THE OBSERVER'S HANDBOOK FOR 1932

PUBLISHED BY

The Royal Astronomical Society of Canada

EDITED BY C. A. CHANT

TWENTY-FOURTH YEAR OF PUBLICATION

TORONTO
198 COLLEGE STREET
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1932

1932 CALENDAR 1932

JANUARY						
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	....	
Fr.	1	8	15	22	29	....
Sat.	2	9	16	23	30	....

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

MARCH						
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	....	

APRIL						
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	

MAY						
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	....	

JUNE						
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	....	

JULY						
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	....

AUGUST						
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	....	

SEPTEMBER						
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	....	

OCTOBER						
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	....

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

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

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CONTENTS

PREFACE

In the present issue of the HANDBOOK is a list of stars occulted by the moon computed for Toronto, but valid for places three hundred miles distant. Computations for other places will be supplied when there is a demand for them. *The American Ephemeris* will hereafter include a list of stars computed for Washington.

It may be stated that four circular star-maps, 9 inches in diameter, roughly for the four seasons, may be obtained from the Director of University Extension, University of Toronto, for one cent each; also a set of 12 circular maps, 5 inches in diameter, with brief explanation, is supplied by *Popular Astronomy*, Northfield, Minn., for 15 cents. Besides these may be mentioned Young's *Uranography*, containing four maps with R.A. and Decl. circles and excellent descriptions of the constellations, price 72 cents; Norton's *Star Atlas and Telescopic Handbook* (10s. 6*d*.); Olcott's *A Field-book of the Stars* ($1.50), and *A Firld-book of the Skies* ($3.50); McKready's *A Beginner's Star Book* ($5.00).

In the preparation of this HANDBOOK the Editor has been assisted by Miss M. S. Burland and Dr. R. J. McDiarmid, of the Dominion Observatory, Ottawa; Mr. J. H. Horning, Toronto; Mr. W. S. Armstrong and his colleague, Dr. R. K. Young, of the University of Toronto.

The minima of Algol have been computed from an observation by Stebbins (*Ap. J.*, vol. 53, 1921), J.D. 2422619.7866 with the period 2.86731077, given by Hellerick (*A.N.*, vol. 209, p. 227, 1919).

TORONTO, December, 1931. THE EDITOR.

ANNIVERSARIES AND FESTIVALS, 1932

New Year's Day	Fri.,	Jan. 1
Epiphany	Wed.,	Jan. 6
Septuagesima Sunday		Jan. 24
Quinquagesima (Shrove Sunday)		Feb. 7
Ash Wednesday		Feb. 10
Quadragesima (First Sunday in Lent)		Feb. 14
St. David	Tues.,	Mar. 1
St. Patrick	Thur.,	Mar. 17
Palm Sunday		Mar. 20
Annunciation (Lady Day)	Fri.,	Mar. 25
Good Friday		Mar. 25
Easter Sunday		Mar. 27
St. George	Sat.,	Apr. 23
Rogation Sunday		May 1
Ascension Day	Thur.,	May 5
Accession of King George V. (1910)	Fri.,	May 6
Pentecost (Whit Sunday)		May 15
Empire (Victoria) Day	Tues.,	May 24
Corpus Christi	Thur.,	May 26
Birthday of Queen Mary (1867)		May 26
Birthday of King George V (1865)	Fri.,	June 3
Birthday of Prince of Wales (1894)	Thur.,	June 23
St. John Baptist (Mid-Summer Day)	Fri.,	June 24
Dominion Day	Fri.,	July 1
Labour Day	Mon.,	Sept. 5
St. Michael (Michaelmas Day)	Thur.,	Sept. 29
Hebrew New Year (Rosh Hashanah (5693)	Sat.,	Oct. 1
All Saints' Day	Tues.,	Nov. 1
Remembrance Day	Fri.,	Nov. 11
First Sunday in Advent		Nov. 27
St. Andrew	Wed.,	Nov. 30
Christmas Day	Sun.,	Dec. 25

Thanksgiving Day, date set by Proclamation

SYMBOLS AND ABBREVIATIONS

SIGNS OF THE ZODIAC

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

SUN, MOON AND PLANETS

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

ASPECTS AND ABBREVIATIONS

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

THE GREEK ALPHABET

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

1932 EPHEMERIS OF THE SUN AT 0h GREENWICH CIVIL TIME

Date	Apparent R.A.	Equation of Time	Apparent Decl.
	h m s	m s	° ′ ″
Jan. 1	18 40 45	+ 2 58.0	−23 07 12
" 4	18 53 59	+ 4 23.0	−22 52 14
" 7	19 07 11	+ 5 44.9	−22 33 09
" 10	19 20 18	+ 7 02.8	−22 10 03
" 13	19 33 21	+ 8 15.7	−21 43 02
" 16	19 46 18	+ 9 23.0	−21 12 14
" 19	19 59 09	+10 24.2	−20 37 48
" 22	20 11 53	+11 18.8	−19 59 51
" 25	20 24 31	+12 06.5	−19 18 32
" 28	20 37 01	+12 47.2	−18 34 03
" 31	20 49 24	+13 20.8	−17 46 30
Feb. 3	21 01 40	+13 47.2	−16 56 06
" 6	21 13 49	+14 06.4	−16 03 01
" 9	21 25 51	+14 18.2	−15 07 27
" 12	21 37 45	+14 22.8	−14 09 34
" 15	21 49 32	+14 20.4	−13 09 36
" 18	22 01 13	+14 11.1	−12 07 44
" 21	22 12 46	+13 55.4	−11 04 08
" 24	22 24 14	+13 33.6	− 9 59 00
" 27	22 35 37	+13 06.4	− 8 52 29
Mar. 1	22 46 54	+12 34.1	− 7 44 46
" 4	22 58 07	+11 57.4	− 6 36 01
" 7	23 09 16	+11 16.6	− 5 26 26
" 10	23 20 21	+10 32.2	− 4 16 12
" 13	23 31 23	+ 9 44.7	− 3 05 29
" 16	23 42 23	+ 8 54.4	− 1 54 29
" 19	23 53 20	+ 8 02.0	− 0 43 21
" 22	0 04 16	+ 7 08.1	+ 0 27 44
" 25	0 15 11	+ 6 13.2	+ 1 38 39
" 28	0 26 05	+ 5 18.0	+ 2 49 13
" 31	0 37 00	+ 4 23.3	+ 3 59 19

Date	Apparent R.A.	Equation of Time	Apparent Decl.
	h m s	m s	° ′ ″
Apr. 3	0 47 56	+ 3 29.3	+ 5 08 45
" 6	0 58 53	+ 2 36.7	+ 6 17 24
" 9	1 09 51	+ 1 45.8	+ 7 25 04
" 12	1 20 52	+ 0 57.1	+ 8 31 35
" 15	1 31 56	+ 0 10.9	+ 9 36 49
" 18	1 43 02	− 0 32.3	+10 40 35
" 21	1 54 12	− 1 12.2	+11 42 46
" 24	2 05 26	− 1 48.1	+12 43 13
" 27	2 16 44	− 2 19.8	+13 41 49
" 30	2 28 07	− 2 46.8	+14 38 24
May 3	2 39 34	− 3 08.9	+15 32 50
" 6	2 51 07	− 3 26.0	+16 24 56
" 9	3 02 44	− 3 38.0	+17 14 36
" 12	3 14 27	− 3 45.0	+18 01 40
" 15	3 26 15	− 3 47.0	+18 45 59
" 18	3 38 07	− 3 44.0	+19 27 27
" 21	3 50 05	− 3 36.2	+20 05 57
" 24	4 02 07	− 3 23.4	+20 41 22
" 27	4 14 14	− 3 06.0	+21 13 36
" 30	4 26 26	− 2 44.0	+21 42 34
June 2	4 38 42	− 2 18.0	+22 08 07
" 5	4 51 01	− 1 48.3	+22 30 13
" 8	5 03 23	− 1 15.7	+22 48 46
" 11	5 15 48	− 0 40.6	+23 03 42
" 14	5 28 15	− 0 03.8	+23 14 59
" 17	5 40 42	+ 0 34.2	+23 22 34
" 20	5 53 11	+ 1 12.8	+23 26 28
" 23	6 05 39	+ 1 51.6	+23 26 39
" 26	6 18 07	+ 2 30.0	+23 23 07
" 29	6 30 34	+ 3 07.4	+23 15 52

1932 EPHEMERIS OF THE SUN AT 0h GREENWICH CIVIL TIME

Date	Apparent R.A.	Equation of Time	Apparent Decl.
	h m s	m s	° ′ ″
July 2	6 43 00	+ 3 43.1	+23 04 58
" 5	6 55 23	+ 4 16.5	+22 50 24
" 8	7 07 43	+ 4 47.0	+22 32 17
" 11	7 19 59	+ 5 13.8	+22 10 38
" 14	7 32 12	+ 5 36.5	+21 45 35
" 17	7 44 20	+ 5 54.7	+21 17 11
" 20	7 56 23	+ 6 08.3	+20 45 33
" 23	8 08 21	+ 6 16.9	+20 10 46
" 26	8 20 14	+ 6 20.6	+19 32 56
" 29	8 32 03	+ 6 19.0	+18 52 10
Aug. 1	8 43 45	+ 6 12.2	+18 08 36
" 4	8 55 23	+ 5 59.9	+17 22 21
" 7	9 06 55	+ 5 42.2	+16 33 34
" 10	9 18 21	+ 5 19.0	+15 42 24
" 13	9 29 42	+ 4 50.5	+14 48 58
" 16	9 40 58	+ 4 16.8	+13 53 26
" 19	9 52 10	+ 3 38.5	+12 55 54
" 22	10 03 17	+ 2 55.8	+11 56 32
" 25	10 14 20	+ 2 09.1	+10 55 27
" 28	10 25 19	+ 1 18.8	+ 9 52 46
" 31	10 36 15	+ 0 25.4	+ 8 48 40
Sept. 3	10 47 09	− 0 31.0	+ 7 43 18
" 6	10 57 59	− 1 29.8	+ 6 36 49
" 9	11 08 48	− 2 30.8	+ 5 29 22
" 12	11 19 35	− 3 33.4	+ 4 21 06
" 15	11 30 21	− 4 37.0	+ 3 12 10
" 18	11 41 07	− 5 41.0	+ 2 02 42
" 21	11 51 53	− 6 44.8	+ 0 52 51
" 24	12 02 39	− 7 47.8	− 0 17 16
" 27	12 13 27	− 8 49.4	− 1 27 29
" 30	12 24 17	− 9 49.2	− 2 37 38
Oct. 3	12 35 10	−10 46.6	− 3 47 33
" 6	12 46 05	−11 41.2	− 4 57 04
" 9	12 57 03	−12 32.6	− 6 06 00
" 12	13 08 05	−13 20.1	− 7 14 12
" 15	13 19 12	−14 03.2	− 8 21 30
" 18	13 30 23	−14 41.4	− 9 27 45
" 21	13 41 40	−15 14.0	−10 32 48
" 24	13 53 03	−15 40.7	−11 36 26
" 27	14 04 33	−16 00.9	−12 38 31
" 30	14 16 09	−16 14.4	−13 38 51
Nov. 2	14 27 52	−16 20.9	−14 37 13
" 5	14 39 42	−16 20.2	−15 33 27
" 8	14 51 40	−16 12.4	−16 27 21
" 11	15 03 45	−15 57.1	−17 18 44
" 14	15 15 57	−15 34.2	−18 07 28
" 17	15 28 17	−15 03.7	−18 53 20
" 20	15 40 45	−14 25.6	−19 36 12
" 23	15 53 20	−13 40.0	−20 15 53
" 26	16 06 03	−12 47.1	−20 52 12
" 29	16 18 52	−11 47.4	−21 25 01
Dec. 2	16 31 48	−10 41.6	−21 54 10
" 5	16 44 49	− 9 30.2	−22 19 32
" 8	16 57 55	− 8 13.9	−22 40 59
" 11	17 11 05	− 6 53.4	−22 58 26
" 14	17 24 19	− 5 29.5	−23 11 48
" 17	17 37 35	− 4 02.8	−23 21 01
" 20	17 50 53	− 2 34.2	−23 26 02
" 23	18 04 13	− 1 04.5	−23 26 49
" 26	18 17 32	+ 0 25.4	−23 23 21
" 29	18 30 51	+ 1 54.4	−23 15 39

To obtain the R.A. of Mean Sun, subtract the Equation of Time from the Right Ascension; adding 12h to this gives the Sidereal Time at 0h G.C.T.

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

TIMES OF SUNRISE AND SUNSET

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

How the Tables are Constructed

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

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

The Times for Any Station

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

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

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

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

JANUARY

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

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

FEBRUARY

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

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

MARCH

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

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

APRIL

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

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

MAY

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

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

JUNE

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

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

JULY

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

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

AUGUST

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

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

SEPTEMBER

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

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

OCTOBER

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

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

NOVEMBER

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

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

DECEMBER

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

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

THE PLANETS DURING 1932

By R. J. McDiarmid

In the following notes on the planets a general account of the phenomena resulting from their motions is given. Fuller details regarding any particular phenomenon will be found on the pages headed "The Sky for the Month" (pages 30, 32,...).

Mercury

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

Its apparent separation from the sun is never great, its maximum value ranging from 18° to 28°. In the year 1932, it reaches greatest elongation seven times. At such times when we search for it, in the west just after sunset, or in the east just before sunrise, it is never high above the horizon, and even with clear sky the planet is not easily located, although it is as bright as a first magnitude star.

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

The greatest eastern elongations in 1932 (Mercury, an evening star), are on March 23, 18° 40′; July 20, 26° 54′; November 14, 22° 36′.

The greatest western elongations (Mercury, a mornlng star), are on January 10, 23° 27′; May 8, 26° 25′; September 3, 18° 04′; December 23, 22° 00′.

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

Venus

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

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

It is so brilliant that it is easily seen with the naked eye in the day time for several weeks when near its greatest elongation. At the beginning of the year Venus is seen as an evening star. On April 19 the planet reaches greatest eastern elongation, when it is nearly 46° east of the sun. Venus reaches its greatest brilliancy May 22, having then stellar magnitude −4.2, nearly fifteen times as bright as Sirius,—a beautiful object for observation.

Venus continues as an evening star till early summer; on June 29 it is in inferior conjunction with the sun; sometime later it is seen in the eastern sky as a morning star. It reaches maximum brightness a second time on August 5, and on September 7 attains its greatest elongation, 46° west of the sun.

On October 19 Venus and Jupiter are in conjunction and will appear as a most interesting morning observation.

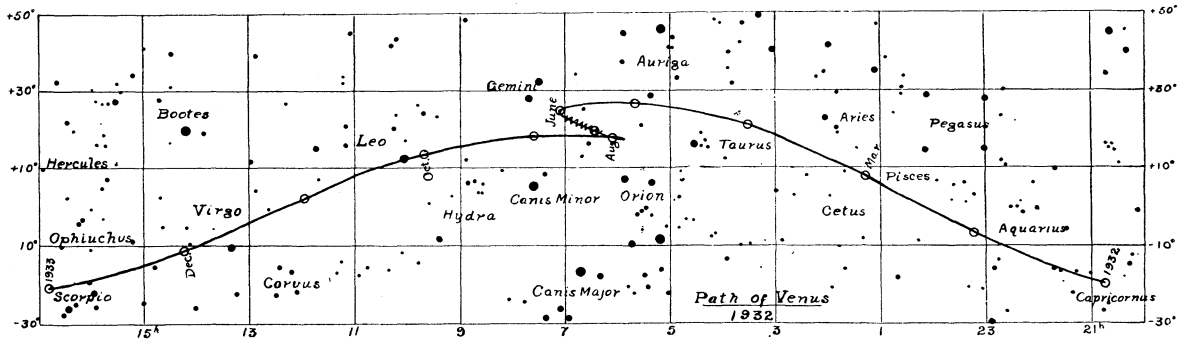

Fig. 1. Path of Venus among the Stars during 1932. The position of the planet on the first of each month is shown by a little circle. From June to August it is retrograding, as it is coming between the earth and the sun, and hence is invisible. This is indicated by the wavy line across the path.

Mars

At the beginning of the year Mars is in the constellation Sagittarius, and on account of its proximity to the sun is not visible. On February 1 it is in conjunction with the sun and it is not till the autumn that it appears as an evening star, of magnitude +1.4 (a little brighter than Polaris), and gradually increases in brightness; by the end of the year Mars is nearly of the same brightness (magnitude +0.3) as Vega.

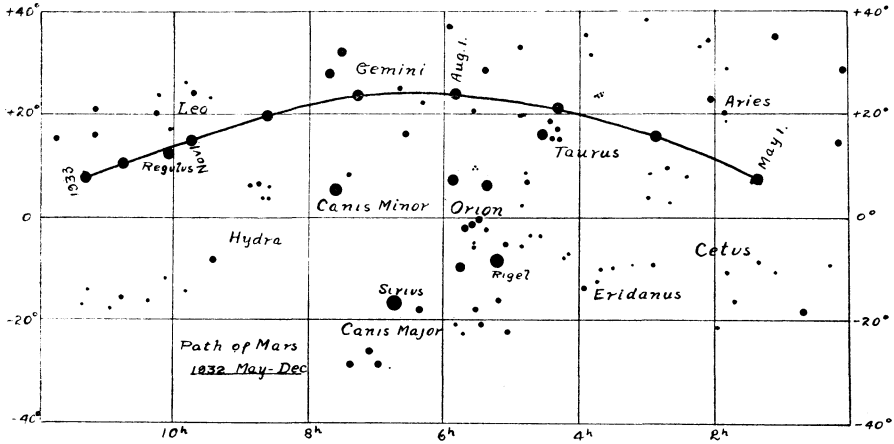

Fig. 2. Path of Mars among the Stars, May-December, 1932.

Jupiter

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

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

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

On February 7 Jupiter is in opposition to the sun, and is visible all night. On August 26 the planet is in conjunction with the sun and for some time is not visible, appearing again in the late autumn as a morning star.

On October 19 Jupiter and Venus are in conjunction and will appear as a fascinating observation for morning observers.

Saturn

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

During 1932 the rings of Saturn are well placed for examination.

Saturn during November and early December, 1931, is an evening star. On account of its increasing proximity to the sun it is not visible in January, 1932, and is in conjunction with the sun on January 16. By March 1 it is again visible as a morning star. On July 24 Saturn is in opposition to the sun, crossing the meridian at midnight, and is therefore visible all night.

During the autumn it is an evening star.

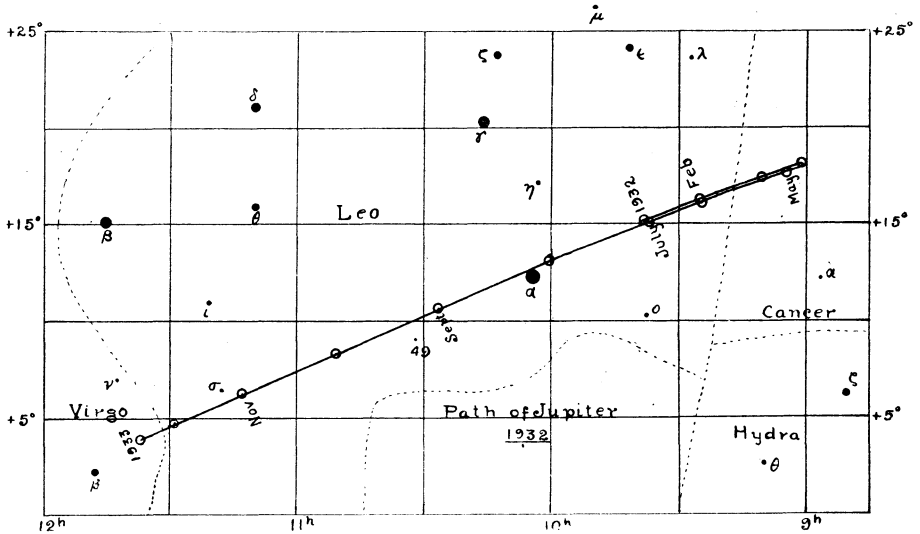

Fig. 3. Path of Jupiter among the Stars during 1932. The position of the planet is marked on its path for the first of each month.

URANUS

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

The period of Uranus about the sun is 84 years, and consequently its motion in the heavens is slow. Its period of rotation is 10¾ hours. It is of the sixth magnitude and can be seen with the naked eye, but its motion is better observed by the aid of a field glass. A large telescope is necessary to show an appreciable disc. Uranus is in conjunction with the sun on April 9. Sometime later it is visible in the morning. On October 14 it is in opposition to the sun and is visible the entire night.

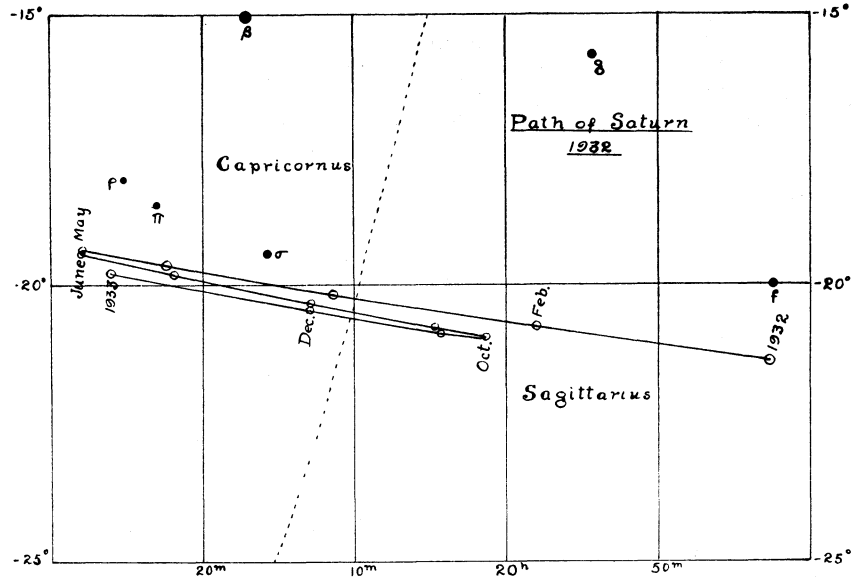

Fig. 4. Path of Saturn among the Stars during 1932. Position on the first of each month is marked.

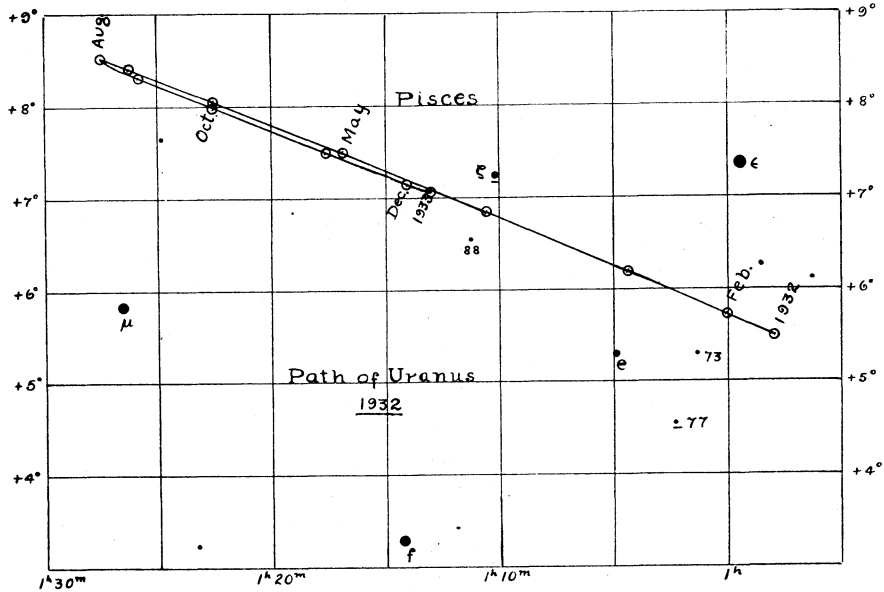

Fig. 5. Path of Uranus among the Stars during 1932. Position on the first of each month is marked.

Neptune

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

Neptune, until two years ago, was considered the most distant planet of the solar system, being 2,800 millions of miles from the sun, and requiring 165 years to complete a revolution. The discovery of a new member of the solar system, Pluto, at Flagstaff Observatory, Arizona, in 1930, has robbed Neptune of this distinction.

Neptune is in opposition to the sun on February 26, and is visible all night at the beginning of the year. On August 31 it is in conjunction with the sun and is not visible. Neptune appears as an eighth magnitude star and hence can be seen only with a telescope. It has a single satellite, with magnitude about 13. The satellite was discovered by Lassell a few months following the discovery of the planet.

Pluto

Percival Lowell, founder and late Director of the Lowell Observatory, Flagstaff, Arizona, through his researches on the motions of the planets Uranus and Neptune, was led in 1915 to predict the position of a body beyond Neptune which was producing small perturbations of these planets. From his extensive mathematical investigations, he gave its position in the heavens within about five degrees.

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

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

The stellar magnitude of the new planet is about 14.

It should be stated that other astronomers had sought for planets beyond Neptune. Among them W. H. Pickering, formerly on the staff of Harvard Observatory and now living in Jamaica, after extensive investigations predicted the position of the planet with fair accuracy. He also predicts that another planet, which he calls P, is to be found in 1932.0 in R.A. 20h 8m, Decl. 53° 9′ S.

ECLIPSES, 1932

In the year 1932 there will be four eclipses, two of the sun and two of the moon.

1. An Annular Eclipse of the Sun, March 7, 1932, invisible in North America.

Circumstances of the Eclipse

		d	h	m	
Eclipse begins	March	7	0	31.0	E.S.T.
Central eclipse begins	"	7	2	27.1	
Central eclipse ends	"	7	3	24.2	
Eclipse ends	"	7	5	20.1	

2. Partial Eclipse of the Moon, March 22, 1932, invisible in Toronto. The beginning visible generally in Eastern Asia, Australia, the Pacific Ocean, North America, except the northeastern part, and the extreme western part of South America; the ending visible generally in Asia, except the southwestern part, the Indian Ocean, the Pacific Ocean, and the extreme northwestern part of North America.

Circumstances of the Eclipse

		d	h	m	
Moon enters penumbra	March	22	4	58.7	E.S.T.
Moon enters umbra	"	22	5	59.2	
Middle of eclipse	"	22	7	32.2	
Moon leaves umbra	"	22	9	5.2	
Moon leaves penumbra	"	22	10	5.6	

Magnitude of eclipse = 0.973 (Moon's diameter = 1.0)

3. A Total Eclipse of the Sun, August 31, 1932, visible as total at Montreal, and partial at Ottawa and Toronto.

Circumstances of the Eclipse

		d	h	m	
Eclipse begins	August	31	12	44.5	E.S.T.
Central eclipse begins	"	31	14	4.2	
Central eclipse at local apparent noon	"	31	14	16.8	
Central eclipse ends	"	31	16	2.6	
Eclipse ends	"	31	17	22.1	

Maximum duration of total phase on the central line is 1m 44.8s and at Montreal duration of total phase is 24 seconds. For fuller information see the *Journal of the R.A.S.C.* for Dec. 1930, or the pamphlet published by the American Ephemeris, obtainable from the Superintendent of Documents, Washington, D.C., price 25 cents.

4. A Partial Eclipse of the Moon, September 14, 1932, invisible in Toronto. The beginning visible generally in Europe, Africa, the eastern part of the Atlantic Ocean, the Indian Ocean, Asia and Australia; the ending visible generally in the

northeastern part of North America, South America, the Atlantic Ocean, Europe, Africa, Western Asia and the Indian Ocean.

Circumstances of the Eclipse

		d	h	m	
Moon enters penumbra	September	14	13	5.2	E.S.T.
Moon enters umbra	"	14	14	18.2	
Middle of eclipse	"	14	16	0.5	
Moon leaves umbra	"	14	17	42.8	
Moon leaves penumbra	"	14	18	55.7	

Magnitude of eclipse = 0.982 (Moon's diameter = 1.0)

THE SKY FOR JANUARY, 1932

By MIRIAM S. BURLAND

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

The Sun—During January the sun's R.A. increases from 18h 41m to 20h 54m, and its Decl. changes from 23° 7′ S. to 17° 30′ S. The equation of time (see p. 6) increases from 2m 58s to 13m 30s. Due to this rapid rise in value the time of mean noon appears, for the first ten days of the month, to remain at the same distance from the time of sunrise, that is the forenoons as indicated by our clocks are of the same length. On the 21st the sun enters the sign Aquarius, the second winter zodiacal sign. On January 2nd the earth is in perihelion.

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

Mercury on the 15th is in R.A. 18h 2m, Decl. 22° 25′ S., and transits at 10.30. On the 11th it reaches its greatest elongation west, and on that date rises about 1½ hours before the sun.

Venus on the 15th is in R.A. 21h 51m, Decl. 14° 46′ S., and transits at 14.19. It is an evening star of magnitude −3.4, and on the 15th, sets about 2½ hours after the sun.

Mars on the 15th is in R.A. 20h 0m, Decl. 21° 39′ S., and transits at 12.26. It is too close to the sun during the month for observation. It is in Sagittarius at the beginning of the month, but near the end moves into the constellation of Capricornus.

Jupiter on the 15th is in R.A. 9h 33m, Decl. 15° 31′ N., and transits at 2.00. On that date it rises about 6.40 in the evening. It is in the constellation of Leo, and has a magnitude of −2.1. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 54.

Saturn on the 15th is in R.A. 19h 50m, Decl. 21° 10′ S., and transits at 12.15. It is too close to the sun for observation. On the 17th it is in conjunction with the sun, after which it becomes a morning star.

Uranus on the 15th is in R.A. 0h 59m, Decl. 5° 34′ N., and transits at 17.23.

Neptune on the 15th is in R.A. 10h 39m, Decl. 9° 25′ N., and transits at 3.05.

JANUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 2h 15m
			h m	
Fri.	1	23h ⊕ in Perihelion	20 40	d34O2
Sat.	2			43O12
Sun.	3			4213O
Mon.	4		17 30	42O13
Tues.	5			41O23
Wed.	6	0h 45m ☌☿☾, ☿ 7° 22′ N.; 20h □♁☉		42O13
● Thur.	7	18h 28.7m N.M.	14 20	4213O
Fri.	8	4h 5m ☌♂☾, ♂ 3° 40′ N.; 7h 35m. ☌♄☾, ♄ 4° 33′ N.		3O412
Sat.	9			3O24*
Sun.	10	5h 34m ☌♀☾, ♀ 1° 36′ N.; 22h ☿ Greatest elong. W. 23° 27′	11 10	231O4
Mon.	11	4h ☌♂♄, ♂ 0° 56′ S.		2O134
Tues.	12			1O234
Wed.	13		8 00	dO134
Thur.	14	23h 42m ☌♁☾, ♁ 2° 24′ S.		d21O4
◑ Fri.	15	15h 55.0m Moon F.Q.		3O124
Sat.	16	19h ☌♄☉	4 50	3O42*
Sun.	17			4231O
Mon.	18			42O13
Tues.	19		1 40	41O23
Wed.	20			4O213
Thur.	21	23h ☿ in ♉	22 30	421O3
Fri.	22			43O21
♋ Sat.	23	8h 44.1m F.M.		341O2
Sun.	24	12h 42m ☌♃☾, ♃ 2° 22′ S.	19 10	d324O
Mon.	25	19h 36m ☌♆☾, ♆ 1° 4′ S.		2O134
Tues.	26			1O234
Wed.	27		16 00	O2134
Thur.	28			21O34
Fri.	29			3O14*
☾ Sat.	30	4h 32.2m Moon L.Q.	12 50	31O24
Sun.	31			32O14

Explanation of symbols and abbreviations on page 4

THE SKY FOR FEBRUARY, 1932

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

The Sun—During February the sun's R.A. increases from 20h 54m to 22h 47m, and its Decl. changes from 17° 30′ S. to 7° 45′ S. The equation of time reaches a maximum value of 14m 23s on the 12th (see p. 6). For changes in the length of day see p. 11. On the 19th the sun enters Pisces, the third winter sign of the zodiac.

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

Mercury on the 15th is in R.A. 21h 16m, Decl. 18° 1′ S., and transits at 11.42. It is a morning star at the beginning of the month, and is approaching the sun. On the 26th it is in superior conjunction with the sun, and after that date becomes an evening star.

Venus on the 15th is in R.A. 0h 11m, Decl. 0° 33′ N., and transits at 14.36. It is an evening star and by the end of the month its magnitude has increased to −3.6. It sets about 2½ hours after the sun on the 15th.

Mars on the 15th is in R.A. 21h 39m, Decl. 15° 12′ S., and transits at 12.03. On the 1st it is in conjunction with the sun, and cannot be observed during the month. About the 20th the planet moves into the constellation of Aquarius.

Jupiter on the 15th is in R.A. 9h 18m, Decl. 16° 48′ N., and transits at 23.38. On the 7th it is in opposition with the sun and is in good position for observation all night. About the 10th it enters the constellation of Cancer. Its magnitude remains at −2.1. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 54.

Saturn on the 15th is in R.A. 20h 5m, Decl. 20° 30′ S., and transits at 10.28. It is now a morning star, and on the 15th rises about 1 hour before the sun. It enters the constellation of Capricornus about the 10th.

Uranus on the 15th is in R.A. 1h 2m, Decl. 5° 56′ N., and transits at 15.24.

Neptune on the 15th is in R.A. 10h 36m, Decl. 9° 42′ N., and transits at 1.00.

FEBRUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 1h 0m
			h	m	
Mon.	1	1h ☌☌☉; 5h ☿ in Aphelion			2O34*
Tues.	2		9	40	14O23
Wed.	3	6h ☌☿♄, ☿ 1° 18′ S.			4O123
Thur.	4	21h 19m ☌♄☾, ♄ 4° 25′ N.			421O3
Fri.	5	2h 13m ☌☿☾, ☿ 2° 51′ N.	6	30	432O1
Sat.	6	5h 49m ☌☌☾ ☌ 2° 30′ N.; 9h 45.1m N.M.			431O2
Sun.	7	10h ☍☌☉			432O1
Mon.	8		3	20	421O*
Tues.	9	16h 15m ☌♀☾, ♀ 0° 58′ S.			d4O23
Wed.	10				4O123
Thur.	11	9h 30m ☌♁☾, ♁ 2° 41′ S.	0	10	21O34
Fri.	12				32O14
Sat.	13h	☌ Greatest Hel. Lat. S.	21	00	31O24
Sun.	14	13h 15.7m Moon F.Q.			d3O14
Mon.	15				213O4
Tues.	16		17	50	O1234
Wed.	17				O1243
Thur.	18				21O43
Fri.	19		14	40	423O1
Sat.	20	16h 41m ☌☌☾, ☌ 2° 34′ S.; 20h ☌☿☌, ☿ 1° 4′ S.			431O2
Sun.	21	13h ☿ Greatest Hel. Lat. S.; 21h 7.4m F.M.			d43O1
Mon.	22	3h 49m ☌♆☾, ♆ 1° 5′ S.	11	20	4213O
Tues.	23				4O123
Wed.	24				4O23*
Thur.	25	2h ♀ in ♌	8	10	421O3
Fri.	26	5h ☍♆☉; 16h ☌☿☉ Superior			423O1
Sat.	27	2h ☌♀♁, ♀ 0° 48′ N.			31O2*
Sun.	28	13h 3.0m Moon L.Q.	5	00	3O214
Mon.	29				213O4

Explanation of symbols and abbreviations on page 4

THE SKY FOR MARCH, 1932

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

The Sun—During March the sun's R.A. increases from 22h 47m to 0h 41m, and its Decl. changes from 7° 45′ S. to 4° 23′ N. The equation of time decreases from 12m 34s to 4m 5s (see p. 6). For changes in the length of the day see p. 12. On the 20th at 19h 54m (G.C.T.) the sun enters the first spring sign of the zodiac. Aries and Spring begins. On that day the sun crosses the equator going north. On the 7th there is an annular eclipse of the sun, but it is invisible in the northern hemisphere.

The Moon—For its phases and conjunctions with the planets, see opp. page. On the 22nd there is a partial eclipse of the moon, the beginning being visible on the North American continent except the northeastern part.

Mercury on the 15th is in R.A. 0h 34m, Decl. 4° 20′ N., and transits at 13.05. It is an evening star throughout the month, reaching its greatest elongation east on the 23rd. On that date it is about 18° above the western horizon at sunset and in good position for observation.

Venus on the 15th is in R.A. 2h 16m, Decl. 14° 58′ N., and transits at 14.47. Its magnitude is continuing to increase. At sunset on the 15th the planet may be seen about 40° above the western horizon.

Mars on the 15th is in R.A. 23h 6m, Decl. 6° 54′ S., and transits at 11.36. It is now a morning star, but too close to the sun for observation. It is in the constellation of Aquarius.

Jupiter on the 15th is in R.A. 9h 5m, Decl. 17° 44′ N., and transits at 21.32. At sunset on that date it is about 40° above the eastern horizon. It is still a bright object in the constellation of Cancer. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 54.

Saturn on the 15th is in R.A. 20h 17m, Decl. 19° 55′ S., and transits at 8.46. At sunrise on the 15th it is about 18° above the southeastern horizon. Its altitude is still rather low for good observation. Its magnitude is +0.9.

Uranus on the 15th is in R.A. 1h 7m, Decl. 6° 28′ N., and transits at 13.35.

Neptune on the 15th is in R.A. 10h 33m, Decl. 10° 0′ N., and transits at 22.59.

MARCH

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 0h 0m
			h	m	
	Tues.	1			O134*
	Wed.	2	1	50	1O234
	Thur.	3 8h 51m ☌♄☾, ♄ 4° 20′ N			d2O34
	Fri.	4	22	40	d2O14
	Sat.	5			31O24
	Sun.	6 10h 01m ☌♂☾, ♂ 0° 38′ N			d3O21
♍	Mon.	7 2h 44.3m N.M.; Annular eclipse of ☉ invisible at Toronto; 23h 55m ☌☿☾, ☿ 0° 49′ S	19	30	4231O
	Tues.	8			42O31
	Wed.	9 9h ♂ in Perihelion; 19h 26m ☌♁☾, ♁ 2° 51′ S			41O23
	Thur.	10	16	20	42O13
	Fri.	11 1h 04m ☌♀☾, ♀ 2° 21′ S.; 14h ☿ in ♌			42O3*
	Sat.	12			431O2
	Sun.	13	13	10	34O12
	Mon.	14			3214O
●	Tues.	15 7h 41.0m Moon F.Q			2O314
	Wed.	16 5h ☿ in Perihelion	10	00	1O234
	Thur.	17			2O134
	Fri.	18 22h 42m ☌♃☾, ♃ 2° 47′ S			2O34*
	Sat.	19	6	40	31O24
	Sun.	20 13h 29m ☌♆☾, ♆ 1° 9′ S.; 14h 54m ☉ enter ♈, Spring commences			3O124
	Mon.	21 15h ☌☿♁, ☿ 2° 54′ N			321O4
♎	Tues.	22 7h 37.4m F.M.; Partial eclipse of ☾, invisible at Toronto	3	30	2O14*
	Wed.	23 7h ☿ Greatest elong. E. 18° 40′			14O23
	Thur.	24			d4O13
	Fri.	25	0	20	421O3
	Sat.	26 11h ☿ Greatest Hel. Lat. N			d43O2
	Sun.	27	21	10	43O12
☾	Mon.	28 22h 43.5m Moon L.Q			4321O
	Tues.	29 15h ♀ in Perihelion			42O1*
	Wed.	30 18h 38m ☌♄☾, ♄ 4° 11′ N	18	00	41O23
	Thur.	31 3h ☿ Stationary in R.A			O213*

Explanation of symbols and abbreviations on page 4

THE SKY FOR APRIL, 1932

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

The Sun—During April the sun's R.A. increases from 0h 41m to 2h 32m, and its Decl. changes from 4° 23′ N. to 14° 57′ N. The equation of time changes from +4m 5s to −2m 55s (see p. 6). For changes in the length of day see p. 13. On the 20th the sun enters Taurus, the second spring zodiacal sign.

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

Mercury on the 15th is in R.A. 1h 1m, Decl. 7° 44′ N., and transits at 11.26. It is approaching the sun and on the 10th is in inferior conjunction with it. After that date it becomes a morning star and at sunrise on the 30th is about 9° above the eastern horizon.

Venus on the 15th is in R.A. 4h 33m, Decl. 25° 11′ N., and transits at 15.01. It is a brilliant object in the evening sky and in good position for observation. On the 19th it reaches its greatest elongation east and sets about 4¼ hours after the sun.

Mars on the 15th in in R.A. 0h 35m, Decl. 2° 48′ N., and transits at 11.02. It is a morning star, though rather close to the sun for observation. At sunrise on the 15th it is about 10° above the eastern horizon. It is in Cetus most of the month.

Jupiter on the 15th is in R.A. 9h 2m, Decl. 17° 56′ N., and transits at 19.26. The planet crosses the meridian about ½ hour after sunset on the 15th. Its magnitude is decreasing, and by the end of the month is −1.7. It is in Cancer all month. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 20h 26m, Decl. 19° 28′ S., and transits at 6.53. It rises about 3 hours before the sun on the 15th, and its position for morning observation is improving. Its magnitude is +0.9 and the planet is in Capricornus. On the 24th it is in quadrature with the sun.

Uranus on the 15th is in R.A. 1h 13m, Decl. 7° 8′ N., and transits at 11.40.

Neptune on the 15th is in R.A. 10h 30m, Decl. 10° 15′ N., and transits at 20.55.

APRIL

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 23h 30m
			h	m	
	Fri.	1			3O14*
	Sat.	2	14	50	3O24*
	Sun.	3			321O4
	Mon.	4 15h 37m ☌♂☾, ♂ 1° 34′ S.			23O14
●	Tues.	5 20h 21.1m N.M.	11	40	1O234
	Wed.	6 4h 59m ☌♁☾, ♁ 2° 58′ S.; 10h 1m ☌☿☾, ☿ 0° 40′ N.			O2143
	Thur.	7			21O43
	Fri.	8 12h ♃ Stationary in R.A.	8	30	43O1*
	Sat.	9 5h ☌♁☉; 22h ☌☿♁, ☿ 3° 12′ N.			431O2
	Sun.	10 1h 12m ☌♀☾, ♀ 1° 59′ S.; 6h ☌☿☉ Inferior			4321O
	Mon.	11	5	20	423O1
	Tues.	12			41O23
◑	Wed.	13 22h 15.5m Moon F.Q.			4O123
	Thur.	14	2	00	421O3
	Fri.	15 6h 48m ☌♃☾, ♃ 2° 47′ S.			423O1
	Sat.	16 22h 51m ☌♆☾♆ 1° 9′ S.	22	50	31O42
	Sun.	17			d32O4
	Mon.	18 22h ☿ in ♉			23O4*
	Tues.	19 14h ♀ Greatest elong. E. 45° 42′	19	40	1O234
●	Wed.	20 14h ♀ Greatest Hel. Lat. N.; 16h 27.1m F.M.			O1234
	Thur.	21 3h ☌☿♂, ☿ 0° 15′ N.			21O34
	Fri.	22 15h ☿ Stationary in R.A.	16	30	2O314
	Sat.	23			31O24
	Sun.	24 16h □♄☉			dd3O1
	Mon.	25	13	20	243O*
	Tues.	26			41O23
☾	Wed.	27 3h 38m ☌♄☾, ♄ 3° 57′ N.; 10h 14.0m Moon L.Q.			4O123
	Thur.	28	10	10	421O3
	Fri.	29 4h ☿ in Aphelion; 14h ☌♂♁, ♂ 0° 10′ S.			42O31
	Sat.	30			431O2

Explanations of symbols and abbreviations on page 4

THE SKY FOR MAY, 1932

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

The Sun—During May the sun's R.A. increases from 2h 32m to 4h 35m, and its Decl. changes from 14° 57′ N., to 22° 0′ N. The equation of time increases from 2m 55s to a maximum of 3m 47s on the 15th, and then decreases to 2m 27s at the end of the month (see p. 6). For changes in the times of sunrise and sunset see p. 14. On the 21st the sun enters Gemini, the third sign of the zodiac.

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

Mercury on the 15th is in R.A. 1h 51m, Decl. 8° 8′ N., and transits at 10.22. On the 8th it reaches its greatest elongation west and on that date, rises about 1 hour before the sun.

Venus on the 15th is in R.A. 6h 29m, Decl. 26° 59′ N., and transits at 14.58. It is still a very prominent evening star and on the 22nd attains its greatest brilliancy, −4.2. At sunset on the 15th it is about 35° above the western horizon.

Mars on the 15th in in R.A. 2h 0m, Decl. 11° 34′ N., and transits at 10.29. It is a morning star and on the 15th rises about one hour before the sun. It is in Pisces at the beginning of the month, but enters the constellation of Aries about the 10th.

Jupiter on the 15th is in R.A. 9h 9m, Decl. 17° 21′ N., and transits at 17.37. On the 4th it is in quadrature with the sun. Its magnitude is still decreasing and is −1.5 at the end of the month. It is in the constellation of Cancer. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 20h 29m, Decl. 19° 21′ S., and transits at 4.58. On the 15th it rises shortly after midnight and may be seen low in the south. Its magnitude is increasing somewhat and by the end of the month is +0.7.

Uranus on the 15th is in R.A. 1h 20m. Decl. 7° 45′ N., and transits at 9.48.

Neptune on the 15th is in R.A. 10h 29m, Decl. 10° 20′ N., and transits at 18.56.

MAY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 22h 45m
			h m	
Sun.	1		7 00	34O21
Mon.	2			3241O
Tues.	3	8h 57m ☌ ☿ ☾, ☿ 5° 16′ S.; 14h 14m ☌ ♁ ☾, ♁ 3° 7′ S.; 20h 30m ☌ ♂ ☾, ♂ 3° 30′ S.	3 50	dO***
Wed.	4	2h □ ♃ ☉		O1234
(Thur.	5	13h 11.5m N.M.		12O34
Fri.	6	15h ☌ ☿ ♁, ☿ 2° 38′ S.		2O134
Sat.	7		0 40	31O24
Sun.	8	4h ☿ Greatest elong. W. 26° 25′		3O214
Mon.	9	11h 35m ☌ ♀ ☾, ♀ 1° 15′ S.	21 30	321O4
Tues.	10			O14**
Wed.	11			4O23*
Thur.	12	16h 53m ☌ ♃ ☾, ♃ 2° 31′ S.	18 10	412O3
) Fri.	13	9h 2.2m Moon F.Q.		42O13
Sat.	14	6h 42m ☌ ♆ ☾, ♆ 0° 59′ S.; 19h ♄ Stationary in R.A.		413O2
Sun.	15		15 00	43O12
Mon.	16	11h ♆ Stationary in R.A.		4321O
Tues.	17			423O1
Wed.	18	15h ☌ ☿ ♂, ☿ 2° 28′ S.	11 50	4O32*
Thur.	19	13h ☿ Greatest Hel. Lat. S.		412O3
(Fri.	20	0h 8.6m F.M.		2O143
Sat.	21		8 40	13O24
Sun.	22	18h ♀ Greatest brilliancy		3O124
Mon.	23			321O4
Tues	24	12h 17m ☌ ♄ ☾, ♄ 3° 40′ N.	5 30	23O14
Wed.	25			1O324
☾ Thur.	26	13h □ ♆ ☉; 23h 54.5m Moon L.Q.		ddO34
Fri.	27		2 20	2O143
Sat.	28			d14O2
Sun.	29		23 10	43O12
Mon.	30	23h 27m ☌ ♁ ☾, ♁ 3° 23′ S.		4312O
Tues.	31			432O1

Explanation of symbols and abbreviations on page 4

THE SKY FOR JUNE, 1932

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

The Sun—During June the sun's R.A. increases from 4h 35m to 6h 39m, and its Decl. from 22° 0′ N. to its maximum value of 23° 27′ N. on the 22nd and then drops to 23° 9′ N., at the end of the month. On the 21st, the sun reaches summer solstice and enters Cancer, the first summer zodiacal sign, and Summer commences. The duration of daylight is now at its longest and does not change appreciably for some days, see p. 15. For changes in the equation of time see p. 6. The increase in this quantity at the end of the month, taken with the shortening of daylight causes the local mean time of sunset to appear almost constant for several days at the end of June and the beginning of July.

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

Mercury on the 15th is in R.A. 5h 41m, Decl. 24° 33′ N., and transits at 12.12. It is approaching the sun and is not favourably situated for observation. On the 13th it is in superior conjunction with the sun, after that date it becomes an evening star. It sets about 1¼ hours after the sun on the 30th.

Venus on the 15th is in R.A. 7h 3m, Decl. 22° 51′ N., and transits at 13.27. During the month its magnitude decreases from −4.2 to −2.8. It is rapidly approaching the sun, and on the 29th is in inferior conjunction with that body, and cannot be observed.

Mars on the 15th is in R.A. 3h 30m, Decl. 18° 40′ N., and transits at 9.57. Its position for observation as a morning star, is improving. About the 15th of the month it enters the constellation of Taurus.

Jupiter on the 15th is in R.A. 9h 26m, Decl. 16° 3′ N., and transits at 15.52. At sunset on that date the planet is about 35° above the western horizon. It is in Cancer at the beginning of the month, but enters Leo about the 10th. Its magnitude reaches −1.4 by the end of the month. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 20h 26m, Decl. 19° 36′ S., and transits at 2.53. On the 15th it rises in the southeast about 10.30 and is favourably situated for observation. Its magnitude reaches +0.5 at the end of the month.

Uranus on the 15th is in R.A. 1h 25m, Decl. 8° 14′ N., and transits at 7.51.

Neptune on the 15th is in R.A. 10h 30m, Decl. 10° 15′ N., and transits at 16.55.

JUNE

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at 22h 0m
			h m	
Wed.	1	22h 59m ☌☍☾, ♂ 4° 41′ S.	20 00	41O32
Thur.	2			4O123
Fri.	3	5h 46m ☌☿☾, ☿ 5° 35′ S.		42O3*
Sat.	4	4h 16.0m N.M.	16 50	41O3*
Sun.	5			34O12
Mon.	6	17h 12m ☌♀☾, ♀ 2° 56′ S.		312O4
Tues.	7	1h ♀ Stationary in R.A.; 13h ☿ in ♌	13 30	32O14
Wed.	8			1O324
Thur.	9	5h 4m ☌♃☾, ♃ 2° 3′ S.		O1234
Fri.	10	13h 14m ☌♆☾, ♆ 0° 42′ S.	10 20	21O34
Sat.	11	16h 39.5m Moon F.Q.		d2O34
Sun.	12	4h ☿ in Perihelion		3O124
Mon.	13	2h ☌☿☉ Superior	7 10	312O4
Tues.	14			324O1
Wed.	15	16h ♀ in ♉		41O32
Thur.	16		4 00	4O123
Fri.	17			421O3
Sat.	18	7h 38.1m F.M.		d42O3
Sun.	19		0 50	43O2*
Mon.	20	20h 13m ☌♄☾, ♄ 3° 28′ N.		d431O
Tues.	21	10h 23m ☉ enters ♋, Summer commences	21 40	324O1
Wed.	22	0h ☌☿♀, ☿ 3° 18′ N.; 10h ☿ Greatest Hel. Lat. N.		13O2*
Thur.	23			O1234
Fri.	24		18 30	21O34
Sat.	25	15h 35.9m Moon L.Q.		2O134
Sun.	26			3O24*
Mon.	27	8h 40m ☌♇☾, ♇ 3° 42′ S.	15 20	31O24
Tues.	28			32O14
Wed.	29	0h ☌♀☉ Inferior		13O24
Thur.	30	22h 38m ☌☍☾, ♂ 5° 5′ S.	12 10	O4132

Explanation of symbols and abbreviations on page 4

THE SKY FOR JULY, 1932

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

The Sun—During July the sun's R.A. increases from 6h 39m to 8h 44m, and its Decl. decreases from 23° 9′ N. to 18° 9′ N. The equation of time increases from 3m 31s on the 1st to 6m 21s on the 27th and then drops to 6m 12s at the end of the month. On the 23rd the sun enters Leo, the second summer sign of the zodiac. For changes in the length of day, see p. 16. On the 3rd the earth is in aphelion.

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

Mercury on the 15th is in R.A. 9h 24m, Decl. 15° 30′ N., and transits at 13.53. It is an evening star during the month. On the 20th it reaches its greatest elongation east and may then be seen at sunset about 10° above the western horizon.

Venus on the 15th is in R.A. 5h 58m, Decl. 17° 59′ N., and transits at 10.26. It is now a morning star, rising on the 15th about 1 hour before the sun. Its magnitude is again increasing and is −4.2 by the end of the month.

Mars on the 15th is in R.A. 4h 59m, Decl. 22° 46′ N., and transits at 9.28. At sunrise on the 15th, the planet is about 25° above the eastern horizon. It is in the constellation of Taurus.

Jupiter on the 15th is in R.A. 9h 48m, Decl. 14° 15′ N., and transits at 14.15. It is approaching the sun and is not favourably situated for observation. On the 15th it sets about 1½ hours after the sun. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 20h 18m, Decl. 20° 4′ S., and transits at 0.47. On the 15th it rises about 30 minutes after sunset and during the month is in good position for observation, being visible all night. On the 22nd, it reaches its greatest brilliancy for the year, when its magnitude is +0.3. On the 24th it is in opposition with the sun and then rises soon after sunset. It is in the constellation of Capricornus.

Uranus on the 15th is in R.A. 1h 27m, Decl. 8° 29′ N., and transits at 5.55.

Neptune on the 15th is in R.A. 10h 33m, Decl. 10° 0′ N., and transits at 15.04.

JULY

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 21h 15m
			h	m	
Fri.	1				41203
Sat.	2				42013
♍ Sun.	3	3h 24m ☌☿☾, ☿ 8° 48′ S.; 15h ⊕ in Aphelion; 17h 19.7m N.M.	9	00	41302
Mon.	4				d4302
Tues.	5	12h 24m ☌☿☾, ☿ 2° 9′ S.			43201
Wed.	6	19h 41m ☌♃☾, ♃ 1° 30′ S.	5	40	4310*
Thur.	7	19h 47m ☌♆☾, ♆ 0° 25′ S.			40132
Fri.	8				41203
Sat.	9	19h ♂ in ♌	2	30	2013*
♑ Sun.	10	22h 6.8m Moom F.Q.			10324
Mon.	11		23	20	30124
Tues.	12				3204*
Wed.	13				31204
Thur.	19		20	10	03124
Fri.	15	21h □♁☉; 21h ☿ in ♈			12034
Sat.	16				20143
♋ Sun.	17	16h 6.4m F.M.	17	00	10432
Mon.	18	2h 42m ☌♄☾, ♄ 3° 26′ N.			34012
Tues.	19				43210
Wed.	20	3h ☿ in Aphelion; 14h ☿ Greatest elong. E. 26° 54′; 15h ☿ Stationary in R.A.	13	50	43210
Thur.	21				4012*
Fri.	22	21h ☌☿♃, ☿ 2° 21′ S.			
Sat.	23		10	40	
Sun.	24	9h ☍♄☉; 17h 30m ☌♁☾, ♁ 4° 0′ S.			
☾ Mon.	25	8h 41.5m Moon L.Q.			
Tues.	26	3h ☿ in Aphelion	7	30	
Wed.	27				
Thur.	28				
Fri.	29	10h ♁ Stationary in R.A.; 19h 58m ☌☌☾, ♂ 4° 51′ S.	4	10	
Sat.	30	4h 7m ☌☿☾, ☿ 10° 41′ S.			
Sun.	31				

Explanation of symbols and abbreviations on page 4

THE SKY FOR AUGUST, 1932

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

The Sun—During August the sun's R.A. increases from 8h 44m to 10h 40m, and its Decl. decreases from 18° 9′ N. to 8° 27′ N. The equation of time decreases from 6m 12s to 0m 7s. The sun enters Virgo, the third summer zodiacal sign on the 23rd. For changes in the length of day see p. 17. On the 31st there is a total eclipse, visible as such in part of eastern Canada. See p. 27.

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

Mercury on the 15th is in R.A. 9h 49m, Decl. 8° 9′ N., and transits at 12.12. It is an evening star at the beginning of the month, but is approaching the sun. On the 17th it is in inferior conjunction with that body, after which the planet may be seen in the morning sky.

Venus on the 15th is in R.A. 6h 37m, Decl. 18° 28′ N., and transits at 9.04. On the 5th it attains its greatest brilliancy, −4.2. It is in good position for observation in the morning.

Mars on the 15th is in R.A. 6h 29m, Decl. 23° 44′ N., and transits at 8.56. It is a morning star in the constellation of Gemini. On the 15th it rises about 4 hours before the sun.

Jupiter on the 15th is in R.A. 10h 13m, Decl. 12° 1′ N., and transits at 12.38. The planet is too close to the sun for observation. On the 26th it is in conjunction with the sun. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 20h 9m, Decl. 20° 36′ S., and transits at 22.32. It is an evening star and at sunset on the 15th may be seen about 10° above the southeastern horizon. It is still visible all night in the constellation of Capricornus.

Uranus on the 15th is in R.A. 1h 27m, Decl. 8° 28′ N., and transits at 3.54.

Neptune on the 15th is in R.A. 10h 37m, Decl. 9° 37′ N., and transits at 13.02.

AUGUST

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satellites at
			h m	
	Mon.	1	1 00	
◍	Tues.	2 4h 41.8m N.M.; 16h ☿ Stationary in R.A.		
	Wed.	3 12h52m ☌ ♃☾, ♃ 0° 54′ S.; 16h 3m ☌ ☿☾, ☿ 5° 44′ S.	21 50	
	Thur.	4 3h 51m ☌ ♆☾, ♆ 0° 13′ S.; 20h ♀ Greatest brilliancy		
	Fri.	5		
	Sat.	6	18 40	
	Sun.	7 12h ☌ ☿ ♃, ☿ 5° 38′ S.		
	Mon.	8		
◑	Tues.	9 2h 40.4m Moon F.Q.	15 30	
	Wed.	10		
	Thur.	11 12h ♀ Greatest Hel. Lat. S.		
	Fri.	12	12 20	
	Sat.	13		
	Sun.	14 7h 26m ☌ ♄☾, ♄ 3° 32′ N.		
	Mon.	15 12h ☿ Greatest Hel. Lat. S.	9 10	
♋	Tues.	16 2h 41.6m F.M.		
	Wed.	17 9h ☌ ☿☉ Inferior		
	Thur.	18	6 00	
	Fri.	19		
	Sat.	20		
	Sun.	21 1h 18m ☌ ♁☾, ♁ 4° 8′ S.	2 50	
	Mon.	22		
	Tues.	23	23 40	
☾	Wed.	24 2h 21.3m Moon L.Q.		
	Fri.	26 11h ☿ Stationary in R.A.; 16h ☌ ♃☉	20 30	
	Sat.	27 15h 37m ☌ ♂☾, ♂ 4° 4′ S.; 22h 4m ☌ ♀☾, ♀ 8° 9′ S.		
	Sun.	28		
	Mon.	29	17 10	
	Tues.	30 5h 19m ☌ ☿☾, ☿ 3° 54′ S.		
◍	Wed.	31 4h ☌ ♆☉; 8h 19m ☌ ♃☾, ♃ 0° 18′ S.; 14h 8m ☌ ♆☾, ♆ 0° 6′ S.; 14h 54.6m N.M.; Total eclipse of ☉ visible as partial eclipse at Toronto		

By reason of the proximity of Jupiter to the Sun the phenomena of the satellites are not given from July 23 to Sepetmber 11.

Explanation of symbols and abbreviations on page 4

THE SKY FOR SEPTEMBER, 1932

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

The Sun—During September the sun's R.A. increases from 10h 40m to 12h 28m, and its Decl. changes from 8° 27′ N. to 3° 1′ S. On the 1st the equation of time is 0m 7s, it becomes zero on that day and then increases to 10m 9s at the end of the month. For changes in the length of day, see p. 18. On the 23rd the sun crosses the equator going south and enters Libra, the first autumn sign of the zodiac.

The Moon—For its phases and conjunctions with the planets, see opp. page. On the 14th there is a partial eclipse of the moon, the ending being visible generally in the northeastern part of North America.

Mercury on the 15th is in R.A. 10h 47m, Decl. 9° 34′ N., and transits at 11.13. On the 3rd it reaches its greatest elongation west and is then most favourably situated for morning observation. At sunrise on that date, the planet is about 15° above the eastern horizon. At the end of the month it is too close to the sun for observation, being in superior conjunction with that body on the 29th.

Venus on the 15th is in R.A. 8h 32m, Decl. 16° 56′ N., and transits at 8.57. It is well situated for morning observation. On the 7th it reaches its greatest elongation west and at sunrise on that date is about 40° above the eastern horizon.

Mars on the 15th is in R.A. 7h 55m, Decl. 21° 44′ N., and transits at 8.19. It rises about 1 a.m. on the 15th, and may be seen in the constellation of Gemini till about the 16th and then in Cancer for the remainder of the month.

Jupiter on the 15th is in R.A. 10h 38m, Decl. 9° 36′ N., and transits at 11.02. It is now a morning star though rather close to the sun for observation. Its magnitude is −1.2 and the planet is in the constellation of Leo. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 20h 2m, Decl. 20° 57′ S., and transits at 20.24. It is in Capricornus and rises about 2½ hours before sunset on the 15th. Its magnitude is now +0.6.

Uranus on the 15th is in R.A. 1h 24m, Decl. 8° 11′ N., and transits at 1.49.

Neptune on the 15th is in R.A. 10h 41m, Decl. 9° 12′ N., and transits at 11.04.

SEPTEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 6h 00m
			h	m	
	Thur.	1	14	00	
	Fri.	2			
	Sat.	3 11h ☿ Greatest elong. W. 18° 4′; 12h ☿ in ♌			
	Sun.	4	10	50	
	Mon.	5			
	Tues.	6			
☽	Wed.	7 7h 48.9m Moon F.Q.; 17h ♀ Greatest elong. W. 45° 58′	7	40	
	Thur.	8 3h ☿ in Perihelion			
	Fri.	9			
	Sat.	10 11h 15m ☌ ♄ ☾, ♄ 3° 38′ N	4	30	
	Sun.	11			
	Mon.	12			41203
	Tues.	13 7h ☌ ☿ ♃, ☿ 0° 46′ N.; 20h ☌ ☿ ♆, ☿ 0° 58′ N	1	20	40312
♋	Wed.	14 16h 6.1m F.M.; Partial eclipse of ☾ invisible at Toronto			d4310
	Thur.	15	22	10	32041
	Fri.	16			31024
	Sat.	17 7h 29m ☌ ♁ ☾, ♁ 4° 6′ S			d024*
	Sun.	18 10h ☿ Greatest Hel. Lat. N.; 16h ☌ ♃ ♆, ♃ 0° 9′ N.	19	00	20134
	Mon.	19			21034
	Tues.	20			01324
	Wed.	21	15	40	13024
☾	Thur.	22 19h 46.9m Moon L.Q.			32014
	Fri.	23 1h 16m ☉ enters ♎, Autumn commences			31024
	Sat.	24	12	30	43012
	Sun.	25 9h 41m ☌ ♂ ☾, ♂ 2° 45′ S			4203*
	Mon.	26 12h 59m ☌ ♀ ☾, ♀ 3° 37′ S			42103
	Tues.	27	9	20	40123
	Wed.	28 2h 3m ☌ ♆ ☾, ♆ 0° 1′ N.; 4h 59m ☌ ♃ ☾, ♃ 0° 21′ N.			41302
	Thur.	29 4h ☌ ☿ ☉ Superior			43201
♍	Fri.	30 0h 29.8m N.M.; 4h 15m ☌ ☿ ☾, ☿ 3° 30′ N	6	10	4310*

Explanation of symbols amd abbreviations on page 4

THE SKY FOR OCTOBER, 1932

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

The Sun—During October the sun's R.A. increases from 12h 28m to 14h 24m, and its Decl. decreases from 3° 1′ S. to 14° 18′ S. On the 23rd the sun enters Scorpio, the second autumnal sign of the zodiac. The equation of time increases from 10m 9s to 16m 19s (see p. 7). For changes in the length of day see p. 19.

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

Mercury on the 15th is in R.A. 13h 59m, Decl. 12° 32′ S., and transits at 12.27. It is an evening star but too close to the sun for favourable observation.

Venus on the 15th is in R.A. 10h 42m, Decl. 8° 48′ N., and transits at 9.09. It is a morning star of magnitude −3.7.

Mars on the 15th is in R.A. 9h 8m, Decl. 17° 52′ N., and transits at 7.34. On that date it rises about 12.30 a.m. and may be observed as a first magnitude star. It is in the constellation of Cancer till about the 20th when it enters Leo.

Jupiter on the 15th is in R.A. 11h 1m, Decl. 7° 19′ N., and transits at 9.27. It is a morning star in Leo. At sunrise on the 15th the planet is about 35° above the eastern horizon. Its magnitude is increasing and by the end of the month is −1.4. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 20h 2m, Decl. 20° 59′ S., and transits at 18.26. It is in quadrature on the 22nd and may be observed during the first half of the night. It is still in Capricornus.

Uranus on the 15th is in R.A. 1h 20m, Decl. 7° 45′ N., and transits at 23.43.

Neptune on the 15th is in R.A. 10h 45m, Decl. 8° 50′ N., and transits at 9.10.

OCTOBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 5h 45m
			h	m	
	Sat.	1			43O12
	Sun.	2 11h ♄ Stationary in R.A.			21O43
	Mon.	3	3	00	d2O43
	Tues.	4			O1234
	Wed.	5	23	50	d1O24
☽	Thur.	6 15h 5.4m Moon F.Q.; 19h ♀ in ♌			32O14
	Fri.	7 16h 4m ☌ ♄ ☾, ♄ 3° 35′ N.			312O4
	Sat.	8	20	40	3O124
	Sun.	9			d1O34
	Mon.	10			2O143
	Tues.	11 21h ☿ in ♉	17	30	4O123
	Wed.	12			41O32
	Thur.	13			432O1
♋	Fri.	14 8h 17.7m F.M.; 12h 8m ☌ ♁ ☾, ♁ 3° 59′ S.; 18h ☍ ♁ ☉	14	20	4312O
	Sat.	15 7h ☌ ♀ ♆, ♀ 0° 13′ S.			43O12
	Sun.	16			41O23
	Mon.	17	11	00	42O13
	Tues.	18			4O23*
	Wed.	19 22h ☌ ♀ ♃, ♀ 0° 7′ S.			1O432
	Thur.	20	7	50	32O14
	Fri.	21 20h □ ♄ ☉			321O4
☾	Sat.	22 3h ☿ in Aphelion; 12h 13.7m Moon L.Q.			3O124
	Sun.	23	4	40	1O324
	Mon.	24 1h 23m ☌ ♂ ☾, ♂ 0° 55′ S.			2O134
	Tues.	25 13h 55m ☌ ♆ ☾, ♆ 0° 13′ N.			1O34*
	Wed.	26 1h 7m ☌ ♃ ☾, ♃ 1° 5′ N.; 12h 59m ☌ ♀ ☾, ♀ 2° 0′ N.	1	30	dO324
	Thur.	27			d32O1
	Fri.	28	22	20	3421O
♍	Sat.	29 9h 56.1m N.M.			43O12
	Sun.	30 18h 28m ☌ ☿ ☾, ☿ 2° 53′ N.			413O2
	Mon.	31	19	10	42O13

Explanation of symbols and abbreviations on page 4

THE SKY FOR NOVEMBER, 1932

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

The Sun—During November the sun's R.A. increases from 14h 24m to 16h 27m, and its Decl. changes from 14° 18′ S. to 21° 45′ S. On the 22nd the sun enters Sagittarius, the third autumn zodiacal sign. The equation of time rises from 16m 19s to a maximum value of 16m 21s on the 3rd, and then decreases to 11m 4s at the end of the month (see p. 7). For changes in the length of day see p. 20.

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

Mercury on the 15th is in R.A. 16h 53m, Decl. 25° 13′ S., and transits at 13.18. On the 14th it reaches its greatest elongation east, and at sunset on that date is about 8° above the southwestern horizon.

Venus on the 15th is in R.A. 13h 0m, Decl. 4° 22′ S., and transits at 9.24. At sunrise on the 15th it is about 30° above the southeastern horizon.

Mars on the 15th is in R.A. 10h 13m, Decl. 13° 3′ N., and transits at 6.37. It rises about midnight on the 15th and may be seen in the constellation of Leo all month. On the 29th it is in quadrature with the sun. Its magnitude is increasing and by the end of the month is +0.9.

Jupiter on the 15th is in R.A. 11h 21m, Decl. 5° 20′ N., and transits at 7.45. On the 15th it rises almost due east about 1.30 in the morning, and may be observed in the constellation of Leo. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 20h 8m, Decl. 20° 43′ S., and transits at 16.30. At sunset on the 15th it may be seen due south, about 25° above the horizon. Its magnitude is decreasing, the value now being +0.8.

Uranus on the 15th is in R.A. 1h 16m, Decl. 7° 19′ N., and transits at 21.37.

Neptune on the 15th is in R.A. 10h 47m, Decl. 8° 35′ N., and transits at 7.10.

NOVEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol		Configurations of Jupiter's Satellites at 5h 15m
			h	m	
	Tues.	1			4103*
	Wed.	2			40132
	Thur.	3	16	00	4320*
	Fri.	4 0h 5m ♂♄☾, ♄ 3° 20′ N.....			3210*
☽	Sat.	5 1h 50.4m Moon F.Q.....			30124
	Sun.	6	12	50	13024
	Mon.	7			20134
	Tues.	8			12034
	Wed.	9 14h ♀ in Perihelion.....	9	40	01234
	Thur.	10 16h 6m ♂♁☾, ♁ 3° 57′ S.....			d304*
	Fri.	11 11h ☿ Greatest Hel. Lat. S.....			32104
	Sat.	12	6	30	30124
♋	Sun.	13 2h 28.0m F.M.....			31402
	Mon.	14 15h ☿ Greatest elong. E. 22° 36′.....			42013
	Tues.	15	3	10	41203
	Wed.	16			40123
	Thur.	17			d4102
	Fri.	18			d4320
	Sat.	19			43012
	Sun.	20	20	50	43102
☾	Mon.	21 2h 57.8m Moon L.Q.; 12h 45m ♂♂☾, ♂ 1° 16′ N.; 23h 43m ♂♆☾, ♆ 0° 32′ N.....			24031
	Tues.	22 18h 19m ♂♃☾, ♃ 1° 51′ N.....			21043
	Wed.	23	17	40	01234
	Thur.	24 14h ☿ Stationary in R.A.....			10324
	Fri.	25 12h 32m ♂♀☾, ♀ 5° 58′ N.....			32014
	Sat.	26	14	30	304**
♍	Sun.	27 19h 43.2m N.M.....			31024
	Mon.	28 17h 24m ♂☿☾, ☿ 4° 25′ N.....			20314
	Tues.	29 10h □♂☉.....	11	20	21043
	Wed.	30 12h ☿ in ♌.....			40123

Explanation of symbols and abbreviations on page 4

THE SKY FOR DECEMBER, 1932

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

The Sun—During December the sun's R.A. increases from 16h 27m to 18h 44m, and its Decl. changes from 21° 45′ S., to its maximum southern value of 23° 27′ S. on the 22nd. The sun is then at the winter solstice, it enters Capricornus and winter begins. From this date on the sun moves slowly northward. The length of daylight is at its minimum and changes very slightly for several days (see p. 21). The equation of time is 11m 4s at the beginning of the month and drops to zero on the 25th (see p. 7).

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

Mercury on the 15th is in R.A. 16h 12m, Decl. 18° 14′ S., and transits at 10.36. On the 4th it is in inferior conjunction with the sun, after which it becomes a morning star. On the 23rd it reaches its greatest elongation west and on that date rises in the south-east about 2 hours before the sun.

Venus on the 15th is in R.A. 15h 21m, Decl. 16° 42′ S., and transits at 9.47. It is still a morning star, and on the 15th rises about 2½ hours before the sun.

Mars on the 15th is in R.A. 11h 2m, Decl. 8° 59′ N., and transits at 5.28. At midnight on the 15th, it may be seen about 10° above the eastern horizon. Its magnitude is still increasing, at the end of the month it is +0.4. It is still in Leo.

Jupiter on the 15th is in R.A. 11h 33m, Decl. 4° 7′ N., and transits at 5.59. On the 14th it is in quadrature with the sun. Its magnitude has increased to −1.7 at the end of the month. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 20h 18m, Decl. 20° 10′ S., and transits at 14.42. It is approaching the sun, and on the 15th sets about 3 hours after sunset. Its magnitude is still decreasing. It is in Capricornus.

Uranus on the 15th is in R.A. 1h 13m, Decl. 7° 4′ N., and transits at 19.36.

Neptune on the 15th is in R.A. 10h 48m, Decl. 8° 31′ N., and transits at 5.14.

DECEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Civil Time)

			Minima of Algol	Configurations of Jupiter's Satallites at 4h 45m
			h m	
	Thur.	1 7h ♀ Greatest Hel. Lat. N.; 12h 18m ☌♄☾, ♄ 2° 57′ N.		41023
	Fri.	2 8h □♆☉	8 10	42301
	Sat.	3		430**
☽	Sun.	4 12h ☌☿☉ Inferior; 16h 44.9m Moon F.Q.		d4302
	Mon.	5 2h ☿ in Perihelion; 3h ☌♂♆, ♂ 1° 38′ N.	5 00	4201*
	Tues.	6		42103
	Wed.	7 20h 51m ☌♁☾, ♁ 4° 4′ S.		40213
	Thur.	8	1 50	1023*
	Fri.	9		23014
	Sat.	10	22 40	32104
	Sun.	11		30124
♋	Mon.	12 21h ♆ Stationary in R.A.; 21h 21.0m F.M.		d014*
	Tues.	13	19 20	21034
	Wed.	14 6h ♀ Stationary in R.A.; 7h □♃☉		02134
	Thur.	15 9h ☿ Greatest Hel. Lat. N.		10234
	Fri.	16	16 10	23041
	Sat.	17		34210
	Sun.	18		43012
	Mon.	19 6h 32m ☌♆☾, ♆ 0° 53′ N.; 16h 43m ☌♂☾, ♂ 3° 26′ N.	13 00	4302*
☾	Tues.	20 6h 25m ☌♃☾, ♃ 2° 34′ N.; 15h 21.9m Moon L.Q.		42103
	Wed.	21 20h 15m ☉ enters ♑, Winter commences		40213
	Thur.	22	9 50	41023
	Fri.	23 10h ☿ Greatest elong. W. 22° 0′		42301
	Sat.	24		34210
	Sun.	25 7h 54m ☌♀☾, ♀ 6° 29′ N.; 18h 38m ☌☿☾, ☿ 6° 52′ N.	6 40	30412
	Mon.	26		31024
♍	Tues.	27 6h 22.4m N.M.		d2034
	Wed.	28	3 30	0134*
	Thur.	29 0h ♁ Stationary in R.A.; 3h 38m ☌♄☾, ♄ 2° 34′ N.		10234
	Fri.	30		d2014
	Sat.	31	0 20	32104

Explanation of symbols and abbreviations on page 4

PHENOMENA OF JUPITER'S SATELLITES, 1932

E—Eclipse, O—occultation, T—transit, S—shadow, D—disappearance, R—reappearance
I—ingress, e—egress. The Roman numerals denote the satellites.
75th Meridian Civil Time.

JANUARY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	0	58	I	SI	16	4	43	I	OR
	1	48	I	TI		23	14	I	SI
	3	16	I	Se		23	45	I	TI
	4	5	I	Te	17	1	32	I	Se
	22	5	I	ED		2	2	I	Te
2	1	13	I	OR		20	21	I	ED
	21	44	I	Se		23	9	I	OR
	22	32	I	Te	18	20	0	I	Se
3	2	37	III	ED		20	28	I	Te
4	2	24	II	ED	20	1	44	II	SI
	6	52	II	OR		2	38	II	TI
5	20	35	II	SI		4	38	II	Se
	22	5	II	TI		5	30	II	Te
	23	28	II	Se	21	0	46	III	SI
6	0	57	II	Te		2	29	III	TI
	20	28	III	Se		4	25	III	Se
	23	24	III	Te		6	5	III	Te
7	5	30	I	ED		20	52	II	ED
	21	24	IV	OD	22	0	33	II	OR
8	2	15	IV	OR		6	39	I	SI
	2	52	I	SI	23	3	46	I	ED
	3	34	I	TI		6	27	I	OR
	5	9	I	Se	24	1	8	I	SI
	5	51	I	Te		1	29	I	TI
	23	59	I	ED		3	25	I	Se
9	2	58	I	OR		3	46	I	Te
	21	20	I	SI		19	33	III	OR
	22	0	I	TI		22	15	I	ED
	23	38	I	Se	25	0	53	I	OR
10	0	17	I	Te		19	36	I	SI
	6	36	III	ED		19	55	I	TI
	21	24	I	OR		21	54	I	Se
11	4	59	II	ED		22	12	I	Te
12	23	9	II	SI	26	19	19	I	OR
13	0	22	II	TI	27	4	20	II	SI
	2	3	II	Se		4	53	II	TI
	3	14	II	Te	28	4	45	III	SI
	20	48	III	SI		5	47	III	TI
	23	10	III	TI		23	27	II	ED
14	0	26	III	Se	29	2	47	II	OR
	2	46	III	Te	30	5	40	I	ED
	22	18	II	OR		20	30	II	Se
15	4	45	I	SI		20	53	II	Te
	5	19	I	TI	31	3	2	I	SI
	23	16	IV	SI		3	12	I	TI
16	1	53	I	ED		5	19	I	Se
	4	2	IV	Se		5	30	I	Te
	4	14	IV	TI		22	49	III	OR

FEBRUARY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen
1	0	9	I	ED	16	1	18	I	SI
	2	37	I	OR		3	23	I	Te
	21	30	I	SI		3	36	I	Se
	21	38	I	TI		22	12	I	OD
	22	1	IV	Se	17	0	45	I	ER
	23	17	IV	Te		19	31	I	TI
	23	48	I	Se		19	47	I	SI
	23	56	I	Te		21	49	I	Te
2	18	38	I	ED		22	4	I	Se
	21	3	I	OR	18	19	10	III	Te
5	2	2	II	ED		19	13	I	ER
	5	0	II	OR		20	19	III	Se
6	20	13	II	SI	21	0	44	II	TI
	20	15	II	TI		1	25	II	SI
	23	6	II	Se		3	37	II	Te

FEBRUARY—*Continued*

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
	23	7	II	Te		4	18	II	Se
7	4	56	I	SI	22	5	0	III	OD
	4	56	I	TI		5	30	I	OD
	22	27	III	OD		19	44	II	OD
8	2	2	I	OD		23	21	II	ER
	2	8	III	ER	23	2	50	I	TI
	4	22	I	ER		3	13	I	SI
	23	22	I	TI		5	7	I	Te
	23	24	I	SI		5	30	I	Se
9	1	39	I	Te		23	57	I	OD
	1	42	I	Se	24	2	39	I	ER
	20	28	I	OD		21	16	I	TI
	22	50	I	ER		21	41	I	SI
10	1	58	IV	OD		23	33	I	Te
	20	5	I	Te		23	59	I	Se
	20	10	I	Se	25	18	51	III	TI
12	4	23	II	OD		20	40	III	SI
13	22	29	II	TI		21	8	I	ER
13	22	49	II	SI		22	28	III	Te
14	1	22	II	Te	26	0	18	III	Se
	1	42	II	Se		18	27	I	Se
15	1	42	III	OD	27	1	33	IV	ER
	3	46	I	OD	28	3	1	II	TI
	6	8	III	ER		4	1	II	SI
	20	46	II	ER	29	21	59	II	OD
16	1	5	I	TI					

MARCH

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen
1	1	56	II	ER		22	5	III	ER
	3	34	I	TI	15	2	35	II	OD
	5	7	I	SI	16	20	50	II	TI
2	1	42	I	OD		22	34	II	SI
	3	34	I	ER		23	43	II	Te
	19	3	II	Te	17	1	27	II	Se
	20	14	II	Se		2	34	I	TI
	23	1	I	TI		3	25	I	SI
	23	36	I	SI		23	41	I	OD
3	1	18	I	Te	18	2	53	I	ER
	1	53	I	Se		20	22	II	ER
	20	8	I	OD		21	0	I	TI
	22	12	III	TI		21	53	I	SI
	23	3	I	ER		23	17	I	Te
4	0	39	III	SI	19	0	10	I	Se
	1	49	III	Te		21	22	I	ER
	3	16	III	Se	21	22	15	III	OR
	19	44	I	Te		22	25	III	ED
	20	21	I	Se	22	2	4	III	ER
5	23	9	IV	TI		19	6	IV	Te
6	3	55	IV	Te		23	12	IV	SI
8	0	16	II	OD	23	23	13	II	TI
	4	30	II	ER	24	1	11	II	SI
9	3	27	I	OD		2	5	II	Te
	19	57	II	SI	25	1	30	I	OD
	21	22	II	Te		22	49	I	TI
	22	50	II	Se		22	57	II	ER
10	0	47	I	TI		23	48	I	SI
	1	30	I	SI	26	1	5	I	Te
	3	4	I	Te		2	4	I	Se
	3	47	I	Se		19	57	I	OD
	21	54	I	OD		23	17	I	ER
11	0	58	I	ER	27	19	33	I	Te
	1	36	III	TI		20	33	I	Se
	19	13	I	TI	28	22	10	III	OD
	19	59	I	SI	29	1	49	III	OR
	21	30	I	Te		2	25	III	ED
	22	16	I	Se	30	22	28	IV	OD
12	19	26	I	ER	31	1	38	II	TI
14	19	35	IV	ER					

APRIL

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	20	12	III	Se	15	19	40	III	TI
	20	31	II	OD		23	16	III	Te
2	0	38	I	TI	16	0	35	III	SI
	1	32	II	ER		1	25	II	OD
	1	42	I	SI		19	55	IV	OR
	2	55	I	Te	17	1	30	I	OD
	21	47	I	OD		19	52	II	TI
3	1	12	I	ER		22	23	II	SI
	19	6	I	TI		22	45	II	Te
	20	0	II	Se		22	48	I	TI
	20	11	I	SI	18	0	1	I	SI
	21	22	I	Te		1	4	I	Te
	22	28	I	Se		1	15	II	Se
4	19	41	I	ER		19	58	I	OD
5	1	49	III	OD		23	32	I	ER
8	19	31	III	Te	19	19	33	I	Te
	20	35	III	SI		19	58	II	ER
	21	59	IV	Se		20	45	I	Se
	22	57	II	OD	22	23	30	III	TI
9	0	11	III	Se	24	22	26	II	TI
	2	29	I	TI		23	29	IV	TI
	23	38	I	OD	25	0	41	I	TI
10	19	45	II	SI		1	0	II	SI
	20	14	II	Te		1	19	II	Te
	20	56	I	TI		21	52	I	OD
	22	.6	I	SI	26	20	24	I	SI
	22	37	II	Se		21	26	I	Te
	23	13	I	Te		22	3	III	ER
11	0	22	I	Se		22	40	I	Se
	21	36	I	ER	27	19	56	I	ER

MAY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
2	23	46	I	OD	12	19	53	II	Te
3	19	45	II	OD		20	58	I	Se
	20	51	IV	ED		22	27	II	Se
	20	52	III	OR	14	20	7	III	Se
	21	4	I	TI	18	22	8	I	OD
	22	19	I	SI	19	20	37	I	SI
	22	25	III	ED		21	40	I	Te
	23	20	I	Te		22	13	II	SI
4	0	35	I	Se		22	34	II	Te
	21	51	I	ER		22	53	I	Se
5	19	49	II	Se	20	20	11	I	ER
10	21	13	III	OD	21	20	32	III	SI
	22	21	II	OD	26	21	21	I	TI
	22	59	I	TI		22	23	II	TI
11	0	14	I	SI		22	32	I	SI
	20	11	I	OD	27	22	6	I	ER
	22	11	IV	Te	28	22	9	II	ER
	23	47	I	ER		23	17	IV	SI
12	19	44	I	Te		23	18	III	Te

JUNE

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
3	20	33	I	OD	13	20	8	II	Te
4	20	4	I	Te		22	16	II	Se
	21	11	I	Se	14	21	59	IV	Se
5	22	2	IV	OD	15	21	47	III	OR
8	22	0	III	ER	18	21	45	I	TI
10	22	32	I	OD	20	22	2	II	SI
11	20	50	I	SI	26	21	2	I	OD
	22	3	I	Te	27	20	31	I	Te
	22	20	II	OD		21	24	I	Se
12	20	25	I	ER					

JULY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
3	20	28	III	SI	4	21	2	I	SI
	20	42	III	Te	5	20	39	I	ER
4	20	14	I	TI					

SEPTEMBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
14	5	15	II	SI	23	5	16	IV	SI
17	5	2	I	SI	30	4	35	II	ED
18	5	1	I	OR					

OCTOBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
3	5	35	I	Se	19	4	40	I	Te
9	5	1	II	Se	23	4	58	III	OR
10	5	12	I	SI	26	3	28	I	SI
11	5	30	I	OR		4	23	I	TI
12	4	10	III	SI		5	45	I	Se
16	4	49	II	SI		3	57	I	OR
18	3	31	II	OR	30	5	25	III	ER
	4	24	I	ED		5	55	III	OD
19	4	51	I	Se					

NOVEMBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	4	16	II	ED	17	4	19	II	SI
2	5	22	I	SI		4	38	III	TI
3	3	53	II	Te	18	3	38	I	SI
	5	55	I	OR		4	46	I	TI
4	3	7	I	Te		5	54	I	Se
	3	12	IV	ED	19	3	52	II	OR
6	5	57	III	ED		4	17	I	OR
10	3	41	III	Te	24	4	0	III	SI
	3	53	II	TI	25	5	32	I	SI
	4	30	II	Se	26	2	46	I	ED
	4	32	I	ED		6	13	I	OR
11	2	49	I	TI	27	2	16	I	Se
	4	1	I	Se		3	27	I	Te
	5	5	I	Te	28	1	58	III	OR
12	2	21	I	OR	29	5	9	IV	SI
17	3	23	III	Se					

DECEMBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
3	3	58	II	ED	18	5	41	I	SI
	4	39	I	ED	19	2	53	I	ED
4	1	54	I	SI		3	47	II	SI
	3	7	I	TI		5	43	III	ED
	4	9	I	Se		6	14	II	TI
	5	22	I	Te		6	22	I	OR
5	1	7	II	TI		6	29	II	Se
	1	9	III	ER	20	0	9	I	SI
	1	24	II	Se		1	23	I	TI
	2	36	I	OR		2	25	I	Se
	2	50	III	OD		3	37	I	Te
	3	45	II	Te	21	0	50	I	OR
	6	1	III	OR		3	41	II	OR
8	3	21	IV	OD	23	0	53	III	TI
10	6	32	I	ED		3	56	III	Te
	6	34	II	ED	25	0	22	IV	OR
11	3	47	I	SI	26	4	46	I	ED
	5	1	I	TI		6	20	II	SI
	6	3	I	Se	27	2	2	I	SI
12	1	0	I	ED		3	15	I	TI
	1	15	II	SI		4	18	I	Se
	1	44	III	ED		5	29	I	Te
	3	41	II	TI	28	1	3	II	ED
	3	57	II	Se		2	41	I	OR
	4	29	I	OR		6	13	II	OR
	5	5	III	ER	28	23	57	I	Te
	6	19	II	Te	29	23	49	III	SI
13	0	31	I	Se	30	0	35	II	Te
	1	44	I	Te		3	6	III	Se
14	1	7	II	OR		4	44	III	TI
16	3	7	IV	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 Diameter Miles	Mass	Density	Volume	Axial Rotation
	⊕ =1	Millions of Miles	Mean Solar Days	Years		⊕ =1	Water =1	⊕ =1	
☿ Mercury	0.387	36.0	87.97	0.24	3009	0.0556	4.7(?)	0.055	88d
♀ Venus	0.723	67.2	224.70	0.62	7575	0.817	4.94	0.88	30d (?)
⊕ Earth	1.000	92.9	365.26	1.00	7917.8	1.000	5.55	1.000	23h 56m 4s
♂ Mars	1.524	141.5	686.97	1.88	4216	0.108	3.92	0.151	24h 37m 23s
♃ Jupiter	5.203	483.3	4332.58	11.86	86728	318.4	1.32	1314	9h 55m ±
♄ Saturn	9.539	886.1	10759.2	29.46	72430	95.2	0.72	765	10h 14m ±
♅ Uranus	19.191	1782.8	30685.9	84.02	30878	14.6	1.22	59	10h 45m ±
♆ Neptune	30.071	2793.4	60187.6	164.79	32932	16.9	1.11	72	16 N
Pʟ Plato	39.60	3700	....	247.7	....	1 (?)	....	....	.....
☉ Sun	....	....	....	....	864392	333400	1.39	1301100	25d 7h 48m±
☾ Moon	From ⊕238,857 mls.		27.32	0.075	2160	0.0123	3.39	0.020	27d 7h 43m 11.5s

SATELLITES OF THE SOLAR SYSTEM

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

DOUBLE STARS

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

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

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

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

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

I. THE MOST LUMINOUS PAIRS

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

II. THE FINEST COLORED PAIRS

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

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

VARIABLE STARS

By FRANK S. HOGG

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

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

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

REPRESENTATIVE BRIGHT VARIABLE STARS

Name	Design.	Max.	Min.	Sp.	Period	Type	Date	Discoverer
η Aql	194700	3.7	4.3	G4	7.17668	VIII	1784	Pigott
N Aql[3]	184300	−0.2	10.9	Q	Irr.	I	1918	Bower
ϵ Aur	045443	3.3	4.1	F5p	9900.	X	1821	Fritsch
δ Cep	222557	3.6	4.3	G0	5.36640	VIII	1784	Goodricke
U Cep	005381	6.8	9.2	A0	2.49293	X	1880	W. Ceraski
o Cet[1]	0214*o3*	2.0	9.6	M5e	329.5	V	1596	Fabricius
RR Cet	012700	8.4	9.0	F0	0.55304	IX	1906	Oppolzer
R CrB	154428	5.8	13.8	G0e	Irr.	III	1795	Pigott
χ Cyg	194632	4.2	13.4	M7e	408.3	V	1686	Kirch
P Cyg	201437a	3.5	6.0	B1qk	Irr.	II	1600	Blaeu
SS Cyg	213843	8.1	12.0	Pec.	Irr.	IV	1896	Wells
XX Cyg	200158	11.4	12.1	A	0.13486	IX	1904	L. Ceraski
ζ Gem	065820	3.7	4.1	cG1	10.15353	VIII	1847	Schmidt
η Gem	060822	3.3	4.2	M2	235.15	V	1865	Schmidt
R Gem	070122a	6.5	13.5	Se	370.1	V	1848	Hind
U Gem	074922	8.8	13.8	Pec.	Irr.	IV	1855	Hind
α Her	171014	3.1	3.9	M5	Irr.	VI	1795	W. Herschel
R Hya	1324*22*	3.5	10.1	M7e	413.6	V	1670	Montanari
R Leo	094211	5.0	10.5	M7e	310.3	V	1782	Koch
β Lyr	184633	3.5	4.1	B5e	12.90801	X	1784	Goodricke
RR Lyr	192242	7.1	7.8	A5	0.56684	IX	1901	Fleming
α Ori[2]	054907	0.2	1.2	M2	Irr.	VI	1840	J. Herschel
U Ori	054920	5.4	12.2	M7e	376.1	V	1885	Gore
β Per[3]	030140	2.3	3.5	B8	2.86731	X	1669	Montanari
ρ Per	025838	3.3	4.1	M4	Irr.	VI	1854	Schmidt
R Sge	200916	8.4	10.4	cG7	70.84	VII	1859	Baxendell
R Sct	1842*05*	4.5	9.0	K5e	141.5	VII	1795	Pigott
λ Tau	035512	3.8	4.2	B3	3.95294	X	1848	Baxendell
RV Tau	044126	8.7	11.8	K0	78.60	VII	1905	L. Ceraski
SU Tau	054319	9.5	15.4	G0e	Irr.	III	1908	Cannon
α UMi[4]	012288	2.3	2.4	cF7	3.96815	VIII	1911	Hertzsprung

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

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

THE DISTANCES OF THE STARS

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

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

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

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

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

THE SUN'S NEIGHBOURS—STARS NEARER THAN FIVE PARSECS

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

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

THE BRIGHTEST STARS

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

Prepared by W. E. HARPER

The accompanying table contains the chief known facts regarding 260 stars brighter than apparent magnitude 3.51 as listed in *Harvard Annals*, Volume 50. The position of the star for 1900 is given in the second and tnird columns. The fourth and fifth columns give the apparent visual magnitude and type taken from the same publication. In a few cases the type is changed to conform with a later determination.

The parallaxes are taken from Schlesinger's Advance Copy of Catalogue of Parallaxes, 1924 Edition, and for such stars the proper motions are copied from the same source. The remaining proper motions were computed using the abbreviated μ_α and μ_δ as they appeared in the HANDBOOK for 1915, where this table first appeared, and are not necessarily correct to the third decimal place. Three or four spectroscopic parallaxes have been added to those given in Schlesinger's catalogue. The small letter *s* following the parallax indicates a spectroscopic determination has also been made. The distance is also given in light years in the eighth column as to the lay mind that seems a fitting unit. The real parallax of a star cannot be a negative quantity, but in some cases the result of the calculation gives a negative quantity. In each such case the distance in light years is computed on the assumption that the parallax is positive and equal to $''.001$. The sign (:) after it indicates that the value is uncertain. The absolute magnitude or the magnitude the star would appear to have if it were at a distance of 32.6 light years is given in the ninth column. At that distance the sun would appear as a star of magnitude 5.5. The radial velocity, taken from Voûte's list supplemented from our observatory card catalogue, is given in the last column. Those starred indicate that the star is a spectroscopic binary for which the velocity of the system is given. Where only the whole number appears the velocity may be regarded as approximate. There are 74 starred out of 235 radial velocities set down or one in three of the bright stars is a spectroscopic binary. The sign || denotes a visual double and the combined magnitude is given.

The 20 first magnitude stars are printed in black face type.

NOTE.—This table will be revised for the 1933 edition in order to include the latest parallaxes and also the radial velocities in the new Radial Velocity Catalogue now in preparation.—EDITOR.

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec
α Andromedae	0 3	+28 32	2.2	Aop	.207	.....	.....	.....	−13.0*
β Cassiopeiae	4	+58 36	2.4	F5	.561	.071 s	46	1.7	+12.8
γ Pegasi	8	+14 38	2.9	B2	.010	.....	.....	.....	+ 7. *
β Hydri	20	−77 49	2.9	G0	2.243	.141	23	3.6	+22.2
α Phoenicis	21	−42 51	2.4	K0	.446	.....	.....	.....	+75.8*
δ Andromedae	34	+30 19	3.5	K2	.167	.026 s	125	0.6	− 5. *
α Cassiopeiae	35	+55 59	2.2-2.8	K0	.062	.016 s	204	−1.8	− 3.0
β Ceti	39	−18 32	2.2	K0	.230	.042 s	78	0.3	+13.5
‖γ Cassiopeiae	51	+60 11	2.2	B0p	.031	.036	91	0.0	− 4.7
β Phoenicis	1 2	−47 15	3.4	K0	.042	.....	.....	.....	− 0.6
β Andromedae	4	+35 5	2.4	M0	.219	.045 s	72	0.7	− 2.
δ Cassiopeiae	19	+59 43	2.8	A5	.306	.....	.....	.....	+ 9.
‖α Ursae Minoris	23	+88 46	2.1	F8	.043	.007 s	466	−3.7	−14.8*
γ Phoenicis	24	−43 50	3.4	K5	.222	.....	.....	.....	+26. *
α **Eridani**	34	−57 44	0.6	B5	.093	.049 s	67	−1.0	
ε Cassiopeiae	47	+63 11	3.4	B3	.043	.001 s	3260	−6.6	− 7.4
β Arietis	49	+20 19	2.7	A5	.150	.064 s	51	1.7	− 0.6*
α Hydri	56	−62 3	3.0	F0	.256	.....	.....	.....	− 5.
‖γ Andromedae	58	+41 51	2.3	K0	.073	.007 s	466	−3.5	−10.9
α Arietis	2 2	+22 59	2.2	K2	.242	.033 s	99	−0.2	−14.3
β Trianguli	4	+34 31	3.1	A5	.161	.014	262	−1.2	.....*
ο Ceti	14	− 3 26	1.7-9.6	M6e	.239	.062	53	0.7	+63.9
‖θ Eridani	54	−40 42	3.4	A2	.071	.....	.....	.....	+20.
α Ceti	57	+ 3 42	2.8	M1	.080	.011 s	296	−2.0	−25.8
γ Persei	58	+53 7	3.1	Gp	.012	.012 s	272	−1.5	+ 2. *
ρ Persei	59	+38 27	3.4-4.2	M6	.176	.038 s	86	1.3	+28.6
β Persei	3 2	+40 34	2.1-3.2	B8	.011	.....	.....	.....	+ 5. *
α Persei	17	+49 30	1.9	F5	.041	.015 s	217	−2.2	− 2.4
δ Persei	36	+47 28	3.1	B5	.047	.005 s	652	−3.4	+ 0.7
‖η Tauri	41	+23 48	3.0	B5p	.053	.007 s	466	−2.8	+15.
ζ Persei	48	+31 55	2.9	B1	.023	−.003 s	3260 :	−7.1	+21.2
γ Hydri	49	−74 33	3.2	Ma	.128	.....	.....	.....	+16.8
‖ε Persei	51	+39 43	3.0	B1	.041	−.012 s	3260 :	−7.0	.....*
γ Eridani	53	−13 47	3.2	K5	.133	.018 s	181	−0.5	+62.2
λ Tauri	55	+12 12	3.3-4.2	B3	.015	−.008	3260 :	−6.7	+13.6*
α Reticuli	4 13	−62 43	3.4	G5	.069	.....	.....	.....	+35.4

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′							km./sec.
α **Tauri**	4 30	+16 18	1.1	K5	.205	.057 s	57	−0.1	+54.5
α Doradus	32	−55 15	3.5	A0p	.003	.....	.....	.....	+26.
π^3 Orionis	44	+ 6 47	3.3	F8	.474	.136 s	24	4.0	+24.7
ι Aurigae	50	+33 0	2.9	K2	.030	.018 s	181	−0.8	+18.5
ε Aurigae	55	+43 41	3.4–4.1	F5p	.015	.002 s	1630	−5.0	− 9. *
η Aurigae	5 0	+41 6	3.3	B3	.082	.014 s	233	−1.0	+ 3.0
ε Leporis	1	−22 30	3.3	K5	.074	.022 s	148	0.0	+ 1.1
β Eridani	3	− 5 13	2.9	A3	.117	.052 s	63	1.5	− 8.
μ Leporis	8	−16 19	3.3	A0p	.053	.....	.....	.....	+28.0
||α **Aurigae**	9	+45 54	0.2	G0	.439	.075 s	43	−0.4	+30.2*
||β **Orionis**	10	− 8 19	0.3	B8p	.005	.006	543	−5.8	+22.6*
||η Orionis	19	− 2 29	3.4	B1	.000	.....	.....	.....	+35.5*
γ Orionis	20	+ 6 16	1.7	B2	.019	.019 s	172	−1.9	+19.
β Tauri	20	+28 31	1.8	B8	.180	.024 s	136	−1.3	+11.
β Leporis	24	−20 50	3.0	G0	.095	.004 s	815	−4.0	−13.7
||δ Orionis	27	− 0 22	2.4	B0	.006	.009 s	362	−2.8	+17.6*
α Leporis	28	−17 54	2.7	F0	.006	.014 s	233	−1.6	+24.6
||ι Orionis	31	− 5 59	2.9	Oe5	.000	.....	.....	.....	+21.3*
ε Orionis	31	− 1 16	1.8	B0	.004	.005 s	652	−3.7	+26.3
ζ Tauri	32	+21 5	3.0	B3p	.028	−.001 s	3260 :	−7.2	+16.4*
||ζ Orionis	36	− 2 0	1.8	B0	.012	−.019 s	3260 :	−8.2	+17.9
α Columbae	36	−34 8	2.8	B5p	.040	.....	.....	.....	.....
κ Orionis	43	− 9 42	2.2	B0	.009	.029 s	112	2.5	+19.
β Columbae	47	−35 48	3.2	K0	.397	.....	.....	.....	+89.2
α **Orionis**	50	+ 7 23	1.0–1.4	M1	.032	.017 s	192	−2.8	+21.3*
β Aurigae	52	+44 56	2.1	A0p	.046	.034 s	96	−0.2	−19. *
||θ Aurigae	53	+37 12	2.7	A0p	.106	.016 s	204	−1.3	+28.5
η Geminorum	6 9	+22 32	3.2–4.2	M2	.062	.014 s	233	−1.1	+20. *
μ Geminorum	17	+22 34	3.2	M3	.129	.016 s	204	−0.8	+55.2
β Can. Majoris	18	−17 54	2.0	B1	.003	.012 s	272	−2.6	+33. *
α **Carinae**	22	−52 38	−0.9	F0	.022	.005 s	652	−7.4	+20.2
γ Geminorum	32	+16 29	1.9	A0	.066	.043 s	76	0.1	−12.3*
ν Puppis	35	−43 6	3.2	B8	.020	.....	.....	.....	+26.0*
ε Geminorum	38	+25 14	3.2	G5	.020	.007 s	466	−2.6	+ 9.5
ξ Geminorum	40	+13 0	3.4	F5	.230	.048 s	68	1.8	+26.7
||α **Can. Majoris**	41	−16 35	−1.6	A0	1.315	.371 s	9	1.2	− 7.4*
α Pictoris	47	−61 50	3.3	A5	.271	.....	.....	.....	.....
τ Puppis	47	−50 30	2.8	K0	.094	.....	.....	.....	+37. *

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
||ε Can. Majoris	6 55	−28 50	1.6	B1	.000	.....	.....	.....	+28.2
ζ Geminorum	58	20 43	3.7–4.3	G0p	.007	.005 s	652	−2.8	+ 6.8*
o^2 Can. Majoris	59	−23 41	3.1	B5p	.000	.....	.....	.....	.....
δ Can. Majoris	7 4	−26 14	2.0	G2p	.005	.010	326	−2.9	+34. *
L ^{2}Puppis	10	−44 29	3.4–6.2	Md	.334	.....	.....	.....	+52.6
π Puppis	14	−36 55	2.7	K5	.012	.....	.....	.....	+16.3
β Can. Minoris	22	+ 8 29	3.1	B8	.063	.020 s	163	−0.4	.....
σ Puppis	26	−43 6	3.3	K5	.192	.....	.....	.....	+87.3
||α_2 Geminorum	28	+32 6	2.0	A0	.201	.077 s	42	1.4	+ 6.2*
α_1 Geminorum	28	+32 6	2.8	A0	.209	.....	.....	.....	− 1.0*
α **Can. Minoris**	34	+ 5 29	0.5	F5	1.242	.312 s	10	3.0	− 4.3
β **Geminorum**	39	+28 16	1.2	K0	.623	.101 s	32	1.2	+ 3.6
ξ Puppis	45	−24 37	3.5	G6p	.007	.003 s	1087	−4.2	+ 4.2
ζ Puppis	8 0	−39 43	2.3	Od	.036	.....	.....	.....	.....
ρ Puppis	3	−24 1	2.9	F5	.097	.028 s	116	0.1	+46.
||γ Velorum	6	−47 3	2.2	Oap	.000	.....	.....	.....	.....
||ε Carinae	8 20	−59 11	1.7	K0	.032	.....	.....	.....	+11.7
o Urs. Majoris	22	+61 3	3.5	G0	.166	−.004 s	3260:	−6.5	+20.3
||ε Hydrae	41	+ 6 47	3.5	F8	.193	.015 s	217	−0.6	+37.2*
δ Velorum	42	−54 20	2.0	A0	.093	.....	.....	.....	.....
ζ Hydrae	50	+ 6 20	3.3	K0	.101	.014 s	233	−1.0	+23.0
ι Urs. Majoris	52	+48 26	3.1	A5	.500	.070 s	47	2.3	+ 8.
λ Velorum	9 4	−43 2	2.2	K5	.022	.....	.....	.....	+18.8
β Carinae	12	−69 18	1.8	A0	.192	.....	.....	.....	−16.0
ι Carinae	14	−58 51	2.2	F0	.023	.....	.....	.....	+13.1
α Lyncis	15	+34 49	3.3	K5	.214	.002 s	1630	−5.1	+38.5
κ Velorum	19	−54 35	2.6	B3	.017	.....	.....	.....	+21.9*
α Hydrae	23	− 8 14	2.2	K2	.036	.006 s	543	−3.9	− 4.0
θ Urs. Majoris	26	+52 8	3.3	F8p	1.096	.056 s	58	2.0	+15.8
N Velorum	28	−56 36	3.0	K5	.041	.....	.....	.....	−13.9
ε Leonis	40	+24 14	3.1	G0p	.045	−.001 s	3260:	−6.9	+ 5.1
||υ Carinae	45	−64 36	3.1	F0	.062	.....	.....	.....	+13.2
α **Leonis**	10 3	+12 27	1.3	B8	.244	.058 s	56	0.1	.....
q Carinae	14	−60 50	3.4	K5	.045	.....	.....	.....	+ 9.2
||γ Leonis	14	+20 21	2.3	K0	.347	.004 s	815	−4.7	−36.
μ Urs. Majoris	16	+42 0	3.2	K5	.082	.034 s	96	0.9	−22.

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

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
ζ Centauri	13 49	−46 48	3.1	B2p	.079	.....	.....	.....	.....
η Boötis	50	+18 54	2.8	G0	.370	.098 s	33	2.8	− 0.2*
β **Centauri**	57	−59 53	0.9	B1	.039	.036	91	−1.3	+12.0*
π Hydrae	14 1	−26 12	3.5	K0	.165	.....	.....	.....	+27.6
θ Centauri	1	−35 53	2.3	K0	.748	.....	.....	.....	+ 1.8
α **Boötis**	11	+19 42	0.2	K0	2.287	.080 s	41	−0.3	−5 .0
γ Boötis	28	+38 45	3.0	F0	.182	.058 s	56	1.8	−35.
η Centauri	29	−41 43	2.6	B3p	.052	.....	.....	.....	0.
||α **Centauri**	33	−60 25	0.3	G0	3.682	.758	4	4.7	+22.2
α Circini	34	−64 32	3.4	F0	.312	.....	.....	.....	+ 7.3
α Lupi	35	−46 58	2.9	B2	.036	.....	.....	.....	+ 8. *
||ε Boötis	41	+27 30	2.7	K0	.045	.016 s	204	−1.3	−16.4
||α^2 Librae	45	−15 38	2.9	K2	.129	.....	.....	.....	−17. *
β Urs. Minoris	51	+74 34	2.2	K5	.028	.011 s	296	−2.6	+17.0
β Lupi	52	−42 44	2.8	B2p	.066	.....	.....	.....	0. *
κ Centauri	53	−41 42	3.4	B3	.037	.....	.....	.....	+10. *
σ Librae	58	−24 53	3.4	M6	.094	.029 s	112	0.7	− 4.2
ζ Lupi	15 5	−51 43	3.5	K0	.132	.....	.....	.....	− 9.2
γT Australis	10	−68 19	3.1	A0	.064	.....	.....	.....	.....
β Librae	12	− 9 1	2.7	B8	.108	.....	.....	.....	−38. *
δ Lupi	15	−40 17	3.4	B2	.032	.....	.....	.....	.....
γ Urs. Minoris	21	+72 11	3.1	A2	.017	.....	.....	.....	− 8.
ι Draconis	23	+59 19	3.5	K0	.010	.034 s	96	1.2	−10.2
γ Lupi	28	−40 50	3.0	B3	.042	.....	.....	.....	.....
α Cor. Borealis	30	+27 3	2.3	A0	.160	.053 s	62	0.9	+ 0.4*
α Serpentis	39	+ 6 44	2.8	K0	.142	.046 s	71	1.1	+ 3.3
βT Australis	46	−63 7	3.0	F0	.440	.....	.....	.....	.....
π Scorpii	53	−25 50	3.0	B2p	.042	.....	.....	.....	*
δ Scorpii	54	−22 20	2.5	B0	.042	.....	.....	.....	*
||β Scorpii	16 0	−19 32	2.8	B1	.041	.....	.....	.....	− 9.5*
δ Ophiuchi	9	− 3 26	3.0	K8	.159	.040 s	82	1.0	−19.0
ε Ophiuchi	13	− 4 27	3.3	K0	.088	.046 s	71	1.6	− 9.2
||σ Scorpii	15	−25 21	3.1	B1	.033	.....	.....	.....	+ 2.0*
||η Draconis	23	+61 44	2.9	G5	.062	.042 s	78	1.0	−13.9
||α **Scorpii**	23	−26 12	1.2	M2p	.032	.026 s	126	−1.7	− 3.1*
β Herculis	26	+21 42	2.8	K0	.104	.030 s	109	0.2	−25.5*
τ Scorpii	30	−28 1	2.9	B0	.042	.....	.....	.....	+ 1.5

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec
ζ Ophiuchi	16 32	−10 22	2.7	B0	.024	.....	.....	.....	−15.0
‖ζ Herculis	38	+31 47	3.0	G0	.601	.111 s	29	3.2	−70. *
α T Australis	38	−68 51	1.9	K2	.034	.....	.....	.....	− 3.7
ϵ Scorpii	44	−34 7	2.4	K0	.668	.....	.....	.....	− 2.0
μ^1 Scorpii	45	−37 53	3.1	B3p	.032	.....	.....	.....	.....
ζ Arae	50	−55 50	3.1	Ma	.047	.....	.....	.....	− 6.1
κ Ophiuchi	53	+ 9 32	3.4	K0	.296	.208 s	116	0.6	−55.3
‖η Ophiuchi	17 5	−15 36	2.6	A0	.094	.....	.....	.....	− 1.1
η Scorpii	5	−43 6	3.4	F2	.291	.....	.....	.....	−28.
ζ Draconis	8	+65 50	3.2	B5	.023	.019 s	172	−0.4	−14.6
‖α Herculis	10	+14 30	3.1-3.9	M7	.030	− .002 s	3260 :	−6.9	−32.4
δ Herculis	11	+24 57	3.2	A2	.164	.029 s	112	0.5	−42. *
π Herculis	12	+36 55	3.4	K2	.021	.019 s	172	−0.2	−25.1
θ Ophiuchi	16	−24 54	3.4	B3	.030	.....	.....	.....	− 0.9
β Arae	17	−55 26	2.8	K2	.035	....	.....	.....	− 1.0
υ Scorpii	24	−37 13	2.8	B3	.040	.....	.....	.....	.....
α Arae	24	−49 48	3.0	B3p	.085	.....	.....	.....	.....
λ Scorpii	27	−37 2	1.7	B2	.040	.....	.....	.....	− 1. *
β Draconis	28	+52 23	3.0	G0	.012	.004 s	815	−4.0	−19.7
θ Scorpii	30	−42 56	2.0	F0	.010	.....	.....	.....	+ 5.
α Ophiuchi	30	+12 38	2.1	A5	.264	.049 s	67	0.5	.....
κ Scorpii	36	−38 58	2.5	B2	.032	.....	.....	.....	.....
β Ophiuchi	39	+ 4 37	2.9	K0	.157	.024 s	136	−0.2	−11.5
ι^1 Scorpii	41	−40 5	3.1	F5p	.000	.....	.....	.....	−27.8
‖μ Herculis	43	+27 47	3.5	G5	.817	.111 s	29	3.7	−15.7
G Scorpii	43	−37 1	3.2	K2	.062	.....	.....	.....	+24.7
ν Ophiuchi	54	− 9 46	3.5	K0	.118	.026 s	126	0.6	+12.6
γ Draconis	54	+51 30	2.4	K5	.026	.017 s	192	−1.4	−27.0
γ Sagittarii	59	−30 26	3.1	K0	.206	.....	.....	.....	+22. *
η Sagittarii	18 11	−36 48	3.2	M6	.223	.....	.....	.....	0.0
δ Sagittarii	15	−29 52	2.8	K0	.042	.....	.....	.....	−20.2
η Serpentis	16	− 2 55	3.4	K0	.898	.065 s	50	2.5	+ 9.5
ϵ Sagittarii	18	−34 26	2.0	A0	.139	.....	.....	.....	−11.0
λ Sagittarii	22	−25 29	2.9	K0	.197	.....	.....	.....	−43.2
‖α **Lyrae**	34	+38 41	0.1	A0	.348	.124 s	26	0.6	−13.8
φ Sagittarii	39	−27 6	3.3	B8	.053	.....	.....	.....	+26. *
‖β Lyrae	46	+33 15	3.4-4.1	B2p	.011	− .014 s	3260 :	−6.6	*
σ Sagittarii	49	−26 25	2.1	B3	.081	.....	.....	.....	− 1.

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

OCCULTATIONS OF STARS BY THE MOON, 1932

By V. KROTKOV

The following predictions have been prepared for Toronto but may be used within a radius of three hundred miles by application of the formula

E.S.T. (for place of observation)
$=$E.S.T. (as given for Toronto) $+a\Delta\lambda+b\Delta\phi$,

where $\Delta\lambda$ and $\Delta\phi$ are the differences between the longitude and latitude of the place of observation and Toronto in degrees. The values of a and b are given in minutes. The longitude of Toronto is 79°,4 and its latitude 43°.7. If you desire to find the time any star will be occulted for a station near Toronto subtract 79°.4 from the longitude and 43°.7 from its latitude. This will give $\Delta\lambda$ and $\Delta\phi$. From the predictions for Toronto for the star in question look for a and b and form the products $a\times\Delta\lambda$ and $b\times\Delta\phi$. Add these to the predicted times for Toronto and you will obtain the times of immersion and emersion for the place approximately. The predictions are given for both immersion and emersion, but it is particularly desirable to obtain the time of immersion. The angle P which gives the point of disappearance or reappearance is measured on the limb of the moon eastward from the north point.

When the occultation takes place near a tangent to the moon and is nearly a grazing contact, the predictions are a little uncertain and differ considerably for small changes in the observer's position on the earth's surface. In these cases the a and b are not computed. The international abbreviations for the constellation names have been used throughout.

OCCULTATIONS VISIBLE AT TORONTO

Date 1932	Star	Mag.	Immersion				Emersion			
			E. S. T. h m	*a* m	*b* m	P °	E. S. T. h m	*a* m	*b* m	P °
Jan. 12	337 B Aqr	6.4	19 30	−1.2	−0.8	76	20 35	−0.3	+0.6	212
" 12	342 B Aqr	6.5	20 59	−0.4	−0.4	58	22 02	0.0	−0.4	239
,, 15	τ Psc	5.6	18 58	−2.3	−0.3	86	20 09	−1.0	+2.0	203
" 19	38 B Aur	6.5	23 01	−1.9	−0.7	59	00 12	−1.1	−2.4	295*
" 28	*f* Vir	6.0	01 01	0.0	−2.0	174	01 45	−1.8	+1.8	259
" 29	550 B Vir	6.0	04 21	−1.5	−0.1	114	05 33	−1.1	−1.1	321
Feb. 13	47 Ari	5.8	22 52	−0.2	−2.2	108	23 46	−0.4	0.0	223
" 14	16 Tau	5.4	20 55	−1.6	−0.6	78	22 14	−1.0	−0.9	257
" 14	17 Tau	3.8	21 04	−1.4	−3.2	123	22 00	−1.5	+1.3	212
" 14	*q* Tau	4.3	21 23	−1.6	+1.0	42	22 25	−0.6	−2.6	293
" 14	20 Tau	4.1	21 34	−1.3	−0.6	73	22 49	−0.7	−1.3	265
" 14	21 Tau	5.8	21 59	.....	.....	24	22 40	.....	.....	316
" 14	22 Tau	6.5	21 57	−1.5	−1.2	35	22 49	−0.3	−3.0	304
" 17	49 Aur	5.1	21 14	−1.9	−1.0	111	22 35	−2.0	−0.6	267
" 20	γ Cnc	4.7	02 36	0.0	−2.5	152	03 26	−0.7	−1.2	263
" 23	80 Leo	6.4	00 28	−1.5	−0.5	112	01 36	−0.9	−1.6	327
" 24	50 Vir	6.2	23 52	+0.1	−1.7	173	00 36	−1.8	+1.6	260*
" 26	214 G Vir	6.5	00 05	.....	.....	49	00 20	.....	.....	19
" 26	43 H Vir	5.5	06 08	−1.4	−1.2	116	07 20	−1.1	−1.6	298‡
Mar. 14	47 B Aur	6.0	18 12	−2.1	+0.9	68	19 36	−1.8	−1.3	281†
" 15	354 B Tau	6.4	00 14	−0.1	−1.0	74	01 07	+0.6	−1.5	294
" 16	47 Gem	5.6	22 17	.....	.....	162	23 00	.....	.....	234
" 17	134 B Gem	6.5	00 45	−0.3	−1.5	99	01 42	+0.2	−1.7	298
" 25	17 G Lib	6.4	03 12	−1.5	−0.7	123	04 26	−1.5	−1.0	292
" 25	18 G Lib	6.1	03 51	−1.5	−1.0	127	05 13	−1.1	−1.1	284
" 26	*b* Sco	4.7	05 13	−2.0	+0.2	50	05 56	−1.5	−2.1	362‡
" 30	ω Sgr	4.8	03 45	−1.2	+1.9	59	04 54	−1.3	+0.9	283
" 30	A Sgr	4.9	05 28	−1.7	+1.4	...	06 50	−2.0	+0.5	§

*Emersion on the following day.
†Immersion before sunset.
§Emersion after sunrise.
‡Almost grazing.

OCCULTATIONS VISIBLE AT TORONTO—*continued*

Date 1932	Star	Mag.	Immersion E. S. T. h m	Immersion a m	Immersion b m	Immersion P °	Emersion E. S. T. h m	Emersion a m	Emersion b m	Emersion P °
Apr. 13	c Gem	5.5	18 56	−2.0	−0.4	94	19 13	−1.1	−1.6	308†
" 18	83 Leo	6.3	00 16	.....	.....	190	00 47	.....	.....	245
" 18	τ Leo	5.2	00 47	−0.1	−2.2	173	01 31	−1.3	−1.2	259
" 19	50 Vir	6.2	20 50	−0.4	−0.8	153	21 50	−1.5	+1.0	282
" 21	43 H Vir	5.5	01 34	−1.4	−1.0	124	02 45	−1.3	−1.2	294
" 21	231 G Vir	6.4	02 49	−1.0	−1.8	157	03 41	−1.2	−1.0	256
" 21	236 G Vir	5.7	03 33	−1.1	−1.8	145	04 30	−0.8	−1.2	236
May 16	31 B Vir	6.4	01 23	−0.3	−1.9	133	emersion be	low		hor.
" 19	17 G Lib	6.4	01 03	−1.4	−1.1	117	02 14	−1.2	−1.4	289
" 19	18 G Lib	6.1	01 40	−1.3	−1.4	125	02 47	−1.0	−1.3	276
" 22	W Sgr	4.3	02 00	−1.8	−0.4	127	03 01	−1.6	+0.3	229
" 25	27 Cap	6.1	04 20	−1.3	+1.0	36	05 34	−2.1	+0.1	265§
" 28	337 B Aqr	6.4	03 39	−1.0	+1.7	69	04 52	−1.0	+2.1	221§
" 31	π Psc	5.6	03 34	0.0	+1.8	70	04 35	−0.2	+1.3	228
June 7	35 B Cnc	6.4.	20 56	+0.2	−1.8	126	21 50	+0.2	−1.3	279
" 14	43 H Vir	5.5	21 13	−1.8	−0.4	104	22 24	−1.3	−1.4	318
" 14	231 G Vir	6.4	22 24	−1.4	−1.1	131	23 35	−1.3	−1.3	284
" 14	236 G Vir	5.7	23 16	−1.4	−1.3	118	00 25	−1.1	−1.5	291*
" 24	ϕ Aqr	4.6	04 03	−1.4	+1.1	51	05 24	−1.4	+1.1	229§
" 30	17 Tau	3.8	04 09	+0.4	+2.3	32	.....	.....	.....	...§
July 10	49 Vir	5.2	22 47	.....	.....	62	emersion be	low		hor.
" 13	4 Sco	5.7	21 07	−1.7	−0.4	103	22 25	−1.6	−1.0	290
" 15	W Sgr	4.3	21 09	−0.9	−0.7	151	21 50	−2.2	+0.7	216
" 18	27 Cap	6.1	22 17	−1.2	+1.2	96	23 23	−1.4	+1.7	219
Aug. 10	τ Sco	2.8	18 18	−1.4	+0.2	114	19 36	−1.9	−0.1	276†
" 10	135 B Sco	6.0	23 09	−1.2	−1.6	111	emersion be	low		hor.
" 16	δ Cap	2.9	02 20	−0.4	+1.0	21	03 19	−1.3	−1.2	267
" 17	ϕ Aqr	4.6	20 32	−0.3	+1.7	80	21 34	−0.5	+1.6	222
" 18	96 Aqr	5.7	00 07	−1.5	+0.8	61	01 25	−1.2	+1.4	219
" 20	60 Psc	6.2	00 10	−1.1	+1.8	67	01 23	−0.9	+2.1	215

*Emersion on the following day.
†Immersion before sunset.
§Emersion after sunrise.
‡Almost grazing.

Date 1932	Star	Mag.	Immersion				Emersion			
			E. S. T. h m	*a* m	*b* m	P °	E. S. T. h m	*a* m	*b* m	P °
Aug. 20	62 Psc	6.1	02 07	−1.4	+1.2	47	03 28	−1.6	+0.3	236
" 22	47 Ari	5.8	imm.	below	hor.		22 05	+0.6	+1.7	215
Sept. 12	42 Aqr	5.5	23 53	−0.8	+1.1	28	01 03	−1.5	+0.3	255*
,, 21	354 B Tau	6.4	23 37	+0.4	+1.9	55	00 34	−0.5	+1.2	278*
" 24	134 B Gem	6.5	01 58	+0.2	+2.5	54	02 49	−1.1	0.0	310
Oct. 10	ι Aqr	4.4	01 17	−0.4	−0.3	61	emers.	below	hor.	
" 18	38 B Aur	6.5	23 29	−0.3	+2.3	52	00 38	−1.5	+1.0	275*
" 19	47 B Aur	6.0	02 42	−1.5	+3.1	39	03 51	−2.2	−2.1	302
" 23	γ Cnc	4.7	00 44	.....	.....	31	01 03	.....	.....	357
" 24	8 Leo	5.9	imm.	below	hor.		02 26	−0.6	−0.2	319
" 31	τ Sco	2.8	16 19	−1.6	−1.2	115	17 24	−0.9	−0.9	254†
Nov. 5	δ Cap	2.9	20 43	−1.4	−0.2	66	21 54	−0.6	+0.2	223
" 6	58 Aqr	6.4	18 49	−0.8	+1.9	19	19 57	−2.2	0.0	265
" 9	62 Psc	6.1	22 32	−1.7	+0.8	60	23 53	−1.2	+0.8	224
" 9	δ Psc	4.5	23 19	−0.8	+2.0	21	00 27	−1.6	−1.1	266*
" 13	17 Tau	3.8	imm. at	suns	et		17 37	+0.2	+1.0	284
" 13	23 Tau	4.3	.....	.....	.....	...	18 06	+0.6	+1.9	118
" 13	η Tau	2.9	18 41	.....	.....	118	19 19	.....	.....	197
" 15	107 B Aur	6.5	19 16	+0.3	+1.3	85	20 12	+0.2	+1.6	254
" 16	406 B Tau	5.6	03 40	−1.7	−1.8	115	05 00	−1.6	−0.6	257
" 22	c Leo	5.1	02 44	−0.6	+0.4	119	03 51	−0.9	+0.5	303
" 23	9 B Vir	6.2	02 24	−0.2	−0.5	117	03 23	−0.4	+0.2	315
Dec. 4	81 Aqr	6.4	.....	.....	.....	...	18 10	−1.2	+1.4	216
" 4	82 Aqr	6.4	18 20	−0.7	+1.8	20	19 29	−2.0	−0.2	260
" 9	20 H^1 Ari	6.4	02 16	.....	.....	18	02 55	.....	.....	305
" 10	ϵ Ari	4.6	03 22	−0.5	−1.5	89	04 24	−0.2	−0.7	247
" 11	q Tau	4.3	01 10	−1.6	−1.7	101	02 24	−1.3	−0.1	237
" 11	20 Tau	4.1	01 48	.....	.....	140	02 26	.....	.....	200
" 11	21 Tau	5.8	01 36	−1.4	−1.2	88	02 52	−0.9	−0.8	252
" 11	22 Tau	6.5	01 42	−1.3	−1.6	94	02 55	−1.0	−0.3	245
" 15	35 B Cnc	6.4	23 49	−1.3	+1.5	84	01 05	−1.7	−0.9	308*

*Emersion on the following day.
†Immersion before sunset.
§Emersion after sunrise.
‡Almost grazing.

ASTRONOMICAL CONSTANTS

Solar Parallax, 8″.80

Mass of the sun, 1.983×10^{33} grams = 332000 times the mass of the earth

Temperature of the sun's surface, 5740° C.

Solar Constant, 1.925 calories per sq. cm. per min.

Obliquity of the ecliptic, 23° 27′ 8″.26 − 0.4684 $(t-1900)$

Mean Distance Earth to Sun, 149,504,201 km. = 92,897,416 statute miles

Mean Distance Earth to Moon, 384,403 km. = 238,857 statute miles

Equatorial Horizontal Parallax of Moon, 57′ 2″.70

Gaussian constant of gravitation, $\kappa = .017202099$

Newtonian constant of gravitation, $\kappa = 6.658 \times 10^{-8}$ c.g.s.

Acceleration in one second due to gravity, $g = 9.8060$ meters $- .0260 \cos 2\phi - \frac{2h}{R} g$

Reduction from geographic latitude ϕ to geocentric latitude ϕ',

$$\phi' - \phi = -11' \; 35''.66 \sin 2\phi + 1''.17 \sin 4\phi.$$

Dimensions of the earth:

Equatorial radius, $a = 6378.388$ km. = 3963.34 statute miles

Polar radius, $b = 6356.909$ km. = 3949.99 statute miles

Mass of the earth, 5.974×10^{27} grams

Density of the earth, 5.515 grams per cubic cm.

Velocity of light, 299,796 km. or 186,285 miles per sec.

Length of the year:

Tropical	$365^d.24219879 - 0000000614$	$(t-1900)$
Sidereal	$365 \; .25636042 + 000000011$	$(t-1900)$
Anomalistic	$365 \; .25964134 + 0000000304$	$(t-1900)$
Eclipse	$346 \; .620031 \; + 00000032$	$(t-1900)$

Length of the day:

Sidereal	$23^h 56^m \; 4^s.091$ of mean solar time
Mean Solar	$24 \; 3 \; 56 \; .555$ of sidereal time

Length of the month:

Synodical	$29^d.530588 = 29^d \; 12^h 44^m \; 2^s.8$
Tropical	$27 \; .321582 = 27 \; 7 \cdot 43 \; 4 \; .7$
Sidereal	$27 \; .321661 = 27 \; 7 \; 43 \; 11 \; .5$
Anomalistic	$27 \; .554550 = 27 \; 13 \; 18 \; 33 \; .1$
Nodical	$27 \; .212220 = 27 \; 5 \; 5 \; 35 \; .8$

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The objects of the Society, incorporated in 1890, are:

(*a*) "To study Astronomy, Astrophysics and such cognate subjects as shall be approved of by the Society and as shall, in its opinion, tend to the better consideration and elucidation of Astronomical and Astrophysical problems; and to diffuse theoretical and practical knowledge with respect to such subjects.

(*b*) To publish from time to time the results of the work of the Society; and,

(*c*) To acquire and maintain a Library, and such apparatus and real and personal property as may be necessary and convenient for the carrying into effect of the objects of the Society."

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

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