THE OBSERVER'S HANDBOOK FOR 1943

PUBLISHED BY

The Royal Astronomical Society of Canada

C. A. CHANT, EDITOR
F. S. HOGG, ASSISTANT EDITOR
DAVID DUNLAP OBSERVATORY

THIRTY-FIFTH YEAR OF PUBLICATION

TORONTO
198 COLLEGE STREET
PRINTED FOR THE SOCIETY
BY THE UNIVERSITY OF TORONTO PRESS
1943

1943 CALENDAR 1943

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

APRIL						
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	....	

MAY						
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	....

JUNE						
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	....	

JULY						
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	

AUGUST						
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	....	

SEPTEMBER						
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	....	

OCTOBER						
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	....

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

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

JULIAN DAY CALENDAR, 1943

J.D. 2,430,000 plus the following:

Jan. 1	726	May 1	846	Sept. 1	969
Feb. 1	757	June 1	877	Oct. 1	999
Mar. 1	785	July 1	907	Nov. 1	1030
Apr. 1	816	Aug. 1	938	Dec. 1	1060

The Julian Day commences at noon.
Thus J.D. 2,430,726 = Jan. 1.5 G.C.T.

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CONTENTS

TABLES IN RECENT OBSERVER'S HANDBOOKS

PRINTED IN CANADA

PREFACE

The HANDBOOK for 1943 is the thirty-fifth issue. The times of moonrise and moonset, first printed last year, are now extended to include five latitudes, namely, 40, 45, 50, 52 and 54 degrees. The page of meteorological information for places in Europe and Asia is not given this year; but the tables of lunar occultations for Canadian stations appear again. Messier's catalogue has been replaced by three tables giving more complete information about clusters, galactic nebulae, and extra-galactic nebulae.

Four circular star maps, 9 inches in diameter at a price of one cent each, and a set of four maps, plotted on equatorial coordinates, bound in a cover at a price of ten cents, are obtainable from the Director of University Extension, University of Toronto. For fuller information reference may be made to Norton's *Star Atlas and Reference Handbook* (Gall and Inglis, eighth edition (1942), price 12s 6d).

Throughout this HANDBOOK distances are based on the standard value 8″.80 for the sun's parallax, rather than the new value 8″.790 as determined by Dr. H. Spencer Jones, the Astronomer Royal. The predictions of the minima of Algol are based on a period of 2.867318 days by W. M. Smart, and from a minimum at J.D. 2,429,234.6859 observed by J. S. Hall.

To the Assistant Editor, Dr. F. S. Hogg, the credit for preparing this volume is chiefly due; but sincere thanks are tendered to all those whose names are mentioned in the book and especially to Miss Ruth J. Northcott of the staff of the David Dunlap Observatory.

C. A. CHANT

David Dunlap Observatory,
Richmond Hill, Ont., December 1942.

ANNIVERSARIES AND FESTIVALS 1943

New Year's Day	Fri.	Jan. 1
Epiphany	Wed.	Jan. 6
Septuagesima Sunday		Feb. 21
St. David	Mon.	Mar. 1
Quinquagesima (Shrove Sunday)		Mar. 7
Ash Wednesday		Mar. 10
St. Patrick	Wed.	Mar. 17
Palm Sunday		Apr. 18
Good Friday		Apr. 23
St. George	Fri.	Apr. 23
Easter Sunday		Apr. 25
Empire Day (Victoria Day)	Mon.	May 24
Birthday of the Queen Mother, Mary (1867)	Wed.	May 26
Rogation Sunday		May 30
Ascension Day	Thu.	Jun. 3
Pentecost (Whit Sunday)		Jun. 13
Trinity Sunday		Jun. 20
St. John Baptist (Midsummer Day)	Thu.	Jun. 24
Dominion Day	Thu.	Jul. 1
Corpus Christi	Thu.	Jul. 1
Birthday of Queen Elizabeth (1900)	Wed.	Aug. 4
Labour Day	Mon.	Sep. 6
St. Michael (Michaelmas Day)	Wed.	Sep. 29
Hebrew New Year (Rosh Hashanah)	Thu.	Sep. 30
All Saints' Day	Mon.	Nov. 1
Remembrance Day	Thu.	Nov. 11
First Sunday in Advent		Nov. 28
St. Andrew	Tue.	Nov. 30
Ascension of King George VI (1936)	Sat.	Dec. 11
Birthday of King George VI (1895)	Tue.	Dec. 14
Christmas Day	Sat.	Dec. 25

Thanksgiving Day, date set by Proclamation

In 1943 Dominion Day is to be observed Monday, July 5.

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

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

THE CONFIGURATIONS OF JUPITER'S SATELLITES

In the Configurations of Jupiter's Satellites (pages 27, 29, 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.

THE CONSTELLATIONS

Latin and English Names with Abbreviations

Andromeda, (*Chained Maiden*)	And	Andr
Antlia, *Air Pump*	Ant	Antl
Apus, *Bird of Paradise*	Aps	Apus
Aquarius, *Water-bearer*	Aqr	Aqar
Aquila, *Eagle*	Aql	Aqil
Ara, *Altar*	Ara	Arae
Aries, *Ram*	Ari	Arie
Auriga, (*Charioteer*)	Aur	Auri
Bootes, (*Herdsman*)	Boo	Boot
Caelum, *Chisel*	Cae	Cael
Camelopardalis, *Giraffe*	Cam	Caml
Cancer, *Crab*	Cnc	Canc
Canes Venatici, *Hunting Dogs*	CVn	CVen
Canis Major, *Greater Dog*	CMa	CMaj
Canis Minor, *Lesser Dog*	CMi	CMin
Capricornus, *Sea-goat*	Cap	Capr
Carina, *Keel*	Car	Cari
Cassiopeia, (*Lady in Chair*)	Cas	Cass
Centaurus, *Centaur*	Cen	Cent
Cepheus, (*King*)	Cep	Ceph
Cetus, *Whale*	Cet	Ceti
Chamaeleon, *Chamaeleon*	Cha	Cham
Circinus, *Compasses*	Cir	Circ
Columba, *Dove*	Col	Colm
Coma Berenices, *Berenice's Hair*	Com	Coma
Corona Australis, *Southern Crown*	CrA	CorA
Corona Borealis, *Northern Crown*	CrB	CorB
Corvus, *Crow*	Crv	Corv
Crater, *Cup*	Crt	Crat
Crux, (*Southern*) *Cross*	Cru	Cruc
Cygnus, *Swan*	Cyg	Cygn
Delphinus, *Dolphin*	Del	Dlph
Dorado, *Swordfish*	Dor	Dora
Draco, *Dragon*	Dra	Drac
Equuleus, *Little Horse*	Equ	Equl
Eridanus, *River Eridanus*	Eri	Erid
Fornax, *Furnace*	For	Forn
Gemini, *Twins*	Gem	Gemi
Grus, *Crane*	Gru	Grus
Hercules, (*Kneeling Giant*)	Her	Herc
Horologium, *Clock*	Hor	Horo
Hydra, *Water-snake*	Hya	Hyda
Hydrus, *Sea-serpent*	Hyi	Hydi
Indus, *Indian*	Ind	Indi
Lacerta, *Lizard*	Lac	Lacr
Leo, *Lion*	Leo	Leon
Leo Minor, *Lesser Lion*	LMi	LMin
Lepus, *Hare*	Lep	Leps
Libra, *Scales*	Lib	Libr
Lupus, *Wolf*	Lup	Lupi
Lynx, *Lynx*	Lyn	Lync
Lyra, *Lyre*	Lyr	Lyra
Mensa, *Table* (*Mountain*)	Men	Mens
Microscopium, *Microscope*	Mic	Micr
Monoceros, *Unicorn*	Mon	Mono
Musca, *Fly*	Mus	Musc
Norma, *Square*	Nor	Norm
Octans, *Octant*	Oct	Octn
Ophiuchus, *Serpent-bearer*	Oph	Ophi
Orion, (*Hunter*)	Ori	Orio
Pavo, *Peacock*	Pav	Pavo
Pegasus, (*Winged Horse*)	Peg	Pegs
Perseus, (*Champion*)	Per	Pers
Phoenix, *Phoenix*	Phe	Phoe
Pictor, *Painter*	Pic	Pict
Pisces, *Fishes*	Psc	Pisc
Piscis Australis, *Southern Fish*	PsA	PscA
Puppis, *Poop*	Pup	Pupp
Pyxis, *Compass*	Pyx	Pyxi
Reticulum, *Net*	Ret	Reti
Sagitta, *Arrow*	Sge	Sgte
Sagittarius, *Archer*	Sgr	Sgtr
Scorpius, *Scorpion*	Scr	Scor
Sculptor, *Sculptor*	Scl	Scul
Scutum, *Shield*	Sct	Scut
Serpens, *Serpent*	Ser	Serp
Sextans, *Sextant*	Sex	Sext
Taurus, *Bull*	Tau	Taur
Telescopium, *Telescope*	Tel	Tele
Triangulum, *Triangle*	Tri	Tria
Triangulum Australe, *Southern Triangle*	TrA	TrAu
Tucana, *Toucan*	Tuc	Tucn
Ursa Major, *Greater Bear*	UMa	UMaj
Ursa Minor, *Lesser Bear*	UMi	UMin
Vela, *Sails*	Vel	Velr
Virgo, *Virgin*	Vir	Virg
Volans, *Flying Fish*	Vol	Voln
Vulpecula, *Fox*	Vul	Vulp

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

MISCELLANEOUS ASTRONOMICAL DATA

Units of Length

1 Angstrom unit	$= 10^{-8}$ cm.		
1 micron	$= 10^{-4}$ cm.		
1 meter	$= 10^{2}$ cm.	= 3.28084 feet	
1 kilometer	$= 10^{5}$ cm.	= 0.62137 miles	
1 mile	$= 1.60935 \times 10^{5}$ cm.	= 1.60935 km.	
1 astronomical unit	$= 1.49504 \times 10^{13}$ cm.	= 92,897,416 miles	
1 light year	$= 9.463 \times 10^{17}$ cm.	$= 5.880 \times 10^{12}$ miles	= 0.3069 parsecs
1 parsec	$= 30.84 \times 10^{17}$ cm.	$= 19.16 \times 10^{12}$ miles	= 3.259 l.y.
1 megaparsec	$= 30.84 \times 10^{23}$ cm.	$= 19.16 \times 10^{18}$ miles	$= 3.259 \times 10^{6}$ l.y.

Units of Time

Sidereal day = $23^h\ 56^m\ 04.09^s$ of mean solar time
Mean solar day = $24^h\ 03^m\ 56.56^s$ of sidereal time
Synodical month = $29^d\ 12^h\ 44^m$; sidereal month = $27^d\ 07^h\ 43^m$
Tropical year (ordinary) = $365^d\ 05^h\ 48^m\ 46^s$
Sidereal year = $365^d\ 06^h\ 09^m\ 10^s$
Eclipse year = $346^d\ 14^h\ 53^m$

The Earth

Equatorial radius, a = 3963.35 miles; flattening, $c = (a-b)/a = 1/297.0$
Polar radius, b = 3950.01 miles
1° of latitude = $69.057 - 0.349 \cos 2\phi$ miles (at latitude ϕ)
1° of longitude = $69.232 \cos \phi - 0.0584 \cos 3\phi$ miles

Mass of earth = 6.6×10^{21} tons; velocity of escape from $\oplus$ = 6.94 miles/sec.

Earth's Orbital Motion

Solar parallax = 8."80; constant of aberration = 20."47
Annual general precession = 50."26; obliquity of ecliptic = 23° 26′ 50″ (1939)
Orbital velocity = 18.5 miles/sec.; parabolic velocity at $\oplus$ = 26.2 miles/sec.

Solar Motion

Solar apex, R.A. $18^h\ 04^m$; Dec. + 31°
Solar velocity = 12.2 miles/sec.

The Galactic System

North pole of galactic plane R.A. $12^h\ 40^m$, Dec. + 28° (1900)
Centre, 325° galactic longitude, = R.A. $17^h\ 24^m$, Dec. −30°
Distance to centre = 10,000 parsecs; diameter = 30,000 parsecs.
Rotational velocity (at sun) = 262 km./sec.
Rotational period (at sun) = 2.2×10^{8} years
Mass = 2×10^{11} solar masses

Extragalactic Nebulae

Red shift = +530 km./sec./megaparsec = +101 miles /sec./million l.y.

Radiation Constants

Velocity of light = 299,774 km./sec. = 186,271 miles/sec.
Solar constant = 1.93 gram calories/square cm./minute
Light ratio for one magnitude = 2.512; log ratio = 0.4000
Radiation from a star of zero apparent magnitude = 3×10^{-6} meter candles
Total energy emitted by a star of zero absolute magnitude = 5×10^{25} horsepower

Miscellaneous

Constant of gravitation, $G = 6.670 \times 10^{-8}$ c.g.s. units
Mass of the electron, $m = 9.035 \times 10^{-28}$ gm.; mass of the proton = 1.662×10^{-24} gm.
Planck's constant, $h = 6.55 \times 10^{-27}$ erg. sec.
Loschmidt's number = 2.705×10^{19} molecules/cu. cm. of gas at N.T.P.
Absolute temperature = $T°\ K = T°C + 273° = 5/9\ (T°\ F + 459°)$

1 radian = 57°.2958
= 3437′.75
= 206,265″

π = 3.141,592,653,6

No. of square degrees in the sky = 41,253

1943 EPHEMERIS OF THE SUN AT 0h GREENWICH CIVIL TIME

Date	Apparent R.A.	Corr. to Sundial	Apparent Dec.	Date	Apparent R.A.	Corr. to Sundial	Apparent Dec.
	h m s	m s	° ′		h m s	m s	° ′
Jan. 1	18 42 11	+03 06	−23 05.4	July 3	06 44 24	+03 49	+23 03.1
" 4	18 55 26	+04 30	−22 50.0	" 6	06 56 47	+04 23	+22 48.2
" 7	19 08 37	+05 52	−22 30.5	" 9	07 09 07	+04 53	+22 29.7
" 10	19 21 44	+07 09	−22 06.9	" 12	07 21 23	+05 19	+22 07.6
" 13	19 34 46	+08 21	−21 39.5	" 15	07 33 35	+05 41	+21 42.2
" 16	19 47 42	+09 28	−21 08.4	" 18	07 45 42	+05 59	+21 13.4
" 19	20 00 32	+10 28	−20 33.6	" 21	07 57 45	+06 12	+20 41.4
" 22	20 13 15	+11 22	−19 55.2	" 24	08 09 43	+06 20	+20 06.3
" 25	20 25 52	+12 09	−19 13.6	" 27	08 21 35	+06 23	+19 28.1
" 28	20 38 22	+12 49	−18 28.7	" 30	08 33 23	+06 21	+18 47.0
" 31	20 50 44	+13 22	−17 40.9				
				Aug. 2	08 45 05	+06 13	+18 03.2
Feb. 3	21 02 59	+13 48	−16 50.2	" 5	08 56 42	+06 01	+17 16.7
" 6	21 15 08	+14 06	−15 56.9	" 8	09 08 13	+05 42	+16 27.6
" 9	21 27 08	+14 17	−15 01.0	" 11	09 19 39	+05 18	+15 36.2
" 12	21 39 02	+14 21	−14 03.0	" 14	09 30 59	+04 49	+14 42.6
" 15	21 50 48	+14 18	−13 02.8	" 17	09 42 15	+04 15	+13 46.8
" 18	22 02 28	+14 08	−12 00.8	" 20	09 53 25	+03 36	+12 49.1
" 21	22 14 01	+13 51	−10 57 0	" 23	10 04 32	+02 53	+11 49.5
" 24	22 25 28	+13 29	−09 51.7	" 26	10 15 34	+02 06	+10 48.2
" 27	22 36 50	+13 01	−08 45.0	" 29	10 26 34	+01 15	+09 45.4
Mar. 2	22 48 07	+12 29	−07 37.2	Sept. 1	10 37 29	+00 21	+08 41.2
" 5	22 59 20	+11 52	−06 28.4	" 4	10 48 22	−00 36	+07 35.7
" 8	23 10 29	+11 10	−05 18.7	" 7	10 59 13	−01 35	+06 29.2
" 11	23 21 34	+10 26	−04 08.5	" 10	11 10 01	−02 36	+05 21.6
" 14	23 32 35	+09 38	−02 57.7	" 13	11 20 48	−03 39	+04 13.3
" 17	23 43 34	+08 47	−01 46.7	" 16	11 31 34	−04 43	+03 04.4
" 20	23 54 32	+07 55	−00 35.6	" 19	11 42 19	−05 47	+01 54.8
" 23	00 05 27	+07 01	+00 35.5	" 22	11 53 05	−06 51	+00 45.0
" 26	00 16 22	+06 06	+01 46.4	" 25	12 03 52	−07 54	−00 25.1
" 29	00 27 17	+05 11	+02 56.9	" 28	12 14 40	−08 55	−01 35.3
Apr. 1	00 38 12	+04 16	+04 06.9	Oct. 1	12 25 30	−09 55	−02 45.4
" 4	00 49 08	+03 23	+05 16.3	" 4	12 36 23	−10 52	−03 55.2
" 7	01 00 05	+02 31	+06 24.8	" 7	12 47 18	−11 46	−05 04.7
" 10	01 11 04	+01 40	+07 32.3	" 10	12 58 16	−12 38	−06 13.5
" 13	01 22 06	+00 52	+08 38.7	" 13	13 09 19	−13 25	−07 21.6
" 16	01 33 09	+00 06	+09 43.8	" 16	13 20 26	−14 08	−08 28.8
" 19	01 44 16	−00 37	+10 47.4	" 19	13 31 38	−14 45	−09 34.9
" 22	01 55 27	−01 16	+11 49.4	" 22	13 42 55	−15 17	−10 39.7
" 25	02 06 41	−01 52	+12 49.6	" 25	13 54 19	−15 43	−11 43.2
" 28	02 18 00	−02 23	+13 48.0	" 28	14 05 49	−16 03	−12 45.1
				" 31	14 17 26	−16 16	−13 45.1
May 1	02 29 23	−02 49	+14 44.3				
" 4	02 40 51	−03 10	+15 38.5	Nov. 3	14 29 10	−16 22	−14 43.3
" 7	02 52 25	−03 27	+16 30.3	" 6	14 41 00	−16 20	−15 39.2
" 10	03 04 03	−03 38	+17 19.7	" 9	14 52 59	−16 12	−16 32.8
" 13	03 15 46	−03 45	+18 06.5	" 12	15 05 04	−15 56	−17 23.9
" 16	03 27 34	−03 46	+18 50.5	" 15	15 17 17	−15 32	−18 12.3
" 19	03 39 28	−03 42	+19 31.6	" 18	15 29 38	−15 01	−18 57.9
" 22	03 51 26	−03 34	+20 09.8	" 21	15 42 07	−14 22	−19 40.4
" 25	04 03 29	−03 20	+20 44.8	" 24	15 54 43	−13 36	−20 19.7
" 28	04 15 37	−03 02	+21 16.7	" 27	16 07 26	−12 42	−20 55.6
" 31	04 27 49	−02 40	+21 45.3	" 30	16 20 16	−11 42	−21 28.0
Jun. 3	04 40 05	−02 13	+22 10.4	Dec. 3	16 33 12	−10 35	−21 56.8
" 6	04 52 25	−01 43	+22 32.1	" 6	16 46 14	−09 24	−22 21.7
" 9	05 04 48	−01 10	+22 50.3	" 9	16 59 20	−08 07	−22 42.7
" 12	05 17 13	−00 35	+23 04.8	" 12	17 12 30	−06 46	−22 59.8
" 15	05 29 39	+00 02	+23 15.7	" 15	17 25 44	−05 22	−23 12.7
" 18	05 42 07	+00 40	+23 22.9	" 18	17 39 01	−03 55	−23 21.4
" 21	05 54 35	+01 19	+23 26.3	" 21	17 52 19	−02 27	−23 26.0
" 24	06 07 04	+01 58	+23 26.1	" 24	18 05 39	−00 57	−23 26.3
" 27	06 19 32	+02 37	+23 22.1	" 27	18 18 58	+00 33	−23 22.4
" 30	06 31 59	+03 14	+23 14.5	" 30	18 32 17	+02 02	−23 14.2

To obtain *local mean* time, apply *corr. to sundial* to *apparent* or *sundial* time.

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 is the *equation of time.* Or, in general, *Apparent Time—Mean Time = Equation of Time.* This is the same as *Correction to Sundial* on page 7, with the sign reversed.

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.

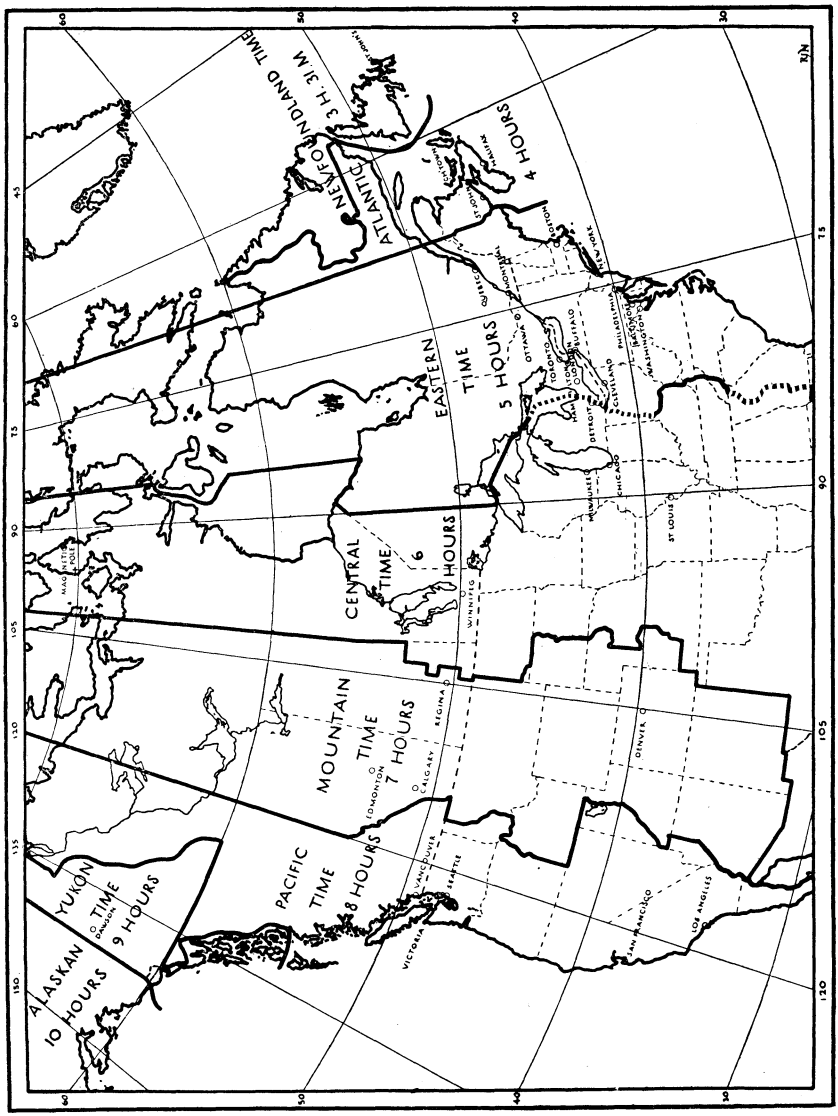
4. *Standard Time*—In everyday life we use still another kind of time. A moment's thought will show that in general two places will not have the same mean time; indeed, difference in longitude between two places is determined from their difference in time. But in travelling it is very inconvenient to 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 9.

Daylight Saving Time is the standard time of the next zone eastward. It is adopted in many places between certain specified dates during the summer. As a war-time measure daylight saving time is being used throughout Canada and the United States for the whole year. This is commonly referred to as Eastern War Time, Pacific War Time, etc.

MAP OF STANDARD TIME ZONES



Revised Zone Limits: replace broken portions of zone limits by a line down the centre of Lake Michigan, thence along northern and eastern borders of Indiana; also along northern and western borders of Georgia.

TIMES OF SUNRISE AND SUNSET

In the tables on pages 11 to 16 are given the times of sunrise and sunset for places in latitudes 36°, 40°, 44°, 46°, 48°, 50° and 52°. The times are given in Local Mean Time, and in the table below are given corrections to change from Local Mean to Standard Time for the cities and towns named.

How the Tables are Constructed

The time of sunrise and sunset at a given place, in local mean time, varies from day to day, and depends principally upon the declination of the sun. Variations in the equation of time, the apparent diameter of the sun and atmospheric refraction at the points of sunrise and sunset also affect the final result. These quantities, as well as the solar declination, do not have precisely the same values on corresponding days from year to year, and so 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 Standard 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 local time of sunrise and sunset for the proper latitude, on the desired day, and apply the correction to get the Standard Time.

34°	min.	**44°**	min.	**46°**	min.	**50°**	m n.
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 St. 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 12.

In the above list Owen Sound is under "44°", and the correction is + 24 min. On page 11 the time of sunrise on February 12 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 7.17 and subtracting 2 min. we get the time of sunrise 7.15 (Mountain Standard Time).

DATE		Latitude 36° Sunrise	Latitude 36° Sunset	Latitude 40° Sunrise	Latitude 40° Sunset	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	h m	h m	h m	h m
January	**1**	7 11	4 57	7 22	4 45	7 35	4 32	7 42	4 25	7 50	4 17	7 59	4 08	8 08	3 59
	3	7 11	4 58	7 23	4 47	7 35	4 34	7 42	4 26	7 50	4 19	7 59	4 10	8 08	4 01
	5	7 12	5 00	7 23	4 49	7 35	4 36	7 42	4 29	7 50	4 22	7 58	4 13	8 07	4 03
	7	7 11	5 02	7 22	4 50	7 35	4 38	7 42	4 31	7 49	4 23	7 58	4 15	8 06	4 06
	9	7 11	5 04	7 22	4 52	7 34	4 40	7 41	4 33	7 49	4 26	7 57	4 18	8 05	4 08
	11	7 11	5 06	7 22	4 54	7 34	4 42	7 40	4 36	7 48	4 28	7 56	4 20	8 05	4 11
	13	7 11	5 08	7 21	4 56	7 33	4 45	7 39	4 39	7 47	4 31	7 55	4 23	8 03	4 14
	15	7 10	5 10	7 20	4 58	7 32	4 48	7 38	4 41	7 45	4 34	7 54	4 26	8 01	4 18
	17	7 10	5 12	7 20	5 00	7 30	4 50	7 37	4 44	7 44	4 37	7 52	4 29	7 59	4 21
	19	7 09	5 14	7 19	5 02	7 29	4 53	7 35	4 46	7 42	4 39	7 50	4 32	7 57	4 24
	21	7 08	5 15	7 18	5 05	7 28	4 55	7 34	4 48	7 40	4 42	7 48	4 35	7 56	4 27
	23	7 07	5 17	7 15	5 08	7 26	4 57	7 32	4 51	7 39	4 45	7 46	4 38	7 54	4 31
	25	7 06	5 19	7 14	5 10	7 26	5 00	7 31	4 54	7 37	4 48	7 44	4 41	7 51	4 35
	27	7 05	5 21	7 12	5 13	7 24	5 02	7 29	4 57	7 35	4 51	7 42	4 45	7 48	4 38
	29	7 04	5 23	7 11	5 15	7 22	5 05	7 27	5 00	7 33	4 54	7 39	4 48	7 46	4 42
	31	7 02	5 25	7 10	5 17	7 19	5 08	7 24	5 03	7 30	4 57	7 36	4 51	7 43	4 45
February	**2**	7 00	5 27	7 08	5 20	7 17	5 11	7 22	5 06	7 27	5 00	7 33	4 55	7 39	4 49
	4	6 59	5 29	7 06	5 22	7 15	5 13	7 20	5 09	7 25	5 04	7 30	4 58	7 35	4 53
	6	6 57	5 32	7 04	5 25	7 13	5 16	7 18	5 11	7 22	5 07	7 27	5 02	7 32	4 56
	8	6 55	5 34	7 02	5 27	7 10	5 19	7 15	5 14	7 20	5 10	7 24	5 05	7 29	5 00
	10	6 53	5 36	7 00	5 29	7 08	5 22	7 13	5 17	7 17	5 13	7 21	5 08	7 25	5 03
	12	6 51	5 38	6 59	5 31	7 05	5 24	7 09	5 20	7 14	5 16	7 17	5 12	7 21	5 07
	14	6 49	5 40	6 55	5 34	7 03	5 27	7 06	5 23	7 10	5 19	7 14	5 15	7 18	5 10
	16	6 47	5 42	6 53	5 36	7 00	5 30	7 02	5 26	7 06	5 23	7 10	5 19	7 14	5 14
	18	6 45	5 44	6 50	5 39	6 57	5 33	6 59	5 29	7 03	5 26	7 07	5 22	7 11	5 18
	20	6 43	5 46	6 48	5 41	6 54	5 35	6 56	5 32	6 59	5 29	7 03	5 26	7 07	5 22
	22	6 40	5 48	6 45	5 43	6 50	5 38	6 53	5 35	6 56	5 32	6 59	5 29	7 02	5 26
	24	6 38	5 50	6 42	5 45	6 47	5 40	6 49	5 38	6 52	5 35	6 55	5 32	6 58	5 30
	26	6 35	5 52	6 39	5 47	6 44	5 43	6 46	5 41	6 49	5 38	6 51	5 36	6 53	5 33
	28	6 33	5 54	6 36	5 49	6 40	5 46	6 43	5 44	6 45	5 41	6 47	5 39	6 49	5 31

DATE		Latitude 36° Sunrise	Latitude 36° Sunset	Latitude 40° Sunrise	Latitude 40° Sunset	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	h m	h m	h m	h m
March	**2**	6 30	5 55	6 33	5 52	6 37	5 48	6 39	5 46	6 41	5 44	6 43	5 42	6 46	5 40
	4	6 27	5 57	6 30	5 54	6 34	5 51	6 36	5 49	6 37	5 47	6 39	5 46	6 41	5 44
	6	6 24	5 59	6 27	5 57	6 30	5 54	6 32	5 52	6 33	5 51	6 35	5 49	6 37	5 47
	8	6 22	6 01	6 24	5 59	6 26	5 56	6 28	5 55	6 29	5 54	6 31	5 53	6 32	5 51
	10	6 19	6 03	6 21	6 01	6 23	5 59	6 24	5 58	6 25	5 57	6 26	5 56	6 28	5 55
	12	6 17	6 04	6 18	6 03	6 19	6 02	6 20	6 01	6 21	6 00	6 22	5 59	6 23	5 58
	14	6 14	6 06	6 15	6 05	6 15	6 04	6 16	6 03	6 17	6 03	6 18	6 02	6 19	6 02
	16	6 11	6 07	6 12	6 07	6 12	6 07	6 13	6 06	6 13	6 06	6 14	6 05	6 14	6 05
	18	6 08	6 10	6 08	6 09	6 08	6 09	6 09	6 09	6 09	6 09	6 10	6 09	6 10	6 09
	20	6 06	6 11	6 05	6 11	6 05	6 11	6 05	6 11	6 05	6 12	6 05	6 12	6 05	6 12
	22	6 03	6 13	6 02	6 13	6 02	6 14	6 02	6 14	6 01	6 15	6 01	6 15	6 00	6 15
	24	6 00	6 15	5 59	6 15	5 58	6 16	5 58	6 16	5 57	6 18	5 57	6 18	5 55	6 19
	26	5 57	6 16	5 56	6 17	5 55	6 19	5 54	6 19	5 53	6 20	5 52	6 21	5 51	6 22
	28	5 54	6 18	5 52	6 19	5 51	6 21	5 50	6 22	5 49	6 23	5 48	6 24	5 46	6 26
	30	5 51	6 19	5 49	6 21	5 48	6 23	5 46	6 24	5 45	6 25	5 43	6 27	5 41	6 29
April	**1**	5 48	6 21	5 46	6 23	5 44	6 25	5 42	6 27	5 41	6 28	5 39	6 30	5 37	6 32
	3	5 45	6 22	5 43	6 25	5 40	6 28	5 38	6 29	5 37	6 31	5 35	6 33	5 32	6 36
	5	5 42	6 24	5 40	6 27	5 37	6 30	5 35	6 33	5 32	6 34	5 30	6 36	5 28	6 39
	7	5 40	6 26	5 36	6 29	5 33	6 33	5 31	6 35	5 28	6 37	5 26	6 40	5 23	6 43
	9	5 37	6 28	5 33	6 31	5 29	6 35	5 27	6 38	5 24	6 40	5 21	6 43	5 19	6 46
	11	5 34	6 29	5 30	6 33	5 25	6 38	5 23	6 40	5 20	6 43	5 17	6 46	5 14	6 49
	13	5 32	6 31	5 27	6 35	5 22	6 40	5 19	6 43	5 16	6 46	5 13	6 49	5 10	6 52
	15	5 29	6 32	5 24	6 38	5 19	6 43	5 16	6 46	5 13	6 49	5 09	6 52	5 06	6 56
	17	5 26	6 35	5 21	6 40	5 15	6 45	5 12	6 48	5 09	6 52	5 05	6 56	5 01	6 59
	19	5 24	6 37	5 18	6 42	5 12	6 48	5 09	6 51	5 05	6 55	5 01	6 59	4 56	7 02
	21	5 21	6 38	5 15	6 44	5 09	6 50	5 05	6 54	5 01	6 58	4 57	7 02	4 52	7 06
	23	5 18	6 40	5 12	6 46	5 06	6 53	5 02	6 56	4 58	7 01	4 53	7 05	4 48	7 09
	25	5 16	6 41	5 09	6 48	5 02	6 55	4 58	6 59	4 54	7 03	4 49	7 08	4 44	7 13
	27	5 13	6 43	5 07	6 50	4 59	6 57	4 55	7 01	4 51	7 06	4 45	7 11	4 40	7 16
	29	5 11	6 44	5 04	6 52	4 56	7 00	4 52	7 04	4 47	7 08	4 42	7 14	4 36	7 20

DATE		Latitude 36° Sunrise	Latitude 36° Sunset	Latitude 40° Sunrise	Latitude 40° Sunset	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	h m	h m	h m	h m
May	**1**	5 09	6 46	5 02	6 53	4 53	7 02	4 49	7 06	4 44	7 11	4 38	7 17	4 32	7 23
	3	5 07	6 48	4 59	6 56	4 50	7 04	4 46	7 09	4 40	7 14	4 34	7 20	4 28	7 26
	5	5 05	6 49	4 56	6 58	4 47	7 07	4 43	7 11	4 37	7 17	4 31	7 23	4 25	7 29
	7	5 03	6 51	4 54	7 00	4 44	7 09	4 40	7 14	4 34	7 20	4 27	7 26	4 21	7 32
	9	5 01	6 52	4 51	7 02	4 42	7 11	4 37	7 16	4 31	7 22	4 24	7 29	4 17	7 36
	11	4 59	6 54	4 49	7 04	4 39	7 14	4 34	7 19	4 28	7 25	4 21	7 32	4 14	7 39
	13	4 57	6 56	4 47	7 06	4 37	7 16	4 31	7 21	4 25	7 28	4 18	7 35	4 11	7 42
	15	4 55	6 57	4 45	7 08	4 35	7 18	4 28	7 24	4 22	7 30	4 15	7 38	4 07	7 45
	17	4 53	6 59	4 44	7 10	4 33	7 20	4 26	7 26	4 20	7 33	4 13	7 40	4 04	7 48
	19	4 51	7 01	4 42	7 11	4 31	7 22	4 24	7 28	4 17	7 35	4 10	7 43	4 01	7 52
	21	4 50	7 03	4 40	7 13	4 29	7 24	4 22	7 31	4 15	7 38	4 07	7 46	3 58	7 55
	23	4 49	7 04	4 39	7 15	4 27	7 26	4 20	7 33	4 13	7 40	4 05	7 48	3 55	7 57
	25	4 48	7 05	4 37	7 16	4 25	7 28	4 18	7 35	4 11	7 43	4 03	7 51	3 53	8 00
	27	4 47	7 07	4 36	7 18	4 24	7 30	4 16	7 37	4 09	7 45	4 01	7 53	3 51	8 03
	29	4 46	7 08	4 35	7 20	4 22	7 32	4 15	7 39	4 07	7 47	3 59	7 56	3 49	8 05
	31	4 45	7 10	4 34	7 21	4 21	7 34	4 14	7 41	4 06	7 49	3 57	7 58	3 47	8 08
June	**2**	4 45	7 11	4 33	7 23	4 20	7 35	4 13	7 43	4 05	7 51	3 56	8 00	3 45	8 10
	4	4 44	7 12	4 33	7 24	4 19	7 37	4 12	7 44	4 04	7 53	3 55	8 02	3 44	8 12
	6	4 44	7 13	4 32	7 25	4 18	7 38	4 11	7 46	4 02	7 54	3 53	8 04	3 42	8 14
	8	4 43	7 14	4 31	7 26	4 17	7 40	4 10	7 47	4 02	7 56	3 52	8 05	3 41	8 16
	10	4 43	7 16	4 31	7 27	4 17	7 41	4 09	7 49	4 01	7 57	3 51	8 07	3 40	8 18
	12	4 43	7 16	4 31	7 28	4 17	7 42	4 09	7 50	4 01	7 58	3 51	8 08	3 40	8 19
	14	4 43	7 17	4 31	7 29	4 17	7 43	4 08	7 51	4 00	7 59	3 50	8 09	3 39	8 20
	16	4 43	7 18	4 31	7 30	4 17	7 44	4 08	7 52	4 00	8 00	3 50	8 10	3 39	8 21
	18	4 43	7 19	4 31	7 31	4 17	7 45	4 08	7 53	4 00	8 01	3 50	8 11	3 39	8 22
	20	4 43	7 19	4 31	7 31	4 17	7 45	4 08	7 54	4 00	8 02	3 50	8 12	3 39	8 23
	22	4 44	7 20	4 31	7 32	4 17	7 46	4 08	7 55	4 01	8 03	3 50	8 12	3 39	8 23
	24	4 44	7 20	4 32	7 32	4 18	7 46	4 09	7 55	4 01	8 03	3 51	8 13	3 40	8 24
	26	4 44	7 21	4 32	7 33	4 18	7 47	4 10	7 55	4 02	8 03	3 52	8 13	3 41	8 24
	28	4 45	7 21	4 33	7 33	4 19	7 47	4 11	7 55	4 03	8 03	3 53	8 13	3 42	8 24
	30	4 46	7 21	4 34	7 33	4 20	7 47	4 12	7 55	4 04	8 03	3 54	8 13	3 43	8 24

DATE		Latitude 36° Sunrise	Latitude 36° Sunset	Latitude 40° Sunrise	Latitude 40° Sunset	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	h m	h m	h m	h m
July	**2**	4 47	7 20	4 35	7 33	4 21	7 47	4 13	7 54	4 05	8 03	3 55	8 13	3 44	8 23
	4	4 48	7 20	4 36	7 33	4 22	7 46	4 14	7 54	4 06	8 02	3 56	8 12	3 46	8 22
	6	4 49	7 19	4 37	7 32	4 23	7 46	4 15	7 53	4 07	8 01	3 58	8 11	3 47	8 21
	8	4 50	7 19	4 38	7 31	4 25	7 45	4 17	7 52	4 09	8 00	3 59	8 10	3 49	8 20
	10	4 51	7 18	4 39	7 30	4 26	7 44	4 18	7 51	4 10	7 59	4 01	8 08	3 51	8 18
	12	4 52	7 18	4 41	7 30	4 28	7 43	4 20	7 50	4 12	7 58	4 03	8 07	3 53	8 17
	14	4 53	7 18	4 42	7 29	4 29	7 42	4 22	7 49	4 14	7 57	4 05	8 06	3 55	8 15
	16	4 55	7 17	4 44	7 28	4 31	7 40	4 24	7 47	4 16	7 56	4 07	8 04	3 58	8 13
	18	4 56	7 16	4 45	7 26	4 32	7 39	4 26	7 46	4 18	7 54	4 10	8 02	4 00	8 11
	20	4 57	7 15	4 47	7 25	4 34	7 38	4 28	7 44	4 20	7 52	4 12	8 00	4 03	8 09
	22	4 59	7 13	4 48	7 23	4 36	7 36	4 30	7 42	4 22	7 50	4 14	7 58	4 06	8 07
	24	5 00	7 12	4 50	7 22	4 38	7 34	4 32	7 40	4 25	7 48	4 17	7 55	4 08	8 04
	26	5 02	7 11	4 52	7 20	4 40	7 32	4 34	7 38	4 27	7 45	4 19	7 53	4 11	8 01
	28	5 03	7 09	4 53	7 18	4 42	7 30	4 37	7 36	4 30	7 43	4 22	7 50	4 14	7 58
	30	5 05	7 07	4 55	7 17	4 44	7 27	4 39	7 33	4 32	7 40	4 25	7 47	4 17	7 55
August	**1**	5 06	7 05	4 57	7 15	4 46	7 25	4 41	7 31	4 35	7 38	4 28	7 44	4 21	7 52
	3	5 08	7 04	4 59	7 12	4 48	7 22	4 43	7 28	4 37	7 35	4 31	7 41	4 24	7 49
	5	5 09	7 02	5 01	7 11	4 50	7 20	4 45	7 26	4 40	7 31	4 33	7 37	4 27	7 45
	7	5 11	7 00	5 02	7 08	4 53	7 17	4 48	7 23	4 42	7 28	4 36	7 34	4 30	7 41
	9	5 12	6 58	5 04	7 06	4 55	7 15	4 50	7 20	4 45	7 25	4 39	7 31	4 33	7 37
	11	5 14	6 56	5 06	7 03	4 58	7 12	4 53	7 17	4 48	7 22	4 42	7 27	4 36	7 34
	13	5 15	6 53	5 08	7 01	5 00	7 09	4 55	7 13	4 50	7 18	4 45	7 24	4 39	7 30
	15	5 17	6 51	5 10	6 58	5 02	7 06	4 58	7 10	4 53	7 15	4 48	7 20	4 42	7 26
	17	5 19	6 49	5 12	6 55	5 05	7 03	5 00	7 07	4 56	7 11	4 51	7 16	4 46	7 21
	19	5 20	6 46	5 14	6 52	5 07	6 59	5 03	7 03	4 59	7 07	4 54	7 12	4 49	7 17
	21	5 22	6 43	5 16	6 49	5 09	6 56	5 05	7 00	5 01	7 04	4 57	7 08	4 52	7 13
	23	5 23	6 41	5 18	6 46	5 11	6 53	5 08	6 56	5 04	7 00	5 00	7 04	4 56	7 09
	25	5 25	6 38	5 20	6 43	5 14	6 50	5 11	6 53	5 07	6 57	5 03	7 00	4 59	7 05
	27	5 26	6 35	5 22	6 40	5 16	6 47	5 13	6 49	5 09	6 53	5 06	6 56	5 02	7 00
	29	5 28	6 33	5 24	6 37	5 18	6 43	5 15	6 45	5 12	6 49	5 09	6 52	5 05	6 56
	31	5 30	6 30	5 25	6 34	5 20	6 40	5 18	6 42	5 15	6 45	5 12	6 48	5 09	6 51

DATE	Latitude 36° Sunrise	Latitude 36° Sunset	Latitude 40° Sunrise	Latitude 40° Sunset	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	h m	h m	h m	h m
September 2	5 31	6 27	5 27	6 31	5 23	6 36	5 20	6 38	5 18	6 41	5 15	6 44	5 12	6 47
4	5 33	6 24	5 29	6 28	5 25	6 32	5 23	6 34	5 20	6 37	5 18	6 40	5 15	6 41
6	5 34	6 22	5 31	6 25	5 27	6 28	5 25	6 31	5 23	6 33	5 21	6 35	5 19	6 37
8	5 36	6 19	5 33	6 22	5 30	6 25	5 28	6 27	5 26	6 29	5 24	6 31	5 22	6 33
10	5 38	6 16	5 35	6 18	5 32	6 21	5 31	6 23	5 29	6 25	5 27	6 27	5 25	6 28
12	5 39	6 13	5 37	6 15	5 34	6 17	5 33	6 19	5 31	6 21	5 30	6 22	5 28	6 23
14	5 41	6 10	5 39	6 12	5 36	6 14	5 35	6 15	5 34	6 16	5 33	6 18	5 31	6 19
16	5 42	6 07	5 41	6 08	5 39	6 10	5 38	6 11	5 37	6 12	5 36	6 13	5 34	6 14
18	5 44	6 04	5 43	6 05	5 41	6 07	5 41	6 07	5 40	6 08	5 39	6 09	5 38	6 10
20	5 46	6 01	5 45	6 02	5 44	6 03	5 44	6 03	5 43	6 04	5 42	6 05	5 41	6 05
22	5 47	5 58	5 47	5 58	5 46	5 59	5 46	5 59	5 45	6 00	5 45	6 00	5 44	6 00
24	5 49	5 55	5 49	5 55	5 48	5 55	5 48	5 55	5 48	5 56	5 48	5 56	5 47	5 56
26	5 51	5 52	5 51	5 52	5 51	5 52	5 51	5 52	5 51	5 51	5 51	5 51	5 51	5 51
28	5 52	5 49	5 52	5 49	5 53	5 48	5 53	5 48	5 54	5 47	5 54	5 47	5 54	5 46
30	5 53	5 46	5 54	5 46	5 55	5 44	5 56	5 44	5 57	5 43	5 57	5 43	5 57	5 42
October 2	5 55	5 44	5 56	5 43	5 57	5 41	5 58	5 40	5 59	5 39	6 00	5 38	6 00	5 37
4	5 56	5 41	5 58	5 40	5 59	5 37	6 01	5 36	6 02	5 35	6 03	5 34	6 04	5 32
6	5 58	5 38	6 00	5 36	6 02	5 34	6 03	5 32	6 04	5 31	6 06	5 29	6 07	5 28
8	5 59	5 35	6 02	5 33	6 04	5 30	6 06	5 28	6 07	5 27	6 09	5 25	6 11	5 23
10	6 01	5 32	6 04	5 30	6 07	5 27	6 08	5 25	6 10	5 23	6 12	5 21	6 14	5 19
12	6 03	5 30	6 06	5 27	6 09	5 24	6 11	5 21	6 13	5 19	6 15	5 17	6 17	5 15
14	6 04	5 27	6 08	5 24	6 11	5 20	6 14	5 18	6 16	5 15	6 19	5 13	6 21	5 10
16	6 06	5 25	6 10	5 21	6 14	5 17	6 17	5 14	6 19	5 11	6 22	5 09	6 25	5 06
18	6 08	5 22	6 12	5 18	6 17	5 13	6 19	5 11	6 22	5 08	6 25	5 05	6 28	5 02
20	6 10	5 19	6 15	5 15	6 20	5 10	6 22	5 07	6 25	5 04	6 28	5 01	6 32	4 58
22	6 12	5 17	6 17	5 12	6 22	5 07	6 25	5 04	6 28	5 00	6 31	4 57	6 35	4 54
24	6 14	5 14	6 19	5 09	6 25	5 04	6 28	5 00	6 31	4 57	6 35	4 53	6 39	4 50
26	6 16	5 12	6 21	5 06	6 27	5 01	6 31	4 57	6 35	4 53	6 38	4 49	6 43	4 46
28	6 18	5 09	6 24	5 03	6 30	4 57	6 34	4 53	6 38	4 49	6 42	4 45	6 47	4 42
30	6 20	5 07	6 26	5 00	6 33	4 55	6 37	4 50	6 41	4 46	6 45	4 42	6 50	4 38

DATE	Latitude 36° Sunrise	Latitude 36° Sunset	Latitude 40° Sunrise	Latitude 40° Sunset	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	h m	h m	h m	h m
November 1	6 22	5 05	6 28	4 58	6 35	4 52	6 39	4 47	6 44	4 43	6 48	4 39	6 53	4 34
3	6 24	5 03	6 31	4 55	6 38	4 49	6 42	4 44	6 47	4 40	6 52	4 35	6 57	4 30
5	6 26	5 01	6 33	4 53	6 41	4 46	6 45	4 41	6 50	4 37	6 55	4 32	7 00	4 27
7	6 27	4 59	6 35	4 51	6 43	4 43	6 48	4 38	6 53	4 34	6 58	4 28	7 04	4 23
9	6 29	4 57	6 37	4 49	6 46	4 41	6 51	4 36	6 56	4 31	7 01	4 25	7 07	4 19
11	6 31	4 56	6 39	4 47	6 48	4 39	6 53	4 33	6 59	4 29	7 04	4 22	7 11	4 16
13	6 33	4 54	6 42	4 45	6 51	4 37	6 56	4 31	7 02	4 26	7 08	4 20	7 14	4 13
15	6 35	4 52	6 44	4 44	6 54	4 35	6 59	4 29	7 05	4 24	7 11	4 17	7 18	4 10
17	6 37	4 51	6 47	4 42	6 57	4 32	7 02	4 27	7 08	4 21	7 15	4 14	7 22	4 07
19	6 39	4 50	6 49	4 41	6 59	4 31	7 04	4 25	7 10	4 19	7 18	4 12	7 25	4 04
21	6 41	4 49	6 51	4 39	7 01	4 29	7 07	4 23	7 13	4 17	7 21	4 10	7 28	4 02
23	6 43	4 48	6 54	4 38	7 04	4 28	7 10	4 21	7 16	4 15	7 24	4 08	7 31	4 00
25	6 45	4 48	6 56	4 37	7 06	4 27	7 12	4 20	7 19	4 14	7 27	4 06	7 35	3 58
27	6 47	4 47	6 58	4 36	7 09	4 25	7 15	4 19	7 22	4 12	7 30	4 04	7 38	3 56
29	6 48	4 47	6 59	4 36	7 11	4 24	7 18	4 18	7 25	4 11	7 33	4 03	7 41	3 55
December 1	6 50	4 47	7 01	4 35	7 13	4 23	7 20	4 17	7 27	4 10	7 36	4 02	7 44	3 54
3	6 52	4 46	7 03	4 35	7 15	4 23	7 22	4 16	7 30	4 09	7 38	4 01	7 47	3 52
5	6 54	4 46	7 05	4 35	7 18	4 23	7 25	4 15	7 32	4 08	7 41	4 00	7 49	3 51
7	6 56	4 46	7 07	4 35	7 20	4 22	7 27	4 15	7 35	4 07	7 43	3 59	7 52	3 50
9	6 57	4 46	7 09	4 35	7 22	4 22	7 29	4 15	7 37	4 07	7 45	3 59	7 54	3 50
11	6 59	4 46	7 10	4 35	7 24	4 22	7 31	4 15	7 39	4 07	7 48	3 58	7 57	3 49
13	7 01	4 47	7 12	4 35	7 25	4 22	7 32	4 15	7 40	4 07	7 50	3 58	7 59	3 49
15	7 02	4 47	7 14	4 36	7 27	4 23	7 34	4 16	7 42	4 07	7 51	3 59	8 01	3 49
17	7 04	4 48	7 16	4 36	7 29	4 23	7 36	4 16	7 44	4 08	7 53	3 59	8 03	3 49
19	7 05	4 49	7 17	4 37	7 30	4 24	7 37	4 17	7 45	4 08	7 54	4 00	8 04	3 49
21	7 06	4 50	7 18	4 38	7 31	4 25	7 38	4 18	7 46	4 09	7 55	4 01	8 05	3 50
23	7 07	4 51	7 19	4 39	7 32	4 26	7 39	4 19	7 47	4 10	7 56	4 02	8 06	3 51
25	7 08	4 52	7 20	4 40	7 33	4 27	7 40	4 20	7 48	4 11	7 57	4 03	8 07	3 52
27	7 09	4 53	7 21	4 41	7 34	4 28	7 41	4 21	7 49	4 13	7 58	4 04	8 08	3 54
29	7 09	4 54	7 21	4 42	7 34	4 30	7 41	4 22	7 50	4 14	7 58	4 06	8 08	3 56
31	7 10	4 56	7 22	4 44	7 35	4 31	7 42	4 24	7 50	4 16	7 59	4 07	8 08	3 58

BEGINNING OF MORNING AND ENDING OF EVENING TWILIGHT

	Latitude 35°		Latitude 40°		Latitude 45°		Latitude 50°		Latitude 52°	
	Morn.	Eve.	Morn.	Eve.	Morn.	Eve.	Morn.	Eve.	Morn.	Eve.
Jan. 1	5 38	6 29	5 45	6 22	5 52	6 15	6 00	6 07	6 04	6 04
11	5 39	6 37	5 45	6 31	5 52	6 24	5 59	6 17	6 02	6 14
21	5 38	6 45	5 43	6 40	5 48	6 35	5 54	6 30	5 56	6 28
31	5 34	6 54	5 38	6 50	5 41	6 47	5 45	6 44	5 46	6 42
Feb. 10	5 27	7 03	5 29	7 01	5 31	7 00	5 32	6 59	5 32	6 58
20	5 17	7 12	5 17	7 12	5 18	7 12	5 15	7 14	5 14	7 15
Mar. 2	5 06	7 20	5 04	7 22	5 02	7 26	4 56	7 30	4 54	7 33
12	4 52	7 29	4 48	7 33	4 43	7 39	4 35	7 47	4 31	7 51
22	4 38	7 38	4 31	7 45	4 23	7 54	4 11	8 06	4 05	8 11
Apr. 1	4 23	7 47	4 13	7 57	4 01	8 09	3 46	8 25	3 38	8 33
11	4 07	7 57	3 55	8 09	3 39	8 25	3 19	8 46	3 08	8 57
21	3 51	8 07	3 36	8 23	3 17	8 43	2 50	9 10	2 36	9 25
May 1	3 37	8 19	3 18	8 37	2 54	9 02	2 20	9 37	2 01	9 57
11	3 23	8 30	3 02	8 52	2 33	9 22	1 48	10 08	1 20	10 37
21	3 12	8 41	2 47	9 07	2 13	9 42	1 13	10 44	0 02	——
31	3 04	8 51	2 36	9 20	1 56	10 01	0 23	11 42	——	——
June 10	2 59	8 59	2 29	9 30	1 43	10 16	——	——	——	——
20	3 02	9 04	2 27	9 35	1 39	10 23	——	——	——	——
30	3 02	9 04	2 31	9 35	1 44	10 22	——	——	——	——
July 10	3 09	9 01	2 39	9 30	1 56	10 13	——	——	——	——
20	3 18	8 54	2 51	9 20	2 14	9 57	1 04	11 04	——	——
30	3 28	8 43	3 05	9 06	2 33	9 38	1 43	10 26	1 07	11 00
Aug. 9	3 39	8 30	3 20	8 50	2 52	9 16	2 15	9 53	1 53	10 15
19	3 50	8 16	3 34	8 32	3 12	8 53	2 42	9 23	2 26	9 38
29	4 00	8 00	3 47	8 14	3 29	8 31	3 06	8 53	2 54	9 05
Sept. 8	4 10	7 44	3 59	7 55	3 46	8 08	3 28	8 26	3 19	8 34
18	4 19	7 28	4 11	7 36	4 01	7-46	3 47	8 00	3 40	8 07
28	4 28	7 13	4 22	7 18	4 15	7 25	4 05	7 35	4 01	7 39
Oct. 8	4 35	6 59	4 32	7 02	4 28	7 06	4 22	7 12	4 18	7 15
18	4 43	6 46	4 42	6 47	4 40	6 49	4 37	6 51	4 36	6 53
28	4 51	6 36	4 52	6 34	4 53	6 34	4 53	6 34	4 52	6 34
Nov. 7	5 00	6 27	5 02	6 24	5 05	6 21	5 07	6 19	5 08	6 18
17	5 08	6 21	5 12	6 17	5 17	6 12	5 21	6 07	5 23	6 06
27	5 16	6 18	5 22	6 13	5 28	6 06	5 34	6 00	5 37	5 57
Dec. 7	5 24	6 18	5 31	6 12	5 38	6 04	5 45	5 57	5 48	5 54
17	5 31	6 21	5 38	6 14	5 45	6 06	5 53	5 58	5 57	5 55
27	5 36	6 26	5 43	6 19	5 51	6 11	5 59	6 03	6 02	6 00
Jan. 1	5 38	6 29	5 45	6 22	5 52	6 15	6 00	6 07	6 03	6 04

The above table gives the local mean time of the beginning of morning twilight, and of the ending of evening twilight, for various latitudes. To obtain the corresponding standard time, the method used is the same as for correcting the sunrise and sunset tables, as described on page 10. The entry —— in the above table indicates that at such dates and latitudes, twilight lasts all night. This table, taken from the American Ephemeris, is computed for *astronomical* twilight, i.e., for the time at which the sun is 108° from the zenith (or 18° below the horizon).

TIMES OF MOONRISE AND MOONSET, 1943

DATE	Latitude 40° Moon rise	Latitude 40° Moon set	Latitude 45° Moon rise	Latitude 45° Moon set	Latitude 50° Moon rise	Latitude 50° Moon set	Latitude 52° Moon rise	Latitude 52° Moon set	Latitude 54° Moon rise	Latitude 54° Moon set
January	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
1	1 35	13 05	1 39	12 59	1 44	12 52	1 47	12 49	1 50	12 46
2	2 41	13 43	2 49	13 34	2 58	13 24	3 02	13 19	3 06	13 14
3	3 50	14 26	4 00	14 16	4 13	14 01	4 19	13 55	4 25	13 48
4	4 59	15 18	5 13	15 05	5 28	14 48	5 35	14 40	5 44	14 32
5	6 08	16 16	6 22	16 01	6 39	15 44	6 48	15 36	6 57	15 27
6 ●	7 11	17 21	7 26	17 07	7 43	16 50	7 52	16 42	8 01	16 33
7	8 09	18 31	8 22	18 19	8 38	18 04	8 45	17 57	8 53	17 49
8	8 58	19 43	9 09	19 33	9 22	19 21	9 28	19 16	9 35	19 09
9	9 42	20 53	9 50	20 47	9 59	20 39	10 03	20 35	10 08	20 31
10	10 19	22 02	10 25	21 57	10 30	21 53	10 33	21 52	10 36	21 50
11	10 54	23 06	10 56	23 06	10 57	23 06	10 59	23 06	11 00	23 05
12	11 27	.. ..	11 26	.. ..	11 24	.. ..	11 23	.. ..	11 23	.. ..
13 ◗	11 59	0 10	11 54	0 12	11 49	0 15	11 47	0 17	11 45	0 19
14	12 30	1 10	12 23	1 16	12 16	1 23	12 11	1 26	12 07	1 29
15	13 04	2 09	12 55	2 17	12 43	2 27	12 38	2 32	12 33	2 37
16	13 40	3 07	13 29	3 17	13 15	3 29	13 09	3 36	13 02	3 42
17	14 19	4 02	14 06	4 15	13 50	4 29	13 43	4 36	13 35	4 44
18	15 02	4 55	14 48	5 09	14 31	5 25	14 23	5 33	14 14	5 41
19	15 48	5 45	15 34	5 59	15 18	6 16	15 10	6 24	15 01	6 34
20	16 39	6 31	16 25	6 45	16 10	7 01	16 01	7 09	15 53	7 18
21 ○	17 33	7 14	17 20	7 26	17 05	7 42	16 58	7 49	16 51	7 59
22	18 28	7 53	18 17	8 03	18 05	8 17	17 59	8 23	17 53	8 30
23	19 25	8 28	19 17	8 36	19 07	8 48	19 03	8 52	18 58	8 57
24	20 22	9 01	20 18	9 07	20 11	9 15	20 08	9 18	20 05	9 23
25	21 21	9 32	21 19	9 36	21 16	9 40	21 14	9 42	21 13	9 44
26	22 22	10 02	22 22	10 03	22 22	10 04	22 23	10 05	22 23	10 05
27	23 23	10 33	23 27	10 31	23 31	10 29	23 33	10 28	23 34	10 27
28	.. ..	11 05	.. ..	11 00	.. ..	10 55	.. ..	10 52	.. ..	10 49
29 ◐	0 27	11 40	0 33	11 33	0 41	11 24	0 45	11 19	0 48	11 15
30	1 32	12 19	1 41	12 09	1 52	11 57	1 57	11 52	2 03	11 45
31	2 39	13 05	2 50	12 52	3 05	12 38	3 11	12 30	3 18	12 22
February										
1	3 46	13 57	3 59	13 43	4 15	13 26	4 23	13 18	4 31	13 10
2	4 50	14 58	5 04	14 43	5 22	14 26	5 30	14 17	5 39	14 08
3	5 50	16 04	6 03	15 51	6 21	15 35	6 28	15 27	6 37	15 18
4 ●	6 44	17 15	6 56	17 04	7 10	16 50	7 17	16 44	7 24	16 37
5	7 31	18 27	7 40	18 19	7 52	18 09	7 57	18 04	8 03	17 59
6	8 13	19 39	8 19	19 33	8 26	19 27	8 30	19 24	8 34	19 21
7	8 50	20 48	8 53	20 46	8 57	20 43	8 59	20 42	9 01	20 41
8	9 25	21 54	9 25	21 55	9 25	21 57	9 25	21 57	9 25	21 58
9	9 58	22 58	9 54	23 02	9 51	23 07	9 50	23 10	9 48	23 12
10	10 30	23 59	10 24	.. ..	10 18	.. ..	10 15	.. ..	10 11	.. ..
11 ◗	11 04	.. ..	10 56	0 06	10 46	0 15	10 41	0 19	10 37	0 23
12	11 40	0 58	11 29	1 08	11 16	1 19	11 11	1 25	11 04	1 31
13	12 17	1 55	12 05	2 07	11 51	2 21	11 44	2 27	11 36	2 35
14	12 59	2 49	12 46	3 02	12 29	3 18	12 22	3 26	12 13	3 35
15	13 45	3 40	13 31	3 54	13 13	4 11	13 06	4 19	12 56	4 28

These are local civil times (75th meridian).
To obtain Standard Time for any station apply corrections as tabulated on page 10.

TIMES OF MOONRISE AND MOONSET, 1943

DATE	Latitude 40°		Latitude 45°		Latitude 50°		Latitude 52°		Latitude 54°	
	Moon rise	Moon set	Moon rise	Moon set	Moon rise	Moon set	Moon rise	Moon set	Moon rise	Moon set
February	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
16	14 34	4 28	14 20	4 42	14 03	4 59	13 55	5 07	13 47	5 16
17	15 26	5 11	15 14	5 24	14 58	5 41	14 50	5 48	14 52	5 57
18	16 21	5 52	16 10	6 03	15 56	6 18	15 51	6 24	15 43	6 31
19	17 18	6 28	17 09	6 39	16 59	6 50	16 54	6 54	16 48	7 01
20 ♒	18 16	7 03	18 10	7 10	18 03	7 19	17 59	7 22	17 55	7 27
21	19 15	7 34	19 12	7 39	19 08	7 45	19 06	7 47	19 04	7 50
22	20 16	8 05	20 15	8 08	20 14	8 09	20 14	8 11	20 14	8 12
23	21 17	8 36	21 20	8 35	21 22	8 34	21 24	8 34	21 25	8 33
24	22 19	9 08	22 25	9 04	22 32	9 00	22 34	8 57	22 37	8 55
25	23 23	9 42	23 32	9 35	23 42	9 27	23 46	9 23	23 51	9 19
26	.. ..	10 18	.. ..	10 09	.. ..	9 58	.. ..	9 53	.. ..	9 47
27 ☾	0 28	11 00	0 39	10 48	0 52	10 35	0 58	10 28	1 05	10 20
28	1 33	11 41	1 46	11 35	2 02	11 19	2 09	11 10	2 17	11 02
March										
1	2 36	12 43	2 50	12 28	3 07	12 11	3 16	12 03	3 25	11 54
2	3 36	13 45	3 50	13 30	4 07	13 13	4 15	13 06	4 24	12 57
3	4 30	14 52	4 43	14 39	4 59	14 24	5 06	14 17	5 15	14 09
4	5 19	16 02	5 31	15 52	5 43	15 40	5 50	15 34	5 56	15 28
5	6 03	17 13	6 12	17 06	6 21	16 58	6 25	16 54	6 30	16 50
6 ♓	6 43	18 23	6 47	18 20	6 53	18 16	6 56	18 13	6 59	18 12
7	7 18	19 32	7 20	19 32	7 23	19 32	7 23	19 32	7 25	19 31
8	7 53	20 39	7 51	20 41	7 50	20 45	7 49	20 47	7 49	20 49
9	8 26	21 43	8 22	21 49	8 17	21 56	8 14	22 00	8 12	22 03
10	9 00	22 44	8 53	22 53	8 45	23 04	8 41	23 09	8 36	23 14
11	9 36	23 44	9 26	23 55	9 15	.. ..	9 09	.. ..	9 03	.. ..
12	10 13	.. ..	10 02	.. ..	9 48	0 09	9 42	0 15	9 34	0 21
13 ☽	10 55	0 40	10 42	0 54	10 25	1 09	10 18	1 16	10 09	1 24
14	11 39	1 33	11 25	1 47	11 08	2 05	11 00	2 12	10 52	2 21
15	12 27	2 23	12 13	2 37	11 56	2 54	11 48	3 02	11 39	3 11
16	13 18	3 08	13 05	3 21	12 49	3 38	12 41	3 46	12 32	3 54
17	14 12	3 49	14 00	4 02	13 46	4 16	13 39	4 24	13 32	4 31
18	15 08	4 27	14 58	4 38	14 47	4 50	14 41	4 56	14 36	5 03
19	16 06	5 02	15 59	5 10	15 51	5 21	15 46	5 25	15 42	5 30
20	17 06	5 35	17 01	5 40	16 56	5 47	16 53	5 51	16 51	5 54
21 ♒	18 07	6 06	18 05	6 10	18 03	6 13	18 03	6 15	18 01	6 16
22	19 08	6 37	19 10	6 38	19 12	6 38	19 13	6 38	19 13	6 38
23	20 11	7 09	20 16	7 06	20 22	7 03	20 24	7 01	20 27	7 00
24	21 16	7 43	21 24	7 37	21 33	7 30	21 37	7 27	21 42	7 23
25	22 22	8 19	22 31	8 10	22 44	8 00	22 50	7 55	22 56	7 50
26	23 26	8 59	23 39	8 48	23 54	8 34	.. ..	8 28	.. ..	8 22
27	.. ..	9 45	.. ..	9 32	.. ..	9 16	0 01	9 09	0 09	9 00
28 ☾	0 30	10 37	0 44	10 23	1 01	10 06	1 09	9 57	1 17	9 48
29	1 30	11 35	1 44	11 21	2 02	11 03	2 10	10 56	2 19	10 46
30	2 25	12 38	2 39	12 25	2 55	12 09	3 03	12 02	3 11	11 53
31	3 14	13 45	3 26	13 35	3 40	13 21	3 47	13 15	3 55	13 08

These are local civil times (75th meridian).
To obtain Standard Time for any station apply corrections as tabulated on page 10.

TIMES OF MOONRISE AND MOONSET, 1943

DATE	Latitude 40°		Latitude 45°		Latitude 50°		Latitude 52°		Latitude 54°	
	Moon rise	Moon set	Moon rise	Moon set	Moon rise	Moon set	Moon rise	Moon set	Moon rise	Moon set
April	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
1	3 58	14 54	4 08	14 46	4 19	14 36	4 24	14 31	4 28	14 27
2	4 38	16 03	4 44	15 58	4 52	15 52	4 56	15 49	4 59	15 46
3	5 14	17 12	5 17	17 10	5 21	17 08	5 23	17 07	5 25	17 05
4 ●	5 48	18 19	5 48	18 20	5 49	18 22	5 49	18 23	5 49	18 24
5	6 22	19 24	6 18	19 29	6 16	19 35	6 13	19 37	6 12	19 40
6	6 55	20 28	6 50	20 36	6 43	20 44	6 40	20 49	6 37	20 54
7	7 31	21 30	7 22	21 40	7 12	21 52	7 07	21 58	7 02	22 04
8	8 08	22 29	7 57	22 41	7 44	22 55	7 38	23 03	7 31	23 11
9	8 48	23 24	8 35	23 38	8 20	23 55	8 13	.. ..	8 05	.. ..
10	9 32	.. ..	9 18	.. ..	9 00	.. ..	8 52	0 03	8 44	0 11
11	10 18	0 16	10 04	0 30	9 46	0 47	9 38	0 56	9 29	1 05
12 ☽	11 09	1 03	10 54	1 17	10 38	1 34	10 30	1 42	10 21	1 51
13	12 02	1 46	11 49	1 59	11 33	2 15	11 26	2 22	11 19	2 30
14	12 57	2 26	12 46	2 36	12 33	2 51	12 27	2 56	12 20	3 04
15	13 53	3 01	13 45	3 10	13 35	3 22	13 31	3 27	13 25	3 32
16	14 52	3 34	14 47	3 41	14 40	3 49	14 36	3 53	14 33	3 57
17	15 53	4 05	15 50	4 10	15 46	4 15	15 45	4 17	15 43	4 20
18	16 54	4 36	16 55	4 38	16 55	4 39	16 55	4 41	16 55	4 41
19	17 59	5 08	18 01	5 06	18 06	5 04	18 07	5 04	18 10	5 03
20 ♋	19 04	5 41	19 10	5 37	19 18	5 31	19 22	5 28	19 25	5 25
21	20 10	6 16	20 20	6 09	20 31	6 00	20 37	5 55	20 42	5 51
22	21 18	6 56	21 29	6 45	21 44	6 34	21 51	6 28	21 58	6 21
23	22 23	7 40	22 37	7 28	22 54	7 13	23 02	7 05	23 11	6 58
24	23 25	8 32	23 40	8 18	23 58	8 00	.. ..	7 52	.. ..	7 43
25	.. ..	9 29	.. ..	9 14	.. ..	8 56	0 06	8 48	0 16	8 38
26	0 23	10 31	0 37	10 17	0 54	10 00	1 02	9 53	1 11	9 44
27 ☾	1 14	11 37	1 26	11 25	1 41	11 10	1 48	11 03	1 56	10 56
28	1 58	12 44	2 08	12 35	2 21	12 23	2 27	12 18	2 33	12 12
29	2 38	13 52	2 45	13 46	2 54	13 38	2 59	13 34	3 03	13 30
30	3 14	14 59	3 18	14 55	3 24	14 52	3 26	14 50	3 29	14 48
May										
1	3 48	16 04	3 49	16 04	3 51	16 05	3 52	16 05	3 53	16 05
2	4 21	17 09	4 19	17 13	4 16	17 17	4 16	17 19	4 15	17 21
3	4 59	18 13	4 48	18 20	4 43	18 27	4 40	18 31	4 38	18 35
4 ●	5 27	19 16	5 20	19 25	5 11	19 36	5 07	19 41	5 02	19 47
5	6 03	20 16	5 53	20 27	5 41	20 41	5 35	20 48	5 29	20 56
6	6 42	21 14	6 29	21 27	6 15	21 43	6 08	21 51	6 01	21 59
7	7 24	22 08	7 10	22 22	6 54	22 40	6 46	22 48	6 37	22 57
8	8 10	22 58	7 55	23 12	7 38	23 29	7 30	23 37	7 20	23 47
9	8 59	23 42	8 45	23 56	8 28	.. ..	8 19	.. ..	8 10	.. ..
10	9 51	.. ..	9 38	.. ..	9 22	0 13	9 14	0 21	9 05	0 30
11	10 46	0 23	10 33	0 36	10 19	0 51	10 13	0 58	10 05	1 05
12 ☽	11 41	1 00	11 31	1 11	11 20	1 23	11 14	1 28	11 09	1 35
13	12 38	1 34	12 32	1 42	12 23	1 51	12 19	1 55	12 10	2 01
14	13 37	2 05	13 33	2 11	13 28	2 17	13 26	2 21	13 20	2 23
15	14 38	2 36	14 37	2 39	14 35	2 42	14 35	2 44	14 33	2 44

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TIMES OF MOONRISE AND MOONSET, 1943

DATE	Latitude 40° Moon rise	Latitude 40° Moon set	Latitude 45° Moon rise	Latitude 45° Moon set	Latitude 50° Moon rise	Latitude 50° Moon set	Latitude 52° Moon rise	Latitude 52° Moon set	Latitude 54° Moon rise	Latitude 54° Moon set
May	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
16	15 40	3 06	15 42	3 06	15 45	3 06	15 45	3 06	15 48	3 06
17	16 45	3 38	16 50	3 34	16 55	3 31	16 59	3 29	17 02	3 28
18	17 52	4 12	18 00	4 06	18 10	3 58	18 15	3 55	18 19	3 51
19 ♍	19 01	4 50	19 12	4 41	19 25	4 30	19 32	4 25	19 38	4 19
20	20 10	5 33	20 22	5 21	20 39	5 07	20 47	5 00	20 55	4 55
21	21 16	6 23	21 30	6 08	21 48	5 52	21 56	5 44	22 06	5 35
22	22 17	7 19	22 32	7 04	22 49	6 46	22 58	6 38	23 07	6 28
23	23 11	8 21	23 25	8 06	23 41	7 49	23 49	7 41	23 57	7 32
24	23 59	9 27	.. ..	9 15	.. ..	8 59	.. ..	8 52	.. ..	8 44
25	.. ..	10 35	0 10	10 26	0 24	10 13	0 30	10 07	0 37	10 00
26 ☾	0 40	11 44	0 49	11 37	0 59	11 27	1 04	11 23	1 10	11 18
27	1 17	12 51	1 23	12 46	1 30	12 41	1 32	12 39	1 36	12 37
28	1 52	13 56	1 54	13 55	1 56	13 54	1 58	13 52	2 00	13 53
29	2 23	15 00	2 23	15 03	2 22	15 06	2 22	15 07	2 22	15 07
30	2 55	16 03	2 52	16 09	2 47	16 15	2 45	16 19	2 44	16 21
31	3 27	17 06	3 21	17 14	3 14	17 24	3 10	17 28	3 06	17 34
June										
1	4 02	18 06	3 53	18 17	3 42	18 30	3 37	18 36	3 32	18 43
2 ♍	4 39	19 05	4 28	19 17	4 14	19 33	4 07	19 40	4 00	19 48
3	5 19	20 00	5 06	20 14	4 50	20 31	4 42	20 40	4 34	20 49
4	6 04	20 52	5 49	21 06	5 32	21 24	5 24	21 33	5 14	21 42
5	6 51	21 39	6 37	21 53	6 19	22 10	6 11	22 18	6 01	22 28
6	7 42	22 21	7 29	22 35	7 12	22 50	7 03	22 58	6 54	23 06
7	8 36	23 00	8 24	23 11	8 08	23 24	8 00	23 31	7 53	23 38
8	9 32	23 35	9 20	23 43	9 08	23 55	9 01	23 59	8 55	.. ..
9	10 28	.. ..	10 19	.. ..	10 09	.. ..	10 05	.. ..	10 00	0 05
10 ☽	11 25	0 06	11 20	0 13	11 13	0 21	11 10	0 25	11 06	0 29
11	12 23	0 36	12 21	0 41	12 18	0 45	12 16	0 48	12 15	0 50
12	13 24	1 06	13 25	1 08	13 25	1 09	13 25	1 10	13 25	1 10
13	14 26	1 36	14 30	1 35	14 34	1 32	14 35	1 32	14 38	1 31
14	15 31	2 08	15 38	2 03	15 45	1 58	15 49	1 55	15 53	1 53
15	16 39	2 43	16 48	2 36	16 59	2 27	17 05	2 22	17 11	2 18
16	17 48	3 23	18 00	3 13	18 14	3 00	18 22	2 54	18 30	2 48
17	18 57	4 09	19 10	3 56	19 28	3 41	19 36	3 34	19 45	3 26
18 ♍	20 02	5 03	20 17	4 48	20 35	4 31	20 43	4 22	20 53	4 13
19	21 01	6 04	21 16	5 49	21 33	5 31	21 41	5 22	21 50	5 13
20	21 54	7 11	22 06	6 57	22 21	6 41	22 28	6 33	22 36	6 24
21	22 39	8 21	22 49	8 09	23 01	7 56	23 07	7 49	23 12	7 42
22	23 20	9 32	23 26	9 23	23 34	9 13	23 38	9 08	23 41	9 03
23	23 55	10 41	23 58	10 36	.. ..	10 30	.. ..	10 26	.. ..	10 23
24 ☾	.. ..	11 49	.. ..	11 46	0 02	11 44	0 04	11 43	0 07	11 42
25	0 28	12 53	0 28	12 55	0 28	12 57	0 29	12 57	0 29	12 57
26	0 59	13 57	0 57	14 02	0 53	14 06	0 52	14 09	0 51	14 11
27	1 31	14 59	1 25	15 07	1 19	15 15	1 16	15 19	1 13	15 24
28	2 04	15 59	1 56	16 09	1 46	16 21	1 42	16 27	1 36	16 33
29	2 40	16 58	2 29	17 10	2 16	17 25	2 10	17 32	2 03	17 39
30	3 18	17 54	3 05	18 08	2 50	18 25	2 43	18 33	2 36	18 41

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TIMES OF MOONRISE AND MOONSET, 1943

DATE	Latitude 40° Moon rise	Latitude 40° Moon set	Latitude 45° Moon rise	Latitude 45° Moon set	Latitude 50° Moon rise	Latitude 50° Moon set	Latitude 52° Moon rise	Latitude 52° Moon set	Latitude 54° Moon rise	Latitude 54° Moon set
July	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
1	4 00	18 47	3 46	19 01	3 29	19 19	3 21	19 27	3 13	19 37
2 ●	4 46	19 36	4 32	19 50	4 14	20 08	4 06	20 16	3 56	20 26
3	5 37	20 20	5 22	20 33	5 04	20 50	4 57	20 58	4 48	21 07
4	6 29	21 00	6 16	21 12	5 59	21 27	5 52	21 33	5 44	21 41
5	7 24	21 36	7 12	21 45	6 58	21 58	6 52	22 04	6 45	22 09
6	8 20	22 08	8 10	22 16	7 59	22 25	7 59	22 30	7 48	22 35
7	9 16	22 39	9 09	22 44	9 01	22 50	8 58	22 53	8 54	22 56
8	10 13	23 08	10 10	23 10	10 05	23 13	10 03	23 15	10 00	23 16
9	11 12	23 37	11 11	23 37	11 10	23 37	11 09	23 36	11 09	23 36
10 ◗	12 12	.. ..	12 14	.. ..	12 16	.. ..	12 18	23 58	12 19	23 57
11	13 14	0 07	13 19	0 04	13 25	0 00	13 28	.. ..	13 31	.. ..
12	14 19	0 40	14 27	0 34	14 36	0 26	14 41	0 23	14 46	0 19
13	15 25	1 16	15 37	1 07	15 49	0 56	15 56	0 51	16 02	0 45
14	16 33	1 56	16 47	1 46	17 03	1 32	17 10	1 25	17 18	1 18
15	17 40	2 47	17 55	2 33	18 13	2 16	18 22	2 09	18 31	1 59
16	18 43	3 43	18 58	3 29	19 17	3 10	19 26	3 02	19 35	2 52
17 ○	19 41	4 49	19 54	4 34	20 11	4 16	20 18	4 08	20 27	3 57
18	20 31	5 59	20 43	5 46	20 56	5 30	21 02	5 23	21 09	5 15
19	21 15	7 11	21 24	7 02	21 33	6 49	21 37	6 43	21 42	6 36
20	21 54	8 24	21 59	8 17	22 05	8 08	22 07	8 05	22 10	8 01
21	22 29	9 34	22 30	9 31	22 32	9 27	22 33	9 25	22 34	9 23
22	23 02	10 43	23 00	10 43	22 58	10 43	22 57	10 43	22 57	10 42
23 ◐	23 34	11 48	23 29	11 52	23 24	11 56	23 21	11 57	23 19	11 59
24	.. ..	12 52	23 59	12 58	23 51	13 05	23 47	13 09	23 42	13 13
25	0 07	13 53	.. ..	14 02	.. ..	14 13	.. ..	14 18	.. ..	14 23
26	0 42	14 53	0 31	15 04	0 20	15 18	0 14	15 24	0 08	15 31
27	1 18	15 49	1 07	16 03	0 53	16 19	0 45	16 26	0 38	16 32
28	1 59	16 43	1 46	16 58	1 29	17 15	1 21	17 23	1 13	17 32
29	2 44	17 33	2 30	17 48	2 12	18 05	2 04	18 14	1 55	18 23
30	3 33	18 19	3 18	18 32	3 01	18 49	2 52	18 58	2 43	19 07
31 ●	4 24	19 00	4 11	19 13	3 54	19 28	3 46	19 35	3 37	19 43
August										
1	5 19	19 37	5 06	19 48	4 51	20 01	4 44	20 07	4 37	20 14
2	6 14	20 11	6 03	20 19	5 52	20 29	5 46	20 34	5 40	20 40
3	7 10	20 42	7 02	20 48	6 53	20 55	6 49	20 59	6 45	21 02
4	8 07	21 11	8 02	21 14	7 56	21 19	7 54	21 20	7 51	21 22
5	9 05	21 40	9 03	21 40	9 01	21 42	9 00	21 42	8 58	21 42
6	10 03	22 09	10 05	22 07	10 06	22 04	10 06	22 03	10 07	22 02
7	11 04	22 40	11 08	22 35	11 12	22 29	11 15	22 26	11 17	22 23
8 ◗	12 05	23 14	12 13	23 05	12 21	22 56	12 25	22 52	12 28	22 47
9	13 10	23 51	13 19	23 40	13 31	23 28	13 36	23 22	13 42	23 15
10	14 15	.. ..	14 27	.. ..	14 42	.. ..	14 49	.. ..	14 56	23 51
11	15 21	0 35	15 35	0 22	15 52	0 07	15 59	0 00	16 08	.. ..
12	16 24	1 26	16 39	1 12	16 57	0 55	17 05	0 47	17 15	0 38
13	17 24	2 26	17 38	2 12	17 56	1 53	18 03	1 45	18 12	1 35
14	18 17	3 33	18 30	3 19	18 45	3 02	18 52	2 54	19 00	2 45
15 ○	19 05	4 45	19 14	4 33	19 27	4 19	19 32	4 12	19 38	4 05

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TIMES OF MOONRISE AND MOONSET, 1943

DATE	Latitude 40° Moon rise	Latitude 40° Moon set	Latitude 45° Moon rise	Latitude 45° Moon set	Latitude 50° Moon rise	Latitude 50° Moon set	Latitude 52° Moon rise	Latitude 52° Moon set	Latitude 54° Moon rise	Latitude 54° Moon set
August	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
16	19 47	5 59	19 53	5 50	20 01	5 40	20 05	5 35	20 09	5 29
17	20 24	7 12	20 28	7 07	20 32	7 01	20 33	6 58	20 35	6 54
18	20 59	8 24	20 59	8 22	20 59	8 20	20 59	8 19	20 59	8 18
19	21 33	9 33	21 29	9 35	21 26	9 36	21 24	9 38	21 22	9 38
20	22 06	10 39	22 00	10 44	21 53	10 50	21 50	10 53	21 45	10 56
21	22 42	11 43	22 32	11 51	22 21	12 01	22 17	12 05	22 11	12 10
22 ☾	23 18	12 44	23 07	12 55	22 53	13 08	22 47	13 14	22 40	13 21
23	23 59	13 44	23 45	13 56	23 29	14 11	23 22	14 18	23 14	14 27
24	.. ..	14 39	.. ..	14 53	.. ..	15 09	.. ..	15 18	23 53	15 27
25	0 42	15 30	0 28	15 44	0 10	16 02	0 02	16 11	.. ..	16 20
26	1 28	16 17	1 14	16 31	0 57	16 48	0 48	16 56	0 39	17 06
27	2 19	16 59	2 05	17 13	1 49	17 29	1 41	17 36	1 31	17 44
28	3 13	17 38	3 00	17 49	2 44	18 03	2 37	18 10	2 29	18 17
29	4 08	18 13	3 57	18 22	3 44	18 33	3 38	18 38	3 31	18 44
30 ●	5 04	18 44	4 56	18 51	4 45	18 59	4 41	19 03	4 36	19 08
31	6 02	19 15	5 56	19 19	5 49	19 24	5 46	19 26	5 42	19 29
September										
1	6 59	19 44	6 57	19 45	6 53	19 47	6 52	19 47	6 50	19 48
2	7 58	20 12	7 58	20 11	7 58	20 10	7 58	20 09	7 58	20 08
3	8 58	20 42	9 00	20 38	9 04	20 33	9 05	20 30	9 08	20 29
4	9 59	21 14	10 05	21 08	10 11	20 59	10 15	20 56	10 19	20 52
5	11 01	21 50	11 10	21 41	11 20	21 29	11 25	21 24	11 30	21 17
6	12 04	22 30	12 16	22 19	12 29	22 03	12 36	21 57	12 43	21 49
7 ☽	13 08	23 17	13 21	23 04	13 38	22 46	13 46	22 38	13 54	22 30
8	14 10	.. ..	14 25	23 56	14 43	23 38	14 52	23 30	15 01	23 20
9	15 10	0 11	15 25	.. ..	15 42	.. ..	15 51	.. ..	16 01	.. ..
10	16 04	1 13	16 18	0 58	16 34	0 41	16 42	0 33	16 51	0 23
11	16 53	2 21	17 05	2 08	17 18	1 52	17 25	1 45	17 31	1 37
12	17 37	3 32	17 46	3 22	17 56	3 10	18 00	3 04	18 05	2 57
13 ○	18 17	4 45	18 22	4 39	18 28	4 30	18 31	4 26	18 33	4 22
14	18 54	5 59	18 55	5 56	18 57	5 51	18 57	5 49	18 59	5 47
15	19 28	7 10	19 26	7 10	19 24	7 10	19 23	7 10	19 22	7 10
16	20 02	8 20	19 57	8 23	19 52	8 28	19 49	8 29	19 45	8 31
17	20 38	9 27	20 29	9 33	20 20	9 42	20 16	9 45	20 11	9 50
18	21 14	10 31	21 04	10 41	20 51	10 52	20 46	10 58	20 39	11 04
19	21 54	11 32	21 41	11 45	21 26	11 59	21 19	12 06	21 12	12 14
20	22 37	12 31	22 23	12 45	22 06	13 01	21 58	13 09	21 49	13 18
21 ☾	23 23	13 24	23 08	13 39	22 51	13 57	22 42	14 05	22 33	14 15
22	.. ..	14 13	23 59	14 28	23 41	14 46	23 33	14 54	23 24	15 04
23	0 13	14 57	.. ..	15 11	.. ..	15 28	.. ..	15 36	.. ..	15 45
24	1 06	15 38	0 53	15 49	0 36	16 05	0 28	16 11	0 20	16 19
25	2 01	16 13	1 49	16 23	1 35	16 36	1 28	16 41	1 21	16 47
26	2 57	16 46	2 47	16 54	2 36	17 03	2 31	17 07	2 25	17 13
27	3 54	17 17	3 47	17 22	3 39	17 28	3 35	17 31	3 31	17 34
28	4 52	17 46	4 48	17 48	4 44	17 51	4 41	17 53	4 38	17 54
29 ●	5 50	18 15	5 50	18 15	5 49	18 14	5 48	18 14	5 48	18 14
30	6 51	18 45	6 53	18 42	6 55	18 38	6 58	18 36	6 58	18 34

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TIMES OF MOONRISE AND MOONSET, 1943

DATE	Latitude 40°		Latitude 45°		Latitude 50°		Latitude 52°		Latitude 54°	
	Moon rise	Moon set	Moon rise	Moon set	Moon rise	Moon set	Moon rise	Moon set	Moon rise	Moon set
October	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
1	7 52	19 17	7 58	19 10	8 03	19 03	8 06	18 59	8 09	18 56
2	8 55	19 51	9 03	19 42	9 13	19 31	9 17	19 26	9 22	19 20
3	9 58	20 30	10 09	20 18	10 22	20 04	10 28	19 58	10 35	19 50
4	11 02	21 14	11 15	21 00	11 31	20 44	11 38	20 35	11 46	20 27
5	12 04	22 05	12 19	21 50	12 37	21 32	12 45	21 24	12 54	21 14
6 ☽	13 04	23 02	13 19	22 47	13 37	22 29	13 45	22 21	13 55	22 11
7	13 58	.. ..	14 12	23 52	14 30	23 35	14 38	23 27	14 47	23 19
8	14 47	0 06	15 00	.. ..	15 14	.. ..	15 22	.. ..	15 30	.. ..
9	15 31	1 14	15 41	1 02	15 53	0 49	15 58	0 42	16 04	0 35
10	16 11	2 25	16 18	2 16	16 25	2 05	16 29	2 01	16 33	1 55
11	16 47	3 36	16 51	3 31	16 55	3 24	16 57	3 21	16 59	3 18
12	17 22	4 47	17 22	4 45	17 22	4 43	17 22	4 43	17 22	4 41
13 ♋	17 56	5 57	17 53	5 59	17 50	6 01	17 47	6 02	17 45	6 02
14	18 32	7 06	18 25	7 11	18 17	7 17	18 14	7 20	18 09	7 23
15	19 08	8 13	18 58	8 21	18 47	8 31	18 41	8 35	18 36	8 41
16	19 47	9 17	19 34	9 28	19 21	9 42	19 14	9 48	19 06	9 55
17	20 29	10 18	20 15	10 31	19 58	10 48	19 51	10 55	19 42	11 03
18	21 15	11 15	21 00	11 29	20 42	11 47	20 34	11 56	20 24	12 05
19	22 04	12 07	21 49	12 22	21 31	12 40	21 22	12 49	21 13	12 59
20 ☾	22 56	12 54	22 43	13 08	22 25	13 25	22 17	13 34	22 08	13 43
21	23 51	13 36	23 38	13 49	23 22	14 04	23 16	14 12	23 08	14 20
22	.. ..	14 13	.. ..	14 24	.. ..	14 38	.. ..	14 44	.. ..	14 51
23	0 46	14 47	0 36	14 55	0 23	15 06	0 17	15 11	0 11	15 17
24	1 43	15 18	1 35	15 24	1 25	15 32	1 22	15 35	1 16	15 38
25	2 41	15 47	2 36	15 51	2 30	15 55	2 27	15 57	2 23	15 59
26	3 39	16 16	3 37	16 17	3 35	16 18	3 34	16 18	3 33	16 18
27	4 40	16 46	4 41	16 44	4 42	16 41	4 42	16 40	4 43	16 38
28 ♌	5 41	17 17	5 46	17 12	5 50	17 05	5 52	17 02	5 54	16 59
29	6 45	17 51	6 52	17 42	7 00	17 32	7 04	17 28	7 09	17 23
30	7 50	18 28	7 59	18 17	8 12	18 04	8 17	17 58	8 23	17 51
31	8 55	19 11	9 07	18 58	9 22	18 42	9 30	18 34	9 37	18 26
November										
1	9 59	20 01	10 13	19 45	10 31	19 28	10 39	19 19	10 49	19 10
2	11 00	20 56	11 15	20 41	11 32	20 22	11 42	20 13	11 52	20 03
3	11 55	21 58	12 11	21 44	12 29	21 26	12 38	21 18	12 47	21 08
4 ☽	12 46	23 04	13 00	22 52	13 15	22 36	13 23	22 29	13 32	22 21
5	13 30	.. ..	13 42	.. ..	13 55	23 51	14 01	23 45	14 07	23 39
6	14 11	0 12	14 19	0 02	14 28	0 00	14 32	.. ..	14 37	.. ..
7	14 47	1 21	14 51	1 15	14 57	1 07	14 59	1 03	15 03	0 59
8	15 21	2 30	15 22	2 27	15 23	2 24	15 25	2 21	15 26	2 20
9	15 54	3 39	15 52	3 39	15 49	3 40	15 49	3 40	15 48	3 40
10	16 27	4 47	16 22	4 51	16 16	4 55	16 13	4 57	16 10	4 59
11 ♍	17 02	5 54	16 54	6 01	16 44	6 09	16 40	6 13	16 35	6 18
12	17 40	6 59	17 27	7 10	17 16	7 22	17 10	7 27	17 03	7 33
13	18 21	8 03	18 08	8 15	17 51	8 31	17 44	8 38	17 36	8 45
14	19 05	9 03	18 51	9 17	18 32	9 34	18 25	9 42	18 15	9 51
15	19 54	9 58	19 39	10 13	19 20	10 32	19 12	10 41	19 02	10 50

These are local civil times (75th meridian).
To obtain Standard Time for any station apply corrections as tabulated on page 10.

TIMES OF MOONRISE AND MOONSET, 1943

DATE	Latitude 40°		Latitude 45°		Latitude 50°		Latitude 52°		Latitude 54°	
	Moon rise	Moon set	Moon rise	Moon set	Moon rise	Moon set	Moon rise	Moon set	Moon rise	Moon set
November	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
16	20 45	10 48	20 31	11 03	20 13	11 21	20 04	11 30	19 54	11 40
17	21 40	11 32	21 26	11 46	21 09	12 03	21 01	12 11	20 53	12 20
18	22 35	12 12	22 23	12 24	22 08	12 38	22 02	12 45	21 55	12 53
19 ☾	23 31	12 47	23 21	12 56	23 11	13 09	23 06	13 14	23 00	13 21
20	.. ..	13 18	.. ..	13 26	.. ..	13 35	.. ..	13 39	.. ..	13 43
21	0 28	13 48	0 22	13 53	0 13	13 59	0 11	14 01	0 06	14 04
22	1 26	14 17	1 23	14 19	1 18	14 21	1 16	14 22	1 13	14 24
23	2 25	14 45	2 24	14 44	2 24	14 44	2 23	14 43	2 22	14 42
24	3 26	15 15	3 29	15 11	3 31	15 07	3 33	15 05	3 34	15 02
25	4 28	15 47	4 34	15 41	4 41	15 32	4 44	15 29	4 48	15 24
26	5 33	16 23	5 41	16 14	5 52	16 02	5 57	15 57	6 03	15 50
27 ●	6 40	17 05	6 51	16 52	7 05	16 37	7 11	16 30	7 19	16 22
28	7 47	17 52	8 00	17 38	8 17	17 20	8 25	17 12	8 34	17 03
29	8 51	18 47	9 06	18 32	9 25	18 13	9 34	18 04	9 43	17 54
30	9 51	19 49	10 06	19 34	10 25	19 15	10 34	19 07	10 44	18 57
December										
1	10 45	20 55	10 59	20 42	11 16	20 25	11 24	20 18	11 33	20 09
2	11 32	22 04	11 44	21 53	11 59	21 40	12 05	21 33	12 13	21 27
3	12 13	23 13	12 22	23 05	12 33	22 56	12 38	22 51	12 44	22 47
4 ☽	12 50	.. ..	12 55	.. ..	13 03	.. ..	13 06	.. ..	13 10	.. ..
5	13 24	0 22	13 26	0 17	13 29	0 12	13 31	0 09	13 32	0 07
6	13 56	1 29	13 55	1 28	13 54	1 27	13 54	1 27	13 54	1 26
7	14 28	2 36	14 24	2 38	14 19	2 41	14 17	2 43	14 16	2 44
8	15 01	3 42	14 55	3 47	14 46	3 54	14 42	3 57	14 38	4 01
9	15 37	4 46	15 27	4 55	15 15	5 06	15 09	5 10	15 04	5 16
10	16 15	5 49	16 03	6 01	15 48	6 15	15 41	6 21	15 33	6 29
11 ○	16 58	6 50	16 43	7 13	16 26	7 21	16 18	7 28	16 09	7 37
12	17 44	7 48	17 29	8 02	17 11	8 21	17 02	8 30	16 52	8 40
13	18 35	8 40	18 19	8 55	18 01	9 14	17 53	9 23	17 43	9 33
14	19 29	9 27	19 14	9 42	18 56	9 59	18 48	10 08	18 39	10 18
15	20 24	10 09	20 11	10 22	19 56	10 38	19 48	10 46	19 40	10 54
16	21 20	10 46	21 09	10 57	20 57	11 11	20 51	11 17	20 45	11 23
17	22 16	11 19	22 08	11 28	21 59	11 38	21 55	11 43	21 50	11 49
18	23 13	11 49	23 08	11 55	23 02	12 03	23 00	12 06	22 56	12 10
19 ☾	.. ..	12 18	.. ..	12 21	.. ..	12 25	.. ..	12 27	.. ..	12 29
20	0 11	12 46	0 09	12 46	0 07	12 47	0 05	12 47	0 04	12 48
21	1 09	13 14	1 11	13 12	1 12	13 09	1 12	13 08	1 13	13 06
22	2 10	13 45	2 15	13 39	2 19	13 32	2 21	13 30	2 23	13 27
23	3 13	14 18	3 20	14 09	3 29	13 59	3 34	13 55	3 37	13 50
24	4 18	14 56	4 29	14 44	4 40	14 31	4 47	14 25	4 53	14 18
25	5 25	15 40	5 38	15 26	5 53	15 10	6 01	15 02	6 09	14 54
26 ●	6 32	16 32	6 47	16 17	7 05	15 59	7 13	15 50	7 23	15 40
27	7 36	17 32	7 51	17 17	8 10	16 58	8 20	16 48	8 30	16 38
28	8 35	18 39	8 50	18 24	9 08	18 07	9 16	17 58	9 26	17 49
29	9 27	19 49	9 40	19 37	9 55	19 22	10 03	19 16	10 11	19 08
30	10 12	21 01	10 23	20 52	10 35	20 41	10 40	20 36	10 46	20 30
31	10 52	22 12	10 59	22 06	11 07	21 59	11 11	21 56	11 15	21 53

These are local civil times (75th meridian).
To obtain Standard Time for any station apply corrections as tabulated on page 10.

THE PLANETS FOR 1943

By R. M. Petrie

MERCURY

Mercury, the smallest planet of the solar system, was known to the ancients but is perhaps the most elusive planet for modern skywatchers. It is the planet closest to the sun and it never appears far from him in the sky; it must be seen then in the twilight and never against a dark sky. Its period of revolution about the sun is 88 days and it therefore changes from morning star (western elongation) to evening star (eastern elongation) several times during the year. Near elongation, Mercury is quite easily visible to the unaided eye, and if one searches the twilight carefully within a week of the time of elongation the planet will be found. In order to facilitate this, the elongations for 1943 are listed in the table giving the angular distances from the sun and the apparent magnitudes.

Elongations of Mercury in 1943

Evening Star			Morning Star		
Date	Distance	Mag.	Date	Distance	Mag.
Jan. 8	19° 08′	−0.4	Feb. 18	26° 24′	+0.3
Apr. 30	20° 45′	+0.4	June 18	23° 01′	+0.8
Aug. 29	27° 17′	+0.5	Oct. 10	18° 01′	−0.2
Dec. 23	20° 02′	−0.2			

The most favourable eastern elongation for observation is that of April 30. At that time the planet is an evening star, setting about 2 hours after the sun. It will be found northwest of the bright star *Aldebaran* and close to the Pleiades. The best date to observe Mercury as a morning star is June 18 when it rises about one and one-half hours before the sun. The planet will then be west and a little north of *Aldebaran*, in *Taurus*. On April 30 Mercury will be nearly twice as bright as *Aldebaran*, on June 18 just a little brighter. On these dates the planet will be approximately 80,000,000 miles from the earth.

VENUS

In contrast to Mercury, Venus is readily seen, being at times the most brilliant heavenly body apart from the sun and moon. Like Mercury it is seen as a morning or evening star but, being farther from the sun than that planet, its elongations are greater and are performed more leisurely. Venus is

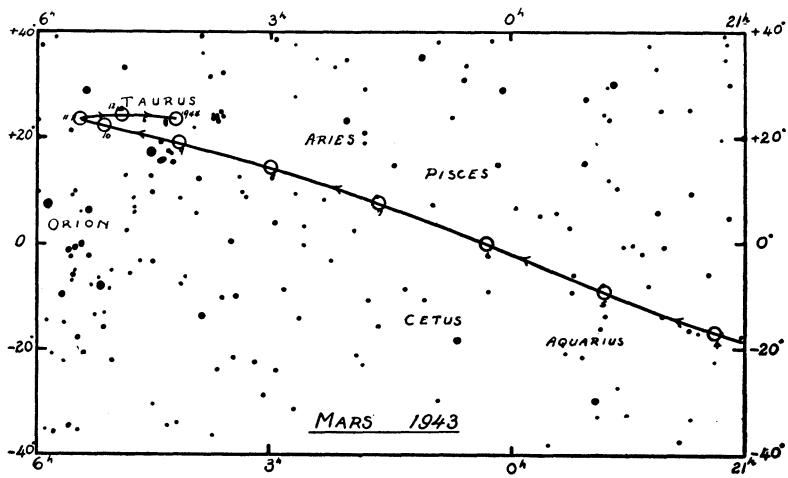
very much like the earth in size and mass, but it is unaccompanied by any moon. It is covered with a dense and extensive atmosphere, highly reflecting, and giving the planet a dazzling white appearance, so that, at maximum brilliancy, it may be seen with the unaided eye in full daylight.

At the beginning of the year Venus is an evening star close to the sun. During the spring it moves slowly east of the sun becoming a splendid evening star and reaching maximum elongation on June 28. At that time the planet is some 45° from the sun and sets about two and one-half hours after it. Venus then approaches the sun, maximum brilliance occurring on August 1 when the stellar magnitude is −4.2. On September 7 the planet passes between us and the sun at a distance of some 26,000,000 miles from the earth. After this it becomes a morning star, greatest brilliancy occurring on October 13, when the planet is of magnitude −4.3, and greatest western elongation occurs on November 16. Venus will then be a magnificent morning star rising about four hours before the sun. During the rest of the year the planet will remain a morning star gradually drawing closer to the sun in the twilight.

MARS

The planet Mars is fourth in order of distance from the sun and its orbit, therefore, lies outside that of the earth. Because of this the planet is seen in the night sky when it is close to us and opposite the sun, and is, hence, well placed for observation. The planet is conspicuous to the unaided eye when in the night sky, because of its brightness and deep orange colouring, but it is small (diam. = 4,200 miles) and only the bolder surface markings are observed under ordinary circumstances.

During the first part of 1943 Mars is an inconspicuous morning star close

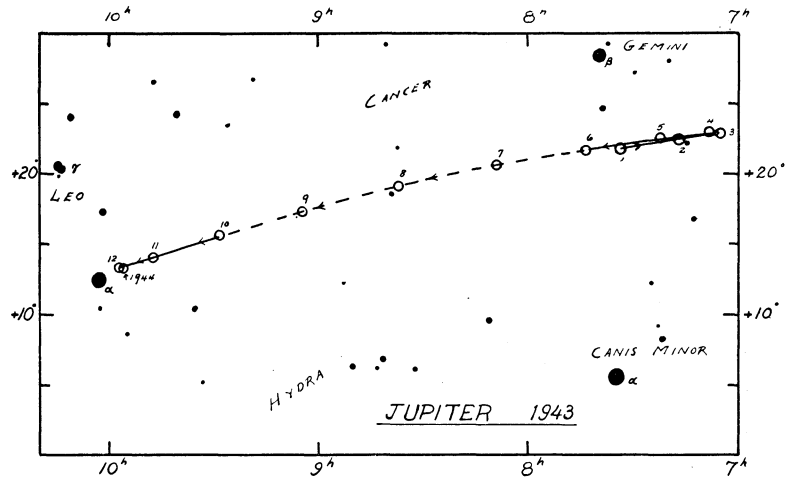


The path of Mars among the stars from April to December 1943, inclusive. An open circle indicates the position of the planet on the first day of each month.

to the sun and between the first and second magnitude in brightness. It moves slowly west of the sun while increasing in brightness as it approaches the earth. On August 24 the planet is in western quadrature with the sun and rises about midnight. The stellar magnitude is then zero, the planet is some 91,000,000 miles from the earth and it exhibits a slightly gibbous disc 9″.5 in diameter Thereafter events move more rapidly; the planet rises earlier each night increasing in brilliance and apparent size as opposition approaches. The nearest approach to the earth occurs on November 28, a week before opposition when Mars will be a brilliant ruddy-hued object of stellar magnitude −1.6, showing a disc 17″ in diameter and being 50,000,000 miles from the earth. During the remainder of the year the planet will be a bright object visible in the evening sky. The accompanying map shows the path of Mars through the constellations from the first of April to the end of the year.

JUPITER

Jupiter, the giant of the solar family of planets, is one of the finest objects for observation. Its great brilliance, surpassed only at intervals by Venus, its



The path of Jupiter among the stars during 1943. The broken part of the line represents the portion when the planet is unfavourably situated for observation.

large apparent disc with the cloud belts and markings, and its attendant bright moons render it a favourite and fascinating object for study with small telescopes and even field glasses.

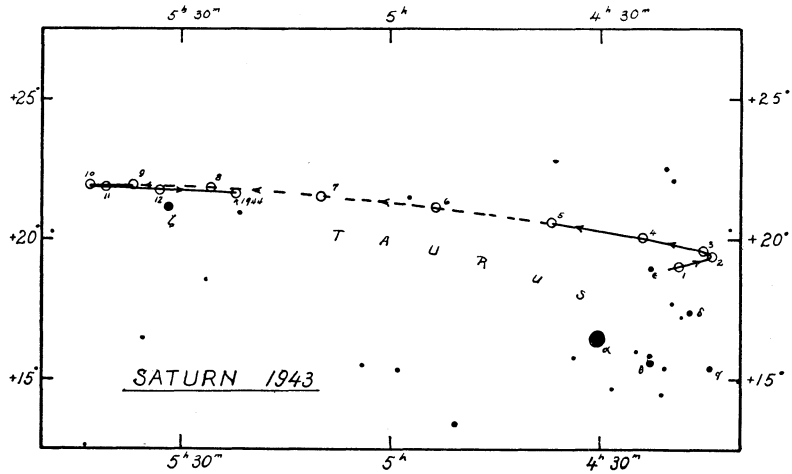
Jupiter is in opposition to the sun at the beginning of 1943 and will be a splendid object throughout the nights in January. Closest approach to the earth occurs on January 10 when the planet will be some 394,000,000 miles from the earth, will be of stellar magnitude −2.2, and will exhibit a disc some 43″ in

diameter. During the spring Jupiter will be an evening star reaching eastern quadrature with the sun on April 6, at which time it sets about midnight. After this it will approach conjunction with the sun and will not be seen during the summer months. Conjunction occurs on July 30 when the planet will be at its greatest distance from us, namely, 586,000,000 miles. During the fall and winter Jupiter will again be a bright object in the morning skies. Western quadrature occurs on November 19 when it will rise about midnight. From then until the end of the year it will be increasingly conspicuous in the night sky.

The path of Jupiter among the stars is shown in the map where its position is indicated for the first day of each month. The broken part of the path indicates the interval when the planet is close to the sun and not well placed for observation.

SATURN

Saturn is the most remote planet known to the ancients and, like Jupiter, is a favourite subject for moderate telescopes. Although appearing only about



The path of Saturn among the stars during 1943. (The coordinates are for the equator and equinox of 1900).

one-half as large as Jupiter its beautiful ring system and delicate surface markings are always appealing. During 1943 the ring system is well "opened" toward the earth and at its best for observation.

At the beginning of the year Saturn is a bright evening star, setting at midnight at the end of February. During the spring it will be too close to the sun for observation, conjunction occurring on June 7 when the planet is at its maximum distance of 990,000,000 miles from us. Saturn becomes a morning star in late summer reaching western quadrature on September 20, when it rises at midnight. During the remainder of the year it will be well placed for observation, rising earlier each night and becoming brighter until opposition on December 16.

At that time Saturn is closest to the earth being removed some 748,000,000 miles; its brightness then is of stellar magnitude −0.3 and its disc has an apparent diameter (polar) of 18″.5.

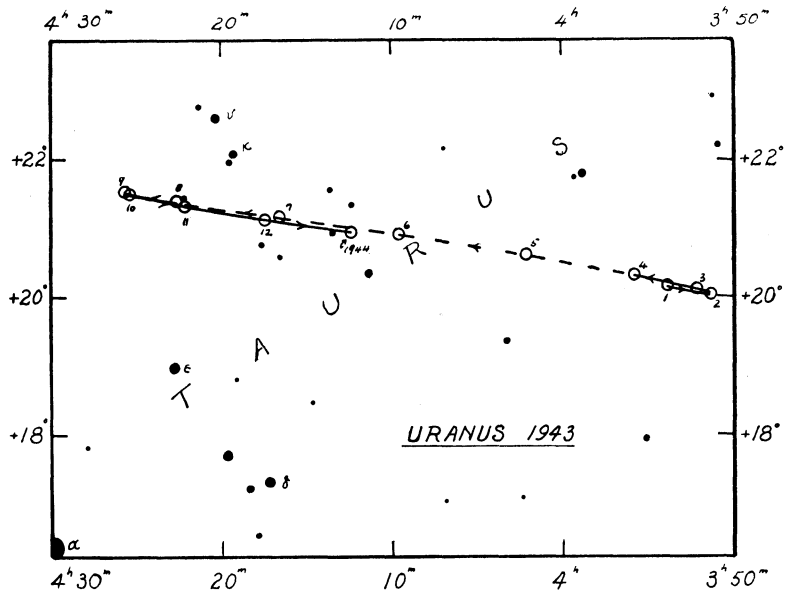
The path of Saturn through the constellations is shown on the map, the broken section indicating, as with Jupiter, the unobservable portion. The planet remains in *Taurus* throughout the year and moves westward, or retrogresses, during November and December.

URANUS

The planet Uranus is too faint to be seen readily with the unaided vision and was unknown until discovered by Sir Wm. Herschel in 1781. The planet is just visible to a keen eye under the most favourable circumstances but is seen without difficulty in a small telescope or field glasses. This object, and Neptune, appear starlike in small instruments but have a definite greenish colour which aids in their identification.

Uranus is suitably placed for observation in the evening sky during the first two months of the year but during the spring and summer it is too close to the sun for easy study. During the last four months of the year, however, it is well placed for observation, coming to opposition on November 29 when it is 1,710,000,000 miles from us, is of magnitude +5.9, and has an apparent diameter of 3″.75. The disc of the planet and its four satellites can be seen only through a powerful telescope.

The accompanying map shows the position of Uranus throughout the year



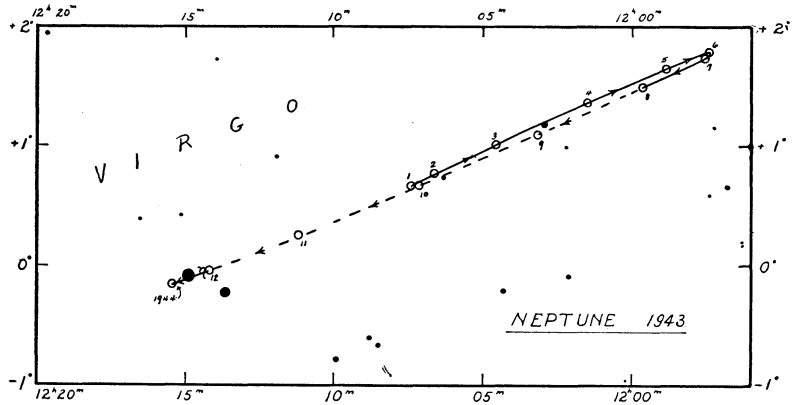
The path of Uranus among the stars during 1943. All stars brighter than magnitude +6.5 are plotted. The planet, near opposition will be about twice as bright as the faintest stars plotted. (Equator and equinox of 1900).

and may be used for identification. All stars to magnitude +6.5 have been plotted so that Uranus will appear about twice as bright as the faintest star shown on the map. The planet is found in *Taurus* and during most of the year is about 5° north and slightly west of the lucida *Aldebaran*.

NEPTUNE

Neptune is the most remote planet visible in moderate telescopes appearing starlike since, at its great distance, the apparent diameter is always less than 3″. Its magnitude near opposition is +7.7, however, so that although invisible to the unaided eye it may be seen without difficulty in a small telescope.

Neptune will be best placed for observation in the spring since it comes to opposition on March 22 when its distance from the earth is some 2,700,000,000



The path of Neptune among the stars during 1943. All stars brighter than magnitude +8.5 are plotted and the planet, near opposition, will be about twice as bright as the faintest stars shown. Note the close approach of Neptune to η *Virginis* in December. (Equator and equinox of 1900).

miles. During the summer months it will be too close to the sun for observation but will again be in a favourable position at the end of the year.

The accompanying map shows that Neptune is in the constellation *Virgo* during 1943 moving westward during the first half of the year and eastward during the second part. In December it is very close to the fourth magnitude star η *Virginis*. The map will serve to identify the planet since all stars brighter than magnitude +8.5 have been plotted. The planet will appear about twice as bright as the faintest stars shown on the map.

PLUTO

Pluto, discovered in March 1930, by the Lowell Observatory is the farthest planet from the sun. Because of its great distance from the sun and its small size, it can be observed only with the largest telescopes and by comparison with good star maps of the region. During 1942 Pluto is a yellowish 15th magnitude star in the constellation Cancer.

THE SKY MONTH BY MONTH

By W. F. M. Buscombe

THE SKY FOR JANUARY, 1943

Positions of the sun and planets are given for 0h Greenwich Civil Time.

The times of transit (at the 75th Meridian) are given in local mean time, 0h at midnight; to change to Standard Time, see p. 10. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During January the sun's R.A. increases from 18h 42m to 20h 55m and its Decl. changes from 23° 05′ S. to 17° 24′ S. The equation of time changes from −3m 6s to −13m 31s, i.e. the sun crosses the meridian a little later after noon local mean time each day. For changes in the length of the day, see p. 11. The earth is in perihelion, or nearest the sun, on January 2.

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. 20h 52m, Decl. 16° 50′ S. and transits at 13.15. During the first part of the month the planet is in the evening sky, reaching greatest eastern elongation from the sun on the 8th, when it sets an hour and 30 minutes after sunset. On the 15th the planet begins to retrograde, passing inferior conjuction with the sun on the 24th. On the 16th it is in conjuction with Venus, and 2° 43′ north of it. In the first week its stellar magnitude is −0.5.

Venus on the 15th is in R.A. 20h 44m, Decl. 19° 35′ S. and transits at 13.12. Having recently passed superior conjunction with the sun, the planet is gradually becoming a more conspicuous object low in the evening twilight, of stellar magnitude −3.4. Through a telescope it is seen in the almost full phase.

Mars on the 15th is in R.A. 17h 23m, Decl. 23° 26′ S. and transits at 9.48. It is thus very low in the south-east in the morning sky.

Jupiter on the 15th is in R.A. 7h 25m, Decl. 22° 17′ N. and transits at 23.46. This is the most favourable part of the year for observing Jupiter, for at opposition on the 11th its magnitude is −2.2. Rising around sunset, Jupiter is now visible almost all night. Its motion at present is retrograde. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 56.

Saturn on the 15th is in R.A. 4h 18m, Decl. 19° 32′ N. and transits at 20.39. The planet retrogrades slowly all month but can easily be recognized as an object of magnitude 0, about 5° north-west of Aldebaran. The rings appear very open, their plane making an angle of 25.°5 to the line of sight.

Uranus on the 15th is in R.A. 3h 55m, Decl. 20° 11′ N. and transits at 20.16.

Neptune on the 15th is in R.A. 12h 10m, Decl. 0° 27′ N. and transits at 4.34.

Pluto—For information in regard to this planet, see p. 31.

ASTRONOMICAL PHENOMENA MONTH BY MONTH

By Ruth J. Northcott

JANUARY

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 0h 45m
Fri.	1					21O34
Sat.	2	0		⊕ in Perihelion. Dist. from ☉, 91,347,000 mi.		d2O41
Sun.	3			Quadrantid meteors	20 19	341O2
		20		♀ in Aphelion		
Mon.	4	5	06	☌☌☾ ♂ 5° 06′ S.		d43O1
		9		♆ Stationary in R.A.		
Tue.	5					4231O
Wed.	6	7		Moon in Perigee. Dist. from ⊕, 221,600 mi.	17 08	d4O23
		7	37	● New Moon		
Thu.	7	5	58	☌♀☾ ♀ 3° 39′ S.		4O123
		17	00	☌☿☾ ☿ 2° 47′ S.		
Fri.	8	16		☿ Greatest elongation E., 19° 08′		421O3
Sat.	9				13 58	42O31
Sun.	10					314O2
Mon.	11	2		☍♃☉ Dist. from ⊕, 393,400,000 mi.		3O241
Tue.	12	5		☿ in ♌	10 47	231O4
Wed.	13	2	48	◑ First Quarter		dO234
Thu.	14					O1234
Fri.	15	5		☿ Stationary in R.A.	07 36	21O34
Sat.	16	3	06	☌♁☾ ♁ 5° 10′ N.		2O314
		6		☌☿♀ ☿ 2° 43′ N.		
		14	23	☌♄☾ ♄ 3° 22′ N.		
		20		☿ in Perihelion		
Sun.	17					31O24
Mon.	18				04 26	3O214
Tue.	19	18		Moon in Apogee. Dist. from ⊕, 252,500 mi.		3214O
Wed.	20	7	19	☌♃☾ ♃ 3° 24′ N.		4O13*
Thu.	21	5	48	○ Full Moon	01 15	4O23*
Fri.	22					421O3
Sat.	23				22 04	42O31
Sun.	24	14		☌☿☉ Inferior		431O2
Mon.	25					43O21
Tue.	26	6	01	☌♆☾ ♆ 1° 54′ S.	18 53	3421O
		9		♀ Greatest Hel. Lat. S.		
Wed.	27	2		☿ Greatest Hel. Lat. N.		42O1*
Thu.	28					1O423
Fri.	29	3	13	☾ Last Quarter	15 43	21O34
Sat.	30					2O134
Sun.	31					31O24

Explanation of symbols and abbreviations on p. 4, of time on p. 8.

THE SKY FOR FEBRUARY, 1943

Positions of the sun and planets are given for 0h Greenwich Civil Time.

The times of transit (at the 75th Meridian) are given in local mean time, 0h at midnight; to change to Standard Time, see p. 10. Estimates of altitude are for observer in latitude 45° N.

The Sun—During February the sun's R.A. increases from 20h 55m to 22h 44m and its Decl. changes from 17° 24′ S. to 8° 00′ S. The equation of time changes from −13m 31s to a limit of −14m 21s on the 12th, and then returns slowly to −12m 40s. For changes in the length of the day, see p. 11. On the 4th a total eclipse of the sun will be visible through a narrow band of the North Pacific, from Japan to Alaska. The partial phase may be seen in eastern Siberia and China, the Philippines and (near sunset) along the west coast of North America (see p. 80).

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. A partial eclipse of the moon will be visible throughout North and South America, the Atlantic and Western Europe, on the night of the 19-20th (see p. 80).

Mercury on the 15th is in R.A. 20h 05m, Decl. 19° 29′ S. and transits at 10.28. It is in the morning sky all month, and ceases its retrograde motion on the 5th. At its greatest western elongation from the sun on the 18th, it is not very favourably placed for morning observations, being only about 10° above the horizon at sunrise. It rises about an hour and a quarter before the sun at this time. On the 3rd it is in conjunction with the moon, when it appears as a star of magnitude 1.0.

Venus on the 15th is in R.A. 23h 14 m, Decl. 6° 24′ S. and transits at 13.38. The planet continues as the evening star, setting over an hour and a half after the sun. A close conjunction with the moon occurs on the 6th.

Mars on the 15th is in R.A. 19h 01m, Decl. 23° 20′ S. and transits at 9.24. Though it rises two hours before the sun, it is still only about 15° above the horizon at sunrise, due to its southern declination.

Jupiter on the 15th is in R.A. 7h 10m, Decl. 22° 49′ N. and transits at 21.29. It retrogrades all month, and remains the brightest starlike object all night. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, see p. 56.

Saturn on the 15th is in R.A. 4h 16m, Decl. 19° 36′ N. and transits at 18.36. It is gradually becoming a little fainter in the evening sky, and is in quadrature with the sun on the 25th when it sets just after midnight.

Uranus on the 15th is in R.A. 3h 54m, Decl. 20° 09′ N. and transits at 18.14.

Neptune on the 15th is in R.A. 12h 08m, Decl. 0° 38′ N. and transits at 2.30.

Pluto—For information in regard to this planet, see p. 31.

FEBRUARY

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 23h 45m
Mon.	1			.....	12 32	32104
Tue.	2	2	09	☌☌☾ ☌ 4° 33′ S.....		23014
Wed.	3	10	25	☌☿☾ ☿ 0° 21′ N.....		10423
		19		Moon in Perigee. Dist. from ⊕, 222,800 mi...		
Thu.	4	18	29	● New Moon.....	09 21	d4013
				Total eclipse of ☉, see p. 80.....		
Fri.	5	4		☿ Stationary in R.A.....		4203*
Sat.	6	4	37	☌♀☾ ♀ 0° 28′ S.....		43102
		12		♄ Stationary in R.A.....		
Sun.	7	21		♁ Stationary in R.A.....	06 11	43012
Mon.	8			.....		43210
Tue.	9			.....		42301
Wed.	10			.....	03 00	41023
Thu.	11	19	40	◑ First Quarter.....		40213
Fri.	12	9	24	☌♁☾ ♁ 5° 15′ N.....	23 49	2043*
		20	17	☌♄☾ ♄ 3° 35′ N.....		
Sat.	13			.....		1304*
Sun.	14			.....		30124
Mon.	15			.....	20 38	32104
Tue.	16	3		Moon in Apogee. Dist. from ⊕, 252,100 mi...		23014
		7	57	☌♃☾ ♃ 3° 41′ N.....		
Wed.	17			.....		10324
Thu.	18	5		☿ Greatest elongation W., 26° 24′.....	17 28	02134
Fri.	19	13		☿ in ♈.....		21043
		23		□♁☉		
Sat.	20			Partial eclipse of ☾, see p. 80.....		dd04*
		0	45	○ Full Moon.....		
Sun.	21			.....	14 17	34012
Mon.	22	10	47	☌♆☾ ♆ 1° 51′ S.....		43120
Tue.	23			.....		42301
Wed.	24			.....	11 07	41032
Thu.	25	5		□♄☉		40213
Fri.	26			.....		42103
Sat.	27	13	22	☾ Last Quarter.....	07 56	d4203
Sun.	28			.....		34012

Explanation of symbols and abbreviations on p. 4, of time on p. 8.

THE SKY FOR MARCH, 1943

Positions of the sun and planets are given for 0h Greenwich Civil Time.

The times of transit (at the 75th Meridian) are given in local mean time, 0h at midnight; to change to Standard Time, see p. 10. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During March the sun's R.A. increases from 22h 44m to 0h 38m and its Decl. changes from 8° 00′ S. to 4° 07′ N. On March 21 at 7.03 E.S.T. the sun crosses the equator on its way north, enters the sign Aries, and spring commences. This is the vernal equinox. The equation of time changes steadily from –12m 40s to –4m 16s. For changes in the length of the day, see p. 12.

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. 22h 35m, Decl. 11° 21′ S. and transits at 11.09. The planet is in the morning sky all month, but not favourably placed for observation, as it rises closer to sunrise each day. On the 4th it is in conjunction with the moon, and about 2° south of it; the stellar magnitude is then about 0.

Venus on the 15th is in R.A. 1h 20m, Decl. 8° 00′ N. and transits at 13.54. As "evening star" it is slowly becoming brighter and sets over two hours after the sun. On the 15th it is just south of west, and nearly 25° above the horizon at sunset. With optical aid the disc can be seen as distinctly less than circular.

Mars on the 15th is in R.A. 20h 30m, Decl. 20° 01′ S. and transits at 9.02. Due to its southern declination, Mars is still only about 15° above the south-eastern horizon at sunrise.

Jupiter on the 15th is in R.A. 7h 06m, Decl. 22° 57′ N. and transits at 19.35. On the 12th it ceases retrograding and begins to move eastward among the stars. At magnitude –1.9 it remains the brightest object of the evening sky. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 56.

Saturn on the 15th is in R.A. 4h 21m, Decl. 19° 54′ N. and transits at 16.51. As its position among the stars changes more slowly than the sun's, it now begins to fade in the early evening sky as it sets earlier each evening.

Uranus on the 15th is in R.A. 3h 56m, Decl. 20° 15′ N. and transits at 16.26.

Neptune on the 15th is in R.A. 12h 06m, Decl. 0° 55′ N. and transits at 0.38. In opposition to the sun on the 22nd, its stellar magnitude is 7.7.

Pluto—For information in regard to this planet, see p. 31.

MARCH

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 23h 15m
Mon.	1	19		☿ in Aphelion		3120 4
Tue.	2	22	25	☌☍☾ ♂ 3° 25′ S	04 45	3201 4
Wed.	3					1032 4
Thu.	4	2		Moon in Perigee. Dist. from ⊕, 225,600 mi.		0123 4
		14	21	☌☿☾ ☿ 2° 08′ S		
Fri.	5				01 34	2103 4
Sat.	6	5	34	● New Moon		2013 4
Sun.	7				22 24	3024*
Mon.	8	3	16	☌♀☾ ♀ 3° 25′ N		d310 4
Tue.	9					3240 1
Wed.	10				19 13	4103 2
Thu.	11	18	33	☌♁☾ ♁ 5° 12′ N		4012 3
		21		♃ Stationary in R.A.		
Fri.	12	6	21	☌♄☾ ♄ 3° 37′ N		4210 3
Sat.	13	14	30	☽ First Quarter	16 02	4201 3
Sun.	14					4310 2
Mon.	15	13	28	☌♃☾ ♃ 3° 43′ N		d430 2
		21		Moon in Apogee. Dist. from ⊕, 251,500 mi.		
Tue.	16				12 52	3420 1
Wed.	17					140**
Thu.	18					0124 3
Fri.	19				09 41	2103 4
Sat.	20					2013 4
Sun.	21	7	03	☉ enters ♈, Spring commences. Long. of ☉, 0°		3102 4
		16	22	☌ΨΨ☾ Ψ 1° 45′ S		
		17	08	○ Full Moon		
Mon.	22	0		☍ΨΨ☉ Dist. from ⊕, 2,718,000,000 mi.	06 30	3012 4
		3		☿ Greatest Hel. Lat. S.		
Tue.	23	16		♀ in ♌		3204*
Wed.	24					1304*
Thu.	25				03 19	0412 3
Fri.	26					1420 3
Sat.	27					4201 3
Sun.	28	20	52	☾ Last Quarter	00 09	4130 2
Mon.	29					4301 2
Tue.	30				20 58	4320*
Wed.	31	12		Moon in Perigee. Dist. from ⊕, 228,900 mi.		4312 0
		17	27	☌☍☾ ♂ 1° 50′ S		

Explanation of symbols and abbreviations on p. 4, of time on p. 8.

THE SKY FOR APRIL, 1943

Positions of the sun and planets are given for 0h Greenwich Civil Time.

The times of transit (at the 75th Meridian) are given in local mean time, 0h at midnight; to change to Standard Time, see p. 10. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During April the sun's R.A. increases from 0h 38m to 2h 29m and its Decl. changes from 4° 07′ N. to 14° 44′ N. The equation of time changes during the first half of the month from −4m 16s to 00m on the 16th, so that on the 16th the sun transits the meridian at local mean noon. By the end of the month the apparent solar time is 2m 49s ahead of the mean solar time. For changes in the length of the day, see p. 12.

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 12m, Decl. 14° 13′ N. and transits at 12.46. In the early part of the month it is too close to the sun to be observed, as it passes into the evening sky after superior conjunction on the 4th. By the 30th it reaches its greatest eastern elongation, setting nearly 2 hours after the sun. At this favourable date for observation Mercury is nearly 20° above the horizon at sunset, and very close to the Pleiades cluster in Taurus. It is about as bright as a star of magnitude −1.

Venus on the 15th is in R.A. 3h 46m, Decl. 21° 03′ N. and transits at 14.18. It is now a very bright object in the western sky, setting more than two hours after the sun. It is almost due west, and 30° above the horizon on the 15th. About the 20th it passes between the Pleiades and Aldebaran.

Mars on the 15th is in R.A. 22h 03m, Decl. 13° 24′ S. and transits at 8.34. Though the planet is moving northward more rapidly, it is still less than 20° above the south-eastern horizon at sunrise. Its magnitude is +1.2.

Jupiter on the 15th is in R.A. 7h 14m, Decl. 22° 46′ N. and transits at 17.41. It is in quadrature with the sun on the 6th, so that later in the month it is beginning to recede into the evening twilight. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 57.

Saturn on the 15th is in R.A. 4h 32m, Decl. 20° 26′ N. and transits at 15.00. At stellar magnitude 0.3 it may especially be noticed on the evening of the 24th, when Saturn is within 3° of Venus and 5° of Aldebaran.

Uranus on the 15th is in R.A. 4h 01m, Decl. 20° 31′ N. and transits at 14.29. It is now passing into the twilight sky.

Neptune on the 15th is in R.A. 12h 02m, Decl. 1° 15′ N. and transits at 22.29.

Pluto—For information in regard to this planet, see p. 31.

APRIL

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 22h 45m
Thu.	1			.....		4O132
Fri.	2			.....	17 47	412O3
Sat.	3			.....		2O413
Sun.	4	3		☌☿⊙ Superior		d1O24
		15	32	☌☿☾ ☿ 3° 14′ N.		
		16	53	● New Moon		
Mon.	5			.....	14 36	3O124
Tue.	6	17		□♃⊙		321O4
Wed.	7	5	54	☌♀☾ ♀ 6° 03′ N.		d32O4
Thu.	8	5	38	☌♁☾ ♁ 5° 02′ N.	11 25	O324*
		19	36	☌♄☾ ♄ 3° 30′ N.		
Fri.	9			.....		d1O34
Sat.	10	4		☿ in ♌		2O143
Sun.	11			.....	08 15	1O342
Mon.	12	0	28	☌♃☾ ♃ 3° 26′ N.		34O12
		10	04	◑ First Quarter		
		17		Moon in Apogee. Dist. from ⊕, 251,100 mi. ..		
Tue.	13			.....		4321O
Wed.	14	19		☿ in Perihelion	05 04	432O1
Thu.	15			.....		4O2**
Fri.	16			.....		41O23
Sat.	17	23		☌♀♁ ♀ 1° 27′ N.	01 54	42O13
		23	21	☌♆☾ ♆ 1° 45′ S.		
Sun.	18			.....		41O3*
Mon.	19			.....	22 42	34O12
Tue.	20	6	11	♋ Full Moon		321O4
Wed.	21			Lyrid Meteors		32O14
Thu.	22			.....	19 31	1O324
Fri.	23			.....		1O234
Sat.	24	23		☌♀♄ ♀ 3° 05′ N.		2O134
Sun.	25	1		☿ Greatest Hel. Lat. N.	16 20	1O34*
		11		Moon in Perigee. Dist. from ⊕, 229,500 mi. ..		
Mon.	26	4		♀ in Perihelion		3O124
Tue.	27	2	51	☾ Last Quarter		312O4
Wed.	28			.....	13 09	d32O1
Thu.	29	11	33	☌♂☾ ♂ 0° 01′ S.		41O2*
Fri.	30	16		☿ Greatest elongation E., 20° 45′		4O123

Explanation of symbols and abbreviations on p. 4, of time on p. 8.

THE SKY FOR MAY, 1943

Positions of the sun and planets are given for 0h Greenwich Civil Time.

The times of transit (at the 75th Meridian) are given in local mean time, 0h at midnight; to change to Standard Time, see p. 10. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During May the sun's R.A. increases from 2h 29m to 4h 32m and its Decl. changes from 14° 44′ N. to 21° 54′ N. The equation of time is small throughout the month, increasing from +2m 49s to +3m 46s on the 15th, and then diminishing to +2m 31s. For changes in the length of the day, see p. 13.

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 13m, Decl. 22° 11′ N. and transits at 12.42. In the first part of the month it is visible in the evening sky. The planet begins to retrograde on the 12th, and reaches inferior conjunction with the sun on the 23rd. Despite the fact that the planet is rapidly coming closer, its brightness decreases greatly as its crescent narrows.

Venus on the 15th is in R.A. 6h 18m, Decl. 25° 42′ N. and transits at 14.51. It is the evening star of magnitude −3.6, setting over 3 hours after sunset, rapidly waning toward the quarter phase.

Mars on the 15th is in R.A. 23h 29m, Decl. 5° 12′ S. and transits at 8.01. It continues to move northward, becoming somewhat brighter; its mean magnitude is 0.9. During the month it passes through the constellation Aquarius. It is still rather low in the south-eastern sky at dawn.

Jupiter on the 15th is in R.A. 7h 31m, Decl. 22° 13′ N. and transits at 16.01. It, with Venus, still dominates the early evening sky, setting in the north-west from 5 to 3 hours after the sun. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 57.

Saturn on the 15th is in R.A. 4h 47m, Decl. 20° 59′ N. and transits at 13.17. It is now too close to the sun to be well seen without optical aid.

Uranus on the 15th is in R.A. 4h 08m, Decl. 20° 50′ N. and transits at 12.38. Conjunction with the sun occurs on the 26th, when the planet passes into the morning sky.

Neptune on the 15th is in R.A. 12h 00m, Decl. 1° 29′ N. and transits at 20.29.

Pluto—For information in regard to this planet, see p. 31.

MAY

75th Meridian Civil Time

	d	h	m		Min. of Algol	Config. of Jupiter's Sat. 22h 15m
					h m	
Sat.	1			.....	09 58	42O3*
Sun.	2			.....		412O3
Mon.	3			.....		43O12
Tue.	4			Eta Aquarid Meteors.....	06 47	4312O
		4	43	☍ New Moon.....		
Wed.	5	13		☌☿♁ ☿ 2° 41′ N.....		432O1
		17	01	☌♁☾ ♁ 4° 53′ N.....		
		17	11	☌☿☾ ☿ 7° 33′ N.....		
Thu.	6	10	10	☌♄☾ ♄ 3° 19′ N.....		413O2
Fri.	7	13	24	☌♀☾ ♀ 6° 14′ N.	03 36	O123*
Sat.	8			.....		2O43*
Sun.	9	15	32	☌♃☾ ♃ 2° 59′ N.....		21O34
Mon.	10	12		Moon in Apogee. Dist. from ⊕, 251,300 mi...	00 25	3O124
Tue.	11			.....		d31O4
Wed.	12	4	52	☽ First Quarter.....	21 14	32O14
		11		☿ Stationary in R.A.....		
Thu.	13			.....		31O24
Fri.	14			.....		O1324
Sat.	15	7	17	☌♆☾ ♆ 1° 55′ S.	18 03	214O3
Sun.	16			.....		d42O3
Mon.	17			.....		d4O12
Tue.	18	4		♀ Greatest Hel. Lat. N.....	14 52	431O2
		10		☌☿♁ ☿ 0° 08′ N.....		
		12		☿ in ♉.....		
Wed.	19	16	13	☺ Full Moon.....		432O1
Thu.	20			.....		431O*
Fri.	21			.....	11 41	4O312
Sat.	22	9		Moon in Perigee. Dist. from ⊕, 226,600 mi...		421O3
Sun.	23	10		☌☿⊙ Inferior.....		24O13
Mon.	24			.....	08 30	O342*
Tue.	25			.....		31O24
Wed.	26	8	33	☾ Last Quarter.....		32O14
		14		☌♁⊙		
Thu.	27			.....	05 19	31O4*
Fri.	28	5	26	☌♂☾ ♂ 1° 42′ N.....		O124*
		7		♂ Greatest Hel. Lat. S.....		
		18		☿ in Aphelion.....		
Sat.	29			.....		12O34
Sun.	30			.....	02 08	2O134
Mon.	31			.....		1O324

Explanation of symbols and abbreviations on p. 4, of time on p. 8.

THE SKY FOR JUNE, 1943

Positions of the sun and planets are given for 0h Greenwich Civil Time.

The times of transit (at the 75th Meridian) are given in local mean time, 0h at midnight; to change to Standard Time, see p. 10. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During June the sun's R.A. increases from 4h 32m to 6h 36m and its Decl. changes from 21° 54′ N. to 23° 27′ N. at the solstice on the 22nd, and then to 23° 11′ N. The equation of time changes from +2m 31s to −3m 26s, being 00m on the 14th. For changes in the length of the day, see p. 13.

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. 3h 57m, Decl. 16° 33′ N. and transits at 10.27. All month the planet is in the morning sky. It ceases its retrograde motion on the 4th, and reaches greatest western elongation on the 18th when it rises one hour before the sun. This is not a favourable elongation for observing Mercury.

Venus on the 15th is in R.A. 8h 44m, Decl. 20° 23′ N. and transits at 15.14. As it approaches closer to the earth, its angular diameter is increasing, but as it has the aspect through a telescope of a half moon, its brightness grows but slowly to about magnitude −4. Venus may now be seen in daylight; look for it, due south, two-thirds way from horizon to zenith, at time of transit.

Mars on the 15th is in R.A. 0h 53m, Decl. 3° 42′ N. and transits at 7.23. It is now rising prominently 3 to 4 hours before the sun, almost due east. It is 30° above the south-eastern horizon at sunrise.

Jupiter on the 15th is in R.A. 7h 55m, Decl. 21° 15′ N. and transits at 14.23. It is becoming steadily harder to identify in the evening twilight, for by the end of the month it sets about an hour and a half after sunset. Venus passes about 2° north of Jupiter on June 1. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 57.

Saturn on the 15th is in R.A. 5h 04m, Decl. 21° 28′ N. and transits at 11.32. At conjunction with the sun on the 7th it passes into the evening sky, but cannot be observed this month.

Uranus on the 15th is in R.A. 4h 16m, Decl. 21° 10′ N. and transits at 10.44.

Neptune on the 15th is in R.A. 12h 00m, Decl. 1° 32′ N. and transits at 18.26. Its retrograde motion ceases on the 11th, and on the 21st it is in quadrature to the sun.

Pluto—For information in regard to this planet, see p. 31.

JUNE

75th Meridian Civil Time

	d	h	m				Min. of Algol h m	Config. of Jupiter's Sat. 21h 30m
Tue.	1	12		☌ ☿ ⚳	☿	2° 03′ N.	22 57	34102
		13	55	☌ ☿ ☾	☿	1° 30′ N.		
Wed.	2	3	27	☌ ♁ ☾	♁	4° 49′ N.		34201
		17	33	●	New Moon			
Thu.	3	0	30	☌ ♄ ☾	♄	3° 10′ N.		43120
Fri.	4	14		☿	Stationary in R.A.		19 45	4012*
Sat.	5							41203
Sun.	6	8	49	☌ ⚳ ☾	⚳	2° 24′ N.		42013
		18	38	☌ ☿ ☾	☿	4° 00′ N.		
Mon.	7	5		Moon in Apogee.		Dist. from ⊕, 251,800 mi.	16 34	41023
		10		☌ ♄ ☉				
Tue.	8							d4302
Wed.	9							3240*
Thu.	10	21	35	☽	First Quarter		13 23	32104
Fri.	11	5		♆	Stationary in R.A.			30124
		15	19	☌ ♆ ☾	♆	2° 09′ S.		
Sat.	12							d1034
Sun.	13						10 12	20134
Mon.	14							10234
Tue.	15							30124
Wed.	16						07 01	3204*
Thu.	17							32104
Fri.	18	0	14	☺	Full Moon			34012
		1		☿	Greatest elongation W., 23° 01′			
		2		☿	Greatest Hel. Lat. S.			
Sat.	19	10		Moon in Perigee.		Dist. from ⊕, 223,700 mi.	03 49	41023
Sun.	20	4		☌ ☿ ♁	☿	3° 08′ S.		42013
Mon.	21	9		□ ♆ ☉				4103*
Tue.	22	2	13	☉	enters ♋, Summer commences. Long. of ☉, 90°		00 38	d4012
		7		♂	in Perihelion			
Wed.	23							43210
Thu.	24	15	08	☾	Last Quarter		21 27	d4320
Fri.	25	23	40	☌ ♂ ☾	♂	2° 59′ N.		43012
Sat.	26							1023*
Sun.	27	20		☿	Greatest elongation E., 45° 26′		18 16	20143
Mon.	28							1034*
Tue.	29	12	33	☌ ♁ ☾	♁	4° 50′ N.		03124
Wed.	30	0		☌ ☿ ♄	☿	0° 06′ S.	15 04	31204
		13	54	☌ ♄ ☾	♄	3° 03′ N.		
		15	58	☌ ☿ ☾	☿	3° 02′ N.		

Explanation of symbols and abbreviations on p. 4, of time on p. 8.

THE SKY FOR JULY, 1943

Positions of the sun and planets are given for 0h Greenwich Civil Time.

The times of transit (at the 75th Meridian) are given in local mean time, 0h at midnight; to change to Standard Time, see p. 10. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During July the sun's R.A. increases from 6h 36m to 8h 41m and its Decl. changes from 23° 11′ N. to 18° 18′ N. The equation of time changes from −3m 26s to −6m 23s on the 27th and then back to −6m 17s. The earth reaches its greatest distance from the sun on the 4th. There will be an annular eclipse of the sun, invisible in Canada, on July 31-Aug. 1 (see p. 80). For changes in the length of the day, see p. 14.

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. 7h 18m, Decl. 23° 28′ N. and transits at 11.54. It is too close to the sun for favourable observation this month, and passes into the evening sky at superior conjunction on the 17th.

Venus on the 15th is in R.A. 10h 30m, Decl. 9° 12′ N. and transits at 15.01. It continues to be very conspicuous in the afternoon and evening sky, reaching its greatest brilliancy on the 31st, stellar magnitude −4.2. Through a telescope its disc now appears as a waning crescent. Soon after moonrise on the morning of the 6th it will be occulted by the moon; this interesting phenomenon may be seen in most parts of eastern North America (see p. 59). On July 6th Venus passes very close to Regulus.

Mars on the 15th is in R.A. 2h 13m, Decl. 11° 24′ N. and transits at 6.44. The distance of Mars from the earth is steadily decreasing, and its brightness increasing. On the 15th its magnitude is +0.5, and it rises about midnight.

Jupiter on the 15th is in R.A. 8h 22m, Decl. 19° 56′ N. and transits at 12.52. At conjunction with the sun on the 30th it passes out of the evening twilight.

Saturn on the 15th is in R.A. 5h 20m, Decl. 21° 48′ N. and transits at 9.50. It is now becoming visible in the north-eastern morning sky, rising 1 to 3 hours before the sun.

Uranus on the 15th is in R.A. 4h 22m, Decl. 21° 26′ N. and transits at 8.52.

Neptune on the 15th is in R.A. 12h 01m, Decl. 1° 24′ N. and transits at 16.29.

Pluto—For information in regard to this planet, see p. 31.

JULY

75th Meridian Civil Time

	d	h	m		Min. of Algol h m
Thu.	1				
Fri.	2	7	44	● New Moon	
Sat.	3				11 53
Sun.	4	2	58	☌☿☾ ☿ 1° 51′ N.	
		5		⊕ in Aphelion. Dist. from ☉, 94,452,000 mi.	
		17		Moon in Apogee. Dist. from ⊕, 252,400 mi.	
Mon.	5				
Tue.	6	11	04	☌♀☾ ♀ 0° 27′ S.	08 42
Wed.	7	3		☿ in ♌	
Thu.	8	22	53	☌♆☾ ♆ 2° 23′ S.	
Fri.	9				05 30
Sat.	10	11	29	☽ First Quarter	
Sun.	11	18		☿ in Perihelion	
Mon.	12				02 19
Tue.	13	5		♀ in ♍	
Wed.	14				23 07
Thu.	15				
Fri.	16				
Sat.	17	7	21	○ Full Moon	19 56
		17		Moon in Perigee. Dist. from ⊕, 222,100 mi.	
		22		☌☿☉ Superior	
Sun.	18				
Mon.	19				
Tue.	20				16 45
Wed.	21				
Thu.	22	0		☿ Greatest Hel. Lat. N.	
		15		☌☿♃ ☿ 1° 20′ N.	
Fri.	23	23	38	☾ Last Quarter	13 33
Sat.	24	17	58	☌♂☾ ♂ 3° 37′ N.	
Sun.	25				
Mon.	26	20	42	☌♁☾ ♁ 4° 53′ N.	10 22
Tue.	27				
Wed.	28			Delta Aquarid Meteors	
		2	11	☌♄☾ ♄ 2° 57′ N.	
Thu.	29				07 11
Fri.	30	8		☌♃☉	
Sat.	31	12		♀ Greatest brilliancy	
		21	19	☌♃☾ ♃ 1° 21′ N.	
		22		Moon in Apogee. Dist. from ⊕, 252,600 mi.	
		23	06	● New Moon	
				Annular eclipse of ☉, see p. 80	

Explanation of symbols and abbreviations on p. 4, of time on p. 8. Jupiter being near the Sun, phenomena of the satellites are not given from June 31 to August 17.

THE SKY FOR AUGUST, 1943

Positions of the sun and planets are given for 0h Greenwich Civil Time.

The times of transit (at the 75th Meridian) are given in local mean time, 0h at midnight; to change to Standard Time, see p. 10. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During August the sun's R.A. increases from 8h 41m to 10h 37m and its Decl. changes from 18° 18′ N. to 8° 41′ N. The equation of time changes from −6m 17s to −0m 21s. For changes in the length of the day, see p. 14.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. A partial eclipse of the moon on the 15th will be seen from southern Europe and Asia to South Africa and Australia (see p. 80).

Mercury on the 15th is in R.A. 11h 04m, Decl. 5° 54′ N. and transits at 13.35. It is an evening planet all month, of about stellar magnitude 0. On the 2nd it is in close conjunction with the moon. Although Mercury reaches its maximum elongation from the sun for the year, 27° east, on the 29th, this is not a favourable elongation, as Mercury is less than 10° above the horizon at sunset.

Venus on the 15th is in R.A. 11h 17m, Decl. 1° 19′ S. and transits at 13.43. It is now becoming closer to the sun in the sky, and begins to retrograde on the 13th. However it remains a bright evening star, and through the telescope appears as a thin crescent whose diameter subtends nearly 1′.

Mars on the 15th is in R.A. 3h 31m, Decl. 17° 23′ N. and transits at 6.00. Quadrature with the sun occurs on the 24th. The planet is now a bright morning star, high in the southern sky at sunrise.

Jupiter on the 15th is in R.A. 8h 50m, Decl. 18° 16′ N. and transits at 11.18. Toward the end of the month it can be seen rising nearly two hours before the sun. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 57.

Saturn on the 15th is in R.A. 5h 34m, Decl. 21° 58′ N. and transits at 8.02. Saturn now rises around midnight, in the north-east.

Uranus on the 15th is in R.A. 4h 27m, Decl. 21° 37′ N. and transits at 6.55.

Neptune on the 15th is in R.A. 12h 03m, Decl. 1° 05′ N. and transits at 14.30.

Pluto—For information in regard to this planet, see p. 31.

AUGUST

75th Meridian Civil Time

	d	h	m		Min. of Algol	Config. of Jupiter's Sat. 5h 30m
					h m	
Sun.	1			.....	03 59	
Mon.	2	10	19	☌☿☾ ☿ 0° 34′ N.		
Tue.	3			.....		
Wed.	4	3	26	☌♀☾ ♀ 6° 32′ S.	00 48	
Thu.	5	6	02	☌♆☾ ♆ 2° 30′ S.		
Fri.	6			.....	21 36	
Sat.	7			.....		
Sun.	8	22	36	☽ First Quarter		
Mon.	9			.....	18 25	
Tue.	10			.....		
Wed.	11			.....		
Thu.	12			Perseid Meteors	15 13	
Fri.	13	4		♀ Stationary in R.A.		
Sat.	14	11		☿ in ♉		
Sun.	15	3		Moon in Perigee. Dist. from ⊕, 222,100 mi.	12 02	
				Partial eclipse of ☾, see p. 80		
		14	34	☍ Full Moon		
Mon.	16	15		♀ in Aphelion		
Tue.	17	2		☌☿♀ ☿ 6° 04′ N.		21043
Wed.	18			.....	08 50	01234
Thu.	19			.....		10324
Fri.	20			.....		32014
Sat.	21			.....	05 39	31204
Sun.	22	10	37	☌♂☾ ♂ 3° 41′ N.		30124
		11	04	☾ Last Quarter		
Mon.	23	4	37	☌♁☾ ♁ 4° 51′ N.		2034*
		21		□♂☉		
Tue.	24	13	29	☌♄☾ ♄ 2° 47′ N.	02 28	21043
		18		☿ in Aphelion		
Wed.	25			.....		40123
Thu.	26			.....	23 16	41032
Fri.	27			.....		43201
Sat.	28	2		Moon in Apogee. Dist. from ⊕, 252,300 mi.		43120
		15	34	☌♃☾ ♃ 0° 50′ N.		
Sun.	29	0		☿ Greatest elongation E., 27° 17′	20 05	43012
		5		☌☿♆ ☿ 3° 58′ S.		
Mon.	30	14	59	● New Moon		d403*
Tue.	31	1	00	☌♀☾ ♀ 11° 28′ S.		42103

Explanation of symbols and abbreviations on p. 4, of time on p. 8.

THE SKY FOR SEPTEMBER, 1943

Positions of the sun and planets are given for 0h Greenwich Civil Time.

The times of transit (at the 75th Meridian) are given in local mean time, 0h at midnight; to change to Standard Time, see p. 10. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During September the sun's R.A. increases from 10h 37m to 12h 26m and its Decl. changes from 8° 41′ N. to 2° 45′ S. The equation of time changes from −0m 21s to +9m 55s. On the 23rd at 17.12 the sun crosses the equator and enters Libra. This is the autumnal equinox. For changes in the length of the day, see p. 15.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Harvest Moon Sept. 13.

Mercury on the 15th is in R.A. 12h 26m, Decl. 7° 18′ S. and transits at 12.50. It is probably too low in the south-western sky at sunset to be visible even at the beginning of the month. On the 24th it is in conjunction with the sun, and becomes a morning star.

Venus on the 15th is in R.A. 10h 24m, Decl. 1° 08′ N. and transits at 10.48. In the first part of the month it is too close to the sun for favourable observation, but later appears as the morning star, following inferior conjunction with the sun on the 5th. By the end of the month it rises more than two hours before the sun. Through the telescope it presents a disc like the new moon, of stellar magnitude −3.6.

Mars on the 15th is in R.A. 4h 39m, Decl. 21° 00′ N. and transits at 5.06. Its magnitude is now −0.2. On the 12th Mars is about 4° north of Aldebaran.

Jupiter on the 15th is in R.A. 9h 16m, Decl. 16° 28′ N. and transits at 9.42. It is now a conspicuous morning object, rising about three hours before the sun, and being over a magnitude brighter than Mars. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 57.

Saturn on the 15th is in R.A. 5h 43m, Decl. 22° 01′ N. and transits at 6.09. On the 20th it is in quadrature with the sun, and is on the meridian at sunrise.

Uranus on the 15th is in R.A. 4h 29m, Decl. 21° 41′ N. and transits at 4.55. It is in quadrature with the sun on the 1st, and begins a retrograde motion on the 14th. On the morning of the 9th it passes just 1° north of Mars.

Neptune on the 15th is in R.A. 12h 07m, Decl. 0° 40′ N. and transits at 12.32. At conjunction with the sun on the 25th it passes into the morning sky.

Pluto—For information in regard to this planet, see p. 31.

SEPTEMBER

75th Meridian Civil Time

	d	h	m				Min. of Algol h m	Config. of Jupiter's Sat. 5h 15m
Wed.	1	13	24	☌♆☾	♆	2° 32′ S.	16 53	4O123
		18	33	☌☿☾	☿	7° 16′ S.		
		22		□♁☉				
Thu.	2							1O32*
Fri.	3							23O14
Sat.	4						13 42	312O4
Sun.	5	19		☌♀☉	Inferior			3O124
Mon.	6							1O24*
Tue.	7	7	33	☽	First Quarter		10 30	d2O34
Wed.	8	2		♀	Greatest Hel. Lat. S.			O2134
Thu.	9	7		☌☌♁	♂	1° 10′ S.		1O324
Fri.	10						07 19	32O14
Sat.	11	3		☿	Stationary in R.A.			3214O
Sun.	12	12		Moon in Perigee.	Dist. from ⊕, 223,900 mi.			43O12
Mon.	13	22	40	☍	Full Moon		04 08	413O2
Tue.	14	2		☿	Greatest Hel. Lat. S.			42O13
		18		♁	Stationary in R.A.			
Wed.	15							4O3**
Thu.	16						00 56	41O23
Fri.	17							423O1
Sat.	18						21 45	3421O
Sun.	19	12	51	☌♁☾	♁	4° 44′ N.		3O12*
		22		□♄☉				
		22	08	☌☌☾	♂	3° 35′ N.		
Mon.	20	23	47	☌♄☾	♄	2° 32′ N.		13O24
Tue.	21	2	06	☾	Last Quarter		18 34	2O134
		18		☌☿♆	☿	5° 12′ S.		
Wed.	22							21O34
Thu.	23	17	12	☉ enters ♎, Autumn commences. Long. of ☉, 180°				dO234
Fri.	24	12		☌☿☉	Inferior		15 22	d2O14
		15		Moon in Apogee.	Dist. from ⊕, 251,800 mi.			
Sat.	25	8		♀	Stationary in R.A.			321O4
		9	23	☌♃☾	♃	0° 18′ N.		
		13		☌♆☉				
Sun.	26	11	15	☌♀☾	♀	8° 22′ S.		3O214
Mon.	27						12 11	31O42
Tue.	28	9	50	☌☿☾	☿	5° 15′ S.		24O31
		21	41	☌♆☾	♆	2° 34′ S.		
Wed.	29	6	29	●	New Moon			421O3
Thu.	30						08 59	4O123

Explanation of symbols and abbreviations on p. 4, of time on p. 8.

THE SKY FOR OCTOBER, 1943

Positions of the sun and planets are given for 0h Greenwich Civil Time.

The times of transit (at the 75th Meridian) are given in local mean time, 0h at midnight; to change to Standard Time, see p. 10. 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 21m and its Decl. changes from 2° 45′ S. to 14° 05′ S. The equation of time increases from 9m 55s to 16m 18s, i.e. the sun transits the meridian before local mean noon each day. For changes in the length of the day, see p. 15.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Hunter's Moon Oct. 13th.

Mercury on the 15th is in R.A. 12h 18m, Decl. 0° 13′ N. and transits at 10.48. It is low in the eastern sky at sunrise, rising about an hour and a half before the sun at greatest western elongation on the 10th. From the earth it appears to reach a stationary point in its motion on the 2nd when it ceases to retrograde.

Venus on the 15th is in R.A. 10h 41m, Decl. 5° 16′ N. and transits at 9.09. It is now a very bright morning star, reaching its greatest brilliancy on the 13th, magnitude −4.3. It continues as a luminous crescent; the area reflecting the sun's light earthward increases while the apparent angular diameter diminishes as the planet recedes from the earth.

Mars on the 15th is in R.A. 5h 21m, Decl. 22° 50′ N. and transits at 3.49. Look for a bright object of magnitude −0.7 rising 2 to 3 hours after sunset.

Jupiter on the 15th is in R.A. 9h 38m, Decl. 14° 51′ N. and transits at 8.05. At moonrise in the Maritime Provinces and New England, on the morning of the 23rd, the emersion of an occultation of Jupiter by the moon will be visible. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 57.

Saturn on the 15th is in R.A. 5h 45m, Decl. 22° 00′ N. and transits at 4.13. It thus rises in the evening about half an hour after Mars.

Uranus on the 15th is in R.A. 4h 27m, Decl. 21° 37′ N. and transits at 2.55.

Neptune on the 15th is in R.A. 12h 11m, Decl. 0° 14′ N. and transits at 10.38.

Pluto—For information in regard to this planet, see p. 31.

OCTOBER

75th Meridian Civil Time

	d	h	m		Min. of Algol	Config. of Jupiter's Sat. 4h 45m
					h m	
Fri.	1			.....		d4O3*
Sat.	2	20		☿ Stationary in R.A.		4321O
Sun.	3	2		☿ in ♌	05 48	43O21
Mon.	4			.....		431O2
Tue.	5			.....		42O31
Wed.	6	15	10	☽ First Quarter	02 37	21O43
Thu.	7	17		☿ in Perihelion		O1243
Fri.	8			.....	23 25	O234*
Sat.	9	14		♄ Stationary in R.A.		231O4
Sun.	10	2		☿ Greatest elongation W., 18° 01′		3O14*
		13		Moon in Perigee. Dist. from ⊕, 226,900 mi.		
Mon.	11			.....	20 14	31O24
Tue.	12	23		♀ Greatest brilliancy		2O14*
Wed.	13	8	23	♍ Full Moon		21O34
		13		☌☿♆ ☿ 0° 37′ N.		
Thu.	14			.....	17 03	O4123
Fri.	15			.....		41O23
Sat.	16	21	13	☌♁☾ ♁ 4° 32′ N.		d423O
Sun.	17	22	41	☌♂☾ ♂ 3° 48′ N.	13 52	43O1*
Mon.	18	0		☿ Greatest Hel. Lat. N.		431O2
		8	42	☌♄☾ ♄ 2° 16′ N.		
Tue.	19			.....		42O1*
Wed.	20	20	42	☾ Last Quarter	10 40	421O3
Thu.	21		..	.....		4O123
Fri.	22			Orionid Meteors		41O23
		8		Moon in Apogee. Dist. from ⊕, 251,300 mi.		
		14		♂ in ♌		
Sat.	23	2	01	☌♃☾ ♃ 0° 14′ S.	07 29	23O14
Sun.	24	21	50	☌♀☾ ♀ 4° 15′ S.		32O4*
Mon.	25			.....		31O24
Tue.	26	7	11	☌♆☾ ♆ 2° 41′ S.	04 18	d3O14
Wed.	27	20		♂ Stationary in R.A.		21O34
Thu	28	1	25	☌☿☾ ☿ 3° 35′ S.		O2134
		20	59	♍ New Moon		
Fri.	29			.....	01 07	1O234
Sat.	30			.....		d2O14
Sun.	31			.....	21 56	d32O*

Explanation of symbols and abbreviations on p. 4, of time on p. 8.

THE SKY FOR NOVEMBER, 1943

Positions of the sun and planets are given for 0h Greenwich Civil Time.

The times of transit (at the 75th Meridian) are given in local mean time, 0h at midnight; to change to Standard Time, see p. 10. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During November the sun's R.A. increases from 14h 21m to 16h 25m and its Decl. changes from 14° 05′ S. to 21° 38′ S. The equation of time increases from 16m 18s to its maximum for the year of 16m 22s on the 4th, then drops to 11m 20s, being positive all month. For changes in the length of the day, see p. 16.

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. 15h 28m, Decl. 19° 20′ S. and transits at 11.56. It is too close to the sun for favourable observation, passing superior conjunction on the 10th.

Venus on the 15th is in R.A. 12h 21m, Decl. 0° 58′ S. and transits at 8.48. It continues all month as the brightest object of the morning sky, being at first quarter phase as it reaches greatest western elongation on the 16th. Appearing as a miniature half-moon of stellar magnitude −4.1, it rises about 4 hours before the sun. It is over 40° above the southern horizon at sunrise.

Mars on the 15th is in R.A. 5h 16m, Decl. 24° 09′ N. and transits at 1.42. As it nears the earth it becomes rapidly brighter. At its closest approach on the 28th (50,120,000 miles) its magnitude is −1.6, just as bright as Sirius. It now rises at about sunset, and is visible throughout the night.

Jupiter on the 15th is in R.A. 9h 53m, Decl. 13° 39′ N. and transits at 6.19. In quadrature with the sun on the 19th, Jupiter rises about midnight. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 57.

Saturn on the 15th is in R.A. 5h 40m, Decl. 21° 57′ N. and transits at 2.06. It becomes somewhat brighter, reaching magnitude −0.1.

Uranus on the 15th is in R.A. 4h 23m, Decl. 21° 27′ N. and transits at 0.49. At opposition on the 29th its magnitude is 5.9, just visible without optical aid to an observer with keen eyes, against a clear sky.

Neptune on the 15th is in R.A. 12h 15m, Decl. 0° 09′ S. and transits at 8.40.

Pluto—For information in regard to this planet, see p. 31.

NOVEMBER

75th Meridian Civil Time

	d	h	m		Min. of Algol	Config of Jupiter's Sat. 4h 15m
					h m	
Mon.	1			.....		d34O2
Tue.	2			.....		43O21
Wed.	3	9		♀ in ♌	18 44	421O3
Thu.	4	22	22	☽ First Quarter		4O213
Fri.	5			.....		41O23
Sat.	6	5		Moon in Perigee. Dist. from ⊕, 229,800 mi...	15 33	42O31
Sun.	7			.....		4321O
Mon.	8			.....		d3O2*
Tue.	9			.....	12 22	3O124
Wed.	10	7		☌☿☉ Superior		21O34
		10		☿ in ♍		
Thu.	11	20	26	♋ Full Moon		O134*
Fri.	12			.....	09 11	1O234
Sat.	13	4	51	☌♁☾ ♁ 4° 27′ N.		2O314
		7		☌♀♆ ♀ 0° 22′ S.		
Sun.	14	4	50	☌♂☾ ♂ 4° 57′ N.		321O4
		15	36	☌♄☾ ♄ 2° 07′ N.		
Mon.	15			.....	06 00	3O124
Tue.	16			Leonid Meteors		
		11		♀ Greatest elongation W., 46° 40′		3O24*
Wed.	17			.....		214O3
Thu.	18			.....	02 49	4O13*
Fri.	19	3		□♃☉		41O23
		5		Moon in Apogee. Dist. from ⊕, 251,200 mi...		
		16	03	☌♃☾ ♃ 0° 41′ S.		
		17	43	☾ Last Quarter		
Sat.	20	17		☿ in Aphelion	23 38	42O13
Sun.	21			.....		
Mon.	22	17	15	☌♆☾ ♆ 2° 55′ S.		4231O
				.....		43O12
Tue.	23	13	18	☌♀☾ ♀ 2° 58′ S.	20 27	43O2*
Wed.	24			.....		d42O*
Thu.	25			.....		24O13
Fri.	26			.....	17 16	1O423
Sat.	27	10	23	● New Moon		dO134
Sun.	28	3	32	☌☿☾ ☿ 5° 54′ S.		213O4
		8		♂ nearest ⊕. Dist. from ⊕, 50,120,000 mi....		
Mon.	29	17		☍♁☉ Dist. from ⊕, 1,707,000,000 mi.....	14 05	3O214
Tue.	30			.....		31O24

Explanation of symbols and abbreviations on p. 4, of time on p. 8.

THE SKY FOR DECEMBER, 1943

Positions of the sun and planets are given for 0h Greenwich Civil Time.

The times of transit (at the 75th Meridian) are given in local mean time, 0h at midnight; to change to Standard Time, see p. 10. Estimates of altitude are for an observer in latitude 45° N.

The Sun—During December the sun's R.A. increases from 16h 25m to 18h 41m and its Decl. changes from 21° 38′ S. to 23° 27′ S. at the solstice on the 22nd, then to 23° 06′ S. The equation of time decreases steadily from 11m 20s to 0m on Christmas Day, and then to −3m 00s at the end of the year. For changes in the length of the day, see p. 16.

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 45m, Decl. 25° 18′ S. and transits at 13.16. It may be seen with difficulty in the evening twilight sky in the latter part of the month, as an object of stellar magnitude 0. At greatest eastern elongation on the 22nd it sets an hour and 20 minutes after the sun. It will be only about 10° above the south-western horizon at sunset. On the 30th it commences a retrograde motion.

Venus on the 15th is in R.A. 14h 24m, Decl. 11° 40′ S. and transits at 8.53. The morning star now exhibits a gibbous phase and is of magnitude −3.8. At the end of the month it is beginning to move perceptibly closer to the sun.

Mars on the 15th is in R.A. 4h 29m, Decl. 24° 14′ N. and transits at 22.52. At opposition on the 5th the planet reaches its brightest for the year, magnitude −1.7. It is now rising in the eastern sky at sunset.

Jupiter on the 15th is in R.A. 9h 58m, Decl. 13° 19′ N. and transits at 4.26. It begins to retrograde on the 14th. On the morning of the 17th the moon passes very close to Jupiter; in Europe this will be observed as an occultation. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 57.

Saturn on the 15th is in R.A. 5h 31m, Decl. 21° 52′ N. and transits at 23.54. At opposition on the 16th its magnitude is −0.3. The rings retain their appearance for telescopic observers almost constant all year; the angle of the line of sight with the plane of the rings is about 26°.

Uranus on the 15th is in R.A. 4h 17m, Decl. 21° 15′ N. and transits at 22.42.

Neptune on the 15th is in R.A. 12h 17m, Decl. 0° 22′ S. and transits at 6.44. It is in quadrature with the sun on the 26th.

Pluto—For information in regard to this planet, see p. 31.

DECEMBER

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 3h 45m
Wed.	1	5		Moon in Perigee. Dist. from ⊕, 228,600 mi...		2O14*
Thu.	2			.....	10 54	2O34*
Fri.	3			.....		1O423
Sat.	4	6	03	☽ First Quarter.....		4O213
Sun.	5	13		☌☍☉ Dist. from ⊕, 50,400,000 mi.....	07 43	4213O
Mon.	6			.....		43O21
Tue.	7	3		☿ in Perihelion.....		431O2
Wed.	8			.....	04 32	423O1
Thu.	9			.....		42O3*
Fri.	10	10	51	☌♁☾ ♁ 4° 30′ N.....		41O23
		18	43	☌☍☾ ☍ 6° 41′ N.....		
Sat.	11	1		☿ Greatest Hel. Lat. S.....	01 21	4O213
		11	24	♋ Full Moon.....		
		20	07	☌♄☾ ♄ 2° 11′ N.....		
Sun.	12			Geminid Meteors.....		d21O*
Mon.	13			.....	22 10	3O14*
Tue.	14	6		♃ Stationary in R.A.....		31O24
Wed.	15	19		☍♄☉ Dist. from ⊕, 748,000,000 mi.....		32O14
Thu.	16			.....	18 59	21O34
Fri.	17	1	44	☌♃☾ ♃ 0° 53′ S.....		dO234
		2		Moon in Apogee. Dist. from ⊕, 251,600 mi...		
Sat.	18			.....		O1234
Sun.	19	15	03	☾ Last Quarter.....	15 48	21O34
Mon.	20	2	41	☌♆☾ ♆ 3° 10′ S.....		3O41*
Tue.	21			.....		341O2
Wed.	22	12	30	☉ enters ♑, Winter commences. Long. of ☉, 270°	12 38	432O1
		21		☿ Greatest elongation E., 20° 02′.....		
Thu.	23	13	46	☌☿☾ ☿ 2° 43′ S.....		421O3
Fri.	24			.....		4O123
Sat.	25			.....	09 27	4O123
Sun.	26	16		□♆☉		421O3
		17		☌☍♁ ☍ 2° 46′ N.....		
		22	50	● New Moon.....		
Mon.	27			.....		432O1
Tue.	28	7	43	☌☿☾ ☿ 1° 37′ S.....	06 16	314O2
		21		Moon in Perigee. Dist. from ⊕, 225,100 mi...		
		21		☿ Greatest Hel. Lat. N.....		
Wed.	29			.....		32O41
Thu.	30	2		☿ in ♌.....		21O34
		7		☿ Stationary in R.A.....		
Fri.	31			.....	03 05	O1234

Explanation of symbols and abbreviations on p. 4, of time on p. 8.

PHENOMENA OF JUPITER'S SATELLITES, 1943

E—eclipse, O—occultation, T—transit, S—shadow, D—disappearance, R—reappearance, I—ingress, e—egress. 75th Meridian Civil Time. (For other times see p. 8.)

JANUARY

d	h	m	Sat.	Phen.
1	21	27	III	SI
	22	23	III	TI
2	00	52	III	Se
	01	49	III	Te
	03	42	IV	SI
	05	29	II	ED
	05	43	IV	TI
3	06	38	I	ED
	23	51	II	SI
4	00	13	II	TI
	02	42	II	Se
	03	04	II	Te
	03	57	I	SI
	04	07	I	TI
	06	13	I	Se
	06	23	I	Te
5	01	07	I	ED
	03	33	I	OR
	18	47	II	ED
	21	51	II	OR
	22	25	I	SI
	22	33	I	TI
6	00	41	I	Se
	00	49	I	Te
	19	36	I	ED
	21	59	I	OR
7	19	10	I	Se
	19	15	I	Te
9	01	26	III	SI
	01	38	III	TI
	04	52	III	Se
	05	04	III	Te
11	02	28	II	SI
	02	28	II	TI
	05	19	II	Te
	05	20	II	Se
	05	50	I	TI
	05	51	I	SI
12	03	00	I	OD
	05	19	I	ER
	18	46	III	ER
	21	15	II	OD
13	00	10	II	ER
	00	16	I	TI
	00	19	I	SI
	02	32	I	Te
	02	35	I	Se
	21	26	I	OD
	23	48	I	ER
14	18	27	II	Te
	18	39	II	Se
	18	42	I	TI
	18	48	I	SI
	20	58	I	Te
	21	04	I	Se
15	18	16	I	ER
16	04	53	III	TI
	05	25	III	SI
18	04	43	II	TI
	05	05	II	SI
	19	50	IV	TI
	21	41	IV	SI
	23	20	IV	Te
19	01	12	IV	Se
	04	44	I	OD
	18	24	III	OD
	22	46	III	ER
	23	28	II	OD

January—Cont.

d	h	m	Sat.	Phen.
20	02	00	I	TI
	02	13	I	SI
	02	44	II	ER
	04	16	I	Te
	04	29	I	Se
	23	10	I	OD
21	01	42	I	ER
	17	51	II	TI
	18	24	II	SI
	20	26	I	TI
	20	42	I	SI
	20	43	II	Te
	21	16	II	Se
	22	41	I	Te
	22	58	I	Se
22	20	11	I	ER
26	21	41	III	OD
27	01	42	II	OD
	02	10	IV	OD
	02	45	III	ER
	03	44	I	TI
	04	08	I	SI
	05	19	II	ER
	05	42	IV	OR
28	00	54	I	OD
	03	37	I	ER
	20	08	II	TI
	21	02	II	SI
	22	10	I	TI
	22	36	I	SI
	22	59	II	Te
	23	54	II	Se
29	00	26	I	Te
	00	52	I	Se
	19	21	I	OD
	22	06	I	ER
30	18	36	II	ER
	18	52	I	Te
	19	21	I	Se

FEBRUARY

d	h	m	Sat.	Phen.
3	01	00	III	OD
	03	57	II	OD
4	02	40	I	OD
	19	19	IV	Se
	22	25	II	TI
	23	40	II	SI
	23	55	I	TI
5	00	31	I	SI
	01	17	II	Te
	02	10	I	Te
	02	31	II	Se
	02	46	I	Se
	21	06	I	OD
6	00	01	I	ER
	18	13	III	Te
	18	21	I	TI
	18	59	I	SI
	20	37	I	Te
	20	51	III	Se
	21	11	II	ER
	21	15	I	Se
7	18	30	I	ER
10	04	23	III	OD
11	04	26	I	OD
12	00	45	II	TI

February—Cont.

d	h	m	Sat.	Phen.
12	01	41	I	TI
	02	17	II	SI
	02	25	I	SI
	03	36	II	Te
	03	56	I	Te
	20	17	IV	OR
	22	52	I	OD
13	00	02	IV	ED
	01	56	I	ER
	03	47	IV	ER
	19	23	II	OD
	20	07	I	TI
	20	54	I	SI
	21	22	III	SI
	21	37	III	Te
	22	23	I	Te
	23	09	I	Se
	23	46	II	ER
14	00	50	III	Se
	20	25	I	ER
15	18	27	II	Se
19	03	07	II	TI
	03	28	I	TI
20	00	40	I	OD
	03	52	I	ER
	21	41	III	TI
	21	43	II	OD
	21	54	I	TI
	22	48	I	SI
21	00	10	I	Te
	01	04	I	Se
	01	06	III	Te
	01	14	IV	TI
	01	22	III	SI
	02	20	II	ER
	19	07	I	OD
	22	21	I	ER
22	18	37	I	Te
	19	09	II	Te
	19	33	I	Se
	21	05	II	Se
24	18	48	III	ER
27	02	28	I	OD
	23	43	I	TI
28	00	04	II	OD
	00	43	I	SI
	01	15	III	TI
	01	58	I	Te
	02	59	I	Se
	20	56	I	OD

MARCH

d	h	m	Sat.	Phen.
1	00	16	I	ER
	18	43	II	TI
	19	12	I	SI
	20	25	I	Te
	20	52	II	SI
	21	27	I	Se
	21	34	II	Te
	21	58	IV	ER
	23	43	II	Se
2	18	45	I	ER
3	19	17	III	ED
	22	48	III	ER
7	01	32	I	TI
	02	28	II	OD

March—Cont.

d	h	m	Sat.	Phen.
7	02	38	I	SI
	22	46	I	OD
8	02	12	I	ER
	20	00	I	TI
	21	06	I	SI
	21	11	II	TI
	22	15	I	Te
	23	22	I	Se
	23	30	II	SI
9	00	02	II	Te
	02	21	II	Se
	20	39	IV	Te
	20	40	I	ER
10	20	48	II	ER
	22	04	III	OR
	23	17	III	ED
	23	48	III	ER
11	02	48	III	ER
15	00	37	I	OD
	21	51	I	TI
	23	01	I	SI
	23	41	II	TI
16	00	06	I	Te
	01	17	I	Se
	02	08	II	SI
	19	05	I	OD
	22	36	I	ER
17	19	45	I	Se
	22	22	III	OD
	23	24	II	ER
18	00	36	IV	OD
	01	49	III	OR
21	20	51	III	Se
22	23	43	I	TI
23	00	56	I	SI
	01	58	I	Te
	20	58	I	OD
24	00	32	I	ER
	19	25	I	SI
	20	26	I	Te
	20	39	II	OD
	21	40	I	Se
25	19	00	I	ER
26	20	56	II	Se
	21	43	IV	SI
27	01	40	IV	Se
28	19	39	III	Te
	21	20	III	SI
	21	58	III	Se
29	00	51	III	Se
30	01	36	I	TI
	22	52	I	OD
31	20	05	I	TI
	21	20	I	SI
	22	19	I	Te
	23	12	II	OD
	23	35	I	Se

APRIL

d	h	m	Sat.	Phen.
1	20	56	I	ER
2	20	43	II	SI
	20	57	II	Te
	23	34	II	Se
3	21	39	IV	OR
4	20	10	III	TI
	23	35	III	Te
7	00	47	I	OD
	21	59	I	TI

April—Cont.

d	h	m	Sat.	Phen.
7	23	15	I	SI
8	00	14	I	Te
	19	16	I	OD
	22	51	I	ER
9	19	59	I	Se
	20	44	II	TI
	23	20	II	SI
	23	34	II	Te
11	20	28	II	ER
12	00	10	III	TI
	19	48	IV	Se
14	23	55	I	TI
15	19	18	III	ED
	21	12	I	OD
	22	52	III	ER
16	19	39	I	SI
	20	39	I	Te
	21	54	I	Se
	23	23	II	TI
18	23	04	II	ER
21	00	16	IV	ED
22	21	43	III	OR
	23	09	I	OD
	23	18	III	ED
23	20	20	I	TI
	21	34	I	SI
	22	35	I	Te
	23	49	I	Se
24	21	11	I	ER
25	20	21	II	OD
27	20	45	II	Se
28	22	33	IV	TI
29	22	23	III	OD
30	22	17	I	TI
	23	29	I	SI

MAY

d	h	m	Sat.	Phen.
1	19	36	I	OD
	23	06	I	ER
2	20	13	I	Se
	23	01	II	OD
3	20	52	III	Se
4	20	31	II	SI
	20	59	II	Te
	23	22	II	Se
7	22	37	IV	ER
8	21	35	I	OD
9	19	52	I	SI
	21	01	I	Te
	22	08	I	Se
10	20	15	III	Te
	21	19	III	SI
11	20	53	II	TI
13	20	10	II	ER
15	21	40	IV	Te
16	20	44	I	TI
	21	47	I	SI
17	21	02	III	TI
	21	26	I	ER
24	20	04	I	OD
25	20	28	I	Se
27	20	35	II	OD
29	20	31	II	Se

JUNE

d	h	m	Sat.	Phen.
1	20	06	I	SI
	21	29	I	Te
	21	48	IV	SI
5	20	16	II	SI

June—Cont.

d	h	m	Sat.	Phen.
5	21	26	II	Te
8	21	13	I	TI
15	20	53	III	Se
16	20	35	I	OD
17	20	42	I	Se
18	20	12	IV	Se
24	20	19	I	SI
30	20	13	II	Se

Jupiter being near the Sun, phenomena of the Satellites are not given from June 31 to August 17.

AUGUST

d	h	m	Sat.	Phen.
30	04	13	II	TI
	04	44	III	OR
31	04	45	I	Se

SEPTEMBER

d	h	m	Sat.	Phen.
7	04	21	I	SI
	04	59	I	TI
8	04	32	I	OR
	04	33	II	OR
15	03	30	I	ED
16	03	47	I	Te
17	03	50	III	Te
22	05	23	I	ED
23	03	29	I	TI
	04	56	I	Se
24	03	00	I	OR
	03	02	II	Se
	04	33	III	TI
	04	43	II	Te
	04	43	III	Se
27	03	42	IV	SI
30	04	32	I	SI
	05	28	I	TI

OCTOBER

d	h	m	Sat.	Phen.
1	02	44	II	SI
	04	35	II	TI
	04	59	I	OR
	05	03	III	SI
5	02	33	III	OR
6	03	05	IV	OR
8	03	38	I	ED
	05	18	II	SI
9	03	12	I	Se
	04	14	I	Te
10	05	06	II	OR
12	02	30	III	ER
	03	09	III	OD
14	02	22	IV	Se
15	05	31	I	ED
16	02	48	I	SI
	03	54	I	TI
	05	06	I	Se
17	02	39	II	ED
	03	23	I	OR
19	02	11	II	Te
	02	49	III	ED
23	04	42	I	SI
	05	51	I	TI
24	01	53	I	ED

October—Cont.

d	h	m	Sat.	Phen.
24	05	15	II	ED
	05	20	I	OR
25	01	28	I	Se
	02	38	I	Te
26	02	00	II	TI
	02	32	II	Se
	04	51	II	Te
30	01	49	III	TI
	05	25	III	Te
31	02	51	IV	TI
	03	46	I	ED

NOVEMBER

d	h	m	Sat.	Phen.
1	01	04	I	SI
	02	17	I	TI
	03	22	I	Se
	04	34	I	Te
2	01	44	I	OR
	02	14	II	SI
	04	38	II	TI
	05	05	II	Se
4	02	34	II	OR
6	00	55	III	SI
	04	32	III	Se
	05	55	III	TI
7	05	39	I	ED
8	02	58	I	SI
	04	12	I	TI
	05	15	I	Se
	05	26	IV	ER
9	03	39	I	OR
	04	47	II	SI
10	00	58	I	Te
11	05	11	II	OR
13	04	53	III	SI
15	04	52	I	SI
	06	06	I	TI
16	02	00	I	ED
	05	33	I	OR
17	00	35	I	TI
	01	37	I	Se
	02	01	IV	Te
	02	52	I	Te
	03	25	III	OR
18	02	19	II	ED
20	01	57	II	Te
23	03	53	I	ED
24	01	14	I	SI
	02	17	III	ER
	02	28	I	TI
	03	31	I	Se
	03	43	III	OD
	04	45	I	Te
25	01	54	I	OR
	04	54	II	ED
27	01	38	II	TI
	02	02	II	Se
	04	29	II	Te
28	23	38	II	OR
30	05	46	I	ED

DECEMBER

d	h	m	Sat.	Phen.
1	02	35	III	ED
	03	07	I	SI
	04	20	I	TI
	05	24	I	Se
	06	14	III	ER
	06	37	I	Te
2	00	14	I	ED

December—Cont.

d	h	m	Sat.	Phen.
2	03	46	I	OR
	23	52	I	Se
3	01	05	I	Te
	03	31	IV	SI
4	01	44	II	SI
	04	08	II	TI
	04	36	II	Se
5	01	16	III	Te
6	02	08	II	OR
8	05	00	I	SI
	06	11	I	TI
	06	33	III	ED
9	02	08	I	ED
	05	36	I	OR
	23	29	I	SI
10	00	38	I	TI
	01	46	I	Se
	02	55	I	Te
11	00	04	I	OR
	04	18	II	SI
	06	36	II	TI
	23	43	IV	OD
12	00	22	III	Se
	01	26	III	TI
	04	33	IV	OR
	05	00	III	Te
	23	23	II	ED
13	04	36	II	OR
14	22	41	II	Te
16	04	01	I	ED
17	01	22	I	SI
	02	28	I	TI
	03	39	I	Se
	04	45	I	Te
	22	29	I	ED
18	01	53	I	OR
	22	08	I	Se
	23	12	I	Te
19	00	42	III	SI
	04	20	III	Se
	05	07	III	TI
20	01	58	II	ED
	02	13	IV	Se
21	22	14	II	TI
	23	01	II	Se
22	01	06	II	Te
	22	21	III	OR
23	05	54	I	ED
24	03	15	I	SI
	04	16	I	TI
	05	33	I	Se
	06	33	I	Te
25	00	22	I	ED
	03	41	I	OR
	21	44	I	SI
	22	43	I	TI
26	00	01	I	Se
	01	00	I	Te
	04	40	III	SI
	22	08	I	OR
	04	32	II	ED
28	06	32	IV	ED
	22	42	II	SI
29	00	37	II	TI
	01	35	II	Se
	03	29	II	Te
	22	07	III	ER
	22	18	III	OD
30	01	54	III	OR
	22	35	II	OR
31	05	09	I	SI
	06	04	I	TI

LUNAR OCCULTATIONS

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 tables given below, adapted from the 1943 Nautical Almanac, give the times of immersion or emersion or both for occultations of stars of magnitude 4.5 or brighter visible at Toronto and at Montreal and also at Vancouver and Calgary, at night.† Emersions at the bright limb of the moon are given only in the case of stars brighter than magnitude 3.5. The terms a and b are for determining corrections to the times of the phenomena for stations within 300 miles of the standard stations. Thus if λ_0, ϕ_0, 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—

Standard Time of phenomenon = Standard Time of phenomenon at the standard station $+a(\lambda-\lambda_0)+b(\phi-\phi_0)$

where $\lambda-\lambda_0$ and $\phi-\phi_0$ 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 MONTREAL, 1943

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. 16	α Tau	1.1	I	10.6	21 13.7	−2.1	+0.4	80	21 26.1	−2.0	+0.1	78
16	α Tau	1.1	E	10.	22 43.0	−1.8	−0.1	254	22 52.6	−1.6	−0.6	259
24	ρ Leo	3.8	I	17.8	No occ.	.....	.....	...	4 01.2	−0.4	−2.0	167
24	ρ Leo	3.8	E	17.8	No occ.	.....	.....	...	4 48.8	−2.1	−0.1	242
25	σ Leo	4.1	I	18.9	3 50.4	.....	.....	57	No occ.	.....	.....	...
25	σ Leo	4.1	E	18.9	4 31.8	.....	.....	357	No occ.	.....	.....	...
30	γ Lib	4.0	I	24.0	5 41.8	−1.0	−0.7	141	5 47.4	−1.2	−0.4	130
30	γ Lib	4.0	E	24.0	6 49.5	−2.1	+0.5	261	Sun	.....	.....	...
Feb. 10	μ Cet	4.4	I	6.2	23 09.6	−0.2	−1.1	79	Low	.....	.....	...
11	f Tau	4.3	I	7.1	No occ.	.....	.....	...	21 20.9	.....	.....	136
12	γ Tau	3.9	I	8.1	20 28.1	−2.1	−1.9	112	20 35.8	−1.8	−1.7	106
23	γ Vir m	2.9	I	18.3	No occ.	.....	.....	...	2 39.3	.....	.....	191
23	γ Vir m	2.9	E	18.3	No occ.	.....	.....	...	3 04.1	.....	.....	225
Apr. 8	α Tau	1.1	I	4.2	21 49.3	+0.1	−1.4	95	Low	.....	.....	...
16	ρ Leo	3.8	I	11.3	2 24.3	+0.1	−2.7	156	2 18.9	+0.1	−2.4	148
21-22	γ Lib	4.0	I	17.3	23 56.0	−1.6	+0.8	93	0 07.4	−1.9	+0.9	81
22	γ Lib	4.0	E	17.3	1 07.8	−1.4	−0.7	311	1 13.5	−1.2	−1.0	321
June 21	θ Cap	4.2	I	18.4	3 46.7	−1.9	−0.3	93	Sun	.....	.....	...
27	ξ^2 Cet	4.3	I	24.5	4 01.3	−0.6	+1.7	76	Sun	.....	.....	...
July 6	Venus†	−4.0	E	4.1	10 10.7	−0.4	+1.3	278	10 15.7	−0.6	+1.2	282
Aug. 2	α Leo†	1.3	I	1.8	18 02.9	−0.4	−2.0	118	18 01.6	−0.3	−1.8	110
2	α Leo†	1.3	E	1.8	19 06.4	−0.1	−1.6	284	19 03.5	0.0	−1.7	291
23	θ^1 Tau	4.0	I	22.2	1 47.9	−0.8	+0.8	115	1 54.2	−1.0	+0.7	118
23	θ^1 Tau	4.0	E	22.2	2 35.7	−0.1	+2.9	209	2 41.8	−0.1	+3.1	206
23	α Tau†	1.1	I	22.3	6 26.8	−2.7	−2.2	125	6 38.0	−2.4	−2.2	123
23	α Tau†	1.1	E	22.3	7 22.3	−1.4	+3.5	203	7 36.7	−1.5	+2.6	209
Sept. 5	γ Lib	4.0	I	6.2	20 40.1	−0.9	−1.3	89	Low	.....	.....	...
Oct. 6	π Sgr	3.0	I	7.6	20 19.0	−1.9	−1.7	125	20 26.3	−1.8	−1.9	127
6	π Sgr	3.0	E	7.6	21 12.9	−0.6	+0.2	220	21 16.3	−0.4	+0.2	217
8	θ Cap	4.2	I	9.5	18 05.1	−1.5	+2.6	23	18 17.9	−1.3	+2.4	20
9	ι Aqr	4.4	I	10.6	18 38.7	−1.3	+1.4	66	18 49.0	−1.5	+1.2	65
14	μ Cet	4.4	I	15.6	20 47.3	.....	.....	352	20 50.2	.....	.....	358
14	μ Cet	4.4	E	15.6	21 03.3	.....	.....	321	21 13.1	.....	.....	315

Date	Star	Mag.	I or E	Age of Moon	Vancouver				Calgary			
					P.S.T.	a	b	P	M.S.T.	a	b	P
				d	h m	m	m	°	h m	m	m	°
Jan. 16	α Tau	1.1	I	10.6	17 36.0	+0.1	+3.7	17	18 42.2	−0.4	+3.2	26
16	α Tau	1.1	E	10.6	18 17.2	−2.0	−0.5	309	19 34.5	−2.0	−0.4	301
24-25	σ Leo	4.1	I	18.9	23 34.4	−0.9	+1.8	82	0 47.3	−1.3	+2.1	73
25	σ Leo	4.1	E	18.9	0 38.9	−1.0	−0.6	319	1 46.3	−0.9	−1.4	332
Feb. 10	μ Cet	4.4	I	6.2	19 29.1	−1.3	+0.3	57	20 40.1	−1.1	−0.1	57
11	f Tau	4.3	I	7.1	Sun	....	....	...	17 58.6	−1.7	+0.5	88
12	θ¹ Tau	4.0	I	8.3	22 04.2	−1.1	−1.9	105	23 10.7	−0.8	−1.8	98
12	θ² Tau	3.6	I	8.3	22 16.5	−0.9	−3.6	132	23 19.1	−0.6	−2.8	123
Apr. 8	α Tau†	1.1	I	4.2	18 15.5	−1.2	−1.6	101	19 23.0	−0.9	−1.5	94
8	α Tau†	1.1	E	4.2	19 25.9	−0.9	−0.6	244	20 31.6	−0.6	−1.0	252
16	σ Leo	4.1	I	12.4	22 06.2	−2.4	+1.0	66	Graze	.....	.....	...
May 12	α Leo†	1.3	I	8.7	17 13.5	−1.9	+2.6	62	18 38.3	.....	.....	43
12	α Leo†	1.3	E	8.7	18 08.8	−1.4	−3.5	338	19 10.3	.....	.....	359
16	γ Vir m	2.9	I	11.9	0 00.6	−0.6	−2.5	159	1 02.8	−0.6	−2.3	149
16	γ Vir m	2.9	E	11.9	0 50.5	−1.1	−1.1	250	1 56.9	−0.7	−1.4	257
June 2	α Tau†	1.1	I	29.3	8 30.8	−1.1	+1.0	105	9 43.6	−1.5	+0.6	112
2	α Tau†	1.1	E	29.3	9 31.5	−0.7	+2.6	220	10 42.3	−0.8	+2.8	214
21	θ Cap	4.2	I	18.4	Low	.....	.....	...	1 00.0	−0.9	+1.2	72
21	θ Cap	4.2	E	18.4	0 56.1	−1.2	+1.2	264	2 09.1	−1.3	+0.8	265
22	ι Aqr	4.4	I	19.5	Low	.....	.....	...	1 33.6	−1.0	+1.1	104
22	ι Aqr	4.4	E	19.5	1 20.6	−1.0	+1.9	223	2 32.7	−1.1	+1.6	223
Aug. 2	α Leo†	1.3	I	1.8	14 15.4	−0.9	−2.8	155	15 20.7	−1.0	−2.2	141
2	α Leo†	1.3	E	1.8	15 15.9	−2.0	−0.2	250	16 30.0	−1.4	−1.1	265
23	θ² Tau	3.6	E	22.2	Low	.....	.....	...	0 47.3	+0.3	+1.9	231
23	θ¹ Tau	4.0	E	22.2	Low	.....	.....	...	0 50.1	+0.1	+1.7	252
23	α Tau	1.1	I	22.3	2 28.5	−0.4	+2.1	61	3 36.0	−0.7	+1.9	67
23	α Tau	1.1	E	22.3	3 36.4	−1.0	+1.5	264	4 48.7	−1.2	+1.4	258
Sep. 16-17	ξ² Cet	4.3	I	17.6	23 59.5	−0.9	+1.7	65	1 10.9	−1.1	+1.4	72
17	ξ² Cet	4.3	E	17.6	1 10.3	−1.2	+1.4	245	2 23.1	−1.2	+1.3	238
Oct. 5	μ Sgr	4.0	I	6.6	18 16.6	−1.6	−0.9	122	19 29.4	−1.5	−1.3	122
6	π Sgr	3.0	E	7.6	Sun	.....	.....	...	18 28.7	−1.5	+0.4	252
23	α Leo†	1.3	I	24.3	No occ.	.....	.....	...	12 26.3	+0.2	−3.3	169
23	α Leo†	1.3	E	24.3	No occ.	.....	.....	...	13 02.9	−1.0	−0.7	234
Nov. 2	ξ Sgr	3.6	I	5.0	No occ.	.....	.....	...	18 41.6	−1.0	−0.3	56

†Daylight Occultation

METEORS OR SHOOTING STARS

The study of meteors gives scientists important information both as to the matter in interplanetary space and the nature of the upper atmosphere of the earth itself. In this study amateur observers without telescopic equipment have made invaluable contributions. For a number of years important work has been carried on by Canadian observers under the direction of Dr. Peter M. Millman, David Dunlap Observatory, Richmond Hill, Ontario.

At the present time Dr. Millman is absent from the Observatory serving in the R.C.A.F. Hence any analysis of observations sent in by amateurs must await his return. However, reports of observations, either of fireballs or of systematic studies of meteor showers, may be sent to the Observatory and put on record here. For complete instructions by Dr. Millman concerning visual observations of meteors see the JOURNAL of the Royal Astronomical Society of Canada, vol. 31, p. 255, 1937; and for meteor photography, vol. 31, p. 295, 1937; or *General Instructions for Meteor Observing*, obtainable for 15 cents postpaid from the offices of this Society.

The dates of the principal annual meteor showers are included in the tables of Astronomical Phenomena, pp. 33-55.

PRINCIPAL ELEMENTS OF THE SOLAR SYSTEM

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

Planet	Mean Distance from Sun (a) ⊕ =1	Mean Distance from Sun (a) millions of miles	Period (P)	Eccentricity (e)	Inclination (i)	Long. of Node (☊)	Long. of Perihelion (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 Diameter miles	Mass ⊕ =1	Density water =1	Axial Rotation	Mean Surface Gravity ⊕ =1	Albedo Bond's	Magnitude at Opposition or Elongation
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^h15^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?	.8 ?					+ 14

SATELLITES OF THE SOLAR SYSTEM

Name	Stellar Mag.	Mean Dist. from Planet		Revolution Period			Diameter Miles	Discoverer
		" *	Miles	d	h	m		
SATELLITE OF THE EARTH								
Moon	−12.6	530	238,857	27	07	43	2160	
SATELLITES OF MARS								
Phobos	12	8	5,800	0	07	39	10?	Hall, 1877
Deimos	13	21	14,600	1	06	18	5?	Hall, 1877
SATELLITES OF JUPITER								
V	13	48	112,600	0	11	57	100?	Barnard, 1892
Io	5	112	261,800	1	18	28	2300	Galileo, 1610
Europa	6	178	416,600	3	13	14	2000	Galileo, 1610
Ganymede	5	284	664,200	7	03	43	3200	Galileo, 1610
Callisto	6	499	1,169,000	16	16	32	3200	Galileo, 1610
VI	14	3037	7,114,000	250	16		100?	Perrine, 1904
VII	16	3113	7,292,000	260	01		40?	Perrine, 1905
X	18	3116	7,300,000	260			15?	Nicholson, 1938
XI	18	5990	14,000,000	692			15?	Nicholson, 1938
VIII	16	6240	14,600,000	739			40?	Melotte, 1908
IX	17	6360	14,900,000	758			20?	Nicholson, 1914
SATELLITES OF SATURN								
Mimas	12	27	115,000	0	22	37	400?	W. Herschel, 1789
Enceladus	12	34	148,000	1	08	53	500?	W. Herschel, 1789
Tethys	11	43	183,000	1	21	18	800?	G. Cassini, 1684
Dione	11	55	234,000	2	17	41	700?	G. Cassini, 1684
Rhea	10	76	327,000	4	12	25	1100?	G. Cassini, 1672
Titan	8	177	759,000	15	22	41	2600?	Huygens, 1655
Hyperion	13	214	920,000	21	06	38	300?	G. Bond, 1848
Iapetus	11	515	2,210,000	79	07	56	1000?	G. Cassini, 1671
Phoebe	14	1870	8,034,000	550			200?	W. Pickering, 1898
SATELLITES OF URANUS								
Ariel	16	14	119,000	2	12	29	600?	Lassell, 1851
Umbriel	16	19	166,000	4	03	28	400?	Lassell, 1851
Titania	14	32	272,000	8	16	56	1000?	W. Herschel, 1787
Oberon	14	42	364,000	13	11	07	900?	W. Herschel, 1787
SATELLITE OF NEPTUNE								
Triton	13	16	220,000	5	21	03	3000?	Lassell, 1846

*As seen from the sun.

Satellites Io, Europa, Ganymede, Callisto are usually denoted I, II, III, IV, respectively, in order of distance from the planet.

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 members 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 STARS

Star	α 1900	δ	Mag. and Spect.	d	D	Remarks
	h m	° ′		″	L.Y.	
π And	00 31.5	+33 10	4.4B3; 8.5	36	410	†
η 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		†
σ 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.

THE BRIGHTEST STARS*

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

The accompanying table contains the principal facts regarding 259 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 48 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 20 stars variable in light this fourth column shows their maximum and minimum magnitudes. The 19 first magnitude 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 this may not necessarily be correct to the third decimal place.

The parallaxes are taken from the Yale Catalogue of Stellar Parallaxes 1935, the mean of the trigonometric and spectroscopic being adopted. The few negative trigonometric parallaxes were adjusted by Dyson's tables before being combined with the spectroscopic. The distance is given also in light years in the eighth column as to the lay mind that seems a fitting unit. 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 258 stars or star systems here listed 146 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, 74; 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 in 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 98 velocities are starred, indicating that 38 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.

*This feature of the HANDBOOK, first appearing in the 1925 edition, was prepared and frequently revised by the late Dr. W. E. Harper (1878-1940).

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 Andr.....	0 3	+28 32	2.2	A1	.217	.034	96	−0.1	−13.0*
β Cass.....	4	+58 36	2.4	F2	.561	.080	41	1.9	+11.4
γ Pegs.....	8	+14 38	2.9	B2	.015	.005	652	−3.6	+ 5.0*
β Hydi.....	20	−77 49	2.9	G0	2.243	.162	21	4.0	+22.8
α Phoe.....	21	−42 51	2.4	G5	.448	.040	81	0.4	+74.6*
δ Andr.....	34	+30 19	3.5	K3	.167	.026	125	0.6	− 7.1*
α Cass.....	35	+55 50	2.2-2.8	G8	.062	.018	181	−1.5	− 3.8
β Ceti.....	39	−18 32	2.2	G7	.233	.052	63	0.8	+13.1
||γ Cass.....	51	+60 11	2.2	B0e	.031	.035	93	−0.1	− 6.8
||β Phoe.....	1 2	−47 15	3.4	G4	.043	.020	163	−0.1	− 1.2
β Andr.....	4	+35 5	2.4	M0	.219	.041	79	0.5	+ 0.1
δ Cass.....	19	+59 43	2.8-2.9	A3	.308	.050	65	1.3	+ 6.8
||α U. Min.....	23	+88 46	2.3-2.4	F7	.043	.008	407	−3.4	−17.4*
γ Phoe.....	24	−43 50	3.4	M1	.223	.008	407	−2.1	+25.7*
α **Erid**.....	34	−57 44	0.6	B9	.093	.046	71	−1.1	+19.
ε Cass.....	47	+63 11	3.4	B5	.043	.011	296	−1.4	− 8.1
β Arie.....	49	+20 19	2.7	A3	.150	.066	49	1.8	− 0.6*
α Hydi.....	56	−62 3	3.0	A7	.255	.080	41	2.5	+ 7.0*
||γ Andr.....	58	+41 51	2.3	K0	.073	.020	163	−1.2	−11.7
α Arie.....	2 2	+22 59	2.2	K2	.242	.045	72	0.5	−14.3
β Tria.....	4	+34 31	3.1	A6	.161	.029	112	0.4	+10.4*
||ο Ceti.....	14	− 3 26	1.7-9.6	M6e	.239	.013	251	−2.7	+57.8*
||θ Erid.....	54	−40 42	3.4	A2	.068	.032	102	0.9	+11.9*
α Ceti.....	57	+ 3 42	2.8	M1	.080	.018	181	−0.9	−25.7
γ Pers.....	58	+53 7	3.1	F9	.012	.017	192	−0.7	+ 1.0*
ρ Pers.....	59	+38 27	3.3-4.1	M6	.176	.024	136	0.3	+28.2
β Pers.....	3 2	+40 34	2.1-3.2	B8	.011	.033	99	−0.3	+ 5.7*
α Pers.....	17	+49 30	1.9	F4	.041	.017	192	−2.0	− 2.4
δ Pers.....	36	+47 28	3.1	B5	.047	.012	272	−1.5	−10. *
||η Taur.....	41	+23 48	3.0	B5p	.053	.014	233	−1.3	+10.3
ζ Pers.....	48	+31 35	2.9	B1	.023	.008	407	−2.6	+20.9
γ Hydi.....	49	−74 33	3.2	M3	.124	.008	407	−2.3	+16.0
||ε Pers.....	51	+39 43	3.0	B2	.041	.006	543	−3.1	− 6 *
γ Erid.....	53	−13 47	3.2	M0	.133	.012	272	−1.6	+61.7
λ Taur.....	55	+12 12	3.8-4.2	B3	.015	.008	407	−2.2	+13.0*
α Reti.....	4 13	−62 43	3.4	G5	.070	.016	204	−0.6	+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 **Taur**.....	4 30	+16 18	1.1	K8	.205	.060	54	0.0	+54.1
α Dora.....	32	−55 15	3.5	A0p	.....	.. .	.....	.....	+25.6
π^3 Orio.....	44	+ 6 47	3.3	F5	.474	.124	26	3.8	+24.6
ι Auri.....	50	+33 0	2.9	K4	.030	.020	163	−0.6	+17.6
ε Auri.....	55	+43 41	3.1-3.8	F2	.015	.006	543	−2.7	−4.1 *
η Auri.....	5 0	+41 6	3.3	B3	.082	013	251	−1.1	+ 7.8
ε Leps.....	1	−22 30	3.3	K5	.074	.016	204	−0.7	+ 1.0
β Erid.....	3	− 5 13	2.9	A1	.117	.055	59	1.6	− 7
μ Leps.....	8	−16 19	3.3	A0p	.053	.020	163	−0.2	+27.7
‖α **Auri**.....	9	+45 54	0.2	G1	.439	.078	42	−0.3	+30.2
‖β **Orio**.....	10	− 8 19	0.3	B8p	.005	.006	543	−5.8	+23.6*
‖η Orio.....	19	− 2 29	3.4	B0	.009	.006	543	−2.7	+19.5*
γ Orio.....	20	+ 6 16	1.7	B2	.019	.015	217	−2.4	+18.0
β Taur.....	20	+28 31	1.8	B8	.180	.028	116	−1.0	+ 8.0
β Leps.....	24	−20 50	3.0	G2	.095	.018	181	−0.7	−13.5
‖δ Orio.....	27	− 0 22	2.4-2.5	B0	.006	.007	466	−3.4	+19.9*
α Leps.....	28	−17 54	2.7	F6	.006	.012	272	−2.1	+24.7
ι Orio.....	31	− 5 59	2.9	O8	.007	.021	155	−0.5	+21.5*
ε Orio.....	31	− 1 16	1.8	B0	.004	.008	407	−3.7	+25.8
ζ Taur.....	32	+21 5	3.0	B3e	.028	.010	326	−2.0	+16.4*
‖ζ Orio.....	36	− 2 0	1.8	B0	.012	.011	296	−3.0	+18.8
α Colm.....	36	−34 8	2.8	B8	.036	.022	148	−0.6	+34.6
κ Orio.....	43	− 9 42	2.2	B0	.009	.006	543	−3.9	+20.1
β Colm.....	47	−35 48	3.2	K0	.397	.026	125	0.3	+89.4
α **Orio**.....	50	+ 7 23	0.5-1.1	M2	.032	.012	272	−4.1	+21.0*
β Auri.....	52	+44 56	2.1-2.2	A0p	.046	.052	63	0.7	−18.1*
‖θ Auri.....	53	+37 12	2.7	A1	.106	.029	112	0.0	+28.6
η Gemi.....	6 9	+22 32	3.2-4.2	M2	.062	.014	233	−1.1	+21.4*
ζ C Maj.....	16	−30 01	3.7	B3	.012	.013	251	−0.7	+33.1*
μ Gemi.....	17	+22 34	3.2	M3	.129	.016	204	−0.8	+54.8
β C Maj.....	18	−17 54	2.0	B1	.003	.014	233	−2.3	+34.4*
α **Cari**.....	22	−52 38	−0.9	F0	.022	.005	652	−7.4	+20.5
γ Gemi.....	32	+16 29	1.9	A2	.066	.050	65	0.4	−11.3*
ν Pupp.....	35	−43 6	3.2	B8	.021	.023	148	0.0	+28.2*
ε Gemi.....	38	+25 14	3.2	G9	.020	.009	362	−2.0	+ 9.9
ξ Gemi.....	40	+13 0	3.4	F5	.230	.054	60	2.1	+25.1
‖α **C Maj**.....	41	−16 35	−1.6	A2	1.315	.386	8	1.3	− 7.5*
α Pict.....	47	−61 50	3.3	A5	.271	.....	.....	.....	+20.6

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
τ Pupp.....	6 47	−50 30	2.8	G8	.091	.025	130	−0.2	+36.4*
‖ε C Maj.....	55	−28 50	1.6	B1	.005	.010	326	−3.4	+27.4
ζ Gemi.....	58	+20 43	3.7-4.3	G0p	.007	.005	652	−2.8	+ 6.7*
o^2 C Maj.....	59	−23 41	3.1	B5p	.006	.007	466	−2.7	+48.6
δ C Maj.....	7 4	−26 14	2.0	G4p	.003	.006	543	−4.1	+34.3*
L^2 Pupp.....	10	−44 29	3.4-6.2	M5e	.332	.018	181	−0.3	+53.0
π Pupp.....	14	−36 55	2.7	K5	.004	.018	181	−1.0	+15.8
η C Maj.....	20	−29 6	2.4	B5p	.007	.012	272	−2.2	+40.4
β C Min.....	22	+ 8 29	3.1	B8	.063	.022	148	−0.2	+23 *
σ Pupp.....	26	−43 6	3.3	M0	.191	.016	204	−0.7	+88.1*
α_2 Gemi.....	28	+32 6	2.0	A2	.201	.074	44	1.4	+ 6.0*
α_1 Gemi.....	28	+32 6	2.8	A0	.209	.074	44	2.2	− 1.2*
‖α **C Min**.....	34	+ 5 29	0.5	F5	1.242	.316	10	3.0	− 3.0*
β **Gemi**.....	39	+28 16	1.2	G9	.623	.105	31	1.3	+ 3.3
ξ Pupp.....	45	−24 37	3.5	K1	.004	.006	543	−2.6	+ 3.7*
ζ Pupp.....	8 0	−39 43	2.3	O8	.032	.004	815	−4.7	−24.
ρ Pupp.....	3	−24 1	2.9	F6	.097	.025	130	−0.1	+46.6
‖γ Velr.....	6	−47 3	2.2	OW9	.002	.....	.....	.....	+ 3.5
‖ε Cari.....	20	−59 11	1.7	K0	.030	.010	326	−3.3	+11.5
o U Maj.....	22	+61 3	3.5	G2	.166	.014	233	−0.8	+19.8
‖ε Hyda.....	41	+ 6 47	3.5	F9	.193	.012	272	−1.1	+36.8*
‖δ Velr.....	42	−54 21	2.0	A0	.093	.030	109	−0.6	+ 2.2
ζ Hyda.....	50	+ 6 20	3.3	G7	.101	.026	125	0.3	+22.6
‖ι U Maj.....	52	+48 26	3.1	A4	.500	.060	54	2.0	+12.6
λ Velr.....	9 4	−43 2	2.2	K4	.024	.016	204	−1.8	+18.4
β Cari.....	12	−69 18	1.8	A0	.192	.....	.....	.....	− 5.
ι Cari.....	14	−58 51	2.2	F0	.023	.....	.....	.....	+13.3
α Lync.....	15	+34 49	3.3	K8	.214	.022	148	0.0	+37.4
κ Velr.....	19	−54 35	2.6	B3	.017	.017	192	−1.2	+21.7*
α Hyda.....	23	− 8 14	2.2	K4	.036	.018	181	−1.5	− 4.4
θ U Maj.....	26	+52 8	3.3	F7	1.096	.072	45	2.6	+15.8
N Velr.....	28	−56 36	3.4-4.2	K5	.038	.022	148	0.1	−13.9
ε Leon.....	40	+24 14	3.1	G0	.045	.009	362	−2.1	+ 5.1
‖υ Cari.....	45	−64 36	3.1	F0	.019	.....	.....	.....	+13.6
α **Leon**.....	10 3	+12 27	1.3	B6	.244	.046	71	−0.4	+ 2.6
q Cari.....	14	−60 50	3.4	K5	.043	.014	233	−0.9	+ 8.6

Star	R.A. 1900	Decl. 1900	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′				″	″		km./sec.
||γ Leo	10 14	+20 21	2.3	G8	.347	.024	136	−0.8	−36.8
μ U Maj	16	+42 0	3.2	K4	.082	.031	105	0.7	−20.3*
θ Cari	39	−63 52	3.0	B0	.022	.007	466	−2.8	+24. *
η Cari	41	−59 10	1.0–7.4	Pec	.007	.....	.....	.....	−25.0
||μ Velr	42	−48 54	2.8	G5	.079	.033	99	0.4	+ 6.9
ν Hyda	45	−15 40	3.3	K3	.218	.020	163	−0.2	− 1.0
β U Maj	56	+56 55	2.4	A3	.089	.045	72	0.7	−12.1*
α U Maj	58	+62 17	2.0	G5	.137	.036	91	−0.2	− 8.6*
ψ U Maj	11 4	+45 2	3.2	K0	.067	.035	93	0.9	− 3.6
δ Leon	9	+21 4	2.6	A2	.208	.058	56	1.4	−23.2
θ Leon	9	+15 59	3.4	A2	.103	.025	130	0.4	+ 7.8
λ Cent	31	−62 28	3.3	B9	.045	.031	105	0.8	+ 7.9
β Leon	44	+15 8	2.2	A2	.507	.084	39	1.8	− 2.3
γ U Maj	49	+54 15	2.5	A0	.095	.035	93	0.2	−11.1
δ Cent	12 3	−50 10	2.9	B3e	.040	.015	217	−1.2	+ 9.
ϵ Corv	5	−22 4	3.2	K2	.063	.024	136	0.1	+ 4.9
δ Cruc	10	−58 12	3.1	B3	.045	.017	192	−0.7	+26.4
δ U Maj	10	+57 35	3.4	A0	.113	.050	65	1.9	−12.
γ Corv	11	−16 59	2.8	B8	.159	.024	136	−0.3	− 4.2*
α^1 Cruc	21	−62 33	1.6	B1	.048	.022	148	−1.7	−12.2*
α^2 Cruc	21	−62 32	2.1	B3	.048	.022	148	−1.2	+ 0.3*
||δ Corv	25	−15 58	3.1	A0	.249	.026	125	0.2	+ 8.7
γ Cruc	26	−56 33	1.5	M4	.270	.....	.....	.....	+21.3
β Corv	29	−22 51	2.8	G5	.059	.027	121	0.0	− 7.7
α Musc	31	−68 35	2.9	B5	.040	.015	217	−1.2	+18.
||γ Cent	36	−48 24	2.4	A0	.200	.032	102	−0.1	− 7.5
||γ Virg	36	− 0 54	2.9	F0	.561	.080	41	2.4	−19.6
||β Musc	40	−67 34	3.3	B3	.039	.011	296	−1.5	+42. *
β Cruc	42	−59 9	1.5	B1	.054	.007	466	−4.3	−20. *
ϵ U Maj	50	+56 30	1.7	A2	.117	.067	49	0.8	−11.9*
||α^2 C. Ven	51	+38 51	2.8	A1	.233	.030	109	0.2	− 3.5
ϵ Virg	57	+11 30	3.0	G6	.270	.037	88	0.8	−14.0
γ Hyda	13 13	−22 39	3.3	G7	.085	.028	116	0.5	− 5.4
ι Cent	15	−36 11	2.9	A2	.351	.049	67	1.4	+ 0.1
||ζ^1 U. Maj	20	+55 27	2.4	A2p	.131	.042	78	0.5	− 9.9*
α **Virg**	20	−10 38	1.2	B2	.051	.018	181	−2.5	+ 1.6*
ζ Virg	30	− 0 5	3.4	A2	.285	.038	86	1.3	−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 Cent.....	13 34	−52 57	2.6	B2	.039	.012	272	−2.0	− 5.6
η U. Maj.....	44	+49 49	1.9	B3	.116	.015	217	−2.2	−10.9
μ Cent	44	−41 59	3.3	B3e	.026	.009	362	−1.9	+12.6
ζ Cent.....	49	−46 48	3.1	B3	.080	.013	251	−1.3	*
η Boot.....	50	+18 54	2.8	G1	.370	.100	33	2.8	− 0.2*
β **Cent**.....	57	−59 53	0.9	B3	.039	.026	125	−2.0	−12. *
π Hyda.....	14 1	−26 12	3.5	K3	.164	.037	88	1.3	+27.2
θ Cent.....	1	−35 53	2.3	G8	.745	.056	58	1.0	+ 1.3
α **Boot**.....	11	+19 42	0.2	K0	2.287	.102	32	0.2	− 5.1
γ Boot.....	28	+38 45	3.0	A3	.182	.063	52	2.0	−35.5
η Cent.....	29	−41 43	2.6	B3	.046	.012	272	−2.0	− 0.2*
||α **Cent**.....	33	−60 25	0.1	G0	3.682	.768	4	4.5	−22.2*
α Circ.....	34	−64 32	3.4	F0	.308	.063	52	2.4	+ 7.4
α Lupi.....	35	−46 58	2.9	B2	.033	.009	362	−2.3	+ 7.3*
||ϵ Boot.....	41	+27 30	2.7	G8	.045	.019	172	−0.9	−16.4
||α^2 Libr.....	45	−15 38	2.9	F1	.128	.056	58	1.6	−10. *
β U. Min.....	51	+74 34	2.2	K4	.028	.030	109	−0.4	+16.9
β Lupi.....	52	−42 44	2.8	B3	.067	.012	272	−1.8	− 0.3*
κ Cent.....	53	−41 42	3.4	B2	.034	.011	296	−1.4	+ 9.1*
σ Libr.....	58	−24 53	3.4	M4	.091	.020	163	−0.1	− 4.3
ζ Lupi.....	15 5	−51 43	3.5	G5	.125	.027	121	0.7	− 9.7
γ Tr. Au.....	10	−68 19	3.1	A0	.064	.....	.....	.....	0.
β Libr.....	12	− 9 1	2.7	B8	.100	.015	217	−1.4	−37. *
δ Lupi.....	15	−40 17	3.4	B3	.031	.012	272	−1.2	+ 1.6
γ U. Min.....	21	+72 11	3.1	A2	.016	.022	148	−0.2	− 3.9*
ι Drac.....	23	+59 19	3.5	K3	.010	.030	109	0.9	−11.1
||γ Lupi.....	28	−40 50	3.0	B3	.038	.013	251	−1.4	+ 6.
α Cor. B.....	30	+27 3	2.3	A0	.160	.054	60	1.0	+ 1.0*
α Serp.....	39	+ 6 44	2.8	K3	.142	.043	76	1.0	+ 3.0
β Tr. Au.....	46	−63 7	3.0	F0	.436	.096	34	2.9	− 0.3
π Scor.....	53	−25 50	3.0	B3	.037	.012	272	−1.6	− 3.0*
δ Scor.....	54	−22 20	2.5	B1	.039	.011	296	−2.3	−16. *
||β Scor.....	16 0	−19 32	2.8	B3	.029	.016	204	−1.2	− 9.3*
δ Ophi.....	9	− 3 26	3.3	K8	.159	.030	109	0.7	−19.8
ϵ Ophi.....	13	− 4 27	3.3	G9	.088	.031	105	0.8	−10.3
||σ Scor.....	15	−25 21	3.1	B1	.033	.009	362	−2.1	− 0.4*
||η Drac.....	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 **Scor**.....	16 23	−26 12	1.2	M1	.032	.019	172	−2.4	− 3.2*
β Herc.....	26	+21 42	2.8	G4	.104	.020	163	−0.7	−25.8*
τ Scor.....	30	−28 1	2.9	B1	.037	.009	362	−2.3	+ 0.6
ζ Ophi.....	32	−10 22	2.7	B0	.023	.008	407	−2.8	−19. *
||ζ Herc.....	38	+31 47	3.0	G0	.601	.105	31	3.1	−70.8*
α Tr. Au.....	38	−68 51	1.9	K5	.031	.025	130	−1.1	− 3.7
ϵ Scor.....	44	−34 7	2.4	G9	.665	.038	86	0.3	− 2.5
μ^1 Scor.....	45	−37 53	3.1	B3p	.030	.011	296	−1.7	*
ζ Arae.....	50	−55 50	3.1	K5	.046	.028	116	0.3	− 6.0
κ Ophi.....	53	+ 9 32	3.1–4.0	K3	.290	.042	78	1.2	−55.6
||η Ophi.....	17 5	−15 36	2.6	A2	.095	.047	69	1.0	− 1.0
η Scor.....	5	−43 6	3.4	A7	.294	.066	49	2.5	−28.4
ζ Drac.....	8	+65 50	3.2	B8	.023	.028	116	0.4	−14.1
||α^1 Herc.....	10	+14 30	3.1–3.9	M7	.030	.008	407	−2.4	−32.5
δ Herc.....	11	+24 57	3.2	A2	.164	.036	91	1.0	−39. *
π Herc.....	12	+36 55	3.4	K3	.021	.018	181	−0.3	−25.7
θ Ophi.....	16	−24 54	3.4	B2	.031	.008	407	−2.1	− 3.6
β Arae.....	17	−55 26	2.8	K1	.036	.023	142	−0.4	− 0.4
υ Scor.....	24	−37 13	2.8	B3	.042	.010	326	−2.2	+18. *
α Arae.....	24	−49 48	3.0	B3e	.090	.015	217	−1.1	− 2.2
λ Scor.....	27	−37 2	1.7	B2	.036	.016	204	−2.3	0. *
β Drac.....	28	+52 23	3.0	G0	.012	.007	466	−2.8	−20.1
θ Scor.....	30	−42 56	2.0	F0	.012	.024	136	−1.1	+ 1.4
α Ophi.....	30	+12 38	2.1	A0	.264	.060	54	1.0	+15. *
κ Scor.....	36	−38 58	2.5	B3	.028	.009	362	−2.7	−10. *
β Ophi.....	38	+ 4 37	2.9	K2	.157	.030	109	0.3	−11.9
ι^1 Scor.....	41	−40 5	3.1	F8	.004	.008	407	−2.4	−27.6*
||μ Herc.....	43	+27 47	3.5	G5	.817	.114	28	3.8	−16.1
G Scor.....	43	−37 1	3.2	K2	.069	.029	112	0.5	+24.7
ν Ophi.....	54	− 9 46	3.5	G7	.118	.022	148	0.2	+12.4
γ Drac.....	54	+51 30	2.4	K5	.026	.026	125	−0.5	−27.8
γ Sgtr.....	59	−30 26	3.1	K0	.202	.030	109	0.5	+22.3*
η Sgtr.....	18 11	−36 48	3.2	M4	.216	.030	109	0.6	+ 0.5
δ Sgtr.....	15	−29 52	2.8	K4	.052	.033	99	0.4	−20.0
η Serp.....	16	− 2 55	3.4	G9	.898	.050	65	1.9	+ 8.9
ϵ Sgtr.....	18	−34 26	2.0	A0	.139	.020	163	−1.5	−10.8
λ Sgtr.....	22	−25 29	2.9	K1	.196	.036	91	0.7	−43.3
α **Lyra**.....	34	+38 41	0.1	A1	.348	.140	23	0.8	−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 Sgtr	18 39	−27 6	3.3	B8	.150	.015	217	−0.8	+21.5*
‖β Lyra	46	+33 15	3.4–4.1	B2p	.011	.006	543	−2.7	−19.0*
σ Sgtr	49	−26 25	2.1	B3	.067	.021	155	−1.3	−10.7
γ Lyra	55	+32 33	3.3	B9p	.008	.016	204	−0.7	−21.5*
‖ζ Sgtr	56	−30 1	2.7	A2	.019	.035	93	0.4	+22.1
τ Sgtr	19 1	−27 49	3.4	K0	.268	.036	91	1.2	+45.4*
ζ Aqil	1	+13 43	3.0	A0	.103	.038	86	0.9	−25. *
π Sgtr	4	−21 11	3.0	F2	.041	.017	192	−0.8	− 9.8
δ Drac	13	+67 29	3.2	G8	.135	.028	116	0.4	+24.8
δ Aqil	21	+ 2 55	3.4	A3	.267	.052	63	2.0	−32.3*
‖β^1 Cygn	27	+27 45	3.2	K0	.010	.010	326	−1.8	−23.9*
γ Agil	42	+10 22	2.8	K3	.018	.018	181	−0.9	− 2.0
‖δ Cygn	42	+44 53	3.0	A1	.067	.023	116	0.2	−20.
α **Aqil**	46	+ 8 36	0.9	A2	.659	.184	18	2.2	−26.1
θ Aqil	20 6	− 1 7	3.4	A0	.035	.018	181	−0.3	−28.6*
‖β Capr	15	−15 6	3.2	F8	.042	.022	148	−0.1	−19.0*
α Pavo	18	−57 3	2.1	B3	.087	.014	233	−2.2	+ 1.8*
γ Cygn	19	+39 56	2.3	F8	.006	.008	407	−3.2	− 7.6
α Indi	31	−47 38	3.2	G2	.072	.034	96	0.9	− 1.1
α **Cygn**	38	+44 55	1.3	A2p	.004	.002	1630	−7.2	− 6.3*
ϵ Cygn	42	+33 36	2.6	G7	.485	.040	81	0.6	−10.5*
ζ Cygn	21 9	+29 49	3.4	G6	.061	.018	181	−0.3	+16.9*
α Ceph	16	+62 10	2.6	A2	.163	.076	43	2.0	− 8.
β Aqar	26	− 6 1	3.1	G1	.020	.008	407	−2.4	+ 6.7
β Ceph	27	+70 7	3.3–3.4	B1	.013	.006	543	−2.8	− 7.2
ϵ Pegs	39	+ 9 25	2.5	K2	.028	.014	233	−1.8	+ 5.2
δ Capr	42	−16 35	3.0	A3	.395	.062	53	2.0	− 6.4*
γ Grus	48	−37 50	3.2	B8	.114	.020	163	−0.3	− 2.1
α Aqar	22 1	− 0 48	3.2	G0	.019	.006	543	−2.9	+ 7.6
α Grus	2	−47 27	2.2	B5	.202	.036	91	0.0	+11.8
α Tucn	12	−60 45	2.9	K5	.088	.019	172	−0.7	+42.2*
β Grus	37	−47 24	2.2	M6	.131	.010	326	−2.8	+ 1.6
η Pegs	38	+29 42	3.1	G1	.039	.016	204	−0.9	+ 4.4*
α **Psc. A**	52	−30 9	1.3	A3	.367	.118	28	1.7	+ 6.5
β Pegs	59	+27 32	2.6	M3	.235	.020	163	−0.9	+ 8.6
α Pegs	59	+14 40	2.6	A0	.077	.033	99	0.2	− 4. *
γ Ceph	23 35	+77 4	3.4	K1	.167	.062	53	2.4	−42.0

STAR CLUSTERS

The star clusters for this observing list have been selected to include the more conspicuous members of the two main classes—open clusters and globular clusters. Most of the data are from Shapley's *Star Clusters* and from Trumpler's catalogue in Lick Bulletin No. 420. In the following table *N.G.C.* indicates the serial number of the cluster in the New General Catalogue of Clusters and Nebulae; *M*, its number in Messier's catalogue; *Con.*, the constellation in which it is located; α and δ, its right ascension and declination; *Cl.*, the kind of cluster, *Op* for open or galactic and *Gl* for globular; *Diam.*, the apparent diameter in minutes of arc; *Mag. B.S.*, the magnitude of the fifth brightest star in the case of open clusters, the mean of the 25 brightest for globulars; *No.*, the number of stars in the open clusters down to the limiting magnitudes of the photographs on which the particular clusters were studied; *Int. mag.*, the total apparent magnitude of the globular clusters; and *Dist.*, the distance in light years.

N.G.C.	M	Con.	α 1900 h m	δ ° ′	Cl.	Diam. ′	Mag. B.S.	No.	Int. mag.	Dist. l.y.
869		hPer	02 12.0	+56 41	Op	30	7			4,300
884		χPer	02 15.4	+56 39	Op	30	7			4,300
1039	34	Per	02 35.6	+42 21	Op	30	9	80		1,500
Pleiades	45	Tau	03 41.5	+23 48	Op	120	4.2	250		490
Hyades		Tau	04 14	+15 23	Op	400	4.0	100		120
1912	38	Aur	05 22.0	+35 45	Op	18	9.7	100		2,800
2099	37	Aur	05 45.8	+32 31	Op	24	9.7	150		2,700
2168	35	Gem	06 02.7	+24 21	Op	29	9.0	120		2,700
2287	41	C Ma	06 42.7	−20 38	Op	32	9	50		1,300
2632	44	Cnc	08 34.3	+20 20	Op	90	6.5	350		490
5139		ωCen	13 20.8	−46 47	Gl	23	12.9		3	22,000
5272	3	C Vn	13 37.6	+28 53	Gl	10	14.2		4.5	40,000
5904	5	Ser	15 13.5	+02 27	Gl	13	14.0		3.6	35,000
6121	4	Scr	16 17.5	−26 17	Gl	14	13.9		5.2	24,000
6205	13	Her	16 38.1	+36 39	Gl	10	13.8		4.0	34,000
6218	12	Oph	16 42.0	−01 46	Gl	9	14.0		6.0	36,000
6254	10	Oph	16 51.9	−03 57	Gl	8	14.1		5.4	36,000
6341	92	Her	17 14.1	+43 15	Gl	8	13.9		5.1	36,000
6494	23	Sgr	17 51.0	−19 00	Op	27	10.2	120		2,200
6611	16	Ser	18 13.2	−13 49	Op	8	10.6	55		6,700
6656	22	Sgr	18 30.3	−23 59	Gl	17	12.9		3.6	22,000
7078	15	Peg	21 25.2	+11 44	Gl.	7	14.3		5.2	43,000
7089	2	Aqr	21 28.3	−01 16	Gl	8	14.6		5.0	45,000
7092	39	Cyg	21 28.6	+48 00	Op	32	6.5	25		11,000
7654	52	Cas	23 19.8	+61 03	Op	13	11.0	120		4,400

GALACTIC NEBULAE

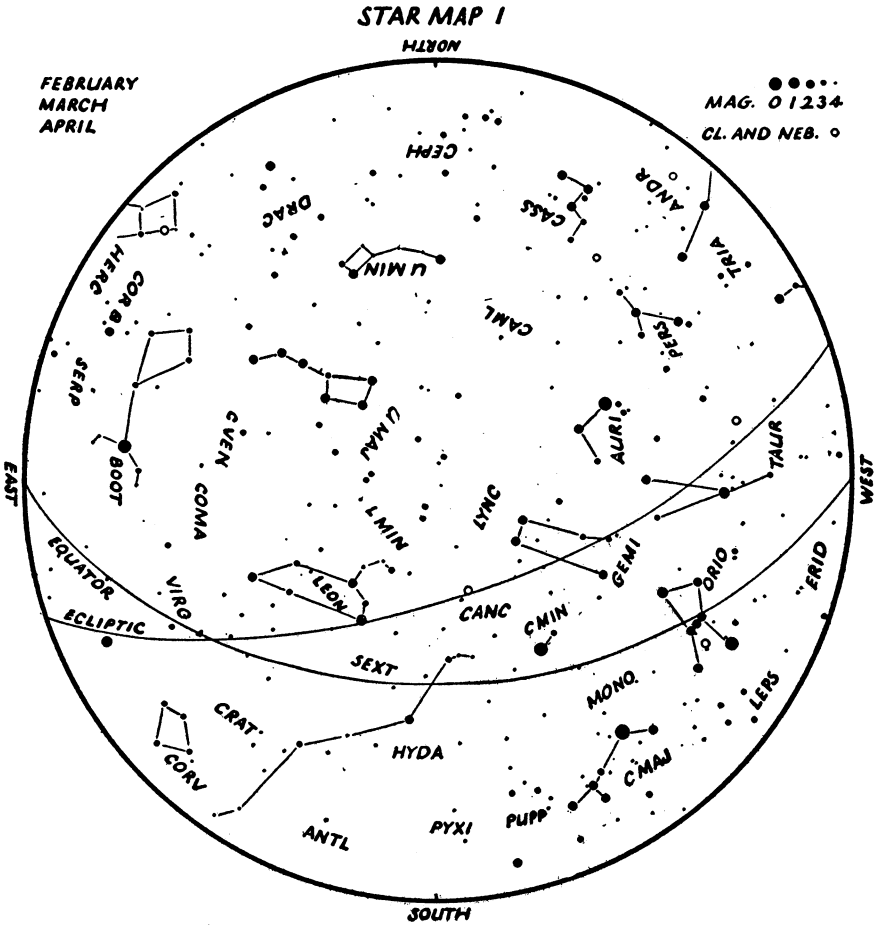
The galactic nebulae here listed have been selected to include the most readily observable representatives of planetary nebulae such as the Ring Nebula in Lyra, diffuse bright nebulae like the Orion nebula and dark absorbing nebulosities such as the Coal Sack. These objects are all located in our own galactic system. The first five columns give the identification and position as in the table of clusters. In the *Cl* column is given the classification of the nebula, planetary nebulae being listed as *Pl*, diffuse nebulae as *Dif*, and dark nebulae as *Drk*. *Size* indicates approximately the greatest apparent diameter in minutes of arc; and *m n* is the magnitude of the planetary nebula and *m* * is the magnitude of its central star. The distance is given in light years, and the name of the nebulae is added for the better known objects.

N.G.C.	M	Con	α 1900 h m	δ ° ′	Cl	Size ′	m n	m *	Dist. l.y.	Name
650	76	Per	01 36.0	+51 04	Pl	1.5	11	17	15,000	
1952	1	Tau	05 28.5	+21 57	Pl	6	11	16	10,000	Crab
1976	42	Ori	05 30.4	−05 27	Dif	30			1,800	Orion
B33		Ori	05 35.9	−02 31	Drk	4			300	Horsehead
2261		Mon	06 33.7	+08 49	Dif	2				Hubble's var
2392		Gem	07 23.3	+21 07	Pl	0.3	8	10	2,800	
2440			07 37.5	−17 58	Pl	0.9	11	16	8,600	
3587	97	UMa	11 09.0	+55 34	Pl	3.3	11	14	12,000	Owl
		Cru	12 45	−63	Drk	300			300	Coalsack
6210		Her	16 40.3	+23 59	Pl	0.3	10	12	5,600	
B72		Oph	17 17.5	−23 32	Drk	20			400	S nebula
6514	20	Sgr	17 56.3	−23 02	Dif	24			3,200	Trifid
B86		Sgr	17 56.8	−27 52	Drk	5				
6523	8	Sgr	17 57.6	−24 23	Dif	50			3,600	Lagoon
6543		Dra	17 58.6	+66 38	Pl	0.4	9	11	3,500	
6572		Oph	18 07.2	+06 50	Pl	0.2	9	12	4,000	
B92		Sgr	18 09.8	−18 16	Drk	15				
6618	17	Sgr	18 15.0	−16 13	Dif	26			3,000	Horseshoe
6720	57	Lyr	18 49.9	+32 54	Pl	1.4	9	14	5,400	Ring
6826		Cyg	19 42.1	+50 17	Pl	0.4	9	11	3,400	
6853	27	Vul	19 55.3	+22 27	Pl	8	8	13	3,400	Dumb-bell
6960		Cyg	20 41.5	+30 21	Dif	60				Network
7000		Cyg	20 55.2	+43 56	Dif	100				N. America
7009		Aqr	20 58.7	−11 46	Pl	0.5	8	12	3,000	
7662		And	23 21.1	+41 59	Pl	0.3	9	13	3,900	

EXTRA GALACTIC NEBULAE

Among the hundreds of thousands of systems far beyond our own galaxy relatively few are readily seen in small telescopes. The following list contains a selection of the closer brighter objects of this kind. The first five columns give the catalogue numbers, constellation and position on the celestial sphere. In the column *Cl, E* indicates an elliptical nebula, *I* an irregular object, and *Sa, Sb, Sc* spiral nebulae, in which the spiral arms become increasingly dominant compared with the nucleus as we pass from *a* to *c*. The remaining columns give the apparent magnitude of the nebula, its distance in light years and the radial velocity in kilometers per second. As these objects have been selected on the basis of ease of observation, the faint, very distant objects which have spectacularly large red shifts, corresponding to large velocities of recession, are not included.

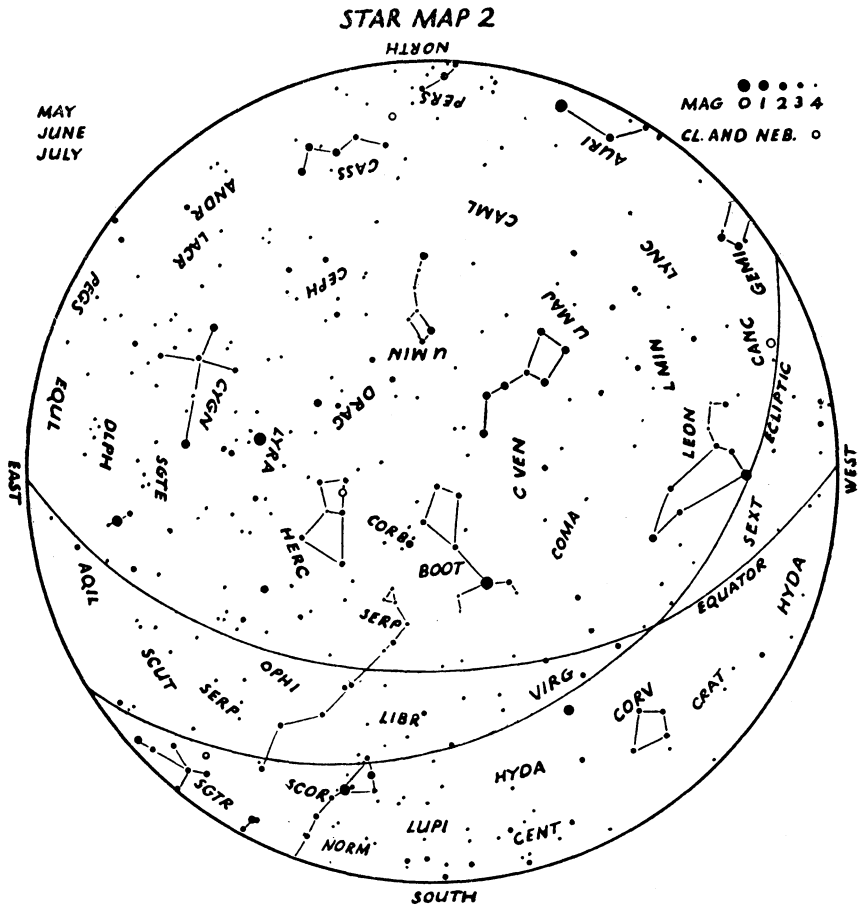
N.G.C.	M	Con	α 1900 h m	δ ° ′	Cl	Dimens. ′ ′	Mag.	Distance l.y.	Vel. km/sec
221	32	And	00 37.2	+40 19	E	3×3	8.8	800,000	− 185
224	31	And	00 37.3	+40 43	Sb	160×40	5.0	800,000	− 220
SMC		Tuc	00 51	−72 54	I	220×220	1.5	100,000	+ 170
598	33	Tri	01 28.2	+30 09	Sc	60×40	7.0	700,000	− 70
LMC		Dor	05 21	−69 30	I	430×530	0.5	90,000	+ 280
3031	81	UMa	09 47.3	+69 32	Sb	16×10	8.3	2,400,000	− 30
3034	82	UMa	09 47.5	+70 10	I	7× 2	9.0	2,600,000	+ 290
3368	96	Leo	10 41.5	+12 21	Sa	7× 4	10.0	5,700,000	+ 940
3623	65	Leo	11 13.7	+13 38	Sb	8× 2	9.9	5,000,000	+ 800
3627	66	Leo	11 15.0	+13 32	Sb	8× 2	9.1	4,300,000	+ 650
4258		CVn	12 14.0	+47 52	Sb	20× 6	8.7	4,600,000	+ 500
4374	84	Vir	12 20.0	+13 26	E	3× 2	9.9	6,000,000	+1050
4382	85	Com	12 20.4	+18 45	E	4× 2	10.0	3,700,000	+ 500
4472	49	Vir	12 24.7	+08 33	E	5× 4	10.1	5,700,000	+ 850
4565		Com	12 31.4	+26 32	Sb	15× 1	11.0	7,600,000	+1100
4594		Vir	12 34.8	−11 04	Sa	7× 2	9.2	7,200,000	+1140
4649	60	Vir	12 38.6	+12 06	E	4× 3	9.5	7,500,000	+1090
4736	94	CVn	12 46.2	+41 40	Sb	5× 4	8.4	3,000,000	+ 290
4826	64	Com	12 51.8	+22 13	Sb	8× 4	9.2	1,300,000	+ 150
5005		CVn	13 06.3	+37 36	Sc	5× 2	11.1	6,600,000	+ 900
5055	63	CVn	13 11.3	+42 34	Sb	8× 3	9.6	3,600,000	+ 450
5194	51	CVn	13 25.7	+47 43	Sc	12× 6	7.4	3,000,000	+ 250
5236	83	Hya	13 31.4	−29 21	Sc	10× 8	8	2,900,000	+ 500
6822		Sgr	19 39.6	−15 01	I	20×10	11	1,000,000	− 150
7331		Peg	22 32.5	+33 54	Sb	9× 2	10.4	5,200,000	+ 500



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.

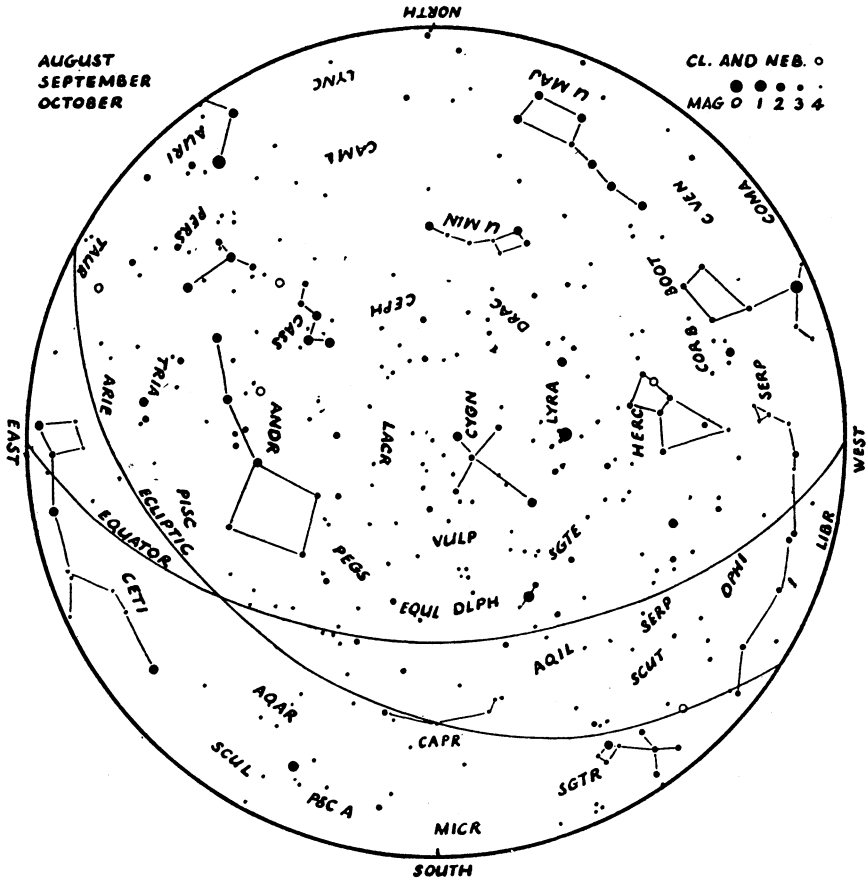


The above map represents the evening sky at

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

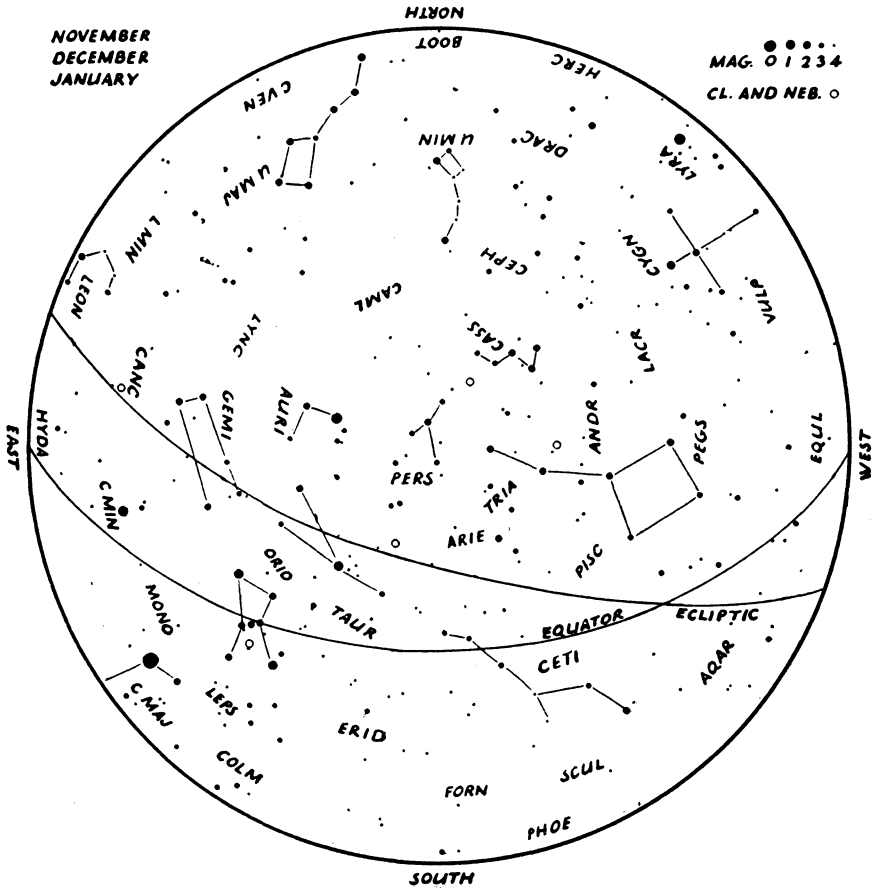


The above map represents the evening sky at

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.

CHIEF STARS USED IN AERIAL NAVIGATION

No.	Name	Pronunciation	Constell. Name	Mag.	R.A. 1900 h m	Dec. ° ′	SHA 1943 ° ′
1	Achernar	ā′ker-när	α Erid	0.6	01 34	S 57 44	336 06
2	Acrux	ă′krŭks	α Cruc	1.1	12 21	S 62 33	174 09
3	Aldebaran	ăl-dĕb′ä-răn	α Taur	1.1	04 30	N 16 18	291 50
4	Alpheratz	ăl-fē′răts	α Andr	2.2	00 03	N 28 32	358 38
5	Altair	ăl-tă′ĭr	α Aqil	0.9	19 46	N 08 36	63 00
6	Antares	ăn-ta′rēz	α Scor	1.2	16 23	S 26 12	113 36
7	Arcturus	ärk-tŭ′rŭs	α Boot	0.2	14 11	N 19 42	146 44
8	Betelgeuse	bĕt-ël-gûz′	α Orio	0.8*	05 50	N 07 23	271 59
9	Canopus	ka-nō′-pûs	α Cari	−0.9	06 22	S 52 38	264 20
10	Capella	kä-pĕl′ä	α Auri	0.2	05 09	N 45 54	281 53
11	Deneb	dĕn′ĕb	α Cygn	1.3	20 38	N 44 55	50 08
12	Dubhe	dōōb′hĕ	α U Maj	2.0	10 58	N 62 17	194 57
13	Fomalhaut	fō′măl-hôt	α Psc A	1.3	23 52	S 30 09	16 22
14	Peacock	pē′kŏk	α Pavo	2.1	20 18	S 57 03	54 43
15	Pollux	pŏl′ŭks	β Gemi	1.2	07 39	N 28 16	244 33
16	Procyon	prō′sĭ-ŏn	α C Min	0.5	07 34	N 05 29	245 55
17	Regulus	rĕg′ū-lŭs	α Leon	1.3	10 03	N 12 27	208 40
18	Rigel	rī′gĕl, rī′jĕl	β Orio	0.3	05 10	S 08 19	282 03
19	Rigil Kent.	r. kĕn-tô′rŭs	α Cent	0.1	14 33	S 60 25	141 04
20	Sirius	sĭr′ĭ-ŭs	α C Maj	−1.6	06 41	S 16 35	259 20
21	Spica	spī′kä	α Virg	1.2	13 20	S 10 38	159 27
22	Vega	vē′gä	α Lyra	0.1	18 34	N 38 41	81 15
30	Denebola	dĕn-ĕb′ō-lä	β Leon	2.2	11 44	N 15 08	183 28
39	Benetnasch	bĕ-nĕt′nash	η U Maj	1.9	13 44	N 49 49	153 41
47	Polaris	pō-lā′rĭs	α U Min	2.3	01 23	N 88 46	333 54

*No. 8. Magnitude varies from 0.5 to 1.1

Abbreviations: 1, Achar; 3, Aldeban; 4, Alphaz; 13, Fomalt; 19, Rikent; 39, Benesch.

Pronunciation Key

ā as in fate	ē as in we	ī as in ice	ō as in go	ū as in unite
ă " fat	ĕ " met	ĭ " ill	ŏ " odd	ŭ " up
ä " arm	ë " water	ōō " food	ô " orb	û " urn

ECLIPSES FOR 1943

During 1943 there will be four eclipses, two of the sun and two of the moon.

I. *A Total Eclipse of the Sun,* February 4-5, 1943, visible as total in the extreme north-west of North America. The path of totality starts in eastern Manchuria and Siberia, crosses northern Japan, the North Pacific, the Alaskan peninsula and ends at the Arctic Circle in Yukon. In Alberta, British Columbia and the western states the eclipse will be visible as partial just before sunset; and the sun will set while still partially eclipsed. At the town of Anchorage, Alaska, the eclipse begins 13h 16m, the middle of the eclipse is at 14h 24m, and the eclipse ends at 15h 30m, Alaskan Time, (10 hours west of Greenwich). The duration of the total phase will be 0.8 minutes.

II. *A Partial Eclipse of the Moon,* February 19-20, 1943. The beginning will be visible over most of Europe and Africa, the Atlantic and the Americas; the ending will be visible in western Europe; north-west Africa, the North Atlantic, the Americas and the eastern and central Pacific.

The Circumstances of the Eclipse (75th Meridian Civil Time)

Moon enters penumbra	February 19d 21h 43.1m
Moon enters umbra	19d 23h 03.0m
Middle of eclipse	20d 00h 38.0m
Moon leaves umbra	20d 02h 13.0m
Moon leaves penumbra	20d 08h 32.4m

Magnitude of eclipse 0.767 (Moon's diameter, 1.0)

III. *An Annular Eclipse of the Sun,* August 1, 1943, invisible in North America. Visibility of the annular phase will be restricted to the Antarctic Ocean; partial phase may be seen from eastern Mozambique, Sumatra, Java, Australia, and, at sunset, in New Zealand.

IV. *A Partial Eclipse of the Moon,* August 15, 1943, invisible in North America. The beginning will be visible in the western Pacific, Asia, Australia, New Zealand; the ending visible in much of Asia and Australia, and in Europe and Africa.

Temperature and Precipitation at Canadian and United States Stations

Prepared by Andrew Thomson.

Station.	Mean Temperature, Fahrenheit. Jan.	Feb.	Ma.	Ap.	May	Ju.	Jul.	Aug.	Sep.	Oc.	No.	De.	Average Annual. M	H	L
Victoria, B.C.	39	40	44	49	53	57	60	60	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

M, *H* and *L* are the mean and 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) Jan.	Feb.	Ma.	Ap.	May	Ju.	Jul.	Aug.	Sep.	Oc.	No.	De.	Year. 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

M, *W* and *D* indicate the mean, 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.

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA
1890-1943

The Society was incorporated in 1890 under the name of The Astronomical and Physical Society of Toronto, and assumed its present name in 1903.

For many years the Toronto organization existed alone, but now the Society is national in extent, having active Centres in Montreal and Quebec, P.Q.; Ottawa, Toronto, Hamilton and London, Ontario.; Winnipeg, Man.; Edmonton, Alta.; Vancouver and Victoria, B.C. As well as about 700 members of these Canadian Centres, there are over 200 members not attached to any Centre, mostly resident in other nations, while some 300 additional institutions or persons are on the regular mailing list for our publications.

The Society publishes a monthly JOURNAL containing about 500 pages and a yearly OBSERVER'S HANDBOOK of 80 pages. Single copies of the JOURNAL or HANDBOOK are 25 cents, postpaid. In quantities of 10 or more copies, the price is 20 cents a copy.

Membership is open to anyone interested in astronomy. Annual dues, $2.00; life membership, $25.00. Publications are sent free to all members or may be subscribed for separately. Applications for membership or publications may be made to the General Secretary, 198 College St., Toronto.

The Society has for Sale:

Reprinted from the JOURNAL of the Royal Astronomical Society, 1936-1942.

The Physical State of the Upper Atmosphere, (revised 1941) by B. Haurwitz, 96 pages; Price 75 cents postpaid.

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