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C. A. CHANT, Editor
F. S. HOGG, Assistant Editor
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1941 CALENDAR 1941

JANUARY

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	..

FEBRUARY

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

MARCH

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	..

APRIL

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	..

MAY

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

JUNE

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

JULY

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

AUGUST

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	

SEPTEMBER

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	..

OCTOBER

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	..

NOVEMBER

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

DECEMBER

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

JULIAN DAY CALENDAR, 1941

J.D. 2,400,000 plus the following:

Jan. 1	29996	May 1	30116	Sept. 1	30239
Feb. 1	30027	June 1	30147	Oct. 1	30269
Mar. 1	30055	July 1	30177	Nov. 1	30300
Apr. 1	30086	Aug. 1	30208	Dec. 1	30330

The Julian Day commences at noon.

Thus J.D. 2,429,996.0=Jan. 1.5 G.C.T.

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PRINTED IN CANADA

PREFACE

The HANDBOOK for 1941, which is the thirty-third issue, is arranged similarly to that of last year. The chief changes are: (1) The ephemerides of the bright asteroids have been omitted; (2) A list of stars used in air navigation has been added.

The small star maps at the back necessarily contain only a few objects. Four similar maps 9 inches in diameter are obtainable from the Director of University Extension, University of Toronto, for one cent each. Observers desiring fuller information are recommended to obtain Norton's *Star Atlas and Reference Handbook* (Gall and Inglis, price 12*s* 6*d*; supplied also by Eastern Science Supply Co., Boston, Mass.). The sixth edition contains late information.

For the preparation of the material in the volume Dr. F. S. Hogg, Assistant Editor, is largely responsible; but hearty thanks are due to all the staff of the David Dunlap Observatory for their assistance.

C. A. CHANT.

David Dunlap Observatory,
Richmond Hill, Ont., December 1940.

ANNIVERSARIES AND FESTIVALS 1941

New Year's Day	Wed.	Jan.	1
Epiphany	Mon.	Jan.	6
Septuagesima Sunday		Feb.	9
Quinquagesima (Shrove Sunday)		Feb.	23
Ash Wednesday		Feb.	26
St. David	Sat.	Mar.	1
St. Patrick	Mon.	Mar.	17
Palm Sunday		Apr.	6
Good Friday		Apr.	11
Easter Sunday		Apr.	13
St. George	Wed.	Apr.	23
Rogation Sunday		May	18
Ascension Day	Thu.	May	22
Empire Day (Victoria Day)	Sat.	May	24
Birthday of the Queen Mother, Mary (1867)	Mon.	May	26
Pentecost (Whit Sunday)		Jun.	1
Trinity Sunday		Jun.	8
Corpus Christi	Thu.	Jun.	12
St. John Baptist (Midsummer Day)	Tue.	Jun.	24
Dominion Day	Tue.	Jul.	1
Birthday of Queen Elizabeth (1900)	Mon.	Aug.	4
Labour Day	Mon.	Sep.	1
Hebrew New Year (Rosh Hashanah)	Mon.	Sep.	22
St. Michael (Michaelmas Day)	Mon.	Sep.	29
All Saints' Day	Sat.	Nov.	1
Remembrance Day	Tue.	Nov.	11
St. Andrew	Sun.	Nov.	30
First Sunday in Advent		Nov.	30
Ascension of King George VI (1936)	Thu.	Dec.	11
Birthday of King George VI (1895)	Sun.	Dec.	14
Christmas Day	Thu.	Dec.	25

Thanksgiving Day, date set by Proclamation

SYMBOLS AND ABBREVIATIONS

SIGNS OF THE ZODIAC

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

SUN, MOON AND PLANETS

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

ASPECTS AND ABBREVIATIONS

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

THE GREEK ALPHABET

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

THE CONFIGURATIONS OF JUPITER'S SATELLITES

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

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 ⊕ = 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 ⊕ = 26.2 miles/sec.

Solar Motion

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

The Galactic System

North pole of galactic plane R.A. $12h$ $40m$, Dec. + 28° (1900)
Centre, 325° galactic longitude, = R.A. $17h$ $24m$, 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 = 6.670×10^{-8} c.g.s. units
Mass of the electron, m = 9.035×10^{-28} gm.; mass of the proton = 1.662×10^{-24} gm.
Planck's constant, h = 6.55×10^{-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

1941 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 44 22	+03 21	−23 03.1	July 3	06 46 25	+03 55	+23 00.9
' 4	18 57 36	+04 46	−22 47.0	" 6	06 58 47	+04 27	+22 45.4
' 7	19 10 46	+06 06	−22 26.9	" 9	07 11 05	+04 56	+22 26.3
' 10	19 23 52	+07 22	−22 02.7	" 12	07 23 21	+05 21	+22 03.8
" 13	19 36 53	+08 33	−21 34.7	" 15	07 35 32	+05 43	+21 37.8
' 16	19 49 48	+09 39	−21 02.9	" 18	07 47 39	+06 00	+21 08.5
" 19	20 02 37	+10 38	−20 27.5	" 21	07 59 41	+06 13	+20 35.9
" 22	20 15 19	+11 31	−19 48.6	" 24	08 11 38	+06 20	+20 00.3
" 25	20 27 55	+12 17	−19 06.4	" 27	08 23 30	+06 23	+19 21.6
' 28	20 40 24	+12 56	−18 21.1	" 30	08 35 17	+06 20	+18 40.1
31	20 52 46	+13 28	−17 32.7	Aug. 2	08 46 58	+06 11	+17 55.8
Feb. 3	21 05 00	+13 53	−16 41.6	" 5	08 58 33	+05 57	+17 08.9
' 6	21 17 06	+14 10	−15 47.9	" 8	09 10 03	+05 37	+16 19.5
' 9	21 29 05	+14 19	−14 51.7	' 11	09 21 28	+05 12	+15 27.7
' 12	21 40 57	+14 21	−13 53.3	" 14	09 32 48	+04 42	+14 33.7
" 15	21 52 42	+14 17	−12 52.8	" 17	09 44 03	+04 07	+13 37.6
18	22 04 21	+14 06	−11 50.5	" 20	09 55 13	+03 28	+12 39.6
" 21	22 15 54	+13 48	−10 46.4	" 23	10 06 19	+02 45	+11 39.7
" 24	22 27 20	+13 26	−09 40.9	" 26	10 17 21	+01 57	+10 38.2
" 27	22 38 42	+12 57	−08 34.0	" 29	10 28 20	+01 06	+09 35.1
Mar. 2	22 49 58	+12 24	−07 26.0	Sept. 1	10 39 15	+00 11	+08 30.7
" 5	23 01 10	+11 46	−06 17.0	" 4	10 50 07	−00 46	+07 25.1
" 8	23 12 18	+11 04	−05 07.3	" 7	11 00 57	−01 46	+06 18.4
' 11	23 23 22	+10 19	−03 56.9	" 10	11 11 44	−02 48	+05 10.7
" 14	23 34 23	+09 30	−02 46.2	" 13	11 22 31	−03 51	+04 02.3
" 17	23 45 21	+08 39	−01 35.2	" 16	11 33 17	−04 55	+02 53.2
' 20	23 56 18	+07 46	−00 24.0	" 19	11 44 03	−05 58	+01 43.6
" 23	00 07 14	+06 52	+00 47.0	" 22	11 54 50	−07 02	+00 33.6
' 26	00 18 09	+05 58	+01 57.9	" 25	12 05 37	−08 04	−00 36.5
" 29	00 29 04	+05 03	+03 08.4	" 28	12 16 25	−09 05	−01 46.7
Apr. 1	00 39 59	+04 09	+04 18.3	Oct. 1	12 27 15	−10 05	−02 56.7
" 4	00 50 55	+03 15	+05 27.5	" 4	12 38 08	−11 02	−04 06.5
" 7	01 01 53	+02 23	+06 35.9	" 7	12 49 03	−11 56	−05 15.8
' 10	01 12 52	+01 32	+07 43.2	" 10	13 00 02	−12 47	−06 24.5
" 13	01 23 53	+00 44	+08 49.3	" 13	13 11 05	−13 33	−07 32.4
" 16	01 34 57	−00 02	+09 54.2	" 16	13 22 13	−14 15	−08 39.5
' 19	01 46 05	−00 44	+10 57.5	" 19	13 33 27	−14 51	−09 45.4
" 22	01 57 16	−01 22	+11 59.3	" 22	13 44 46	−15 22	−10 50.1
" 25	02 08 31	−01 57	+12 59.3	" 25	13 56 10	−15 47	−11 53.3
" 28	02 19 51	−02 27	+13 57.3	" 28	14 07 42	−16 05	−12 54.9
May 1	02 31 15	−02 52	+14 53.3	" 31	14 19 19	−16 17	−13 54.7
' 4	03 42 44	−03 13	+15 47.1	Nov 3	14 31 04	−16 23	−14 52.4
" 7	02 54 18	−03 29	+16 38.5	" 6	14 42 56	−16 20	−15 48.0
" 10	03 05 56	−03 40	+17 27.5	" 9	14 54 55	−16 11	−16 41.2
" 13	03 17 40	−03 46	+18 13.8	" 12	15 07 02	−15 53	−17 31.9
' 16	03 29 29	−03 46	+18 57.3	" 15	15 19 17	−15 28	−18 19.9
" 19	03 41 23	−03 42	+19 38.0	" 18	15 31 39	−14 55	−19 05.0
" 22	03 53 23	−03 32	+20 15.6	" 21	15 44 10	−14 15	−19 47.0
' 25	04 05 27	−03 18	+20 50.2	" 24	15 56 47	−13 27	−20 25.7
" 28	04 17 36	−02 58	+21 21.6	" 27	16 09 31	−12 33	−21 01.1
" 31	04 29 49	−02 35	+21 49.6	' 30	16 22 22	−11 32	−21 32.9
June 3	04 42 05	−02 08	+22 14.2	Dec. 3	16 35 18	−10 25	−22 01.1
" 6	04 54 25	−01 38	+22 35.3	' 6	16 48 20	−09 12	−22 25.4
" 9	05 06 48	−01 05	+22 52.9	" 9	17 01 27	−07 55	−22 45.7
" 12	05 19 13	−00 30	+23 06.8	' 12	17 14 38	−06 34	−23 02.1
" 15	05 31 40	+00 07	+23 17.1	" 15	17 27 53	−05 08	−23 14.3
" 18	05 44 08	+00 46	+23 23.6	" 18	17 41 11	−03 41	−23 22.4
" 21	05 56 37	+01 25	+23 26.5	" 21	17 54 30	−02 11	−23 26.3
" 24	06 09 05	+02 04	+23 25.7	" 24	18 07 49	−00 41	−23 25.9
" 27	06 21 34	+02 43	+23 21.1	" 27	18 21 08	+00 48	−23 21.3
' 30	06 34 00	+03 20	+23 12.8	" 30	18 34 26	+02 16	−23 12.5

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.

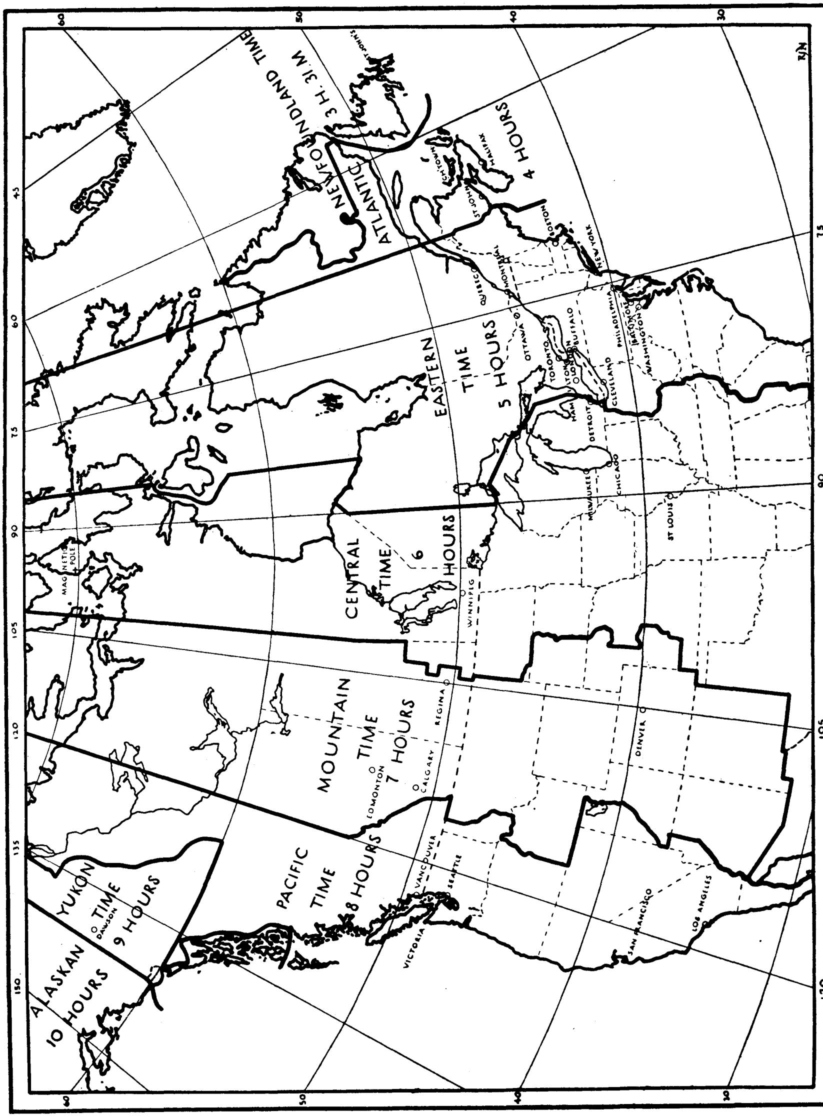
3. *Sidereal Time*—This is time as determined from the stars. It is sidereal noon when the Vernal Equinox or First of Aries is on the meridian. In accurate time-keeping the moment when a star is on the meridian is observed and the corresponding mean time is then computed with the assistance of the Nautical 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.

MAP OF STANDARD TIME ZONES



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 r.
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 05	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°		Latitude 40°		Latitude 44°		Latitude 46°		Latitude 48°		Latitude 50°		Latitude 52°	
		Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	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 01	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 57	5 54	5 47	5 54	5 46
	30	5 53	5 46	5 54	5 46	5 55	5 44	5 56	5 43	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).

THE PLANETS FOR 1941

By A. F. Bunker

MERCURY

Mercury, the smallest planet of the solar system, is seen least frequently of all the planets. It moves swiftly in an orbit lying closest to the sun and consequently is lost in the sun's brilliance much of the year. From the earth, it appears to move rapidly from one side of the sun to the other several times each year. Only near the ends of these apparent oscillations (greatest eastern and western elongations) can the planet be seen with the naked eye. Its maximum angular distance from the sun is never large, varying from 18 to 28 degrees.

When Mercury is at greatest eastern elongation it appears in the evening twilight only a few degrees above the horizon. At greatest western elongation it can be seen in the morning just before sunrise. The most favourable times for observation are during eastern elongation in the spring, and western elongation in the fall, at which times the ecliptic is nearly vertical.

The dates of greatest elongation in 1941, the angular separations from the sun and stellar magnitudes are as follows: Eastern elongation—Feb. 11, 18° 10′, -0.3 (most favourable); June 16, 23° 47′, 0.7; Oct. 3, 25° 42′, 0.2; Western elongation—Mar. 25, 27° 48′, 0.5; July 24, 20° 00′, 0.5; Nov. 12, 19° 11′, -0.3 (most favourable).

At these times its semi-diameter is between 3″ and 4″ while its distance from the earth is approximately 90,000,000 miles.

VENUS

The planet Venus moves in an orbit lying outside that of Mercury. Its apparent motions are similar to Mercury's, oscillating about the sun. Because of its greater distance from the sun, it moves more slowly, requiring 1.6 years for a complete oscillation, and reaching a greatest elongation of about 47 degrees. Venus approaches the earth more closely than any of the principal planets, being only 26,000,000 miles from the earth at inferior conjunction.

In size and mass Venus is nearly the earth's twin, being only slightly smaller and less dense. A dense atmosphere surrounds the planet which prevents observation of surface markings.

With the exception of the sun and moon, Venus is the brightest object in the sky. During times of greatest elongation it is easily visible to the naked eye in full daylight.

At the beginning of 1941 Venus will be morning star of magnitude –3.4 two hours west of the sun. It will slowly approach the sun until superior conjunction occurs April 19. After conjunction Venus will become the evening star, increasing in brilliance as it moves eastward toward the earth. On November 23 Venus will reach greatest eastern elongation, 47° 16′ from the sun. At that time its semidiameter will be 12″.7, and its distance 62,000,000 miles from the earth. It will not reach its greatest brilliance, magnitude –4.4, until December 29. It will then be 38,000,000 miles from the earth and have a semi-diameter of 20″.5. The phase of the planet can be seen easily with a small telescope at this time.

MARS

During the latter part of 1941 Mars, the fourth planet from the sun, will be well situated for observation. On October 10 it will come into opposition with the sun and appear in the evening sky in the constellation Pisces as a "star" of magnitude –2.4. The opposition will be of great interest as Mars will come within 38,000,000 miles of the earth. This is not the closest approach possible (34,000,000 miles) as Mars will have passed perihelion in August. For northern observers this approach will be more favourable than the 1939 approach since Mars will have a declination of +03° in contrast to the declination of –25° in 1939, although the planet was then 2,000,000 miles closer.

At the beginning of 1941, Mars is the morning star three hours west of the sun. The angular separation increases gradually until opposition occurs in October. Its magnitude increases from 0.9 to –2.4 at opposition. Its semidiameter will then be 11″.3.

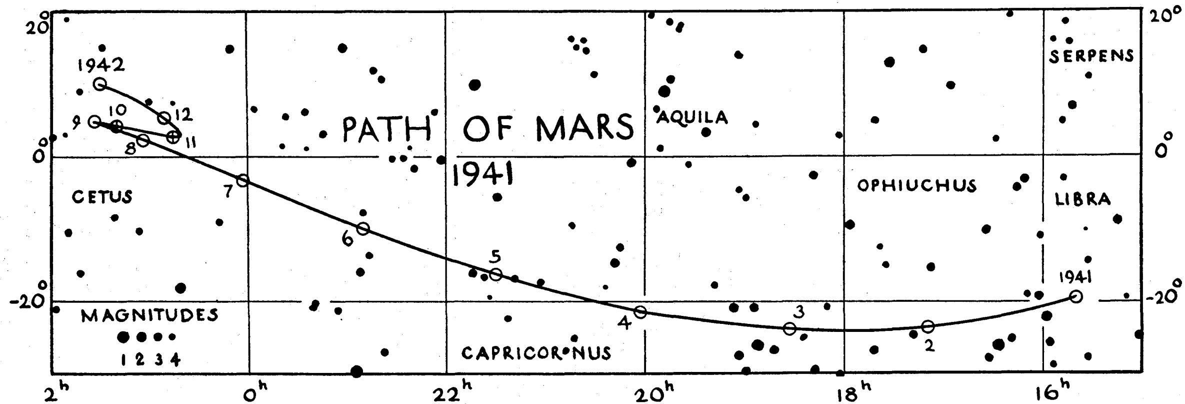
Mars is the planet next to the earth in order of distance from the sun. Its apparent motions in the sky are characteristic of planets moving outside the earth's orbit. It appears to move eastward among the stars until the earth, moving faster in a smaller orbit, starts to pass the outer planet. Mars then retrogrades until the earth is well past opposition, and then continues its eastward movement.

Because of its small size, 4,200 miles in diameter, and density, 4.0, Mars has difficulty retaining its atmosphere. The resulting thin atmosphere permits observation of surface markings which show seasonal and irregular variations.

THE ASTEROIDS

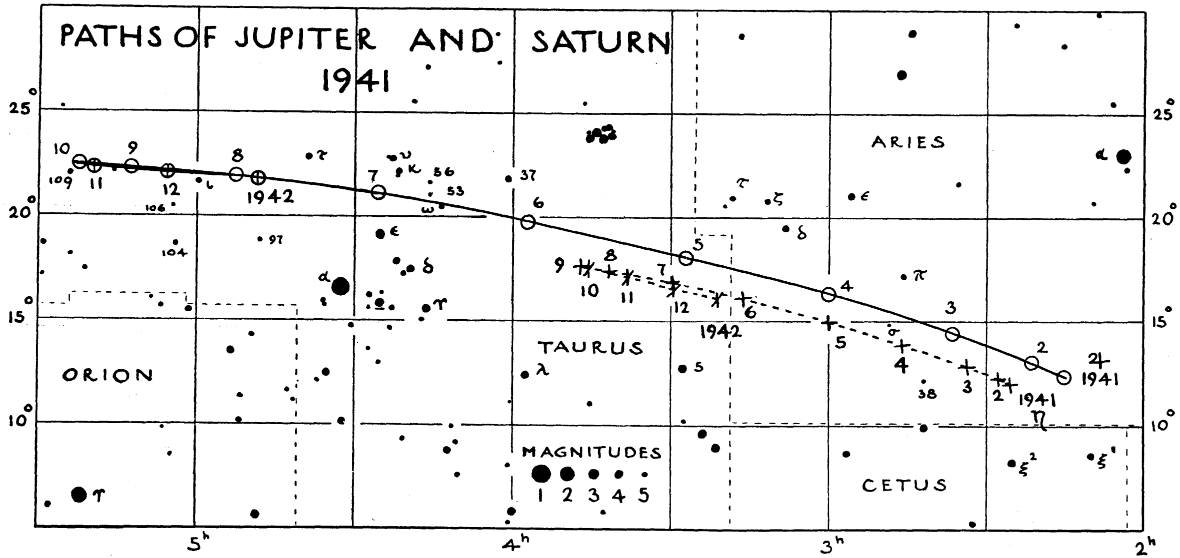
Between the orbits of Mars and Jupiter a large number of small bodies revolve around the sun. Most of these planetoids are less than 50 miles in diameter, while the largest is nearly 500 miles. Since the first one was discovered in 1801, many more have been found. The orbits of over 1,400 have been determined, and these cover a wide range of eccentricity and inclination. They all revolve from west to east, some approaching the earth closely.

In most telescopes these asteroids show no discs, but their changing brightness and rapid motions among the stars make them interesting objects for observation.



PATHS OF MARS AMONG THE STARS 1941

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



Paths of Jupiter and Saturn 1941

Jupiter, solid line above; Saturn, broken line below.

JUPITER

Jupiter is the largest and most massive planet of the solar system. It is an easy object to study with a telescope or even a good pair of field-glasses. Its cloud-banded surface, flattened at the poles by rapid rotation, and the ever changing configuration of the satellites, make it a fascinating object to observe.

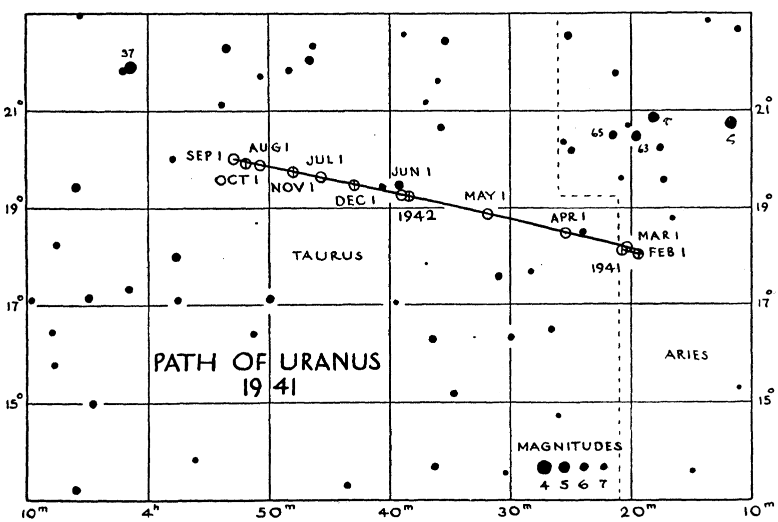
Jupiter is a conspicuous object during the first and last months of the year. In January it is seen in Aries as a –2.4 magnitude object. The sun slowly overtakes it, conjunction occurring on May 9. In July it appears as morning star two hours west of the sun. It continues to move eastward until October when it starts retrograding. Opposition with the sun occurs December 8, when it is 380,000,000 miles from the earth. Its magnitude is –2.4 and its semi-diameter 22″.47.

The configuration of Jupiter's four bright moons are given among the phenomena.

URANUS

Uranus, the planet beyond Saturn, was discovered by Sir William Herschel in 1781. When the planet was first seen it was thought to be a comet. Uranus has four faint satellites, of about magnitude 14. The planet itself is of the sixth magnitude and can be easily recognized with field-glasses. Its disc can be distinguished only with a large telescope as its semi-diameter is but 1″.85.

Uranus is in the constellation Taurus throughout the year. From April to July it is hidden by the sun's brilliance. It comes into opposition November 21 at which time it is 1,730,000 miles from the earth.



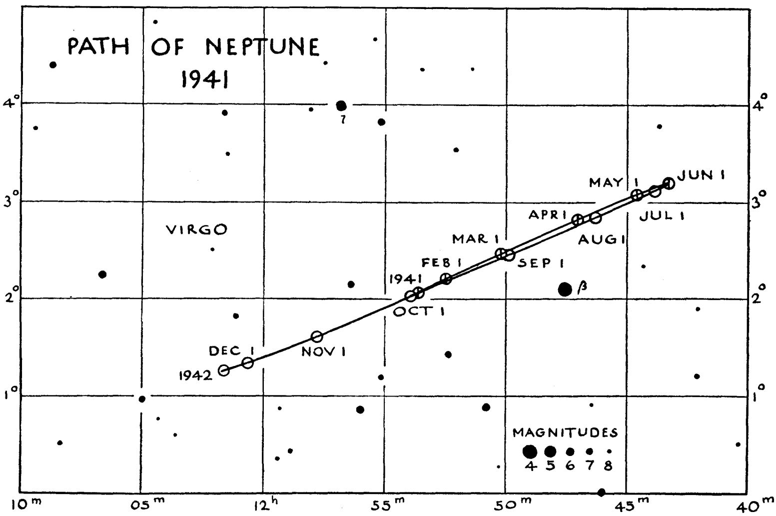
SATURN

Saturn, the next planet beyond Jupiter, is a very interesting object for telescopic observation, because of its ring system. There are three major rings, the bright main ring, an outer one, and the inner crepe ring. The rings are composed of a large number of small satellites revolving about Saturn in a plane. In 1941 the ring system is well opened out to the earth. Since the system is inclined 27 degrees to the planet's orbit, the rings appear to open out twice during the planet's 29.5-year period. In 1936 the rings were on edge and invisible, so in 1943 they will be fully opened.

At the beginning of 1941 Saturn is conspicuous in the constellation Aries, having passed opposition two months previously. It becomes less noticeable as the sun overtakes it and the two come into conjunction in May. Later Saturn appears as a morning star, with increasing brightness, rises earlier each night until opposition occurs on November 17. It will then have a semi-diameter of 9".16 and a magnitude of -0.1. At this time it is nearest the earth, 760,000,000 miles distant, and most favourably situated for observation.

NEPTUNE

Neptune's discovery in 1846 was the result of the calculations of Leverrier and Adams. It had been noted that Uranus was not following the orbit predicted. From the perturbations, the two astronomers independently predicted the existence and position of Neptune. It was found within a degree of the predicted position.



Neptune, because of its great distance from the sun, 2,800 million miles, appears as an eighth magnitude star. Its semi-diameter is only $1''.2$ hence it can be observed with only a large telescope.

Neptune remains in the constellation Virgo throughout the year. It can be observed best in March when it is in opposition with the sun. Conjunction occurs in September so the planet will be lost to observers a few months before and after that date.

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. During 1941, Pluto is a yellowish 15th magnitude star in the constellation Cancer. Its position near opposition in January is: $\alpha\ 8^h\ 26^m\ 12^s$, $\delta\ 23^\circ\ 37'\ 35''$.

ECLIPSES FOR 1941

In 1941 there will be four eclipses, two of the sun and two of the moon.

1. *Partial Eclipse of the Moon*, March 13, 1941. The beginning is visible generally in North America, except the extreme northeastern part, the western half of the Pacific Ocean, Australia, the Indian Ocean, Asia, Eastern Europe, and Africa, except the northwestern part. The ending is visible in the western part of North America, the Pacific Ocean, Australia, the Indian Ocean, and eastern Asia, except the extreme northwestern part.

Circumstances of the Eclipse (75th Meridian Civil Time)

Moon enters penumbra	March 13 d. 4 h. 37.6 m.
Moon enters umbra	March 13 d. 5 h. 55.1 m.
Middle of Eclipse	March 13 d. 6 h. 55.4 m.
Moon leaves umbra	March 13 d. 7 h. 55.8 m.
Moon leaves penumbra	March 13 d. 9 h. 13.1 m.

Magnitude of the eclipse is 0.328 (Moon's diameter=1).

2. *An Annular Eclipse of the Sun*, March 27, 1941, invisible in Canada. The path of the central eclipse is short, sweeping up across the Southern Pacific to Peru and ending in central South America at sunset. The partial phase is visible in most of the Southern Pacific Ocean, Central and South America.

3. *A Partial Eclipse of the Moon*, September 5, 1941. The beginning is visible generally in the northwestern extremity of North America, the western half of the Pacific Ocean, Australia, the Indian Ocean, Asia, eastern Europe, and Africa, except the northwestern part. The ending is visible generally in the western part of the Pacific Ocean, Australia, Indian Ocean, Asia, Europe, except the southwestern part, and Africa except the extreme northwestern part.

Circumstances of the Eclipse

Moon enters penumbra	September 5 d. 10 h. 25.3 m.
Moon enters umbra	September 5 d. 12 h. 18.9 m.
Middle of the eclipse	September 5 d. 12 h. 46.9 m.
Moon leaves umbra	September 5 d. 13 h. 14.6 m.
Moon leaves penumbra	September 5 d. 15 h. 08.3 m.

4. *A Total Eclipse of the Sun*, September 21, 1941, invisible in Canada. The path of totality crosses Asia and passes out into the Pacific where it ends at sunset. The maximum duration of totality is 3 minutes, 20 seconds.

THE SKY MONTH BY MONTH

By P. M. Millman

THE SKY FOR JANUARY, 1941

The times of transit 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 44m to 20h 57m and its Decl. changes from 23° 03′ S. to 17° 16′ S. The equation of time drops from –3m 21s to –13m 37s (see p. 7). Owing to this rapid drop in value the time of mean noon appears, for the first ten days of the month, to remain at the same distance from sunrise, that is, the forenoons as indicated by our clocks are of the same length. For changes in the length of the day, see p. 11. The sun enters Aquarius, the second winter sign of the zodiac, on the 20th of the month. The sign Aquarius now corresponds in the main with the stars of the constellation Capricornus, a condition brought about by the shifting position of the Vernal Equinox. The earth is nearest the sun, that is in perihelion, on January 3.

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

Mercury on the 15th is in R.A. 19h 57m, Decl. 22° 50′ S. and transits at 12.23. It is in superior conjunction with the sun on January 11, and too near the sun to be observed this month.

Venus on the 15th is in R.A. 18h 06m, Decl. 22° 58′ S. and transits at 10.31. It is slowly approaching the sun in the morning sky and rises about an hour and twenty minutes before sunrise. It is a bright star of magnitude –3.4.

Mars on the 15th is in R.A. 16h 20m, Decl. 21° 13′ S. and transits at 8.43. It is a red star between first and second magnitude and rises about three hours before the sun in the morning sky.

Jupiter on the 15th is in R.A. 2h 16m, Decl. 12° 30′ N. and transits at 18.37. It is a prominent object for the first half of the night and sets a little over an hour after midnight. Jupiter is of magnitude –2.1. Quadrature with the sun takes place on the 27th. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 50.

Saturn on the 15th is in R.A. 2h 25m, Decl. 11° 53′ N. and transits at 18.45. It is still fairly near Jupiter in Aries and sets a little over an hour after midnight. It is at a stationary point in its orbit on January 10 and in quadrature with the sun on the 28th. For the elongations of Saturn's satellites, etc., see p. 52.

Uranus on the 15th is in R.A. 3h 20m, Decl. 18° 05′ N. and transits at 19.39.

Neptune on the 15th is in R.A. 11h 53m, Decl. 2° 07′ N. and transits at 4.16.

Pluto—For information in regard to this planet, see p. 24.

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. 21h 30m
Wed.	1			....		34120
Thu.	2			....	16 31	32041
Fri.	3	13		⊕ in Perihelion. Dist. from ☉, 91,345,000 mi.		31024
				Quadrantid Meteors, p. 54		
Sat.	4			....		01234
Sun.	5	8	40	☽ First Quarter........................	13 20	2034*
Mon.	6	0		Moon in Apogee. Dist. from ⊕, 251,200 mi....		21034
Tue.	7	2	11	☌ ♃ ☾ ♃ 1° 27′ N................		d0124
		7	17	☌ ♄ ☾ ♄ 0° 17′ N................		
Wed.	8	10	37	☌ ♅ ☾ ♅ 3° 29′ N................	10 09	d3104
Thu.	9			....		32014
Fri.	10	5		♄ Stationary in R.A....................		31042
Sat.	11	5		☌ ☿ ☉ Superior........................	06 58	40132
Sun.	12			....		4203*
Mon.	13	6	04	○ Full Moon............................		42103
Tue.	14			....	03 48	40312
Wed.	15			....		43102
Thu.	16			....		43201
Fri.	17	23	13	☌ ♆ ☾ ♆ 1° 56′ N................	00 37	4310*
Sat.	18			....		4012*
Sun.	19	3		Moon in Perigee. Dist. from ⊕, 230,000 mi....	21 26	21043
		10		☿ Greatest Hel. Lat. S..................		
Mon.	20	5	01	☾ Last Quarter..........................		d2043
Tue.	21			....		01324
Wed.	22			....	18 15	31024
Thu.	23	4	48	☌ ♂ ☾ ♂ 4° 37′ S................		32014
Fri.	24			....		3104*
Sat.	25	10		♀ in ♉..................................	15 05	03124
		15	10	☌ ♀ ☾ ♀ 5° 00′ S................		
Sun.	26			....		21043
Mon.	27	1		□ ♃ ☉		20413
		6	03	● New Moon..............................		
Tue.	28	8		□ ♄ ☉	11 54	4032*
		8	53	☌ ☿ ☾ ☿ 5° 16′ S................		
Wed.	29			....		43102
Thu.	30	3		♅ Stationary in R.A....................		43201
Fri.	31			....	08 43	43120

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

THE SKY FOR FEBRUARY, 1941

The times of transit 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 February the sun's R.A. increases from 20h 57m to 22h 46m and its Decl. changes from 17° 16′ S. to 7° 49′ S. The equation of time drops to a minimum of −14m 21s on February 11 and then rises to −12m 36s at the end of the month (see p. 7). For changes in the length of the day, see p. 11. The sun enters Pisces, the third winter sign of the zodiac, on the 20th.

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 54m, Decl. 4° 59′ S. and transits at 13.13. It reaches greatest elongation east of the sun in the evening sky on the 11th. This is a favourable period of the year during which to observe Mercury in the evening. The planet will be visible for about a week before and after the above date. It will set approximately one and a half hours after the sun in the southwest and will be 16° above the horizon at sunset. Inferior conjunction with the sun is on the 26th.

Venus on the 15th is in R.A. 20h 51m, Decl. 18° 30′ S. and transits at 11.14. It is in the morning sky and is the bright star which rises shortly before the sun in the morning twilight.

Mars on the 15th is in R.A. 17h 51m, Decl. 23° 35′ S. and transits at 8.12. It is slowly separating from the sun in the morning sky and rises in the southeast about three hours before sunrise.

Jupiter on the 15th is in R.A. 2h 28m, Decl. 13° 37′ N. and transits at 16.46. It is a bright star, visible for the first half of the night. Conjunction with Saturn takes place on February 20. This is the last time these two planets are in conjunction for approximately twenty years. Jupiter will be a little over a degree north of Saturn. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 50.

Saturn on the 15th is in R.A. 2h 30m, Decl. 12° 24′ N. and transits at 16.48. It is visible near Jupiter during the first half of the night. Conjunction with Jupiter takes place on February 20. For the elongations of Saturn's satellites, etc., see p. 52.

Uranus on the 15th is in R.A. 3h 20m, Decl. 18° 06′ N. and transits at 17.38.

Neptune on the 15th is in R.A. 11h 51m, Decl. 2° 20′ N. and transits at 2.12.

Pluto—For information in regard to this planet, see p. 24.

				FEBRUARY 75th Meridian Civil Time			Min. of Algol		Config. of Jupiter's Sat. 21h 15m
	d	h	m				h	m	
Sat.	1								43O12
Sun.	2	21		Moon in Apogee. Dist. from ⊕, 251,300 mi.					412O3
Mon.	3	9		♂ in ♉			05	33	42O13
		13	59	☌ ♃ ☾	♃	2° 00′ N.			
		16	28	☌ ♄ ☾	♄	0° 44′ N.			
Tue.	4	6	42	☽ First Quarter					41O23
		18	37	☌ ♅ ☾	♅	3° 44′ N.			
Wed.	5								31O42
Thu.	6						02	22	32O14
Fri.	7	11		☿ in ☊					312O4
Sat.	8						23	11	3O124
Sun.	9								d1O34
Mon.	10	19		☿ Greatest elongation E., 18° 10′					2O134
Tue.	11	2		□ ♅ ☉			20	01	1O234
		19	26	○ Full Moon					
Wed.	12	1		☿ in Perihelion					d3O24
Thu.	13								324O*
Fri.	14	5	36	☌ ♆ ☾	♆	1° 50′ N.	16	50	3421O
		15		Moon in Perigee. Dist. from ⊕, 227,000 mi.					
Sat.	15								43O12
Sun.	16	15		☿ Stationary in R.A.					41O23
Mon.	17						13	39	42O13
Tue.	18	13	07	☾ Last Quarter					41O3*
Wed.	19								d4O12
Thu.	20	14		☌ ♃ ♄	♃	1° 21′ N.	10	29	432O*
		21	52	☌ ♂ ☾	♂	5° 28′ S.			
Fri.	21								3214O
Sat.	22	8		☿ Greatest Hel. Lat. N.					3O142
Sun.	23						07	18	1O234
Mon.	24	21	15	☌ ♀ ☾	♀	4° 34′ S.			2O134
Tue.	25	22	02	● New Moon					1O34*
		22	22	☌ ☿ ☾	☿	1° 39′ N.			
Wed.	26	7		☌ ☿ ☉	Inferior		04	07	O3124
Thu.	27								321O4
Fri.	28								d32O4

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

THE SKY FOR MARCH, 1941

The times of transit 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 46m to 0h 40m and its Decl. changes from 7° 49′ S. to 4° 18′ N. The equation of time increases from -12m 36s to -4m 09s (see p. 7). For changes in the length of the day, see p. 12. The sun is at the vernal equinox at 19h 21m E.S.T. on March 20. At this time the sun crosses the equator on its trip north, enters the sign of Aries, and spring commences. There is an annular eclipse of the sun on March 27. For details see p. 25.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. There is a partial eclipse of the moon on March 13. For details see p. 25.

Mercury on the 15th is in R.A. 22h 05m, Decl. 11° 05′ S. and transits at 10.35. The planet is in the morning sky for the first half of the month but too near the sun to be seen. It reaches greatest elongation west of the sun on March 25 but will be difficult to see as it rises only one hour before the sun and is just 9° above the horizon at sunrise.

Venus on the 15th is in R.A. 23h 07m, Decl. 7° 13′ S. and transits at 11.39. It is rapidly fading into the twilight in the morning sky. Venus will be very close to the old moon on the morning of March 27.

Mars on the 15th is in R.A. 19h 15m, Decl. 22° 57′ S. and transits at 7.46. It is in the morning sky and is slowly growing brighter, appearing about three hours before the sun.

Jupiter on the 15th is in R.A. 2h 46m, Decl. 15° 09′ N. and transits at 15.15. It is a bright object in the early evening sky and sets approximately four hours after the sun. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 50.

Saturn on the 15th is in R.A. 2h 39m, Decl. 13° 14′ N. and transits at 15.07. It is in the evening sky and sets over four hours after the sun. Saturn is a pale yellow star of magnitude +0.5. Its rings are now fairly well open, being inclined to the line of sight by 20°. We see their southern side. For the elongations of Saturn's satellites, etc., see p. 52.

Uranus on the 15th is in R.A. 3h 23m, Decl. 18° 17′ N. and transits at 15.50.

Neptune on the 15th is in R.A. 11h 49m, Decl. 2° 38′ N. and transits at 0.19. Opposition to the sun is on the 17th.

Pluto—For information in regard to this planet, see p. 24.

				MARCH 75th Meridian Civil Time			Min. of Algol		Config. of Jupiter's Sat. 20h 45m
	d	h	m				h	m	
Sat.	1	3		♀	in Aphelion		00	57	3O142
Sun.	2	16		Moon in Apogee. Dist. from ⊕, 251,800 mi.					14O2*
Mon.	3	3	44	☌ ♄ ☾	♄	1° 08′ N.	21	46	42O13
		5	31	☌ ♃ ☾	♃	2° 33′ N.			
		8		☌ ☿ ♀	☿	4° 48′ N.			
Tue.	4	3	20	☌ ♅ ☾	♅	3° 55′ N.			412O3
Wed.	5								4O132
Thu.	6	2	43	☽	First Quarter		18	35	4312O
Fri.	7								432O1
Sat.	8								43O2*
Sun.	9						15	24	41O2*
Mon.	10	15		☿	Stationary in R.A.				2O413
Tue.	11								12O43
Wed.	12						12	14	O1324
Thu.	13			Partial eclipse of ☾, see p. 25					d31O4
		6	47	○	Full Moon				
		14	18	☌ ♆ ☾	♆	1° 53′ N.			
Fri.	14	17		Moon in Perigee. Dist. from ⊕, 223,800 mi.					32O14
Sat.	15						09	03	3O24*
Sun.	16								31O24
Mon.	17	3		☍ ♆ ☉		Dist. from ⊕, 2,716,000,000 mi.			2O134
		19		☿	in ☋				
Tue.	18						05	52	12O43
Wed.	19	21	51	☾	Last Quarter				4O123
Thu.	20	19	21	☉ enters ♈, Spring commences. Long. of ☉, 0°.					413O2
Fri.	21	16	31	☌ ♂ ☾	♂	5° 46′ S.	02	42	432O1
Sat.	22								431O*
Sun.	23	7		♀	Greatest Hel. Lat. S.		23	31	d43O2
Mon.	24								42O13
Tue.	25	6	08	☌ ☿ ☾	☿	3° 43′ S.			421O3
		10		☿	Greatest elongation W., 27° 48′				
Wed.	26						20	20	4O123
Thu.	27			Annular eclipse of ☉, see p. 25					13O42
		3	46	☌ ♀ ☾	♀	1° 38′ S.			
		15	14	●	New Moon				
Fri.	28	1		☿	in Aphelion				32O14
Sat.	29						17	09	31O4*
Sun.	30	5		Moon in Apogee. Dist. from ⊕, 252,400 mi.					3O124
		16	07	☌ ♄ ☾	♄	1° 26′ N.			
		23	11	☌ ♃ ☾	♃	3° 01′ N.			
Mon.	31	12	15	☌ ♅ ☾	♅	4° 00′ N.			2O34*

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

THE SKY FOR APRIL, 1941

The times of transit 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 40m to 2h 31m and its Decl. changes from 4° 18′ N. to 14° 53′ N. The equation of time increases from –4m 09s to +2m 52s at the end of the month (see p. 7). For changes in the length of the day, see p. 12. The sun enters Taurus, the second spring sign of the zodiac, on the 20th.

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

Mercury on the 15th is in R.A. 0h 20m, Decl. 0° 33′ S. and transits at 10.50. Mercury is in the morning sky but not well placed for observation during April owing to its proximity to the sun.

Venus on the 15th is in R.A. 1h 29m, Decl. 8° 04′ N. and transits at 11.58. It reaches superior conjunction with the sun on the 19th, and will be too near the sun to be seen this month.

Mars on the 15th is in R.A. 20h 46m, Decl. 19° 18′ S. and transits at 7.14. It rises barely three hours before the sun in the morning sky and is a red star of magnitude +0.8.

Jupiter on the 15th is in R.A. 3h 12m, Decl. 17° 05′ N. and transits at 13.39. The planet is rapidly fading into the evening twilight and at the middle of the month sets only two hours after the sun. Jupiter is now of magnitude –1.6, just the brightness of Sirius. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 50.

Saturn on the 15th is in R.A. 2h 53m, Decl. 14° 21′ N. and transits at 13.19. It is approaching the sun in the evening sky and may still be seen at the first of the month to the west of Jupiter in the evening twilight.

Uranus on the 15th is in R.A. 3h 28m, Decl. 18° 39′ N. and transits at 13.54.

Neptune on the 15th is in R.A. 11h 46m, Decl. 2° 57′ N. and transits at 22.10.

Pluto—For information in regard to this planet, see p. 24.

APRIL

75th Meridian Civil Time

	d	h	m	Phenomenon	Min. of Algol h	m	Config. of Jupiter's Sat. 20h 30m
Tue.	1				13	58	21O34
Wed.	2						O1234
Thu.	3						1O324
Fri.	4	19	12	☽ First Quarter	10	48	32O41
Sat.	5						3412O
Sun.	6						43O12
Mon.	7				07	37	d41O3
Tue.	8						421O3
Wed.	9						4O123
Thu.	10	0	12	☌♆☾ ♆ 1° 59′ N.	04	26	41O32
Fri.	11	16	15	🌕 Full Moon			432O1
Sat.	12	3		Moon in Perigee. Dist from ⊕, 222,000 mi.			3412O
Sun.	13				01	15	3O412
Mon.	14						1O24*
Tue.	15				22	04	d2O34
Wed.	16						O1234
Thu.	17	9		☿ Greatest Hel. Lat. S.			1O324
Fri.	18	8	03	☾ Last Quarter	18	53	32O14
Sat.	19	2		☌♀☉ Superior			312O4
		12	26	☌♂☾ ♂ 5° 29′ S.			
Sun.	20						3O124
Mon.	21			Lyrid Meteors, p. 54	15	43	13O42
Tue.	22						24O13
Wed.	23						4O3**
Thu.	24				12	32	41O32
Fri.	25	6	07	☌☿☾ ☿ 0° 12′ N.			423O1
Sat.	26	8		Moon in Apogee. Dist. from ⊕, 252,600 mi.			4321O
		8	23	🌑 New Moon			
		10	58	☌♀☾ ♀ 2° 20′ N.			
Sun.	27	4	59	☌♄☾ ♄ 1° 40′ N.	09	21	43O12
		17	55	☌♃☾ ♃ 3° 23′ N.			
		21	16	☌♅☾ ♅ 4° 01′ N.			
Mon.	28						413O2
Tue.	29						24O13
Wed.	30				06	10	1O243

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

THE SKY FOR MAY, 1941

The times of transit 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 31m to 4h 34m and its Decl. changes from 14° 53′ N. to 21° 58′ N. The equation of time increases from +2m 52s to +3m 47s on the 15th and then drops to +2m 27s at the end of the month (see p. 7). For changes in the length of the day, see p. 13. On May 21 the sun enters Gemini, the third spring sign of the zodiac.

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

Mercury on the 15th is in R.A. 4h 07m, Decl. 22° 20′ N. and transits at 12.42. Mercury is too near the sun to be well seen this month. It is in superior conjunction with the sun on the 6th. The planet might possibly be glimpsed in the evening sky after sunset during the last few days of May.

Venus on the 15th is in R.A. 3h 54m, Decl. 20° 07′ N. and transits at 12.25. Venus is now in the evening sky but very near the sun and not well placed for observation.

Mars on the 15th is in R.A. 22h 08m, Decl. 13° 36′ S. and transits at 6.38. It is becoming more prominent in the morning sky, having now brightened to magnitude +0.4. It rises three hours before the sun.

Jupiter on the 15th is in R.A. 3h 41m, Decl. 18° 51′ N. and transits at 12.09. Conjunction with the sun takes place on May 19 so that the planet will be too close to the sun for observation this month.

Saturn on the 15th is in R.A. 3h 08m, Decl. 15° 28′ N. and transits at 11.36. Conjunction with the sun takes place on the 9th and Saturn is too near the sun to be observed during May.

Uranus on the 15th is in R.A. 3h 35m, Decl. 19° 03′ N. and transits at 12.03. Conjunction with the sun is on the 17th.

Neptune on the 15th is in R.A. 11h 44m, Decl. 3° 09′ N. and transits at 20.10.

Pluto—For information in regard to this planet, see p. 24.

MAY

75th Meridian Civil Time

	d	h	m	Phenomenon			Min. of Algol h	m
Thu.	1							
Fri.	2							
Sat.	3						02	59
Sun.	4	7	49	☽ First Quarter				
		13		☌ ♀ ♄	♀	1° 33′ N.		
				Eta Aquarid Meteors, p. 54				
Mon.	5						23	48
Tue.	6	0		☌ ☿ ☉ Superior				
		10		☿ in ☊				
Wed.	7	2		☌ ♃ ♅	♃	0° 32′ S.		
		9	23	☌ ♆ ☾	♆	1° 54′ N.		
		12		☌ ☿ ♄	☿	2° 19′ N.		
Thu.	8	20		☌ ♄ ☉			20	37
Sat.	10	14		Moon in Perigee. Dist. from ⊕, 222,000 mi.				
		23		☌ ♀ ♅	♀	0° 05′ S.		
Sun.	11	0		☌ ☿ ♅	☿	1° 03′ N.	17	26
		0	15	🌕 Full Moon				
		1		☿ in Perihelion				
		1		☌ ☿ ♀	☿	1° 08′ N.		
		8		☌ ☿ ♃	☿	1° 38′ N.		
		15		☌ ♀ ♃	♀	0° 28′ N.		
Wed.	14						14	15
Sat.	17	7		☌ ♅ ☉			11	04
		20	17	☾ Last Quarter				
Sun.	18	8	51	☌ ♂ ☾	♂	4° 41′ S.		
		14		♀ in ☊				
Mon.	19	15		☌ ♃ ☉				
Tue.	20						07	53
Wed.	21	7		☿ Greatest Hel. Lat. N.				
Fri.	23	13		Moon in Apogee. Dist. from ⊕, 252,400 mi.			04	42
Sat.	24	18	08	☌ ♄ ☾	♄	1° 54′ N.		
Sun.	25	6	32	☌ ♅ ☾	♅	4° 05′ N.		
		13	13	☌ ♃ ☾	♃	3° 43′ N.		
Mon.	26	0	18	🌑 New Moon			01	30
		20	41	☌ ♀ ☾	♀	5° 15′ N.		
Tue.	27	21	50	☌ ☿ ☾	☿	7° 16′ N.		
Wed.	28						22	19
Sat.	31						19	08

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 May 1 to June 18.

THE SKY FOR JUNE, 1941

The times of transit 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 34m to 6h 38m and its Decl. changes from 21° 58′ N. to a maximum of 23° 27′ N. on June 22, and then decreases to 23° 09′ N. The equation of time drops from +2m 27s to –3m 32s at the end of the month (see p. 7). For changes in the length of the day, see p. 13. The sun reaches its most northerly position at 14h 34m E.S.T. on June 21 and this marks the beginning of summer when the sun enters the sign of Cancer. During the last half of June the days are longest in the northern hemisphere and the duration of daylight changes little. The local mean time of sunset is almost constant owing to the decrease in the equation of time.

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 04m, Decl. 22° 23′ N. and transits at 13.30. It reaches its greatest apparent distance from the sun in the evening sky on June 6 and should be easy to locate during the first half of the month as this is the most favourable time of the year to observe Mercury in the evening sky. It will set approximately two hours after the sun, somewhat north of the west point. It will be 18° above the horizon at sunset. Look for a reddish star of magnitude +0.6.

Venus on the 15th is in R.A. 6h 38m, Decl. 24° 12′ N. and transits at 13.07. It is slowly separating from the sun in the evening sky but sets less than an hour after sunset and so is difficult to observe. Its magnitude is –3.4.

Mars on the 15th is in R.A. 23h 26m, Decl. 6° 42′ S. and transits at 5.54. It is in the morning sky and is in quadrature with the sun on June 2. Mars rises four hours before the sun and will be seen as a red star of magnitude zero in Aquarius, just to the east of the meridian at sunrise.

Jupiter on the 15th is in R.A. 4h 11m, Decl. 20° 22′ N. and transits at 10.37. It is now in the morning sky but very close to the sun. It may be glimpsed just before sunrise near the end of the month. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 50.

Saturn on the 15th is in R.A. 3h 23m, Decl. 16° 28′ N. and transits at 9.49. It is in the morning sky and rises shortly before the sun, being poorly placed for observation.

Uranus on the 15th is in R.A. 3h 42m, Decl. 19° 28′ N. and transits at 10.08

Neptune on the 15th is in R.A. 11h 43m, Decl. 3° 11′ N. and transits at 18.08.

Pluto—For information in regard to this planet, see p. 24.

JUNE

75th Meridian Civil Time

	d	h	m	Phenomenon	Min. of Algol h	Min. of Algol m	Config. of Jupiter's Sat. 4h 30m
Sun.	1						
Mon.	2	4		□♂☉			
		16	56	☽ First Quarter			
Tue.	3	16	43	☌♆☾ ♆ 1° 42′ N.	15	58	
Wed.	4						
Thu.	5	23		☿ Greatest elongation E., 23° 47′			
Fri.	6	5		♆ Stationary in R.A.	12	46	
Sat.	7	21		Moon in Perigee. Dist. from ⊕, 223,800 mi.			
Sun.	8						
Mon.	9	7	34	○ Full Moon	09	35	
Tue.	10						
Wed.	11						
Thu.	12				06	23	
Fri.	13	18		☿ in ☋			
Sat.	14						
Sun.	15				03	12	
Mon.	16	4	24	☌♂☾ ♂ 3° 37′ S.			
		7		□♆☉			
		10	45	☾ Last Quarter			
Tue.	17				00	01	
Wed.	18						
Thu.	19	6		☿ Stationary in R.A.			42103
Fri.	20	2		Moon in Apogee. Dist. from ⊕, 251,900 mi.	20	50	04123
		7		☌☿♀ ☿ 2° 54′ S.			
Sat.	21	7	21	☌♄☾ ♄ 2° 10′ N.			10234
		11		♀ in Perihelion			
		14	34	☉ enters ♋, Summer commences. Long. of ☉, 90°			
		16	10	☌♅☾ ♅ 4° 14′ N.			
Sun.	22	8	49	☌♃☾ ♃ 4° 02′ N.			d2304
Mon.	23				17	38	32014
Tue.	24	0		☿ in Aphelion			31024
		14	22	● New Moon			
Wed.	25	12	54	☌☿☾ ☿ 1° 40′ N.			32014
Thu.	26	5	50	☌♀☾ ♀ 5° 53′ N.	14	27	21034
Fri.	27						02143
Sat.	28						10423
Sun.	29				11	16	24031
Mon.	30	22	40	☌♆☾ ♆ 1° 24′ N.			4320*

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

THE SKY FOR JULY, 1941

The times of transit 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 38m to 8h 43m and its Decl. changes from 23° 09′ N. to 18° 11′ N. The equation of time decreases from –3m 32s to a minimum of –6m 23s on the 27th and then increases to –6m 15s (see p. 7). For changes in the length of the day, see p. 14. The sun enters Leo, the second summer sign of the zodiac, on July 23. The earth is in aphelion, that is the point in its orbit furthest from the sun, on July 2 (see opposite page).

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

Mercury on the 15th is in R.A. 6h 27m, Decl. 19° 06′ N. and transits at 10.55. It is in inferior conjunction with the sun on July 2 and will be too near the sun to be seen for the first half of the month. Its greatest apparent separation from the sun in the morning sky takes place on the 24th, at which time Mercury will rise nearly two hours before the sun and reach an altitude of 15° above the horizon at sunrise. It will be a reddish star of magnitude +0.4, almost due east.

Venus on the 15th is in R.A. 9h 13m, Decl. 17° 48′ N. and transits at 13.44. The planet is in the evening sky setting about an hour after the sun. It is just over 10° above the horizon at sunset.

Mars on the 15th is in R.A. 0h 32m, Decl. 0° 29′ S. and transits at 5.01. It now rises in the east before midnight and is very prominent as a red star of magnitude –0.7. The apparent diameter of Mars as seen in the telescope has now increased to 13 seconds of arc.

Jupiter on the 15th is in R.A. 4h 38m, Decl. 21° 26′ N. and transits at 9.07. It is slowly separating from the sun in the morning sky, rising about three hours before sunrise. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 50.

Saturn on the 15th is in R.A. 3h 36m, Decl. 17° 10′ N. and transits at 8.04. It is in the morning sky and rises a little before Jupiter. For the elongations of Saturn's satellites, etc., see p. 52.

Uranus on the 15th is in R.A. 3h 48m, Decl. 19° 47′ N. and transits at 8.16.

Neptune on the 15th is in R.A. 11h 45m, Decl. 3° 01′ N. and transits at 16.12.

Pluto—For information in regard to this planet, see p. 24.

				JULY 75th Meridian Civil Time	Min. of Algol		Config. of Jupiter's Sat. 4h 0m
	d	h	m		h	m	
Tue.	1	23	24	☽ First Quarter........................			43102
Wed.	2	16		☌ ☿ ☉ Inferior........................	08	05	d4301
		19		⊕ in Aphelion. Dist. from ☉, 94,450,000 mi.			
Thu.	3			....			42103
Fri.	4			....			40213
Sat.	5	21		Moon in Perigee. Dist. from ⊕, 226,700 mi....	04	53	41023
Sun.	6			....			42031
Mon.	7			....			3204*
Tue.	8	15	17	🌕 Full Moon............................	01	42	d3024
Wed.	9			....			30214
Thu.	10	8		♂ Greatest Hel. Lat. S....................	22	30	21034
Fri.	11			....			0134*
Sat.	12			....			10234
Sun.	13	1		♀ Greatest Hel. Lat. N....................	19	19	20134
		19		☿ Stationary in R.A....................			
Mon.	14	9		☿ Greatest Hel. Lat. S....................			23104
		20	39	☌ ♂ ☾ ♂ 2° 37′ S..................			
Tue.	15			....			30142
Wed.	16	3	07	☾ Last Quarter.........................	16	08	34012
Thu.	17	19		Moon in Apogee. Dist. from ⊕, 251,300 mi....			4210*
Fri.	18	20	14	☌ ♄ ☾ ♄ 2° 25′ N..................			4013*
Sat.	19	2	02	☌ ♅ ☾ ♅ 4° 27′ N..................	12	56	41023
Sun.	20	4	13	☌ ♃ ☾ ♃ 4° 19′ N..................			42013
Mon.	21			....			42310
Tue.	22	11	07	☌ ☿ ☾ ☿ 2° 18′ N..................	09	45	43012
Wed.	23	23		☿ Greatest elongation W., 20° 00′.........			3402*
Thu.	24	2	39	🌑 New Moon..........................			2104*
Fri.	25			....	06	34	20134
Sat.	26	8	04	☌ ♀ ☾ ♀ 3° 48′ N..................			10234
Sun.	27			....			d0134
Mon.	28	4	51	☌ ♆ ☾ ♆ 1° 08′ N..................	03	22	21304
				Delta Aquarid Meteors, p. 54.................			
Tue.	29			....			30124
Wed.	30			....			31024
Thu.	31	4	19	☽ First Quarter........................	00	11	d2304

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

THE SKY FOR AUGUST, 1941

The times of transit 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 43m to 10h 39m and its Decl. changes from 18° 11′ N. to 8° 31′ N. The equation of time increases from -6m 15s to -0m 11s (see p. 7). For changes in the length of the day, see p. 14. The sun enters Virgo, the third summer sign of the zodiac, on August 23.

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

Mercury on the 15th is in R.A. 9h 22m, Decl. 17° 11′ N. and transits at 11.53. The planet will be too near the sun to be seen during this month. Superior conjunction takes place on the 19th.

Venus on the 15th is in R.A. 11h 35m, Decl. 3° 52′ N. and transits at 14.03. It is still not very favourably placed for observation except by those who have a clear west horizon. It sets slightly over an hour after the sun in the evening sky.

Mars on the 15th is in R.A. 1h 21m, Decl. 3° 55′ N. and transits at 3.48. It rises a little over two hours after sunset and is in view for the rest of the night. It is a brilliant red star of magnitude -1.3 in Pisces. Its apparent diameter has increased to 17 seconds of arc and its south pole is turned towards the earth.

Jupiter on the 15th is in R.A. 5h 02m, Decl. 22° 06′ N. and transits at 7.29. Jupiter now rises over five hours before the sun in the morning sky and has brightened to magnitude -1.8. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 50.

Saturn on the 15th is in R.A. 3h 45m, Decl. 17° 35′ N. and transits at 6.11. It rises a little over an hour before midnight and is just east of the meridian at sunrise. Quadrature with the sun takes place on the 21st. For the elongations of Saturn's satellites, etc., see p. 52.

Uranus on the 15th is in R.A. 3h 52m, Decl. 19° 58′ N. and transits at 6.18.

Neptune on the 15th is in R.A. 11h 48m, Decl. 2° 41′ N. and transits at 14.13.

Pluto—For information in regard to this planet, see p. 24.

	d	h	m	AUGUST 75th Meridian Civil Time	Min. of Algol h	m	Config. of Jupiter's Sat. 3h 30m
Fri.	1	17		Moon in Perigee. Dist. from ⊕, 229,400 mi.			20413
Sat.	2	9		☿ in ☊	20	59	41023
Sun.	3						40213
Mon.	4	9		♂ in Perihelion			d4210
Tue.	5				17	48	43021
Wed.	6						43102
Thu.	7	0		☿ in Perihelion			43201
		0	38	🌕 Full Moon			
Fri.	8				14	36	4203*
Sat.	9						14023
Sun.	10						02143
Mon.	11				11	25	21034
Tue.	12	4	53	☌♂☾ ♂ 2° 01′ S.			3014*
				Perseid Meteors, p. 54			
Wed.	13						31024
Thu.	14	13		Moon in Apogee. Dist. from ⊕, 251,100 mi.	08	14	32014
		20	40	☾ Last Quarter			
Fri.	15	7	51	☌♄☾ ♄ 2° 35′ N.			2034*
		11	31	☌♅☾ ♅ 4° 40′ N.			
Sat.	16	22	19	☌♃☾ ♃ 4° 32′ N.			10234
Sun.	17	6		☿ Greatest Hel. Lat. N.	05	02	01243
		19		☌♀♆ ♀ 0° 18′ S.			
Mon.	18	19		☌☿☉ Superior			21403
Tue.	19						4301*
Wed.	20				01	51	43102
Thu.	21	11		□♄☉			43201
Fri.	22	13	34	🌑 New Moon	22	39	4210*
		23	48	☌☿☾ ☿ 3° 30′ N.			
Sat.	23	15		□♅☉			d4023
Sun.	24	12	59	☌♆☾ ♆ 0° 57′ N.			40123
Mon.	25	2	45	☌♀☾ ♀ 0° 29′ S.	19	28	42103
Tue.	26	20		Moon in Perigee. Dist. from ⊕, 228,800 mi.			32401
Wed.	27						31042
Thu.	28				16	16	d3014
Fri.	29	9	04	☽ First Quarter			21304
Sat.	30						01234
Sun.	31				13	05	0234*

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

THE SKY FOR SEPTEMBER, 1941

The times of transit 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 39m to 12h 27m and its Decl. changes from 8° 31′ N. to 2° 57′ S. The equation of time rises from -0m 11s to +10m 05s at the end of the month (see p. 7). For changes in the length of the day, see p. 15. The sun enters Libra and is at the autumnal equinox at 5h 33m E.S.T. on September 23. This is the beginning of autumn and day and night are approximately equal all over the world. There is a total eclipse of the sun on September 21. For details see page 25.

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. 12h 44m, Decl. 5° 28′ S. and transits at 13.11. It is in the evening sky during this month but too near the sun to be well seen. It may be possible to glimpse Mercury during the last few days of September since greatest elongation is on October 3. However, this is a very unfavourable elongation of the planet.

Venus on the 15th is in R.A. 13h 50m, Decl. 11° 49′ S. and transits at 14.16. It is in the evening sky and has now started to brighten slightly, being of magnitude -3.5. Venus sets about an hour and twenty minutes after the sun in the southwest

Mars on the 15th is in R.A. 1h 33m, Decl. 4° 55′ N. and transits at 1.57. It is steadily growing brighter as it approaches opposition, reaching magnitude -2.1 on the 15th. It rises about an hour after sunset and is the most prominent object in the evening sky. Mars is stationary in right ascension on the 6th and commences to retrograde, or to move west among the stars, at this time.

Jupiter on the 15th is in R.A. 5h 18m, Decl. 22° 25′ N. and transits at 5.43. It is in quadrature with the sun on the 13th and is visible for the last half of the night, being on the meridian at sunrise. The stellar magnitude is now -2.0. For the configurations of Jupiter's stellites see opposite page, and for their eclipses, etc., see p. 50.

Saturn on the 15th is in R.A. 3h 47m, Decl. 17° 37′ N. and transits at 4.11. It rises about three hours after sunset a little north of the east point and has now brightened to magnitude +0.2. Saturn reaches a stationary point and starts to retrograde on the 11th. For the elongations of Saturn's satellites, etc., see p. 52.

Uranus on the 15th is in R.A. 3h 53m, Decl. 20° 00′ N. and transits at 4.17.

Neptune on the 15th is in R.A. 11h 52m, Decl. 2° 15′ N. and transits at 12.15. Conjunction with the sun is on the 20th.

Pluto—For information in regard to this planet, see p. 24.

SEPTEMBER

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 3h 0m
Mon.	1			....		21034
Tue.	2			....		23014
Wed.	3			....	09 54	31042
Thu.	4			....		34021
Fri.	5			Partial eclipse of ☾, see p. 25................		42130
		1		☌ ☿ ♆ ☿ 0° 44′ S..................		
		12	36	🌕 Full Moon............................		
		13		♅ Stationary in R.A.......................		
Sat.	6	13		♂ Stationary in R.A......................	06 42	40213
Sun.	7	3		♀ in ☋................................		4023*
Mon.	8	21	15	☌ ♂ ☾ ♂ 1° 50′ S..................		d4203
Tue.	9	17		☿ in ☋................................	03 31	42301
Wed.	10	22		♄ Stationary in R.A......................		43102
Thu.	11	8		Moon in Apogee. Dist. from ⊕, 251,500 mi....		34021
		17	00	☌ ♄ ☾ ♄ 2° 36′ N..................		
		19	45	☌ ♅ ☾ ♅ 4° 44′ N..................		
Fri.	12			....	00 19	23140
Sat.	13	7		□ ♃ ☉		0134*
		13	16	☌ ♃ ☾ ♃ 4° 36′ N..................		
		14	31	☾ Last Quarter..........................		
Sun.	14			....	21 08	10234
Mon.	15			....		20134
Tue.	16			....		20314
Wed.	17			....	17 57	31024
Thu.	18			....		30124
Fri.	19			....		23104
Sat.	20	0		☿ in Aphelion............................	14 45	0431*
		15		☌ ♆ ☉; Total eclipse of ☉, see p. 25..........		
		23	37	☌ ♆ ☾ ♆ 0° 51′ N..................		
		23	38	🌑 New Moon..........................		
Sun.	21			....		41023
Mon.	22	14	28	☌ ☿ ☾ ☿ 4° 32′ S..................		42013
Tue.	23	5		Moon in Perigee. Dist. from ⊕, 225,600 mi....	11 34	4203*
		5	33	☉ enters ♎, Autumn commences. Long. of ☉, 180°		
		18	44	☌ ♀ ☾ ♀ 5° 03′ S..................		
Wed.	24			....		43102
Thu.	25			....		43012
Fri.	26			....	08 22	43210
Sat.	27	15	09	☽ First Quarter..........................		42031
Sun.	28			....		41023
Mon.	29			....	05 11	d0413
Tue.	30			....		2034*

THE SKY FOR OCTOBER, 1941

The times of transit 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 27m to 14h 23m and its Decl. changes from 2° 57′ S. to 14° 14′ S. The equation of time rises from +10m 05s to +16m 20s (see p. 7). For changes in the length of the day, see p. 15. On October 23 the sun enters Scorpio, the second autumnal sign of the zodiac.

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

Mercury on the 15th is in R.A. 14h 35m, Decl. 18° 37′ S. and transits at 12.59. It reaches its greatest apparent distance from the sun in the evening sky on October 3 but will be very difficult to see since the planet sets just three-quarters of an hour after the sun in the southwest. It is only 6° above the horizon at sunset. Inferior conjunction is on October 27, at which time Mercury enters the morning sky.

Venus on the 15th is in R.A. 16h 10m, Decl. 23° 17′ S. and transits at 14.38. It sets nearly two hours after the sun in the evening sky and has brightened to magnitude –3.7. It is now a prominent object low in the evening twilight, being about 13° above the horizon at sunset.

Mars on the 15th is in R.A. 1h 02m, Decl. 3° 15′ N. and transits at 23.23. It is now in view all night and is closest to the earth on October 3. It is just 38,100,000 miles distant from the earth on this date. This is a fairly favourable opposition though not quite as close as those of 1937 and 1939. The apparent diameter of the disk of Mars is 23 seconds of arc at this time. Actual opposition takes place a few days after closest approach, that is on October 10. The apparent magnitude of the planet is –2.4.

Jupiter on the 15th is in R.A. 5h 23m, Decl. 22° 28′ N. and transits at 3.49. It rises about three hours after sunset and is in view for the rest of the night. Jupiter reaches a stationary point in its orbit on the 10th and commences to retrograde, that is to move westward among the stars, at this time. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 51.

Saturn on the 15th is in R.A. 3h 43m, Decl. 17° 19′ N. and transits at 2.10. The planet is now of zero magnitude and rises less than two hours after sunset. In the telescope its rings appear well open, inclined to the line of sight by 24°. For the elongations of Saturn's satellites, etc., see p. 52.

Uranus on the 15th is in R.A. 3h 50m, Decl. 19° 53′ N. and transits at 2.17.

Neptune on the 15th is in R.A. 11h 56m, Decl. 1° 49′ N. and transits at 10.21.

Pluto—For information in regard to this planet, see p. 24.

	OCTOBER 75th Meridican Civil Time	Min. of Algol	Config. of Jupiter's Sat. 2h 15m
d h m		h m	
Wed. 1	....		d3024
Thu. 2	....	02 00	30124
Fri. 3 0	☿ Greatest elongation E., 25° 42′..........		32104
2	♂ nearest ⊕. Dist. from ⊕, 38,130,000 miles		
Sat. 4	....	22 48	2014*
Sun. 5 3 32	Full Moon...........................		10234
17 34	☌ ♂ ☾ ♂ 1° 27′ S..................		
Mon. 6	....		02143
Tue. 7	....	19 37	21043
Wed. 8 22 53	☌ ♄ ☾ ♄ 2° 27′ N..................		43012
Thu. 9 1	Moon in Apogee. Dist. from ⊕, 252,100 mi....		
2 09	☌ ♅ ☾ ♅ 4° 41′ N..................		4302*
Fri. 10 3	♃ Stationary in R.A......................	16 26	43210
8	☍ ♂ ☉ Dist. from ⊕, 38,510,000 mi........		
8	☿ Greatest Hel. Lat. S....................		
23 09	☌ ♃ ☾ ♃ 4° 32′ N..................		
Sat. 11 19	♀ in Aphelion..........................		4201*
Sun. 12	....		41023
Mon. 13 7 52	☾ Last Quarter.........................	13 14	40213
Tue. 14	....		42103
Wed. 15 10	☿ Stationary in R.A......................		4301*
Thu. 16	....	10 03	3042*
Fri. 17	....		32104
Sat. 18 11 48	☌ ♆ ☾ ♆ 0° 44′ N..................		23014
Sun. 19	....	06 52	10234
Mon. 20 9 20	New Moon...........................		02134
Tue. 21 2 40	☌ ☿ ☾ ☿ 6° 32′ S..................		21034
9	Moon in Perigee. Dist. from ⊕, 222,900 mi....		
Wed. 22	Orionid Meteors, p. 54......................	03 41	3014*
Thu. 23 12 13	☌ ♀ ☾ ♀ 7° 49′ S..................		31042
Fri. 24	....		d3240
Sat. 25	....	00 30	42301
Sun. 26 22	☌ ☿ ☉ Inferior........................		41023
Mon. 27 0 04	☽ First Quarter.........................	21 18	40123
Tue. 28	....		42103
Wed. 29 8	☿ in ☊................................		d4201
Thu. 30	....	18 07	43102
Fri. 31	....		d3401

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

THE SKY FOR NOVEMBER, 1941

The times of transit 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 23m to 16h 27m and its Decl. changes from 14° 14′ S. to 21° 43′ S. The equation of time increases from +16m 20s to a maximum of +16m 23s on November 4, and then drops to +11m 10s at the end of the month. For changes in the length of the day, see p. 16. The sun enters Sagittarius, the third autumnal sign of the zodiac, on the 22nd of the month.

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. 14h 08m, Decl. 10° 35′ S. and transits at 10.34. Greatest apparent distance from the sun is reached on November 12 and this is the best opportunity of the year to see Mercury in the morning sky. It will rise two hours before the sun, being 19° above the southeast horizon at sunrise. It will also be quite bright, being of magnitude -0.3.

Venus on the 15th is in R.A. 18h 41m, Decl. 26° 19′ S. and transits at 15.07. It is a very brilliant star, setting over three hours after the sun in the evening sky. Venus is at greatest apparent distance from the sun on November 23, at which time the magnitude of the planet has brightened to -4.0.

Mars on the 15th is in R.A. 0h 43m, Decl. 3° 34′ N. and transits at 21.04. It is still very prominent in the evening sky but its brightness has dropped a whole magnitude since October. Mars is now of magnitude -1.5 and sets about three hours before sunrise, being in view for the first three-quarters of the night. It reaches a stationary point and ceases to retrograde on November 12.

Jupiter on the 15th is in R.A. 5h 14m, Decl. 22° 20′ N. and transits at 1.38. It rises a little over an hour after sunset and has brightened to magnitude -2.3 being the most prominent object in the sky after Venus has set. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 51.

Saturn on the 15th is in R.A. 3h 34m, Decl. 16° 47′ N. and transits at 23.54. It is now in view all night and has brightened to magnitude -0.1. Opposition to the sun is on November 17, at which time Saturn rises at sunset. For the elongations of Saturn's satellites, etc., see p. 52.

Uranus on the 15th is in R.A. 3h 46m, Decl. 19° 38′ N. and transits at 0.10. Opposition to the sun is on the 20th.

Neptune on the 15th is in R.A. 11h 59m, Decl. 1° 27′ N. and transits at 8.22.

Pluto—For information in regard to this planet, see p. 24.

NOVEMBER

75th Meridian Civil Time

Day	d	h	m	Phenomenon		Min. of Algol h m	Config. of Jupiter's Sat. 1h 45m
Sat.	1	9	35	☌♂☾	♂ 0° 06′ S.		2340*
Sun.	2	23		♀	Greatest Hel. Lat. S.	14 56	10234
		23		☿	in Perihelion		
Mon.	3	21	00	🌕	Full Moon		01234
Tue.	4	13		☿	Stationary in R. A.		21034
Wed.	5	1	50	☌♄☾	♄ 2° 16′ N.	11 45	20314
•		6	47	☌♅☾	♅ 4° 34′ N.		
		12		Moon in Apogee.	Dist. from ⊕, 252,500 mi.		
Thu.	6						31024
Fri.	7	2	57	☌♃☾	♃ 4° 24′ N.		30214
Sat.	8					08 34	2304*
Sun.	9						10243
Mon.	10						40123
Tue.	11	22		☿	Greatest elongation W., 19° 11′	05 23	42103
		23	53	☾	Last Quarter		
Wed.	12	3		♂	Stationary in R.A.		42031
Thu.	13	6		☿	Greatest Hel. Lat. N.		43102
Fri.	14	23	29	☌♆☾	♆ 0° 33′ N.	02 11	43021
Sat.	15						43210
Sun.	16			Leonid Meteors, p. 54		23 00	d403*
Mon.	17	12	00	☌☿☾	☿ 1° 38′ S.		40123
		14		☍♄☉.	Dist. from ⊕, 756,300,000 mi.		
Tue.	18	19	04	🌑	New Moon		21043
		21		Moon in Perigee.	Dist. from ⊕, 221,700 mi.		
Wed.	19					19 49	20134
Thu.	20	20		☍♅☉	Dist. from ⊕, 1,719,000,000 mi.		31024
Fri.	21						30214
Sat.	22	5	23	☌♀☾	♀ 7° 40′ S.	16 38	32104
Sun.	23	0		♀	Greatest elongation E., 47° 16′		014**
Mon.	24						0234*
Tue.	25	12	52	☽	First Quarter	13 27	12043
Wed.	26						20413
Thu.	27						41302
Fri.	28	17	10	☌♂☾	♂ 1° 51′ N.	10 16	43012
Sat.	29						43210
Sun.	30						42301

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

THE SKY FOR DECEMBER, 1941

The times of transit 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 27m to 18h 43m and its Decl. changes from 21° 43′ S. to 23° 27′ S. on December 22 and then increases to 23° 04′ S. The equation of time drops from +11m 10s to -3m 14s at the end of the month. At 0h 45m E.S.T. December 22 the sun enters Capricornus, winter commences and the days are shortest in the northern hemisphere. The length of the day changes very little at this time (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. 17h 11m, Decl. 23° 50′ S. and transits at 11.40. It is in superior conjunction with the sun on December 22, passing into the evening sky at this time. Mercury will be too near the sun to be seen this month.

Venus on the 15th is in R.A. 20h 43m, Decl. 20° 12′ S. and transits at 15.09. It grows rapidly brighter throughout December, being at its greatest brilliancy on the 29th. It is of stellar magnitude -4.4 at this time and sets over three hours after the sun. During the last part of the month it should be possible to see Venus in broad daylight. One way to locate it is to look due south, 20° below the celestial equator, at the time Venus is due to cross the meridian.

Mars on the 15th is in R.A. 1h 06m, Decl. 7° 21′ N. and transits at 19.30. It is a brilliant red star of magnitude -0.5, setting about two hours after midnight. It is rapidly fading by about one magnitude a month. Its apparent diameter is now only 12 seconds of arc. It is fairly prominent in Pisces for the first half of the night.

Jupiter on the 15th is in R.A. 4h 57m, Decl. 22° 02′ N. and transits at 23.19. It is in view all night during this month and is a bright star of magnitude -2.4. Opposition to the sun takes place on December 8. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 51.

Saturn on the 15th is in R.A. 3h 25m, Decl. 16° 17′ N. and transits at 21.47. It is a bright object in the evening sky, being of zero magnitude. Saturn is in the eastern sky for the first part of the night. For the elongations of Saturn's satellites, etc., see p. 52.

Uranus on the 15th is in R.A. 3h 41m, Decl. 19° 22′ N. and transits at 22.03.

Neptune on the 15th is in R.A. 12h 01m, Decl. 1° 16′ N. and transits at 6.26.

Pluto—For information in regard to this planet, see p. 24.

				DECEMBER 75th Meridian Civil Time	Min. of Algol		Config. of Jupiter's Sat. 0h 15m
	d	h	m		h	m	
Mon.	1				07	05	41023
Tue.	2	3	33	☌♄☾ ♄ 2° 13′ N.			dd4O3
		10	36	☌♅☾ ♅ 4° 31′ N.			
		12		Moon in Apogee. Dist. from ⊕, 252,200 mi.			
Wed.	3	15	51	🌕 Full Moon			42O13
Thu.	4	2	24	☌♃☾ ♃ 4° 21′ N.	03	53	413O2
		16		♂ in ♌			
Fri.	5						3O412
Sat.	6	16		☿ in ♉			321O4
Sun.	7				00	43	23O14
Mon.	8	15		☍♃☉ Dist. from ⊕, 380,000,000 mi.			1O324
Tue.	9				21	32	O1234
Wed.	10						2O134
Thu.	11	13	48	☾ Last Quarter			13O24
Fri.	12	8	32	☌♆☾ ♆ 0° 15′ N.	18	22	3O142
				Geminid Meteors, p. 54			
Sat.	13						3124O
Sun.	14						432O1
Mon.	15				15	12	41O32
Tue.	16	23		☿ in Aphelion			4O123
Wed.	17	9		Moon in Perigee. Dist. from ⊕, 222,500 mi.			42O3*
Thu.	18	1	14	☌☿☾ ☿ 6° 10′ S.	12	00	41O3*
		05	18	🌑 New Moon			
Fri.	19						43O12
Sat.	20						3412O
Sun.	21	11	10	☌♀☾ ♀ 4° 04′ S.	08	49	324O1
		19		☌☿☉ Superior			
		21		□♆☉			
Mon.	22	0	45	☉ enters ♑, Winter commences. Long. of ☉, 270°			1O324
Tue.	23						O1234
Wed.	24				05	38	21O34
Thu.	25	5	43	☽ First Quarter			dO34*
Fri.	26	17	02	☌♂☾ ♂ 3° 49′ N.			3O124
Sat.	27				02	27	312O4
Sun.	28	20		♀ Greatest Brilliancy			32O14
Mon.	29	6	24	☌♄☾ ♄ 2° 24′ N.	23	16	1O342
		7		♀ in ♌			
		14	59	☌♅☾ ♅ 4° 38′ N.			
		19		Moon in Apogee. Dist. from ⊕, 252,200 mi.			
Tue.	30						4O123
Wed.	31	1	37	☌♃☾ ♃ 4° 28′ N.			421O3

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

PHENOMENA OF JUPITER'S SATELLITES, 1941

E—eclipse, O—occulation, T—transit, S—shadow, D—disappearance, R—reappearance, I—ingress, e—egress. The Roman numerals denote the satellites.
75th Meridian Civil Time. (For other times see p. 8).

JANUARY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	17	54	II	TI	15	00	09	III	TI
	20	21	II	SI		22	57	II	TI
	20	27	II	Te	17	19	40	II	OR
	22	53	II	Se		19	45	II	ED
4	00	52	I	OD		22	19	II	ER
	22	01	I	TI	18	19	38	III	ED
	23	15	I	SI		21	36	III	ER
5	00	10	I	Te	19	23	07	I	OD
	01	24	I	Se	20	20	16	I	TI
	19	20	I	OD		21	35	I	SI
	22	46	I	ER		22	25	I	Te
6	17	44	I	SI		23	44	I	Se
	18	38	I	Te	21	21	06	I	ER
	19	53	I	Se		18	13	I	Se
7	01	16	II	OD	24	19	40	II	OD
	20	18	III	TI		22	16	II	OR
	22	18	III	Te		22	23	II	ED
8	20	24	II	TI	25	18	08	III	OD
	22	58	II	SI		20	18	III	OR
	22	58	II	Te		23	40	III	ED
10	19	42	II	ER	26	20	03	II	Se
11	23	54	I	TI	27	22	11	I	TI
12	21	13	I	OD		23	31	I	SI
13	00	42	I	ER	28	19	31	I	OD
	18	22	I	TI		23	02	I	ER
	19	40	I	SI	29	18	00	I	SI
	20	31	I	Te		18	50	I	Te
	21	48	I	Se		20	09	I	Se
14	19	11	I	ER	31	22	18	II	OD

FEBRUARY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	22	11	III	OD		22	44	I	Te
2	20	03	II	Te	13	21	22	I	ER
	20	09	II	SI	14	18	29	I	Se
	22	40	II	Se	16	22	50	II	TI
4	21	27	I	OD	18	22	10	II	ER
5	18	37	I	TI	19	20	29	III	TI
	19	34	III	Se		22	32	I	TI
	19	56	I	SI		22	41	III	Te
	20	46	I	Te	20	19	52	I	OD
	22	05	I	Se	21	19	12	I	Te
6	19	26	I	ER		20	25	I	Se
9	20	08	II	TI	25	19	45	II	OD
	22	43	II	Te	27	19	49	II	Se
	22	45	II	SI		21	51	I	OD
11	19	32	II	ER	28	19	01	I	TI
12	18	28	III	Te		20	12	I	SI
	20	34	I	TI		21	12	I	Te
	21	41	III	SI		22	21	I	Se
	21	52	I	SI					

MARCH

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	19	42	I	ER	15	19	25	II	ER
2	19	49	III	ED		20	21	I	OD
	21	48	III	ER	16	19	43	I	Te
6	19	53	II	SI		20	42	I	Se
	20	14	II	Te	20	19	49	III	Se
7	21	01	I	TI	23	19	33	I	TI
8	21	37	I	ER		20	28	I	SI
9	18	46	I	Se	24	19	56	I	ER
	19	18	III	OD	27	20	30	III	Te
	21	34	III	OR	29	20	24	II	OD
13	20	25	II	TI	31	19	31	II	Se

APRIL

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	19	03	I	Se	15	20	09	I	TI
7	19	34	II	SI	16	19	18	II	ER
8	20	18	I	Te		20	10	I	ER
14	19	44	III	OR	23	19	28	I	OD
	19	56	III	ED					

Jupiter being near the Sun, phenomena of the Satellites are not given from May 1 to June 18.

JUNE

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
25	03	47	II	Te	29	04	13	III	Se

JULY

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
2	03	58	II	TI	23	02	11	I	ED
7	03	55	I	ED	24	02	43	I	Te
8	03	25	I	Se		03	58	III	ED
	04	14	I	Te	27	02	12	II	Se
15	03	09	I	SI		04	18	II	Te
	04	03	I	TI	30	04	05	I	ED
16	03	23	I	OR	31	02	31	I	TI
17	03	41	III	OD		03	36	I	Se
18	02	49	II	ED					

AUGUST

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	01	51	I	OR	22	01	06	III	OD
3	02	12	II	SI		03	31	III	OR
	04	27	II	TI		04	15	I	ED
4	02	37	III	TI	23	01	37	I	SI
5	02	16	II	OR		02	53	I	TI
7	03	20	I	SI		03	47	I	Se
	04	30	I	TI	24	02	13	I	OR
8	03	49	I	OR	28	01	52	II	Se
11	02	03	III	SI		01	54	II	TI
	04	17	III	Se		04	31	II	Te
15	02	21	I	ED	29	02	14	III	ER
16	00	57	I	TI	30	03	31	I	SI
	01	53	I	Se		04	49	I	TI
	03	07	I	Te	31	00	37	I	ED
19	02	31	II	ED		04	09	I	OR
21	01	51	II	Te					

SEPTEMBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	00	09	I	Se	11	04	27	II	SI
	01	28	I	Te	12	23	33	II	ED
4	01	52	II	SI	13	02	10	II	ER
	04	28	II	Se		02	15	II	OD
	04	33	II	TI		04	53	II	OR
5	03	55	III	ED	14	04	25	I	ED
	23	40	II	OD		23	06	II	Te
6	02	17	II	OR	15	01	46	I	SI
7	02	31	I	ED		03	06	I	TI
	23	53	I	SI		03	56	I	Se
8	01	12	I	TI		05	16	I	Te
	02	02	I	Se	16	00	19	III	Se
	03	22	I	Te		02	26	I	OR
	23	26	III	TI		03	26	III	TI
9	00	33	I	OR		23	44	I	Te
	01	49	III	Te	20	02	08	II	ED

SEPTEMBER—*Cont.*

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
	04	45	II	ER	24	00	18	I	Se
	04	48	II	OD		01	36	I	Te
21	22	59	II	Se		22	47	I	OR
	23	03	II	TI	26	23	36	III	OR
22	01	41	II	Te	27	04	42	II	ED
	03	40	I	SI	28	22	58	II	SI
	04	59	I	TI	29	01	35	II	Se
23	00	47	I	ED		01	36	II	TI
	01	59	III	SI		04	13	II	Te
	04	19	I	OR	30	02	41	I	ED
	04	19	III	Se		23	11	II	OR
	23	27	I	TI					

OCTOBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	00	02	I	SI	17	00	27	I	Se
	01	18	I	TI		01	34	I	Te
	02	12	I	Se		22	46	I	OR
	03	28	I	Te	18	03	51	III	ED
2	00	39	I	OR	21	22	14	III	TI
3	22	15	III	ER	22	00	37	III	Te
4	00	59	III	OD		01	42	II	ED
	03	25	III	OR		05	42	I	SI
6	01	34	II	SI	23	02	52	I	ED
	04	06	II	TI		22	11	II	TI
	04	12	II	Se		22	43	II	Se
7	04	35	I	ED	24	00	10	I	SI
8	01	38	II	OR		00	49	II	Te
	01	55	I	SI		01	11	I	TI
	03	08	I	TI		02	21	I	Se
	04	05	I	Se		03	21	I	Te
	05	18	I	Te		21	20	I	ED
	23	03	I	ED	25	00	34	I	OR
9	02	29	I	OR		20	49	I	Se
	21	35	I	TI		21	48	I	Te
	22	34	I	Se	28	21	53	III	SI
	23	45	I	Te	29	00	20	III	Se
10	23	51	III	ED		01	45	III	TI
11	02	16	III	ER		04	08	III	Te
	04	43	III	OD		04	16	II	ED
13	04	10	II	SI	30	04	46	I	ED
14	23	08	II	ED		22	41	II	SI
15	03	49	I	SI	31	00	33	II	TI
	04	03	II	OR		01	21	II	Se
	04	57	I	TI		02	04	I	SI
16	00	57	I	ED		02	58	I	TI
	04	19	I	OR		03	11	II	Te
	22	17	I	SI		04	14	I	Se
	22	24	II	Te		05	08	I	Te
	23	24	I	TI		23	14	I	ED

NOVEMBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	02	20	I	OR	8	01	09	I	ED
	20	32	I	SI		04	06	I	OR
	21	24	I	TI		20	08	II	ED
	21	55	II	OR		21	14	III	OR
	22	43	I	Se		22	26	I	SI
	23	34	I	Te		23	09	I	TI
2	20	47	I	OR	9	00	12	II	OR
5	01	53	III	SI		00	37	I	Se
	04	20	III	Se		01	20	I	Te
	05	12	III	TI		19	37	I	ED
7	01	18	II	SI		22	33	I	OR
	02	53	II	TI	10	19	46	I	Te
	03	58	I	SI	12	05	52	III	SI
	03	58	II	Se	14	03	55	II	SI
	04	43	I	TI		05	11	II	TI
	05	31	II	Te		05	51	I	SI
	06	08	I	Se	15	03	03	I	ED

NOVEMBER—*Cont.*

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
	05	51	I	OR		03	54	III	OR
	19	48	III	ED		04	25	I	Se
	22	42	II	ED		04	42	II	OR
16	00	20	I	SI		04	48	I	Te
	00	35	III	OR		23	26	I	ED
	00	54	I	TI	24	02	02	I	OR
	02	28	II	OR		19	52	II	SI
	02	31	I	Se		20	36	II	TI
	03	04	I	Te		20	42	I	SI
	21	32	I	ED		21	03	I	TI
17	00	17	I	OR		22	32	II	Se
	19	20	I	TI		22	53	I	Se
	19	55	II	Se		23	14	I	Te
	20	59	I	Se		23	15	II	Te
	20	59	II	Te	25	20	28	I	OR
	21	30	I	Te	30	03	49	III	ED
22	04	58	I	ED		03	51	II	ED
	23	48	III	ED		04	07	I	SI
23	01	16	II	ED		04	21	I	TI
	02	13	I	SI		06	19	I	Se
	02	38	I	TI		06	31	I	Te

DECEMBER

d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
1	01	21	I	ED		02	24	I	SI
	03	45	I	OR		03	21	II	TI
	22	29	II	SI		03	45	II	SI
	22	36	I	SI		04	24	I	Te
	22	47	I	TI		04	36	I	Se
	22	51	II	TI		06	00	II	Te
2	00	47	I	Se		23	27	I	OD
	00	57	I	Te	17	01	52	I	ER
	01	10	II	Se		20	39	I	TI
	01	30	II	Te		20	53	I	SI
	19	50	I	ED		21	50	II	OD
	22	11	I	OR		22	50	I	Te
3	17	50	III	SI		23	05	I	Se
	18	25	III	TI	18	00	54	III	TI
	19	16	I	Se		00	57	II	ER
	19	23	I	Te		01	49	III	SI
	20	01	II	OR		03	19	III	Te
	20	23	III	Se		04	24	III	Se
	20	49	III	Te		17	53	I	OD
7	06	02	I	SI		20	21	I	ER
	06	04	I	TI	19	17	33	I	Se
	06	25	II	ED		19	08	II	Te
8	03	16	I	ED		19	44	II	Se
	05	29	I	OR	21	18	25	III	ER
9	00	30	I	SI	23	03	57	I	TI
	00	30	I	TI		04	19	I	SI
	01	06	II	TI		05	37	II	TI
	01	07	II	SI	24	01	11	I	OD
	02	41	I	Te		03	48	I	ER
	02	42	I	Se		22	23	I	TI
	03	45	II	Te		22	47	I	SI
	03	48	II	Se	25	00	03	II	OD
	21	43	I	OD		00	34	I	Te
	23	57	I	ER		00	59	I	Se
10	18	56	I	TI		03	32	II	ER
	18	59	I	SI		04	10	III	TI
	19	37	II	OD		19	37	I	OD
	21	06	I	Te		22	16	I	ER
	21	10	I	Se	26	18	45	II	TI
	21	39	III	TI		19	00	I	Te
	21	50	III	SI		19	28	I	Se
	22	22	II	ER		19	41	II	SI
11	00	04	III	Te		21	24	II	Te
	00	23	III	Se		22	22	II	Se
	18	26	I	ER	28	17	48	III	OD
15	05	01	I	OD		22	26	III	ER
16	02	13	I	TI	31	02	56	I	OD

SATURN'S SATELLITES TITAN AND IAPETUS

ELONGATION				CONJUNCTION			
TITAN				TITAN			
Eastern		Western		Inferior		Superior	
d	h	d	h	d	h	d	h
Jan. 7	13.4	Jan. 15	12.5	Jan. 11	16.4	Jan. 3	10.1
23	12.3	31	11.6	27	15.5	19	08.8
Feb. 8	11.7	Feb. 16	11.2	Feb. 12	15.0	Feb. 4	08.1
24	11.6	Mar. 4	11.1	28	14.9	20	07.9
July 18	18.9	July 26	16.4	July 22	20.9	July 30	14.3
Aug. 3	19.0	Aug. 11	16.1	Aug. 7	20.8	Aug. 15	14.1
19	18.6	27	15.5	23	20.3	31	13.3
Sept. 4	17.8	Sept. 12	14.3	Sept. 8	19.3	Sept. 16	12.1
20	16.4	28	12.7	24	17.7	Oct. 2	10.3
Oct. 6	14.4	Oct. 14	10.6	Oct. 10	15.7	18	08.0
22	12.0	30	08.1	26	13.3	Nov. 3	05.4
Nov. 7	09.3	Nov. 15	05.5	Nov. 11	10.6	19	02.6
23	06.4	Dec. 1	02.8	27	07.9	Dec. 4	23.9
Dec. 9	03.7	17	00.3	Dec. 13	05.3	20	21.4
25	01.2			29	03.0		

IAPETUS				IAPETUS			
Eastern		Western		Inferior		Superior	
d	h	d	h	d	h	d	h
Jan. 3	12.2	Aug. 23	08.5	Feb. 21	15.5	Jan. 11	18.2
Oct. 1	04.9	Nov. 10	02.8	Aug. 3	12.4	Sept. 11	06.6
Dec. 18	05.9			Oct. 21	19.0	Nov. 28	15.2

LUNAR OCCULTATIONS

Prepared by J. F. HEARD

When the moon passes between the observer and a star that star is said to be occulted by the moon and the phenomenon is known as a lunar occultation. The passage of the star behind the east limb of the moon is called the immersion and its appearance from behind the west limb the emersion. As in the case of eclipses, the times of immersion and emersion and the duration of the occultation are different for different places on the earth's surface. The tables given below, adapted from the 1941 Nautical Almanac, give the times of immersion or emersion or both for occultations of stars brighter than magnitude 5.0 visible at Toronto and at Montreal and also at Vancouver and Calgary, at night.† Occultations of stars fainter than magnitude .5 are excluded for 24 hours before and after Full Moon. Emersions at the bright ilmb of the moon are given only in the case of stars brighter than magnitude 3.5, and immersions at the bright limb only in the case of stars brighter than magnitude 4.5; so that most of the phenomena listed take place at the dark limb. The terms *a* and *b* are for determining corrections to the times of the phenomena for stations within 300 miles of Toronto or Montreal in the first table, and within 300 miles of Vancouver or Calgary, in the second table. 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, 1941

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. 22	θ Lib	4.3	I	24.6	5 03.0	−1.1	+0.9	99	5 11.9	−1.4	+1.1	88
" "	" "	"	E	"	6 14.7	−1.3	+0.2	295	6 22.5	−1.3	−0.2	304
Mar. 5†	α Tau	1.1	I	7.7	12 29.0	−0.1	+1.7	75	12 33.1	−0.3	+1.7	76
" "†	" "	"	E	"	13 33.3	−0.6	+1.7	259	13 40.2	−0.7	+1.7	258
Apr. 1	α Tau	1.1	I	5.2	22 09.3	+0.1	−1.6	102	Low	—	—	—
" 8	π Leo	4.9	I	11.4	2 11.8	0.0	−2.6	156	2 07.2	0.0	−2.3	147
" 14	θ Lib	4.3	I	17.5	2 57.6	−1.7	−0.7	116	3 05.8	−1.6	−0.8	110
" "	" "	"	E	"	4 11.3	−1.6	−0.6	268	4 18.7	−1.4	−0.9	271
June 8	θ Lib	4.3	I	13.0	0 36.6	−1.6	−0.9	101	0 43.5	−1.4	−1.0	97
Aug. 16	θ^1 Tau	4.0	I	23.0	1 56.5	−0.5	+1.1	104	2 01.8	−0.7	+1.1	105
" "	θ^2 Tau	3.6	I	"	2 07.4	−1.0	−0.1	133	2 13.8	−1.3	−0.3	135
" "	θ^2 Tau	"	E	"	2 42.7	+0.3	+3.7	198	2 48.5	+0.2	+4.1	196
" "	θ^1 Tau	4.0	E	"	2 55.0	−0.3	+2.4	228	3 01.9	−0.5	+2.6	226
" "†	α Tau	1.1	I	23.2	6 34.7	−2.0	+0.8	79	6 47.4	−2.0	+0.6	76
" "†	" "	"	E	"	8 05.1	−2.0	0.0	259	8 15.6	−1.8	−0.5	265
Oct. 6	ξ^1 Cet	4.5	I	16.0	21 14.7	−1.0	+0.8	112	21 23.2	−1.3	+0.7	114
" "	" "	"	E	"	22 06.1	−0.4	+3.0	204	22 14.1	−0.4	+3.1	202
Nov. 5	ν Tau	3.9	E	16.5	20 12.0	+0.3	+2.8	208	20 15.8	+0.2	+3.0	207
" 6	α Tau	1.1	I	16.8	5 51.5	−0.8	−1.7	100	5 52.6	−0.6	−1.5	91

LUNAR OCCULTATIONS VISIBLE AT VANCOUVER AND CALGARY, 1941

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	°
Feb. 9	λ Gem	3.6	I	13.0	4 19.3	0.0	−1.1	75	Low	—	—	—
Mar. 21	ρ Sgr	4.0	I	23.5	4 37.8	−1.1	+1.4	79	5 51.2	−1.3	+1.2	74
Apr. 1†	α Tau	1.1	I	5.2	18 34.4	−1.3	−2.0	111	19 41.7	−1.0	−1.8	103
" "	" "	"	E	"	19 43.8	−1.0	−0.5	241	20 50.6	−0.7	−1.0	251
" 4	λ Gem	3.6	I	8.4	22 28.5	−0.9	−1.2	79	23 33.9	−0.7	−1.0	68
" 7	π Leo	4.9	I	11.4	No occ.	—	—	—	23 49.5	—	—	182
" 14	θ Lib	4.3	I	17.5	Low	—	—	—	0 14.9	−0.7	+0.2	131
" "	" "	"	E		0 01.3	−1.4	+1.7	247	1 15.9	−1.4	+1.0	259
May 4	ο Leo	3.8	I	8.7	22 33.9	−1.1	−0.9	69	23 42.2	−1.0	−0.7	55
June 7	θ Lib	4.3	I	13.0	20 33.4	−0.9	+0.4	120	21 43.3	−1.1	+0.4	109
Aug. 16	+15° 637	4.8	E	23.1	0 53.5	−0.3	+0.6	308	1 58.0	−0.5	+0.9	302
" "	α Tau	1.1	I	23.2	3 07.0	+0.3	+4.0	15	4 11.8	−0.2	+3.6	24
" "	" "	"	E	"	3 41.7	—	—	318	4 57.6	−1.9	−0.4	309
Sept. 12	ν Tau	3.9	I	20.7	3 31.2	−2.1	−0.6	121	4 49.0	−2.1	−1.4	125
" "	" "	"	E	"	4 31.2	−1.2	+2.9	211	5 47.0	−1.4	+2.7	211
Oct. 6	ξ^1 Cet	4.5	E	16.0	Low	—	—	—	20 12.8	−0.1	+1.9	243
Nov. 5	θ^1 Tau	4.0	I	16.7	21 02.2	−0.8	+0.8	119	22 12.5	−1.3	+0.3	126
" "	" "	"	E	"	21 51.8	−0.2	+3.0	212	22 58.5	−0.3	+3.4	205
" 5-6	+15° 637	4.8	E	"	23 19.2	−1.1	+2.0	241	0 32.4	−1.3	+1.9	237
" 6	α Tau	1.1	I	16.8	1 40.0	−1.8	+0.2	86	2 56.0	−1.7	−0.2	85
" "	" "	"	E	"	3 05.7	−1.7	−0.1	255	4 18.9	−1.4	−0.7	260

*Immersion or Emersion.

†Daytime occultations of the first magnitude star, α Tauri, have been included.

METEORS OR SHOOTING STARS

By PETER M. MILLMAN

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

In addition to the so-called sporadic meteors there are well-marked groups of meteors which travel in elliptical orbits about the sun and appear at certain seasons of the year. The meteors of any one group, or shower, move along parallel paths and hence, owing to the laws of perspective, seem to radiate from a point in the sky known as the radiant. The shower is usually named after the constellation in which the radiant is located. The following table lists the chief meteoric showers of the year. The material was collected from different sources, including the publications of Denning and Olivier.

The Chief Annual Meteor Showers for the Northern Hemisphere.

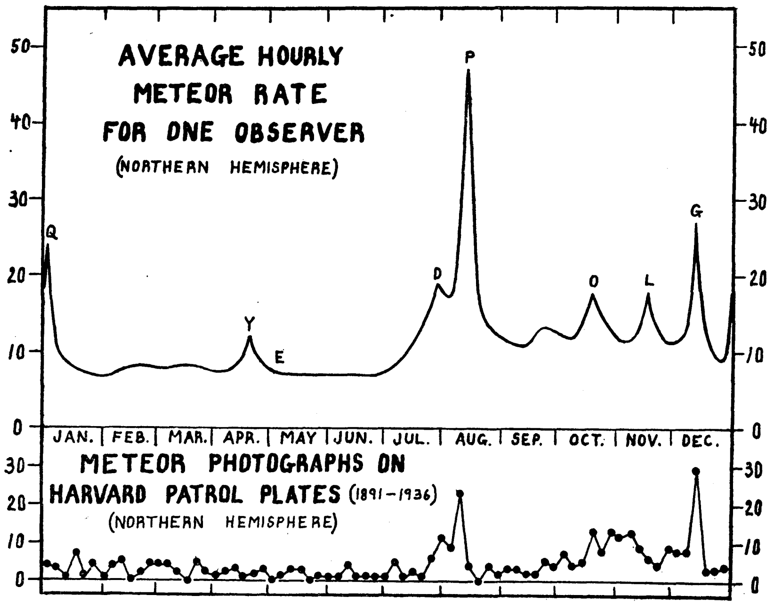
Shower	Approx. Radiant α	Approx. Radiant δ	Maximum Date	Hourly No. (all meteors)	Duration (in days)	Abbre-viation
Quadrantids	232°	+52°	Jan. 3	20	4	Q
Lyrids	280	+37	Apr. 21	10	4	Y
Eta Aquarids	336	− 1	May 4	10	8	E
Delta Aquarids	340	−17	July 28	20	3	D
Perseids	47	+57	Aug. 12	50	25	P
Orionids	96	+15	Oct. 22	20	14	O
Leonids	152	+22	Nov. 16	20	14	L
Geminids	110	+33	Dec. 12	30	14	G

The date of maximum given above applies to either morning or evening and is approximate only, as local irregularities in the showers in addition to the effect of leap year may shift it by a day or more. With the exception of the Geminids, all the showers listed are most active well after midnight. It should be noted that large numbers of meteors appeared on June 28, 1916, and on Oct. 9, 1933, and there is the possibility of a return of these showers.

A meteor observer should make as complete a record as he can with efficiency. The most important information to note includes the number of meteors per hour, their magnitudes and positions in the sky, evidences of enduring trains and, where several stations are co-operating, the exact time of the appearance of each meteor. Magnitudes of meteors are generally determined by comparison with stars and the positions of meteor trails may most conveniently be recorded by plotting them as straight lines on gnomonic star maps. The observer should also make sure that the record sheet contains his name, the exact place of observation, the night when the observations were made given as a double date (e.g. the evening of May 4 or the morning of May 5 would be recorded as May 4-5), and finally, a note on the weather conditions.

The first curve shown in the figure below gives the expected hourly rate of meteors for a single observer at different times of the year. It has been drawn from data published by Denning, Olivier, and Hoffmeister. This curve varies somewhat from year to year. The corresponding curve for the southern hemisphere, which is not plotted, lacks the high maximum at P, has its highest maxima at E and D, and best general rates from April through July.

The second curve gives the number of meteor photographs found on all Harvard patrol plates up to Oct. 15, 1936, for each five-day interval throughout the year, taken from a catalogue of meteor photographs published by Miss Hoffleit. Since these plates were exposed on a uniform system the curve gives some indication of the favourable periods for meteor photography. The high photographic efficiency of the Geminid shower is a marked feature.



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

For more complete instructions concerning the visual observation of meteors see the JOURNAL of the Royal Astronomical Society of Canada, vol. 31, p. 255, 1937; and for meteor photography volume 31, p. 295, 1937.

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	$10^h 15^m$±	1.2	.63?	0±
Uranus	♅	31,000	14.6	1.3	$10^h.8$±	.9	.63?	+ 5.7
Neptune	♆	33,000	17.2	1.3	16^h ?	1.0	.73?	+ 7.6
Pluto	♇	4,000?	< .1					+ 14

SATELLITES OF THE SOLAR SYSTEM

Name	Stellar 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.

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

VARIABLE STARS

By FRANK S. HOGG

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

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

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

1941 maxima of bright variable stars (E.S.T.)

o Ceti *June. 25*	β Lyr *Jan. 11.0, 23.9, etc.*
δ Cep *Jan. 0.7, 6.1, etc.*	R Sct *May. 7, Sept. 25*
χ Cyg *Nov. 17*	β Per (*See pp. 27-41*)

REPRESENTATIVE BRIGHT VARIABLE STARS

Name	Design.	Max.	Min.	Sp.	Period	Type	Date	Discoverer
η Aql	194700	3.7	4.4	G4	7.17652	VIII	1784	Pigott
N Aql	184300	-0.2	10.9	Q	Irr.	I	1918	Bower
ε Aur	045443	3.3	4.1	F5p	9833.	X	1821	Fritsch
δ Cep	222557	3.6	4.3	G0	5.36640	VIII	1784	Goodricke
U Cep	005381	6.8	9.2	A0	2.49293	X	1880	W. Ceraski
o Cet[1]	0214*03*	2.0	10.1	M5e	331.8	V	1596	Fabricius
RR Cet	012700	8.4	9.0	F0	0.55304	IX	1906	Oppolzer
R CrB	154428	5.8	13.8	cG0e	Irr.	III	1795	Pigott
χ Cyg	194632	4.2	14.0	M7e	412.9	V	1686	Kirch
P Cyg	201437a	3.5	6.0	B1qk	Irr.	II	1600	Blaeu
SS Cyg	213843	8.1	12.0	Pec.	Irr.	IV	1896	Wells
XX Cyg	200158	11.4	12.1	A	0.13486	IX	1904	L. Ceraski
ζ Gem	065820	3.7	4.1	cG1	10.15353	VII	1847	Schmidt
η Gem	060822	3.3	4.2	M2	235.58	V	1865	Schmidt
R Gem	070122a	6.5	14.3	Se	370.1	V	1848	Hind
U Gem	074922	8.8	13.8	Pec.	Irr.	IV	1855	Hind
α Her	171014	3.1	3.9	M5	Irr.	VI	1795	W. Herschel
R Hya	1324*22*	3.5	10.1	M7e	414.7	V	1670	Montanari
R Leo	094211	5.0	10.5	M7e	310.3	V	1782	Koch
β Lyr	184633	3.4	4.3	B5e	12.92504	X	1784	Goodricke
RR Lyr	192242	7.2	8.0	A5	0.56685	IX	1901	Fleming
α Ori[2]	054907	0.2	1.2	M2	2070. Irr.	VI	1840	J. Herschel
U Ori	054920	5.4	12.2	M7e	376.9	V	1885	Gore
β Per[3]	030140	2.3	3.5	B8	2.86731	X	1669	Montanari
ρ Per	025838	3.3	4.1	M4	Irr.	VI	1854	Schmidt
R Sge	200916	8.6	10.4	cG7	70.84	VII	1859	Baxendell
R Sct	1842*05*	4.5	9.0	K5e	141.5	VII	1795	Pigott
λ Tau	035512	3.8	4.1	B3	3.95294	X	1848	Baxendell
RV Tau	044126	9.4	12.5	K0	78.60	VII	1905	L. Ceraski
SU Tau	054319	9.5	15.4	G0e	Irr.	III	1908	Cannon
α UMi[4]	012288	2.3	2.4	cF7	3.96858	VIII	1911	Hertzsprung
N Her	180445	1.5	14.0	Q	Irr.	I	1934	Prentice
N Lac	221255	2.2	—	Q	Irr.	I	1936	Peltier

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

Most of the data in this Table are from Prager's 1936 *Katalog und Ephemeriden Veränderlicher Sterne*. The stars are arranged alphabetically in order of constellations. The second column, the Harvard designation, gives the 1900 position of the star. The first four figures of the designation give the hour and minute of right ascension, the last two the declination in degrees, italicised for stars south of the equator. Thus the position of the fourth star of the list, δ Cephei, is R.A. 22h 25m, Dec. +57 , (222557). The remaining columns give the maximum and minimum magnitudes, spectral class, the period in days and decimals of a day, the classification on Ludendorff's system, and the discoverer and date. In the case of eclipsing stars, the spectrum is that of the brighter component.

THE DISTANCES OF THE STARS

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

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

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

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

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

THE SUN'S NEIGHBOURS

By J. A. PEARCE

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

Star	α(1900)δ		Sp	μ	π	L.y.	m	M	L
	h m	° ′		″	″				
Sun...........	.....	....	G0				−26.7	4.8	1.0
Groom 34A....	0 13	+43 27	M2	2.89	0.274	11.9	8.1	10.3	.0063
Groom 34B....	.....	....	M5	2.85	.271	12.1	10.7	12.9	.0006
van Maanen...	0 44	+ 4 55	F3	3.01	.242	13.5	12.3	14.2	.0002
τCeti..........	1 39	−16 28	G7	1.92	.292	11.2	3.6	5.9	.36
εEri...........	3 28	− 9 48	K1	0.96	.304	10.7	3.8	6.2	.28
40 Eri A.......	4 11	− 7 49	K0	4.08	.213	15.3	4.5	6.1	.30
40 Eri B.......	.....	....	A0	4.03	.213	15.3	9.7	11.3	.0025
40 Eri C.......	.....	....	M6	4.03	.213	15.3	10.8	12.4	.0009
Gould 5h 243...	5 08	−44 59	M0	8.70	.264	12.3	9.2	11.3	.0025
αCMa A.......	6 41	−16 35	A2	1.32	.373	8.7	− 1.6	1.3	25.1
αCMa B.......	.....	....	F0	1.32	.373	8.7	8.4	11.3	.0025
αCMi A.......	7 34	+ 5 29	F4	1.24	.303	10.8	0.5	2.9	5.8
αCMi B.......	.....	....	.....	1.24	.303	10.8	12.5	14.9	.00009
Groom 1618....	10 05	+49 58	M0	1.45	.230	14.2	6.8	8.6	.030
WB 10h 234....	10 14	+20 22	M4e	0.49	.217	15.0	9.0	10.7	.0044
Wolf 359......	10 52	+ 7 36	M6e	4.84	.413	7.9	13.5	16.6	.00002
Lal 21185......	10 58	+36 38	M2	4.78	.381	8.6	7.6	10.5	.0052
Innes..........	11 12	−57 02	.....	2.69	.339	9.6	(12.5)	13.2	.0004
αCen A........	14 33	−60 25	G5	3.68	.758	4.3	0.3	4.7	1.10
αCen B........	.....	....	K1	3.68	.758	4.3	1.7	6.1	.30
Prox. Cen......	14 23	−62 15	M	3.85	.758	4.3	11.0	15.4	.00006
DM−12.4523 .	16 25	−12 24	M5	1.24	.270	12.1	9.5	11.7	.0017
DM−46.11540	17 21	−46	.....	1.06	.239	13.6	9.4	11.3	.0025
CD−44.11909 .	17 30	−44	.....	1.14	.215	15.2	(12.9)	12.6	.0008
AO 17415......	17 37	+68 26	M4	1.33	.214	15.2	9.1	10.7	.0044
Barnard.......	17 53	+ 4 25	M5	10.30	.541	6.0	9.7	13.4	.0004
Bu 8798A......	18 42	+59 29	M4	2.31	290	11.2	9.2	11.5	.0021
Bu 8798B......	.....	....	M5	2.31	290	11.2	9.7	12.0	.0013
αAqu..........	19 46	+ 8 36	A2	0.66	.207	15.7	0.9	2.5	8.3
61 Cyg A.......	21 02	+38 15	K8	5.27	.301	10.8	5.6	8.0	.052
61 Cyg B......	.....	....	M0	5.15	.301	10.8	6.3	8.7	.028
Lac 8760.......	21 11	−39 15	M1	3.53	.255	12.8	6.6	8.6	.030
εIndi..........	21 56	−57 12	K8	4.70	.288	11.3	4.7	7.0	.13
Kruger 60A....	22 24	+57 12	M3	0.87	.247	13.2	9.2	11.2	.0028
Kruger 60B....	.....	....	M4	0.92	.247	13.2	10.8	12.8	.0006
BD+43.4305..	22 42	+43 49	M5e	0.86	.217	15.0	9.5	11.2	.0028
Lac 9352......	22 59	−36 26	M2	6.90	.274	11.9	7.4	9.6	.012
Ross 248.......	23 36	+43	M6	1.82	.319	10.2	(13.8)	14.3	.0002
DM−37.15492.	23 59	−37 51	M3	6.11	.217	15.0	8.3	10.0	.0083

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

THE BRIGHTEST STARS

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

By W. E. Harper

The accompanying table contains the principal facts regarding 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.

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*
‖o 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*
α¹ Cruc........	21	−62 33	1.6	B1	.048	.022	148	−1.7	−12.2*
α² 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*
||α² 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
||ζ¹ 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.	Red. 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.	Red. 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*
‖β¹ Cygn.......	27	+27 45	3.2	K0	.010	.010	326	−1.8	−23.9*
γ Aqil........	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 AND NEBULAE

Prepared by J. F. HEARD

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

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

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

MESSIER'S CATALOGUE OF CLUSTERS AND NEBULAE

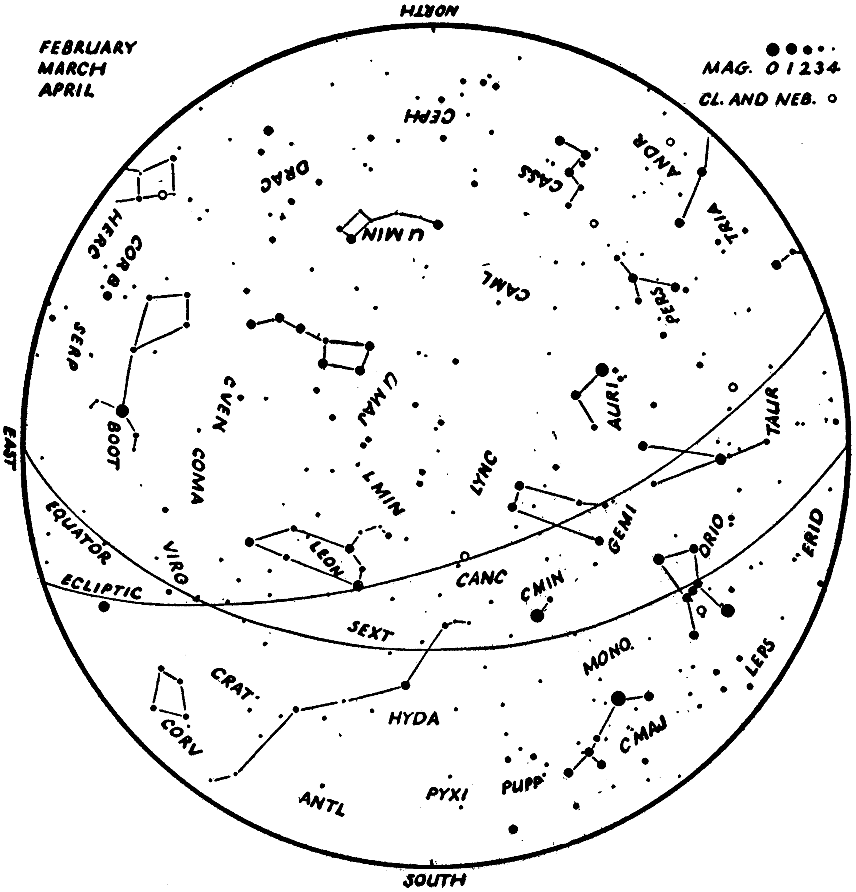
Messier	N.G.C.	R.A. (1900)	Dec. (1900)	Type of Object	Remarks
		h m	° ′		
1	1952	5 28.5	+21 57	Diffuse nebula	The Crab nebula in Taurus
2	7089	21 28.3	− 1 16	Globular cluster	
3	5272	13 37.6	+28 53	Globular cluster	
4	6121	16 17.5	−26 17	Globular cluster	
5	5904	15 13.5	+ 2 27	Globular cluster	
6	6405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

MESSIER'S CATALOGUE OF CLUSTERS AND NEBULAE—*continued*

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

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

STAR MAP I

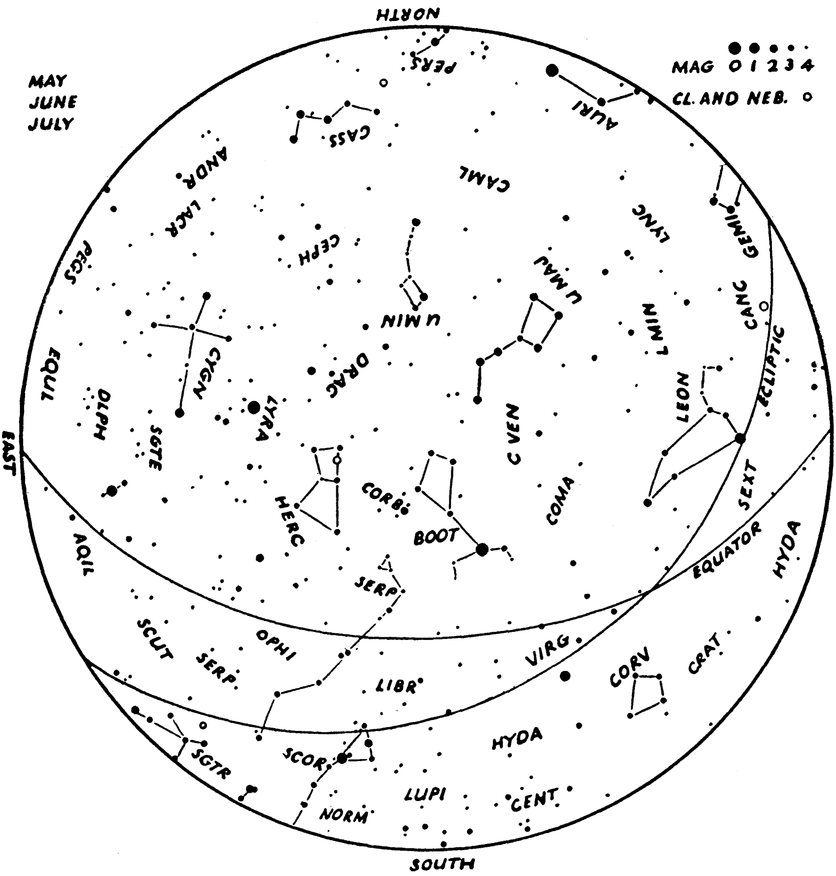


The above map represents the evening sky at

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

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

STAR MAP 2

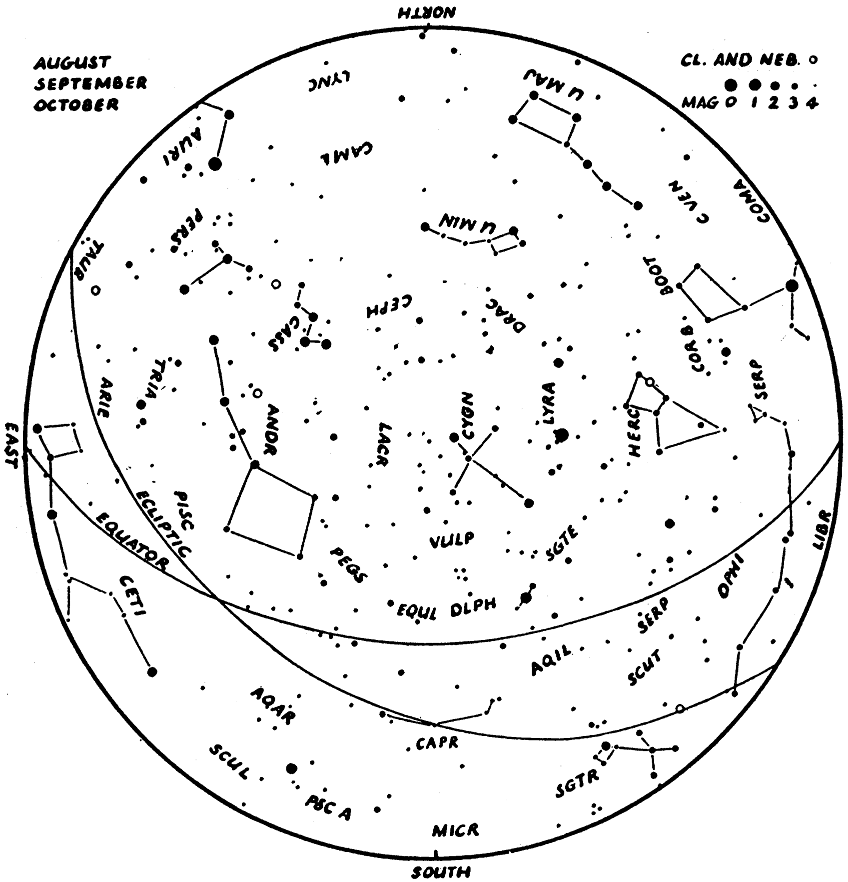


The above map represents the evening sky at

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

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

STAR MAP 3

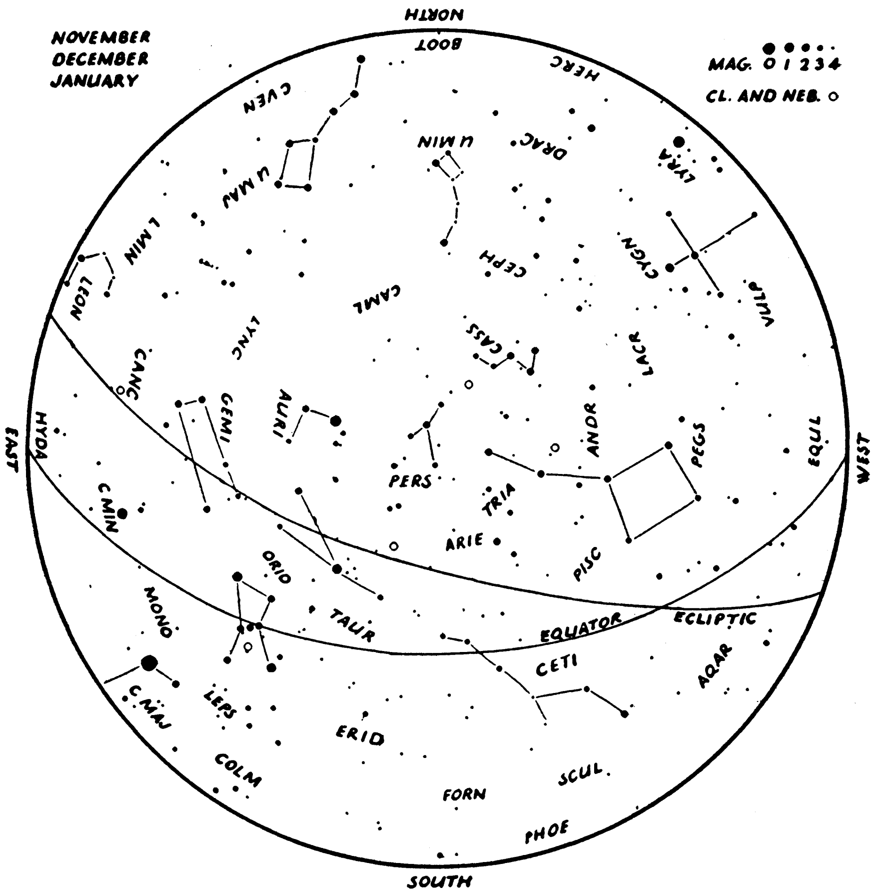


The above map represents the evening sky at

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

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

STAR MAP 4



The above map represents the evening sky at

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

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

CHIEF STARS USED IN AERIAL NAVIGATION

No.	Name	Pronunciation	Constellation Name	Mag.	R.A. h	m	1900 Dec.	°	′
1	Achernar	ā'ker-när	α Eridani	0.6	01	34	S	57	44
2	Acrux	ă'krŭks	α Crucis	1.1	12	21	S	62	33
3	Aldebaran	ăl-dĕb'ä-răn	α Tauri	1.1	04	30	N	16	18
4	Alpheratz	ăl-fē'răts	α Andromedae	2.2	00	03	N	28	32
5	Altair	ăl-tä'ĭr	α Aquilae	0.9	19	46	N	08	36
6	Antares	ăn-ta'rēz	α Scorpii	1.2	16	23	S	26	12
7	Arcturus	ärk-tŭ'rŭs	α Bootis	0.2	14	11	N	19	42
8	Betelgeuse	bĕt-ël-gûz'	α Orionis	0.8*	05	50	N	07	23
9	Canopus	ka-nō'-pûs	α Argus	−0.9	06	22	S	52	38
10	Capella	kä-pĕl'ä	α Aurigae	0.2	05	09	N	45	54
11	Deneb	dĕn'ĕb	α Cygni	1.3	20	38	N	44	55
12	Dubhe	dōōb'hĕ	α Ursae Majoris	2.0	10	58	N	62	17
13	Fomalhaut	fō'măl-hôt	α Piscis Australis	1.3	23	52	S	30	09
14	Peacock	pē'kŏk	α Pavonis	2.1	20	18	S	57	03
15	Pollux	pŏl'ŭks	β Gemini	1.2	07	39	N	28	16
16	Procyon	prō'sĭ-ŏn	α Canis Minoris	0.5	07	34	N	05	29
17	Regulus	rĕg'ū-lūs	α Leonis	1.3	10	03	N	12	27
18	Rigel	rī'gĕl, rī'jĕl	β Orionis	0.3	05	10	S	08	19
19	Rigil Kent.	r. kĕn-tô'rŭs	α Centauri	0.1	14	33	S	60	25
20	Sirius	sĭr'ĭ-ŭs	α Canis Majoris	−1.6	06	41	S	16	35
21	Spica	spī'kä	α Virginis	1.2	13	20	S	10	38
22	Vega	vē'gä	α Lyrae	0.1	18	34	N	38	41
47	Polaris	pō-lā'rĭs	α Ursae Minoris	2.3	01	23	N	88	46

*No. 8. Magnitude varies from 0.5 to 1.1

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	....	ô " orb	û " urn
....	....	....	ōō " food	....

Temperature and Precipitation at Canadian and United States Stations

Prepared by Andrew Thomson.

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

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.

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