THE
OBSERVER'S HANDBOOK
FOR 1938

PUBLISHED BY

The Royal Astronomical Society of Canada

EDITED BY C. A. CHANT

THIRTIETH YEAR OF PUBLICATION

TORONTO
198 COLLEGE STREET
PRINTED FOR THE SOCIETY
1938

1938 CALENDAR 1938

JANUARY

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	..

FEBRUARY

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

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

JULIAN DAY CALENDAR, 1938

J. D. 2,420,000 plus the following

Jan. 1	8900	May 1	9020	Sep. 1	9143
Feb. 1	8931	June 1	9051	Oct. 1	9173
Mar. 1	8959	July 1	9081	Nov. 1	9204
Apr. 1	8990	Aug. 1	9112	Dec. 1	9234

The Julian Day commences at noon.

Thus J. D. 2,428,900.0=Jan. 1.5 G.C.T.

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CONTENTS

PREFACE

The chief new features of the HANDBOOK for 1938 are a map illustrating the standard time belts in the United States and Canada and two tables of meteorological data which are printed this year on the third page of the cover.

The four small star maps which first appeared in 1937 necessarily contain comparatively few objects. Four circular maps 9 inches in diameter, roughly for the seasons, are obtainable from the Director of University Extension, University of Toronto, for one cent each. Observers desiring fuller information are recommended to obtain Norton's *Star Atlas and Reference Handbook* (Gall and Inglis, price 12*s* 6*d*; supplied also by Eastern Science Supply Co., Boston). It is now in its sixth edition and is widely used.

In the preparation of this volume the Editor has received cordial and generous assistance. He wishes to thank those whose names are mentioned in the text, also Messrs. Gordon Shaw and Robert Peters of the Victoria Centre; but he is under special obligation to Dr. F. S. Hogg and Miss Ruth J. Northcott, M.A., of the David Dunlap Observatory.

C.A.C.

Richmond Hill, Ont., December 1937.

ANNIVERSARIES AND FESTIVALS 1938

New Year's Day	Sat.	Jan. 1
Epiphany	Thu.	Jan. 6
Septuagesima Sunday		Feb. 13
Quinquagesima (Shrove Sunday)		Feb. 27
St. David	Tue.	Mar. 1
Ash Wednesday		Mar. 2
Quadragesima (First Sunday in Lent)		Mar. 6
St. Patrick	Thu.	Mar. 17
Annunciation (Lady Day)	Fri.	Mar. 25
Palm Sunday		Apr. 10
Good Friday		Apr. 15
Easter Sunday		Apr. 17
St. George	Sat.	Apr. 23
Rogation Sunday		May 22
Empire Day (Victoria Day)	Tue.	May 24
Birthday of the Queen Mother, Mary (1867)	Thu.	May 26
Pentecost (Whit Sunday)		June 5
Trinity Sunday		June 12
Corpus Christi	Thu.	June 16
St. John Baptist (Midsummer Day)	Fri.	June 24
Dominion Day	Fri.	July 1
Birthday of Queen Elizabeth (1900)	Thu.	Aug. 4
Labour Day	Mon.	Sept. 5
Hebrew New Year (Rosh Hashana)	Mon.	Sept. 26
St. Michael (Michaelmas Day)	Thu.	Sept. 29
All Saints' Day	Tue.	Nov. 1
Remembrance Day	Fri.	Nov. 11
First Sunday in Advent		Nov. 27
St. Andrew	Wed.	Nov. 30
Accession King George VI (1936)	Sun.	Dec. 11
Birthday of King George VI (1895)	Wed.	Dec. 14
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.	♇ Pluto

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

Α, α,	Alpha.	Ι, ι,	Iota.	Ρ, ρ,	Rho.
Β, β,	Beta.	Κ, κ,	Kappa.	Σ, σ, ς,	Sigma.
Γ, γ,	Gamma.	Λ, λ,	Lambda.	Τ, τ,	Tau.
Δ, δ,	Delta.	Μ, μ,	Mu.	Υ, υ,	Upsilon.
Ε, ε,	Epsilon.	Ν, ν,	Nu.	Φ, φ,	Phi.
Ζ, ζ,	Zeta.	Ξ, ξ,	Xi.	Χ, χ,	Chi.
Η, η,	Eta.	Ο, ο,	Omicron.	Ψ, ψ,	Psi.
Θ, θ, ϑ,	Theta.	Π, π,	Pi.	Ω, ω,	Omega.

THE CONFIGURATIONS OF JUPITER'S SATELLITES

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.

ABBREVIATIONS FOR THE CONSTELLATIONS

Andromeda	And	Andr
Antlia	Ant	Antl
Apus	Aps	Apus
Aquarius	Aqr	Aqar
Aquila	Aql	Aqil
Ara	Ara	Arae
Aries	Ari	Arie
Auriga	Aur	Auri
Bootes	Boo	Boot
Caelum	Cae	Cael
Camelopardalis	Cam	Caml
Cancer	Cnc	Canc
Canes Venatici	CVn	CVen
Canis Major	CMa	CMaj
Canis Minor	CMi	CMin
Capricornus	Cap	Capr
Carina	Car	Cari
Cassiopeia	Cas	Cass
Centaurus	Cen	Cent
Cepheus	Cep	Ceph
Cetus	Cet	Ceti
Chamaeleon	Cha	Cham
Circinus	Cir	Circ
Columba	Col	Colm
Coma Berenices	Com	Coma
Corona Australis	CrA	CorA
Corona Borealis	CrB	CorB
Corvus	Crv	Corv
Crater	Crt	Crat
Crux	Cru	Cruc
Cygnus	Cyg	Cygn
Delphinus	Del	Dlph
Dorado	Dor	Dora
Draco	Dra	Drac
Equuleus	Equ	Equl
Eridanus	Eri	Erid
Fornax	For	Forn
Gemini	Gem	Gemi
Grus	Gru	Grus
Hercules	Her	Herc
Horologium	Hor	Horo
Hydra	Hya	Hyda
Hydrus	Hyi	Hydi
Indus	Ind	Indi
Lacerta	Lac	Lacr
Leo	Leo	Leon
Leo Minor	LMi	LMin
Lepus	Lep	Leps
Libra	Lib	Libr
Lupus	Lup	Lupi
Lynx	Lyn	Lync
Lyra	Lyr	Lyra
Mensa	Men	Mens
Microscopium	Mic	Micr
Monoceros	Mon	Mono
Musca	Mus	Musc
Norma	Nor	Norm
Octans	Oct	Octn
Ophiuchus	Oph	Ophi
Orion	Ori	Orio
Pavo	Pav	Pavo
Pegasus	Peg	Pegs
Perseus	Per	Pers
Phoenix	Phe	Phoe
Pictor	Pic	Pict
Pisces	Psc	Pisc
Piscis Australis	PsA	PscA
Puppis	Pup	Pupp
Pyxis	Pyx	Pyxi
Reticulum	Ret	Reti
Sagitta	Sge	Sgte
Sagittarius	Sgr	Sgtr
Scorpius	Scr	Scor
Sculptor	Scl	Scul
Scutum	Sct	Scut
Serpens	Ser	Serp
Sextans	Sex	Sext
Taurus	Tau	Taur
Telescopium	Tel	Tele
Triangulum	Tri	Tria
Triangulum Australe	TrA	TrAu
Tucana	Tuc	Tucn
Ursa Major	UMa	UMaj
Ursa Minor	UMi	UMin
Vela	Vel	Velr
Virgo	Vir	Virg
Volans	Vol	Voln
Vulpecula	Vul	Vulp

The 4-letter abbreviations are intended to be used in cases where a maximum saving of space is not necessary.

From *Transactions of the I.A.U.*, Vol. IV., 1932, page 221.

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.

The boundaries of the time belts are shown on the map on page 8.

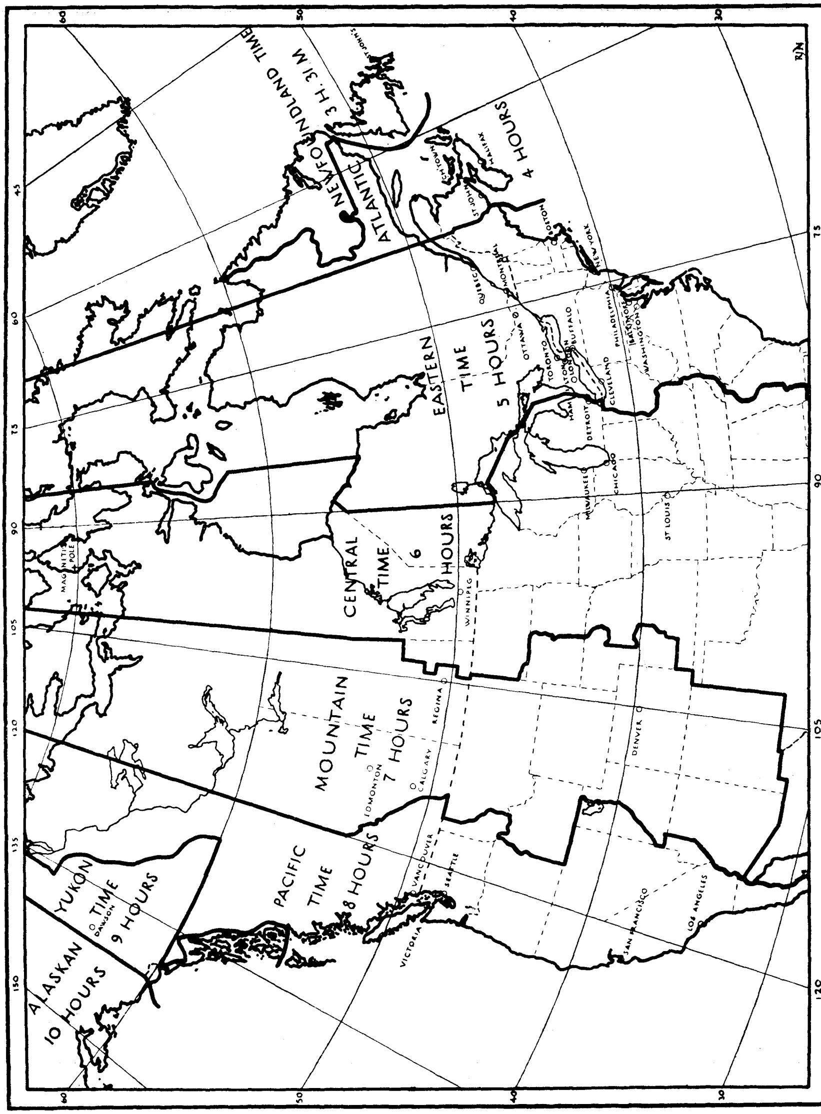
1938 EPHEMERIS OF THE SUN AT 0h. GREENWICH CIVIL TIME

Date	Apparent R.A.	Equation of Time	Apparent Dec.	Date	Apparent R.A.	Equation of Time	Apparent Dec.
	h m s	m s	° ′ ″		h m s	m s	° ′ ″
Jan. 1	18 43 11	+03 14	−23 04.5	July 3	06 45 18	+03 51	+23 02.2
" 4	18 56 25	+04 38	−22 48.7	" 6	06 57 40	+04 24	+22 47.0
" 7	19 09 36	+05 59	−22 28.9	" 9	07 09 59	+04 53	+22 28.3
" 10	19 22 42	+07 16	−22 05.1	" 12	07 22 15	+05 19	+22 06.0
" 13	19 35 44	+08 28	−21 37.4	" 15	07 34 26	+05 41	+21 40.3
" 16	19 48 39	+09 34	−21 06.0	" 18	07 46 33	+05 58	+21 11.3
" 19	20 01 29	+10 34	−20 30.9	" 21	07 58 36	+06 11	+20 39.1
" 22	20 14 12	+11 27	−19 52.3	" 24	08 10 34	+06 19	+20 03.7
" 25	20 26 48	+12 14	−19 10.4	" 27	08 22 26	+06 22	+19 25.3
" 28	20 39 18	+12 54	−18 25.3	" 30	08 34 13	+06 20	+18 44.0
" 31	20 51 40	+13 26	−17 37.2	Aug. 2	08 45 55	+06 12	+18 00.0
Feb. 3	21 03 55	+13 51	−16 46.3	" 5	08 57 31	+05 58	+17 13.3
" 6	21 16 02	+14 09	−15 52.8	" 8	09 09 02	+05 39	+16 24.1
" 9	21 28 02	+14 19	−14 56.8	" 11	09 20 27	+05 15	+15 32.5
" 12	21 39 55	+14 22	−13 58.6	" 14	09 31 47	+04 45	+14 38.7
" 15	21 51 40	+14 18	−12 58.3	" 17	09 43 02	+04 11	+13 42.8
" 18	22 03 20	+14 08	−11 56.1	" 20	09 54 13	+03 32	+12 44.9
" 21	22 14 52	+13 51	−10 52.2	" 23	10 05 19	+02 49	+11 45.2
" 24	22 26 20	+13 28	−09 46.8	" 26	10 16 22	+02 01	+10 43.8
" 27	22 37 41	+13 01	−08 40.0	" 29	10 27 21	+01 11	+09 40.9
Mar. 2	22 48 58	+12 28	−07 32.1	Sept. 1	10 38 16	+00 16	+08 36.6
" 5	23 00 10	+11 50	−06 23.2	" 4	10 49 09	−00 41	+07 31.0
" 8	23 11 19	+11 09	−05 13.5	" 7	10 59 59	−01 40	+06 24.4
" 11	23 22 23	+10 24	−04 03.2	" 10	11 10 47	−02 42	+05 16.8
" 14	23 33 24	+09 36	−02 52.5	" 13	11 21 34	−03 45	+04 08.5
" 17	23 44 23	+08 45	−01 41.5	" 16	11 32 20	−04 48	+02 59.4
" 20	23 55 20	+07 52	−00 30.3	" 19	11 43 05	−05 52	+01 49.9
" 23	00 06 16	+06 58	+00 40.7	" 22	11 53 52	−06 56	+00 39.9
" 26	00 17 11	+06 03	+01 51.6	" 25	12 04 39	−07 58	−00 30.2
" 29	00 28 06	+05 08	+03 02.1	" 28	12 15 27	−09 00	−01 40.4
Apr. 1	00 39 01	+04 14	+04 12.1	Oct. 1	12 26 17	−09 59	−02 50.5
" 4	00 49 57	+03 20	+05 21.4	" 4	12 37 10	−10 56	−04 00.3
" 7	01 00 54	+02 28	+06 29.9	" 7	12 48 05	−11 51	−05 09.6
" 10	01 11 53	+01 37	+07 37.3	" 10	12 59 04	−12 42	−06 18.4
" 13	01 22 54	+00 49	+08 43.6	" 13	13 10 06	−13 29	−07 26.4
" 16	01 33 58	+00 03	+09 48.5	" 16	13 21 14	−14 11	−08 33.6
" 19	01 45 05	−00 40	+10 52.0	" 19	13 32 26	−14 48	−09 39.6
" 22	01 56 16	−01 19	+11 53.9	" 22	13 43 45	−15 19	−10 44.4
" 25	02 07 31	−01 54	+12 54.0	" 25	13 55 09	−15 45	−11 47.8
" 28	02 18 50	−02 24	+13 52.3	" 28	14 06 40	−16 04	−12 49.5
May 1	02 30 14	−02 50	+14 48.5	" 31	14 18 17	−16 16	−13 49.5
" 4	02 41 42	−03 11	+15 42.5	Nov. 3	14 30 01	−16 22	−14 47.4
" 7	02 53 16	−03 27	+16 34.1	" 6	14 41 52	−16 20	−15 43.2
" 10	03 04 54	−03 38	+17 23.3	" 9	14 53 50	−16 11	−16 36.6
" 13	03 16 37	−03 45	+18 09.8	" 12	15 05 57	−15 55	−17 27.5
" 16	03 28 26	−03 46	+18 53.6	" 15	15 18 11	−15 31	−18 15.8
" 19	03 40 19	−03 42	+19 34.5	" 18	15 30 32	−14 58	−19 01.1
" 22	03 52 18	−03 33	+20 12.5	" 21	15 43 02	−14 19	−19 43.4
" 25	04 04 21	−03 19	+20 47.3	" 24	15 55 39	−13 32	−20 22.5
" 28	04 16 30	−03 01	+21 19.0	" 27	16 08 22	−12 38	−20 58.1
" 31	04 28 42	−02 38	+21 47.3	" 30	16 21 12	−11 37	−21 30.3
June 3	04 40 59	−02 11	+22 12.2	Dec. 3	16 34 09	−10 31	−21 58.7
" 6	04 53 19	−01 41	+22 33.6	" 6	16 47 10	−09 19	−22 23.4
" 9	05 05 41	−01 08	+22 51.5	" 9	17 00 17	−08 02	−22 44.1
" 12	05 18 06	−00 33	+23 05.8	" 12	17 13 27	−06 41	−23 00.9
" 15	05 30 32	+00 04	+23 16.4	" 15	17 26 42	−05 16	−23 13.5
" 18	05 43 00	+00 42	+23 23.3	" 18	17 39 59	−03 49	−23 21.9
" 21	05 55 29	+01 21	+23 26.5	" 21	17 53 18	−02 20	−23 26.2
" 24	06 07 58	+02 00	+23 26.0	" 24	18 06 37	−00 50	−23 26.2
" 27	06 20 26	+02 39	+23 21.8	" 27	18 19 57	+00 40	−23 22.0
" 30	06 32 53	+03 16	+23 13.8	" 30	18 33 15	+02 08	−23 13.5

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 cases ubtract it from, apparent or Sun-dial Time.

MAP OF STANDARD TIME ZONES



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 below are given corrections to change these times to the Standard times of the cities and towns named.

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 preceisely the same values of corresponding days from year to year, and so the table gives only approximately average values. The times are for the rising and setting of the upper limb of the sun, and are corrected for refraction. 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.

34°	min.	**44°**	min.	**46°**	min.	**50°**	min.
Los Angeles	− 7	Brantford	+ 21	Glace Bay	0	Brandon	+40
		Guelph	+ 21	Moncton	+ 19	Kenora	+18
38°		Halifax	+ 14	Montreal	− 6	Medicine Hat	+22
St. Louis	+ 1	Hamilton	+ 20	New Glasgow	+ 11	Moose Jaw	+ 2
San Francisco	+ 10	Kingston	+ 6	North Bay	+ 18	Port. la Prairie	+33
Washington	+ 8	Kitchener	+ 22	Ottawa	+ 3	Regina	− 2
		Milwaukee	− 8	Parry Sound	+ 20	Trail	− 9
40°		Minneapolis	+ 13	Quebec	− 15	Vancouver	+12
Baltimore	+ 6	Orillia	+ 18	St. John, N.B.	+ 24	Winnipeg	+28
New York	− 4	Oshawa	+ 15	Sault S. Marie	+ 37		
Philadelphia	+ 1	Owen Sound	+ 24	Sherbrooke	− 12	**52°**	
Pittsburgh	+ 20	Peterborough	+ 13	Sudbury	+ 24	Calgary	+36
		St. Catharines	+ 17	Sydney	+ 1	Saskatoon	+ 6
42°		Stratford	+ 24	Three Rivers	− 10		
Boston	− 16	Toronto	+ 18			**54°**	
Buffalo	+ 15	Woodstock, Ont.	+23	**48°**		Edmonton	+34
Chicago	− 10	Yarmouth	+ 24	Port Arthur	+ 57	Prince Albert	+ 1
Cleveland	+ 26			St. John's, Nfd.	0	Prince Rupert	+41
Detroit	− 28	**46°**		Seattle	+ 9		
London, Ont.	+ 25	Charlottetown	+ 13	Timmins	+ 26	**60°**	
Windsor	+ 32	Fredericton	+ 26	Victoria	+ 13	Dawson	+18

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 (Mountain Standard Time).

JANUARY

Day of Month	Latitude 44° Sunrise	Latitude 44° Sunset	Latitude 46° Sunrise	Latitude 46° Sunset	Latitude 48° Sunrise	Latitude 48° Sunset	Latitude 50° Sunrise	Latitude 50° Sunset	Latitude 52° Sunrise	Latitude 52° 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 page 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 page 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 page 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 page 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 page 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 page 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 page 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 page 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 page 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 page 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 page 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 page 9.

THE SUN AND PLANETS FOR 1938

By Donald A. MacRae

THE SUN

It is a well-known fact that the variations in the number and positions of sun-spots observed on the sun are roughly periodic. The average interval between maxima is 11.2 years, but the observed periods range from eight to fourteen years. It is therefore not possible to predict the exact time of maximum activity. An extrapolation of the graph showing the decreasing latitude of spots to the latitude reached at the times of the maxima of 1918 and 1928 shows that the next sun-spot maximum should occur about the beginning of 1938. During 1938 we should therefore expect an increase in the phenomena associated with sun-spot activity, such as magnetic storms, radio fade-outs, and auroral displays.

MERCURY

Mercury, the planet closest to the sun, is also the smallest and least massive. With the exception of Pluto, its orbit is the most eccentric and has the greatest inclination to the ecliptic. Mercury appears to move swiftly from one side of the sun to the other several times each year and at times of greatest elongation its angular distance from the sun is always small, varying from 18° to 28°. It is visible to the naked eye for about two weeks at these times.

When Mercury is near greatest elongation east of the sun it appears in the evening, setting very soon after the sun. When near greatest western elongation it can be seen in the morning just before sunrise. In northern and southern latitudes at sunset the ecliptic is most nearly vertical in the spring; at sunrise it is most nearly vertical in the autumn. Therefore eastern elongations in the spring and western elongations in the autumn are most favourable for observing Mercury.

Mercury reaches eastern elongation three times during 1938. The dates, angular distances from the sun, and magnitudes are: April 2 (most favourable), 19°, +0.0; July 31, 27°, +0.6; November 25, 22°, —0.2.

Mercury reaches western elongation three times as follows, January 20, 24°, +0.1; May 19, 26°, +0.8; September 13 (most favourable), 18°, +0.0.

At its closest approach to the earth this year (inferior conjunction, April 21) its distance will be 53 million miles. At greatest elongations its semi-diameter is between three and four seconds of arc.

VENUS

Venus is the next planet in order from the sun. In size and mass and perhaps in other respects it resembles the earth. To us it appears as the most brilliant "star" in the sky. Venus performs in the same way as Mercury but moves much more slowly and is farther removed from the sun. The time for one complete oscillation is 1.6 years and greatest elongation is about 45°. When east of the sun, as it is for the greater part of 1938, Venus appears as the evening star and in this position it was known to the ancients as Hesperus. When west of the sun it is the morning star, Phosphorus.

At the beginning of the year Venus is close to the sun on the far side and passes superior conjunction on February 3. During the spring and summer it is moving slowly to the east of the sun. In August it will set about one and one-half hours after sunset. On September 10 it reaches its maximum elongation east of the sun (46° and magnitude —4.0) and then rather quickly moves in towards the sun again.

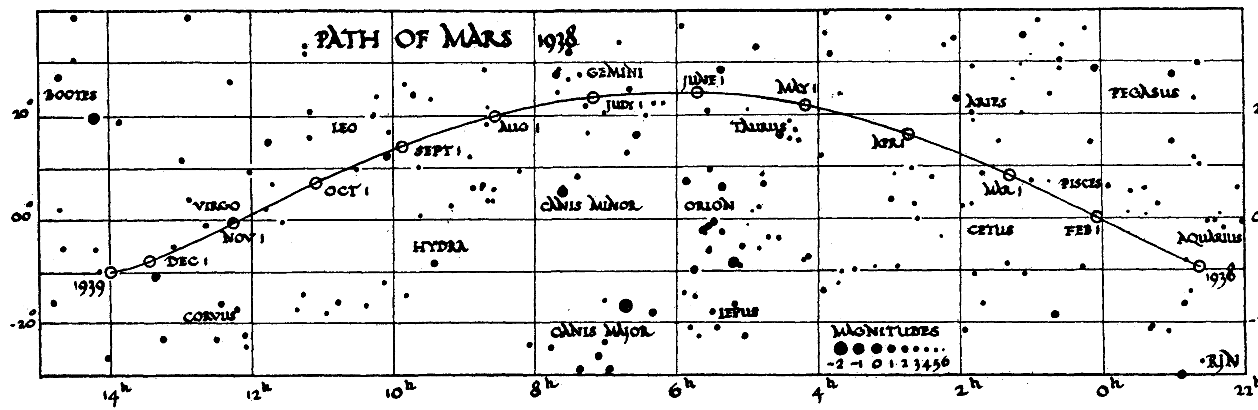
Owing to the unfavourable positions of both the ecliptic and the planet's orbit, Venus actually becomes more poorly situated for observation as maximum elongation is approached. For a few weeks in September and October it can be easily seen during the day. On October 16 it will be at its greatest brilliancy in the western sky, magnitude —4.3. Its closest approach to the earth will be at inferior conjunction on November 20 when it will be twenty-five million miles away. This is about one hundred times the distance of the moon and is closer than any other major planet approaches the earth. Rising early Christmas morning, Venus will be "a star in the east" at its brightest for the year, magnitude —4.4, thirteen times as bright as Sirius. Its apparent semidiameter changes from about 5″ at superior conjunction to almost 32″ at inferior conjunction.

MARS

Mars is the fourth planet from the sun and the first superior planet. Its path in the sky is similar to all planets beyond the earth, a slow motion in the region of the zodiac from west to east with occasional periods in which it is regreding. During 1938 however, Mars will not be in a good position for observation as it is close to the sun most of the year.

On January 1 it is of magnitude +1.1, four hours east of the sun in the constellation Aquarius, 150 million miles from the earth. It is moving closer to the sun and from June to the middle of September the planet is less than one hour of right ascension away from the sun. On July 24 it is in conjunction, and on August 4 it is at its greatest distance from the earth, 250 million miles. On October 8 it passes aphelion. At the end of the year it is of magnitude +1.7, 180 million miles from the earth, and four hours west of the sun in the constellation Libra. The accompanying chart gives its path among the stars during the year.

Mars is best observed at favourable oppositions which occur every 15 or 17 years, the last one being in August, 1924.



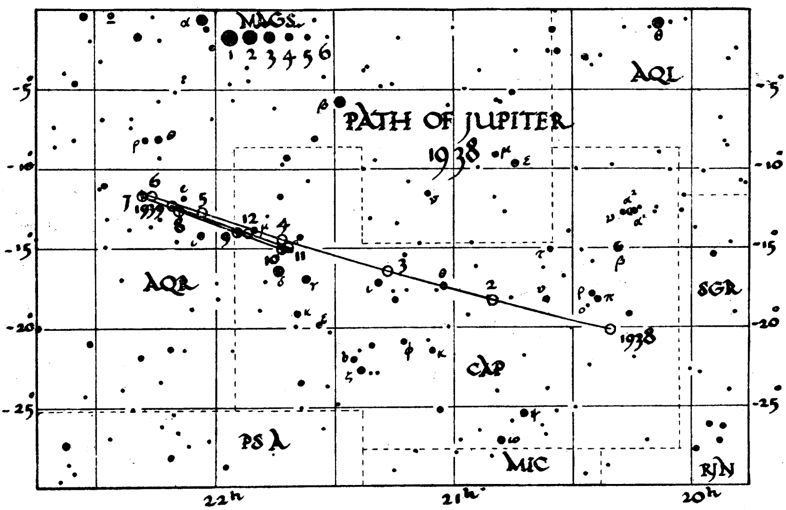
PATH OF MARS AMONG THE STARS DURING 1938

In this and the following maps, the position of the planet is indicated for the first of each month.

THE ASTEROIDS

Between the orbits of Mars and Jupiter there are a large number of small bodies revolving about the sun. The first of these minor planets to be discovered was Ceres, found by Piazzi in 1801. Within the next few years three others were found, Pallas, Juno, and Vesta. The number has now reached about 1400. The majority of these planetoids are less than 50 miles in diameter. They all revolve from west to east, and some approach very close to the earth. Eros will come within twenty million miles of us in January.

In most telescopes these asteroids show no discs but their motions among the stars can be easily observed. It is planned to publish, from time to time in the JOURNAL, maps of the paths of the brighter asteroids.



JUPITER

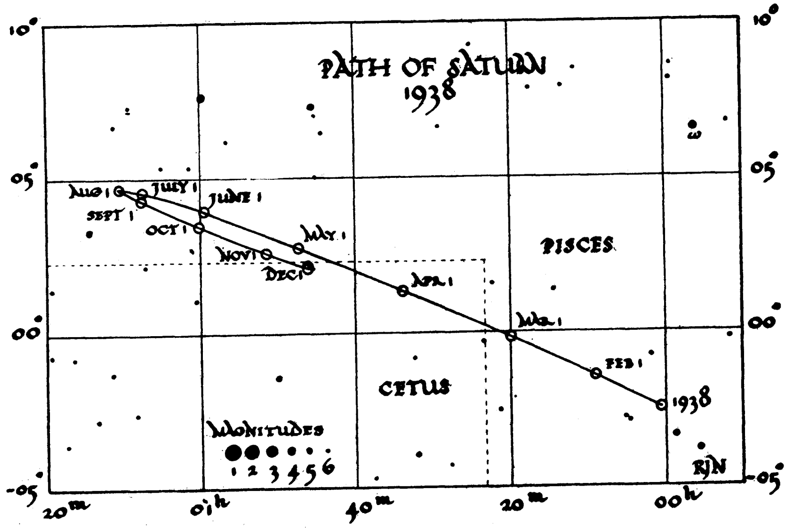
Jupiter is the largest and most massive planet of the solar system. Because of its distance from the sun and the earth, its motion among the stars is quite slow. During 1938 it will be in the constellations Capricornus and Aquarius. Since it is in conjunction with the sun on January 29, it is not easily seen until the end of February. At this time it is a morning star of magnitude —1.5. It is in western quadrature on May 22, and opposition on August 20 at which time it is at its maximum brightness for the year, magnitude —2.4, and is visible all night. After eastern quadrature on November 16 it will be an evening star and will be approaching the sun again. Its magnitude at the end of the year is —1.8. For its path among the stars, see the accompanying chart; it is retrograding from June 22 to October 20.

Jupiter has four moons that can be seen with a good pair of binoculars. Their configurations are given among the phenomena. The five smaller moons are too faint to be seen in any but the largest telescopes. The moons, the surface detail, its large disk and its position in the sky make Jupiter a very interesting object for observation during the latter part of the year.

Its period of rotation is the shortest of all planets, about ten hours; as a result there is a marked flattening at the poles. In August its apparent semi-diameter is 23″ and its distance from the earth is 373 million miles.

SATURN

Saturn is the next planet in order from the sun. It is also next to Jupiter in size and mass. Its motion in the heavens is very slow. During 1938 it will be a yellowish first magnitude object in the constellations Pisces and Cetus. It will be visible in January and February east of the sun and at magnitude +1.2. During March and April it will be so close to the sun that it cannot

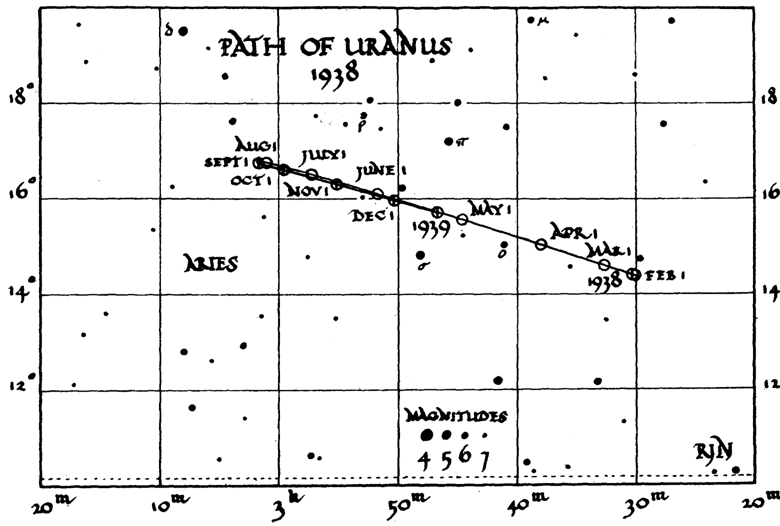


be conveniently observed; conjunction is on March 29. Until quadrature on July 10 it will be a morning star west of the sun. Maximum brightness for the year, magnitude +0.4, is at the time of opposition, October 8, and near the end of the year it will be an evening star again, of magnitude +0.9. The path of Saturn among the stars is given in the chart; from August 1 to December 16 it is retrograding.

Saturn's unique ring system makes it one of the most interesting objects in our skies. These rings, the outer ring, the bright ring, and the crape ring, are composed of a large number of very small satellites which revolve about Saturn in one plane. Since this plane is inclined at an angle of 27° to the planet's orbit, they are presented sometimes well opened out and sometimes edge on. In the latter case they are invisible. The rings disappeared in 1936 so that during 1938 they will be opening out again. They will be at their maximum in 1943, when the planet will be in an excellent position for observation in the northern hemisphere. In October 1938 its distance from the earth is 780 million miles and its semidiameter is almost 9″.

URANUS

The ancient astronomers were well familiar with the first six planets. The seventh, Uranus, was not discovered until telescopic observation was firmly established. To Sir William Herschel goes the credit for finding this body, which he at first thought was a comet. Later observations proved it to be the next planet beyond Saturn. Herschel suggested calling it *Georgium*



Sidus after George III. During 1938 it will appear as a blue-green sixth magnitude star in the constellation Aries. Its semidiameter is 1″.8.

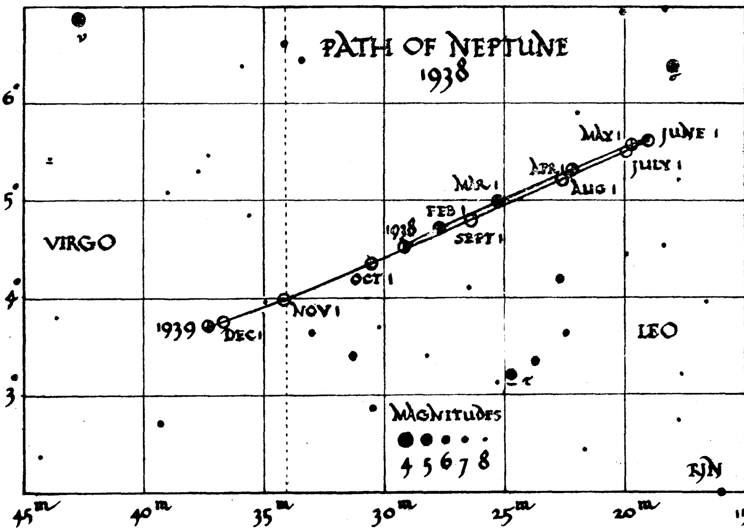
Eastern quadrature is on January 30 so that for the first three months it can be observed in the evening. In April and May it is near the sun and so unfavourably situated for observation. Conjunction occurs on May 4. Western quadrature is on August 10, and opposition on November 8, when it is above the horizon all night. The path of Uranus among the stars is given in the chart. Its motion is direct from January 18 to August 24.

NEPTUNE

Although Uranus was discovered by accident, the next planet was found by means of the so-called "astronomy of the invisible." The story of its almost simultaneous discovery in 1846 by Leverrier and Adams is one of the most interesting in Astronomy. The observed deviations of Uranus from its calculated orbit led them both to predict correctly the position in the sky of the perturbing planet Neptune.

In 1938 Neptune appears as a blue-green eighth magnitude star in the constellations Leo and Virgo. It is conveniently situated for observation in the first half of the year, reaching opposition on March 10 at magnitude 7.7 and eastern quadrature on June 9. From August to October it is rather close to the sun, passing conjunction on September 14. It is in western quadrature on December 15 and can be seen in the morning. The accompanying chart will identify Neptune among the stars; until June 1 the planet is retrograding.

Neptune's rotation period is quite short. It has been determined spectrographically as 15¾ hours. At opposition it is about 2,700 million miles from the earth and has an apparent semidiameter of 1″.25.



PLUTO

The success of the theory of perturbations in this field led Lowell to investigate the existence of a trans-Neptunian planet. The observatory which he founded announced the discovery of Pluto reasonably near its predicted position on March 13, 1930, the anniversary of Lowell's birth and of Herschel's discovery of Uranus.

During 1938 Pluto is a yellowish star in the constellation Cancer, just south of λ Cancri. It is about magnitude 15 and so is invisible in all but the largest telescopes. The position, which changes only slightly during the year, on August 2 is

$$\alpha : 8^h\ 11^m.3 \qquad \delta : +23^\circ\ 10'$$

It takes light about 5½ hours to come from Pluto to the earth.

ECLIPSES, 1938

In the year 1938 there will be four eclipses, two of the sun and two of the moon.

I. *A Total Eclipse of the Moon,* 1938 May 14, visible in Canada; the beginning visible generally in the Atlantic Ocean, except the eastern part, North America, except the extreme northern part, South America, Antarctica, the eastern extremity of Australia, the Pacific Ocean, except the north-western part; the ending visible generally in the central and western part of North America, the western part of South America, Antarctica, the Pacific Ocean, Australia, and the north-eastern extremity of Asia.

Circumstances of the Eclipse (75th Meridian Civil Time)

		d	h	m
Moon enters penumbra	May	14	0	44
Moon enters umbra	"	14	1	57
Total eclipse begins	"	14	3	18
Middle of eclipse	"	14	3	44
Total eclipse ends	"	14	4	09
Moon leaves umbra	"	14	5	31
Moon leaves penumbra	"	14	6	43

Magnitude of the eclipse = 1.102 (Moon's diameter = 1.0).

II. *A Total Eclipse of the Sun.* 1938 May 29, invisible in Canada. The path of totality is short and lies completely in the extreme southern part of the Atlantic Ocean. The duration of the total phase is about 4 minutes. The eclipse is visible in its partial phase in the southern part of South America, the South Atlantic Ocean, and the southern tip of Africa.

III. *A Total Eclipse of the Moon,* 1938 November 7, visible in Canada; the beginning visible generally in Eurasia, the western part of Australia, the Indian Ocean, Africa, the Atlantic Ocean, the Arctic Ocean, the extreme north-eastern part of North America, and the extreme eastern part of South America; the ending visible generally in central and western Asia, the western part of the Indian Ocean, Europe, Africa, the Atlantic Ocean, the Arctic Ocean, North America, except the extreme western and north-western part, and South America.

Circumstances of the Eclipse (75th Meridian Civil Time)

		d	h	m
Moon enters penumbra	November	7	14	39
Moon enters umbra	"	7	15	41
Total eclipse begins	"	7	16	45
Middle of eclipse	"	7	17	26
Total eclipse ends	"	7	18	08
Moon leaves umbra	"	7	19	12
Moon leaves penumbra	"	7	20	14

Magnitude of the eclipse = 1.359 (Moon's diameter = 1.0).

IV. *A Partial Eclipse of the Sun,* 1938 November 21. For most stations on the west coast of North America the beginning of the partial eclipse will be visible just before sunset, but the greatest eclipse for the place will occur after the sun has set. The eclipse is visible generally in the northern part of the Pacific Ocean, Japan, the east coast of Asia, Alaska, and the west coast of North America.

Circumstances of the Eclipse (75th Meridian Civil Time)

		d	h	m		°	′		°	′
Eclipse begins	November	21	16	45	Long.	−143	58	Lat.	+48	00
Greatest eclipse	"	21	18	52	"	+162	03	"	+68	57
Eclipse ends	"	21	20	59	"	+138	25	"	+35	41

Magnitude of greatest eclipse = 0.778 (Sun's diameter = 1.0).

THE SKY MONTH BY MONTH

By P. M. Millman

THE SKY FOR JANUARY, 1938

The times of transit are given in local mean time, 0h at midnight; 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 43m to 20h 56m, and its Decl. changes from 23° 4′ S. to 17° 21′ S. The equation of time (see p. 7) increases from +3m 14s to +13m 35s. Owing 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 sunrise, that is, the forenoons as indicated by our clocks are of the same length. On the 20th of the month the sun enters the sign Aquarius, the second winter zodiacal sign. It must be remembered that the signs of the zodiac are quite independent of the constellations of the zodiac. Though bearing constellation names the signs are all exactly 30° of longitude in length, and commence at the first point of Aries, which point moves steadily westward, owing to precession. The sun is actually in the constellations Sagittarius and Capricornus during January. The earth is nearest the sun, that is in perihelion, on January 3.

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

Mercury on the 15th is in R.A. 18h 4m, Decl. 21° 10′ S. and transits at 10.28. It is at greatest elongation west of the sun on the 20th near which date it may be glimpsed in the south-east shortly before sunrise. Though Mercury rises about an hour and a half before the sun this is not a particularly favourable elongation for its observation since the planet is only 11 degrees above the horizon at sunrise.

Venus on the 15th is in R.A. 19h 24m, Decl. 22° 42′ S. and transits at 11.50. It is fast approaching the sun in the morning sky and is too close to that body to be favourably observed this month.

Mars on the 15th is in R.A. 23h 18m, Decl. 5° 14′ S. and transits at 15.42. It is still visible as a red star of the 1st magnitude in the western evening sky in the constellation Aquarius.

Jupiter on the 15th is in R.A. 20h 34m, Decl. 19° 19′ S. and transits at 12.56. It is in conjunction with the sun on the 29th at which time it enters the morning sky. It is too near the sun for convenient observation during the month. 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. 0h 4m, Decl. 2° 5′ S. and transits at 16.25. It is a yellow star in the evening sky of magnitude +1.2 and is on the meridian at sunset. For the elongations, etc., of its satellites see p. 55.

Uranus on the 15th is in R.A. 2h 30m, Decl. 14° 21′ N. and transits at 18.51.

Neptune on the 15th is in R.A. 11h 29m, Decl. 4° 36′ N. and transits at 3.52.

Pluto—For information regarding this planet, see p. 28.

ASTRONOMICAL PHENOMENA MONTH BY MONTH

By Ruth J. Northcott

JANUARY

75th Meridian Civil Time

	d	h	m	Phenomenon		Min. of Algol h m	Config. of Jupiter's Sat. 17h 30m
Sat.	1	2	31	☌ ☿ ☾	☿ 0° 24′ N.		34O12
		13	58	● New Moon.			
Sun.	2	6		☌ ☿ ♀	☿ 3° 16′ N.		43O2*
Mon.	3	3		⊕ in Perihelion. Dist. from ☉, 91,345,000 mi.		08 30	4213O
		13	20	☌ ♃ ☾	♃ 5° 05′ S.		
Tue.	4						42O13
Wed.	5	18		☿ Greatest Hel. Lat. N.			41O23
Thu.	6	19	09	☌ ♂ ☾	♂ 6° 23′ S.	05 20	d4O13
Fri.	7						4213O
Sat.	8	4	12	☌ ♄ ☾	♄ 7° 31′ S.		34O12
Sun.	9	9	13	☽ First Quarter		02 10	31O2*
		15		☿ Stationary in R.A.			
Mon.	10	23	19	☌ ♅ ☾	♅ 2° 42′ S.		d23O4
Tue.	11					23 00	2O134
Fri.	14	21		Moon in Perigee. Dist. from ⊕, 223,200 mi.		19 50	
Sun.	16	0	53	○ Full Moon.			
Mon.	17					16 40	
Tue.	18	4		♅ Stationary in R.A.			
Thu.	20	1	48	☌ ♆ ☾	♆ 6° 29′ N.	13 30	
		18		☿ Greatest elongation W., 24° 17′.			
Sun.	23	3	09	☾ Last Quarter		10 20	
Wed.	26					07 00	
Thu.	27	1		Moon in Apogee. Dist. from ⊕, 252,000 mi.			
Sat.	29	4		☿ in ☋		03 50	
		8	09	☌ ☿ ☾	☿ 3° 28′ S.		
		18		☌ ♃ ☉			
Sun.	30	3		□ ♅ ☉			
		20		☌ ♀ ♃	♀ 0° 37′ S.		
Mon.	31	8	35	● New Moon.			
		9	00	☌ ♃ ☾	♃ 5° 24′ S.		
		10	16	☌ ♀ ☾	♀ 6° 04′ S.		

Explanation of symbols and abbreviations on p. 4, of time on p. 6. Jupiter being near the Sun, phenomena of the Satellites are not given from January 12 to March 27.

THE SKY FOR FEBRUARY, 1938

The times of transit are given in local mean time, 0h at midnight; 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 56m to 22h 45m and its Decl. changes from 17° 21′ S. to 7° 55′ S. The equation of time reaches a maximum value of +14m 22s on the 11th (see p. 7). For changes in the length of the day see p. 11. On the 19th the sun enters the sign Pisces, the third winter sign of the zodiac.

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

Mercury on the 15th is in R.A. 21h 51m, Decl. 19° 30′ S. and transits at 11.15. During the month it is too near the sun for observation.

Venus on the 15th is in R.A. 22h 4m, Decl. 13° 23′ S. and transits at 12.27. It is in superior conjunction with the sun on the 4th at which time it enters the evening sky. Venus is too close to the sun for observation in February.

Mars on the 15th is in R.A. 0h 43m, Decl. 4° 22′ N. and transits at 15.04. It is 40 degrees above the south-west horizon at sunset and sets 4 hours after the sun.

Jupiter on the 15th is in R.A. 21h 3m, Decl. 17° 24′ S. and transits at 11.24. It is very near the sun in the morning sky and not well placed for observation.

Saturn on the 15th is in R.A. 0h 14m, Decl. 0° 52′ S. and transits at 14.34. It sets about three hours after the sun in the evening sky.

Uranus on the 15th is in R.A. 2h 31m, Decl. 14° 28′ N. and transits at 16.50.

Neptune on the 15th is in R.A. 11h 27m, Decl. 4° 51′ N. and transits at 1.48.

Pluto—For information regarding this planet, see p. 28.

FEBRUARY

75th Meridian Civil Time

	d	h	m	Phenomenon		Min. of Algol h	Min. of Algol m	Config. of Jupiter's Sat.
Tue.	1	10		♀ in Aphelion		00	40	
Wed.	2	15		☌ ♂ ♄	♂ 2° 01′ N.			
Thu.	3	22		☌ ♀ ☉	Superior	21	30	
Fri.	4	13	27	☌ ♄ ☾	♄ 7° 06′ S.			
		15	48	☌ ♂ ☾	♂ 4° 59′ S.			
Sat.	5							
Sun.	6					18	20	
Mon.	7	5	43	☌ ♅ ☾	♅ 2° 25′ S.			
		19	32	☽ First Quarter.				
Tue.	8	11		☿ in Aphelion.				
Wed.	9					15	10	
Thu.	10							
Fri.	11							
Sat.	12	1		Moon in Perigee. Dist. from ⊕, 226,200 mi.		12	00	
Sun.	13							
Mon.	14	12	14	🌕 Full Moon.				
Tue.	15					08	50	
Wed.	16	10	57	☌ ♆ ☾	♆ 6° 20′ N.			
Thu.	17	0		☌ ☿ ♃	☿ 1° 23′ S.			
Fri.	18					05	40	
Sat.	19							
Sun.	20							
Mon.	21	23	24	☾ Last Quarter		02	30	
Tue.	22							
Wed.	23	19		♀ Greatest Hel. Lat. S.		23	10	
		20		Moon in Apogee. Dist. from ⊕, 251,400 mi.				
Thu.	24							
Fri.	25							
Sat.	26					20	00	
Sun.	27							
Mon.	28	5	38	☌ ♃ ☾	♃ 5° 45′ S.			
		18		☿ Greatest Hel. Lat. S.				

Explanation of symbols and abbreviations on p. 4, of time on p. 6. Jupiiter being near the Sun, phenomena of the Satellites are not given from January 12 to March 27.

THE SKY FOR MARCH, 1938

The times of transit are given in local mean time, 0h at midnight; 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 45m to 0h 39m and its Decl. changes from 7° 55′ S. to 4° 12′ N. The equation of time decreases from +12m 39s to +4m 14s (see p. 7). For changes in the length of the day see p. 12. The sun crosses the equator on its journey north on the 21st of the month at 6h 43m G.C.T. It is at the vernal equinox at this time and spring commences, day and night being approximately equal all over the world.

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

Mercury on the 15th is in R.A. 0h 1m, Decl. 0° 48′ S. and transits at 12.36. The most favourable elongation east of the sun occurs at the beginning of April and for the last week in March Mercury is well placed for observation in the western sky after sunset, appearing almost due west.

Venus on the 15th is in R.A. 0h 14m, Decl. 0° 8′ N. and transits at 12.47. It is slowly separating from the sun in the western evening sky but still sets too soon after sunset to be well observed.

Mars on the 15th is in R.A. 1h 59m, Decl. 12° 18′ N. and transits at 14.30. It is slowly approaching the sun in the western evening sky and growing fainter as it nears conjunction with the sun. It is a red star of magnitude +1.4 setting a little over three hours after the sun.

Jupiter on the 15th is in R.A. 21h 29m, Decl. 15° 33′ S. and transits at 9.59. It is still poorly placed for observation in the morning sky, rising about an hour before the sun. 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. 0h 26m, Decl. 0° 28′ N. and transits at 12.56. It is in conjunction with the sun on the 29th and too near that body for observation during the month.

Uranus on the 15th is in R.A. 2h 35m, Decl. 14° 46′ N. and transits at 15.04.

Neptune on the 15th is in R.A. 11h 24m, Decl. 5° 9′ N. and transits at 23.51.

Pluto—For information regarding this planet, see p. 28.

MARCH

75th Meridian Civil Time

Day	d	h	m	Phenomenon			Min. of Algol h m	Config. of Jupiter's Sat. 6h 15m
Tue.	1	17		♂ in ☊			16 50	
		18	59	☌ ☿ ☾	☿	7° 33′ S.		
Wed.	2	0	40	● New Moon.				
		18	47	☌ ♀ ☾	♀	6° 39′ S.		
Thu.	3							
Fri.	4	0	47	☌ ♄ ☾	♄	6° 43′ S.	13 40	
Sat.	5	9	51	☌ ♂ ☾	♂	2° 57′ S.		
Sun.	6	12	14	☌ ♅ ☾	♅	2° 05′ S.		
Mon.	7						10 30	
Tue.	8	7		☌ ☿ ☉ Superior.				
Wed.	9	3	35	◐ First Quarter.				
Thu.	10	19		☍ ♆ ☉		Dist. from ⊕, 2,714,000,000 mi.	07 20	
Fri.	11	3		Moon in Perigee. Dist. from ⊕, 229,500 mi.				
Sat.	12							
Sun.	13						04 10	
Mon.	14							
Tue.	15	19	16	☌ ♆ ☾	♆	6° 18′ N.		
Wed.	16	0	15	○ Full Moon			01 00	
Thu.	17	19		☌ ♀ ♄	♀	1° 04′ N.		
Fri.	18	14		☌ ☿ ♄	☿	2° 07′ N.	21 50	
Sat.	19	19		☿ in ☊.				
Sun.	20	0		☌ ☿ ♀	☿	1° 17′ N.		
Mon.	21	1	43	☉ enters ♈, Spring commences. Long. of ☉, 0°.			18 30	
Tue.	22							
Wed.	23	16		Moon in Apogee. Dist. from ⊕, 251,100 mi.				
		20	06	☾ Last Quarter.				
Thu.	24	10		☿ in Perihelion			15 20	
Fri.	25							
Sat.	26							
Sun.	27						12 10	
Mon.	28	2	13	☌ ♃ ☾	♃	6° 06′ S.		431O2
		17		☌ ♂ ♅	♂	0° 44′ N.		
Tue.	29	3		☌ ♄ ☉				43O21
Wed.	30						09 00	4321O
Thu.	31	13	52	● New Moon				4O31*
		14	35	☌ ♄ ☾	♄	6° 27′ S.		

Explanation of symbols and abbreviations on p. 4, of time on p. 6. Jupiter being near the Sun, phenomena of the Satellites are not given from January 12 to March 27.

THE SKY FOR APRIL, 1938

The times of transit are given in local mean time, 0h at midnight; 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 39m to 2h 30m and its Decl. changes from 4° 12′ N. to 14° 48′ N. The equation of time changes from +4m 14s to —2m 50s (see p. 7). For changes in the length of the day see p. 13. On the 20th the sun enters the sign Taurus, the second spring sign of the zodiac.

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

Mercury on the 15th is in R.A. 2h 7m, Decl. 15° 53′ N. and transits at 12.33. Greatest elongation east of the sun takes place on the 2nd and this is the most favourable time of the year for observing Mercury. It is 19 degrees above the western horizon. at sunset and sets almost two hours after the sun, appearing as a reddish star of magnitude 0.

Venus on the 15th is in R.A. 2h 37m, Decl. 15° 4′ N. and transits at 13.08. It sets about an hour and a half after the sun, being 15 degrees above the western horizon at sunset. Its magnitude is faint for Venus, —3.3.

Mars on the 15th is in R.A. 3h 26m, Decl. 19° 14′ N. and transits at 13.55. It is visible for a few hours after sunset as a red star, low in the west. It is in fairly close conjunction with the moon on the 3rd.

Jupiter on the 15th is in R.A. 21h 53m, Decl. 13° 37′ S. and transits at 8.21. It is in the morning sky rising about two hours before the sun and appears as a star of magnitude —1.7. 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. 0h 40m, Decl. 1° 58′ N. and transits at 11.08. It has just entered the morning sky but is too near the sun for observation this month.

Uranus on the 15th is in R.A. 2h 41m, Decl. 15° 15′ N. and transits at 13.08.

Neptune on the 15th is in R.A. 11h 21m, Decl. 5° 27′ N. and transits at 21.46.

Pluto—For information regarding this planet, see p. 28.

APRIL

75th Meridian Civil Time

	d	h	m		Min. of Algol h	m	Config. of Jupiter's Sat. 5h 30m
Fri.	1	18	22	☌ ♀ ☾ ♀ 3° 39′ S.			41O23
Sat.	2	0	51	☌ ☿ ☾ ☿ 0° 11′ N.	05	50	d42O3
		16		☿ Greatest elongation E., 19° 05′			
		20	56	☌ ♅ ☾ ♅ 1° 49′ S.			
Sun.	3	2	46	☌ ♂ ☾ ♂ 0° 42′ S.			42O13
		17		☿ Greatest Hel. Lat. N.			
Mon.	4	23		Moon in Perigee. Dist. from ⊕, 229,000 mi.....			31O2*
Tue.	5			....	02	40	3O124
Wed.	6			....			321O4
Thu.	7	10	10	☽ First Quarter	23	30	2O14*
Fri.	8	11		☌ ☿ ♀ ☿ 3° 52′ N.			1O234
Sat.	9			....			dO134
Sun.	10			....	20	20	2O134
Mon.	11	12		☿ Stationary in R.A.			31O24
Tue.	12	1	42	☌ ♆ ☾ ♆ 6° 23′ N.			3O412
Wed.	13			....	17	10	3421O
Thu.	14	13	21	○ Full Moon			42O1*
Fri.	15	15		☌ ♀ ♅ ♀ 0° 09′ N.			41O23
Sat.	16			....	13	50	4O213
Sun.	17			....			42O3*
Mon.	18			....			431O2
Tue.	19			....	10	40	43O12
Wed.	20	12		Moon in Apogee. Dist. from ⊕, 251,400 mi.....			3421O
Thu.	21	2		♀ in ☊			23O41
		17		☌ ☿ ☉ Inferior			
Fri.	22	15	14	☾ Last Quarter	07	30	1O324
Sat.	23			....			O2134
Sun.	24	21	07	☌ ♃ ☾ ♃ 6° 23′ S.			21O34
Mon.	25			....	04	20	ddO4*
Tue.	26			....			3O124
Wed.	27	3		☿ in ☋			312O4
Thu.	28	5	54	☌ ♄ ☾ ♄ 6° 17′ S.	01	10	23O14
Fri.	29	5	14	☌ ☿ ☾ ☿ 3° 23′ S.			1O432
Sat.	30	0	28	● New Moon	22	00	4O213
		8	18	☌ ♅ ☾ ♅ 1° 38′ S.			

Explanation of symbols and abbreviations on p. 4, of time on p. 6

The times of transit are given in local mean time, 0h at midnight; 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 30m to 4h 33m and its Decl. changes from 14° 48′ N. to 21° 56′ N. The equation of time decreases from —2m 50s to a minimum of —3m 46s on the 15th and then increases to —2m 29s at the end of the month (see p. 7). For changes in the time of sunrise and sunset see p. 14. On May 21 the sun enters the sign Gemini. This is the third spring sign of the zodiac. On May 29 there is a total eclipse of the sun, invisible in this hemisphere. For details see p. 29.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. There is a total eclipse of the moon on May 14, visible over most of the North American continent. For details see p. 29.

Mercury on the 15th is in R.A. 1h 51m, Decl. 7° 58′ N. and transits at 10.22. It is at its greatest elongation west of the sun on the 19th and at that time will be in the morning sky. This is not a favourable elongation for observing Mercury as it rises barely 50 minutes before the sun and is only 8 degrees above the horizon at sunrise.

Venus on the 15th is in R.A. 5h 9m, Decl. 23° 56′ N. and transits at 13.41. It is 20 degrees above the horizon at sunset and sets a little over two hours after the sun. Venus is in fairly close conjunction with the moon on the 1st and with Mars on the 8th. The two planets will be within 2 minutes of arc of each other at this time, that is about half the distance between the components of ϵ Lyrae. Though Mars is becoming quite faint for observation in the sunset sky, being of the second magnitude, the pair should be a very interesting sight in binoculars or small telescopes. The distance between the planets will be small for some days before and after the above date.

Mars on the 15th is in R.A. 4h 52m, Decl. 23° 17′ N. and transits at 13.23. It now sets about two and a half hours after the sun and is of the second magnitude so that it is not very conspicuous. It is in close conjunction with Venus on the 8th, see above.

Jupiter on the 15th is in R.A. 22h 10m, Decl. 12° 13′ S. and transits at 6.40. It now rises three hours before the sun in the eastern sky and is about 25 degrees above the south-east horizon at sunrise. Quadrature with the sun is on the 22nd. 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. 0h 53m, Decl. 3° 16′ N. and transits at 9.23. It is in the morning sky but not very well placed for observation, rising about one and a half hours before the sun.

Uranus on the 15th is in R.A. 2h 48m, Decl. 15° 47′ N. and transits at 11.17.

Neptune on the 15th is in R.A. 11h 19m, Decl. 5° 37′ N. and transits at 19.47.

Pluto—For information regarding this planet, see p. 28.

MAY

75th Meridian Civil Time

	d	h	m		Min. of Algol h	m	Config. of Jupiter's Sat. 4h 15m
Sun.	1	14	04	☌ ♀ ☾ ♀ 0° 57′ N.			42103
		19	38	☌ ♂ ☾ ♂ 1° 27′ N.			
Mon.	2	8		Moon in Perigee. Dist. from ⊕, 225,900 mi.			4031*
Tue.	3				18	50	4302*
Wed.	4	1		☿ Stationary in R.A.			43120
		15		☌ ♅ ⊙.			
Thu.	5						43201
Fri.	6	16	24	☽ First Quarter	15	40	41032
Sat.	7	10		☿ in Aphelion			0123*
		19		☌ ♀ ♂ ♀ 0° 02′ N.			
Sun.	8						21043
Mon.	9	6	45	☌ ♆ ☾ ♆ 6° 29′ N.	12	30	20134
Tue.	10						3024*
Wed.	11						dd304
Thu.	12				09	10	32014
Fri.	13						1024*
Sat.	14	3	39	○ Full Moon. Total Eclipse of ☾, see p. 29			01234
Sun.	15				06	00	21043
Mon.	16						d2013
Tue.	17						43102
Wed.	18	4		Moon in Apogee. Dist. from ⊕, 251,900 mi.	02	50	43012
Thu.	19	9		☿ Greatest elongation W., 25° 37′			43201
Fri.	20				23	40	41302
Sat.	21						40123
Sun.	22	7	36	☾ Last Quarter			41203
		10		□ ♃ ⊙			
		12	18	☌ ♃ ☾ ♃ 6° 32′ S.			
Mon.	23				20	30	42013
Tue.	24	19		♀ in Perihelion			13402
Wed.	25	20	53	☌ ♄ ☾ ♄ 6° 09′ S.			30124
Thu.	26				17	20	3204*
Fri.	27	18		☿ Greatest Hel. Lat. S.			104**
		18	07	☌ ☿ ☾ ☿ 4° 24′ S.			
		21	07	☌ ♅ ☾ ♅ 1° 29′ S.			
Sat.	28						01324
Sun.	29	5		☌ ☿ ♅ ☿ 2° 35′ S.			
		9	00	● New Moon. Total Eclipse of ⊙, see p. 29.	14	10	12034
Mon.	30	12		Moon in Perigee. Dist. from ⊕, 223,300 mi.			20134
		12	54	☌ ♂ ☾ ♂ 3° 20′ N.			
		15		♆ Stationary in R.A.			
Tue.	31	10	52	☌ ♀ ☾ ♀ 5° 06′ N.			13024

THE SKY FOR JUNE, 1938

The times of transit are given in local mean time, 0h at midnight; 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 33m to 6h 37m and its Decl. changes from 21° 56′ N. to its maximum value of 23° 27′ N. on the 22nd and then drops to 23° 10′ N. at the end of the month. At 2h 4m G.C.T. on the 22nd of the month the sun is at the summer solstice and enters the sign Cancer, the first summer zodiacal sign. Summer commences at this time. The duration of daylight is now greatest and does not change appreciably for some days, see p. 15. For changes in the equation of time see p. 7. 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 at the end of June and the beginning of July.

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

Mercury on the 15th is in R. A. 4h 49m, Decl. 22° 16′ N. and transits at 11.22. It is too near the sun for observation during June.

Venus on the 15th is in R.A. 7h 52m, Decl. 22° 50′ N. and transits at 14.22. Its apparent distance from the sun will continue to increase until the middle of September but, owing to the unfavourable lie of the ecliptic combined with the inclination of the planet's orbit, Venus will gradually become more poorly placed for observation in the evening sky as the year advances. It now sets about two hours after the sun a little north of the west point.

Mars on the 15th is in R.A. 6h 23m, Decl. 24° 16′ N. and transits at 12.52. It is rapidly approaching the sun in the evening sky and not well placed for observation.

Jupiter on the 15th is in R.A. 22h 18m, Decl. 11° 35′ S. and transits at 4.46. It is growing brighter in the morning sky and is well in view for the second half of the night in the constellation Aquarius. For the configurations of its satellites see next page, and for their eclipses, etc., see p. 54. Jupiter reaches a stationary point in its orbit and commences to retrograde on the 22nd.

Saturn on the 15th is in R.A. 1h 4m, Decl. 4° 15′ N. and transits at 7.31. It is a yellow star of the first magnitude rising several hours before the sun in the morning sky. For the elongations, etc., of its satellites see p. 55.

Uranus on the 15th is in R.A. 2h 54m, Decl. 16° 16′ N. and transits at 9.22.

Neptune on the 15th is in R.A. 11h 19m, Decl. 5° 37′ N. and transits at 17.45.

Pluto—For information regarding this planet, see p. 28.

JUNE

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 3h 00m
Wed.	1				11 00	30124
Thu.	2					32140
Fri.	3					d4320
Sat.	4	23	32	☽ First Quarter	07 50	40132
Sun.	5	12	06	☌ ♆ ☾ ♆ 6° 27′ N.		d4103
Mon.	6					42013
Tue.	7				04 40	41032
Wed.	8					43012
Thu.	9	17		□ ♆ ☉		34210
Fri.	10				01 20	32401
Sat.	11					0342*
Sun.	12	18	47	○ Full Moon	22 10	10234
Mon.	13					20134
Tue.	14	13		Moon in Apogee. Dist. from ⊕, 252,400 mi.		10234
Wed.	15	14		♀ Greatest Hel. Lat. N.	19 00	30124
		19		☿ in ☊.		
Thu.	16					32104
Fri.	17					32014
Sat.	18	22	05	☌ ♃ ☾ ♃ 6° 34′ S.	15 50	0342*
Sun.	19					d4023
Mon.	20	9		☿ in Perihelion		42013
		20	52	☾ Last Quarter.		
Tue.	21	21	04	☉ enters ♋, Summer commences. Long. of ☉, 90°	12 40	4103*
Wed.	22	0		♃ Stationary in R.A.		43012
		9	36	☌ ♄ ☾ ♄ 5° 59′ S.		
		16		☌ ☿ ☉ Superior		
Thu.	23					43120
Fri.	24	9	29	☌ ♅ ☾ ♅ 1° 18′ S.	09 30	43201
Sat.	25					4102*
Sun.	26					d4023
Mon.	27	16	10	● New Moon	06 20	20143
		20		Moon in Perigee. Dist. from ⊕, 222,000 mi.		
Tue.	28	4	08	☌ ☿ ☾ ☿ 5° 29′ N.		1034*
		6	30	☌ ♂ ☾ ♂ 4° 53′ N.		
Wed.	29	3		☌ ☿ ♂ ☿ 0° 45′ N.		30124
Thu.	30	8	39	☌ ♀ ☾ ♀ 7° 13′ N.	03 10	31204
		16		☿ Greatest Hel. Lat. N.		

Explanation of symbols and abbreviations on p. 4, of time on p. 6

THE SKY FOR JULY, 1938

The times of transit are given in local mean time, 0h at midnight; 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 37m to 8h 42m and its Decl. changes from 23° 10′ N. to 18° 15′ N. The equation of time increases from +3m 28s to a maximum of +6m 22s on the 22nd and then drops to +6m 15s at the end of the month. On the 23rd the sun enters the sign Leo, the second summer sign of the zodiac. For changes in the length of the day see p. 16. On the 3rd the earth is in aphelion, the point of its orbit furthest from the sun. For our distance from the sun at this time see opposite page.

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

Mercury on the 15th is in R.A. 9h 5m, Decl. 18° 00′ N. and transits at 13.38. It is in the evening sky and on the 31st reaches its greatest elongation east, that is its greatest apparent distance from the sun in the western sky. It will, at this time be 12 degrees above the horizon at sunset and set about an hour and a quarter after the sun, the stellar magnitude being +0.6. This is not an especially favourable elongation but, given a clear horizon, it should be possible to see the planet for the last week in July.

Venus on the 15th is in R.A. 10h 14m, Decl. 12° 33′ N. and transits at 14.45. It is a brilliant white star in the western evening sky, setting two hours after the sun.

Mars on the 15th is in R.A. 7h 48m, Decl. 22° 12′ N. and transits at 12.18. It is in conjunction with the sun on the 24th and too near that body for observation during July.

Jupiter on the 15th is in R.A. 22h 15m, Decl. 12° 0′ S. and transits at 2.45. It is approaching opposition with the sun and is in view for the major part of the night, rising shortly after sunset. It has brightened to magnitude —2.3. 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. 1h 10m, Decl. 4° 43′ N. and transits at 5.39. It is in quadrature on the 10th and rises over 5 hours before the sun. For the elongations, etc., of its satellites see p. 55.

Uranus on the 15th is in R.A. 2h 59m, Decl. 16° 37′ N. and transits at 7.29.

Neptune on the 15th is in R.A. 11h 21m, Decl. 5° 25′ N. and transits at 15.49.

Pluto—For information regarding this planet, see p. 28.

JULY

75th Meridian Civil Time

	d	h	m		Min. of Algol h	m	Config. of Jupiter's Sat. 2h 15m
Fri.	1			....			32O14
Sat.	2	19	27	☌ ♆ ☾ ♆ 6° 17′ N..................			1O24*
		23		⊕ in Aphelion. Dist. from ☉, 94,452,000 mi...			
Sun.	3			....	00	00	O1234
Mon.	4	8	47	☽ First Quarter........................			2O43*
Tue.	5			....	20	40	21O43
Wed.	6			....			43O12
Thu.	7			....			d431O
Fri.	8			....	17	30	432O1
Sat.	9			....			413O2
Sun.	10	10		□ ♄ ☉....................................			4O123
Mon.	11	16		Moon in Apogee. Dist. from ⊕, 252,500 mi.....	14	20	421O3
Tue.	12	10	04	🌕 Full Moon..............................			d42O3
Wed.	13			....			43O12
Thu.	14			....	11	10	31O24
Fri.	15			....			32O14
Sat.	16	2	04	☌ ♃ ☾ ♃ 6° 33′ S..................			13O24
Sun.	17			....	08	00	O1324
Mon.	18			....			21O34
Tue.	19	18	39	☌ ♄ ☾ ♄ 5° 50′ S..................			2O134
Wed.	20	7	19	☾ Last Quarter............................	04	50	dO124
Thu.	21	19	39	☌ ♅ ☾ ♅ 1° 02′ S..................			31O24
Fri.	22			....			324O1
Sat.	23			....	01	40	431O2
Sun.	24	3		☿ in ☋..................................			4O312
		14		☌ ♂ ☉.			
Mon.	25			....	22	30	421O3
Tue.	26	6		Moon in Perigee. Dist. from ⊕, 222,500 mi.....			42O13
		22	54	🌑 New Moon.			
		23	57	☌ ♂ ☾ ♂ 5° 59′ N.			
Wed.	27			....			4O32*
Thu.	28	23	57	☌ ☿ ☾ ☿ 4° 24′ N..................	19	20	431O2
Fri.	29			....			342O1
Sat.	30	3	36	☌ ♀ ☾ ♀ 5° 43′ N..................			31O**
		5	18	☌ ♆ ☾ ♆ 6° 03′ N.			
Sun.	31	2		☌ ♀ ♆ ♀ 0° 26′ S..................	16	10	O3142
		12		☿ Greatest elongation E., 27° 15′.			
		21		♄ Stationary in R.A.			

Explanation of symbols and abbreviations on p. 4, of time on p. 6

THE SKY FOR AUGUST, 1938

The times of transit are given in local mean time, 0h at midnight; 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 42m to 10h 38m and its Decl. decreases from 18° 15′ N. to 8° 37′ N. The equation of time decreases from +6m 15s to +0m 16s, see p. 7. The sun enters the sign Virgo, the third summer zodiacal sign, on the 23rd. For changes in the length of the day see p. 17.

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

Mercury on the 15th is in R.A. 10h 49m, Decl. 3° 14′ N. and transits at 13.14. During the first week in August it may be just glimpsed in the western sky shortly after sunset. For the remainder of the month it is too near the sun for observation.

Venus on the 15th is in R.A. 12h 21m, Decl. 2° 37′ S. and transits at 14.50. It is increasing slightly in brightness as it approaches greatest elongation but, owing to its rapid southward motion, is steadily slipping back into the twilight sky. It is only about 17 degrees above the south-west horizon at sunset and sets an hour and a half after the sun.

Mars on the 15th is in R.A. 9h 10m, Decl. 17° 29′ N. and transits at 11.39. It is faint and too near the sun to be well observed during the month.

Jupiter on the 15th is in R.A. 22h 3m, Decl. 13° 16′ S. and transits at 0.31. It is in opposition with the sun on the 21st and throughout August is in view all night appearing as a bright yellow star of magnitude —2.4. 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. 1h 10m, Decl. 4° 36′ N. and transits at 3.37. It is at a stationary point in its orbit on the 1st and commences to retrograde at this time. Saturn is well in view for the second half of the night. For the elongations, etc., of its satellites see p. 55.

Uranus on the 15th is in R.A. 3h 2m, Decl. 16° 47′ N. and transits at 5.29.

Neptune on the 15th is in R.A. 11h 24m, Decl. 5° 3′ N. and transits at 13.50.

Pluto—For information regarding this planet, see p. 28.

AUGUST

75th Meridian Civil Time

Day	d	h	m	Phenomena			Min. of Algol h	m	Config. of Jupiter's Sat. 1h 00m
Mon.	1								12O34
Tue.	2	21	00	☽	First Quarter				2O134
Wed.	3	9		☿ in Aphelion			12	50	1O324
Thu.	4								d3O24
Fri.	5								32O14
Sat.	6						09	40	312O4
Sun.	7	22		Moon in Apogee. Dist. from ⊕, 252,100 mi.					O412*
Mon.	8								d14O3
Tue.	9						06	30	42O13
Wed.	10	15		♀ in ♉					41O23
		21		□♅☉					
Thu.	11	0	57	○	Full Moon				43O12
Fri.	12	2	08	☌♃☾	♃	6° 33′ S.	03	20	432O*
Sat.	13	15		☿	Stationary in R.A.				4321O
Sun.	14								4O12*
Mon.	15						00	10	d41O3
Tue.	16	0	03	☌♄☾	♄	5° 43′ S.			2O413
Wed.	17						21	00	1O234
Thu.	18	2	49	☌♅☾	♅	0° 45′ S.			3O124
		15	30	☾	Last Quarter.				
Fri.	19								321O4
Sat.	20	19		☍♃☉	Dist. from ⊕, 373,000,000 mi.		17	50	321O4
Sun.	21								3O124
Mon.	22								1O234
Tue.	23	12		Moon in Perigee. Dist. from ⊕, 224,700 mi.			14	40	2O143
		17		☿	Greatest Hel. Lat. S.				
		23		♅	Stationary in R.A.				
Wed.	24	16	46	☌♂☾	♂	6° 31′ N.			1O423
Thu.	25	6	17	●	New Moon				43O12
		14	51	☌☿☾	☿	0° 21′ N.			
Fri.	26	16	47	☌♆☾	♆	5° 52′ N.	11	20	4321O
Sat.	27								d432O
Sun.	28	4		☌☿☉	Inferior				43O12
		18	22	☌♀☾	♀	1° 03′ N.			
Mon.	29						08	10	41O23
Tue.	30								42O13
Wed.	31								41O3*

Explanation of symbols and abbreviations on p. 4, of time on p. 6

THE SKY FOR SEPTEMBER, 1938

The times of transit are given in local mean time, 0h at midnight; 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 38m to 12h 26m and its Decl. decreases from 8° 37′ N. to 2° 50′ S. The equation of time decreases from +0m 16s to —9m 59s. For changes in the length of the day see p. 18. On the 23rd the sun is at the autumnal equinox and crosses the equator going south. It enters Libra, the first autumn sign of the zodiac, at this time and autumn commences. Day and night are approximately equal all over the world (see p. 18).

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

Mercury on the 15th is in R.A. 10h 23m, Decl. 10° 50′ N. and transits at 10.51. Greatest elongation west of the sun takes place on the 13th and the two weeks centred about this date provide the best opportunity of the year for observing Mercury in the morning sky. The planet will rise an hour and a half before the sun and will be 18 degrees above the eastern horizon at sunrise.

Venus on the 15th is in R.A. 14h 17m, Decl. 17° 4′ S. and transits at 14.43. It is at greatest elongation east of the sun on the 11th but is poorly placed for observation because of its southern position. It is 12 degrees above the horizon at sunset and sets an hour and a half after the sun.

Mars on the 15th is in R.A. 10h 27m, Decl. 10° 57′ N. and transits at 10.53. It is in the morning sky but not well placed for observation, being a star of the second magnitude rising a little over an hour and a half before the sun.

Jupiter on the 15th is in R.A. 21h 48m, Decl. 14° 35′ S. and transits at 22.10. It is a bright star of magnitude —2.4, visible between Aquarius and Capricornus for most of the night. 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. 1h 4m, Decl. 3° 55′ N. and transits at 1.30. Its magnitude has now brightened to +0.5 and it rises shortly after sunset, being in view for the remainder of the night. For the elongations, etc., of its satellites see p. 55.

Uranus on the 15th is in R.A. 3h 1m, Decl. 16° 44′ N. and transits at 3.26.

Neptune on the 15th is in R.A. 11h 28m, Decl. 4° 37′ N. and transits at 11.52.

Pluto—For information regarding this planet, see p. 28.

SEPTEMBER

75th Meridian Civil Time

	d	h	m		Phenomenon	Min. of Algol h m	Config. of Jupiter's Sat. 23h 15m
						h m	
Thu.	1	12	28	☽	First Quarter	05 00	31204
Fri.	2	16		♂	Greatest Hel. Lat. N.		32014
Sat.	3						3024*
Sun.	4	12			Moon in Apogee. Dist. from ⊕, 251,600 mi.	01 50	10324
		15		☌ ☿ ♂	☿ 3° 32′ S.		
Mon.	5	22		☿	Stationary in R.A.		20134
Tue.	6					22 40	12034
Wed.	7						03124
Thu.	8	2	03	☌ ♃ ☾	♃ 6° 37′ S.		d3104
Fri.	9	15	08	○	Full Moon	19 30	32401
Sat.	10	22		♀	Greatest elongation E., 46° 19′		43102
Sun.	11	18		☿	in ☊		d4032
Mon.	12	3	22	☌ ♄ ☾	♄ 5° 45′ S.	16 20	42013
Tue.	13	16		☿	Greatest elongation W., 17° 54′		41203
Wed.	14	3		♀	in Aphelion		40312
		4		☌ ♆ ☉			
		7	48	☌ ♅ ☾	♅ 0° 32′ S.		
Thu.	15					13 10	d4310
Fri.	16	9		☿	in Perihelion		34201
		10		☌ ☿ ♂	☿ 0° 10′ S.		
		22	12	☾	Last Quarter.		
Sat.	17						3102*
Sun.	18					10 00	0124*
Mon.	19						2034*
Tue.	20	7			Moon in Perigee. Dist. from ⊕, 227,800 mi.		21034
Wed.	21					06 50	01324
Thu.	22	8	31	☌ ♂ ☾	♂ 6° 22′ N.		31024
		19	02	☌ ☿ ☾	☿ 6° 46′ N.		
Fri.	23	4	16	☌ ♆ ☾	♆ 5° 47′ N.		32014
		12	00	☉	enters ♎, Autumn comm. Long. of ☉ 180°.		
		15	34	●	New Moon.		
Sat.	24					03 30	3104*
Sun.	25						0142*
Mon.	26	0		☌ ☿ ♆	☿ 0° 50′ N.		4203*
		15		☿	Greatest Hel. Lat. N.		
Tue.	27	3	58	☌ ♀ ☾	♀ 4° 25′ S.	00 20	42103
Wed.	28						40132
Thu.	29					21 10	43102
Fri.	30						43201

Explanation of symbols and abbreviations on p. 4, of time on p. 6.

THE SKY FOR OCTOBER, 1938

The times of transit are given in local mean time, 0h at midnight; 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 26m to 14h 22m and its Decl. changes from 2° 50′ S. to 14° 9′ S. On the 24th the sun enters the sign Scorpio, the second autumnal sign of the zodiac. The equation of time decreases from —9m 59s to —16m 19s during the month. For changes in the length of the day see p. 19.

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

Mercury on the 15th is in R.A. 13h 30m, Decl. 8° 50′ S. and transits at 12.00. It is too near the sun for observation during October.

Venus on the 15th is in R.A. 15h 49m, Decl. 25° 52′ S. and transits at 14.16. It is at its position of greatest brilliance on the 16th at which time the planet has a magnitude —4.3. It is very poorly placed for observation, however, as it is only 6 degrees above the south-west horizon at sunset and sets just a little over 30 minutes after the sun. It reaches a stationary point in its orbit on the 30th and commences to retrograde, that is to move westward among the stars, at this time.

Mars on the 15th is in R.A. 11h 38m, Decl. 3° 39′ N. and transits at 10.06. It is slowly increasing its apparent distance from the sun in the morning sky but is not yet well placed for observation.

Jupiter on the 15th is in R.A. 21h 41m, Decl. 15° 9′ S. and transits at 20.05. It is gradually moving out of the morning sky and sets 5 hours before sunrise on the 15th. Jupiter ceases its retrograde motion and commences to move eastward again on the 19th. 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. 0h 56m, Decl. 3° 1′ N. and transits at 23.20. It is in opposition to the sun on the 8th and is visible all night during October, appearing as a yellow star of magnitude +0.4. For the elongations, etc., of its satellites see p. 55.

Uranus on the 15th is in R.A. 2h 58m, Decl. 16° 29′ N. and transits at 1.25.

Neptune on the 15th is in R.A. 11h 32m, Decl. 4° 12′ N. and transits at 9.58.

Pluto—For information regarding this planet, see p. 28.

OCTOBER

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 21h 30m
Sat.	1	6	45	☽ First Quarter		4312O
Sun.	2	6		Moon in Apogee. Dist. from ⊕, 251,200 mi.	18 00	43O12
Mon.	3					412O3
Tue.	4					2O143
Wed.	5	5	32	☌ ♃ ☾ ♃ 6° 43′ S.	14 50	O234*
Thu.	6	12		♀ Greatest Hel. Lat. S.		13O24
Fri.	7					32O14
Sat.	8	8		☍ ♄ ☉ Dist. from ⊕, 781,000,000 mi.	11 40	312O4
		21		♂ in Aphelion.		
Sun.	9	4	37	🌕 Full Moon		3O124
		7	05	☌ ♄ ☾ ♄ 5° 55′ S.		
Mon.	10	6		☌ ☿ ☉ Superior		d1O34
Tue.	11	12	41	☌ ♅ ☾ ♅ 0° 29′ S.	08 30	2O143
Wed.	12	4		☌ ♂ ♆ ♂ 0° 05′ N.		O423*
Thu.	13					413O2
Fri.	14				05 20	432O1
Sat.	15					4312O
Sun.	16	0		♀ Greatest Brilliancy		43O12
		3		Moon in Perigee. Dist. from ⊕, 230,000 mi.		
		4	24	☾ Last Quarter.		
Mon.	17				02 10	41O23
Tue.	18					42O13
Wed.	19	6		♃ Stationary in R.A.	22 00	41O23
Thu.	20	2		☿ in ☋		dd4O2
		14	06	☌ ♆ ☾ ♆ 5° 48′ N.		
		23	03	☌ ♂ ☾ ♂ 5° 33′ N.		
Fri.	21					32O1*
Sat.	22				19 40	321O4
Sun.	23	3	42	● New Moon		3O124
		21	35	☌ ☿ ☾ ☿ 0° 23′ N.		
Mon.	24					1O234
Tue.	25	18	47	☌ ♀ ☾ ♀ 7° 34′ S.	16 30	2O134
Wed.	26					1O34*
Thu.	27					O1324
Fri.	28				13 20	32O4*
Sat.	29					3214O
Sun.	30	2		Moon in Apogee. Dist. from ⊕, 251,300 mi.		43O12
		8		☿ in Aphelion.		
		16		♀ Stationary in R.A.		
Mon.	31	2	45	☽ First Quarter	10 10	41O2*

Explanation of symbols and abbreviations on p. 4, of time on p. 6

THE SKY FOR NOVEMBER, 1938

The times of transit are given in local mean time, 0h at midnight; 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 22m to 16h 26m, and its Decl. decreases from 14° 9′ S. to 21° 40′ S. On the 22nd the sun enters the sign Sagittarius, the third autumnal sign of the zodiac. The equation of time decreases from —16m 19s to a minimum value of —16m 22s on the 3rd and then increases to —11m 16s at the end of the month (see p. 7). For changes in the length of the day see p. 20. There is a partial eclipse of the sun on November 21, visible on the Pacific Coast just at sunset. For details see p. 29.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. There is a total eclipse of the moon on November 8, the ending visible over most of North America. For details see p. 29.

Mercury on the 15th is in R.A. 16h 38m, Decl. 24° 32′ S. and transits at 13.06. It reaches greatest elongation east of the sun in the evening sky on the 25th but will not be very favourably situated for observation. It will be about 7 degrees above the south-west horizon at sunset, setting under an hour after the sun.

Venus on the 15th is in R.A. 15h 49m, Decl. 24° 18′ S. and transits at 12.11. It is in inferior conjunction with the sun on the 20th and enters the morning sky at this time. Throughout the month it is too near the sun to be well observed.

Mars on the 15th is in R.A. 12h 50m, Decl. 4° 7′ S. and transits at 9.15. It rises several hours before the sun almost due east and is a red star of magnitude +1.9.

Jupiter on the 15th is in R.A. 21h 45m, Decl. 14° 42′ S. and transits at 18.08. It is in quadrature with the sun on the 16th, its magnitude having dropped to —2.0. It appears just to the east of the meridian at sunset. 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. 0h 48m, Decl. 2° 16′ N. and transits at 21.10. It is in view practically all night, setting shortly before sunrise. For the elongations, etc., of its satellites see p. 55.

Uranus on the 15th is in R.A. 2h 53m, Decl. 16° 8′ N. and transits at 23.14.

Neptune on the 15th is in R.A. 11h 36m, Decl. 3° 52′ N. and transits at 8.00.

Pluto—For information regarding this planet, see p. 28.

NOVEMBER

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 20h 15m
Tue.	1	14	07	☌ ♃ ☾ ♃ 6° 45′ S.		42O13
Wed.	2					412O3
Thu.	3				07 00	4O132
Fri.	4					4321O
Sat.	5	12	50	☌ ♄ ☾ ♄ 6° 04′ S.		d342O
Sun.	6				03 50	34O12
Mon.	7	17	23	🌕 Full Moon		1O24*
				Total Eclipse of Moon, see p. 29		
		19	21	☌ ♅ ☾ ♅ 0° 34′ S.		
Tue.	8	14		☌ ☿ ♀ ☿ 3° 15′ N.		2O134
		16		☍ ♅ ☉ Dist. from ⊕, 218,000,000 mi.		
Wed.	9				00 40	12O34
Thu.	10	23		Moon in Perigee. Dist. from ⊕, 227,600 mi.		O1324
Fri.	11				21 30	d31O4
Sat.	12					d32O4
Sun.	13					3O24*
Mon.	14	11	20	☾ Last Quarter	18 20	13O42
Tue.	15					24O13
Wed.	16	13		□ ♃ ☉		412O3
		21	33	☌ ♆ ☾ ♆ 5° 48′ N.		
Thu.	17				15 00	4O123
Fri.	18	12	38	☌ ♂ ☾ ♂ 4° 09′ N.		413O2
Sat.	19	16		☿ Greatest Hel. Lat. S.		432O1
Sun.	20	1		☌ ♀ ☉ Inferior	11 50	43O**
Mon.	21			Partial Eclipse of Sun, see p. 29		431O2
		12	29	☌ ♀ ☾ ♀ 3° 26′ S.		
		19	05	🌑 New Moon.		
Tue.	22					42O13
Wed.	23	16	18	☌ ☿ ☾ ☿ 5° 30′ S.	08 40	21O3*
Thu.	24					O1243
Fri.	25	6		☿ Greatest elongation E., 21° 51′		d1O24
Sat.	26	22		Moon in Apogee. Dist. from ⊕, 251,900 mi.	05 30	32O14
Sun.	27					31O4*
Mon.	28					d3O24
Tue.	29	3	12	☌ ♃ ☾ ♃ 6° 38′ S.	02 20	2O134
		22	59	☽ First Quarter.		
Wed.	30					21O43

Explanation of symbols and abbreviations on p. 4, of time on p. 6

THE SKY FOR DECEMBER, 1938

The times of transit are given in local mean time, 0h at midnight; 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 26m to 18h 42m and its Decl. changes from 21° 40′ S. to its extreme southerly value of 23° 27′ S. on the 22nd and then rises to 23° 6′ S. at the end of the month. At 12h 14m (G.C.T.) on the 22nd the sun enters Capricornus, the first winter sign of the zodiac. The sun is at the winter solstice at this time and winter commences. The length of daylight in the northern hemisphere is at a minimum and changes very slightly for several days (see p. 21). The equation of time changes from —11m 16s at the beginning of the month to +3m 6s at the end (see p. 7).

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

Mercury on the 15th is in R.A. 17h 21m, Decl. 21° 11′ S. and transits at 11.42. It will be too near the sun for observation during December.

Venus on the 15th is in R.A. 15h 13m, Decl. 15° 15′ S. and transits at 9.39. It is separating from the sun in the morning sky and by the end of the month is well placed for observation. It is at greatest brilliance on the 26th at which time it rises three and a half hours before the sun and is 26 degrees above the southern horizon at sunrise. It appears as a brilliant white star of magnitude —4.4. It should be possible to follow it on into the daylight at this time.

Mars on the 15th is in R.A. 14h 0m, Decl. 11° 10′ S. and transits at 8.27. It rises a little over four hours before the sun and is 32 degrees above the southern horizon at sunrise. It is brightening very slowly but is still of the second magnitude.

Jupiter on the 15th is in R.A. 22h 0m, Decl. 13° 22′ S. and transits at 16.25. It is visible as a bright yellow star in the south-western sky for the first half of the night. 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. 0h 45m, Decl. 2° 4′ N. and transits at 19.09. It is at a stationary point in its orbit on the 15th and sets 6 hours before sunrise, being well in view as a first magnitude star for the first half of the night. For the elongations, etc., of its satellites see p. 55.

Uranus on the 15th is in R.A. 2h 48m, Decl. 15° 49′ N. and transits at 21.12.

Neptune on the 15th is in R.A. 11h 37m, Decl. 3° 43′ N. and transits at 6.03.

Pluto—For information regarding this planet, see p. 28.

DECEMBER

75th Meridian Civil Time

	d	h	m		Min. of Algol h	m	Config. of Jupiter's Sat. 19h 15m
Thu.	1	19		♀ in ☊	23	10	O4123
Fri.	2	20	39	☌ ♄ ☾ ♄ 6° 02′ S.			41O32
Sat.	3						432O1
Sun.	4	12		☿ Stationary in R.A.	20	00	4312O
Mon.	5	3	59	☌ ♅ ☾ ♅ 0° 39′ S.			43O12
Tue.	6						42O3*
Wed.	7	5	22	○ Full Moon	16	50	421O3
Thu.	8	17		☿ in ☊			4O123
		20		Moon in Perigee. Dist. from ⊕, 224,200 mi.			
Fri.	9	8		♀ Stationary in R.A.			41O32
Sat.	10				13	40	32O41
Sun.	11						312O4
Mon.	12						3O124
Tue.	13	8		☿ in Perihelion	10	20	d1O4*
		20	17	☾ Last Quarter.			
Wed.	14	3	36	☌ ♆ ☾ ♆ 5° 43′ N.			21O34
		5		☌ ☿ ☉ Inferior.			
Thu.	15	16		♄ Stationary in R.A.			O1234
		17		□ ♆ ☉.			
Fri.	16				07	10	1O324
Sat.	17	1	57	☌ ♂ ☾ ♂ 2° 21′ N.			23O14
Sun.	18	11	02	☌ ♀ ☾ ♀ 2° 46′ N.			312O4
Mon.	19				04	00	34O12
Tue.	20	8	34	☌ ☿ ☾ ☿ 0° 33′ N.			413O2
Wed.	21	13	07	● New Moon			d42O3
Thu.	22	7	14	☉ enters ♑ Winter comm. Long. of ☉, 270°.	00	50	4O3**
Fri.	23	15		☿ Greatest Hel. Lat. N.			41O32
Sat.	24	7		☿ Stationary in R.A.	21	40	423O1
		14		Moon in Apogee. Dist. from ⊕, 252,400 mi.			
Sun.	25						4321O
Mon.	26	2		♀ Greatest Brilliancy			34O12
		11		♆ Stationary in R.A.			
		19	09	☌ ♃ ☾ ♃ 6° 22′ S.			
Tue.	27				18	30	13O2*
Wed.	28						2O134
Thu.	29	17	53	☽ First Quarter			O34**
Fri.	30	5	30	☌ ♄ ☾ ♄ 5° 44′ S.	15	20	1O234
Sat.	31						32O14

Explanation of symbols and abbreviations on p. 4, of time on p. 6

PHENOMENA OF JUPITER'S SATELLITES, 1938

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. (For other times see p. 6).

JANUARY

d	h	m	Sat.	Phen.
9	17	36	IV	OD

Jupiter being near the Sun, phenomena of the Satellites of Jupiter are not given from January 12 to March 27.

APRIL

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
2	05	08	I	Se	17	03	49	I	ED
7	04	32	III	OD	18	04	01	II	OR
9	04	17	II	Se		04	33	I	Te
	04	45	I	SI	25	04	14	I	TI
14	04	12	III	ED	26	03	46	I	OR
16	04	00	II	SI					

MAY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
2	03	57	II	ED	18	03	09	I	SI
4	02	55	I	Te		03	46	II	SI
	04	04	II	Te	19	04	03	I	OR
7	03	33	IV	ED	20	03	51	III	ER
10	04	00	I	ED		03	54	II	OR
11	02	34	I	TI	24	02	30	IV	ER
	03	32	I	Se	26	02	17	I	ED
	03	53	II	TI	27	01	47	I	Se
	04	02	II	Se		03	07	I	Te
16	01	58	IV	TI		04	12	III	ED
					29	01	19	II	Te
					31	03	04	III	Te

JUNE

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
2	04	11	I	ED		02	03	III	SI
3	01	24	I	SI	18	00	51	III	OR
	02	43	I	TI		01	17	IV	SI
	03	29	II	ED		02	27	I	ED
	03	40	I	Se	19	00	53	I	TI
4	02	19	I	OR		01	56	I	Se
5	01	02	II	TI		03	08	I	Te
	01	11	II	Se		03	33	II	SI
	03	53	II	Te	20	00	28	I	OR
7	01	39	III	Se	21	03	10	II	OR
	03	26	III	TI	24	23	50	III	ER
10	03	18	I	SI	25	01	00	III	OD
	04	06	IV	OD	26	01	33	I	SI
11	00	33	I	ED		02	42	I	TI
	04	10	I	OR		03	49	I	Se
12	00	56	II	SI	27	01	23	IV	OR
	01	18	I	Te		02	18	I	OR
	03	34	II	TI		23	25	I	Te
	03	48	II	Se	28	00	29	II	ED
14	00	43	II	OR	30	00	32	II	Te

JULY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
2	00	12	III	ED	5	00	12	I	Se
	03	49	III	ER		00	17	IV	Se
3	03	27	I	SI		01	12	I	Te
4	00	44	I	ED		03	03	II	ED
	04	06	I	OR	7	00	07	II	TI
	22	56	I	TI		00	56	II	Se

JULY—*Con.*

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
	02	56	II	Te	20	23	12	I	Te
9	04	12	III	ED	21	03	17	II	SI
11	02	39	I	ED	22	01	17	IV	Te
	23	49	I	SI	23	01	45	II	OR
12	00	43	I	TI	26	03	36	I	SI
	02	05	I	Se		04	14	I	TI
	02	59	I	Tэ	27	00	56	I	ED
13	00	20	I	OR		02	02	III	SI
	01	13	III	Te		03	51	I	OR
	04	03	IV	ED		04	32	III	TI
14	00	40	II	SI		22	05	I	SI
	02	28	II	TI		22	40	I	TI
	03	32	II	Se	28	00	22	I	Se
15	23	27	II	OR		00	57	I	Te
19	01	42	I	SI		22	17	I	OR
	02	29	I	TI	29	22	13	IV	ED
	03	59	I	Se	30	00	05	II	ED
	22	02	III	SI		03	00	IV	ER
	23	01	I	ED		03	23	IV	OD
20	01	10	III	TI		04	01	II	OR
	01	37	III	Se		21	55	III	OR
	02	05	I	OR	31	22	04	II	Se
	22	28	I	Se		23	03	II	Te

AUGUST

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
3	02	50	I	ED		22	14	IV	OR
	23	59	I	SI	16	21	37	II	OR
4	00	24	I	TI	18	03	47	I	SI
	02	16	I	Se		03	52	I	TI
	02	41	I	Te	19	01	08	I	ED
	21	19	I	ED		03	29	I	OR
5	00	01	I	OR		22	16	I	SI
	20	45	I	Se		22	17	I	TI
	21	07	I	Te	20	00	34	I	Se
6	02	41	II	ED		00	35	I	Te
7	01	13	III	OR		21	55	I	ER
	21	48	II	SI	21	04	15	III	OD
	22	29	II	TI	22	02	58	II	TI
8	00	40	II	Se		03	01	II	SI
	01	18	II	Te	23	21	02	II	OD
10	04	45	I	ED	24	00	02	II	ER
11	01	53	I	SI		01	19	IV	TI
	02	08	I	TI		02	04	IV	SI
	04	10	I	Se		21	12	III	Te
	04	25	I	Te		21	40	III	Se
	23	14	I	ED	26	02	55	I	OD
12	01	45	I	OR	27	00	01	I	TI
	20	21	I	SI		00	11	I	SI
	20	34	I	TI		02	18	I	Te
	22	39	I	Se		02	28	I	Se
	22	51	I	Te		21	21	I	OD
13	20	11	I	OR		23	50	I	ER
14	00	15	III	ED	28	20	44	I	Te
	04	30	III	OR		20	57	I	Se
15	00	25	II	SI	30	23	16	II	OD
	00	43	II	TI	31	02	39	II	ER
	03	16	II	Se		20	58	III	TI
	03	33	II	Te		22	06	III	SI

SEPTEMBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	00	28	III	Te	13	19	16	I	Se
	01	40	III	Se	15	22	52	II	TI
	21	09	II	Te	16	00	09	II	SI
	21	47	II	Se		01	41	II	Te
3	01	45	I	TI	17	21	11	II	ER
	02	06	I	SI		22	21	IV	OD
	23	05	I	OD	18	02	35	I	OD
4	01	44	I	ER		23	42	I	TI
	20	11	I	TI		23	55	III	ER
	20	34	I	SI	19	00	25	I	SI
	22	29	I	Te		01	59	I	Te
	22	52	I	Se		02	42	I	Se
5	20	13	I	ER		21	02	I	OD
7	01	31	II	OD	20	00	03	I	ER
8	00	15	III	TI		18	53	I	SI
	02	07	III	SI		20	26	I	Te
	20	35	II	TI		21	11	I	Se
	21	33	II	SI	23	01	10	II	TI
	23	25	II	Te	24	19	16	II	OD
9	00	23	II	Se		23	49	II	ER
	20	09	IV	Te	25	20	55	III	OD
	20	19	IV	SI	26	01	29	I	TI
	01	03	IV	Se		18	53	II	Se
11	00	50	I	OD		19	15	IV	Se
	19	54	III	ER		22	48	I	OD
	21	56	I	TI	27	01	58	I	ER
	22	29	I	SI		19	56	I	TI
12	00	14	I	Te		20	49	I	SI
	00	47	I	Se		22	13	I	Te
	19	16	I	OD		23	06	I	Se
	22	08	I	ER	28	20	27	I	ER

OCTOBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	21	38	II	OD	13	21	26	I	Se
3	00	25	III	OD		22	17	III	SI
	18	41	II	SI	14	18	46	I	ER
	19	31	II	Te	17	21	32	II	TI
	21	29	II	Se		23	53	II	SI
4	00	36	I	OD	18	00	21	II	Te
	21	44	I	TI	19	21	01	II	ER
	22	44	I	SI		22	43	I	OD
	23	01	IV	ED	20	19	52	I	TI
5	00	01	I	Te		21	05	I	SI
	01	01	I	Se		21	21	III	TI
	19	03	I	OD		22	09	I	Te
	22	22	I	ER		23	21	I	Se
6	18	15	III	SI	21	20	41	I	ER
	18	28	I	Te		21	49	IV	ER
	19	30	I	Se	24	20	01	III	ER
	21	45	III	Se		23	59	II	TI
9	00	02	II	OD	26	18	13	II	OD
10	19	06	II	TI		23	40	II	ER
	21	17	II	SI	27	21	44	I	TI
	21	55	II	Te		23	01	I	SI
11	00	05	II	Se	28	00	01	I	Te
	23	34	I	TI		18	34	II	Se
12	00	40	I	SI		19	03	I	OD
	18	23	II	ER		22	36	I	ER
	20	52	I	OD	29	18	29	I	Te
	21	58	IV	TI		19	25	IV	Te
13	00	17	I	ER		19	46	I	Se
	19	09	I	SI	31	18	48	III	OR
	20	18	I	Te		20	32	III	ED
	21	12	III	Te					

NOVEMBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
2	20	46	II	OD		20	56	I	ER
4	18	23	II	SI	14	18	07	I	Se
	18	36	II	Te	15	21	27	IV	SI
	20	56	I	OD	18	18	28	III	SI
	21	10	II	Se		20	57	II	TI
5	18	06	I	TI		21	54	III	Se
5	19	25	I	SI	19	21	57	I	TI
	20	23	I	Te	20	19	14	I	OD
	21	42	I	Se		20	56	II	ER
6	19	00	I	ER	21	17	46	I	SI
	22	58	IV	OD		18	43	I	Te
7	19	08	III	OD		20	03	I	Se
	22	43	III	OR	23	21	54	IV	OR
11	17	52	III	Se	25	20	39	III	Te
	18	21	II	TI	27	18	00	II	OD
	20	59	II	SI		21	11	I	OD
	21	09	II	Te	28	18	24	I	TI
	22	50	I	OD		19	42	I	SI
12	20	01	I	TI		20	41	I	Te
	21	21	I	SI		21	59	I	Se
	22	18	I	Te	29	18	15	II	Se
13	18	17	II	ER		19	15	I	ER

DECEMBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
2	20	08	IV	Se	14	19	08	I	Te
	21	16	III	TI		20	20	I	Se
4	20	42	II	OD	15	17	34	I	ER
5	20	22	I	TI		18	11	II	ER
	21	38	I	SI	20	20	02	III	OD
6	17	38	I	OD		21	00	II	TI
	18	05	II	SI	21	18	50	I	TI
	18	23	II	Te		19	59	I	SI
	20	09	III	ER	22	19	30	I	ER
	20	51	II	Se		20	50	II	ER
	21	10	I	ER	24	18	03	III	Se
7	18	24	I	Se	27	18	18	IV	ED
13	18	17	II	TI	29	18	05	I	OD
	19	18	III	OR		18	27	II	OD
	19	36	I	OD	30	17	38	I	Te
	20	41	II	SI		18	40	I	Se
	20	44	III	ED	31	17	57	II	Se
	21	05	II	Te		17	59	III	Te
14	18	03	I	SI		18	43	III	SI

From April until August Jupiter's satellites I, II, III, IV, are eclipsed on the west side of the planet, and from September until December on the east side. The disappearance of satellites I and II is visible from March until August, and the reappearance in January and from September until December. Both disappearance and reappearance of satellites III and IV are visible from April until July and from September until December. Note that satellite IV is eclipsed during 1938.

PRINCIPAL ELEMENTS OF THE SOLAR SYSTEM

ORBITAL ELEMENTS (Jan. 1, 0^h, 1938)

Planet	Mean Distance from Sun (a) ⊕ = 1	millions of miles	Period (P)	Eccen-tri-city (e)	In-clina-tion (i)	Long. of Node (☊)	Long. of Peri-helion (π)	Long. of Planet
					°	°	°	°
Mercury........	.387	36.0	88.0days	.206	7.0	47.6	76.5	96.3
Venus..........	.723	67.2	224.7	.007	3.4	76.1	130.7	259.3
Earth..........	1.000	92.9	365.3	.017	....	.....	101.9	99.5
Mars...........	1.524	141.5	687.0	.093	1.9	49.1	334.9	7.3
Jupiter.........	5.203	483.3	11.86yrs.	.048	1.3	99.8	13.3	311.8
Saturn..........	9.54	886.	29.46	.056	2.5	113.1	91.8	11.5
Uranus.........	19.19	1783.	84.0	.047	0.8	73.7	169.7	46.7
Neptune........	30.07	2793.	164.8	.009	1.8	131.1	44.1	168.6
Pluto..........	39.46	3666.	247.7	.249	17.1	109.5	223.4	148.0

PHYSICAL ELEMENTS

Object	Symbol	Mean Dia-meter miles	Mass ⊕ = 1	Density water = 1	Axial Rotation	Mean Sur-face Grav-ity ⊕ = 1	Albedo Bond's	Magni-tude at Opposi-tion or Elonga-tion
Sun..........	☉	864,000	332,000	1.4	$24^d.7$ (equatorial)	27.9		− 26.7
Moon........	☾	2,160	.0123	3.3	$27^d\ 7.7^h$	.16	.07	− 12.6
Mercury......	☿	3,010	.056	3.8	88^d	.27	.07	0±
Venus........	♀	7,580	.82	4.9	30^d ?	.85	.59	− 4±
Earth........	⊕	7,918	1.00	5.5	$23^h\ 56^m$	1.00	.29	
Mars.........	♂	4,220	.108	4.0	$24^h\ 37^m$	.38	.15	− 2±
Jupiter.......	♃	87,000	318.	1.3	$9^h\ 50^m$±	2.6	.56?	− 2±
Saturn.......	♄	72,000	95.	.7	$10^h 15^m$±	1.2	.63?	0±
Uranus.......	♅	31,000	14.6	1.3	$10^h.8$±	.9	.63?	+ 5.7
Neptune......	♆	33,000	17.2	1.3	16^h ?	1.0	.73?	+ 7.6
Pluto........	♇	4,000?	<.1					+ 14

SATELLITES OF THE SOLAR SYSTEM

Name	Stellar Magnitude	Mean Distance in Miles	Sidereal Period d. h. m. s.	Discoverer	Date
			THE EARTH		
The Moon..	-12.6	238,840	27 6 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

METEORS OR SHOOTING STARS

By Peter M. Millman

Meteors are small fragmentary particles of iron or stone, the debris of space, which, on entering the earth's atmosphere at high velocity, ignite and are in general completely vaporized. On a clear moonless night a single observer should see on the average about 7 meteors per hour during the first six months of the year and approximately twice this number during the second half of the year. The above figures are averages over the whole night, however, and it should be noted that meteors are considerably more numerous during the second half of the night at which time the observer is on the preceding hemisphere of the earth in its journey around the sun.

In addition to the so-called sporadic meteors mentioned above there are well-marked groups of meteors which travel in elliptical orbits about the sun and appear at certain seasons of the year. The meteors of any one group, or shower, move along parallel paths and hence, owing to the laws of perspective, seem to radiate from a point in the sky known as the radiant. The shower is usually named after the constellation in which the radiant is located. Prof. C. P. Olivier, president of the American Meteor Society, has listed the chief meteoric showers of the year as follows:

The Most Important Meteoric Showers of the Year

Shower	Duration in days	Date of maximum (evening date)	Hourly number of all meteors on this date (for one observer)
Quadrantids	4	Jan. 2	28
Lyrids	4	Apr. 21	7
Eta Aquarids	8	May 4	7
Delta Aquarids	3	July 28	27
Perseids	25	Aug. 11	69
Orionids	14	Oct. 19	21
Leonids	7	Nov. 15	21
Geminids	14	Dec. 12	23

In addition to the above dates there are three other periods at which good displays have appeared in certain years. Large number of meteors appeared on June 28, 1916; Oct. 9, 1933; and on Nov. 20 during the latter part of the nineteenth century. These dates should be carefully watched because of the possibility of a reappearance of these showers.

Of recent years the study of meteors has become increasingly important both because of its cosmic significance and because of its close association with studies of the upper atmosphere. The amateur who does not possess a telescope can render more real assistance in this field than in any other. In particular, all observations of very bright meteors or fireballs should be reported immediately in full to an observatory where such objects are being studied. Maps and instructions for meteor observations may be secured from the writer at the Dunlap Observatory, Richmond Hill, Ont.

Important records of meteors may also be made photographically by anyone possessing a camera of speed F 6.3 or better. The Perseids and the Geminids are the best subjects for meteor photography. For more complete details see Amateur Telescope Making, Advanced, p. 544, or The Journal of the Royal Astronomical Society of Canada, Vol. 31, p. 295, 1937.

LUNAR OCCULTATIONS

Prepared by J. F. HEARD

When the moon passes between the observer and a star that star is said to be occulted by the moon and the phenomenon is known as a lunar occultation. The passage of the star behind the east limb of the moon is called the immersion and its appearance from behind the west limb the emersion. As in the case of eclipses, the times of immersion and emersion and the duration of the occultation are different for different places on the earth's surface. The table given below, adapted from the 1938 Nautical Almanac, gives the times of immersion or emersion or both for occultations of stars brighter than magnitude 5.0 visible at Toronto and at Montreal at night. Occultations of stars fainter than magnitude 4.5 are excluded for 24 hours before and after Full Moon. Emersions at the bright limb of the moon are given only in the case of stars brighter than magnitude 3.5, and immersions at the bright limb only in the case of stars brighter than magnitude 4.5; so that most of the phenomena listed take place at the dark limb. The terms a and b are for determining corrections to the times of the phenomena for stations within 300 miles of Toronto or Montreal. Thus if λ_o, ϕ_o, be the longitude and latitude of the standard station and λ, ϕ, the longitude and latitude of the neighbouring station then for the neighbouring station we have—

E.S.T. of phenomenon = E.S.T. of phenomenon at the standard station

$$+a(\lambda - \lambda_o) + b(\phi - \phi_o)$$

where $\lambda - \lambda_o$ and $\phi - \phi_o$ are expressed in degrees. The quantity P in the table is the position angle of the point of contact on the moon's disc reckoned from the north point towards the east.

LUNAR OCCULTATIONS VISIBLE AT TORONTO AND AT MONTREAL 1938

Date	Star		Mag.	I or E*	Age of Moon	Toronto				Montreal			
						E.S.T.	a	b	P	E.S.T.	a	b	P
					d	h m	m	m		h m	m	m	
Jan. 13	ζ	Tau	3.0	I	12.4	22 20.2	−1.7	−1.6	126	22 27.1	−1.6	−1.3	117
" 13	ζ	Tau	3.0	E	12.4	23 24.8	−1.9	+0.7	243	23 35.6	−1.6	−0.1	254
Feb. 9	ω	Tau	4.8	I	8.6	0 53.3	−0.2	−1.1	83	0 52.4	−0.1	−0.9	73
Mar. 10	χ^2	Ori	4.7	I	8.0	0 39.0	0.0	−1.7	112	0 36.0	0.0	−1.5	103
" 23	58	Oph	4.9	E	21.2	4 47.9	—	—	328	4 54.7	—	—	336
Apr. 18	ω	Oph	4.6	E	17.6	4 13.1	—	—	328	4 21.2	—	—	329
" 20	μ	Sgr	4.0	I	19.6	2 05.4	−1.8	+1.9	56	2 19.7	−1.9	+1.8	49
" 20	μ	Sgr	4.0	E	19.6	3 19.4	−1.9	0.0	298	3 30.4	−2.0	−0.4	302
July 10	μ	Sgr	4.0	I	13.3	22 31.2	−2.0	+1.1	56	22 44.6	−1.9	+0.8	54
Aug. 14	λ	Psc	4.6	E	18.2	3 25.6	—	—	179	3 32.2	—	—	175
Sept. 29	ξ	Oph	4.5	I	6.2	19 40.1	−1.2	−0.6	68	19 45.2	−1.0	−0.8	70
Oct. 12	ε	Tau	3.6	I	19.4	23 10.4	—	—	147	23 19.2	—	—	150
" 12	ε	Tau	3.6	E	19.4	23 35.0	—	—	191	23 40.8	—	—	188
" 30	β	Cap	3.2	I	7.6	18 56.3	−1.0	+1.5	27	18 04.1	−0.9	+1.0	30
" 30	β	Cap	3.2	E	7.6	20 01.7	−2.2	−1.7	287	20 09.8	−1.8	−1.7	283
" 31	ν	Aqr	4.5	I	8.7	19 49.9	−1.2	+1.1	37	19 58.0	−1.1	+0.7	41
Dec. 28	λ	Psc	4.6	I	7.3	19 34.8	−1.8	−1.1	90	19 42.4	−1.5	−1.3	90

***Immersion or Emersion.**

DOUBLE AND MULTIPLE STARS

By FRANK S. HOGG

A number of the stars which appear as single to the unaided eye may be separated into two or more components by field glasses or a small telescope. Such objects are spoken of as *double* or *multiple stars*. With larger telescopes pairs which are still closer together may be resolved, and it is found that, up to the limits of modern telescopes, over ten per cent. of all the stars down to the ninth magnitude are numbers of double stars.

The possibility of resolving a double star of any given separation depends on the diameter of the telescope objective. Dawes' simple formula for this relation is $d''=4.5/A$, where d is the separation, in seconds of arc, of a double star that can be just resolved, and A is the diameter of the objective in inches. Thus a one-inch telescope should resolve a double star with a distance of $4''.5$ between its components, while a ten-inch telescope should resolve a pair $0''.45$ apart. It should be noted that this applies only to stars of comparable brightness. If one star is markedly brighter than its companion, the glare from the brighter makes it impossible to separate stars as close as the formula indicates. This formula may be applied to the observation of double stars to test the quality of the seeing and telescope.

It is obvious that a star may appear double in one of two ways. If the components are at quite different distances from the observer, and merely appear close together in the sky the stars form an *optical* double. If, however, they are in the same region of space, and have common proper motion, or orbital motion about one another, they form a *physical* double. An examination of the probability of stars being situated sufficiently close together in the sky to appear as double shows immediately that almost all double stars must be physical rather than optical.

Double stars which show orbital motion are of great astrophysical importance, in that a careful determination of their elliptical orbits and parallaxes furnishes a measure of the gravitational attraction between the two components, and hence the mass of the system.

In the case of many unresolvable close doubles, the orbital motion may be determined by means of the spectroscope. In still other doubles, the observer is situated in the orbital plane of the binary, and the orbital motion is shown by the fluctuations in light due to the periodic eclipsing of the components. Such doubles are designated as *spectroscopic* binaries and *eclipsing* variables.

The accompanying table provides a list of double stars, selected on account of their brightness, suitability for small telescopes, or particular astrophysical interest. The data are taken chiefly from Aitken's *New General Catalogue of Double Stars*, and from the Yale *Catalogue of Bright Stars*. Successive columns give the star, its 1900 equatorial coordinates, the magnitudes and spectral classes of its components, their separation, in seconds of arc, and the approximate distance of the double star in light years. The last column gives, for binary stars of well determined orbits, the period in years, and the mean separation of the components in astronomical units. For stars sufficiently bright to show colour differences in the telescope used, the spectral classes furnish an indication of the colour. Thus O and B stars are bluish white, A and F white, G yellow, K orange and M stars reddish.

A good reference work in the historical, general, and mathematical study of double stars is Aitken's *The Binary Stars*.

REPRESENTATIVE DOUBLE STAR

Star	α 1900	δ	Mag. and Spect.	d	D	Remarks
	h m	° ′		″	L.Y.	
η And	00 31.5	+33 10	4.4B3; 8.5	36	410	†
π Cas	00 43.0	+57 17	3.6F8; 7.2M0	8	18	479y; 66AU
α UMi	01 22.6	+88 46	var. F8; 8.8	19	270	Polaris
γ Ari	01 48.1	+18 48	4.8A0; 4.8A0	8.3	200	
α Pis	01 56.9	+02 17	5.2A2; 4.3A2	2.4	162	††
γ And	01 57.8	+41 51	2.3K0; 5.4A0; 6.6	10, 0.7	220	5.5y; 23AU
6 Tri	02 06.6	+29 50	5.4G4; 7.0F3	3.6	270	††
η Per	02 43.4	+55 29	3.9K0; 8.5	28	360	
32 Eri	03 49.3	−03 15	5.0A; 6.3G5	6.7	330	
β Ori	05 09.7	−08 19	0.3B8; 7.0	9	540	†
θ Ori	05 30.4	−05 27	5.4;6.8; 6.8; 7.9; O	13, 17	1100	Trapezium
β Mon	06 24.0	−06 58	4.7B2; 5.2; 5.6	7, 25	330	†
12 Lyn	06 37.4	+59 33	5.3A2; 6.2; 7.4	1.7, 8	190	
α CMa	06 40.7	−16 35	−1.6A0; 8.5F	11	9	50y; 20AU
δ Gem	07 14.2	+22 10	3.5F0; 8.0M0	6.8	58	†
α Gem	07 28.2	+32 06	2.0A0; 2.8A0; 9M10	4, 70	44	340y; 79AU
ζ Cnc	08 06.5	+17 57	5.6G0; 6.0; 6.2	1, 5	71	60y; 21AU
γ Leo	10 14.5	+20 21	2.6K0; 3.8G5	4	140	
ξ UMa	11 12.9	+32 06	4.4G0; 4.9G0	2	23	††60y; 20AU
ι Leo	11 18.7	+11 05	4.1F3; 6.8F3	2	57	
γ Vir	12 36.6	−00 54	3.6F0; 3.7F0	6	38	178y; 42AU
α CVn	12 51.4	+38 51	2.9A0; 5.4A0	20	130	††
ζ UMa	13 19.9	+55 27	2.4A2; 4.0A2	14	76	††
π Boo	14 36.0	+16 51	4.9A0; 5.1A0	6	200	†
ε Boo	14 40.6	+27 30	2.7K0; 5.1A0	3	180	
ξ Boo	14 46.8	+19 31	4.8G5; 6.7	3	21	151y; 31AU
δ Ser	15 30.0	+10 52	4.2F0; 5.2F0	4	130	
ξ Sco	15 58.9	−11 06	5.1F3; 4.8; 7G7	1, 7	86	44.7y; 19AU
α Her	17 10.1	+14 30	var.M5; 5.4G	5	470	†
δ Her	17 10.9	+24 57	3.2A0; 8.1G2	11	91	† Optical
ε Lyr	18 41.0	+39 32	5.1, 6.0A3; 5.1, 5.4A5	3, 2	230	Pairs 207″
β Cyg	19 26.7	+27 45	3.2K0; 5.4B9	34	220	†
α Cap	20 12.3	−12 50	3.8G5; 4.6G0	376		Optical
γ Del	20 42.0	+15 46	4.5G5; 5.5F8	10	96	
61 Cyg	21 02.4	+38 15	5.6K5; 6.3K5	23	11	
β Cep	21 27.4	+70 07	var.B1; 8.0A3	14	410	†
ζ Aqr	22 23.7	−00 32	4.4F2; 4.6F1	3	120	
δ Cep	22 25.5	+57 54	var.G0; 7.5A0	41	650	
8 Lac	22 31.4	+39 07	5.8B3; 6.5B5	22		†
α Cas	23 53.9	+55 12	5.1B2; 7.2B3	3	650	

† or ††, one, or two of the components are themselves very close visual double or, more generally, spectroscopic binaries.

VARIABLE STARS

By Frank S. Hogg

Of the naked eyes 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, RS Ophiuchi.
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	4.4	G4	7.17652	VIII	1784	Pigott
N Aql	184300	-0.2	10.9	Q	Irr.	I	1918	Bower
ε Aur	045443	3.3	4.1	F5p	9833.	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*03*	2.0	10.1	M5e	331.8	V	1596	Fabricius
RR Cet	012700	8.4	9.0	F0	0.55304	IX	1906	Oppolzer
R CrB	154428	5.8	13.8	cG0e	Irr.	III	1795	Pigott
χ Cyg	194632	4.2	14.0	M7e	412.9	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	VII	1847	Schmidt
η Gem	060822	3.3	4.2	M2	235.58	V	1865	Schmidt
R Gem	070122a	6.5	14.3	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	414.7	V	1670	Montanari
R Leo	094211	5.0	10.5	M7e	310.3	V	1782	Koch
β Lyr	184633	3.4	4.3	B5e	12.90800	X	1784	Goodricke
RR Lyr	192242	7.2	8.0	A5	0.56685	IX	1901	Fleming
α Ori[2]	054907	0.2	1.2	M2	2070. Irr.	VI	1840	J. Herschel
U Ori	054920	5.4	12.2	M7e	376.9	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	8.6	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	4.1	B3	3.95294	X	1848	Baxendell
RV Tau	044126	9.4	12.5	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	3.96858	VIII	1911	Hertzsprung
N Her	180445	1.5	14.0	Q	Irr.	I	1934	Prentice
N Lac	221255	2.2	—	Q	Irr.	I	1936	Peltier

[1]o Cet (Mira); [2]α Ori (Betelgeuse); [3]β Per (Algol); [4]α UMi (Polaris).

Most of the data in this Table are from Prager's 1936 *Katalog und Ephemeriden Veranderlicher 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, δ Cephei, 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 observations, deduced the parallax of Alpha Centauri to be 0″.75. For a long time this was considered to be the nearest of all the stars in the sky, but in 1913 Innes, director of the Union Observatory, Johannesburg, South Africa, discovered a small 11th mag. star, 2° 13′ from Alpha Centauri, with a large proper motion and 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

By J. A. Pearce

Through the kindness of Dr. Adriaan van Maanen, who has supplied the fundamental data, this table has been revised to contain all stars known to be nearer than five parsecs or 16.3 light-years. One star of the former table, has been discarded, and five new members have been added, making a total of forty stars in a space of 524 cubic parsecs. With the exceptions of Sirius, Procyon and Altair, all the stars are dwarfs; the list including the three white dwarfs, Sirius B, 40 Eridani B, and van Maanen's star. Forty-five per cent. of the stars are members of binary systems.

Star	α(1900)	δ	Sp	μ	π	L.y.	m	M	L
	h m	° ′		″	″				
Sun..........	.....	....	G0				−26.7	4.8	1.0
Groom 34A....	0 13	+43 27	M2	2.89	0 274	11.9	8.1	10.3	.0063
Groom 34B....	.....	....	M5	2.85	.271	12.1	10.7	12.9	.0006
van Maanen...	0 44	+ 4 55	F3	3.01	.242	13.5	12.3	14.2	.0002
τCeti..........	1 39	−16 28	G7	1.92	.292	11.2	3.6	5.9	.36
εEri...........	3 28	− 9 48	K1	0.96	.304	10.7	3.8	6.2	.28
40 Eri A.......	4 11	− 7 49	K0	4.08	.213	15.3	4.5	6.1	.30
40 Eri B.......	.....	....	A0	4.03	.213	15.3	9.7	11.3	.0025
40 Eri C.......	.....	....	M6	4.03	.213	15.3	10.8	12.4	.0009
Gould 5h 243...	5 08	−44 59	M0	8.70	.264	12.3	9.2	11.3	.0025
αCMa A.......	6 41	−16 35	A2	1.32	.373	8.7	− 1.6	1.3	25.1
αCMa B.......	.....	....	F0	1.32	.373	8.7	8.4	11.3	.0025
αCMi A.......	7 34	+ 5 29	F4	1.24	.303	10.8	0.5	2.9	5.8
αCMi B.......	.....	....	.....	1.24	.303	10.8	12.5	14.9	.00009
Groom 1618....	10 05	+49 58	M0	1.45	.230	14.2	6.8	8.6	.030
WB 10h 234....	10 14	+20 22	M4e	0.49	.217	15.0	9.0	10.7	.0044
Wolf 359......	10 52	+ 7 36	M6e	4.84	.413	7.9	13.5	16.6	.00002
Lal 21185......	10 58	+36 38	M2	4.78	.381	8.6	7.6	10.5	.0052
Innes..........	11 12	−57 02	.....	2.69	.339	9.6	(12.5)	13.2	.0004
αCen A........	14 33	−60 25	G5	3.68	.758	4.3	0.3	4.7	1.10
αCen B........	.....	....	K1	3.68	.758	4.3	1.7	6.1	.30
Prox. Cen......	14 23	−62 15	M	3.85	.758	4.3	11.0	15.4	.00006
DM−12.4523 .	16 25	−12 24	M5	1.24	.270	12.1	9.5	11.7	.0017
DM−46.11540	17 21	−46	.....	1.06	.239	13.6	9.4	11.3	.0025
CD−44.11909 .	17 30	−44	.....	1.14	.215	15.2	(12.9)	12.6	.0008
AO 17415......	17 37	+68 26	M4	1.33	.214	15.2	9.1	10.7	.0044
Barnard.......	17 53	+ 4 25	M5	10.30	.541	6.0	9.7	13.4	.0004
Bu 8798A......	18 42	+59 29	M4	2.31	.290	11.2	9.2	11.5	.0021
Bu 8798B......	.....	....	M5	2.31	.290	11.2	9.7	12.0	.0013
αAqu..........	19 46	+ 8 36	A2	0.66	.207	15.7	0.9	2.5	8.3
61 Cyg A.......	21 02	+38 15	K8	5.27	.301	10.8	5.6	8.0	.052
61 Cyg B......	.....	....	M0	5.15	.301	10.8	6.3	8.7	.028
Lac 8760.......	21 11	−39 15	M1	3.53	.255	12.8	6.6	8.6	.030
εIndi..........	21 56	−57 12	K8	4.70	.288	11.3	4.7	7.0	.13
Kruger 60A....	22 24	+57 12	M3	0.87	.247	13.2	9.2	11.2	.0028
Kruger 60B....	.....	....	M4	0.92	.247	13.2	10.8	12.8	.0006
BD+43.4305..	22 42	+43 49	M5e	0.86	.217	15.0	9.5	11.2	.0028
Lac 9352......	22 59	−36 26	M2	6.90	.274	11.9	7.4	9.6	.012
Ross 248.......	23 36	+43	M6	1.82	.319	10.2	(13.8)	14.3	.0002
DM−37.15492.	23 59	−37 51	M3	6.11	.217	15.0	8.3	10.0	.0083

Note.—Magnitudes in brackets are photographic, all others are visual. A colour index of +2.0 has been taken to compute the visual absolute magnitudes of these stars. *Symbols*: Sp, spectrum; μ, proper motion; π, parallax; L.-y., light-year; m, apparent magnitude; M, absolute magnitude; L, luminosity compared to the sun.

THE BRIGHTEST STARS

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

By W. E. Harper

The accompanying table contains the principal facts regarding 257 stars brighter than apparent magnitude 3.51 which it is thought may be of interest to our amateur members. The various columns should be self-explanatory but some comments may be in order.

The first column gives the name of the star and if it is preceded by the sign || such means that the star is a visual double and the combined magnitude is entered in the fourth column. Besides the 44 thus indicated there are 12 others on the list with faint companions but for these it is not thought that there is any physical connection. In the case of the 13 stars variable in light this fourth column shows their maximum and minimum magnitudes. The 20 first magnitudes stars are set up in bold face type.

In the fifth column are given the types as revised at various observatories—principally at our own, but omitting the *s* and *n* designations descriptive of the line character. The annual proper motion follows in the next column and these may not necessarily be correct to the third decimal place.

The parallaxes are taken from Schlesinger's Catalogue of Bright Stars, 1930. The distance is given also in light years in the eighth column as to the lay mind that seems a fitting unit. In only one case (α Cygni) was the parallax negative and it was entered as formerly as ″.005. The absolute magnitudes in the ninth column are the magnitudes the stars would have if all were at a uniform distance of 32.6 light years ($\pi = 0.''1$). At that distance the sun would appear as a star of magnitude 4.8.

The radial velocities in the last column have been taken from Vol. 18 of the Lick Publications. An asterisk * following the velocity means that such is variable. In these cases the velocity of the system, if known, is given; otherwise a mean velocity for the observations to date is set down.

Of the 257 stars or star systems here listed 144 are south and 113 north of the equator. This is to be expected from the fact that the northern half of the sky includes less of the Milky Way than the southern.

The number in each spectral class, apart from the one marked peculiar, is as follows: O, 3; B, 72; A, 55; F, 22; G, 43; K, 42 and M, 19. The B-stars are intrinsically luminous and appear in this list out of all proportion to their total number. The stars of Classes A and K are by far the most numerous but the revision of types throws many originally labelled K back into the G group.

From the last column we see that 92 velocities are starred, indicating that 36 per cent. of the bright stars, or at least one in every three, are binary in character. For visual binaries the proportion has usually been listed as one in nine. Our list shows one in six but it is only natural to expect that we would observe a higher proportion among the nearby stars, such as these are on the average.

Other relationships can be established from the list if our amateur members care to study it.

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	A1	.217	.040	81	0.2	−13.0*
β Cassiopeiae	4	+58 36	2.4	F2	.561	.071	46	1.7	+11.4
γ Pegasi	8	+14 38	2.9	B2	.010	.010	326	−2.1	+ 5.0*
β Hydri	20	−77 49	2.9	G0	2.243	.141	23	3.6	+22.8
α Phoenicis	21	−42 51	2.4	G5	.446	.045	72	0.7	+74.6*
δ Andromedae	34	+30 19	3.5	K3	.167	.028	116	0.7	− 7.1*
α Cassiopeiae	35	+55 59	2.2–2.8	G8	.062	.017	192	−1.6	− 3.8
β Ceti	39	−18 32	2.2	G7	.230	.040	81	0.3	+13.1
‖γ Cassiopeiae	51	+60 11	2.2	B0e	.031	.036	91	0.0	− 6.8
‖β Phoenicis	1 2	−47 15	3.4	G4	.042	.021	155	0.0	− 1.2
β Andromedae	4	+35 5	2.4	M0	.219	.044	74	0.6	+ 0.1
δ Cassiopeiae	19	+59 43	2.8	A3	.306	.030	109	0.2	+ 6.8
‖α Ursae Minoris	23	+88 46	2.1	F7	.043	.012	272	−2.3	−17.4*
γ Phoenicis	24	−43 50	3.4	M1	.222	.024	136	0.3	+25.7*
α **Eridani**	34	−57 44	0.6	B9	.093	.045	72	−1.1	+19
ε Cassiopeiae	47	+63 11	3.4	B5	.043	.013	251	−1.0	− 8.1
β Arietis	49	+20 19	2.7	A3	.150	.066	49	1.8	− 0.6*
α Hydri	56	−62 3	3.0	A7	.256	.067	49	2.2	+ 7.0*
γ Andromedæ	1 58	+41 51	2.3	K0	.073	.015	217	−1.0	−11.7
α Arietis	2 2	+22 59	2.2	K2	.242	.040	81	0.2	−14.3
β Trianguli	4	+34 31	3.1	A6	.161	.027	121	0.2	+10.4*
‖o Ceti	14	− 3 26	1.7–9.6	M6e	.239	.013	251	−2.7	+59.8*
‖θ Eridani	54	−40 42	3.4	A2	.071	.022	148	0.1	+11.9*
α Ceti	57	+ 3 42	2.8	M1	.080	.017	192	−0.1	−25.7
γ Persei	58	+53 7	3.1	F9	.012	.017	192	−0.8	+ 1.0*
ρ Persei	59	+38 27	3.4–4.2	M6	.176	.018	181	−0.3	+28.2
β Persei	3 2	+40 34	2.1–3.2	B8	.011	.025	130	−0.9	+ 5.7*
α Persei	17	+49 30	1.9	F4	.041	.020	163	−1.6	− 2.4
δ Persei	36	+47 28	3.1	B5	.047	.015	217	−1.0	−10.0*
‖η Tauri	41	+23 48	3.0	B5p	.053	.013	251	−1.5	+10.3
ζ Persei	48	+31 35	2.9	B1	.023	.006	543	−3.2	+20.9
γ Hydri	49	−74 33	3.2	M3	.128	.012	272	−1.4	+16.0
‖ε Persei	51	+39 43	3.0	B2	.041	.006	543	−3.2	− 6. *
γ Eridani	53	−13 47	3.2	M0	.133	.021	155	−0.2	+61.7
λ Tauri	55	+12 12	3.3–4.2	B3	.015	.006	543	−2.8	+13.0*
α Reticuli	4 13	−62 43	3.4	G5	.069	.022	148	0.1	+35.6

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
α **Tauri**	4 30	+16 18	1.1	K8	.205	.057	57	−0.1	+54.1
α Doradus	32	−55 15	3.5	A0p	.003	....	....	.....	+25.6
π^3 Orionis	44	+ 6 47	3.3	F5	.474	.124	26	3.0	+24.6
ι Aurigae	50	+33 0	2.9	K4	.030	.021	155	−0.5	+17.6
ε Aurigae	55	+43 41	3.4–4.1	F2	.015	.006	543	−2.8	− 4.1*
η Aurigae	5 0	+41 6	3.3	B3	.082	.012	272	−1.3	+ 7.8
ε Leporis	1	−22 30	3.3	K5	.074	.026	125	0.4	+ 1.0
β Eridani	3	− 5 13	2.9	A1	.117	.052	63	1.5	− 7.
μ Leporis	8	−16 19	3.3	A0p	.053	.030	109	0.7	+27.7
‖α **Aurigae**	9	+45 54	0.2	G1	.439	.068	48	−0.6	+30.2*
‖β **Orionis**	10	− 8 19	0.3	B8p	.005	.006	543	−5.8	+23.6*
‖η Orionis	19	− 2 29	3.4	B0	.009	.007	466	−2.3	+19.5*
γ Orionis	20	+ 6 16	1.7	B2	.019	.017	192	−2.2	+18.0
β Tauri	20	+28 31	1.8	B8	.180	.035	93	−0.5	+ 8.0
β Leporis	24	−20 50	3.0	G2	.095	.021	155	−0.4	−13.5
‖δ Orionis	27	− 0 22	2.4	B0	.006	.009	362	−2.8	+19.9*
α Leporis	28	−17 54	2.7	F6	.006	.017	192	−1.2	+24.7
ι Orionis	31	− 5 59	2.9	O8	.007	.007	466	−2.9	+21.5*
ε Orionis	31	− 1 16	1.8	B0	.004	.008	407	−.73	+25.8
ζ Tauri	32	+21 5	3.0	B3e	.028	.014	233	−1.3	+16.4*
‖ζ Orionis	36	− 2 0	1.8	B0	.012	.008	407	−3.4	+18.0
α Columbae	36	−34 8	2.8	B8	.040	.022	148	−0.5	+34.6
κ Orionis	43	− 9 42	2.2	B0	.009	.013	251	−2.2	+20.1
β Columbae	47	−35 48	3.2	K0	.397	.019	172	−0.4	+89.4
α **Orionis**	50	+ 7 23	0.5–1.1	M2	.032	.012	272	−4.1	+21.0*
β Aurigae	52	+44 56	2.1	A0p	.046	.029	112	−0.4	−18.1*
θ Aurigae	53	+37 12	2.7	A1	.106	.032	102	0.2	+28.6
η Geminorum	6 9	+22 32	3.2–4.2	M2	.062	.013	251	−1.2	+21.4*
μ Geminorum	17	+22 34	3.2	M3	.129	.016	204	−0.8	+54.8
β Canis Majoris	18	−17 54	2.0	B1	.003	.012	272	−2.6	+34.4*
α **Carinae**	22	−52 38	−0.9	F0	.022	.016	204	−4.8	+20.5
γ Geminorum	32	+16 29	1.9	A2	.066	.047	69	0.3	−11.3*
ν Puppis	35	−43 6	3.2	B8	.020	.025	130	0.2	+28.2*
ε Geminorum	38	+25 14	3.2	G9	.020	.010	326	−1.8	+ 9.9
ξ Geminorum	40	+13 0	3.4	F5	.230	.048	68	1.8	+25.1
‖α **Canis Majoris**	41	−16 35	−1.6	A2	1.315	.375	9	1.3	− 7.5*
α Pictoris	47	−61 50	3.3	A5	.271	....	....	.....	+20.9

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
τ Puppis	6 47	−50 30	2.8	G8	.094	.031	105	0.3	+36.4*
‖ε Canis Majoris	55	−28 50	1.6	B1	.005	.012	272	−3.0	+27.4
ζ Geminorum	58	+20 43	3.7–4.3	G0p	.007	.004	815	−3.3	+ 6.7*
o^2 Can. Majoris	59	−23 41	3.1	B5p	.000	.007	466	−2.7	+48.6
δ Can. Majoris	7 4	−26 14	2.0	G4p	.005	.010	326	−2.9	+34.3*
L^2 Puppis	10	−44 29	3.4–6.2	M5e	.334	....	....	.....	+53.0
π Puppis	14	−36 55	2.7	K5	.012	.023	142	−0.4	+15.8
β Can. Minoris	22	+ 8 29	3.1	B8	.063	.024	136	0.0	+23.
σ Puppis	26	−43 6	3.3	M0	.192	.027	121	0.4	+88.1
α_2 Geminorum	28	+32 6	2.0	A2	.201	.074	44	1.4	+ 6.0*
α_1 Geminorum	28	+32 6	2.8	A0	.209	.074	44	2.2	− 1.2*
‖α **Can. Minoris**	34	+ 5 29	0.5	F5	1.242	.310	10	2.9	− 3.0*
β **Geminorum**	39	+28 16	1.2	G9	.623	.110	30	1.4	+ 3.3
ξ Puppis	45	−24 37	3.5	K1	.007	.004	815	−3.5	+ 3.7*
ζ Puppis	8 0	−39 43	2.3	O8	.036	....	....	.....	−24.
ρ Puppis	3	−24 1	2.9	F6	.097	.016	204	−1.1	+46.6
‖γ Velorum	6	−47 3	2.2	OW9	.002	....	....	.....	+35.
‖ε Carinae	20	−59 11	1.7	K0	.032	.014	233	−2.5	+11.5
o Urs. Majoris	22	−61 3	3.5	G2	.166	.011	296	−1.3	+19.8
‖ε Hydrae	41	+ 6 47	3.5	F9	.193	.024	136	0.4	+36.8*
δ Velorum	42	−54 20	2.0	A0	.093	.030	109	−0.6	+ 2.2
ζ Hydrae	50	+ 6 20	3.3	G7	.101	.016	204	−0.7	+22.6
ι Urs. Majoris	52	−48 26	3.1	A4	.500	.070	47	2.3	+12.6
λ Velorum	9 4	−43 2	2.2	K4	.022	.018	181	−1.5	+18.4
β Carinae	12	−69 18	1.8	A0	.192	....	....	.....	− 5.
ι Carinae	14	−58 51	2.2	F0	.023	....	....	.....	+13.3
α Lyncis	15	+34 49	3.3	K8	.214	.023	142	0.1	+37.4
κ Velorum	19	−54 35	2.6	B3	.017	.015	217	−1.5	+21.7*
α Hydrae	23	− 8 14	2.2	K4	.036	.016	204	−1.8	− 4.4
θ Urs. Majoris	26	−52 8	3.3	F7	1.096	.060	54	2.2	+15.8
N Velorum	28	−56 36	3.0	K5	.041	.039	84	1.4	−13.9
ε Leonis	40	+24 14	3.1	G0	.045	.012	272	−1.4	+ 5.1
‖υ Carinae	45	−64 36	3.1	F0	.019	....	....	.....	+13.6
α **Leonis**	10 3	+12 27	1.3	B6	.244	.055	59	0.0	+ 2.6
q Carinae	14	−60 50	3.4	K5	.045	.012	272	−1.2	+ 8.6
‖γ Leonis	14	+20 21	2.3	G8	.347	.024	136	−0.7	−36.8

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
μ Urs. Majoris	10 16	+42 0	3.2	K4	.082	.033	99	0.8	−20.3
θ Carinae	39	−63 52	3.0	B0	.023	.008	407	−2.4	+24. *
η Carinae	41	−59 10	1.0–7.4	Pec.	.007	....	....	.....	−25.0
μ Velorum	42	−48 54	2.8	G5	.084	.028	116	0.1	+ 6.9
ν Hydrae	45	−15 40	3.3	K3	.214	.033	99	0.9	−1.0
β Urs. Majoris	56	+56 55	2.4	A3	.089	.043	76	0.6	−12.1*
α Urs. Majoris	58	+62 17	2.0	G5	.137	.030	109	−0.7	− 8.6
ψ Urs. Majoris	11 4	+45 2	3.2	K0	.067	.044	74	1.4	− 3.6
δ Leonis	9	+21 4	2.6	A2	.208	.072	45	1.9	−23.2
θ Leonis	9	+15 59	3.4	A2	.103	.025	130	0.4	+ 7.8
λ Centauri	31	−62 28	3.3	B9	.046	.022	148	0.0	+ 7.9
β Leonis	44	+15 8	2.2	A2	.507	.095	34	2.1	− 2.3
γ Urs. Majoris	49	+54 15	2.5	A0	.095	.041	79	0.6	−11.1
δ Centauri	12 3	−50 10	2.9	B3e	.044	.018	181	−0.8	+ 9.
ε Corvi	5	−22 4	3.2	K2	.063	.027	121	−0.4	+ 4.9
δ Crucis	10	−58 12	3.1	B3	.051	....	....	.....	+26.4
δ Urs. Majoris	10	+57 35	3.4	A0	.113	.044	74	1.7	−12.
γ Corvi	11	−16 59	2.8	B8	.159	.021	155	−0.6	− 4.2*
α^1 Crucis	21	−62 33	1.6	B1	.048	.015	217	−2.5	−12.2*
α^2 Crucis	21	−62 32	2.1	B3	.048	.015	217	−2.0	+ 0.3*
‖δ Corvi	25	−15 58	3.1	A0	.249	.030	109	0.5	+ 8.7
γ Crucis	26	−56 33	1.5	M4	.270	....	....	.....	+21.3
β Corvi	29	−22 51	2.8	G5	.061	.020	163	−0.6	− 7.7
α Muscae	31	−68 35	2.9	B5	.038	.012	272	−1.7	+18.
‖γ Centauri	36	−48 24	2.4	A0	.200	.032	102	−0.1	− 7.5
‖γ Virginis	36	− 0 54	2.9	F0	.561	.085	38	2.6	−19.6
β Muscae	40	−67 34	3.3	B3	.041	.014	233	−1.0	+42. *
β Crucis	42	−59 9	1.5	B1	.054	.011	296	−3.3	+20.0
ε Urs. Majoris	50	+56 30	1.7	A2	.117	.045	72	0.0	−11.9*
ǀα Can. Venat.	51	+38 51	2.8	A1	.233	.025	130	−0.1	− 3.6*
ε Virginis	57	+11 30	3.0	G6	.270	.034	96	0.6	−14.0
γ Hydrae	13 13	−22 39	3.3	G7	.085	.017	192	−0.5	− 5.4
ι Centauri	15	−36 11	2.9	A2	.351	....	....	.....	+ 0.1
‖ζ^1 Urs. Majoris	20	+55 27	2.4	A2p	.131	.043	76	0.6	− 9.9*
α **Virginis**	20	−10 38	1.2	B2	.051	.017	192	−2.6	+ 1.6*
ζ Virginis	30	− 0 5	3.4	A2	.285	.036	91	1.2	−13.1

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel
	h m	° ′			″	″			km./sec
ε Centauri	13 34	−52 57	2.6	B2	.040	.013	251	−1.9	+ 5.6
η Urs. Majoris	44	+49 49	1.9	B3	.116	.013	251	−2.5	−10.9
μ Centauri	44	−41 59	3.3	B3e	.030	....	....	.....	+12.6
ζ Centauri	49	−46 48	3.1	B3	.079	.010	326	−1.9	*
η Boötis	50	+18 54	2.8	G1	.370	.100	33	2.8	− 0.2*
β **Centauri**	57	−59 53	0.9	B3	.039	.020	163	−2.6	+12.0*
π Hydrae	14 1	−26 12	3.5	K3	.165	.036	91	−1.3	+27.2
θ Centauri	1	−35 53	2.3	G8	.748	.067	49	−1.4	+ 1.3
α **Boötis**	11	+19 42	0.2	K0	2.287	.085	38	−0.1	− 5.1
γ Boötis	28	+38 45	3.0	A3	.182	.058	56	1.8	−35.5
η Centauri	29	−41 43	2.6	B3e	.052	.016	204	−1.3	− 0.2
||α **Centauri**	33	−60 25	0.1	G0	3.682	.760	4	4.7	−22.2
α Circini	34	−64 32	3.4	F0	.312	.070	47	2.6	+ 7.4
α Lupi	35	−46 58	2.9	B2	.036	.009	362	−2.3	+ 7.3*
||ε Boötis	41	+27 30	2.7	G8	.045	.018	181	−1.0	+16.4
||α^2 Librae	45	−15 38	2.9	F1	.129	.073	45	2.2	−10. *
β Urs. Minoris	51	+74 34	2.2	K4	.028	.035	93	0.0	+16.9
β Lupi	52	−42 44	2.8	B3	.066	.012	272	−1.8	− 0.3*
κ Centauri	53	−41 42	3.4	B2	.037	.009	362	−1.9	+ 9.1*
σ Librae	58	−24 53	3.4	M4	.094	.024	136	0.3	− 4.3
ζ Lupi	15 5	−51 43	3.5	G5	.132	.017	192	−0.4	− 9.7
γT Australis	10	−68 19	3.1	A0	.064	....	....	.....	0.
β Librae	12	− 9 1	2.7	B8	.108	.024	136	−0.4	−37. *
δ Lupi	15	−40 17	3.4	B3	.032	.010	326	−1.6	+ 1.6
γ Urs. Minoris	21	+72 11	3.1	A2	.017	.042	78	1.3	− 3.9*
ι Draconis	23	+59 19	3.5	K3	.010	.031	105	0.9	−11.1
||γ Lupi	28	−40 50	3.0	B3	.042	.016	204	−1.0	+ 6.
α Cor. Borealis	30	+27 3	2.3	A0	.160	.044	74	0.5	+ 1.0*
α Serpentis	39	+ 6 44	2.8	K3	.142	.045	72	1.0	+ 3.0
βT Australis	46	−63 7	3.0	F0	.440	.090	36	2.8	− 0.3
π Scorpii	53	−25 50	3.0	B3	.042	.012	272	−1.6	− 3.0*
δ Scorpii	54	−22 20	2.5	B1	.042	.011	296	−2.3	−16. *
||β Scorpii	16 0	−19 32	2.8	B3	.041	.005	652	−1.4	− 9.3*
δ Ophiuchi	9	− 3 26	3.3	K8	.159	.029	112	0.4	−19.8
ε Ophiuchi	13	− 4 27	3.3	G9	.088	.030	109	0.7	−10.3
||σ Scorpii	15	−25 21	3.1	B1	.033	.007	466	−2.7	− 0.4*
||η Draconis	23	+61 44	2.9	G5	.062	.038	86	0.8	−14.3

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 **Scorpii**	16 23	−26 12	1.2	M1	.032	.020	163	−2.3	− 3.2*
β Herculis	26	+21 42	2.8	G4	.104	.021	155	−0.6	−25.8*
τ Scorpii	30	−28 1	2.9	B1	.042	.007	466	−2.9	+ 0.6
ζ Ophiuchi	32	−10 22	2.7	B0	.024	.009	362	−2.5	−19. *
||ζ Herculis	38	+31 47	3.0	G0	.601	.106	31	3.1	−70.8*
αT Australis	38	−68 51	1.9	K5	.034	.030	109	−0.7	− 3.7
ε Scorpii	44	−34 7	2.4	G9	.668	.040	81	0.4	− 2.5
μ^1 Scorpii	45	−37 53	3.1	B3	.032	.012	272	−1.5	*
ζ Arae	50	−55 50	3.1	K5	.047	.021	155	−0.3	− 6.0
κ Ophiuchi	53	+ 9 32	3.4	K3	.296	.037	88	1.3	−55.6
||η Ophiuchi	17 5	−15 36	2.6	A2	.094	.036	91	0.4	− 1.0
η Scorpii	5	−43 6	3.4	A7	.294	.069	47	2.6	−28.4
ζ Draconis	8	+65 50	3.2	B8	.023	.026	125	0.3	−14.1
||α Herculis	10	+14 30	3.1–3.9	M7	.030	.007	466	−2.7	−32.5
δ Herculis	11	+24 57	3.2	A2	.164	.036	91	0.9	−39. *
π Herculis	12	+36 55	3.4	K3	.021	.022	148	0.1	−25.7
θ Ophiuchi	16	−24 54	3.4	B2	.030	.009	362	−1.9	− 3.6
β Arae	17	−55 26	2.8	K1	.035	.017	192	−1.0	− 0.4
υ Scorpii	24	−37 13	2.8	B3	.040	.010	326	−2.2	+18. *
α Arae	24	−49 48	3.0	B3e	.085	.017	192	−0.9	− 2.2
λ Scorpii	27	−37 2	1.7	B2	.040	.016	204	−2.3	0. *
β Draconis	28	+52 23	3.0	G0	.012	.008	407	−2.5	−20.1
θ Scorpii	30	−42 56	2.0	F0	.010	....	....	.....	+ 1.4
α Ophiuchi	30	+12 38	2.1	A0	.264	.052	63	0.7	+15. *
κ Scorpii	36	−38 58	2.5	B3	.032	.011	296	−2.3	−10. *
β Ophiuchi	38	+ 4 37	2.9	K2	.157	.036	91	0.7	−11.9
ι^1 Scorpii	41	−40 5	3.1	F8	.004	.007	466	−2.6	−27.6
||μ Herculis	43	+27 47	3.5	G5	.817	.112	29	3.7	−16.1
G Scorpii	43	−37 1	3.2	K2	.068	.028	116	0.5	+24.7
ν Ophiuchi	54	− 9 46	3.5	G7	.118	.023	142	0.3	+12.4
γ Draconis	54	+51 30	2.4	K5	.026	.028	116	−0.3	−27.8
γ Sagittarii	59	−30 26	3.1	K0	.206	.041	79	−1.1	+22.3*
η Sagittarii	18 11	−36 48	3.2	M4	.223	.032	102	0.7	+ 0.5
δ Sagittarii	15	−29 52	2.8	K4	.042	.035	93	0.6	−20.0
η Serpentis	16	− 2 55	3.4	G9	.898	.060	54	2.3	+ 8.9
ε Sagittarii	18	−34 26	2.0	A0	.139	....	....	.....	−10.8
λ Sagittarii	22	25 29	2.9	K1	.197	.048	68	−1.4	−43.3
α **Lyrae**	34	+38 41	0.1	A1	.348	.123	26	0.6	−13.8

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
φ Sagittarii	18 39	−27 6	3.3	B8	.053	.018	181	−0.4	+21.5*
‖β Lyrae	46	+33 15	3.4–4.1	B2p	.011	.003	1086	−4.2	−19.0*
σ Sagittarii	49	−26 25	2.1	B3	.081	.018	181	−1.6	−10.7
γ Lyrae	55	+32 33	3.3	B9p	.010	.016	204	−0.7	−21.5*
‖ζ Sagittarii	56	−30 1	2.7	A2	.026	.036	91	0.5	+22.1
τ Sagittarii	19 1	−27 49	3.4	K0	.265	.043	76	1.6	+45.4*
ζ Aquilae	1	+13 43	3.0	A0	.103	.037	88	0.9	−25. *
π Sagittarii	4	−21 11	3.0	F2	.041	.022	148	−0.3	− 9.8
δ Draconis	13	+67 29	3.2	G8	.135	.032	102	0.8	+24.8
δ Aquilae	21	+ 2 55	3.4	A3	.267	.057	57	2.2	−32.3*
‖β Cygni	27	+27 45	3.2	K0	.010	.020	163	0.3	−23.9*
γ Aquilae	42	+10 22	2.8	K3	.018	.023	142	−0.4	− 2.0
‖δ Cygni	42	+44 53	3.0	A1	.067	.034	96	0.6	−20.
α **Aquilae**	46	+ 8 36	0.9	A2	.659	.200	16	2.4	−26.1
θ Aquilae	20 6	− 1 7	3.4	A0	.035	.017	192	−0.5	−28.6*
‖β Capricorni	15	−15 6	3.2	F8	.042	.017	192	−0.6	−19.0*
α Pavonis	18	−57 3	2.1	B3	.090	.013	251	−2.3	+ 1.8*
γ Cygni	19	+39 56	2.3	F8	.006	.007	466	−3.4	− 7.6
α Indi	31	−47 38	3.2	G2	.072	.036	91	1.0	− 1.1
α **Cygni**	38	+44 55	1.3	A2p	.004	.005	652	−5.2	− 6.3*
ε Cygni	42	+33 36	2.6	G7	.485	.045	72	0.9	−10.5*
ζ Cygni	21 9	+29 49	3.4	G6	.061	.018	181	−0.3	+16.9*
α Cephei	16	+62 10	2.6	A2	.163	.078	42	2.1	− 8.
β Aquarii	26	− 6 1	3.1	G1	.020	.006	543	−3.0	+ 6.7
β Cephei	27	+70 7	3.3	B1	.013	.008	407	−2.2	− 7.2*
ε Pegasi	39	+ 9 25	2.5	K2	.028	.020	163	−1.0	+ 5.2
δ Capricorni	42	−16 35	3.0	A3	.395	.095	34	2.9	− 6.4*
γ Gruis	48	−37 50	3.2	B8	.108	.018	181	−0.6	− 2.1
α Aquarii	22 1	− 0 48	3.2	G0	.018	.007	466	−2.6	+ 7.6
α Gruis	2	−47 27	2.2	B5	.200	.028	116	−0.6	+11.8
α Tucanae	12	−60 45	2.9	K5	.085	.023	142	−0.3	+42.2*
β Gruis	37	−47 24	2.2	M6	.132	.015	217	−1.9	+ 1.6
η Pegasi	38	+29 42	3.1	G1	.039	.013	251	−1.3	+ 4.4*
α **P Australis**	52	−30 9	1.3	A3	.367	.122	26	1.7	+ 6.5
β Pegasi	59	+27 32	2.6	M3	.235	.020	163	−0.9	+ 8.6
α Pegasi	59	+14 40	2.6	A0	.077	.034	96	0.2	− 4. *
γ Cephei	23 35	+77 4	3.4	K1	.167	.069	47	2.6	−42.0

STAR CLUSTERS AND NEBULAE

Prepared by J. F. HEARD

The amateur who possesses a telescope will find great interest in the observation and identification of star clusters and nebulae. Such objects, of course, have been extensively catalogued and classified. The most frequently quoted catalogue is Dreyer's New General Catalogue (N.G.C.) containing 7,840 objects, extended by the Index Catalogue (I.C.) containing 5,386 more. The most interesting catalogue historically, however, and one which is still quoted for reference to the more conspicuous objects is Messier's Catalogue (M) which contains 103 objects. It was drawn up in 1781 by Charles Messier for his own convenience in identifying comets.

Messier's Catalogue as given below is adapted from a publication by Shapley and Davis (Pub. A.S.P., XXIX, 178, 1917). It includes the Messier number, the N.G.C. number, the 1900 position, the classification of the object and, under remarks, the name of the object (if any).

The classification is not that of Messier; it is the new classification based on modern knowledge of these objects. The clusters are classified as open clusters, which are loose irregular aggregates usually of a few scores of stars, or as globular clusters which are compact aggregates of upwards to hundreds of thousands of stars in spherical formation. The nebulae are classified as diffuse, planetary or spiral. The diffuse nebulae are great clouds of gas and "star-dust" rendered luminous by nearby stars and the planetaries are compact atmospheres of the same materials surrounding a single star. The spirals, on the other hand, are self-luminous and quite outside our stellar system and must be thought of as island universes or other galaxies like our own.

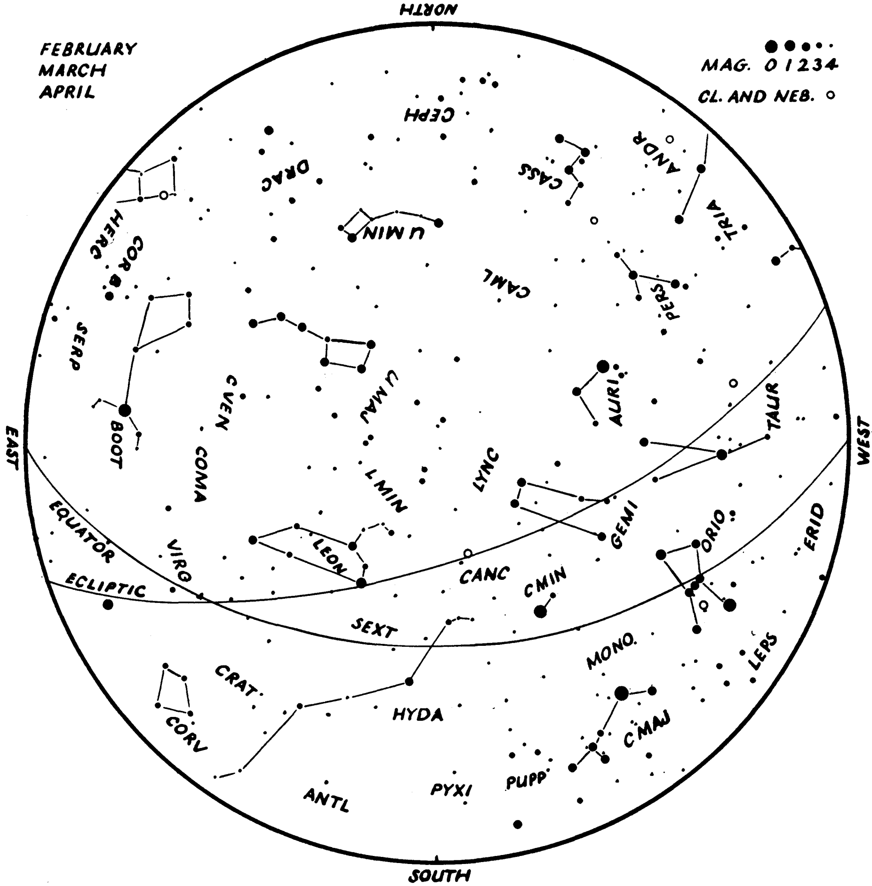
MESSIER'S CATALOGUE OF CLUSTERS AND NEBULAE

Messier	N.G.C.	R.A. (1900)	Dec. (1900)	Type of Object	Remarks
		h m	° ′		
1	1952	5 28.5	+21 57	Diffuse nebula	The Crab nebula in Taurus
2	7089	21 28.3	− 1 16	Globular cluster	
3	5272	13 37.6	+28 53	Globular cluster	
4	6121	16 17.5	−26 17	Globular cluster	
5	5904	15 13.5	+ 2 27	Globular cluster	
6	6405	17 33.5	−32 9	Open cluster	
7	6475	17 47.3	−34 47	Open cluster	
8	6523	17 57.6	−24 23	Diffuse nebula	The Lagoon nebula —very large
9	6333	17 13.3	−18 25	Globular cluster	
10	6254	16 51.9	− 3 57	Globular cluster	
11	6705	18 45.7	− 6 23	Open cluster	
12	6218	16 42.0	− 1 46	Globular cluster	
13	6205	16 38.1	+36 39	Globular cluster	The Hercules cluster —best example

Messier	N.G.C.	R.A. (1900)	Dec. (1900)	Type of Object	Remarks
		h m	° ′		
14	6402	17 32.4	− 3 11	Globular cluster	
15	7078	21 25.2	+11 44	Globular cluster	
16	6611	18 13.2	−13 49	Open cluster	
17	6618	18 15.0	−16 13	Diffuse nebula	The Horseshoe or Omega nebula—bright
18	6613	18 14.1	−17 10	Open cluster	
19	6273	16 56.4	−26 7	Globular cluster	
20	6514	17 56.3	−23 2	Diffuse nebula	The Trifid nebula—bright
21	6531	17 58.6	−22 30	Open cluster	
22	6656	18 30.3	−23 59	Globular cluster	
23	6494	17 51.0	−19 0	Open cluster	
24	6603	18 12.6	−18 27	Open cluster	
25	I.C. 4725	18 25.8	−19 19	Open cluster	
26	6694	18 39.8	− 9 30	Open cluster	
27	6853	19 55.3	+22 27	Planetary nebula	The Dumb-bell nebula
28	6626	18 18.4	−24 55	Globular cluster	
29	6913	20 20.3	+38 12	Open cluster	
30	7099	21 34.7	−23 38	Globular cluster	
31	224	0 37.3	+40 43	Spiral nebula	The Andromeda nebula—largest spiral
32	221	0 37.2	+40 19	Spiral nebula	Very close to M31 much smaller
33	598	1 28.2	+30 9	Spiral nebula	
34	1039	2 35.6	+42 21	Open cluster	
35	2168	6 2.7	+24 21	Open cluster	
36	1960	5 29.5	+34 4	Open cluster	
37	2099	5 45.8	+32 31	Open cluster	
38	1912	5 22.0	+35 45	Open cluster	
39	7092	21 28.6	+48 0	Open cluster	
40	....	12 17.4	+58 40	....	Two faint stars mistaken for a nebula by Messier
41	2287	6 42.7	−20 38	Open cluster	
42	1976	5 30.4	− 5 27	Diffuse nebula	The Orion nebula—very bright
43	1982	5 30.6	− 5 20	Diffuse nebula	
44	2632	8 34.3	+20 20	Open cluster	Praesepe or the Beehive cluster
45	....	3 41.5	+23 48	Open cluster	The Pleiades
46	2437	7 37.2	−14 35	Open cluster	
47	2478	7 50.2	−15 9	Open cluster	
48	....	8 9.0	− 1 39	Open cluster	
49	4472	12 24.7	+ 8 33	Spiral nebula	
50	2323	6 58.2	− 8 12	Open cluster	
51	5194	13 25.7	+47 43	Spiral nebula	The Whirlpool nebula
52	7654	23 19.8	+61 3	Open cluster	
53	5024	13 8.0	+18 42	Globular cluster	
54	6715	18 48.7	−30 36	Globular cluster	

Messier	N.G.C.	R.A. (1900)	Dec. (1900)	Type of Object	Remarks
		h m	° ′		
55	6809	19 33.7	−31 10	Globular cluster	
56	6779	19 12.7	+30 0	Globular cluster	
57	6720	18 49.9	+32 54	Planetary nebula	The Ring nebula in Lyra
58	4579	12 32.7	+12 22	Spiral nebula	
59	4621	12 37.0	+12 12	Spiral nebula	
60	4649	12 38.6	+12 6	Spiral nebula	
61	4303	12 16.8	+ 5 2	Spiral nebula	
62	6266	16 54.8	−29 58	Globular cluster	
63	5055	13 11.3	+42 34	Spiral nebula	
64	4826	12 51.8	+22 13	Spiral nebula	
65	3623	11 13.7	+13 38	Spiral nebula	
66	3627	11 15.0	+13 32	Spiral nebula	
67	2682	8 45.8	+12 11	Open cluster	
68	4590	12 34.2	−26 12	Globular cluster	
69	6637	18 24.8	−32 25	Globular cluster	
70	6681	18 36.7	−32 23	Globular cluster	
71	6838	19 49.3	+18 31	Open cluster	
72	6981	20 48.0	−12 55	Globular cluster	
73	6994	20 53.5	−13 1	Open cluster	
74	628	1 31.3	+15 16	Spiral nebula	
75	6864	20 0.2	−22 12	Globular cluster	
76	650	1 36.0	+51 4	Planetary nebula	
77	1068	2 37.6	− 0 26	Spiral nebula	
78	2068	5 41.6	+ 0 1	Diffuse nebula	
79	1904	5 20.1	−24 37	Globular cluster	
80	6093	16 11.1	−22 44	Globular cluster	
81	3031	9 47.3	+69 32	Spiral nebula	
82	3034	9 47.5	+70 10	Spiral nebula	
83	5236	13 31.4	−29 21	Spiral nebula	
84	4374	12 20.0	+13 26	Spiral nebula	
85	4382	12 20.4	+18 45	Spiral nebula	
86	4406	12 21.1	+13 30	Spiral nebula	
87	4486	12 25.8	+12 57	Spiral nebula	
88	4501	12 26.9	+14 58	Spiral nebula	
89	4552	12 30.6	+13 6	Spiral nebula	
90	4569	12 31.8	+13 43	Spiral nebula	
91	....	12 36.0	+13 50	....	Not confirmed—probably comet
92	6341	17 14.1	+43 15	Globular cluster	
93	2447	7 40.5	−23 38	Open cluster	
94	4736	12 46.2	+41 40	Spiral nebula	
95	3351	10 38.7	+12 14	Spiral nebula	
96	3368	10 41.5	+12 21	Spiral nebula	
97	3587	11 9.0	+55 34	Planetary nebula	The Owl nebula
98	4192	12 8.7	+15 27	Spiral nebula	
99	4254	12 13.8	+14 58	Spiral nebula	
100	4321	12 17.9	+16 23	Spiral nebula	
101	5457	13 59.6	+54 50	Spiral nebula	
102	5866?	15 3.8	+56 9	Spiral nebula	
103	581	1 26.6	+60 11	Open cluster	

STAR MAP I

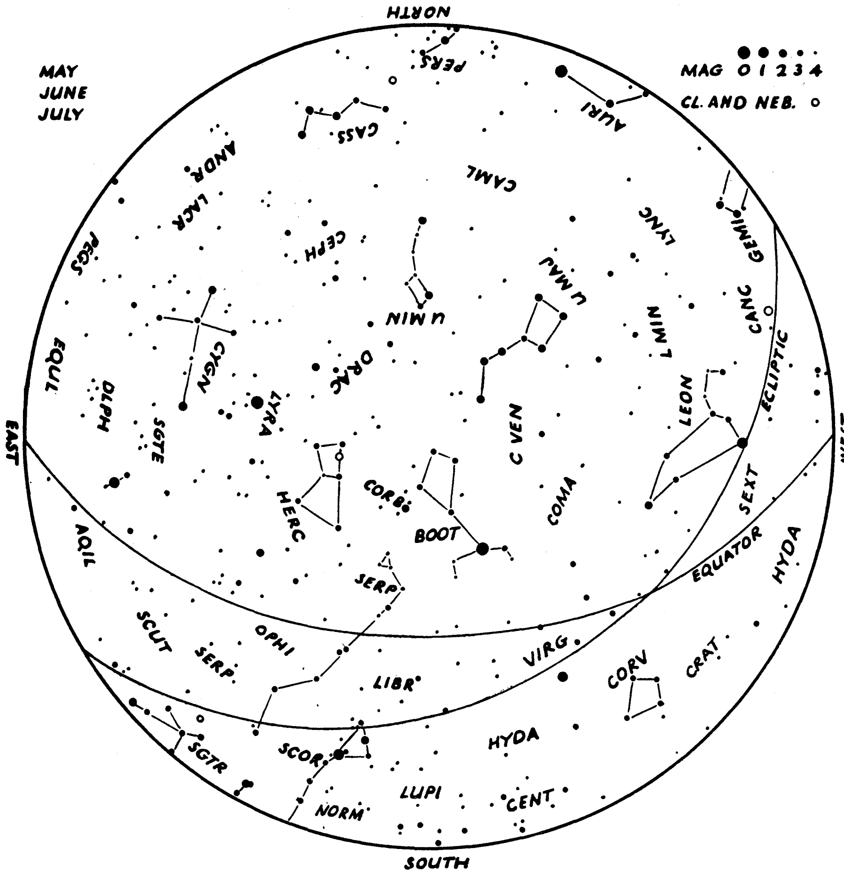


The above map represents the evening sky at

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

The centre of the map is the zenith, the circumference the horizon. To identify the stars hold the map so that the part of the horizon you are facing is down.

STAR MAP 2

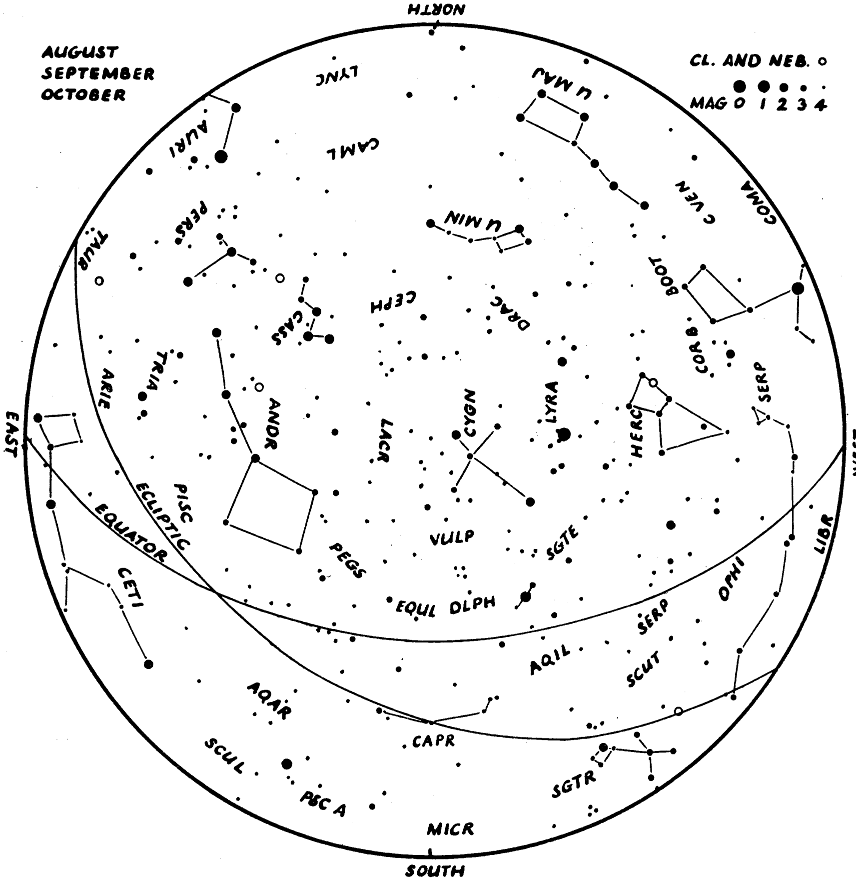


The above map represents the evening sky at

Midnight......	May	8
11 p.m........	"	24
10 "	June	7
9 "	"	22
8 "	July	6

The centre of the map is the zenith, the circumference the horizon. To identify the stars hold the map so that the part of the horizon you are facing is down.

STAR MAP 3

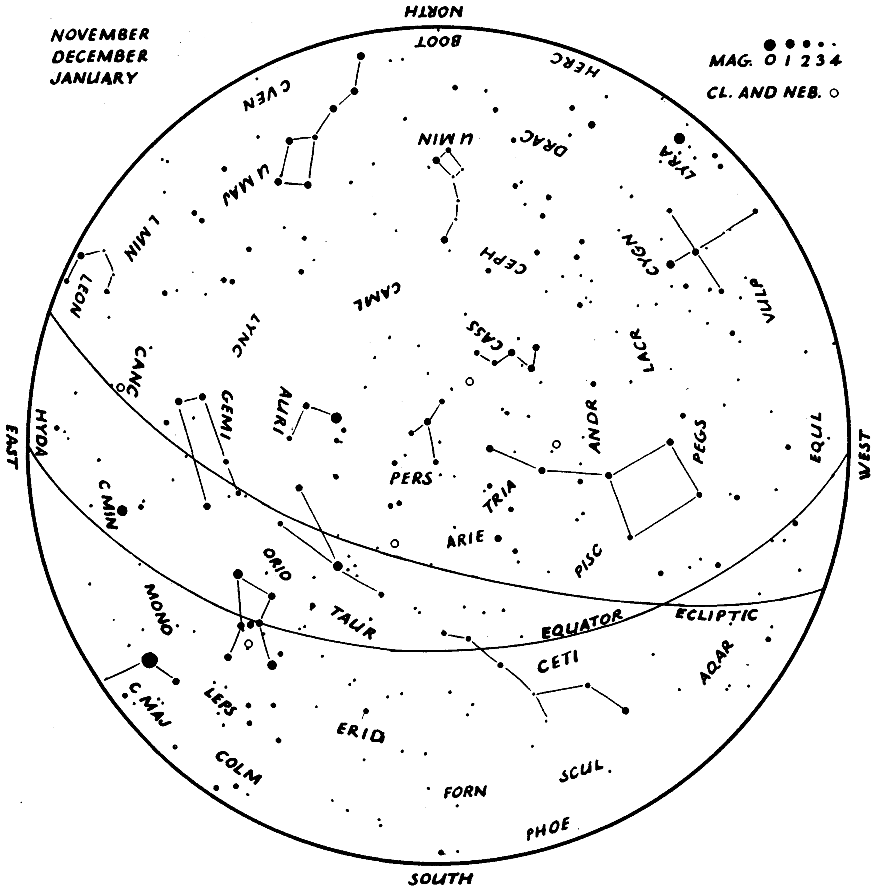


The above map represents the evening sky at

Midnight	Aug.	5
11 p.m	"	21
10 "	Sept.	7
9 "	"	23
8 "	Oct.	10
7 "	"	26
6 "	Nov.	6
5 "	"	21

The centre of the map is the zenith, the circumference the horizon. To identify the stars hold the map so that the part of the horizon you are facing is down.

STAR MAP 4



The above map represents the evening sky at

Midnight......	Nov.	6
11 p.m........	"	21
10 "	Dec.	6
9 "	"	21
8 "	Jan.	5
7 "	"	20
6 "	Feb.	6

The centre of the map is the zenith, the circumference the horizon. To identify the stars hold the map so that the part of the horizon you are facing is down.

Temperature and Precipitation at Canadian and United States Stations

Prepared by Andrew Thompson.

Station.	Mean Temperature, Fahrenheit.												Average Annual.		
	Jan.	Feb.	Ma.	Ap.	May	Ju.	Jul.	Aug.	Sep.	Oc.	No.	De.	M	H	L
Victoria, B.C.	30	40	44	49	53	57	60	56	56	51	45	41	49	86	19
Vancouver, B.C.	36	39	43	48	53	60	63	63	57	50	43	38	50	86	13
Edmonton, Alta.	6	12	22	40	51	57	62	59	50	41	26	14	37	89	−41
Calgary, Alta.	11	14	25	40	49	56	61	59	50	42	26	20	38	91	−34
Regina, Sask.	−4	−2	14	37	50	59	64	61	51	39	21	8	33	94	−40
Winnipeg, Man.	−3	2	16	38	52	62	62	64	54	41	22	6	35	94	−38
Toronto, Ont.	23	22	30	42	53	63	69	67	60	48	37	27	45	92	−12
Ottawa, Ont.	12	13	25	42	55	65	69	66	59	46	33	17	42	93	−24
Montreal, Que.	14	15	26	41	55	65	70	67	59	47	33	20	43	90	−18
Halifax, N.S.	23	23	30	39	49	58	65	64	58	49	39	28	44	89	−9
Churchill, Man.	−19	−17	−6	15	29	42	53	52	41	26	7	−10	18	81	−46
Aklavik, N.W.T.	−18	−16	−12	8	31	49	56	50	38	19	−4	−14	16	83	−52
St. John's, Nfld.	23	22	28	35	43	51	59	60	54	45	37	29	41	83	−6
New York, N.Y.	31	31	37	49	60	68	73	73	56	56	44	35	52	95	2
Washington, D.C.	33	35	42	53	64	72	76	75	68	57	45	36	55	98	4
Chicago, Ill.	25	28	36	48	59	68	74	73	66	55	41	30	50	95	−10
Denver, Colo.	29	32	39	47	57	67	72	71	63	51	39	32	50	97	−13
San Francisco	50	51	53	54	56	57	57	58	60	59	55	51	55	91	37

High and *Low* are the averages of the highest and of the lowest temperatures each year at the station, over the total time since the station was installed.

Station	Mean Precipitation. (Unit =one tenth of an inch)												Year.		
	Jan.	Fe.	Ma.	Ap.	May	Ju.	Jul.	Aug.	Sep.	Oc.	No.	De.	M	W	D
Victoria, B.C.	45	30	23	12	10	9	4	6	15	28	43	47	271	510	173
Vancouver, B.C.	88	57	52	32	28	23	13	16	38	58	85	86	575	676	378
Edmonton, Alta.	9	7	7	9	17	31	33	24	13	7	7	8	171	278	82
Calgary, Alta.	5	6	7	7	24	32	26	27	13	6	7	5	164	346	79
Regina, Sask.	4	3	5	7	20	32	25	19	12	7	5	4	141	272	101
Winnipeg, Man.	9	8	11	13	22	31	31	23	23	15	11	9	206	302	102
Toronto, Ont.	28	25	25	25	29	27	30	29	30	24	28	26	325	436	176
Ottawa, Ont.	30	25	26	22	28	32	33	30	27	28	25	29	335	444	232
Montreal, Que.	37	32	35	25	30	35	37	35	35	33	35	37	407	530	292
Halifax, N.S.	56	45	50	45	42	37	39	45	36	53	54	54	555	678	388
Churchill, Man.	6	10	11	10	10	20	18	25	26	13	12	9	168		
Aklavik, N.W.T.	7	8	6	7	8	7	16	14	10	8	10	5	105	150	98
St. John's, Nfld.	54	51	45	42	36	36	37	36	38	54	61	49	538	691	427
New York, N.Y.	36	41	35	33	32	34	42	43	34	35	30	35	430	587	331
Washington, D.C.	35	35	37	33	36	42	46	39	33	28	24	32	422	614	307
Chicago, Ill.	19	23	26	28	35	34	33	32	32	25	24	20	327	461	244
Denver, Colo.	4	6	10	21	22	14	17	14	10	11	6	7	141	228	79
San Francisco	44	42	31	17	8	2	0	0	4	11	24	39	220	390	91

Wettest and *Driest* indicate the greatest and the least total precipitation in one year from Jan. 1 to Dec. 31 recorded at a station, records being available for varying periods from 30 to 50 years.

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