R. K. Young

THE OBSERVER'S HANDBOOK FOR 1922

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The Royal Astronomical Society of Canada

EDITED BY C. A. CHANT.

FOURTEENTH YEAR OF PUBLICATION

TORONTO
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1922

1922 CALENDAR 1922

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

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

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

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

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

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

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

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

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

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

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

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

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CONTENTS

PREFACE

The HANDBOOK for 1922 follows the same lines as that for 1921. As Mars comes into opposition this year a fuller account of the motions of that planet is given, with suitable map and diagram. The map showing the path of Uranus is on a larger scale than that of last year, and will be found more useful for those who wish to follow its motion amongst the stars with a field-glass.

As in the last issue, the brief descriptions of the constellations and the star maps are not included, since fuller information is available in a better form and at a reasonable price in many publications, such as: Young's *Uranography* (72c.), Upton's *Star Atlas* ($3.00) and McKready's *Beginner's Star Book* (about $3.50).

To those mentioned in the body of the book; to Mr. J. P. Henderson, M.A., of the Dominion Observatory, Ottawa; and especially to Mr. J. A. Pearce, B.A., thanks are due for their assistance.

THE EDITOR.

TORONTO, December, 1921.

ANNIVERSARIES AND FESTIVALS, 1922

New Year's Day	Sun.,	Jan. 1	Pentecost (Whit Sunday)		June 4
Epiphany	Fri.,	Jan. 6	Trinity Sunday		June 11
Septuagesima Sunday		Feb. 12	Corpus Christi	Thur.,	June 15
Quinquagesima (Shrove Sunday)		Feb. 26	St. John Baptist	Sat.,	June 24
Ash Wednesday		Mar. 1	Dominion Day	Sat.,	July 1
St. David	Wed.,	Mar. 1	Labor Day	Mon.,	Sept. 4
St. Patrick	Fri.,	Mar. 17	St. Michael (Michaelmas Day)	Fri.,	Sept. 29
Palm Sunday		Apr. 9	All Saints Day	Wed.,	Nov. 1
Good Friday		Apr. 14	St. Andrew	Thur.,	Nov. 30
Easter Sunday		Apr. 16	First Sunday in Advent		Dec. 3
St. George	Sun.,	Apr. 23	Conception Day	Fri.,	Dec. 8
Rogation Sunday		May 21	St. Thomas	Thur.,	Dec. 21
Victoria Day	Wed.,	May 24	Christmas Day	Mon.,	Dec. 25
Ascension Day (Holy Thursday)		May 25			

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

SYMBOLS AND ABBREVIATIONS

SIGNS OF THE ZODIAC

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

SUN, MOON AND PLANETS

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

ASPECTS AND ABBREVIATIONS

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

THE GREEK ALPHABET

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

In the Configurations of Jupiter's Satellites (pages 29, 31, etc.), O represents the disc of the planet, d signifies that the satellite is on the disc, * signifies that the satellite is behind the disc or in the shadow. Configurations are for an inverting telescope.

SOLAR AND SIDEREAL TIME

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

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

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

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

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

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

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.

1922, EPHEMERIS OF SUN AT GREENWICH MEAN NOON

Date	R.A.	Equation of Time	Declination	Date	R.A.	Equation of Time	Declination
	h m s	m s	° ′ ″		h m s	m s	° ′ ″
Jan. 1	18 44 53	+ 3 28.0	S23 2 44	Apr. 1	0 40 22	+ 4 7.0	N 4 20 44
" 4	18 58 7	+ 4 52.2	22 46 28	" 4	0 51 18	+ 3 13.2	5 29 54
" 7	19 11 17	+ 6 12.6	22 26 9	" 7	1 2 15	+ 2 20.7	6 38 12
" 10	19 24 22	+ 7 28.4	22 1 50	" 10	1 13 14	+ 1 30.0	7 45 29
" 13	19 37 23	+ 8 39.1	21 33 40	" 13	1 24 15	+ 0 41.5	8 51 34
" 16	19 50 18	+ 9 44.2	21 1 45	" 16	1 35 19	− 0 4.0	9 56 20
" 19	20 3 6	+10 43.3	20 26 13	" 19	1 46 27	− 0 46.2	10 59 38
" 22	20 15 49	+11 35.9	19 47 12	" 22	1 57 38	− 1 24.6	12 1 20
" 25	20 28 24	+12 21.8	19 4 52	" 25	2 8 53	− 1 59.0	13 1 15
" 28	20 40 53	+13 0.7	18 19 23	" 28	2 20 13	− 2 28.9	13 59 15
" 31	20 53 14	+13 32.2	17 30 57				
Feb. 3	21 5 28	+13 56.2	16 39 43	May 1	2 31 37	− 2 54.4	14 55 10
" 6	21 17 34	+14 12.7	15 45 52	" 4	2 43 6	− 3 15.1	15 48 53
" 9	21 29 33	+14 21.8	14 49 37	" 7	2 54 40	− 3 31.1	16 40 13
" 12	21 41 24	+14 23.7	13 51 8	" 10	3 6 18	− 3 42.1	17 29 4
" 15	21 53 9	+14 18.8	12 50 36	" 13	3 18 2	− 3 48.0	18 15 16
" 18	22 4 47	+14 7.4	11 48 11	" 16	3 29 51	− 3 48.7	18 58 44
" 21	22 16 19	+13 49.9	10 44 5	" 19	3 41 45	− 3 44.1	19 39 18
" 24	22 27 46	+13 26.7	9 38 28	" 22	3 53 45	− 3 34.4	20 16 53
" 27	22 39 7	+12 58.1	8 31 33	" 25	4 5 49	− 3 19.8	20 51 21
				" 28	4 17 58	− 3 0.6	21 22 36
				" 31	4 30 11	− 2 37.3	21 50 31
Mar. 2	22 50 23	+12 24.6	7 23 31	June 3	4 42 27	− 2 10.3	22 15 1
" 5	23 1 34	+11 46.4	6 14 32	" 6	4 54 47	− 1 40.2	22 36 1
" 8	23 12 42	+11 4.1	5 4 47	" 9	5 7 10	− 1 7.2	22 53 28
" 11	23 23 45	+10 18.2	3 54 27	" 12	5 19 35	− 0 32.0	23 7 17
" 14	23 34 46	+ 9 29.3	2 43 41	" 15	5 32 2	+ 0 5.2	23 17 27
" 17	23 45 45	+ 8 38.0	1 32 40	" 18	5 44 30	+ 0 43.6	23 23 55
" 20	23 56 41	+ 7 45.0	S 0 21 32	" 21	5 56 59	+ 1 22.7	23 26 41
" 23	0 7 37	+ 6 51.0	N 0 49 32	" 24	6 9 27	+ 2 2.0	23 25 43
" 26	0 18 32	+ 5 56.3	2 0 22	" 27	6 21 55	+ 2 40.4	23 21 3
" 29	0 29 27	+ 5 1.4	3 10 50	" 30	6 34 22	+ 3 17.4	23 12 41

1922, EPHEMERIS OF THE SUN AT GREENWICH MEAN NOON

Date	R.A.	Equation of Time	Declination	Date	R.A.	Equation of Time	Declination
	h m s	m s	° ′ ″		h m s	m s	° ′ ″
July 3	6 46 47	+ 3 52.2	N23 0 40	Oct. 1	12 27 37	−10 7.2	S 2 59 4
" 6	6 59 8	+ 4 24.3	22 45 2	" 4	12 38 30	−11 4.1	4 8 50
" 9	7 11 27	+ 4 53.2	22 25 51	" 7	12 49 26	−11 58.0	5 18 10
" 12	7 23 42	+ 5 18.5	22 3 11	" 10	13 0 25	−12 48.3	6 26 52
" 15	7 35 53	+ 5 39.9	21 37 6	" 13	13 11 29	−13 34.4	7 34 50
" 18	7 48 0	+ 5 57.0	21 7 42	" 16	13 22 37	−14 15.6	8 41 52
" 21	8 0 2	+ 6 9.5	20 35 4	" 19	13 33 51	−14 51.6	9 47 48
" 24	8 11 59	+ 6 17.1	19 59 19	" 22	13 45 10	−15 22.0	10 52 27
" 27	8 23 51	+ 6 19.5	19 20 34	" 25	13 56 35	−15 46.5	11 55 38
" 30	8 35 38	+ 6 16.4	18 38 57	" 28	14 8 6	−16 4.7	12 57 10
				" 31	14 19 44	−16 16.4	13 56 53
Aug. 2	8 47 19	+ 6 7.6	17 54 35	Nov. 3	14 31 29	−16 21.1	14 54 34
" 5	8 58 54	+ 5 53.3	17 7 35	" 6	14 43 22	−16 18.5	15 50 5
" 8	9 10 24	+ 5 33.6	16 18 6	" 9	14 55 21	−16 8.4	16 43 14
" 11	9 21 49	+ 5 8.5	15 26 15	" 12	15 7 29	−15 50.6	17 33 50
" 14	9 33 8	+ 4 38.5	14 32 10	" 15	15 19 44	−15 24.9	18 21 43
" 17	9 44 23	+ 4 3.7	13 35 59	" 18	15 32 7	−14 51.5	19 6 42
" 20	9 55 34	+ 3 24.4	12 37 51	" 21	15 44 38	−14 10.6	19 48 36
" 23	10 6 40	+ 2 40.9	11 37 54	" 24	15 57 16	−13 22.6	20 27 16
" 26	10 17 42	+ 1 53.4	10 36 18	" 27	16 10 0	−12 27.7	21 2 30
" 29	10 28 40	+ 1 2.1	9 33 12	" 30	16 22 51	−11 26.5	21 34 12
Sept. 1	10 39 35	+ 0 7.5	8 28 44	Dec. 3	16 35 48	−10 19.3	22 2 11
" 4	10 50 27	− 0 50.0	7 23 3	" 6	16 48 50	− 9 6.6	22 26 20
" 7	11 1 17	− 1 49.8	6 16 18	" 9	17 1 57	− 7 49.1	22 46 34
" 10	11 12 5	− 2 51.5	5 8 36	" 12	17 15 9	− 6 27.2	23 2 46
" 13	11 22 52	− 3 54.3	4 0 7	" 15	17 28 24	− 5 1.9	23 14 51
" 16	11 33 38	− 4 57.7	2 50 58	" 18	17 41 42	− 3 34.0	23 22 47
" 19	11 44 24	− 6 1.2	1 41 20	" 21	17 55 1	− 2 4.6	23 26 29
" 22	11 55 11	− 7 4.4	N 0 31 20	" 24	18 8 20	− 0 34.6	23 25 58
" 25	12 5 58	− 8 6.7	S 0 38 50	" 27	18 21 39	+ 0 54.8	23 21 12
" 28	12 16 47	− 9 7.8	1 49 1	" 30	18 34 57	+ 2 23.0	23 12 12

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

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

OCCULATION OF STARS BY THE MOON, 1922

Prepared by R. M. Motherwell

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

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

Date	Star	Mag.	Immersion*	Emersion*	Position Angle	
					Immer.	Emer.
1922			h m	h m	°	°
Jan. 2	θAquarii	4.3	1 45.9	2 54.9	29	284
Jan. 12	λGeminorum	3.6	13 40.1	14 45.6	120	265
Feb. 10	αCancri	4.3	16 56.0	.....	91	...
Feb. 21	ρSagittarii	4.0	23 33.3	0 25.8	112	252
Mar. 8	λGeminorum	3.6	10 58.4	11 54.7	68	318
Apr. 6	αCancri	4.3	12 44.4	13 35.2	82	312
May 1	λGeminorum	3.6	.....	22 44.2	...	290
May 29	λGeminorum	3.6	5 34.3	6 39.3	118	262
June 27	oLeonis	3.8	22 18.3	23 21.8	108	280
July 8	ρSagittarii	4.0	14 56.2	16 02.2	53	279
Aug. 28	θLibrae	4.4	7 04.0	8 07.5	133	245
Sept. 12	αTauri	1.1	18 47.6	19 57.1	106	244
Sept. 15	λGeminorum	3.6	16 13.5	17 17.0	120	244
Sept. 18	ρSagittarii	4.0	9 00.3	10 14.0	92	242
Oct. 21	θLibrae	4.4	23 59.8	00 45.8	157	234
Nov. 12	oLeonis	3.8	21 58.3	23 00.6	114	283

*Eastern Standard Time, the hours numbering from noon.

TIMES OF SUNRISE AND SUNSET

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

How the Tables are Constructed

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

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

The Times for Any Station

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

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

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

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

JANUARY

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

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

FEBRURAY

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

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

MARCH

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

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

APRIL

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

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

MAY

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

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

JUNE

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

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

JULY

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

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

AUGUST

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

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

SEPTEMBER

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

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

OCTOBER

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

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

NOVEMBER

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

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

DECEMBER

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

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

THE PLANETS DURING 1922

In the following notes on the Planets a general account of the phenomena connected with their motions is given. Fuller details will be found on the pages headed *The Sky for the Month* (pages, 28, 30, . .).

MERCURY ☿

Mercury's apparent separation from the sun is never great, and consequently the planet is comparatively seldom seen with the naked eye; but when near its greatest elongation, or angular distance from the sun, it is easily visible as a star of the first magnitude. It can often be seen for about a fortnight at such times, but some of these occasions are much more favourable than others. For instance, on January 29 the planet is 18° east of the sun, while on September 20 it is 26° east. Yet the former is the better time to look for the planet, since it is then *higher above the horizon* after the sun has set. In general, the planet can best be seen at an eastern elongation (that is, as an evening star) during late winter and spring, and at a western elongation (that is, as a morning star) in the autumn.

By reference to the *Planetary Phenomena*, on pages 29, 37, 47, it will be seen that maximum eastern elongations occur on January 29, and May 23, near which dates the planet should be well seen as an evening star; a favourable western elongation occurs on October 30, when it should be a good morning star. The planet can probably be seen at the other elongations too, but those named are expecially favourable.

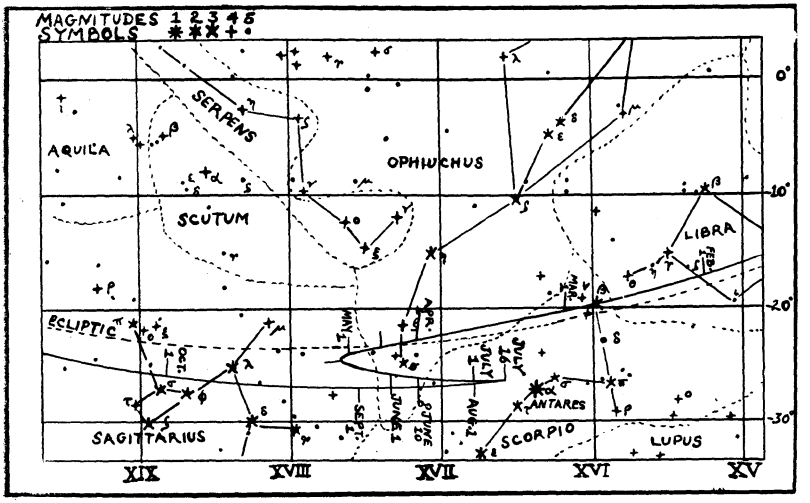
VENUS ♀

At the beginning of the year Venus rises about half an hour before the sun and it remains a morning star until February 9, when it reaches superior conjunction with the sun. Then it is an evening star until November 25, when it reaches inferior conjunction, and after this it is a morning star again. From February 9 it slowly separates from the sun, and it is not until September 15 that it reaches its greatest elongation east. It attains its greatest brilliancy on October 21, and after inferior conjunction on November 25, reaches greatest brilliancy as a moving star on December 30.

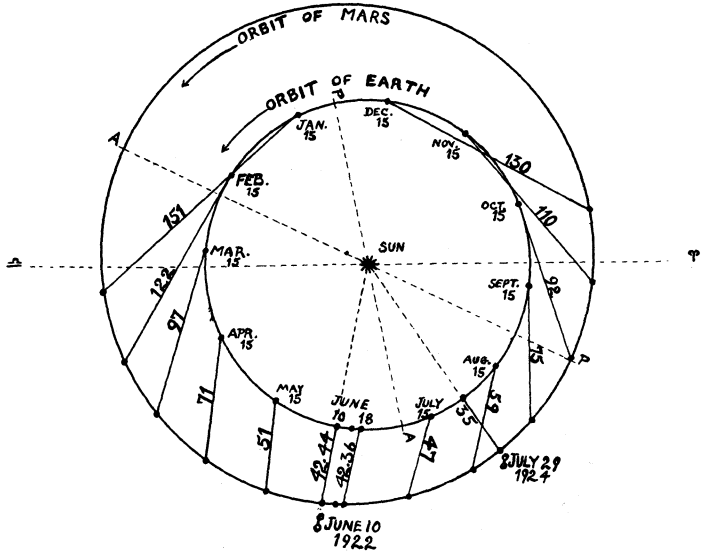
The phases of Venus can easily be seen with a small telescope. When about midway between greatest elongation and inferior conjunction the planet has an apparent diameter of 40″, and with a magnifying power of only 45 it looks in the telescope exactly as the moon when four days old does to the naked eye, and of the same apparent size.

MARS ♂

This planet is a most interesting object of study, and during 1922 it will be well placed for observation. On January 1 it is in R.A. 14h 7m, Decl. 11° 25′ S., about 11° east of Spica, and to a person in middle north latitude it rises at about 2.20 a.m. As its distance from the earth at that time is about 170 million miles



The Path of Mars amongst the Stars, 1922



The Orbits of Mars and the Earth, 1922

it is comparatively faint, its stellar magnitude being +1.5, a little fainter than Regulus or Deneb, each of which is of mag. 1.3.

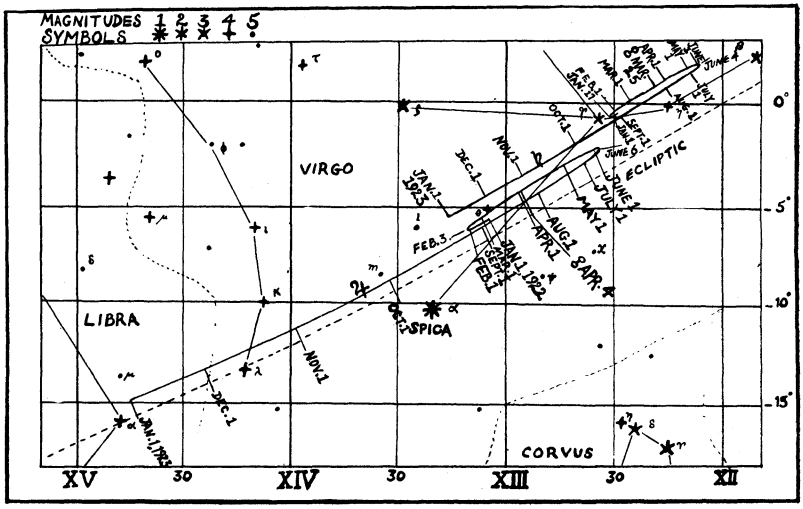
With each month, however, the planet comes closer to the earth, the distance on the 15th of each month being given on pages 28, 30, . . . , and the brightness increases. It comes to opposition with the sun on June 10, but it is nearest to the earth on June 18. The accompanying map shows the path of Mars amongst the stars.

As will be seen, it moves eastward through Virgo, Libra and Scorpio until May 7 when it reaches a stationary point. It then retrogrades until July 16, on which date reaches a stationary point, and after that it moves eastward again.

When in opposition to the sun the distance of Mars from the earth may vary from 61 to 35.5 millions of miles, the average being about 48.6 millions of miles. The distance at this opposition is 42.44 millions and hence the planet should be very bright. Its stellar magnitude will be −2.1, while that of Jupiter at opposition is −2.0. The opposition in 1924 will be still more favourable. The relative positions of Mars and the earth throughout the year are shown in the diagram.

Jupiter 2|

Jupiter is the greatest of all the planets. Its brightness exceeds that of any of the fixed stars, and though at times Mars rivals it, Venus only distinctly outshines it. Jupiter is always a conspicuous object in the sky but it reaches its best in March and April, when it is visible all night long. After that it apparently drifts steadily to the western sky and it is a brilliant evening star until it becomes



The Paths of Jupiter and Saturn amongst the Stars, 1922

lost in the sun's rays. It reaches conjunction with the sun on October 23, and a few weeks later it will be a bright morning star.

Jupiter is a fine object for a small telescope. Even a field glass will reveal its disc and also its four large moons. These were discovered by Galileo in 1610, but since then five more have been discovered—all very faint objects (see page 56).

The paths of Jupiter and Saturn are shown in the accompanying map.

Jupiter passed Saturn on September 22, 1921, and on January 1, 1922, is about 10° east of it.

Saturn ♄

At the beginning of the year Saturn is moving slowly eastward and it becomes stationary on January 18. It then retrogrades until June 4. It is in opposition to the sun on March 25, and is then visible all night. It is in the constellation Virgo all the year.

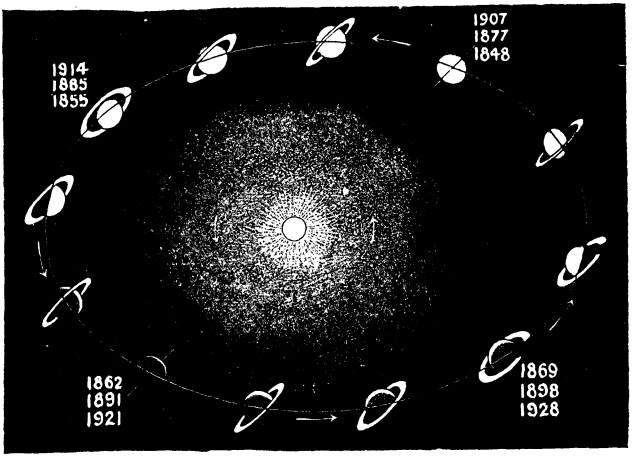
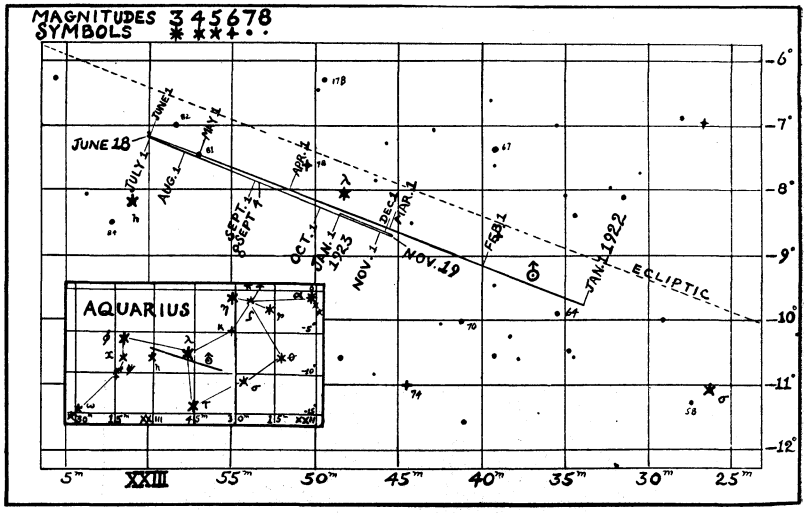


Diagram of Saturn's Orbit

By many observers Saturn, with its unique ring-system and its numerous satellites, is considered the finest object in the sky. During some months in 1921 the rings were invisible (as explained in the Handbook for 1921), and we now see their north face. On January 15 the long axis of the outer ring is 40″.9; the short axis, 4″.8; on June 8 these are 40″.5 and 2″.6, respectively; and December 25, 38″.1 and 7″.7. For about seven years the rings will appear to open out and then they will close in again. See the accompanying figure.

Uranus ♅

This planet was discovered by Sir William Herschelin 1781 and it appears to the naked eye on a dark night as a small star of the sixth magnitude. It is in the constellation Aquarius the entire year, not far from the star Lambda Aquarii



The Path of Uranus amongst the Stars, 1922

(Mag. 3.8). It moves eastward until June 18, when it begins to retrograde, continuing to do so until November 19. It is in opposition on September 4 (see page 45) when it will be visible all night. For some weeks before and after this date the planet can be best observed, and its position and motion can be followed with a field-glass.

Neptune ♆

The planet Neptune is the most distant known member of the solar system, being 2,800 millions of miles from the sun and requiring 165 years to complete a revolution. During the year it moves from the eastern portion of Cancer into Leo. It is in opposition to the sun on February 4 (see page 31). It appears as a star of the eighth magnitude and so cannot be seen with the naked eye.

Algol

The minima of Algol are calculated from Chandler's formula, with Hartwig's correction of 1h 30m earlier. The times are given to the nearest 10 minutes.

ECLIPSES IN 1922

In 1922 there will be the minimum number of eclipses, namely, two of the sun.

1. An annular eclipse, March 28, 1922.

The eclipse (annular phase) begins at 10.01 a.m. G.M.T. in Peru, crosses Brazil, the Atlantic Ocean, Senegal, the Sahara, Egypt, and ends in Arabia, near the Persian Gulf. It is visible as a partial eclipse in Central and South America, the West Indies, Africa (north of the equator), Europe and Western Asia.

2. A total eclipse, September 20, 1922.

The path of totality commences in Somaliland, crosses the Indian Ocean, passing over the Maldive Islands and Christmas Island, reaches Australia in latitude 20° S, and after crossing the continent emerges at the east coast almost at the boundary between Queensland and New South Wales. It ends in the Pacific Ocean about 5° north of New Zealand.

It is visible as a partial eclipse in Madagascar, Southern Asia, the East Indies, Australia and New Zealand.

The duration of totality of this eclipse is exceptionally long, namely 5m 59s, and expeditions will be made to various stations to observe it, chiefly to test the Einstein theory. It is expected that Evershed, of Kodaikanal, India, will observe at the Maldives, the duration being 4m 10s, time 8.16 a.m. (L.A.T.); a party from the Greenwich Observatory, as well as a Dutch-German party to include Professor Einstein, will go to Christmas Island, duration there 3m 40s, time 11.50 a.m.; the Lick Observatory will send an expedition to Western Australia, duration 5m 18s, time 1.40 p.m., and others may also go to this part of the continent; the eastern coast, however, is much more accessible, and it is expected that many observations will be made there, though the duration is shorter, about 3½ minutes, and the time about 4.30 p.m.

THE SKY FOR JANUARY 1922

The Sun.—During January the sun's R.A. increases from 18h 45m to 20h 57m, and its Decl. changes from 23° 3′ S, to 17° 14′ S. The equation of time (see page 6) increases from 3m 28s to 13m 41s, and, on account of this rapid rise in value, the time of mean noon appears to remain, for the first ten days of the month, at the same distance from the time of sunrise, that is, the forenoons, as indicated by our clocks, are of the same length. On the 20th the sun enters the sign Aquarius, the second of the winter signs of the zodiac. The change in the length of the day for any latitude may be found on page 10. On January 3 the earth is in perihelion, at a distance of 91,346,200 miles.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 2nd the moon occults a star in Aquarius and on the 12th one in Gemini (see page 8).

Mercury on the 15th is in R.A. 20h 37m, Decl. 20° 34 S, and transits at 13.01 (L.M.T.). It was in superior conjunction with the sun on December 27, 1921. It slowly separates from the sun and on January 29 it attains greatest elongation east, 18° 23′. This is a moderately good time to see the planet as an evening star. It will be found about 9° south of the setting sun and about 16° above the horizon. Field-glasses will be useful to locate it. It sets about 1½ hrs. after the sun, its stellar magnitude is −0.8 and its phase, visible in a small telescope, resembles the moon at first quarter.

Venus on the 15th is in R.A. 19h 21m, Decl. 22° 45′S, and transits at 11.44 (L.M.T.). At the beginning of the year it is a morning star rising about half an hour before the sun. All the month it is approaching the sun and so is not in a good position for observation.

Mars on the 15th is in R.A. 14h 38m, Decl. 14° 6′ S, and transits at 7.02 (L.M.T.). Its distance from the earth on this date is 151,483,000 miles and consequently it is comparatively faint, stellar magnitude +1.4. It is in the constellation Virgo. See figures on page 23.

Jupiter on the 15th is in R.A. 13h 10m, Decl. 5° 57′ S, and transits at 5.34 (L.M.T.). It is about 10° east of Saturn and 5° north of Spica. It is a conspicuous morning star of magnitude −1.6. During the month it continues to rise earlier and thus improves its position for observation. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 12h 32m, Decl. 0° 48′ S, and transits at 4.56 (L.M.T.). It is in Virgo about 1° west of γ (2.9). It is a good morning star and during the month improves its position for observation. It begins to retrograde on the 18th. Its stellar magnitude is +1.0.

Uranus on the 15th is in R.A. 22h 37m, Decl. 9° 33′ S, and transits at 14.59 (L.M.T.).

Neptune on the 15th is in R.A. 9h 10m, Decl. 16° 24′ N, and transits at 1.36 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

JANUARY

ASTRONOMICAL PHENOMENA

(75 Meridian Time, Hours Numbering from Midnight)

			Minima of Algol h	Minima of Algol m	Configurations of Jupiter's Satellites at 3h 45m
	Sun.	1			42O13
	Mon.	2 18h Moon in Apogee			421O3
	Tues.	3 2h 19m ☌ ♁ ☾, ♁ 3° 56′ S.; 10h ⊕ in Perihelion; 91,346,200 miles distance	20	00	4O123
	Wed.	4			413O2
	Thur.	5			432O1
☽	Fri.	6 5h 24m Moon F.Q.	16	50	431O*
	Sat.	7			34O12
	Sun.	8 18h □ ♃ ☉			2O143
	Mon.	9 21h ☿ Greatest Hel. Lat. S.	13	40	21O43
	Tues.	10			O1234
	Wed.	11			1O324
	Thur.	12	10	30	32O14
♋	Fri.	13 9h 36m F.M.			31O4*
	Sat.	14 12h Moon in Perigee; 23h 33m ☌ Ψ ☾, Ψ 4° 28′ N.			3O124
	Sun.	15	7	20	2O34*
	Mon.	16			214O3
	Tues.	17			4O123
	Wed.	18 4h ♄ Stationary; 13h 9m ☌ ♄ ☾, ♄ 2° 55′ N.	4	10	41O32
	Thur.	19 6h 32m ☌ ♃ ☾, ♃ 0° 49′ N.			432O1
☾	Fri.	20 1h Moon L.Q.			4312O
	Sat.	21 3h 50m ☌ ♂ ☾, ♂ 1° 34′ S.	1	00	43O12
	Sun.	22			d4O3O
	Mon.	23	21	50	d42O3
	Tues.	24			4O123
	Wed.	25			1O342
	Thur.	26	18	40	32O14
♍	Fri.	27 15h 15m ☌ ♀ ☾, ♀ 5° 46′ S.; 18h 48m N.M.			312O4
	Sat.	28 21h ☿ in ♌			3O124
	Sun.	29 13h 52m ☌ ☿ ☾, ☿ 3° 25′ S.; 19h ☿ Greatest Elong. E. 18° 23′	15	20	1O324
	Mon.	30 7h Moon in Apogee; 11h 20m ☌ ♁ ☾, ♁ 3° 38′ S.			2O134
	Tues.	31			O1234

Explanation of symbols and abbreviations on page 4.

THE SKY FOR FEBRUARY 1922

The Sun.—During February the sun's R.A. increases from 20h 57m to 22h 47m, and its Decl. changes from 17° 14′ S to 7° 46′ S. On the 19th the sun enters the third winter sign, Pisces. For the change in the length of the day see page 11. The equation of time reaches a maximum value of 14m 24s on the 11th (see page 6).

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 10th the moon occults a star in Cancer, and on the 21st one in Sagittarius (see page 8).

Mercury on the 15th is in R.A. 21h 39m, Decl. 10° 6′ S, and transits at 12.00 (L.M.T.). On the 29th of last month the planet reached greatest elongation east, and so it should be visible as an evening star during the first few days of this month. It then draws in towards the sun, and reaches inferior conjunction on the 14th. Consequently during nearly all the month the planet is not in a suitable position for observation.

Venus on the 15th is in R.A. 22h 1m, Decl. 13° 38′ S, and transits at 12.22 (L.M.T.). It reaches superior conjunction on the 9th, after which it is an evening star; but during the entire month it is not suitably placed for observation.

Mars on the 15th is in R.A. 15h 46m, Decl. 18° 45′ S (in Libra), and transits at 6.07 (L.M.T.). Its distance from the earth on that date is 122,490,000 miles. The planet is increasing in brightness, its stellar magnitude on the 15th being +0.9, the same as that of Altair. It is steadily improving its position for observation.

Jupiter on the 15th is in R.A. 13h 11m, Decl. 5° 56′ S (in Virgo), and transits at 3.34 (L.M.T.). It began to retrograde on the 3rd, and it is steadily becoming better placed for observation and getting brighter, attaining the magnitude −1.9 before the end of the month. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 12h 29m, Decl. 0° 23′ S (in Virgo), and transits at 2.52 (L.M.T.). As the planet is still retrograding it is slightly farther from γ Virginis this month than last. Its position for observation is continually improving and its stellar magnitude is +0.8.

Uranus on the 15th is in R.A. 22h 43m, Decl. 8° 57′ S, and transits at 13.04 (L.M.T.).

Neptune on the 15th is in R.A. 9h 7m, Decl. 16° 40′ N, and transits at 23.26 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

FEBRUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 2h 30m
			h m	
	Wed.	1	12 10	10432
	Thur.	2 12h ☿ in Perihelion		32401
	Fri.	3 4h ♀ in Aphelion; 8h ♃ Stationary; 23h ☌ ♆ ☉		34210
☽	Sat.	4 17h ☿ Stationary; 23h 52m Moon F.Q.	9 00	43012
	Sun.	5 19h ♃ Greatest Hel. Lat. N.		4102*
	Mon.	6		42013
	Tues.	7	5 50	403**
	Wed.	8		41032
	Thur.	9 2h ☌ ♀ ☉ Superior		43201
	Fri.	10	2 40	32140
♋	Sat.	11 9h 30m ☌ ♆ ☾, ♆ 4° 28′ N.; 20h 18m F.M.		30124
	Sun.	12 6h Moon in Perigee; 18h ☿ Greatest Hel. Lat. N.; 23h ☌ ☿♀, ☿ 5° 15′ N.	23 30	13024
	Mon.	13		20134
	Tues.	14 5h ☌ ☿ ☉ Inferior; 20h 38m ☌ ♄ ☾, ♄ 2° 55′ N.		1034*
	Wed.	15 14h 36m ☌ ♃ ☾, ♃ 0° 42′ N.	20 20	d0234
	Thur.	16		23014
	Fri.	17		32104
☾	Sat.	18 13h 18m Moon L.Q.; 13h 28m ☌ ♂ ☾, ♂ 2° 59′ S.	17 10	30421
	Sun.	19 23h □ ♂☉		41302
	Mon.	20		42013
	Tues.	21	14 00	41203
	Wed.	22		41023
	Thur.	23		dd40*
	Fri.	24 12h ☌♀ ♁, ♀ 0° 46′ S.; 20h ☌☿ ☾, ☿ 1° 46′ S.	10 50	43210
	Sat.	25 15h ♀ Greatest Hel. Lat. S.		43021
♍	Sun.	26 7h ☿ Stationary; 10h Moon in Apogee, 13h 48m N.M.; 20h 40m ☌ ♁ ☾, ♁ 3° 27′ S.		34102
	Mon.	27 2h 56m ☌♀ ☾, ♀ 3° 57′ S.	7 30	20431
	Tues.	28 18h ☌ ♁ ☉		21043

Explanation of symbols and abbreviations on page 4.

THE SKY FOR MARCH 1922

The Sun.—During March the sun's R.A. increases from 22h 47m to 0h 40m, and its Decl. changes from 7° 46′ S to 4° 21′ N. On the 21st the sun enters the first sign of spring, Aries (see opp. page). The equation of time decreases from 12m 36s to 4m 7s (see page 6). For changes in the length of the day, see page 12.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On March 8 the moon occults a star in Gemini (see page 8).

Mercury on the 15th is in R.A. 21h 58m, Decl. 13° 40′ S, and transits at 10.28 (L.M.T.). On the 12th the planet reaches greatest elongation west (see opp. page), but although 28° from the sun, to an observer in middle north latitude it is only 13° above the horizon at sunrise and 25° southward from the sun. This is owing to the small inclination of the ecliptic to the eastern horizon at sunrise at this time of the year. Field-glasses and a clear sky are essential to locate the planet at this elongation. Stellar magnitude +0.3, brightness decreasing.

Venus on the 15th is in R.A. 0h 11m, Decl. 0° 11′ S, and transits at 12.42 (L.M.T.). Its stellar magnitude is −3.4, and so it is a brilliant evening star, each day improving its position for observation.

Mars on the 15th is in R.A. 16h 41m, Decl. 21° 28′ S, and transits 5.12 (L.M.T.). Its distance from the earth on that date is 96,578,000 miles. Its stellar magnitude then is +0.3 and as it is approaching the earth nearly 900,000 miles per day its brightness is rapidly increasing. Its path among the stars is shown on page 23. It rises at about 0.30 (L.M.T.) and is improving its position for observation continually.

Jupiter on the 15th is in R.A. 13h 3m, Decl. 5° 1′ S, and transits at 1.36 (L.M.T.). It rises at about 20.00 (L.M.T.) and so is well placed for observation. Its stellar magnitude is −2.0. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 12h 23m, Decl. 0° 24′ N, and transits at 0.55 (L.M.T.). Still retrograding and improving its position for observation. On the 25th it is in opposition to the sun and is visible all night. Stellar magnitude, +0.7.

Uranus on the 15th is in R.A. 22h 49m, Decl. 8° 22′ S, and transits at 11.20 (L.M.T.).

Neptune on the 15th is in R.A. 9h 4m, Decl. 16° 52′ N, and transits at 21.34 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

MARCH

ASTRONOMICAL PHENOMENA

(75 Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configurations of Jupiter's Satellites at 1h 15m
			h	m	
	Wed.	1			01234
	Thur.	2	4	20	10234
	Fri.	3			d2304
	Sat.	4			30214
	Sun.	5	1	10	31024
☽	Mon.	6 13h 22m Moon F.Q.			20314
	Tues.	7	22	00	21043
	Wed.	8 5h ☿ in ♉			40123
	Thur.	9			41023
	Fri.	10 19h 30m ☌ ♆ ☾, ♆ 4° 34′ N.	18	50	42301
	Sat.	11			4301*
	Sun.	12 14h ☿ Greatest Elong. W. 27° 32′; 19h Moon in Perigee			43102
♋	Mon.	13 6h 14m F.M.	15	40	42031
	Tues.	14 4h 51m ☌ ♄ ☾, ♄ 3° 6′ N.; 21h 43m ☌ ♃ ☾, ♃ 0° 54′ N.			42103
	Wed.	15			40123
	Thur.	16	12	30	10243
	Fri.	17			23014
	Sat.	18 11h ☿ in Aphelion; 21h 25m ☌ ♂ ☾, ♂ 4° 7′ S.			3204*
	Sun.	19	9	20	31024
☾	Mon.	20 3h 43m Moon L.Q.			2014*
	Tues.	21 4h 49m ☉ Enters ♈, Spring commences			21034
	Wed.	22	6	10	02134
	Thur.	23			10243
	Fri.	24			23401
	Sat.	25 12h ☍ ♄ ☉; 15h Moon in Apogee; 21h ☌ ☿ ♁, ☿ 1° 34′ S.	2	50	34210
	Sun.	26 5h 57m ☌ ♁ ☾, ♁ 3° 21′ S.; 7h 5m ☌ ☿ ☾, ☿ 4° 54′ S.			d4302
	Mon.	27	23	40	d4301
♍	Tues.	28 8h 3m N.M.; Ann. Eclipse Invis. in Canada (see page 27)			42103
	Wed.	29 9h 54m ☌ ♀ ☾, ♀ 0° 7′ N.			40213
	Thur.	30	20	30	41023
	Fri.	31			42301

Explanation of symbols and abbreviations on page 4.

THE SKY FOR APRIL, 1922

The Sun.—During April the sun's R.A. increases from 0h 40m to 2h 32m, and its Decl. increases from 4° 21′ to 14° 55′ N. On the 20th it enters the second spring sign, Taurus. The equation of time changes from +4m 7s to −2m 54s (see page 6). For the length of the day in various latitudes, consult page 13.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 6th the moon occults a star in Cancer (see page 8).

Mercury on the 15th is in R.A. 0h 57m, Decl. 4° 16′ N, and transits at 11.26 (L.M.T.). It approaches the sun and on the 24th reaches superior conjunction after which it is an evening star; but at no time during the month is it suitably placed for observation.

Venus on the 15th is in R.A. 2h 34m, Decl. 14° 48′ N, and transits at 13.03 (L.M.T.). It continues to improve its position as an evening star. Its stellar magnitude is the same as in March, −3.4.

Mars on the 15th is in R.A. 17h 27m, Decl. 23° 15′ S, and transits at 3.56 (L.M.T.). Its distance from the earth on that date is 70,542,000 miles, diminishing about 850,000 miles per day. Its stellar magnitude is −0.5, and consequently its brightness has more than doubled during the last month. It rises at about 23.45 (L.M.T.), and is improving its position daily. For its path among the stars and its position in its orbit, see page 23.

Jupiter on the 15th is in R.A. 12h 49m, Decl. 3° 31′ S, and transits at 23.15 (L.M.T.). It is in opposition to the sun on the 4th, and so can be seen all night. Its stellar magnitude is −2.0. For its path among the stars, see page 24, for the configurations of its satellite see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 12h 14m, Decl. 1° 20′ N, and transits at 22.41 (L.M.T.). It is fine position for observation, and has a stellar magnitude +0.8. For the position of the planet among the stars, see page 24.

Uranus on the 15th is in R.A. 22h 55m, Decl. 7° 45′ S, and transits at 9.24 (L.M.T.).

Neptune on the 15th is in R.A. 9h 3m, Decl. 16° 59′ N, and transits at 19.30 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

APRIL

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configurations of Jupiter's Satellites at 0h 0m
			h	m	
Sat.	1				32104
Sun.	2		17	20	30124
Mon.	3				3024*
Tues.	4	8h ☌♃☉			21034
☽ Wed.	5	0h 46m Moon F.Q.; 3h ♃ in Aphelion	14	10	02134
Thur.	6				10234
Fri.	7	3h 45m ☌♆☾, ♆ 4° 37′ N.; 20h ☿ Greatest Hel, Lat. S.			d2014
Sat.	8		11	00	32104
Sun.	9				30412
Mon.	10	4h Moon in Perigee; 12h 35m ☌♄☾, ♄ 3° 19′ N.			34102
♉ Tues.	11	3h 31m ☌♃☾, ♃ 1° 15′ N.; 15h 44m F.M.	7	50	42103
Wed.	12				4013*
Thur.	13				41023
Fri.	14	20h ♂ in ♉	4	40	42031
Sat.	15	23h 49m ☌ ♂☾, ♂ 5° 6′ S.			43210
Sun.	16				43012
Mon.	17		1	30	34102
☾ Tues.	18	19h 54m Moon L.Q.			d2043
Wed.	19		22	10	20143
Thur.	20				10234
Fri.	21				20314
Sat.	22	5h Moon in Apogee; 15h 21m ☌♁☾, ♁ 3° 14′ S.; 22h ☿ in ♌	19	00	32104
Sun.	23				30124
Mon.	24	8h ♆ Stationary; 13h ☌☿☉ Superior			31024
Tues.	25		15	50	20134
Wed.	26	20h ☿ in ♌			2403*
● Thur.	27	0h 4m N.M.; 4h 42m ☌☿☾, ☿ 2° 49′ N			41023
Fri.	28	14h 22m ☌♀☾, ♀ 4° 14′ N	12	40	42013
Sat.	29				42310
Sun.	30				43021

Explanation of symbols and abbreviations on page 4.

THE SKY FOR MAY 1922

The Sun.—During May the sun's R.A. increases from 2h 32m to 4h 34m, and its Decl. increases from 14° 55′ to 21° 59′ N. On the 21st the sun enters Gemini, the third spring sign of the zodiac. The equation of time increases from 2m 54s to a maximum of 3m 49s on the 15th, and then falls to 2m 37s on the 31st (see page 6). The length of the day in latitude 44° N increases 63m during the month (see page 14).

The Moon.—For its phases and conjunctions with the planets, see opposite page. On May 1 and again on the 29th the moon occults the star Lambda Geminorum (see page 8).

Mercury on the 15th is in R.A. 4h 50m, Decl. 24° 51′ N, and transits at 13.20 (L.M.T.). On the 23rd the planet reaches greatest elongation east (see next page). This is the most favourable time of this year to see Mercury as an evening star. At sunset it will be about 10° south of the sun and 18° above the horizon. When observed in a telescope the phase of the planet will resemble the moon at first quarter. Its stellar magnitude will be +0.5, the same as Procyon.

Venus on the 15th is in R.A. 5h 6m, Decl. 23° 49′ N, and transits at 13.36 (L.M.T.). Its stellar magnitude is −3.3, and it sets 2h after the sun. A fine evening star!

Mars on the 15th is in R.A. 17h 38m, Decl. 24° 44′ S, and transits at 2.10 (L.M.T.). On the 7th it began to retrograde and will continue to do so until July 16. On May 15 it is about 15° east of Antares. Stellar magnitude −1.4, 11 times as bright as Antares. Distance from the earth 51,222,000 miles.

Jupiter on the 15th is in R.A. 12h 38m, Decl. 2° 27′ S, and transits at 21.07 (L.M.T.). Since April 15 it has retrograded about 3°, and is now about 15° northwest of Spica (see page 24). Its stellar magnitude is −1.9, and so it is 17 times as bright as Spica. For the configuration of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 12h 8m, Decl. 1° 54′ N, and transits at 20.37 (L.T.M.). It is in excellent position for observation. Stellar magnitude +1.0, slightly fainter than a month ago. For its position among the stars, see page 24.

Uranus on the 15th is in R.A. 22h 59m, Decl. 7° 20′ S, and transits at 7.30 (L.M.T.).

Neptune on the 15th is in R.A. 9h 3m, Decl. 16° 58′, and transits 17.32 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

MAY

ASTROMNOICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 23h 15m
			h m	
Mon.	1	11h ☿ in Perihelion	9 30	42O1*
Tues.	2			421O3
Wed.	3			d4O23
☽ Thur.	4	6h □ΨO; 7h 56m Moon F.Q.; 10h 1m ☌Ψ☾, Ψ 4° 31′ N.	6 20	O2134
Fri.	5			231O4
Sat.	6			3O214
Sun.	7	18h 53m ☌♄ ☾, ♄ 3° 21′ N.; 22h ♂ Stationary	3 10	31O24
Mon.	8	2h Moon in Perigee; 8h 8m ☌♃ ☾, ♃ 1° 26′ N		23O14
Tues.	9			21O34
Wed.	10		0 00	dO234
♒ Thur.	11	1h 6m F.M.; 17h ☿ Greatest Hel. Lat. N.		O1243
Fri.	12		20 50	2431O
Sat.	13	14h 7m ☌♂ ☾; ♂ 6° 18′ S.		34O1*
Sun.	14			431O2
Mon.	15		17 40	423O1
Tues.	16			421O3
Wed.	17			4O123
☾ Thur.	18	13h 17m Moon L.Q.	14 20	4O23*
Fri.	19			2413O
Sat.	20	20h Moon in Apogee; 0h 35m ☌♁ ☾, ♁ 3° 2′ S.		32O41
Sun.	21		11 10	31O24
Mon.	22			32O14
Tues.	23	14h ☿ Greatest Elong. E. 22° 37′		21O34
Wed.	24		8 00	O1234
Thur.	25			1O234
♍ Fri.	26	13h ♀ in Perihelion; 13h 4m N.M.		dd2O4
Sat.	27		4 50	32O14
Sun.	28	7h 2m ☌☿ ☾, ☿ 6° 29′ N.; 17h 39m ☌♀ ☾, ♀ 6° 30′ N.		31O42
Mon.	29			432O1
Tues.	30		1 40	421O3
Wed.	31	15h 53m ☌Ψ ☾, Ψ 4° 19′ N.		4O123

Explanation of symbols and abbreviations on page 4.

THE SKY FOR JUNE 1922

The Sun.—During June the sun's R.A. increases from 4h 34m, to 6h 39m, and its Decl. increases to the maximum, 23° 27′, on the 22nd. On that date the sun enters the first summer sign, Cancer, and our days are longest, being 15h 28m in latitude 44° N (see page 15). The declination falls to 23° 13′ on the 30th. The equation of time becomes zero on 14th, and rises to 3m 17s on the 30th (see page 6). The increase in the equation of time taken with decreasing length of the day causes the local mean time of sunset to appear constant for several days at the end of June and the beginning of July.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 27th the moon occults a star in Leo (see page 8).

Mercury on the 15th is in R.A. 5h 51m, Decl. 20° 23′ N, and transits at 12.19 (L.M.T.). During June the planet is too near the sun for convenient observation. It reaches inferior conjunction on the 18th, after which it is a morning star.

Venus on the 15th is in R.A. 7h 49m, Decl. 22° 55′ N, and transits at 14.17 (L.M.T.). Its stellar magnitude is −3.4, and it sets 2h 15m after the sun. A splendid evening star.

Mars on the 15th is in R.A. 17h 3m, Decl. 26° 2′ S, and transits at 23.29 (L.M.T.). It is in opposition to the sun on the 10th, but it becomes closest to the earth on the 18th (see page 23). It is now visible all night and its stellar magnitude is −2.1, that is the planet is nearly twice as bright as a month ago. On the 15th it is 42,445,000 miles from the earth, while on the 18th the distance is 42,357,000 miles.

Jupiter on the 15th is in R.A. 12h 36m, Decl. 2° 20′ S, and transits at 19.02 (L.M.T.). Its position in the sky is nearly the same as last month, as it reached a stationary point on the 6th (see opp. page); after this date it moves eastward again. Stellar magnitude −1.7, and is 14 times as bright as Spica. For the configurations of its satellites, see next page; and for their eclipse, etc., see page 52.

Saturn on the 15th is in R.A. 12h 7m, Decl. 1° 52′ N, and transits at 18.34 (L.M.T.). After the 4th it begins to move eastward again, *i.e.*, towards γ Virginis. It is a good evening star. Stellar magnitude +1.2, slightly fainter than a month ago, and equal in brightness to Spica. For its position among the stars, see page 24.

Uranus on the 15th is in R.A. 23h 1m, Decl. 7° 10′ S, and transits at 5.30 (L.M.T.).

Neptune on the 15th is in R.A. 9h 6m, Decl. 16° 48′ N, and transits at 15.33 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

JUNE

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol		Configurations of Jupiter's Satellites at 22h 15m
			h	m	
	Thur.	1	22	30	41023
☽	Fri.	2 13h 10m Moon F.Q.			42013
	Sat.	3 14h Moon in Perigee			4320*
	Sun.	4 0h 14m ☌♄ ☾, ♄ 3° 8′ N.; 5h ☿ in ♉; 7h ♄ Stationary; 12h 48m ☌♃ ☾, ♃ 1° 16′ N.; 18h □♁ ☉	19	20	34102
	Mon.	5 17h ☿ Stationary			34021
	Tues.	6 15h ♃ Stationary			2104*
	Wed.	7	16	10	0134*
	Thur.	8			10234
♋	Fri.	9 10h 58m F.M.; 11h 54m ☌ ♂☾, ♂ 7° 44′ S.			20134
	Sat.	10 9h ☍ ♂☉	13	00	3204*
	Sun.	11			31024
	Mon.	12			30214
	Tues.	13	9	40	21034
	Wed.	14 10h ☿ in Aphelion			4013*
	Thur.	15			41023
	Fri.	16 9h 3m ☌♁ ☾, ♁ 2° 46′ S.; 18h Moon in Apogee	6	30	42013
☾	Sat.	17 7h 3m Moon L.Q.; 10h ♀ Greatest Hel. Lat. N.			42310
	Sun.	18 4h ☌☿ ☉ Inferior; 18h ♂ Nearest ⊕, distance 42,357,200 miles			d4302
	Mon.	19 0h ♁ Stationary	3	20	43012
	Tues.	20			42130
	Wed.	21			42013
	Thur.	22 0h 27m ☉ enters ♋, Summer commences	0	10	14023
	Fri.	23 5h □♄ ☉			20143
●	Sat.	24 6h 38m ☌☿ ☾, ☿ 0° 23′ N.; 23h 20m N.M.	21	00	23104
	Sun.	25			30124
	Mon.	26			3024*
	Tues.	27 16h 32m ☌♀ ☾, ♀ 6° 3′ N.; 23h 16m ☌♆ ☾, ♆ 4° 5′ N.	17	50	23104
	Wed.	28 22h Moon in Perigee			20134
	Thur.	29 20h ☿ Stationary			10234
	Fri.	30	14	40	20143

Explanation of symbols and abbreviations on page 4.

THE SKY FOR JULY 1922

The Sun.—During July the sun's R.A. increases from 6h 39m to 8h 43m and its Decl. decreases from 23° 9′ to 18° 10′ N. On the 23rd it enters Leo, the second summer sign of the zodiac. The equation of time increases from 3m 29s on the 1st to 6m 14s on the 31st. During the month the length of the day in lat. 44° N decreases by 50m (see page 16). The earth is farthest from the sun on July 2, being 94,451,000 miles distant.

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 8th it occults a star in Sagittarius (see page 8).

Mercury on the 15th is in R.A. 6h 8m, Decl. 21° 32′ N, and transits at 10.38 (L.M.T.). The planet reaches greatest elongation west on the 11th, its distance from the sun then being 21°. At sunrise it is about 13° above the horizon and 15° south of the sun, measured along the horizon. On account of the brightness of the sky it will probably require a field glass to "pick up" the planet. Stellar magnitude +0.1.

Venus on the 15th is in R.A. 10h 12m, Decl. 12° 44′ N, and transits at 14.42 (L.M.T.). Its stellar mag. at this time is −3.5, a little brighter than last month. It is a little east of Regulus which it outshines 76-fold. Venus sets about 1h 45m after the sun.

Mars on the 15th is in R.A. 16h 36m, Decl. 26° 6′ S, and transits at 21.04 (L.M.T.). Since opposition its distance has increased slightly being now 46,897,000 miles. As a consequence its stellar magnitude has decreased (−1.6). At its stationary point on the 16th, it is only 3° distant from Antares which it outshines more than 13 times.

Jupiter on the 15th is in R.A. 12h 43m, Decl. 3° 16′ S, and transits at 17.12 (L.M.T.). The planet is now moving eastward agian, but it is only about 2° east of its place a month ago. On the 29th there is a close conjunction with the moon (see opp. page). Its stellar magnitude is −1.5,—still a prominent evening star.

For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 12h 12m, Decl. 1° 15′ N, and transits at 16h 41m (L.M.T.). It is still a prominent evening star, setting 3h after the sun. On the 30th it is about 1° N. of Eta Virginis (4.0), see page 24.

Uranus on the 15th is in R.A. 23h 0m, Decl. 7° 18′ S, and transits at 3.31 (L.M.T.).

Neptune on the 15th is in R.A. 9h 9m, Decl. 16° 32′ S, and transits 13.39 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

JULY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 21h 15m
			h m	
☽ Sat.	1	3h ☌♀ Ψ, ♀ 1° 44′ N.; 6h 24m ☌♄ ☾, ♄ 2° 43′ N.; 17h 52m Moon F.Q.; 19h 32m ☌♃ ☾, ♃ 0°·48′ N.		2143O
Sun.	2	12h □♃☉; 16h ⊕ in Aphelion, distance 94,451,000 miles		34021
Mon.	3		11 30	43102
Tues.	4	19h ☿ Greatest Hel. Lat. S.		d423O
Wed.	5			42013
Thur.	6	5h 11m ☌ ♂☾, ♂ 8° 39′ S.	8 20	41023
Fri.	7			4O213
㉙ Sat.	8	22h 7m F.M.		d421O
Sun.	9		5 00	34O1*
Mon.	10			31024
Tues.	11	1h ☿ Greatest Elong. W. 20° 58′		32014
Wed.	12		1 50	2O34*
Thur.	13	16h 9m ☌ ♁ ☾, ♁ 2° 34′ S.		1O234
Fri.	14	12h Moon in Apogee	22 40	O2134
Sat.	15			21O34
Sun.	16	22h ♂ Stationary		3O14*
☾ Mon.	17	0h 11m Moon L.Q.	19 30	31O42
Tues.	18			342O1
Wed.	19			42O**
Thur.	20		16 20	41O23
Fri.	21			4O123
Sat.	22			42103
Sun.	23	4h 47m ☌☿ ☾, ☿ 4° 51′ N.; 19h ☿ in ♌	13 10	432O1
● Mon.	24	7h 47m N.M.		43102
Tues.	25	9h 8m ☌Ψ ☾, Ψ 3° 55′ N.		342O1
Wed.	26	11h Moon in Perigee	10 00	21O4*
Thur.	27	8h 21m ☌♀ ☾, ♀ 2° 36′ N.		dO243
Fri.	28	10h ☿ in Perihelion; 15h 18m ☌♄ ☾, ♄ 2° 13′ N.		O1234
Sat.	29	6h ☌♃ ☾, ♃ 0° 11′ N.	6 50	21O34
Sun.	30			32014
Mon.	31			31024

Explanation of symbols and abbreviations on page 4.

THE SKY FOR AUGUST 1922

The Sun.—During August the sun's R.A. increases from 8h 43m to 10h 40m and its Decl. decreases from 18° 10′ to 8° 29′. On the 24th it enters the third summer sign, Virgo. The equation of time falls from 6m 11s to 0m 8s (see page 7) and the length of the day decreases by 1h 23m in lat. 44° (see page 17).

The Moon.—For its phases and conjunctions with the planets, see opposite page. On August 28, it occults a star in Libra (see page 8).

Mercury on the 15th is in R.A. 10h 12m, Decl. 12° 53′ N, and transits at 12.39 (L.M.T.). The planet reaches superior conjunction on the 7th and during the entire month it is too close to the sun for observation.

Venus on the 15th is in R.A. 12h 20m, Decl. 2° 27′ S, and transits 14.48 (L.M.T.). The stellar magnitude of the planet has now become −3.7, or the brightness is 1.2 times that of a month ago. It is a splendid evening star, remaining above the horizon about 1h 30m after sunset.

Mars, on the 15th is in R.A. 17h 0m, Decl. 26° 33′ S, and transits at 19.27 (L.M.T.). It is still near its rival Antares, although during the remainder of the year the distance between them will increase. On the 15th its stellar magnitude is −0.9, and it is distant from us 59,431,000 miles.

Jupiter on the 15th is in R.A. 12h 59m, Decl. 5° 1′ S, and transits at 15.26 (L.M.T.). It is moving eastward more rapidly this month and approaching Spica, its stellar magnitude is −1.3 that is the planet is 10 times brighter than Spica. On the 15th, it sets about 2h after the sun. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 12h 21m, Decl. 0° 8′ S, and transits at 14.49 (L.M.T.). It is moving more rapidly this month, approaching γ Virginis (2.9), stellar magnitude still (+1.2), or nearly 5 times brighter than γ Virginis. For its position among the stars, see page 24.

Uranus on the 15th is in R.A. 22h 56m, Decl. 7° 39′ S, and transits at 1.26 (L.M.T.).

Neptune on the 15th is in R.A. 9h 14m, Decl. 16° 12′ N, and transits at 11.41 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

AUGUST

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 20h 15m
			h m	
Tues.	1		3 40	d3O14
Wed.	2	12h 55m ☌ ♂☾, ♂ 8° 52′ S.		213O4
Thur.	3			O1423
Fri.	4		0 20	4O23*
Sat.	5			421O3
Sun.	6		21 10	423O1
♍ Mon.	7	1h ☌☿☉ Superior; 11h 19m F.M.; 15h ☌☿♆, ☿ 1° 41′ N.; 17h ☿ Greatest Hel. Lat. N.		431O2
Tues.	8	21h ☌♆☉		43O21
Wed.	9	21h 41m ☌ ♁☾, ♁ 2° 30′ S.	18 00	4213O
Thur.	10			4O13*
Fri.	11	4h Moon in Apogee		41O23
Sat.	12	11h ♀ in ♉	14 50	d2O43
Sun.	13			d2O14
Mon.	14			31O24
☾ Tues.	15	14h ☌♀♄, ♀ 2° 42′ S.; 15h 46m Moon L.Q.	11 40	3O214
Wed.	16			231O4
Thur.	17			O134*
Fri.	18		8 30	1O234
Sat.	19			d2O43
Sun.	20			2O43*
Mon.	21	20h 59m ☌♆☾, ♆ 3° 52′ N.	5 20	341O2
♎ Tues.	22	15h 34m N.M.		43O12
Wed.	23	15h Moon in Perigee; 19h 16m ☌☿☾, ☿ 2° 18′ N.		4321O
Thur.	24		2 10	42O31
Fri.	25	3h 43m ☌♄☾, ♄ 1° 46′ N.; 19h 3m ☌♀☾, ♀ 2° 44′ S.; 20h 46m ☌♃☾, ♃ 0° 27′ S.		41O23
Sat.	26		23 00	42O13
Sun.	27	1h ☌♀♃, ♀ 2° 29′ S.		42O3*
Mon.	28			341O2
☽ Tues.	29	6h 55m Moon F.Q.	19 50	3O142
Wed.	30	13h 57m ☌ ♂☾, ♂ 8° 45′ S.		321O4
Thur.	31	4h ☿ in ♉		2O14*

Explanation of symbols and abbreviations on page 4.

THE SKY FOR SEPTEMBER 1922

The Sun.—During September the sun's R.A. increases from 10h 40m. to 12h 28m, and its Decl. changes from 8° 29′ N to 2° 59′ S. On the 23rd the sun crosses the equator and enters Libra, the first autumn sign of the zodiac. The equation of time becomes zero on the 2nd and then increases to 10m 7s. In lat. 44° the length of the day decreases by 1h 30m (see page 18).

The Moon.—For its phases and conjunctions with the planets, see opposite page. It occults a star in Taurus (Aldebaran) on the 12th, one in Gemini on the 15th and one in Sagittarius on the 28th (see page 8).

Mercury on the 15th is in R.A. 13h 2m, Decl. 8° 53′ S, and transits at 13.28 (L.M.T.). The planet reaches greatest elongation east on the 20th, and though it is 26° from the sun it is too near the horizon to be conveniently observed.

Venus on the 15th is in R.A. 14h 19m, Decl. 17° 1′ S, and transits at 14.45 (L.M.T.). On the 15th the planet reaches its greatest elongation east, namely 46°. At this time it sets at 19.40 (L.M.T.), or about 1h 30m after the sun. Its magnitude then is −4.0, and its brightness 1.3 times that of a month ago. In the telescope the planet resembles the moon at first quarter.

Mars on the 15th is in R.A. 18h 5m, Decl. 26° 37′ S, and transits at 18.30 (L.M.T.). Its magnitude has now fallen to −0.4, but it is still a conspicuous evening star in the constellation of Sagittarius, setting about 22.45 (L.M.T.). Its distance from us is now increasing at the rate of about 500,000 miles daily, being on the 15th, 75,079,000 miles.

Jupiter on the 15th is in R.A. 13h 20m, Decl. 7° 16′ S, and transits at 13.45 (L.M.T.). The sun is rapidly overtaking the planet which on the 15th sets about 1h after sunset. On the 17th it is in conjunction with Spica, being 3° north of the star, and 10 times brighter. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 12h 34m, Decl. 1° 17′ S, and transits at 12.59 (L.M.T.). The sun is rapidly catching up to Saturn, which on the 15th sets about 35m after the sun. On the 23rd it is in conjunction with γ Virginis (2.9) being about 40′ S. See page 24.

Uranus on the 15th is in R.A. 22h 52m, Decl. 8° 7′ S, and transits at 23.15 (L.M.T.).

Neptune on the 15th is in R.A. 9h 18m, Decl. 15° 53′ N, and transits at 9.44 (L.M.T.).

For information regarding *Uranus* and *Neptune*, see page 25.

SEPTEMBER

ASTRONOMICAL PHENOMENA

(75 Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 19h 0m
			h m	
Fri.	1		16 30	1O234
Sat.	2			O2134
Sun.	3			21O34
Mon.	4	18h ☌♇☉	13 20	d3O24
Tues.	5			3O124
♍ Wed.	6	2h 1m ☌♇☾, ♇ 2° 34′ S.; 2h 47m F.M.		321O4
Thur.	7	13h Moon in Apogee	10 10	423O1
Fri.	8	7h ☌☿♄, ☿ 3° 37′ S.		41O23
Sat.	9			4O213
Sun.	10	10h ☿ in Aphelion	7 00	421O3
Mon.	11			43O1*
Tues.	12			43O2*
Wed.	13		3 50	3421O
☾ Thur.	14	5h 20m Moon L.Q.		234O1
Fri.	15	17h ♀ Greatest Elong. E. 46° 24′; 21h ♀ in Aphelion		1O423
Sat.	16		0 40	O2143
Sun.	17			21O34
Mon.	18	9h 11m ☌♆☾, ♆ 3° 51′ N.; 19h ♂ Greatest Hel. Lat. S.	21 30	23O14
Tues.	19			31O24
♎ Wed.	20	6h ☿ Greatest Elong. E. 26° 26′; 23h 38m N.M. Total Eclipse ☉ Invisible in Canada (see page 27)		d32O4
Thur.	21	1h Moon in Perigee; 7h ☌☿♃, ☿ 4° 13′ S.; 19h 0m ☌♄☾, ♄ 1° 24′ N.	18 20	23O14
Fri.	22	15h 7m ☌♃☾, ♃ 1° 2′ S.; 16h 31m ☌☿☾, ☿ 5° 29′ S.		1O234
Sat.	23	15h 10m ☉ Enters ♎, Autumn commences		4O123
Sun.	24	2h 40m ☌♀☾, ♀ 7° 48′ S.	15 10	421O3
Mon.	25			42O31
Tues.	26			431O2
● Wed.	27	17h 40m Moon F.Q.	11 50	d43O1
Thur.	28	3h 14m ☌♂☾, ♂ 8° 8′ S.		
Fri.	29			
Sat.	30	19h ☿ Greatest Hel. Lat. S.	8 40	

See page 47

Explanation of symbols and abbreviations on page 4.

THE SKY FOR OCTOBER 1922

The Sun.—During October the sun's R.A. increases from 12h 28m to 14h 24m, and its Decl. increases from 2° 59′ to 14° 16′ S. On the 24th the sun enters the second autumnal sign Scorpio. The equation of time rises from 10m 7s to 16m 19s, to be subtracted from apparent time (see page 7). The length of the day in lat. 44° N decreases by 1h 29m (see page 19).

The Moon.—For its phases and conjunctions with the planets, see opposite page. On the 21st it occults a star in Libra (see page 8).

Mercury on the 15th is in R.A. 13h 16m, Decl. 9° 42′ S, and transits at 11.43 (L.M.T.). Inferior conjunction with the sun is reached on the 15th, and the planet then rapidly separates from the sun attaining greatest elongation west on the 30th (see next page). The distance from the sun is 19° and at sunrise the planet is nearly 17° above the horizon and 7° south of the sun. It is also near the bright star Spica. This is a favourable time to see the planet. It should be visible for some days before and after the 30th.

Venus on the 15th is in R.A. 15h 59m, Decl. 26′ 2° S, and transits at 14.26 (L.M.T.). The planet is slowly drawing in towards the sun and on the 21st attains its greatest brilliancy. At this time its stellar magnitude is −4.3, or its brightness is 1.3 times that on September 15. The planet is near the star Antares, in Scorpio, but it is 160 times as bright!

Mars on the 15th is in R.A. 19h 26m, Decl. 24° 28′ S, and transits at 17.53 (L.M.T.). It is now at practically the same distance from us as the sun, being 91,712,000 miles away while the sun on the same day is 92,607,000 miles distant. Its stellar magnitude has decreased to +0.1. On the second it is in conjunction with σ Sagittarii (2.1), being about a degree north of the star.

Jupiter on the 15th is in R.A. 13h 44m, Decl. 9° 37′ S, and transits at 12.11 (L.M.T.). It is too near the sun this month for observation, conjunction occuring on the 23rd, after which date it becomes a morning star.

Saturn on the 15th, is in R.A. 12h 48m, Decl. 2° 43′ S, and transits at 11.15 (L.M.T.). It is in conjunction with the sun on the 4th, and therefore too near for observation.

Uranus on the 15th is in R.A. 22h 48m, Decl. 8° 30′ S, and transits at 21.14 (L.M.T.).

Neptune on the 15th is in R.A. 9h 21m, Decl. 15° 38′ N, and transits at 7.49 (L.M.T.).

For information regarding *Uranus* and *Neptune* see page 25.

OCTOBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbered from Midnight)

Minima of Algol

			h	m
Sun.	1			
Mon.	2			
Tues.	3	2h ☿ Stationary; 6h 4m ☌ ♁ ☾, ♁ 2° 40′ S.	5	30
Wed.	4	12h ☌ ♄ ☉; 15h Moon in Apogee		
♍ Thur.	5	19h 58m F.M.		
Fri.	6		2	20
Sat.	7			
Sun.	8	8h ♀ Greatest Hel. Lat. S.	23	10
Mon.	9	4h ☌ ☿ ♃, ☿ 4° 26′ S.		
Tues.	10	1h □ ☌ ☉		
Wed.	11		20	00
Thur.	12			
☾ Fri.	13	14h ♂ in Perihelion; 16h 55m Moon L.Q.		
Sat.	14		16	50
Sun.	15	6h ☌ ☿ ☉ Inferior; 19h 39m ☌ ♆ ☾, ♆ 3° 47′ N.		
Mon.	16			
Tues.	17		13	40
Wed.	18			
Thur.	19	11h 18m ☌ ♄ ☾, ♄ 1° 5′ N.; 12h Moon in Perigee; 16h 4m ☌ ☿ ☾, ☿ 1° 38′ S.; 19h ☿ in ♌		
♍ Fri.	20	8h 40m N.M.; 11h 26m ☌ ♃ ☾, ♃ 1° 34′ S.	10	30
Sat.	21	1h ♀ Greatest Brilliancy		
Sun.	22	23h 43m ☌ ♀ ☾, ♀ 10° 36m S.		
Mon.	23	7h ☌ ♃ ☉; 16h ☿ Stationary	7	10
Tues.	24	9h ☿ in Perihelion		
Wed.	25			
Thur.	26	23h 53m ☌ ♂ ☾, ♂ 6° 53′ S.	4	00
☽ Fri.	27	8h 26m Moon F.Q.		
Sat.	28			
Sun.	29		0	50
Mon.	30	11h 4m ☌ ♁ ☾, ♁ 2° 39 S.; 21h ☿ Greatest Elong. W. 18° 38′		
Tues.	31	22h Moon in Apogee	21	40

By reason of the proximity of Jupiter to the Sun the phenomena of the Satellites are not given from September 28 to November 17.

Explanation of symbols and abbreviations on page 4.

THE SKY FOR NOVEMBER 1922

The Sun.—During November the sun's R.A. increases from 14h 24m to 16h 27m, and its Decl. changes from 14° 16′ to 21° 44′ S. On the 23rd the sun enters Sagittarius, the third autumn sign of the zodiac. The equation of time rises to a maximum of 16m 21s on the 3rd (see page 7). In lat. 44° N the length of the day decreases by 1h 6m (see page 20).

The Moon.—For its phases and conjunctions with the planets, see opposite page. On November 12 it occults a star in Leo (see page 8).

Mercury on the 15th is in R.A. 14h 33m, Decl. 13° 37′ S, and transits at 10.58 (L.M.T.). For about a week at the beginning of the month the planet should be easily observed—see last month's notes—and then it moves in towards the sun and is swallowed up in its rays during the rest of November.

Venus on the 15th is in R.A. 16h 20m, Decl. 25° 48′ S, and transits at 12.44 (L.M.T.). The planet is rapildy closing in on the sun and on the 25th it comes into inferior conjunction with the sun, after which it is a morning star.

Mars on the 15th is in R.A. 20h 56m, Decl. 19° 8′ S, and transits at 17.21 (L.M.T.). It is now in Capricornus, and sets shortly after 22h (L.M.T.), stellar magnitude +0.5 slowly decreasing. On the 15th, it is 110,304,000 miles distant from the earth. On the 22nd Mars will be in conjunction with *i* Capricorni (+4.3), about 10′ south of the star.

Jupiter on the 15th is in R.A. 14h 9m, Decl. 11° 58′ S, and transits at 10.34 (L.M.T.). It is a morning star rising about 1h 40m before the sun. On the 21st it is in conjunction with λ Virginis (4.6) being about 40′ north of the star. For the configurations of its satellites, see next page; and for their eclipses, etc., see page 52.

Saturn on the 15th is in R.A. 13h 01m, Decl. 4° 3′ S, and transits at 9.26 (L.M.T.). It is now a morning star rising about 2h 40m before the sun, on the 15th. Stellar magnitude during November and December +1.0.

Uranus on the 15th is in R.A. 22h 46m, Decl. 8° 40′ S, and transits at 19.10 (L.M.T.).

Neptune on the 15th is in R.A. 9h 23m, Decl. 15° 33′ N, and transits at 5.48 (L.M.T.).

For information regarding *Uranus* and *Neptune* see page 25.

NOVEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 6h 0m
			h m	
	Wed.	1		
	Thur.	2		
	Fri.	3 16h ☿ Greatest Hel. Lat. N.	18 30	
♋	Sat.	4 13h 36m F.M.; 16h ♀ Stationary		
	Sun.	5		
	Mon.	6	15 20	
	Tues.	7		
	Wed.	8		
	Thur.	9	12 10	
	Fri.	10 17h ☌☿♃, ☿ 0° 47′ N.		
	Sat.	11 3h □♆☉		
☾	Sun.	12 2h 52m Moon L.Q.; 3h 5m ☌♆☾, ♆ 3° 36′ N.	9 00	
	Mon.	13		
	Tues.	14		
	Wed.	15	5 50	
	Thur.	16 2h 12m ☌♄☾, ♄ 0° 47′ N.; 19h Moon in Perigee		
	Fri.	17 7h 28m ☌♃☾, ♃ 2° 3′ S.; 23h 10m ☌☿☾, ☿ 2° 42′ S.		
♍	Sat.	18 19h 6m N.M.	2 40	43210
	Sun.	19 8h 30m ☌♀☾, ♀ 8° 18′ S.; 21h ♁ Stationary		40132
	Mon.	20	23 20	41203
	Tues.	21 5h ♆ Stationary		24013
	Wed.	22		10324
	Thur.	23	20 10	30124
	Fri.	24		32104
	Sat.	25 0h 7m ☌♂☾, ♂ 4° 53′ S.; 1h ☌♀☉ Inferior		d3204
♑	Sun.	26 3h 15m Moon F.Q.; 17h 57m ☌♁☾, ♁ 2° 26′ S.	17 00	01324
	Mon.	27 3h ☿ in ♉; 21h ☌☿♀, ☿ 1° 26′ N.		d1034
	Tues.	28 14h Moon in Apogee		20134
	Wed.	29	13 50	10234
	Thur.	30		34012

See page 47

Explanation of symbols and abbreviations on page 4.

THE SKY FOR DECEMBER 1922

The Sun.—During December the sun's R.A. increases from 16h 27m to 18h 44m, and its Decl. reaches the maximum value of 23° 27′ S on the 22nd. On that date the sun enters the first zodiacal sign of winter, Capricornus; and it is vertical to points on the Tropic of Capricorn on the earth. From this time it slowly moves northward. The equation of time changes from 11m 5s "watch slow" to 3m 21s "watch fast" (see page 7). The length of the daylight in lat. 44° N reaches a minimum of 8h 53m on the 22nd (see page 21).

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

Mercury on the 15th is in R.A. 17h 49m, Decl. 25° 10′ S, and transits at 12.16 (L.M.T.). On the 6th the planet comes into superior conjunction with the sun, and at no time during the month will it be suitably placed for observation.

Venus on the 15th is in R.A. 15h 31m, Decl. 16° 30′ S, and transits at 9.58 (L.M.T.). The planet is now a morning star, rapidly separating from the sun and by the end of the month is easily observed. It is so bright that there is no difficulty in locating it in the south-eastern sky.

Mars on the 15th is in R.A. 22h 21m, Decl. 11° 27′ S, and transits at 16.47 (L.M.T.) It is now in Aquarius, setting about 22.15 (L.M.T.). Stellar magnitude +0.8 on the 15th, and +1.0 on the 31st. Its distance is now 129,662.000 miles. On the 25th, there is in close conjunction with the planet Uranus, Mars being 7′ south.

Jupiter on the 15th is in R.A. 14h 33m, Decl. 13° 54′ S, and transits at 9.00 (L.M.T.). It is improving as a morning star rising on the 15th about 3h 30m before the sun or 4.00 (L.M.T.). Its position at the end of the year is very near α Libra (2.9). For the configurations of its satellites, see next page; and for their eclipses, see page 52.

Saturn on the 15th is in R.A. 13h 11m, Decl. 5° 1′ S, and transits at 7.38 (L.M.T.). It is a better morning star this month than last, rising on the 15th about 0.30 (L.M.T.). Its position at the end of the year is about 5° north of Spica. See page 24.

Uranus on the 15th is in R.A. 22h 47m, Decl. 8° 33′ S, and transits at 17.13 (L.M.T.).

Neptune on the 15th is in R.A. 9h 22m, Decl. 15° 36′ N, and transits at 3.50 (L.M.T.).

For information regarding *Uranus* and *Neptune* see page 25.

DECEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

			Minima of Algol	Configurations of Jupiter's Satellites at 5h 30m
			h m	
Fri.	1			34210
Sat.	2	12h □♃⊙	10 40	43201
Sun.	3	14h♀ in ♌		4032*
♋ Mon.	4	6h 24m F.M.		41023
Tues.	5		7 30	42013
Wed.	6	13h ☌☿⊙ Superior		41023
Thur.	7	9h ☿ in Aphelion		43012
Fri.	8		4 20	31240
Sat.	9	8h 13m ☌♆☾, ♆ 3° 21′ N.		32014
Sun.	10			1024*
☾ Mon.	11	11h 41m Moon L.Q.	1 10	d0234
Tues.	12			20134
Wed.	13	13h 45m ☌♄☾, ♄ 0° 27′ N.	22 00	1034*
Thur.	14	11h Moon in Perigee; 11h♀ Stationary		30124
Fri.	15	1h 5m ☌♃☾, ♃ 2° 33′ S.		31204
Sat.	16	1h 33m ☌♀☾, ♀ 1′ 44′ S.	18 50	32014
Sun.	17			13402
♍ Mon.	18	7h 20m N.M.; 20h 31m ☌☿☾, ☿ 6 54′ S.		40123
Tues.	19		15 30	4203*
Wed.	20			42103
Thur.	21			43012
Fri.	22	9h 57m ⊙ Enters ♑, Winter commences	12 20	d4310
Sat.	23			43201
Sun.	24	1h 26m ☌♂☾, ♂ 2° 17′ S.; 2h 57m ☌♁☾, ♁ 2° 5′ S.		43102
Mon.	25	4h ☌♂♁, ♂ 0° 7′ S.	9 10	40132
☽ Tues.	26	0h 53m Moon F.Q.; 11h Moon in Apogee		2043*
Wed.	27	18h ☿ Greatest Hel. Lat. S.		21034
Thur.	28		6 00	03124
Fri.	29			31024
Sat.	30	21h♀ Greatest Brilliancy		32014
Sun.	31		2 50	31024

Explanation of symbols and abbreviations on page 4.

PHENOMENA OF JUPITER'S SATELLITES, 1922

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

JANUARY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	1	28	I	OR	21	6	25	I	SI
4	2	6	III	Te	22	2	25	II	TI
	5	39	II	SI		2	38	II	Se
6	5	1	II	OR		3	42	I	ED
	5	28	I	ED		4	55	II	Te
7	2	38	I	SI	23	0	53	I	SI
	3	52	I	TI		2	5	I	TI
	4	51	I	Se		3	6	I	Se
	6	3	I	Te		4	16	I	Te
8	3	21	I	OR	24	1	32	I	OR
11	1	19	III	Se	25	6	42	III	SI
	3	55	III	TI	29	1	36	III	OD
	6	3	III	Te		2	34	II	SI
13	2	29	II	ED		3	37	III	OR
14	4	32	I	SI		4	53	II	TI
	5	45	I	TI		5	10	II	Se
	6	44	I	Se		5	35	I	ED
15	1	49	I	ED	30	2	47	I	SI
	2	25	II	Te		3	56	I	TI
	5	14	I	OR		4	59	I	Se
16	1	12	I	Se		6	7	I	Te
	2	24	I	Te	31	0	3	I	ED
18	2	44	III	SI		1	54	II	OR
	5	15	III	Se		3	22	I	OR
20	5	5	II	ED		23	28	I	Se

FEBRUARY

1	0	34	I	Te	15	22	54	II	TI
5	0	38	III	ED		23	32	II	Se
	3	8	III	ER	16	0	39	III	Te
	5	7	II	SI		1	21	II	Te
	5	20	III	OD		1	26	I	OR
6	4	40	I	SI		22	39	I	Te
	5	46	I	TI	21	4	46	II	ED
	23	34	II	ED		5	42	I	ED
7	1	56	I	ED	22	2	56	I	SI
	4	21	II	OR		3	49	I	TI
	5	11	I	OR		5	8	I	Se
	23	9	I	SI		5	59	I	Te
8	0	13	I	TI		22	32	III	SI
	1	21	I	Se		23	29	II	SI
	2	24	I	Te	23	0	10	I	ED
	22	59	II	Te		0	59	III	Se
	23	38	I	OR		1	14	II	TI
12	4	35	III	ED		2	5	II	Se
13	6	34	I	SI		2	18	III	TI
14	2	10	II	ED		3	12	I	OR
	3	49	I	ED		3	42	II	Te
15	1	2	I	SI		4	9	III	Te
	2	2	I	TI		22	16	I	TI
	3	15	I	Se		23	36	I	Se
	4	12	I	Te	24	0	26	I	Te
	22	45	III	TI		22	21	II	OR

MARCH

1	4	49	I	SI	2	4	56	III	Se
	5	35	I	TI		4	58	I	OR
2	2	2	II	SI		5	46	III	TI
	2	3	I	ED		6	0	II	Te
	2	31	III	SI		23	18	I	SI
	3	32	II	TI	3	0	2	I	TI
	4	37	II	Se		1	30	I	Se

MARCH—*Continued*

d	h	m	Sat.	Phen.	d	h	n	Sat.	Phen.
3	2	12	I	Te	18	23	46	I	Se
	23	24	I	OR	19	0	9	I	Te
4	0	41	II	OR		20	25	II	SI
5	21	19	III	OR		21	11	II	TI
9	3	56	I	ED		21	19	I	OR
	4	35	II	SI		23	0	II	Se
	5	49	II	TI		23	39	II	Te
10	1	11	I	SI	20	0	24	III	ED
	1	47	I	TI		4	0	III	OR
	3	24	I	Se	24	4	59	I	SI
	3	56	I	Te		5	16	I	TI
	22	25	I	ED	25	2	11	I	ED
	23	17	II	ED		4	30	II	ED
11	1	9	I	OR		4	37	I	OR
	3	0	II	OR		23	28	I	SI
	21	53	I	Se		23	42	I	TI
	22	24	I	Te	26	1	40	I	Se
12	21	25	II	Te		1	53	I	Te
13	0	40	III	OR		20	40	I	ED
16	5	50	I	ED		22	59	II	SI
17	3	5	I	SI		23	3	I	OR
	3	32	I	TI		23	25	II	TI
	5	18	I	Se	27	1	33	II	Se
	5	42	I	Te		1	54	II	Te
18	0	18	I	ED		4	22	III	ED
	1	53	II	ED		20	9	I	Se
	2	53	I	OR		20	19	I	Te
	5	17	II	OR	28	20	41	II	OR
	21	34	I	SI	30	20	45	III	Se
	21	58	I	TI		20	57	III	Te

APRIL

1	4	5	I	ED	10	23	57	I	Se
2	1	22	I	SI	11	21	8	I	ER
	1	26	I	TI		22	41	II	OD
	3	35	I	Se	12	1	37	II	ER
	3	37	I	Te	13	19	28	II	Te
	22	33	I	ED		19	57	II	Se
3	0	47	I	OR	14	1	34	III	TI
	1	32	II	SI		2	21	III	SI
	1	38	II	TI		3	34	III	Te
	4	7	II	Se		4	41	III	Se
	4	7	II	Te	17	2	4	I	OD
	19	50	I	SI		4	33	I	ER
	19	52	I	TI		23	20	I	TI
	22	3	I	Te		23	39	I	SI
	22	3	I	Se	18	1	32	I	Te
4	19	14	I	ER		1	52	I	Se
	20	24	II	ED		20	30	I	OD
	23	1	II	ER		23	1	I	ER
6	22	18	III	TI	19	0	56	II	OD
	22	22	III	SI		4	14	II	ER
7	0	15	III	Te	19	19	58	I	Te
	0	43	III	Se		20	20	I	Se
9	3	10	I	TI	20	19	57	II	SI
	3	16	I	SI		21	43	II	Te
10	0	20	I	OD		22	31	II	Se
	2	39	I	ER	24	3	48	I	OD
	3	51	II	TI		22	35	III	ER
	4	6	II	SI	25	1	5	I	TI
	21	36	I	TI		1	34	I	SI
	21	45	I	SI		3	17	I	Te
	23	47	I	Te		3	46	I	Se

APRIL—*Continued*

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
25	22	14	I	OD	26	22	15	I	Se
26	0	56	I	ER	27	21	28	II	TI
	3	13	II	OD		22	32	II	SI
	19	32	I	TI		23	59	II	Te
	20	3	I	SI	28	1	5	II	Se
	21	43	I	Te	29	20	8	II	ER

MAY

1	21	45	III	OD	12	20	32	I	Se
	23	55	III	OR	13	21	2	II	OD
2	0	15	III	ED	14	1	21	II	ER
	2	33	III	ER	18	0	52	I	TI
	2	51	I	TI		1	47	I	SI
	3	29	I	SI		21	59	I	OD
	23	59	I	OD	19	1	7	I	ER
3	2	50	I	ER		20	16	I	SI
	21	17	I	TI		20	42	III	Te
	21	57	I	SI		21	31	I	Te
	23	29	I	Te		22	16	III	SI
4	0	9	I	Se		22	27	I	Se
	21	18	I	ER	20	0	30	III	Se
	23	45	II	TI		23	25	II	OD
5	1	7	II	SI	22	20	9	II	Te
	2	17	II	Te		22	6	II	Se
6	22	45	II	ER	25	23	48	I	OD
9	1	8	III	OD	26	21	8	I	TI
10	1	45	I	OD		21	59	III	TI
	23	4	I	TI		22	11	I	SI
	23	52	I	SI		23	20	I	Te
11	1	16	I	Te	27	0	19	III	Te
	2	4	I	Se		0	22	I	Se
	20	12	I	OD		21	30	I	ER
	23	13	I	ER	29	20	0	II	TI
12	2	4	II	TI		22	10	II	SI
	19	43	I	Te		22	34	II	Te
	20	32	III	Se	30	0	41	II	Se

JUNE

2	22	58	I	Ti	10	0	50	I	TI
3	0	6	I	SI		21	56	I	OD
	1	10	I	Te	11	20	29	I	SI
	20	5	I	OD		21	29	I	Te
	23	25	I	ER		22	40	I	Se
4	20	45	I	Se	13	21	34	III	OR
5	22	26	II	TI	14	0	11	III	ED
6	0	45	II	SI	17	23	49	I	OD
	1	1	II	Te	18	21	10	I	TI
	20	12	III	ED		22	24	I	SI
	22	24	III	ER		23	22	I	Te
7	22	27	II	ER	19	21	43	I	ER

JUNE—*Continued*

d	h	m	Sat.	Phem.	d	h	m	Sat.	Phen.
20	22	57	III	OD	26	20	10	I	OD
21	22	33	II	OD		23	38	I	ER
23	21	46	II	Se	27	20	58	I	Se
24	20	22	III	Se	30	21	51	II	SI
25	23	4	I	TI		21	53	II	Te

JULY

1	22	12	III	SI	12	21	57	I	ER
3	22	5	I	OD	19	20	9	III	ED
4	20	43	I	SI		20	26	I	OD
	21	39	I	Te		22	16	III	ER
	22	53	I	Se	20	20	0	I	Te
7	21	53	II	TI		21	11	I	Se
8	20	56	III	TI	25	21	29	II	Se
9	22	7	II-	ER	26	21	38	III	OR
11	21	23	I	TI	27	20	56	I	SI
	22	38	I	SI	28	20	16	I	ER

AUGUST

1	21	36	II	SI	19	20	11	I	TI
6	20	12	III	Se	20	20	30	I	ER
11	20	50	I	OD	26	19	31	II	Te
12	20	23	I	Te	27	19	20	I	OD
13	20	15	III	Te	28	19	42	I	Se
17	19	49	II	OD					

SEPTEMBER

2	19	43	II	TI	4	19	26	I	SI

NOVEMBER

18	5	57	I	Te	25	5	47	I	TI
22	5	48	III	SI	27	5	52	II	TI

DECEMBER

6	5	23	II	OR	22	4	11	II	Se
10	5	39	III	ER	22	6	1	II	Te
	6	21	I	ED	26	4	36	I	ED
11	5	40	I	Se	27	3	54	I	Se
	6	26	I	Te		4	52	I	Te
18	5	24	I	SI	28	5	37	III	TI
18	6	15	I	TI	29	4	22	II	SI
19	5	46	I	OR		6	24	II	TI
20	6	42	II	ED		6	46	II	Se

METEORS AND SHOOTING STARS

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

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

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

SATELLITES OF THE SOLAR SYSTEM

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

DOUBLE STARS

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

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

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

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

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

I. THE MOST LUMINOUS PAIRS

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

II. THE FINEST COLORED PAIRS

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

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

VARIABLE STARS

The study of variable stars is especially suited to amateur observers. In it they can make observations of permanent scientific value, since all the brighter and more interesting objects are within the range of modest instruments. An ordinary field glass or a small telescope is all that is required.

In recent years there has been organized the American Association of Variable Star Observers, with a working membership of about 70, and reports of observations are published monthly in *Popular Astronomy*. The recording secretary is Howard O. Eaton, 428 Lake St., Madison, Wis., and additional observers are desired.

The *novae* or "new" stars comprise one class of variables, and all the recent brighter objects of this sort have been discovered by amateurs. The long-period variable Omicron Ceti, or *Mira*, was discovered by Fabricius in 1596, while Algol, the best-known variable of short-period, was discovered by Goodricke, a deaf mute, in 1783.

Several attempts have been made to classify the variable stars; but a scientific system of classification, in harmony with the chief deductions of theory as well as the facts of observation, is still wanting. The best known system is that formulated by Professor E. C. Pickering in 1880, and reproduced (with slight additions) in his "Provisional Catalogue of Variable Stars" (1903). This includes five classes, two of which are subdivided, as follows:—

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

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

THE DISTANCES OF THE STARS

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

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

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

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

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

In the following short list the parallaxes and some other information are given for a few stars. While the distances of some of those at the top of the list are comparatively accurate, those towards the end must be considered only approximate. Some of the brightest stars in the sky, such as Canopus, Rigel, Spica, Deneb, and others, are so distant that is impossible to obtain even an approximate value for the parallax.

Name	Magnitude	Annual Parallax	Proper Motion	Distance	
				Times Sun's Distance	Light Years
		″	″		
α Centauri....	0.7	0.75	3.67	275,000	4
21 185 Lalande.	6.9	0.50	4.75	447,000	6.5
61 Cygni.....	5.1	0.40	5.16	550,000	8
Sirius.....	−1.4	0.39	1.31	570,000	8.3
Procyon....	0.5	0.27	1.25	825,000	12
σ Draconis....	4.7	0.25	.....	907,000	13.2
Altair.....	1.0	0.20	0.65	1,120,000	16.3
ε Indi.....	5.2	0.20	4.60	1,120,000	16.3
o^2 Eridani.....	4.5	0.19	4.05	1,169,000	17
β Cassiopeiæ..	2.4	0.16	0.55	1,375,000	20
Vega.....	0.2	0.16	0.36	1,375,000	20
70 Ophiuchi....	4.1	0.15	1.13	1,444,000	21
e Eridani.....	4.4	0.14	3.03	1,581,000	23
Aldebaran..	1.0	0.12	0.19	1,856,000	27
Capella.....	0.2	0.11	0.43	1,994,000	29
Regulus....	1.4	0.10	0.27	2,200,000	32
Polaris.....	2.1	0.07	0.05	3,231,000	47
85 Pegasi.....	5.8	0.054	1.29	4,125,000	60

GEOGRAPHICAL POSITIONS OF SOME POINTS IN CANADA

Name	Latitude N.			Longitude W.			Feet above Sea Level
	°	′	″	°	′	″	
Banff, Alta	51	10		115	35		4542
Barrie, Ont	44	23		79	41		839
Battleford, Sask	52	41		108	20		1620
Brandon, Man	49	51		99	57		1176
Calgary, Alta	51	02	39.21	7	36	15.1	3428
Charlottetown, P.E.I	46	14		63	10		38
Collingwood, Ont	44	30		80	15		595
Edmonton, Alta	53	31	58.81	113	30	27.0	2188
Father Point, Que	48	31		68	19		20
Fort Churchill	58	51		94	11		....
Fort Simpson	61	52		121	43		....
Fredericton, N.B	45	57		66	36		164
Golden, B.C	51	16		116	55		2550
Gravenhurst, Ont	44	54		79	20		770
Guelph, Ont	43	32	43.7	80	15	09.0	1063
Halifax, N.S	44	39		63	36		97
Hamilton, Ont	43	16		79	54		303
Herschel Is	69	30		139	15		....
Kingston, Ont	44	13		76	29		285
London, Ont	42	59		81	13		808
Medicine Hat	50	1		110	37		2161
Moncton, N.B	46	9		64	45		50
Montreal, Que	45	30	17.0	73	34	39.45	187
New Westminster, B.C	49	13		122	54		330
No. West River, Ungava	53	31	31.45	60	10	17.85	....
Ottawa, Ont	45	23	38	75	42	58.20	273.4
Owen Sound, Ont	44	33	56.42	80	56	40.5	585
Peterborough, Ont	44	17		78	19		722
Portage la Prairie, Man	49	58		98	17		830
Port Simpson, B.C	54	34		130	26		26
Prince Albert, Sask	53	10		106	0		1432
Quebec, Que	46	48		71	13		296
Regina, Sask	50	27		104	37		1885
Revelstoke, B.C	51	00	11.25	7	52	49.8	1503
Rose Point, Ont	45	19	00.73	80	02	28.5	602
St. Catharines, Ont	43	10		79	17		347
St. John, N.B	45	17		66	4		70
St. Johns, Nfd	47	34		52	42		125
Stratford, Ont	43	23		81	00		1191
Toronto, Ont	43	39	35.9	79	23	39.75	350
Vancouver, B.C	49	17	48.0	123	07	05.52	11
Victoria, B.C	48	25	31.38	123	21	42.0	55
Windsor, Ont	42	20		83	4		625
Winnipeg, Man	49	53	51.53	97	08	28.53	751
York Factory	57	00		92	28		55

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THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

The Library and the offices of the General Secretary and the General Treasurer are at 198 College Street, Toronto.

Ordinary meetings are held in Toronto in the Physics Building on alternate Tuesdays, beginning in September and continuing to the end of May. In addition, ordinary meetings are at present held at Montreal, Ottawa, Winnipeg and Victoria. The Society also has organizations at Guelph, Hamilton, Peterborough and Regina, but during the war the meetings were discontinued and have not yet been revived.

The Society publishes a monthly JOURNAL, containing each year about 500 pages of interesting articles, and a yearly HANDBOOK of 64 pages, containing information for the amateur observer. Subscription, $2.00 a year; single copies of the JOURNAL or HANDBOOK, 25 cents.

Membership in the Society is open to anyone interested in Astronomy and many more members are desired. The annual fee of $2.00 includes subscription to the publications.

For further information apply to the General Secretary, Mr. A. F. Hunter, M.A., at the above address.