0	F8p	000	00		+35·5*	
L^2 Puppis	10	−44 29	3·4-6·2	Md	+·009	+·32			
π Puppis	14	−36 55	2·7	K5	−·001	00		+16·4	
β Canis Minoris	22	+ 8 29	3·1	B8	−·003	−·04			
σ Puppis	26	−43 6	3·3	K5	−·006	+·18			
‖α Geminorum	28	+32 6	1·6	A	−·014	·11	·069	− 1·0* + 6·2	4·8 ±
‖α Canis Minoris	34	+ 5 29	0·5	F5	−·047	−1·03	·324	− 0·5*	1·3
ζ 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		Parallax	Rad. Vel. km./sec.	Mass
					μ	μ'			
	h m s	° ′			s	″	″		
‖γ Velorum	8 6	−47 3	2·2	Oap	000	00			
ϵ Carinæ	20	−59 11	1·7	Kp	−·004	+·01		+12	
o Urs. Majoris	22	+61 3	3·5	G	−·017	−·11	·087	+19·4	
‖ϵ Hydræ	41	+6 47	3·5	F8	−·013	−·05	(·25)	+37 *	3·3
δ Velorum	42	−54 20	2·0	A	+·003	−·09			
ζ Hydræ	50	+6 20	3·3	K	−·007	+·01		+23·1	
ι Urs. Majoris	52	+48 26	3·1	A5	−·044	−·25	·061	+6·0	
λ Velorum	9 4	−43 2	2·2	K5	−·002	00		+19·2	
β Carinæ	12	−69 18	1·8	A	−·031	+·10		−14·0	
ι Carinæ	14	−58 51	2·2	F	−·003	00		+13·3	
α Lyncis	15	+34 49	3·3	K5	−·018	+·01	−·057	+38·6	
κ Velorum	19	−54 35	2·6	B3	−·002	00		+21·9*	
α Hydræ	23	−8 14	2·2	K2	−·001	+·03		−3·5	
θ Urs. Majoris	26	+52 8	3·3	F8	−·103	−·55	·092	+15·7	
N Velorum	28	−56 36	3·0	K5	−·005	00		−13·5	
ϵ Leonis	40	+24 14	3·1	Gp	−·003	−·02		+5·0	
‖υ Carinæ	45	−64 36	3·1	F	−·003	+·01		+13·8	
α Leonis	10 3	+12 27	1·3	B8	−·017	00	·033		
η Carinæ	14	−60 50	3·4	K5	−·006	−·01		+8·3	
‖γ Leonis	14	+20 21	2·3	K	+·022	−·18	−·035	−35	
μ Urs. Majoris	16	+42 0	3·2	K5	−·007	+·02	·051	*	
θ Carinæ	39	−63 52	3·0	B	−·003	+·01		+16	
η Carinæ	41	−59 10	1·0–7·4	Pec.	000	00			
μ Velorum	42	−48 54	2·8	G5	+·005	−·06		+7·4	
ν Hydræ	45	−15 40	3·3	K	+·006	+·19		−1·1	
β Urs. Majoris	56	+56 55	2·4	A	+·010	+·03	(·08)	−16·8*	
α Urs. Maj.	58	+62 17	2·0	K	−·017	−·07		*	
ψ Urs. Majoris	11 4	+45 2	3·2	K	−·006	−·04		−3·4	
δ Leonis	9	+21 4	2·6	A2	+·011	−·14			
θ Leonis	9	+15 59	3·4	A	−·004	−·09		+7·7	
λ Centauri	31	−62 28	3·3	B9	−·006	−·02		+11	
β Leonis	44	+15 8	2·2	A2	−·034	−·12	·129	−4·0	
γ Urs. Majoris	49	+54 15	2·5	A	+·011	00		−9	
δ Centauri	12 3	−50 10	2·9	B3p	−·004	−·02			
ϵ Corvi	5	−22 4	3·2	K	−·005	+·01		+4·8	
δ Crucis	10	−58 12	3·1	B3	−·006	−·02		+25	
δ Urs. Majoris	10	+57 35	3·4	A2	+·014	00			
γ Corvi	11	−16 59	2·8	B8	−·011	+·01		−7 *	
α Crucis	21	−62 33	1·0	B1	−·007	−·02	·055	+7	
‖δ Corvi	25	−15 58	3·1	A	−·014	−·14			
γ Crucis	26	−56 33	1·5	Mb	+·002	−·27		+22	
β Corvi	29	−22 51	2·8	G5	000	−·06		−7·1	
α Muscæ	31	−68 35	2·9	B3	−·006	−·02		+13·5	
γ Centauri	36	−48 24	2·4	A	−·020	−·02		−7·0	
‖γ Virginis	36	−0 54	2·9	F	−·038	00	·058	−20·0	

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

Star	R.A. 1900	Decl. 1900	Mag.	Type	Proper Motion μ	Proper Motion μ'	Parallax	Rad. vel. km./sec.	Mass
	h m	° ′			s	″	″		
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	+ ·020	+ ·32	− ·182	− 10 *	
ζ Cygni	21 9	+ 29 49	3·4	K	000	− ·06		+ 17 *	
α Cephei	16	+ 62 10	2·6	A5	+ ·022	+ ·05			
β Aquarii	26	− 6 1	3·1	G	+ ·001	− ·01		+ 6·9	
β Cephei	27	+ 70 7	3·3	B1	+ ·002	00		− 5 *	
ϵ Pegasi	39	+ 9 25	2·5	K	+ ·002	00		+ 5·0	
δ Capricorni	42	− 16 35	3·0	A5	+ ·018	− ·30		*	
γ Gruis	48	− 37 50	3·2	A	+ ·009	− ·02		− 3·0	
α Aquarii	22 1	− 0 48	3·2	G	+ ·001	− ·01		+ 7·5	
α Gruis	2	− 47 27	2·2	B5	+ ·012	− ·16	·024		
α Tucanæ	12	− 60 45	2·9	K2	− ·011	− ·03		+ 41 *	
β Gruis	37	− 47 24	2·2	Mb	+ ·012	− ·02		+ 1·2	
η Pegasi	38	+ 29 42	3·1	G	+ ·001	− ·04		+ 4·3*	
α P Australis	52	− 30 9	1·3	A3	+ ·025	− ·17	·138	+ 6·7	
β Pegasi	59	+ 27 32	2·2–2·4	Mb	+ ·014	+ ·13		+ 8·4	
α Pegasi	59	+ 14 40	2·6	A	+ ·004	− ·04		*	
γ Cephei	23 35	+ 77 4	3·4	K	− ·018	+ ·16		− 42·2	

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

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.

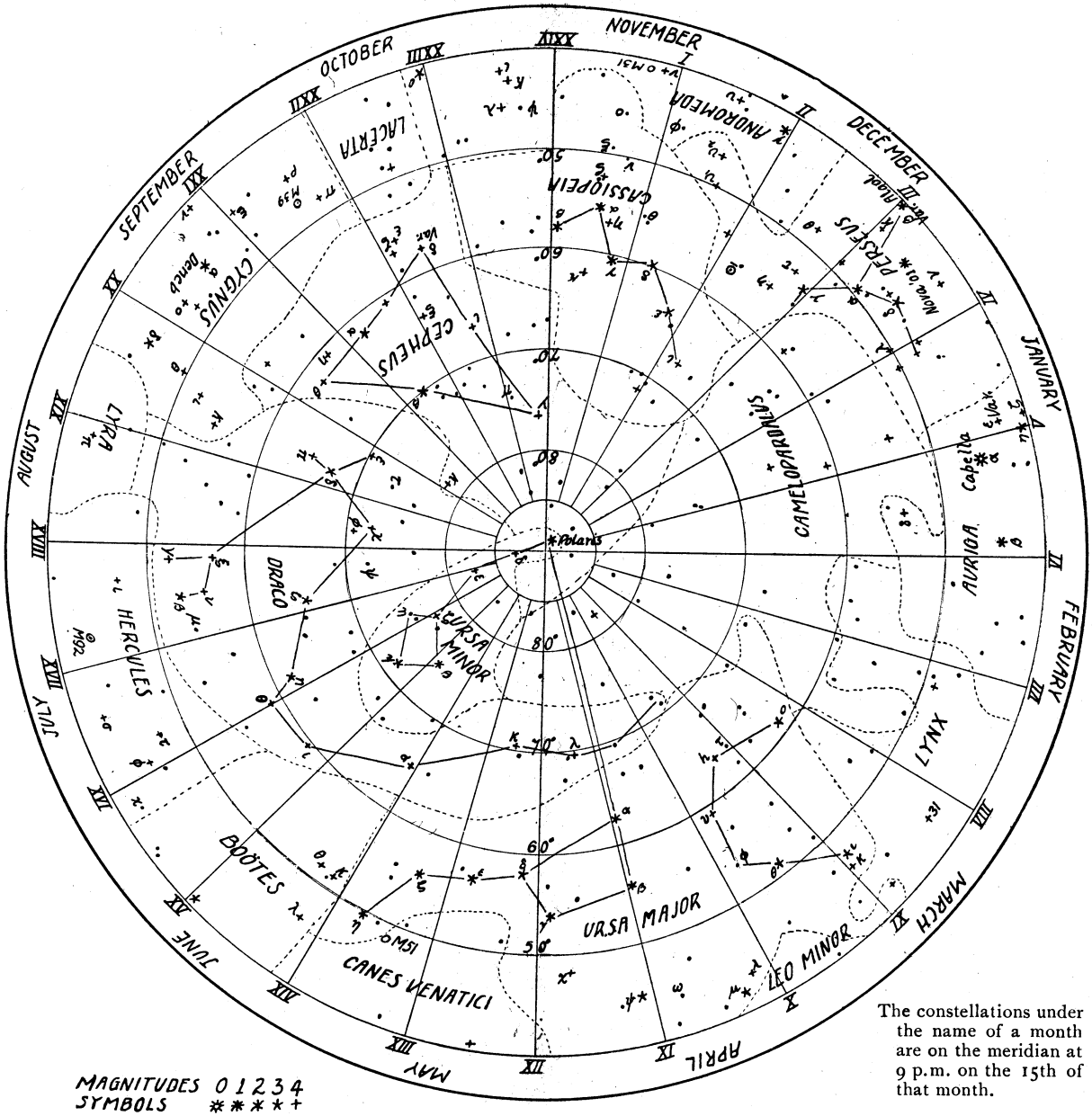
For the positions of the sun and the planets consult pages 22, 24, 26, etc.

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.

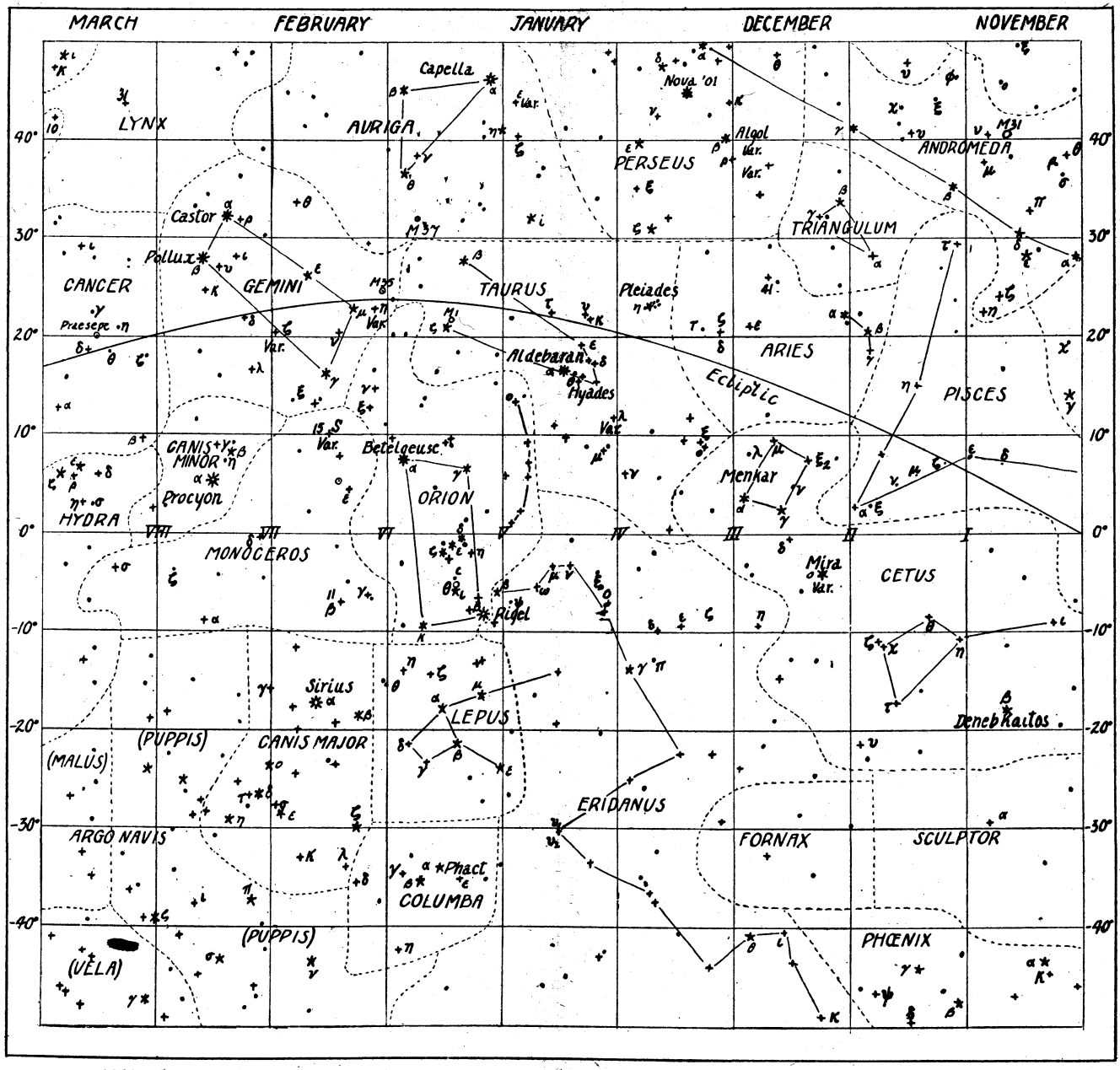
Auriga (The Charioteer) may readily be recognised by Capella, its brightest star, which crosses the meridian not far from the zenith at 9 p.m. on January 24. Capella, Vega and Arcturus are the three brightest stars of the northern hemisphere, each being approximately of magnitude 0·2. Sirius, which is 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.

MAP I.--NORTH POLAR CONSTELLATIONS



The constellations under the name of a month are on the meridian at 9 p.m. on the 15th of that month.

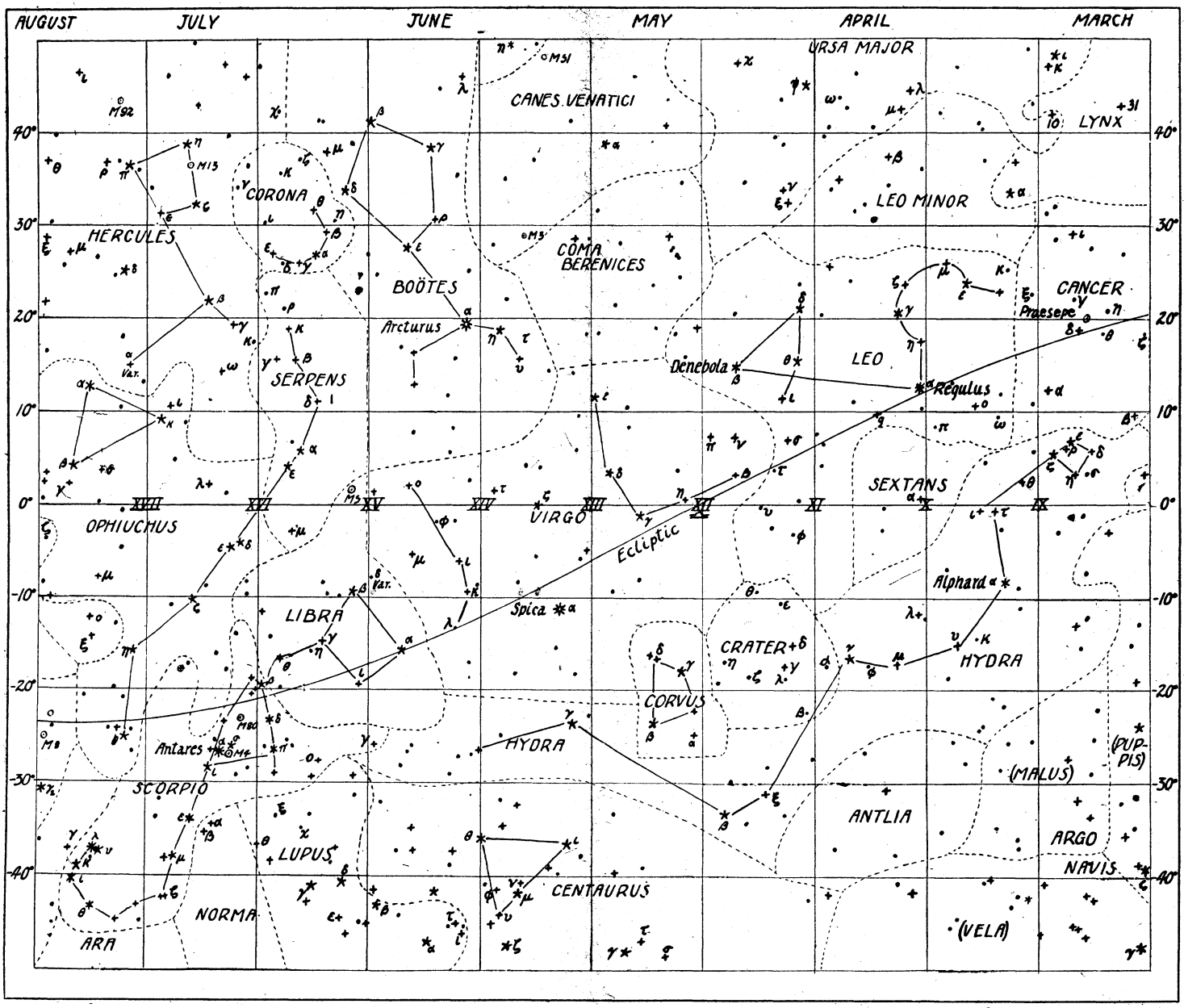
MAP II.--CONSTELLATIONS. from 0h to 9h in Right Ascension



MAGNITUDES 0 1 2 3 4 Nebula Cluster
SYMBOLS ✱ ✱ ✱ ✱ + O ⊙

The constellations under the name of a month are on the meridian at 9 p.m. on the 15th of that month.

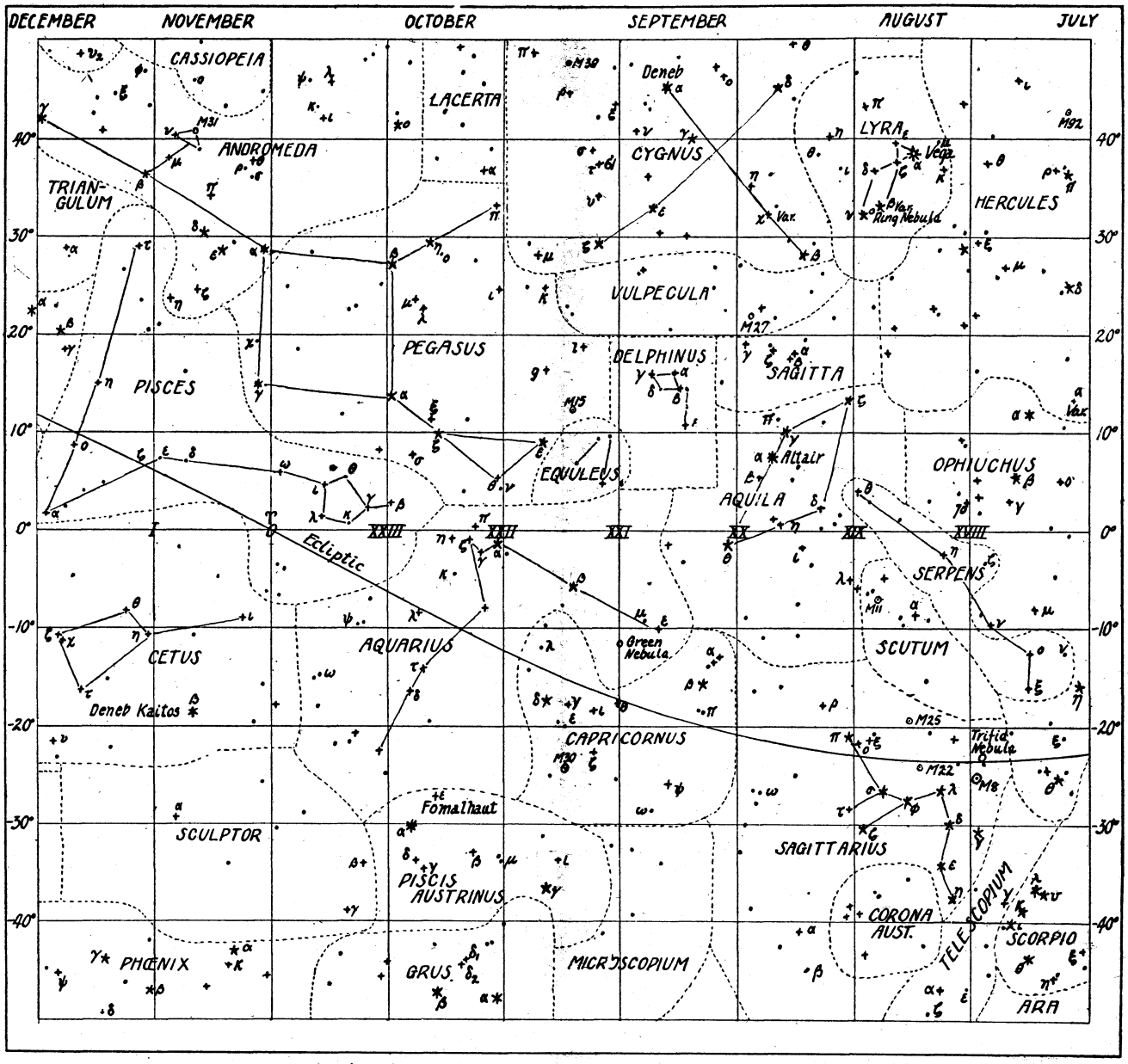
MAP III.--CONSTELLATIONS. from 8h to 18h in Right Ascension



MAGNITUDES 0 1 2 3 4 Nebula Cluster
SYMBOLS * * * * + O ⊙

The constellations under the name of a month are on the meridian at 9 p.m. on the 15th of that month.

MAP IV,--CONSTELLATIONS, from 17h to 24h and 0h to 2h in Right Ascension



MAGNITUDES 0 1 2 3 4 Nebula Cluster
SYMBOLS ✱ ✱ ✱ ✱ + ○ ⊙

The constellations under the name of a month are on the meridian at 9 p.m. on the 15th of that month.

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 $5''{\cdot}5$. 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. $9^h\ 11^m$; Decl. $37°\ 21'$; mags. 4 and $7\frac{1}{2}$; distance $2''{\cdot}9$; 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. $8^h\ 40^m$, 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.

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 $14''{\cdot}5$. The large star of this pair is also a spectroscopic binary—the first one discovered. (2) ξ, R.A. $11^h\ 13^m$, 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. $9^h\ 45^m$, 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 $3''{\cdot}4$; a binary with a period of about 400 years. (2) ι (about 5° S. W. from β); mags. 4 and 7; distance $2''{\cdot}5$; 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 $6''{\cdot}2$; 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 $18''{\cdot}6$.

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* 24m 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 1915

By R. M. Motherwell

Delavan's Comet, 1913*f*, was visible as a bright telescopic object in the morning sky at the beginning of the year, but was too far south for the northern observers.

Comet 1915*a* was discovered by Mellish, of Cottage Grove, Wisconsin, about February 10. It was then in the constellation of Ophiuchus and moving east and southward. Its nearest approach to the earth was in June, when its distance was approximately forty million miles, but it was then very far south. Its spectrum was noted as peculiar by Professor Lowell in April, the regular cometary bright lines having an "intense background of continuous spectrum of the emission bands" and the cyanogen bands being abnormal. Professor Barnard observed two companions to the main nucleus on May 12, and on May 18 one was observed at Goodsell Observatory. About May 23 Professor Lowell observed four smaller nuclei gradually receding from the main nucleus, so evidently the comet was disrupting rapidly.

M. Thiele, of Hamburg Observatory, photographed a comet on April 4, and further observations revealed its identity as Winnecke's periodic comet. This comet was first seen by Pons in 1819 and Encke gave it a period of 5½ years. It was next observed by Winnecke in 1858 and observations made on each return, especially in 1886, indicated a marked irregularity in the date of perihelion passage. Its magnitude as observed by M. Thiele was approximately sixteen.

Comet 1915*c* also proved to be periodic, Tempel's second periodic comet, which was first observed by Tempel, at Milan, on July 3, 1873. Its period is 5·158 years and it has been observed on several returns but is growing fainter.

The fourth comet of 1915 was discovered by Mellish, at Yerkes Observatory, on September 13, but no satisfactory observations were obtained until September 18. It was then in the constellation of Leo Minor and visible in a small telescope, but it was moving rapidly towards the sun and in a few days it was invisible.

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