THE OBSERVER'S HANDBOOK 1958

Fiftieth Year of Publication

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

Price 75 cents

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

Incorporated 1890 — Royal Charter 1903

The National Headquarters of the Royal Astronomical Society of Canada, seen above, is located at 252 College Street, Toronto 2B, Ontario. The business office of the Society, reading rooms and astronomical library, are housed here, as well as a large room for the accommodation of telescope making groups.

Membership in the Society is open to anyone interested in astronomy. Applicants may affiliate with one of the Society's thirteen centres across Canada, or may join the National Society. Centres of the Society are established in Halifax, Quebec, Montreal, Ottawa, Hamilton, London, Windsor, Winnipeg, Edmonton, Vancouver, Victoria, and Toronto. Addresses of the Centres' secretaries may be obtained from the National Headquarters.

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EDITOR
RUTH J. NORTHCOTT

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THE ROYAL ASTRONOMICAL SOCIETY
OF CANADA

252 COLLEGE STREET, TORONTO 2B, ONTARIO

CONTENTS

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CLARENCE AUGUSTUS CHANT, 1865–1956

Since the last issue of the Observer's Handbook went to press death has claimed Dr. C. A. Chant who conceived the Handbook in the year 1907 and who edited it continuously for fifty years.

ACKNOWLEDGEMENTS

The Observer's Handbook for 1958 is the 50th and largest yet published. In preparing this volume the Editor has had invaluable assistance with the manuscript and the proof. For the expenditure of much time and effort our cordial thanks are offered to Gustav Bakos, Barbara Gaizauskas, Charles M. Good, James Hogg, Helge Mairo, Kulli Milles, Donald Morton, Isabel K. Williamson and Dorothy Yane. Special thanks are due Margaret W. Mayall, A.A.V.S.O. Director, for the predictions of times of maxima of the long-period variables.

Our deep indebtedness to the British *Nautical Almanac* and the *American Ephemeris* is thankfully acknowledged.

RUTH J. NORTHCOTT

ANNIVERSARIES AND FESTIVALS, 1958

New Year's Day	Wed.	Jan. 1
Epiphany	Mon.	Jan. 6
Septuagesima Sunday		Feb. 2
Accession of Queen Elizabeth (1952)	Thu.	Feb. 6
Quinquagesima (Shrove Sunday)		Feb. 16
Ash Wednesday		Feb. 19
St. David	Sat.	Mar. 1
St. Patrick	Mon.	Mar. 17
Palm Sunday		Mar. 30
Good Friday		Apr. 4
Easter Sunday		Apr. 6
Birthday of Queen Elizabeth (1926)	Mon.	Apr. 21
St. George	Wed.	Apr. 23
Rogation Sunday		May 11
Ascension Day	Thu.	May 15
Empire Day (Victoria Day)	Mon.	May 19
Pentecost (Whit Sunday)		May 25
Trinity Sunday		June 1
Corpus Christi	Thu.	June 5
St. John Baptist (Midsummer Day)	Tue.	June 24
Dominion Day	Tue.	July 1
Birthday of Queen Mother Elizabeth (1900)	Mon.	Aug. 4
Labour Day	Mon.	Sept. 1
Hebrew New Year (Rosh Hashanah)	Mon.	Sept. 15
St. Michael (Michaelmas Day)	Mon.	Sept. 29
Thanksgiving Day	Mon.	Oct. 13
All Saints' Day	Sat.	Nov. 1
Remembrance Day	Tue.	Nov. 11
St. Andrew	Sun.	Nov. 30
First Sunday in Advent		Nov. 30
Christmas Day	Thu.	Dec. 25

SYMBOLS AND ABBREVIATIONS

SUN, MOON AND PLANETS

☉ The Sun	☾ The Moon generally	♃ Jupiter
🌑 New Moon	☿ Mercury	♄ Saturn
🌕 Full Moon	♀ Venus	♅ 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 R.A., Right Ascension; δ or Dec., Declination.
h, m, s, Hours, Minutes, Seconds of Time.
° ′ ″, Degrees, Minutes, Seconds of Arc.

SIGNS OF THE ZODIAC

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

THE GREEK ALPHABET

Α, α	Alpha	Ι, ι	Iota	Ρ, ρ	Rho
Β, β	Beta	Κ, κ	Kappa	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, o	Omicron	Ψ, ψ	Psi
Θ, θ, ϑ	Theta	Π, π	Pi	Ω, ω	Omega

THE CONFIGURATIONS OF JUPITER'S SATELLITES

In the Configurations of Jupiter's Satellites (pages 33, 35, etc.), O represents the disk of the planet, d signifies that the satellite is on the disk, * signifies that the satellite is behind the disk or in the shadow. Configurations are for an inverting telescope.

CALCULATIONS FOR ALGOL

The calculations for the minima of Algol are based on the epoch J.D. 2434576.5110 and period 2.86731 days as published in the 1954 International Supplement, Kracow Observatory.

CELESTIAL DISTANCES

Celestial distances given herein are based on the standard value of 8.80″ for the sun's parallax, not the more recent value 8.790″ determined by Sir Harold Spencer Jones.

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*	Sco	Scor
Sculptor, *Sculptor*	Scl	Scul
Scutum, *Shield*	Sct	Scut
Serpens, *Serpent*	Ser	Serp
Sextans, *Sextant*	Sex	Sext
Taurus, *Bull*	Tau	Taur
Telescopium, *Telescope*	Tel	Tele
Triangulum, *Triangle*	Tri	Tria
Triangulum Australe, *Southern Triangle*	TrA	TrAu
Tucana, *Toucan*	Tuc	Tucn
Ursa Major, *Greater Bear*	UMa	UMaj
Ursa Minor, *Lesser Bear*	UMi	UMin
Vela, *Sails*	Vel	Velr
Virgo, *Virgin*	Vir	Virg
Volans, *Flying Fish*	Vol	Voln
Vulpecula, *Fox*	Vul	Vulp

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

MISCELLANEOUS ASTRONOMICAL DATA

UNITS OF LENGTH

1 Angstrom unit $= 10^{-8}$ cm.

1 micron $= 10^{-4}$ cm.

1 meter $= 10^{2}$ cm. $=$ 3.28084 feet

1 kilometer $= 10^{5}$ cm. $=$ 0.62137 miles

1 mile $= 1.60935 \times 10^{5}$ cm. $=$ 1.60935 km.

1 astronomical unit $= 1.49504 \times 10^{13}$ cm. $=$ 92,897,416 miles

1 light year $= 9.463 \times 10^{17}$ cm. $= 5.880 \times 10^{12}$ miles $=$ 0.3069 parsecs

1 parsec $= 30.84 \times 10^{17}$ cm. $= 19.16 \times 10^{12}$ miles $=$ 3.259 l.y.

1 megaparsec $= 30.84 \times 10^{23}$ cm. $= 19.16 \times 10^{18}$ miles $= 3.259 \times 10^{6}$ l.y.

UNITS OF TIME

Sidereal day $=$ 23*h* 56*m* 04.09*s* of mean solar time

Mean solar day $=$ 24*h* 03*m* 56.56*s* of sidereal time

Synodical month $=$ 29*d* 12*h* 44*m*; sidereal month $=$ 27*d* 07*h* 43*m*

Tropical year (ordinary) $=$ 365*d* 05*h* 48*m* 46*s*

Sidereal year $=$ 365*d* 06*h* 09*m* 10*s*

Eclipse year $=$ 346*d* 14*h* 53*m*

THE EARTH

Equatorial radius, a $=$ 3963.35 miles; flattening, c $= (a-b)/a = 1/297.0$

Polar radius, b $=$ 3950.01 miles

1° of latitude $= 69.057 - 0.349 \cos 2\phi$ miles (at latitude ϕ)

1° of longitude $= 69.232 \cos \phi - 0.0584 \cos 3\phi$ miles

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

EARTH'S ORBITAL MOTION

Solar parallax $=$ 8.″80; constant of aberration $=$ 20.″47

Annual general precession $=$ 50.″26; obliquity of ecliptic $=$ 23° 26′ 50″ (1939)

Orbital velocity $=$ 18.5 miles/sec.; parabolic velocity at $\oplus$ $=$ 26.2 miles/sec.

SOLAR MOTION

Solar apex, R.A. 18*h* 04*m*; Dec. + 31°

Solar velocity $=$ 12.2 miles/sec.

THE GALACTIC SYSTEM

North pole of galactic plane R.A. 12*h* 40*m*, Dec. + 28° (1900)

Centre, 325° galactic longitude, $=$ R.A. 17*h* 24*m*, Dec. −30°

Distance to centre $=$ 10,000 parsecs; diameter $=$ 30,000 parsecs.

Rotational velocity (at sun) $=$ 262 km./sec.

Rotational period (at sun) $= 2.2 \times 10^{8}$ years

Mass $= 2 \times 10^{11}$ solar masses

EXTRA-GALACTIC NEBULAE

Red shift $= +180$ km./sec./megaparsec $= +34$ 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 $= 3 \times 10^{-6}$ meter candles

Total energy emitted by a star of zero absolute magnitude $= 5 \times 10^{25}$ horsepower

MISCELLANEOUS

Constant of gravitation, $G = 6.670 \times 10^{-8}$ c.g.s. units

Mass of the electron, $m = 9.1055 \times 10^{-28}$ gm.; mass of the proton $= 1.6725 \times 10^{-24}$ gm.

Planck's constant, $h = 6.6234 \times 10^{-27}$ erg. sec.

Loschmidt's number $= 2.6873 \times 10^{19}$ molecules/cu. cm. of gas at N.T.P.

Absolute temperature $= T^\circ \text{K} = T^\circ\text{C} + 273^\circ = 5/9\,(T^\circ \text{F} + 459^\circ)$

1 radian $=$ 57°.2958 $\qquad \pi =$ 3.141,592,653,6

$=$ 3437′.75 $\qquad$ No. of square degrees in the sky

$=$ 206,265″ $\qquad =$ 41,253

1958 EPHEMERIS OF THE SUN AT 0h GREENWICH CIVIL TIME

Date 1958	Apparent R.A.	Corr. to Sun-dial	Apparent Dec.
	h m s	m s	° ′
Jan. 1	18 43 50	+ 3 16	−23 03.6
4	18 57 03	+ 4 40	−22 47.7
7	19 10 13	+ 6 00	−22 27.7
10	19 23 19	+ 7 16	−22 03.7
13	19 36 20	+ 8 28	−21 35.8
16	19 49 16	+ 9 34	−21 04.2
19	20 02 05	+10 34	−20 28.9
22	20 14 49	+11 27	−19 50.2
25	20 27 25	+12 14	−19 08.1
28	20 39 54	+12 53	−18 22.9
31	20 52 15	+13 25	−17 34.7
Feb. 3	21 04 29	+13 49	−16 43.7
6	21 16 36	+14 06	−15 50.1
9	21 28 35	+14 16	−14 54.0
12	21 40 28	+14 19	−13 55.7
15	21 52 14	+14 15	−12 55.3
18	22 03 53	+14 05	−11 52.9
21	22 15 26	+13 48	−10 48.9
24	22 26 53	+13 26	− 9 43.4
27	22 38 15	+12 58	− 8 36.6
Mar. 2	22 49 31	+12 24	− 7 28.7
5	23 00 43	+11 46	− 6 19.8
8	23 11 51	+11 04	− 5 10.1
11	23 22 55	+10 19	− 3 59.8
14	23 33 56	+ 9 31	− 2 49.0
17	23 44 55	+ 8 40	− 1 38.0
20	23 55 53	+ 7 48	− 0 26.8
23	0 06 49	+ 6 54	+ 0 44.3
26	0 17 44	+ 6 00	+ 1 55.2
29	0 28 39	+ 5 05	+ 3 05.7
Apr. 1	0 39 34	+ 4 11	+ 4 15.6
4	0 50 30	+ 3 17	+ 5 24.8
7	1 01 27	+ 2 24	+ 6 33.2
10	1 12 26	+ 1 34	+ 7 40.6
13	1 23 28	+ 0 46	+ 8 46.8
16	1 34 32	+ 0 01	+ 9 51.7
19	1 45 40	− 0 41	+10 55.2
22	1 56 52	− 1 19	+11 57.0
25	2 08 07	− 1 54	+12 57.1
28	2 19 26	− 2 24	+13 55.2
May 1	2 30 50	− 2 50	+14 51.3
4	2 42 19	− 3 11	+15 45.1
7	2 53 52	− 3 27	+16 36.6
10	3 05 31	− 3 38	+17 25.6
13	3 17 15	− 3 44	+18 12.1
16	3 29 04	− 3 44	+18 55.7
19	3 40 59	− 3 39	+19 36.5
22	3 52 58	− 3 30	+20 14.3
25	4 05 02	− 3 15	+20 49.0
28	4 17 11	− 2 56	+21 20.4
31	4 29 23	− 2 34	+21 48.6
June 3	4 41 39	− 2 07	+22 13.3
6	4 53 59	− 1 37	+22 34.5
9	5 06 22	− 1 04	+22 52.2
12	5 18 47	− 0 28	+23 06.2
15	5 31 14	+ 0 09	+23 16.6
18	5 43 43	+ 0 48	+23 23.4
21	5 56 12	+ 1 27	+23 26.4
24	6 08 40	+ 2 06	+23 25.6
27	6 21 08	+ 2 45	+23 21.2
30	6 33 35	+ 3 21	+23 13.1

Date 1958	Apparent R.A.	Corr. to Sun-dial	Apparent Dec.
	h m s	m s	° ′
July 3	6 45 59	+ 3 56	+23 01.3
6	6 58 21	+ 4 28	+22 45.9
9	7 10 40	+ 4 57	+22 26.9
12	7 22 55	+ 5 23	+22 04.5
15	7 35 07	+ 5 45	+21 38.6
18	7 47 14	+ 6 03	+21 09.4
21	7 59 17	+ 6 16	+20 37.0
24	8 11 14	+ 6 23	+20 01.4
27	8 23 06	+ 6 26	+19 22.9
30	8 34 52	+ 6 22	+18 41.5
Aug. 2	8 46 33	+ 6 14	+17 57.3
5	8 58 09	+ 6 00	+17 10.5
8	9 09 39	+ 5 40	+16 21.2
11	9 21 04	+ 5 16	+15 29.5
14	9 32 24	+ 4 46	+14 35.5
17	9 43 40	+ 4 12	+13 39.5
20	9 54 50	+ 3 33	+12 41.5
23	10 05 56	+ 2 49	+11 41.7
26	10 16 58	+ 2 01	+10 40.3
29	10 27 56	+ 1 09	+ 9 37.4
Sept. 1	10 38 51	+ 0 15	+ 8 33.0
4	10 49 43	− 0 43	+ 7 27.4
7	11 00 33	− 1 43	+ 6 20.8
10	11 11 21	− 2 44	+ 5 13.2
13	11 22 08	− 3 47	+ 4 04.7
16	11 32 55	− 4 50	+ 2 55.6
19	11 43 40	− 5 54	+ 1 46.1
22	11 54 26	− 6 58	+ 0 36.2
25	12 05 13	− 8 01	− 0 33.9
28	12 16 01	− 9 02	− 1 44.0
Oct. 1	12 26 51	−10 02	− 2 54.1
4	12 37 43	−11 00	− 4 03.8
7	12 48 38	−11 54	− 5 13.1
10	12 59 38	−12 44	− 6 21.9
13	13 10 41	−13 31	− 7 29.9
16	13 21 49	−14 12	− 8 37.0
19	13 33 02	−14 49	− 9 43.0
22	13 44 20	−15 20	−10 47.6
25	13 55 44	−15 46	−11 50.9
28	14 07 15	−16 05	−12 52.5
31	14 18 52	−16 18	−13 52.3
Nov. 3	14 30 36	−16 23	−14 50.1
6	14 42 28	−16 21	−15 45.8
9	14 54 27	−16 12	−16 39.1
12	15 06 34	−15 54	−17 29.9
15	15 18 49	−15 29	−18 18.0
18	15 31 11	−14 57	−19 03.2
21	15 43 40	−14 17	−19 45.3
24	15 56 17	−13 30	−20 24.2
27	16 09 00	−12 36	−20 59.6
30	16 21 50	−11 36	−21 31.6
Dec. 3	16 34 47	−10 29	−21 59.9
6	16 47 49	− 9 17	−22 24.3
9	17 00 56	− 7 59	−22 44.9
12	17 14 07	− 6 38	−23 01.4
15	17 27 22	− 5 13	−23 13.8
18	17 40 39	− 3 45	−23 22.0
21	17 53 57	− 2 16	−23 26.1
24	18 07 16	− 0 47	−23 25.9
27	18 20 35	+ 0 42	−23 21.5
30	18 33 53	+ 2 10	−23 12.8

PRINCIPAL ELEMENTS OF THE SOLAR SYSTEM

ORBITAL ELEMENTS (1954, Dec. 31, 12^h G.C.T.)

Planet	Mean Distance from Sun (a) $\oplus = 1$	Mean Distance from Sun (a) millions of miles	Period of Revolution Sidereal (P)	Period of Revolution Mean Synodic	Eccentricity (e)	Inclination (i)	Long. of Node (☊)	Long. of Perihelion (π)	Mean Long. of Planet
				days		°	°	°	°
Mercury	0.387	36.0	88.0d.	116	.206	7.0	47.8	76.8	305.8
Venus	0.723	67.2	224.7	584	.007	3.4	76.3	130.9	127.1
Earth	1.000	92.9	365.3	. . .	.017	. . . .	. . . .	102.2	99.4
Mars	1.524	141.5	687.0	780	.093	1.8	49.2	335.2	21.3
Jupiter	5.203	483.3	11.86y.	399	.048	1.3	100.0	13.6	108.0
Saturn	9.539	886.	29.46	378	.056	2.5	113.3	92.2	219.5
Uranus	19.18	1783.	84.01	370	.047	0.8	73.8	169.9	119.8
Neptune	30.06	2791.	164.8	367	.009	1.8	131.3	44.2	205.9
Pluto	39.52	3671.	248.4	367	.249	17.1	109.6	223.2	137.6

PHYSICAL ELEMENTS

Object	Symbol	Mean Diameter* miles	Mass* $\oplus = 1$	Mean Density* water = 1	Axial Rotation	Mean Surface Gravity* $\oplus = 1$	Albedo*	Magnitude at Greatest Brilliancy
Sun	☉	864,000	332,000	1.41	$24^d.7$ (equatorial)	27.9		−26.8
Moon	☾	2,160	0.0123	3.33	27^d 7.7^h	0.16	0.072	−12.6
Mercury	☿	3,010	0.0543	5.46	88^d	0.38	0.058	− 1.9
Venus	♀	7,610	0.8136	5.06	30^d?	0.88	0.76	− 4.4
Earth	⊕	7,918	1.0000	5.52	23^h $56^m.1$	1.00	0.39	
Mars	♂	4,140	0.1069	4.12	24^h $37^m.4$	0.39	0.148	− 2.8
Jupiter	♃	86,900	318.35	1.35	9^h $50^m\pm$	2.65	0.51	− 2.5
Saturn	♄	71,500	95.3	0.71	10^h $02^m\pm$	1.17	0.50	− 0.4
Uranus	⛢	29,500	14.54	1.56	$10^h.8\pm$	1.05	0.66	+ 5.7
Neptune	♆	26,800	17.2	2.47	$15^h.8\pm$	1.23	0.62	+ 7.6
Pluto	♇	3,600	0.033?	2?		0.16?	0.16	+14

*Kuiper, "The Atmospheres of the Earth and Planets," 1952.

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
XII	18	—	—		—		15?	Nicholson, 1951
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								
Miranda	17	9	81,000	1	09	56		Kuiper, 1948
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
SATELLITES OF NEPTUNE								
Triton	13	16	220,000	5	21	03	3000?	Lassell, 1846
Nereid	19	260	3,460,000	359			200?	Kuiper, 1949

*As seen from the sun.

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

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 Sun-dial*** 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. At 0h. G.C.T. the Greenwich Sidereal Time = R.A. apparent sun + 12h. — correction to sun-dial (p. 7). Sidereal time gains with respect to mean time at the rate of 3m. 56s. a day or about 2 hours a month.

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 seven standard time belts, as follows;—Newfoundland Time, 3h. 30m. slower than Greenwich; 60th meridian or Atlantic Time, 4h.; 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 11.

Daylight Saving Time is the standard time of the next zone eastward. It is adopted in many places between certain specified dates during the summer.

MAP OF STANDARD TIME ZONES

Revisions: Newfoundland Time is 3h. 30m. slower than Greenwich Time.
The "panhandle" region of Alaska, containing such towns as Juneau and Skagway, is on 120th meridian (Pacific) Time, instead of Yukon Time.

JULIAN DAY CALENDAR, 1958

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

Jan. 1..........6,205	May 1..........6,325	Sept. 1.........6,448
Feb. 1..........6,236	June 1..........6,356	Oct. 1.........6,478
Mar. 1..........6,264	July 1..........6,386	Nov. 1.........6,509
Apr. 1..........6,295	Aug. 1..........6,417	Dec. 1.........6,539

The Julian Day commences at noon. Thus J.D. 2,436,205.0 = Jan. 1.5 G.C.T.

TIMES OF RISING AND SETTING OF THE SUN AND MOON

The times of sunrise and sunset for places in latitudes ranging from 32° to 54° are given on pages 13 to 18, and of twilight on page 19. The times of moonrise and moonset are given on pages 20 to 25. The times are given in Local Mean Time, and in the table below are given corrections to change from Local Mean Time to Standard Time for the cities and towns named.

The tabulated values are computed for the sea horizon for the rising and setting of the upper limb of the sun and moon, and are corrected for refraction. Because variations from the sea horizon usually exist on land, the tabulated times can rarely be observed.

The sun's declination, apparent diameter and the equation of time do not have precisely the same values on corresponding days from year to year. As the times of sunrise and sunset depend upon these factors, these tables for the solar phenomena can give only average values which may be in error by one or two minutes.

The Standard Times for Any Station

To derive the Standard Time of rising and setting phenomena for any place, 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 Mean Time of the phenomenon for the proper latitude on the desired day. Finally apply the correction to get the Standard Time.

CANADIAN CITIES AND TOWNS						AMERICAN CITIES		
	Lat.	Cor.		Lat.	Cor.		Lat.	Cor.
Belleville	44	+ 09	Peterborough	44	+ 13	Atlanta	34	+ 37
Brandon	50	+ 40	Port Arthur	48	+ 57	Baltimore	39	+ 06
Brantford	43	+ 21	Prince Albert	53	+ 03	Birmingham	34	− 13
Calgary	51	+ 36	Prince Rupert	54	+ 41	Boston	42	− 16
Charlottetown	46	+ 13	Quebec	47	− 15	Buffalo	43	+ 15
Chatham	42	+ 29	Regina	50	− 02	Chicago	42	− 10
Cornwall	45	− 01	St. Catharines	43	+ 17	Cincinnati	39	+ 38
Dawson	64	+ 18	St. Hyacinthe	46	− 09	Cleveland	42	+ 26
Edmonton	54	+ 34	Saint John, N.B.	45	+ 24	Dallas	33	+ 27
Fort William	48	+ 57	St. John's, Nfld.	48	+ 01	Denver	40	00
Fredericton	46	+ 26	St. Thomas	43	+ 25	Detroit	42	+ 32
Galt	43	+ 21	Sarnia	43	+ 30	Fairbanks	65	− 10
Glace Bay	46	00	Saskatoon	52	+ 07	Indianapolis	40	− 15
Granby	45	− 09	Sault Ste. Marie	47	+ 37	Juneau	58	+ 58
Guelph	44	+ 21	Shawinigan Falls	47	− 09	Kansas City	39	+ 18
Halifax	45	+ 15	Sherbrooke	45	− 13	Los Angeles	34	− 07
Hamilton	43	+ 19	Stratford	43	+ 24	Louisville	38	− 17
Hull	45	+ 03	Sudbury	47	+ 24	Memphis	35	00
Kingston	44	+ 06	Sydney	46	+ 01	Milwaukee	43	− 09
Kitchener	43	+ 22	Timmins	48	+ 26	Minneapolis	45	+ 13
London	43	+ 25	Toronto	44	+ 18	New Orleans	30	00
Medicine Hat	50	+ 23	Three Rivers	46	− 10	New York	41	− 04
Moncton	46	+ 19	Trail	49	− 09	Omaha	41	+ 24
Montreal	45	− 06	Truro	45	+ 13	Philadelphia	40	+ 01
Moose Jaw	50	+ 02	Vancouver	49	+ 12	Pittsburgh	40	+ 20
Niagara Falls	43	+ 16	Victoria	48	+ 14	Portland	46	+ 11
North Bay	46	+ 18	Windsor	42	+ 32	St. Louis	39	+ 01
Oshawa	44	+ 15	Winnipeg	50	+ 29	San Francisco	38	+ 10
Ottawa	45	+ 03	Woodstock	43	+ 23	Seattle	48	+ 09
Owen Sound	45	+ 24	Yellowknife	63	+ 37	Washington	39	+ 08

Example—Find the time of sunrise at Owen Sound, on February 12.

In the above list Owen Sound is under "45°", and the correction is + 24 min. On page 13 the time of sunrise on February 12 for latitude 45° is 7.07; add 24 min. and we get 7.31 (Eastern Standard Time).

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

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

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

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

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

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

BEGINNING OF MORNING AND ENDING OF EVENING TWILIGHT

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

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 12. 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).

DATE	Latitude 35° Moon Rise	Latitude 35° Moon Set	Latitude 40° Moon Rise	Latitude 40° Moon Set	Latitude 45° Moon Rise	Latitude 45° Moon Set	Latitude 50° Moon Rise	Latitude 50° Moon Set	Latitude 54° Moon Rise	Latitude 54° Moon Set
Jan.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
1	13 42	02 54	13 32	03 03	13 20	03 15	13 06	03 28	12 51	03 42
2	14 27	03 51	14 16	04 02	14 02	04 16	13 46	04 32	13 30	04 47
3	15 19	04 49	15 06	05 01	14 52	05 15	14 34	05 32	14 17	05 49
4	16 16	05 44	16 03	05 57	15 49	06 11	15 32	06 29	15 15	06 46
5 ○	17 18	06 37	17 06	06 49	16 53	07 02	16 38	07 18	16 22	07 35
6	18 23	07 27	18 14	07 36	18 03	07 48	17 51	08 02	17 37	08 15
7	19 30	08 12	19 24	08 20	19 15	08 29	19 06	08 39	18 57	08 49
8	20 38	08 54	20 34	09 00	20 29	09 05	20 24	09 12	20 19	09 18
9	21 45	09 34	21 44	09 36	21 43	09 39	21 42	09 42	21 41	09 44
10	22 52	10 12	22 53	10 11	22 56	10 10	22 59	10 10	23 02	10 09
11	23 58	10 49	.. ..	10 46	.. ..	10 42	.. ..	10 38	.. ..	10 33
12 ☾	.. ..	11 28	00 02	11 22	00 08	11 15	00 15	11 07	00 21	10 59
13	01 02	12 09	01 10	12 01	01 19	11 51	01 29	11 39	01 40	11 28
14	02 06	12 54	02 16	12 43	02 28	12 31	02 41	12 17	02 55	12 02
15	03 08	13 42	03 20	13 30	03 33	13 16	03 49	12 59	04 05	12 43
16	04 06	14 33	04 18	14 21	04 33	14 06	04 51	13 48	05 08	13 31
17	05 00	15 28	05 12	15 16	05 27	15 02	05 45	14 45	06 02	14 27
18	05 50	16 25	06 01	16 13	06 15	16 01	06 31	15 45	06 47	15 29
19 ●	06 34	17 22	06 44	17 12	06 56	17 02	07 10	16 48	07 23	16 35
20	07 13	18 19	07 22	18 11	07 31	18 03	07 43	17 53	07 53	17 42
21	07 49	19 15	07 55	19 10	08 02	19 05	08 10	18 57	08 19	18 50
22	08 22	20 10	08 26	20 08	08 31	20 04	08 36	20 00	08 41	19 57
23	08 53	21 04	08 55	21 04	08 57	21 03	08 59	21 03	09 01	21 03
24	09 24	21 58	09 23	22 01	09 22	22 02	09 22	22 05	09 20	22 08
25	09 54	22 52	09 51	22 57	09 48	23 01	09 44	23 07	09 39	23 14
26	10 26	23 46	10 21	23 53	10 15	.. ..	10 07	.. ..	10 01	.. ..
27 ☽	11 00	.. ..	10 53	.. ..	10 44	00 00	10 34	00 09	10 24	00 19
28	11 37	00 41	11 28	00 50	11 17	01 00	11 04	01 12	10 52	01 24
29	12 19	01 37	12 08	01 47	11 55	01 59	11 40	02 14	11 25	02 28
30	13 06	02 33	12 54	02 45	12 40	02 58	12 23	03 14	12 06	03 31
31	13 59	03 28	13 46	03 40	13 32	03 54	13 15	04 12	12 58	04 29
Feb.										
1	14 57	04 23	14 46	04 35	14 33	04 48	14 16	05 05	14 00	05 22
2	16 01	05 14	15 51	05 25	15 40	05 37	15 25	05 52	15 11	06 07
3	17 08	06 02	17 01	06 11	16 52	06 21	16 40	06 33	16 29	06 45
4 ○	18 18	06 47	18 13	06 53	18 07	07 00	18 00	07 09	17 53	07 17
5	19 28	07 29	19 25	07 32	19 23	07 36	19 20	07 41	19 17	07 46
6	20 37	08 09	20 38	08 09	20 39	08 10	20 40	08 11	20 41	08 12
7	21 46	08 48	21 50	08 46	21 54	08 43	21 59	08 40	22 04	08 37
8	22 53	09 29	22 59	09 23	23 07	09 17	23 17	09 11	23 25	09 04
9	23 59	10 10	.. ..	10 03	.. ..	09 53	.. ..	09 43	.. ..	09 33
10 ☾	.. ..	10 54	00 08	10 44	00 18	10 33	00 31	10 19	00 43	10 06
11	01 02	11 40	01 13	11 29	01 25	11 16	01 41	11 01	01 56	10 44
12	02 02	12 31	02 13	12 19	02 27	12 05	02 44	11 48	03 01	11 30
13	02 57	13 23	03 09	13 12	03 23	12 58	03 40	12 40	03 58	12 23
14	03 47	14 19	03 58	14 08	04 12	13 54	04 29	13 38	04 45	13 22
15	04 32	15 15	04 42	15 05	04 55	14 54	05 09	14 39	05 24	14 26
16	05 13	16 12	05 21	16 03	05 32	15 54	05 44	15 42	05 56	15 31
17	05 49	17 07	05 56	17 02	06 04	16 55	06 14	16 46	06 23	16 38
18 ●	06 24	18 02	06 28	17 59	06 34	17 55	06 40	17 49	06 46	17 45
19	06 55	18 57	06 58	18 56	07 00	18 54	07 04	18 52	07 07	18 51
20	07 26	19 51	07 26	19 52	07 26	19 53	07 27	19 55	07 27	19 56
21	07 56	20 44	07 54	20 48	07 52	20 52	07 49	20 57	07 46	21 01
22	08 28	21 38	08 23	21 44	08 19	21 50	08 12	21 58	08 07	22 06
23	09 00	22 32	08 54	22 40	08 46	22 49	08 38	23 00	08 29	23 10
24	09 36	23 27	09 27	23 37	09 18	23 47	09 06	.. ..	08 55	.. ..
25	10 15	.. ..	10 05	.. ..	09 53	.. ..	09 39	00 01	09 25	00 14
26 ☽	10 58	00 21	10 47	00 32	10 34	00 45	10 17	01 01	10 02	01 16
27	11 47	01 16	11 35	01 27	11 21	01 41	11 04	01 58	10 47	02 14
28	12 41	02 09	12 29	02 21	12 16	02 35	11 59	02 51	11 42	03 80

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

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

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

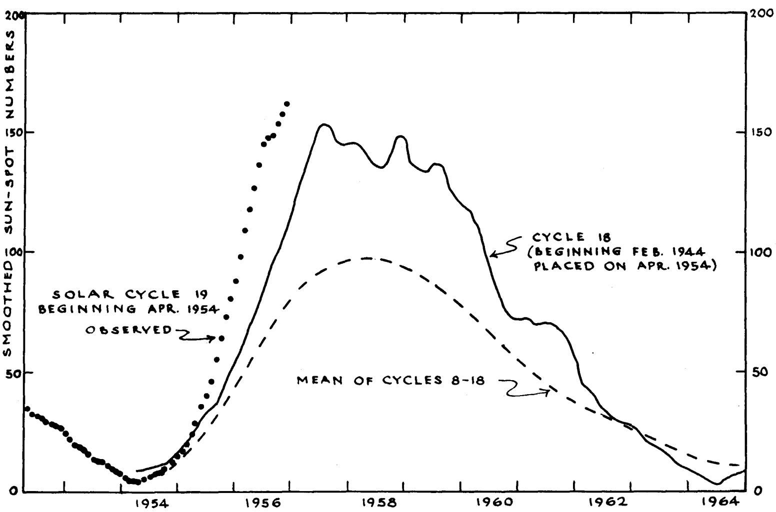
DATE	Latitude 35° Moon		Latitude 40° Moon		Latitude 45° Moon		Latitude 50° Moon		Latitude 54° Moon	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
Sept.	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
1	20 12	08 33	20 07	08 37	20 02	08 41	19 55	08 47	19 49	08 52
2	20 45	09 26	20 39	09 33	20 31	09 39	20 21	09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

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

THE PLANETS FOR 1958

THE SUN

The dots on the diagram represent the sun-spot activity of the current 19th cycle, as far as the final numbers are available. The present cycle began at the minimum in April 1954. For comparison, cycle 18 which began February 1944 (solid curve), and the mean of cycles 8 to 18 (dashed curve), are placed with their minima on April 1954. It is evident that the present cycle is showing much higher activity than usual. It is running ahead of the predicted values which indicate the maximum to be reached in July 1957.



A special emphasis on observations of solar activity is given by the International Geophysical Year running from July 1957 to December 1958. A combined effort in fields of solar astronomy, the upper atmosphere, meteorology and geophysics will promote a better understanding of the sun's influence on the earth as a whole.

MERCURY

Mercury is exceptional in many ways. It is the planet nearest the sun and travels fastest in its orbit, its speed varying from 23 mi. per sec. at aphelion to 35 mi. per sec. at perihelion. The amount of heat and light from the sun received by it per square mile is, on the average, 6.7 times the amount received by the earth. Its period of rotation on its axis is believed to be the same as its period of revolution about the sun, which is 88 days.

Mercury's orbit is well within that of the earth, and the planet, as seen from the earth, appears to move quickly from one side of the sun to the other several times in the year. Its quick motion earned for it the name it bears. Its greatest elongation (i.e., its maximum angular distance from the sun) varies between 18° and 28°, and on such occasions it is visible to the naked eye for about two weeks.

When the elongation of Mercury is east of the sun it is an evening star, setting soon after the sun. When the elongation is west, it is a morning star and rises shortly before the sun. Its brightness when it is treated as a star is considerable but it is always viewed in the twilight sky and one must look sharply to see it.

The most suitable times to observe Mercury are at an eastern elongation in the spring and at a western elongation in the autumn. The dates of greatest elongation this year, together with the planet's separation from the sun and its stellar magnitude, are given in the following table:

MAXIMUM ELONGATIONS OF MERCURY DURING 1958

Elong. East—Evening Star			Elong. West—Morning Star		
Date	Distance	Mag.	Date	Distance	Mag.
Mar. 29	19°	+0.1	Jan. 15	24°	0.0
July 26	27°	+0.6	May 14	26°	+0.7
Nov. 20	22°	−0.1	Sept. 9	18°	0.0
			Dec. 29	22°	−0.1

The most favourable elongations to observe are: in the evening, Mar. 29, and in the morning, Sept. 9. At these times Mercury is over 80 million miles from the earth and in a telescope looks like a half-moon about 7″ in diameter.

VENUS

Venus is the next planet in order from the sun. In size and mass it is almost a twin of the earth. Venus being within the earth's orbit, its apparent motion is similar to Mercury's but much slower and more stately. The orbit of Venus is almost circular with radius of 67 million miles, and its orbital speed is 22 miles per sec.

On Jan. 1, 1958, Venus is in the evening sky and crosses the meridian almost 2½ hours after the sun. Its declination is −15° and it appears rather low in the south-western sky at sunset. It is very brilliant, its stellar magnitude being −4.3. By Jan. 28 it is in inferior conjunction with the sun. It now becomes a morning star and attains greatest brilliancy, mag. −4.3, on Mar. 4. It reaches greatest elongation west, 46° 23′, on Apr. 8, with magnitude −4.0. Its declination is −10° and it transits the meridian less than 3 hours before the sun. It returns to the evening sky on Nov. 11. On Dec. 31 it is in declination −23° and transits the meridian an hour after the sun.

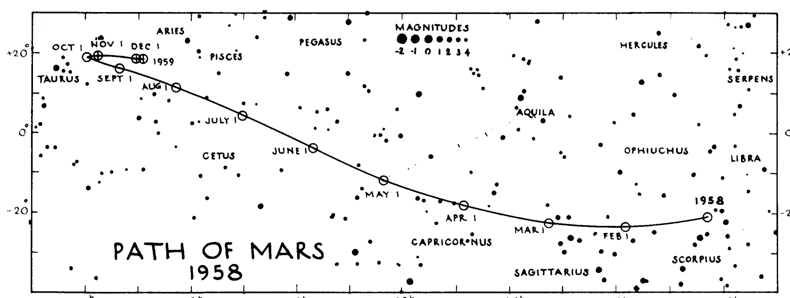
With the exception of the sun and moon, Venus is the brightest object in the sky. Its brilliance is largely due to the dense clouds which cover the surface of the planet. They reflect well the sun's light; but they also prevent the astronomer from detecting any solid object on the surface of the body. If such could be observed it would enable him to determine the planet's rotation period. It is probably around 30 days.

MARS

The orbit of Mars is outside that of the earth and consequently its planetary phenomena are quite different from those of the two inferior planets discussed above. Its mean distance from the sun is 141 million miles and the eccentricity of its orbit is 0.093, and a simple computation shows that its distance from the sun ranges between 128 and 154 million miles. Its distance from the earth varies from 35 to 235 million miles and its brightness changes accordingly. When Mars is nearest it is conspicuous in its fiery red, but when farthest away it is no brighter than Polaris. Unlike Venus, its atmosphere is very thin, and features on the solid surface are distinctly visible. Utilizing them its rotation period of 24h. 37m. has been accurately determined.

The sidereal, or true mechanical, period of revolution of Mars is 687 days; and the synodic period (for example, the interval from one opposition to the next one) is 780 days. This is the average value; it may vary from 764 to 810 days. At the opposition on Sept. 10, 1956, the planet was closer to the earth than it will be for some years. The next opposition is on Nov. 16, 1958, although Mars is nearest the earth on Nov. 8. On that date the distance between the two bodies is 45,310,000 miles, and the planet's stellar magnitude is -1.9.

On Jan. 1, 1958, Mars is in Scorpius, crossing the meridian about $2\frac{1}{2}$ hours before the sun. Its stellar magnitude is $+1.8$. Mars is overtaking Saturn and is closest to it on Jan. 23. It moves eastward in the sky until Oct. 9, when it becomes stationary in R.A. Then it retrogrades through opposition and becomes stationary in R.A. on Dec. 20. Again it moves eastward, and on Dec. 31 it is in Aries. See the map for its position throughout the year.

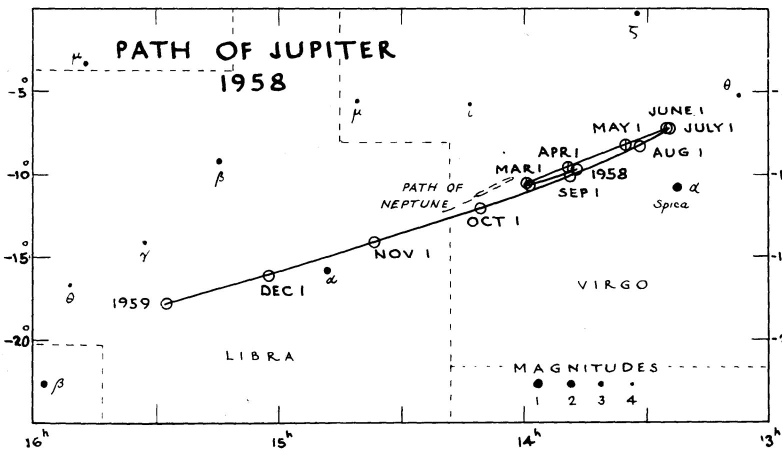


JUPITER

Jupiter is the giant of the family of the sun. Its mean diameter is 87,000 miles and its mass is $2\frac{1}{2}$ times that of all the rest of the planets combined! Its mean distance is 483 million miles and the revolution period is 11.9 years. This planet is known to possess 12 satellites, the last discovered in 1951 (see p. 9). Not so long ago it was generally believed that the planet was still cooling down from its original high temperature, but from actual measurements of the radiation from it to the earth it has been deduced that the surface is at about $-200°$F. The spectroscope shows that its atmosphere is largely ammonia and methane.

Jupiter is a fine object for the telescope. Many details of the surface as well as the flattening of the planet, due to its short rotation period, are visible, and the phenomena of its satellites provide a continual interest.

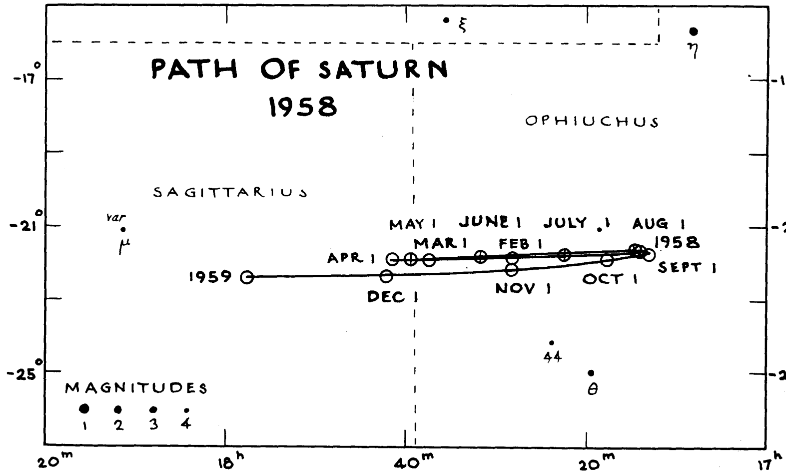
On Jan. 1, 1958, Jupiter is in the morning sky in the constellation Virgo, crossing the meridian about 7 a.m. Its stellar magnitude is −1.4. It comes into opposition with the sun on Apr. 17, when it moves into the evening sky. Its magnitude has brightened to −2.0. It retrogrades from Feb. 15 to June 19 (see map). It is in conjunction with the sun on Nov. 4, and is in the morning sky for the rest of the year. On Dec. 31 it is in Libra and its stellar magnitude is −1.4.



SATURN

Saturn was the outermost planet known until modern times. In size it is a good second to Jupiter. In addition to its family of nine satellites, this planet has a unique system of rings, and it is one of the finest of celestial objects in a good telescope. The plane of the rings makes an angle of 27° with the plane of the planet's orbit, and twice during the planet's revolution period of 29½ years the rings appear to open out widest; then they slowly close in until, midway between the maxima, the rings are presented edgewise to the sun or the earth, at which times they are invisible. The rings were edgewise in 1937 and 1950, and at maximum in 1944 and will be again at maximum in 1958.

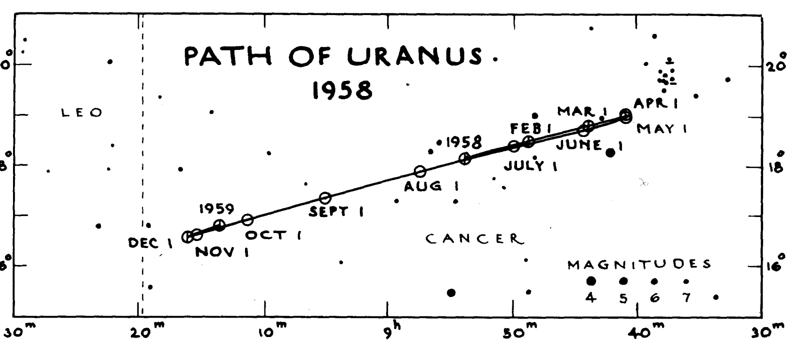
On Jan. 1, 1958, Saturn is in Ophiuchus in the morning sky (see map). Its stellar magnitude is +0.7. On Apr. 4 it reaches a stationary point and begins to move westward, or retrograde. Opposition occurs on June 13, and it will be visible most of the night with stellar magnitude +0.2. It continues to retrograde until Aug. 24, when it again begins to move eastward. Conjunction with the sun occurs on Dec. 20.



URANUS

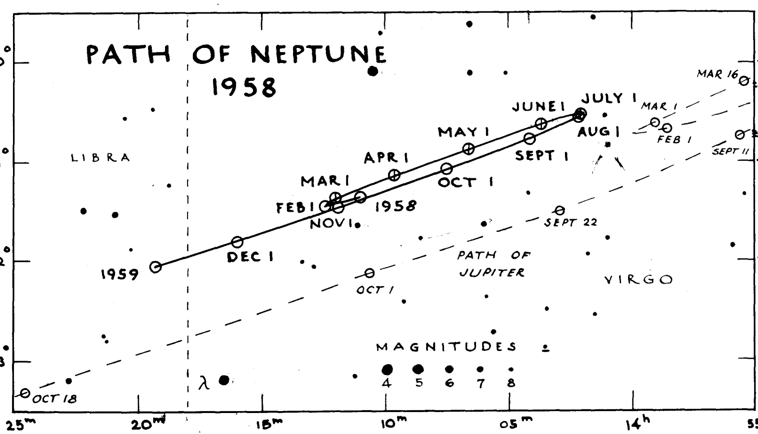
Uranus was discovered in 1781 by Sir William Herschel by means of a $6\frac{1}{4}$-in. mirror-telescope made by himself. The object did not look just like a star and he observed it again four days later. It had moved amongst the stars, and he assumed it to be a comet. He could not believe that it was a new planet. However, computation later showed that it was a planet nearly twice as far from the sun as Saturn. Its period of revolution is 84 years and it rotates on its axis in about 11 hours. Its five satellites are visible only in a large telescope. The fifth satellite was discovered by G P. Kuiper in 1948 at the McDonald Observatory (see p. 9).

Uranus remains in Cancer during 1958 (see map). At the beginning of the year it is retrograding or moving westward among the stars until April 15. Opposition to the sun occurs on Jan. 29, when its apparent diameter is 3.9″. At this time its stellar magnitude is +5.8, and by conjunction it has faded to +6.0. Conjunction with the sun occurs on Aug. 4. It is in the morning sky for the rest of the year.



NEPTUNE

Neptune was discovered in 1846 after its existence in the sky had been predicted from independent calculations by Leverrier in France and Adams in England. It caused a sensation at the time. Its distance from the sun is 2791 million miles and its period of revolution is 165 years. A satellite was discovered in 1846 soon after the planet. A second satellite was discovered by G. P. Kuiper at the McDonald Observatory on May 1, 1949. Its magnitude is about 19.5, its period about a year, and diameter about 200 miles. It is named Nereid.



During 1958, Neptune is still in the constellation Virgo. It is in opposition to the sun on Apr. 23. Its stellar magnitude is then +7.68, and during the year fades slightly to +7.82. Thus it is too faint to be seen with the naked eye. In the telescope it shows a greenish tint and an apparent diameter of from 2.5″ to 2.3″. It is in conjunction with the sun on Oct. 28.

PLUTO

Pluto, the most distant known planet, was discovered at the Lowell Observatory in 1930. Its mean distance from the sun is 3671 million miles and its revolution period is 248 years. It appears as a 15th mag. star in the constellation Leo. It is in opposition to the sun on Feb. 20, at which its astrometric position is R.A. $10^h\ 30^m$, Dec. $+22°\ 10'$.

THE SKY MONTH BY MONTH

By J. F. Heard

THE SKY FOR JANUARY, 1958

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

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

The Sun—During January the sun's R.A. increases from 18h 44m to 20h 56m and its Decl. changes from 23° 04′ S. to 17° 18′ S. The equation of time changes from −3m 16s to −13m 34s. The earth is in perihelion or nearest the sun on the 3rd. For changes in the length of the day, see p. 13.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 20.

Mercury on the 15th is in R.A. 18h 02m, Decl. 21° 48′ S, and transits at 10h 27m. Greatest western elongation is on the 15th (mag. 0.0). At about this time it may be seen as a morning star low in the south-east just before sunrise; however, this is a poor elongation.

Venus on the 15th is in R.A. 21h 06m, Decl. 12° 18′ S., mag. −3.9, and transits at 13h 26m. Early in the month it may be seen low in the south-west just after sunset, but by the 28th it is in inferior conjunction.

Mars on the 15th is in R.A. 16h 59m, Decl. 22° 47′ S., mag. 1.7, and transits at 9h 23m. It is in Ophiuchus and may be seen in the south-east for a few hours before sunrise. It is in conjunction with Saturn on the 23rd, Mars passing 1° 31′ south of Saturn.

Jupiter on the 15th is in R.A. 13h 54m, Decl. 10° 19′ S., mag. −1.5, and transits at 6h 17m. Not far from Spica, it rises after midnight and is past the meridian at dawn. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 56.

Saturn on the 15th is in R.A. 17h 21m, Decl. 21° 48′ S., mag. 0.8, and transits at 9h 43m. It is a morning star visible low in the south-east for an hour or two before sunrise (see Mars).

Uranus on the 15th is in R.A. 8h 52m, Decl. 18° 19′ N. and transits at 1h 15m.

Neptune on the 15th is in R.A. 14h 12m, Decl. 11° 26′ S. and transits at 6h 34m.

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

ASTRONOMICAL PHENOMENA MONTH BY MONTH

BY RUTH J. NORTHCOTT

	d	h	m	JANUARY 75th Meridian Civil Time	Min. of Algol h m	Config. of Jupiter's Sat. 5h 30m
Wed.	1			....	10 21	d3O42
Thu.	2	4		☿ Greatest Hel. Lat. N................		24O13
Fri.	3			Quadrantid meteors		
		9		⊕ in Perihelion. Dist. from ⊙, 91, 342,000 mi.		421O3
Sat.	4			....	7 10	4O123
Sun.	5	4		☿ Stationary in R.A.		41O32
		15	09	🌕 Full Moon		
Mon.	6	3		♀ Stationary in R.A.		432O1
Tue.	7	12	33	☌ ♅ ☾ ♅ 5° 55′ N..................	3 59	431O*
Wed.	8	0		♂ in ♉		d43O2
		19		Moon in Perigee. Dist. from ⊕, 227,600 mi.		
Thu.	9			....		42O13
Fri.	10			....	0 48	21O43
Sat.	11			....		O1243
Sun.	12	9	01	☾ Last Quarter	21 38	1O324
Mon.	13	0	12	☌ ♃ ☾ ♃ 2° 00′ N.		32O14
		8	17	☌ ♆ ☾ ♆ 2° 03′ N.		
Tue.	14			....		312O4
Wed.	15	23		☿ Greatest elongation W., 23° 53′	18 27	3O124
Thu.	16	10	06	☌ ♂ ☾ ♂ 3° 19′ S.		dO34*
		17	47	☌ ♄ ☾ ♄ 2° 09′ S.		
Fri.	17	16	50	☌ ☿ ☾ ☿ 3° 00′ S.		21O34
Sat.	18			....	15 16	O4123
Sun.	19	17	08	🌑 New Moon		41O32
Mon.	20	18	52	☌ ♀ ☾ ♀ 0° 40′ N.		423O1
Tue.	21	0		□ ♃ ⊙ West	12 05	4312O
Wed.	22			....		43O12
Thu.	23	5		☌ ♂ ♄ ♂ 1° 31′ S.		4O2**
Fri.	24	19		Moon in Apogee. Dist. from ⊕, 251,800 mi.	8 55	d42O3
Sat.	25	0		□ ♆ ⊙ West		4O213
		15		☿ in ♉		
Sun.	26			....		41O32
Mon.	27	21	16	☽ First Quarter	5 44	23O41
Tue.	28	15		☌ ♀ ⊙ Inferior		321O4
Wed.	29	19		☍ ♅ ⊙ Dist. from ⊕, 1,626,000,000 mi.		3O124
Thu.	30	3		♀ in Perihelion	2 33	1O24*
Fri.	31			....		d2O34

Explanation of symbols and abbreviations on p. 4, of time on p. 10.

THE SKY FOR FEBRUARY, 1958

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

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

The Sun—During February the sun's R.A. increases from 20h 56m to 22h 46m and its Decl. changes from 17° 18′ S. to 7° 51′ S. The equation of time changes from −13m 34s to a minimum of −14m 19s on the 12th and then to −12m 36s at the end of the month. For changes in the length of the day, see p. 13.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 20.

Mercury on the 15th is in R.A. 21h 05m, Decl. 18° 45′ S. and transits at 11h 29m. It is too close to the sun for observation.

Venus on the 15th is in R.A. 20h 06m, Decl. 12° 28′ S., mag. −4.1, and transits at 10h 25m. At the beginning of the month it is too close to the sun for observation, but later in the month it may be seen as a morning star low in the south-east before sunrise.

Mars on the 15th is in R.A. 18h 35m, Decl. 23° 40′ S., mag. 1.5, and transits at 8h 57m. It is in Sagittarius and may be seen low in the south-east for a few hours before sunrise.

Jupiter on the 15th is in R.A. 14h 00m, Decl. 10° 44′ S., mag. −1.8, and transits at 4h 20m. It is in Virgo, rising just before midnight. On the 15th it is stationary in right ascension and begins to retrograde, i.e., move westward among the stars. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 56.

Saturn on the 15th is in R.A. 17h 33m, Decl. 21° 57′ S., mag. 0.8, and transits at 7h 53m. It is in Ophiuchus east of Antares and rises about three hours before sunrise.

Uranus on the 15th is in R.A. 8h 46m, Decl. 18° 41′ N. and transits at 23h 03m.

Neptune on the 15th is in R.A. 14h 12m, Decl. 11° 26′ S. and transits at 4h 33m.

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

FEBRUARY

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 4h 15m
Sat.	1				23 23	O34**
Sun.	2					1O234
Mon.	3	20	33	☌ ♅ ☾ ♅ 5° 52′ N.		23O14
Tue.	4	3	05	🌕 Full Moon	20 12	321O4
		21		☿ in Aphelion		
Wed.	5	16		♆ Stationary in R.A.		34O12
		18		Moon in Perigee. Dist. from ⊕, 224,200 mi.		
Thu.	6					431O2
Fri.	7	2		☌ ☿ ♀ ☿ 9° 36′ S.	17 01	42O13
Sat.	8					4O3**
Sun.	9	8	45	☌ ♃ ☾ ♃ 1° 40′ N.		41O23
		14	11	☌ ♆ ☾ ♆ 1° 47′ N.		
Mon.	10			Aurigid meteors	13 51	d42O1
		18	34	☾ Last Quarter		
Tue.	11					4321O
Wed.	12					34O21
Thu.	13	3	59	☌ ♄ ☾ ♄ 2° 29′ S.	10 40	31O42
Fri.	14	6	49	☌ ♂ ☾ ♂ 5° 00′ S.		2O134
Sat.	15	20		♃ Stationary in R.A.		21O34
Sun.	16	1	17	☌ ♀ ☾ ♀ 2° 36′ N.	7 29	dO234
Mon.	17	13		♀ Stationary in R.A.		dO314
		16	05	☌ ☿ ☾ ☿ 7° 15′ S.		
Tue.	18	10	38	🌑 New Moon		321O4
Wed.	19				4 18	3O214
Thu.	20	0		☍ ♇ ⊙ Dist. from ⊕ 3,095,000,000 mi.		31O24
		23		♀ Greatest Hel. Lat. N.		
Fri.	21	10		Moon in Apogee. Dist. from ⊕, 252,300 mi.		24O31
Sat.	22				1 08	421O3
Sun.	23					4O123
Mon.	24				21 57	4O23*
Tue.	25	5		☿ Greatest Hel. Lat. S.		4231O
Wed.	26	15	51	🌓 First Quarter		43O21
Thu.	27				18 46	431O2
Fri.	28					42O31

Explanations of symbols and abbreviations on p. 4, of time on p. 10.

THE SKY FOR MARCH, 1958

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

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

The Sun—During March the sun's R.A. increases from 22h 46m to 0h 40m and its Decl. changes from 7° 51′ S. to 4° 16′ N. The equation of time changes from −12m 36s to −4m 11s. On the 20th at 22h 06m E.S.T. the sun crosses the equator on its way north, enters the sign of Aries, and spring commences. This is the vernal equinox. For changes in the length of the day, see p. 14.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 21.

Mercury on the 15th is in R.A. 0h 17m, Decl. 1° 30′ N. and transits at 12h 50m. Superior conjunction is on the 3rd and by the 29th greatest eastern elongation is reached (mag. 0.1). Thus, towards the end of the month, Mercury is a good evening star, standing about 17 degrees above the western horizon at sunset. On the 21st there is an occultation of Mercury visible in eastern Canada, see p. 60.

Venus on the 15th is in R.A. 20h 48m, Decl. 13° 39′ S., mag. −4.2, and transits at 9h 19m. It is a morning star, and, although it is only about 15° above the south-eastern horizon at sunrise, it is very prominent, greatest brilliancy being on the 4th of this month.

Mars on the 15th is in R.A. 20h 02m, Decl. 21° 22′ S., mag. 1.3, and transits at 8h 34m. It is moving from Sagittarius to Capricornus and may be seen low in the south-east for a few hours before sunrise.

Jupiter on the 15th is in R.A. 13h 56m, Decl. 10° 15′ S., mag. −1.9, and transits at 2h 26m. It rises late in the evening and is visible all night not far east of Spica. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 56.

Saturn on the 15th is in R.A. 17h 40m, Decl. 21° 59′ S., mag. 0.7, and transits at 6h 10m. It is in Ophiuchus and rises in the south-east an hour or so after midnight.

Uranus on the 15th is in R.A. 8h 42m, Decl. 18° 56′ N. and transits at 21h 09m.

Neptune on the 15th is in R.A. 14h 11m, Decl. 11° 18′ S. and transits at 2h 41m.

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

MARCH

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 2h 45m
Sat.	1			....		21403
Sun.	2			....	15 36	01243
Mon.	3	5	47	☌ ♅ ☾ ♅ 5° 58′ N..................		10234
		15		☌ ☿ ☉ Superior		
Tue.	4	5		♀ Greatest brilliancy, magnitude −4.3		d2304
Wed.	5	13	28	○ Full Moon	12 25	3014*
Thu.	6	4		Moon in Perigee. Dist. from ⊕, 222,100 mi.		31024
Fri.	7			....		23014
Sat.	8	16	04	☌ ♃ ☾ ♃ 1° 37′ N.................	9 14	21034
		21	50	☌ ♆ ☾ ♆ 1° 37′ N.................		
Sun.	9			....		01423
Mon.	10			....		41023
Tue.	11			....	6 03	42301
Wed.	12	5	48	☾ Last Quarter		4301*
		12	44	☌ ♄ ☾ ♄ 2° 46° S.		
Thu.	13			....		43102
Fri.	14			....	2 53	43201
Sat.	15	6	20	☌ ♂ ☾ ♂ 6° 11′ S.		42103
Sun.	16	6		☿ in ☊	23 42	40213
		6	00	☌ ♀ ☾ ♀ 1° 17′ S..................		
		7		□ ♄ ☉ West		
Mon.	17			....		41023
Tue.	18			....		23041
Wed.	19			....	20 31	3204*
Thu.	20	4	50	● New Moon		31024
		14		Moon in Apogee. Dist. from ⊕, 252,600 mi. . .		
		21		☿ in Perihelion		
		22	06	☉ enters ♈. Spring commences. Long. of ☉, 0°		
Fri.	21	16	58	☌ ☿ ☾ ☿ 0° 12′ S.		d3014
Sat.	22			....	17 21	21034
Sun.	23			....		02134
Mon.	24			....		10234
Tue.	25			....	14 10	23014
Wed.	26			....		32401
Thu.	27			....		d3402
Fri.	28	6	18	☽ First Quarter	10 59	43021
Sat.	29	2		☿ Greatest elongation E., 18° 52′.......		42103
Sun.	30	14	31	☌ ♅ ☾ ♅ 6° 05′ N..................		40213
Mon.	31	3		☿ Greatest Hel. Lat. N................	7 48	41023

Explanations of symbols and abbreviations on p. 4, of time on p. 10

THE SKY FOR APRIL, 1958

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

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

The Sun—During April the sun's R.A. increases from 0h 40m to 2h 31m and its Decl. changes from 4° 16′ N. to 14° 51′ N. The equation of time changes from −4m 11s to +2m 50s, being zero on the 16th; that is, the apparent sun moves from east to west of the mean sun on that date. There is an annular eclipse of the sun on the 19th invisible in North America. For changes in the length of the day, see p. 14.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 21.

Mercury on the 15th is in R.A. 1h 39m, Decl. 12° 45′ N. and transits at 12h 04m. At the very beginning of the month it may be seen as an evening star low in the west just after sunset. Later it is too close to the sun to be seen, inferior conjunction being on the 16th.

Venus on the 15th is in R.A. 22h 39m, Decl. 8° 12′ S., mag. −3.9, and transits at 9h 09m. It is a brilliant object low in the east before sunrise. Although greatest western elongation is on the 8th, the planet is only about 14° above the horizon at sunrise.

Mars on the 15th is in R.A. 21h 36m, Decl. 15° 45′ S., mag. 1.0, and transits at 8h 04m. It is in Capricornus and may be seen low in the south-east for a few hours before sunrise.

Jupiter on the 15th is in R.A. 13h 43m, Decl. 9° 00′ S., mag. −2.0, and transits at 0h 11m. Just east of Spica, it rises about at sunset and is visible all night. It is in opposition on the 17th. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 56.

Saturn on the 15th is in R.A. 17h 41m, Decl. 21° 57′ S., mag. 0.6, and transits at 4h 09m. It is in Ophiuchus, rising at about midnight. On the 4th it is stationary in right ascension and commences to retrograde, i.e., move westward among the stars.

Uranus on the 15th is in R.A. 8h 40m, Decl. 19° 01′ N. and transits at 19h 06m.

Neptune on the 15th is in R.A. 14h 08m, Decl. 11° 02′ S. and transits at 0h 37m.

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

				APRIL 75th Meridian Civil Time	Min. of Algol	Config. of Jupiter's Sat. 1h 00m
	d	h	m		h m	
Tue.	1			. . . .		42O31
Wed.	2			. . . .		4321O
Thu.	3	16		Moon in Perigee. Dist. from ⊕, 221,800 mi. . .	4 37	34O12
		22	45	🌕 Full Moon		
Fri.	4	16		♄ Stationary in R.A.		3O24*
		22	39	☌ ♃ ☾ ♃ 1° 52′ N.		
Sat.	5	7	23	☌ ♆ ☾ ♆ 1° 37′ N.		21O34
Sun.	6	10		☿ Stationary in R.A.	1 27	O134*
Mon.	7			. . . .		1O234
Tue.	8	18		♀ Greatest elongation W., 46° 23′	22 16	2O314
		21	10	☌ ♄ ☾ ♄ 2° 53′ S.		
Wed.	9			. . . .		321O4
Thu.	10	18	50	☾ Last Quarter		3O124
Fri.	11			. . . .	19 05	31O24
Sat.	12			. . . .		d24O3
Sun.	13	7	53	☌ ♂ ☾ ♂ 6° 37′ S.		42O13
Mon.	14	19	26	☌ ♀ ☾ ♀ 4° 09′ S.	15 54	41O23
Tue.	15	7		♅ Stationary in R.A.		42O31
Wed.	16	14		☌ ☿ ☉ Inferior		4231O
		18		Moon in Apogee. Dist. from ⊕, 252,500 mi.		
Thu.	17	2		☍ ♃ ☉ Dist. from ⊕, 413,000,000 mi.	12 43	43O12
Fri.	18	0		♀ in ♉		431O2
		14	10	☌ ☿ ☾ ☿ 0° 49′ N.		
		22	23	● New Moon		
Sat.	19			Annular eclipse of ☉. See p. 59		42O1*
Sun.	20			. . . .	9 32	24O13
Mon.	21			. . . .		1O423
Tue.	22			Lyrid meteors		dO134
Wed.	23	14		☿ in ♉	6 21	231O4
		21		☍ ♆ ☉ Dist. from ⊕, 2,724,000,000 mi.		
Thu.	24			. . . .		3O214
Fri.	25			. . . .		31O24
Sat.	26	16	36	☽ First Quarter	3 10	23O14
		21	55	☌ ♅ ☾ ♅ 6° 06′ N.		
Sun.	27			. . . .		2O34*
Mon.	28	5		□ ♅ ☉ East.	23 59	1O423
		22		☿ Stationary in R.A.		
Tue.	29			. . . .		4O213
Wed.	30			. . . .		4213O

Explanations of symbols and abbreviations on p. 4, of time on p. 10.

THE SKY FOR MAY, 1958

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

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

The Sun—During May the sun's R.A. increases from 2h 31m to 4h 33m and its Decl. changes from 14° 51′ N. to 21° 57′ N. The equation of time changes from +2m 50s to a maximum of +3m 45s on the 15th and then to +2m 25s at the end of the month. For changes in the length of the day, see p. 15.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 22. There is a partial eclipse of the moon on the night of the 2nd-3rd visible in the western part of North America.

Mercury on the 15th is in R.A. 1h 48m, Decl. 7° 39′ N. and transits at 10h 19m. Greatest western elongation is on the 14th (mag. 0.7). However, it will be difficult to see Mercury at that time since it will be only about ten degrees above the eastern horizon at sunrise.

Venus on the 15th is in R.A. 0h 41m, Decl. 2° 35′ N., mag. −3.6, and transits at 9h 13m. It is a morning star rising about an hour before the sun.

Mars on the 15th is in R.A. 23h 01m, Decl. 8° 17′ S., mag. 0.8, and transits at 7h 31m. It is in Aquarius, and it rises only about two hours before the sun.

Jupiter on the 15th is in R.A. 13h 29m, Decl. 7° 46′ S., mag. −2.0, and transits at 21h 56m. Now approaching very close to Spica it is already risen at sunset and sets before dawn. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 56.

Saturn on the 15th is in R.A. 17h 36m, Decl. 21° 53′ S., mag. 0.4, and transits at 2h 06m. It is in Ophiuchus, rising about two hours before midnight and visible for the rest of the night.

Uranus on the 15th is in R.A. 8h 42m, Decl. 18° 55′ N. and transits at 17h 10m.

Neptune on the 15th is in R.A. 14h 05m, Decl. 10° 46′ S. and transits at 22h 32m.

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

	d	h	m	MAY 75th Meridian Civil Time	Min. of Algol h m	Config. of Jupiter's Sat. 0h 00m
Thu.	1			....	20 48	43021
Fri.	2	1		Moon in Perigee. Dist. from ⊕, 223,400 mi.		43102
		4	21	☌ ♃ ☾ ♃ 2° 11′ N.		
		17	14	☌ ♆ ☾ ♆ 1° 41′ N.		
Sat.	3			Partial eclipse of ☾. See p. 59.		42301
		7	23	🌕 Full Moon		
		21		☿ in Aphelion		
Sun.	4			....	17 37	42103
Mon.	5			η Aquarid meteors		d4023
Tues.	6	5	22	☌ ♄ ☾ ♄ 2° 49′ S.		40123
Wed.	7			....	14 26	21304
Thu.	8			....		3014*
Fri.	9			....		31024
Sat.	10	9	37	☾ Last Quarter	11 15	32014
Sun.	11			....		21034
Mon.	12	9	58	☌ ♂ ☾ ♂ 6° 07′ S.		01234
Tue.	13			....	8 04	0234*
Wed.	14	6		Moon in Apogee. Dist. from ⊕, 252,000 mi..		
		9		☿ Greatest elongation W., 26° 01′......		d2104
		19	25	☌ ♀ ☾ ♀ 3° 46′ S.		
Thu.	15			....		32041
Fri.	16	9	16	☌ ☿ ☾ ☿ 3° 33′ S.	4 53	34102
Sat.	17			....		43201
Sun.	18	14	00	🌑 New Moon		42103
Mon.	19			....	1 42	40123
Tue.	20			....		4023*
Wed.	21			....	22 31	42103
Thu.	22	8		♀ in Aphelion		43201
Fri.	23			....		31402
Sat.	24	4		☿ Greatest Hel. Lat. S.	19 20	32014
		4	38	☌ ♅ ☾ ♅ 6° 00′ N..................		
Sun.	25	23	38	☽ First Quarter		21034
Mon.	26			....		01234
Tue.	27			....	16 09	10234
Wed.	28			....		d2034
Thu.	29	9	25	☌ ♃ ☾ ♃ 2° 17′ N.		32014
Fri.	30	1	38	☌ ♆ ☾ ♆ 1° 42′ N.	12 58	31024
		2		Moon in Perigee. Dist. from ⊕, 226,300 mi.		
Sat.	31			....		d3014

Explanations of symbols and abbreviations on p. 4, of time on p. 10.

THE SKY FOR JUNE, 1958

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

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

The Sun—During June the sun's R.A. increases from 4h 33m to 6h 38m and its Decl. changes from 21° 57′ N. to 23° 27′ N. at the solstice on the 21st at 16h 57m E.S.T. and then to 23° 10′ N. at the end of the month. The equation of time changes from +2m 25s to zero on the 14th and then to −3m 33s at the end of the month. For changes in the length of the day, see p. 15.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 22.

Mercury on the 15th is in R.A. 5h 11m, Decl. 23° 25′ N. and transits at 11h 44m. It is too close to the sun for observation, superior conjunction being on the 18th.

Venus on the 15th is in R.A. 2h 57m, Decl. 14° 39′ N., mag. −3.5, and transits at 9h 26m. It is a morning star, rising about two hours before the sun.

Mars on the 15th is in R.A. 0h 24m, Decl. 0° 11′ N., mag. 0.4, and transits at 6h 52m. It is in Pisces and rises about three hours before the sun.

Jupiter on the 15th is in R.A. 13h 23m, Decl. 7° 14′ S., mag. −1.8, and transits at 19h 47m. A few degrees north of Spica, it is about on the meridian at sunset and sets soon after midnight. On the 19th it is stationary in right ascension and resumes direct, i.e., eastward, motion among the stars. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 57.

Saturn on the 15th is in R.A. 17h 27m, Decl. 21° 48′ S., mag. 0.2, and transits at 23h 51m. It rises about at sunset and sets about at sunrise. Opposition is on the 13th.

Uranus on the 15th is in R.A. 8h 47m, Decl. 18° 36′ N. and transits at 15h 12m.

Neptune on the 15th is in R.A. 14h 03m, Decl. 10° 34′ S. and transits at 20h 27m.

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

				JUNE 75th Meridian Civil Time	Min. of Algol	Config. of Jupiter's Sat. 23h 15m
	d	h	m		h m	
Sun.	1	15	55	☺ Full Moon		4O213
Mon.	2	12	35	☌ ♄ ☾ ♄ 2° 40′ S.	9 47	41O23
Tue.	3			....		42O13
Wed.	4			....		432O*
Thu.	5			....	6 35	431O2
Fri.	6			....		43O21
Sat.	7			....		421O*
Sun.	8			....	3 24	4O13*
Mon.	9	1	59	☾ Last Quarter		1O243
Tue.	10	11	08	☌ ♂ ☾ ♂ 4° 47′ S.		2O134
Wed.	11	0		Moon in Apogee. Dist. from ⊕, 251,300 mi.	0 13	231O4
Thu.	12	5		☿ in ☊		31O24
Fri.	13	18		☍ ♄ ☉ Dist. from ⊕, 839,900,000 mi.	21 02	3O124
		21		♀ Greatest Hel. Lat. S.		
		21	31	☌ ♀ ☾ ♀ 0° 47′ S.		
Sat.	14	2		♂ Greatest Hel. Lat. S.		213O4
Sun.	15			....		2O134
Mon.	16	20		☿ in Perihelion	17 51	1O423
		22	40	☌ ☿ ☾ ☿ 4° 54′ N.		
Tue.	17	2	59	● New Moon		42O13
Wed.	18	12		☌ ☿ ☉ Superior		4231O
Thu.	19	11		♃ Stationary in R.A.	14 39	d43O2
Fri.	20	12	14	☌ ♅ ☾ ♅ 5° 49′ N.		43O12
Sat.	21	16	57	☉ enters ♋, Summer commences. Long. of ☉, 90°		4231O
Sun.	22			....	11 28	42O13
Mon.	23			....		41O23
Tue.	24	4	44	☽ First Quarter		42O13
Wed.	25	14	59	☌ ♃ ☾ ♃ 2° 02′ N.	8 17	213O4
Thu.	26	4		Moon in Perigee. Dist. from ⊕, 229,200 mi.		3O124
		7	57	☌ ♆ ☾ ♆ 1° 34′ N.		
Fri.	27	3		☿ Greatest Hel. Lat. N.		3O24*
Sat.	28				5 05	231O4
Sun.	29	18	10	☌ ♄ ☾ ♄ 2° 36′ S.		2O134
Mon.	30			....		1O234

Explanations of symbols and abbreviations on p. 4, of time on p. 10.

THE SKY FOR JULY, 1958

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

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

The Sun—During July the sun's R.A. increases from 6h 38m to 8h 43m and its Decl. changes from 23° 10′ N. to 18° 12′ N. The equation of time changes from −3m 33s to a minimum of −6m 26s on the 27th and then to −6m 17s at the end of the month. On the 5th the earth is in aphelion or farthest from the sun. For changes in the length of the day, see p. 16.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 23.

Mercury on the 15th is in R.A. 9h 15m, Decl. 16° 51′ N. and transits at 13h 47m. On the 26th it is at greatest eastern elongation (mag. 0.6) and thus visible as an evening star, though only about ten degrees above the western horizon at sunset. It passes just south of Regulus at this time.

Venus on the 15th is in R.A. 5h 23m, Decl. 22° 00′ N., mag. −3.3, and transits at 9h 54m. It is a morning star rising in the north-east about two hours before the sun.

Mars on the 15th is in R.A. 1h 40m, Decl. 7° 48′ N., mag. 0.1, and transits at 6h 10m. It is in Pisces, rising about at midnight and visible in the east during the morning hours.

Jupiter on the 15th is in R.A. 13h 26m, Decl. 7° 43′ S., mag. −1.6, and transits at 17h 53m. Still close to Spica, it is well past the meridian at sunset and sets before midnight. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 57.

Saturn on the 15th is in R.A. 17h 18m, Decl. 21° 44′ S., mag. 0.4, and transits at 21h 44m. It is in Ophiuchus not far east of Antares and it is well up in the south-east at sunset and is visible most of the night.

Uranus on the 15th is in R.A. 8h 53m, Decl. 18° 09′ N. and transits at 13h 21m.

Neptune on the 15th is in R.A. 14h 02m, Decl. 10° 31′ S. and transits at 18h 29m.

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

				JULY 75th Meridian Civil Time.	Min. of Algol	Config. of Jupiter's Sat. 22h 00m
	d	h	m		h m	
Tue.	1	1	04	🌕 Full Moon	1 54	O2134
Wed.	2					21O34
Thu.	3				22 43	3O41*
Fri.	4					341O2
Sat.	5	15		⊕ in Aphelion. Dist. from ☉, 94,449,000 mi.		d432O
Sun.	6				19 31	42O13
Mon.	7					41O23
Tue.	8	18		Moon in Apogee. Dist. from ⊕, 251,100 mi.		4O213
		19	21	☾ Last Quarter		
Wed.	9	10	00	☌ ♂ ☾ ♂ 2° 58′ S.	16 20	421O3
		14		♂ in Perihelion		
Thu.	10	22		☌ ☿ ♅ ☿ 0° 44′ N.		43O1*
Fri.	11					341O2
Sat.	12				13 09	32O14
Sun.	13					2O34*
Mon.	14	1	21	☌ ♀ ☾ ♀ 2° 49′ N.		1O234
		18		♆ Stationary in R.A.		
Tue.	15	15		□ ♃ ☉ East	9 57	O2134
Wed.	16	13	33	🌑 New Moon		21O34
Thu.	17	21	55	☌ ♅ ☾ ♅ 5° 40′ N.		32O14
Fri.	18	15	55	☌ ☿ ☾ ☿ 5° 05′ N.	6 46	31O24
Sat.	19					32O14
Sun.	20	13		☿ in ♉		24O**
Mon.	21	6		Moon in Perigee. Dist. from ⊕, 229,100 mi.	3 34	41O23
Tue.	22	22	43	☌ ♃ ☾ ♃ 1° 31′ N.		4O123
Wed.	23	9	19	☽ First Quarter		421O3
		13	11	☌ ♆ ☾ ♆ 1° 19′ N.		
Thu.	24				0 23	432O1
Fri.	25	7		□ ♆ ☉ East		431O2
Sat.	26	16		☿ Greatest elongation E., 27° 06′	21 12	d43O1
		22	23	☌ ♄ ☾ ♄ 2° 43′ S.		
Sun.	27	2		□ ♂ ☉ West		4231O
Mon.	28					d4O23
Tue.	29			δ Aquarid meteors	18 00	O1423
Wed.	30	11	47	🌕 Full Moon		21O34
		20		☿ in Aphelion		
Thu.	31					23O14

Explanations of symbols and abbreviations on p. 4, of time on p. 10.

THE SKY FOR AUGUST, 1958

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

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

The Sun—During August the sun's R.A. increases from 8h 43m to 10h 39m and its Decl. changes from 18° 12′ N. to 8° 33′ N. The equation of time changes from −6m 17s to −0m 15s. For changes in the length of the day, see p. 16.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 23.

Mercury on the 15th is in R.A. 10h 26m, Decl. 4° 53′ N. and transits at 12h 50m. Inferior conjunction is on the 23rd and Mercury is thus too close to the sun for observation this month.

Venus on the 15th is in R.A. 8h 04m, Decl. 20° 40′ N., mag. −3.3, and transits at 10h 33m. It is a morning star rising in the north-east about an hour before the sun. Venus passes to the north of Uranus, within 7′, on the 26th.

Mars on the 15th is in R.A. 2h 51m, Decl. 13° 56′ N., mag. −0.3, and transits at 5h 19m. It rises before midnight and is a prominent object in Aries for the rest of the night. On the night of the 6th–7th there is a close conjunction of Mars with the moon.

Jupiter on the 15th is in R.A. 13h 39m, Decl. 9° 05′ S., mag. −1.4, and transits at 16h 04m. It is a few degrees east of Spica and it is well down in the west by sunset, setting within two hours. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 57.

Saturn on the 15th is in R.A. 17h 13m, Decl. 21° 44′ S., mag. 0.6, and transits at 19h 38m. It is in Ophiuchus not far east of Antares. It is nearly to the meridian at sunset and sets about midnight. On the 24th it is stationary in right ascension and thereafter resumes direct or eastward motion among the stars.

Uranus on the 15th is in R.A. 9h 01m, Decl. 17° 38′ N. and transits at 11h 27m. (See Venus.)

Neptune on the 15th is in R.A. 14h 03m, Decl. 10° 38′S., and transits at 16h 28m.

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

	d	h	m	AUGUST 75th Meridian Civil Time	Min. of Algol h m	Config. of Jupiter's Sat. 20h 45m
Fri.	1			....	14 49	31O24
Sat.	2			....		3O214
Sun.	3			....		231O4
Mon.	4	17		☌ ♅ ☉	11 37	O134*
Tue.	5	13		Moon in Apogee. Dist. from ⊕, 251,300 mi...		O423*
Wed.	6			....		241O3
Thu.	7	4	45	☌ ♂ ☾ ♂ 1° 05′ S.	8 26	d42O1
		12	49	☾ Last Quarter		
Fri.	8	18		☿ Stationary in R.A.		431O2
Sat.	9	3		♀ in ☋		43O21
Sun.	10			....	5 14	4231O
Mon.	11			....		4O13*
Tue.	12			Perseid meteors		41O23
Wed.	13	6	02	☌ ♀ ☾ ♀ 5° 20′ N.	2 03	d42O3
Thu.	14	9	47	☌ ♅ ☾ ♅ 5° 37′ N.		24O13
		22	33	● New Moon		
Fri.	15	21	16	☌ ☿ ☾ ☿ 0° 55′ S.	22 52	31O24
Sat.	16			....		3O214
Sun.	17	10		Moon in Perigee. Dist. from ⊕, 226,200 mi...		321O4
Mon.	18			....	19 40	2O14*
Tue.	19	10	06	☌ ♃ ☾ ♃ 0° 51′ N.		1O234
		19	22	☌ ♆ ☾ ♆ 1° 01′ N.		
Wed.	20	4		☿ Greatest Hel. Lat. S.		2O134
Thu.	21	14	45	☽ First Quarter	16 29	2O34*
Fri.	22			....		31O24
Sat.	23	2	47	☌ ♄ ☾ ♄ 2° 58′ S.		34O12
		10		☌ ☿ ☉ Inferior		
Sun.	24	0		♄ Stationary in R.A.	13 17	4321O
Mon.	25	13		☌ ♇ ☉		42O1*
Tue.	26	18		☌ ♀ ♅ ♀ 0° 07′ N.		41O23
Wed.	27			....	10 06	d4O13
Thu.	28			....		42O3*
Fri.	29	0	53	○ Full Moon		431O2
Sat.	30			....	6 54	34O12
Sun.	31			....		321O4

Explanations of symbols and abbreviations on p. 4, of time on p. 10.

THE SKY FOR SEPTEMBER, 1958

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

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

The Sun—During September the sun's R.A. increases from 10h 39m to 12h 27m and its Decl. changes from 8° 33′ N. to 2° 54′ S. The equation of time changes from −0m 15s to +10m 02s, the apparent sun passing to the west of the mean sun on the 1st. On the 23rd at 8h 10m E.S.T. the sun crosses the equator moving southward, enters the sign of Libra, and autumn commences. For changes in the length of the day, see p. 17.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 24.

Mercury on the 15th is in R.A. 10h 31m, Decl. 10° 46′N. and transits at 10h 58m. Greatest western elongation is on the 9th (mag. 0.0) and so about this time it is a good morning star, standing some 16 degrees above the eastern horizon at sunrise. On the morning of the 10th it will be seen as a very close companion to Regulus, and on the evening of the 17th it will be close to Venus.

Venus on the 15th is in R.A. 10h 36m, Decl. 10° 13 N., mag. −3.3, and transits at 11h 03m. It is a morning star, rising in the east about an hour before the sun. On the 9th it passes quite close to Regulus.

Mars on the 15th is in R.A. 3h 46m, Decl. 17° 46′ N. mag. −0.8, and transits at 4h 11m. It rises a few hours after sunset and is a prominent object in Taurus during the rest of the night.

Jupiter on the 15th is in R.A. 13h 58m, Decl. 11° 01′ S., mag. −1.3, and transits at 14h 22m. It is only about ten degrees above the horizon in the south-west at sunset. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 57.

Saturn on the 15th is in R.A. 17h 15m, Decl. 21° 51′ S., mag. 0.7, and transits at 17h 37m. Still in Ophiuchus not far east of Antares, it is now past the meridian at sunset and sets before midnight.

Uranus on the 15th is in R.A. 9h 08m, Decl. 17° 07′ N. and transits at 9h 32m.

Neptune on the 15th is in R.A. 14h 06m, Decl. 10° 54′ S. and transits at 14h 29m. Towards the end of the month it will be within a degree of Jupiter, Jupiter passing south of it.

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

	d	h	m	SEPTEMBER 75th Meridian Civil Time		Min. of Algol h m	Config. of Jupiter's Sat. 19h 15m
Mon.	1	8		☿	Stationary in R.A.		23O14
Tue.	2	6		Moon in Apogee. Dist. from ⊕, 251,900 mi.		3 43	1O234
Wed.	3						O2134
Thu.	4	15	56	☌ ♂ ☾	♂ 0° 31′ N.		21O34
		21		☌ ☿ ♀	☿ 2° 05′ S.		
Fri.	5					0 32	3O14*
Sat.	6	5	24	☾	Last Quarter		3O24*
Sun.	7					21 20	312O4
Mon.	8	5		☿	in ☊		23O41
Tue.	9	4		☿	Greatest elongation W., 17° 59′		14O23
Wed.	10	22	48	☌ ♅ ☾	♅ 5° 40′ N.	18 09	4O213
Thu.	11	16		♀	in Perihelion		421O3
Fri.	12	4	03	☌ ☿ ☾	☿ 5° 10′ N.		d42O1
		7	36	☌ ♀ ☾	♀ 5° 24′ N.		
		12		□ ♄ ☉	East		
		20		☿	in Perihelion		
Sat.	13	7	02	●	New Moon	14 57	43O2*
Sun.	14	12		Moon in Perigee. Dist. from ⊕, 223,400 mi.			4321O
Mon.	15						423O1
Tue.	16	1	37	☌ ♃ ☾	♃ 0° 11′ N.	11 46	41O23
		4	11	☌ ♆ ☾	♆ 0° 47′ N.		
Wed.	17						O4213
Thu.	18	1		☌ ☿ ♀	☿ 0° 21′ N.		21O43
Fri.	19	9	33	☌ ♄ ☾	♄ 3° 15′ S.	8 34	2O314
		22	17	☽	First Quarter		
Sat.	20						31O24
Sun.	21						dd3O4
Mon.	22					5 23	
Tue.	23	2		☿	Greatest Hel. Lat. N.		
		8	10	☉ enters ♎, Autumn commences. Long. of ☉, 180°			
Wed.	24						
Thu.	25					2 12	
Fri.	26	1		☌ ♃ ♆	♃ 0° 46′ S.		
Sat.	27	16	43	○	Full Moon. Harvest Moon	23 00	
Sun.	28						
Mon.	29	17		Moon in Apogee. Dist. from ⊕, 252,400 mi.			
Tue.	30					19 49	

Jupiter being near the sun, configurations of the satellites are not given from September 23 to November 22.

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

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

The Sun—During October the sun's R.A. increases from 12h 27m to 14h 23m and its Decl. changes from 2° 54′ S. to 14° 12′ S. The equation of time changes from +10m 02s to +16m 20s. There is a total eclipse of the sun on the 12th invisible in North America. For changes in the length of the day, see p. 17.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 24.

Mercury on the 15th is in R.A. 13h 43m, Decl. 10° 30′ S. and transits at 12h 13m. On the 5th it is in superior conjunction and it remains all month too close to the sun for observation.

Venus on the 15th is in R.A. 12h 54m, Decl. 4° 18′ S., mag. −3.4, and transits at 11h 22m. It is too close to the sun for easy observation.

Mars on the 15th is in R.A. 4h 02m, Decl. 19° 27′ N., mag. −1.4, and transits at 2h 29m. It is a brilliant object in Taurus visible during the whole night. On the 9th it is stationary in right ascension and begins to retrograde, i.e., move westward among the stars.

Jupiter on the 15th is in R.A. 14h 22m, Decl. 13° 07′ S. and transits at 12h 48m. It is too close to the sun for easy observation.

Saturn on the 15th is in R.A. 17h 22m, Decl. 22° 04′ S., mag. 0.8, and transits at 15h 47m. In Ophiuchus, it is well past the meridian at sunset and sets about three hours later.

Uranus on the 15th is in R.A. 9h 13m, Decl. 16° 45′ N. and transits at 7h 39m.

Neptune on the 15th is in R.A. 14h 09m, Decl. 11° 15′ S. and transits at 12h 35m.

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

OCTOBER

75th Meridian Civil Time

		h	m		Min. of Algol h m
Wed.	1				
Thu.	2	13	23	☌ ♂ ☾ ♂ 1° 46′ N.	
Fri.	3	15		♀ Greatest Hel.Lat.N.	16 38
Sat.	4				
Sun.	5	7		☌ ☿ ☉ Superior	
		20	20	☾ Last Quarter	
Mon.	6				13 26
Tue.	7				
Wed.	8	11	02	☌ ♅ ☾ ♅ 5° 43′ N.	
Thu.	9	17		♂ Stationary in R.A.	10 15
Fri.	10				
Sat.	11				
Sun.	12			Total eclipse of ☉. See p. 59	7 04
		4	34	☌ ♀ ☾ ♀ 2°34′ N.	
		15	52	● New Moon	
		21		Moon in Perigee. Dist. from ⊕, 221,900 mi.	
Mon.	13	1	15	☌ ☿ ☾ ☿ 0° 09′ N.	
		15	49	☌ ♆ ☾ ♆ 0° 39′ N.	
		20	34	☌ ♃ ☾ ♃ 0° 26′ S.	
Tue.	14				
Wed.	15				3 52
Thu.	16	12		☿ in ☋	
		20	12	☌ ♄ ☾ ♄ 3° 28′ S.	
Fri.	17				
Sat.	18				0 41
Sun.	19	5		☌ ☿ ♆ ☿ 2° 08′ S.	
		9	07	☽ First Quarter	
Mon.	20			Orionid meteors	21 30
Tue.	21				
Wed.	22	7		☌ ☿ ♃ ☿ 1° 41′ S.	
Thu.	23				18 19
Fri.	24				
Sat.	25				
Sun.	26	19		Moon in Apogee. Dist. from ⊕, 252,500 mi.	15 07
		19		☿ in Aphelion	
Mon.	27	10	41	○ Full Moon. Hunter's Moon	
Tue.	28	6		☌ ☿ ☉	
Wed.	29	14	14	☌ ♂ ☾ ♂ 2° 43′ N.	11 56
Thu.	30				
Fri.	31			Taurid meteors	
		9		☌ ♀ ♆ ♀ 0° 44′ S.	

Jupiter being near the sun, configurations of the satellites are not given from September 23 to November 22.

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

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

The Sun—During November the sun's R.A. increases from 14h 23m to 16h 26m and its Decl. changes from 14° 12′ S. to 21° 41′ S. The equation of time changes from +16m 20s to a maximum of +16m 23s on the 4th and then to +11m 14s at the end of the month. For changes in the length of the day, see p. 18.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 25.

Mercury on the 15th is in R.A. 16h 47m, Decl. 24°58′S. and transits at 13h 13m. On the 20th it is at greatest eastern elongation (mag. −0.1) and so an evening star at this time. However, this elongation is particularly unfavourable, Mercury being less than 10 degrees above the horizon in the south-west at sunset.

Venus on the 15th is in R.A. 15h 23m. Decl. 18°00′S., mag. −3.5, and transits at 11h 49m. It is too close to the sun for observation. Superior conjunction is on the 11th.

Mars on the 15th is in R.A. 3h 27m, Decl. 19° 12′ N., mag. −2.0 and transits at 23h 47m. Still in Taurus, it rises at about sunset and is very prominent for the whole night. On the 8th it is nearest the earth and on the 16th it is in opposition.

Jupiter on the 15th is in R.A. 14h 48m, Decl. 15° 15′ S. and transits at 11h 12m. It is too close to the sun for observation, conjunction being on the 4th.

Saturn on the 15th is in R.A. 17h 34m, Decl. 22° 18′ S., mag. 0.7, and transits at 13h 57m. It is well down in the south-west at sunset and sets within two hours thereafter.

Uranus on the 15th is in R.A. 9h 16m, Decl. 16° 35′ N. and transits at 5h 40m.

Neptune on the 15th is in R.A. 14h 14m, Decl. 11° 38′ S. and transits at 10h 37m.

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

NOVEMBER

75th Meridian Civil Time.

	d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 7h 45m
Sat.	1			....	8 45	
Sun.	2			....		
Mon.	3			....		
Tue.	4	9	19	☾ Last Quarter	5 34	
		20		☌ ♃ ☉		
		20	33	☌ ♅ ☾ ♅ 5° 40′ N.		
Wed.	5			Taurid meteors		
Thur.	6	11		☌ ♀ ♃ ♀ 0° 06′ S.		
Fri.	7			....	2 23	
Sat.	8	7		♂ in ♌		
		8		♂ nearest ⊕. Dist. from ⊕, 45,310,000 mi....		
Sun.	9	0		□ ♅ ☉ West	23 12	
Mon.	10	4	42	☌ ♆ ☾ ♆ 0° 33′ N.		
		9		Moon in Perigee. Dist. from ⊕, 222,300 mi.		
		17	14	☌ ♃ ☾ ♃ 0° 59′ S.		
Tue.	11	0	40	☌ ♀ ☾ ♀ 1° 40′ S.		
		1	34	● New Moon		
		7		☌ ♀ ☉ Superior		
Wed.	12	11	13	☌ ☿ ☾ ☿ 6° 25′ S.	20 00	
Thu.	13	10	32	☌ ♄ ☾ ♄ 3° 36′ S.		
Fri.	14			....		
Sat.	15			....	16 49	
Sun.	16			Leonid meteors		
		3		☿ Greatest Hel. Lat. S.		
		9		☍ ♂ ☉ Dist. from ⊕, 45,860,000 mi.		
Mon.	17	23	59	☽ First Quarter		
Tue.	18			....	13 38	
Wed.	19			....		
Thu.	20	14		☿ Greatest elongation E., 22° 13′.......		
Fri.	21			....	10 27	
Sat.	22	7		♅ Stationary in R.A.		42013
Sun.	23	0		Moon in Apogee. Dist. from ⊕, 252,200 mi.		41032
Mon.	24			....	7 16	30412
Tue.	25	1	40	☌ ♂ ☾ ♂ 3° 25′ N.		32104
Wed.	26	5	16	○ Full Moon		d3204
Thu.	27			....	4 05	03124
Fri.	28	17		♀ in ♉		10234
Sat.	29			....		20134
Sun.	30	3		☿ Stationary in R.A.	0 54	10234

Jupiter being near the sun, configurations of the satellites are not given from September 23 to November 22.

Explanation of symbols and abbreviations on p. 4, of time on p. 10.

THE SKY FOR DECEMBER, 1958

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

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

The Sun—During December the sun's R.A. increases from 16h 26m to 18h 43m and its Decl. changes from 21° 41′ S. to 23° 26′ S. at the solstice on the 22nd at 3h 40m E.S.T. and then to 23° 05′ S. at the end of the month. The equation of time changes from +11m 14s to zero on the 25th and then to −3m 08s at the end of the month. For changes in the length of the day, see p. 18.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 25.

Mercury on the 15th is in R.A. 16h 42m, Decl. 19° 32′ S. and transits at 11h 05m. Early in the month it is too close to the sun for observation, inferior conjunction being on the 9th. However, by the 29th it is at greatest western elongation (mag. −0.1) and so at the end of the month Mercury may be seen low in the south-east just before sunrise.

Venus on the 15th is in R.A. 18h 03m, Decl. 24° 04′ S., mag. −3.4, and transits at 12h 32m. It is an evening star now, but until late in the month it is too low at sunset for easy observation.

Mars on the 15th is in R.A. 2h 55m, Decl. 18° 21′ N., mag. −1.1, and transits at 21h 18m. It is in Aries now. It is already well up in the east at sunset and, although fading now, remains a prominent object visible all night. On the 20th it resumes direct, i.e. eastward, motion among the stars.

Jupiter on the 15th is in R.A. 15h 14m, Decl. 17° 02′ S., mag. −1.3, and transits at 9h 40m. It is now a morning star and may be seen very low in the south-east just before sunrise. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 57.

Saturn on the 15th is in R.A. 17h 49m, Decl. 22° 27′ S. and transits at 12h 14m. It is too close to the sun for observation, conjunction being on the 20th.

Uranus on the 15th is in R.A. 9h 15m, Decl. 16° 40′ N. and transits at 3h 41m.

Neptune on the 15th is in R.A. 14h 18m, Decl. 11° 57′ S. and transits at 8h 43m.

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

				DECEMBER 75th Meridian Civil Time	Min. of Algol	Config. of Jupiter's Sat. 7h 30m
	d	h	m		h m	
Mon.	1			. . . .		30124
Tue.	2	2	41	☌ ♅ ☾ ♅ 5° 31′ N.	21 43	32104
Wed.	3	20	24	☾ Last Quarter		34201
Thu.	4			. . . .		402**
Fri.	5	4		☿ in ☊	18 32	41023
Sat.	6			. . . .		42013
Sun.	7	6		☌ ☿ ♀ ☿ 1° 03′ N.		4103*
		16	22	☌ ♆ ☾ ♆ 0° 24′ N.		
Mon.	8	13	16	☌ ♃ ☾ ♃ 1° 32′ S.	15 21	43012
		19		Moon in Perigee. Dist. from ⊕, 224,600 mi.		
Tue.	9	19		☿ in Perihelion		43120
		22		☌ ☿ ⊙ Inferior		
Wed.	10	9	58	☌ ☿ ☾ ☿ 2° 31′ S.		32401
		12	23	● New Moon		
Thu.	11	0	52	☌ ♀ ☾ ♀ 5° 06′ S.	12 10	31042
		2	45	☌ ♄ ☾ ♄ 3° 41′ S.		
Fri.	12	0		☌ ♀ ♄ ♀ 1° 30′ S.		d0234
Sat.	13			Geminid meteors		20134
Sun.	14			. . . .	8 59	12034
Mon.	15			. . . .		30124
Tue.	16			. . . .		31204
Wed.	17	18	52	☽ First Quarter	5 48	32014
Thu.	18			. . . .		31024
Fri.	19	21		☿ Stationary in R.A.		d0423
Sat.	20	1		☿ Greatest Hel. Lat. N.	2 38	42013
		7		☌ ♄ ⊙		
		13		♂ Stationary in R.A.		
		16		Moon in Apogee. Dist. from ⊕, 251,600 mi.		
Sun.	21	23	56	☌ ♂ ☾ ♂ 4° 05′ N.		42103
Mon.	22			Ursid meteors	23 27	40312
		3	40	⊙ enters ♑. Winter commences. Long. of ⊙, 270°		
Tue.	23			. . . .		d4310
Wed.	24			. . . .		43201
Thu.	25	22	54	○ Full Moon	20 16	43102
Fri.	26			. . . .		40132
Sat.	27			. . . .		2403*
Sun.	28			. . . .	17 05	21043
Mon.	29	7	02	☌ ♅ ☾ ♅ 5° 21′ N.		03124
		9		☿ Greatest elongation W., 22° 25′		
Tue.	30			. . . .		31024
Wed.	31			. . . .	13 54	32014

Explanation of symbols and abbreviations on p. 4, of time on p. 10.

JANUARY

d	h	m	Sat.	Phen.
1	3	20	I	TI
	4	21	I	Se
	5	30	I	Te
2	2	48	I	OR
5	4	29	III	Se
	6	55	III	TI
7	3	23	II	ED
	5	48	II	ER
	5	52	II	OD
	6	52	I	ED
8	4	04	I	SI
	5	16	I	TI
	6	15	I	Se
9	2	59	II	Te
	4	42	I	OR
10	1	54	I	Te
12	5	59	III	SI
14	5	58	II	ED
15	5	57	I	SI
16	3	08	III	OR
	3	13	I	ED
	3	13	II	Se
	3	17	II	TI
	5	33	II	Te
	6	36	I	OR
17	1	39	I	TI
	2	36	I	Se
	3	49	I	Te
23	2	17	III	ER
	3	23	II	SI
	4	56	III	OD
	5	06	I	ED
	5	46	II	Se
	5	50	II	TI
24	2	19	I	SI
	3	33	I	TI
	4	30	I	Se
	5	42	I	Te
25	2	43	II	OR
	2	57	I	OR
30	3	45	III	ED
	5	56	II	SI
	6	13	III	ER
31	4	12	I	SI
	5	25	I	TI
	6	23	I	Se

FEBRUARY

d	h	m	Sat.	Phen.
1	0	27	II	ED
	1	26	I	ED
	2	52	II	ER
	3	00	II	OD
	4	49	I	OR
	5	16	II	OR
2	0	51	I	Se
	2	02	I	Te
3	0	55	III	Te
7	6	06	I	SI
8	3	03	II	ED
	3	19	I	ED
	5	28	II	ER
	5	31	II	OD
9	0	34	I	SI
	1	45	I	TI
	2	45	I	Se
	3	53	I	Te
10	0	05	II	TI
	0	06	II	Se
	0	13	III	Se
	1	07	I	OR
	2	18	II	Te
10	2	42	III	TI
	4	42	III	Te
15	5	12	I	ED
	5	39	II	ED
16	2	27	I	SI
	3	35	I	TI
	4	38	I	Se
	5	44	I	Te
	23	40	I	ED
17	0	17	II	SI
	1	46	III	SI
	2	31	II	TI
	2	39	II	Se
	2	56	I	OR
	4	11	III	Se
	4	44	II	Te
	6	27	III	TI
18	0	11	I	Te
	23	30	II	OR
23	4	21	I	SI
	5	24	I	TI
24	1	33	I	ED
	2	50	II	SI
	4	44	I	OR
	4	55	II	TI
	5	11	II	Se
	5	44	III	SI
	23	51	I	TI
25	1	00	I	Se
	2	00	I	Te
	23	11	I	OR
26	1	55	II	OR
27	23	46	III	OD
28	1	41	III	OR

MARCH

d	h	m	Sat.	Phen.
3	3	26	I	ED
	5	23	II	SI
4	0	43	I	SI
	1	39	I	TI
	2	54	I	Se
	3	47	I	Te
5	0	09	II	ED
	0	58	I	OR
	4	18	II	OR
6	22	38	II	Te
	23	32	III	ED
7	1	56	III	ER
	3	18	III	OD
	5	12	III	OR
10	5	19	I	ED
11	2	36	I	SI
	3	25	I	TI
	4	47	I	Se
	5	34	I	Te
	23	48	I	ED
12	2	44	I	OR
	2	45	II	ED
	21	52	I	TI
	23	16	I	Se
13	0	01	I	Te
	22	45	II	TI
	23	33	II	Se
14	0	57	II	Te
	3	29	III	ED
17	22	28	III	Te
18	4	30	I	SI
	5	11	I	TI
19	1	41	I	ED
	4	29	I	OR
	5	21	II	ED
	22	58	I	SI
19	23	38	I	TI
20	1	10	I	Se
20	1	47	I	Te
	22	56	I	OR
	23	45	II	SI
21	1	02	II	TI
	2	05	II	Se
	3	14	II	Te
22	22	07	II	OR
24	21	35	III	SI
	23	57	III	Se
25	0	00	III	TI
	1	50	III	Te
26	3	34	I	ED
27	0	52	I	SI
	1	22	I	TI
	3	03	I	Se
	3	32	I	Te
	22	02	I	ED
28	0	40	I	OR
	2	19	II	SI
	3	18	II	TI
	4	39	II	Se
	21	32	I	Se
	21	58	I	Te
29	21	14	II	ED
30	0	24	II	OR

APRIL

d	h	m	Sat.	Phen.
1	1	33	III	SI
	3	19	III	TI
	3	54	III	Se
	5	10	III	Te
3	2	46	I	SI
	3	07	I	TI
	4	57	I	Se
	5	16	I	Te
	23	56	I	ED
4	2	24	I	OR
	4	52	II	SI
	21	15	I	SI
	21	33	I	TI
	23	26	I	Se
	23	42	I	Te
5	20	50	I	OR
	23	50	II	ED
6	2	40	II	OR
7	20	30	II	Se
	20	52	II	Te
10	4	40	I	SI
	4	51	I	TI
11	1	50	I	ED
	4	08	I	OR
	22	00	III	OR
	23	09	I	SI
	23	17	I	TI
12	1	20	I	Se
	1	26	I	Te
	20	18	I	ED
	22	34	I	OR
13	2	27	II	ED
	4	56	II	OR
	19	48	I	Se
	19	52	I	Te
14	20	43	II	SI
	20	52	II	TI
	23	04	II	Se
	23	06	II	Te
18	3	42	I	OD
	23	19	III	ED
19	1	01	I	TI
	1	03	I	SI
	1	40	III	ER
	3	10	I	Te
	3	14	I	Se
	22	08	I	OD
20	0	22	I	ER
	19	27	I	TI
	19	31	I	SI
	21	36	I	Te
	21	42	I	Se
21	23	06	II	TI
	23	17	II	SI
22	1	20	II	Te
	1	38	II	Se
23	20	42	II	ER
26	2	35	III	OD
	2	45	I	TI
	2	57	I	SI
	23	52	I	OD
27	2	16	I	ER
	21	11	I	TI
	21	26	I	SI
	23	20	I	Te
	23	37	I	Se
28	20	45	I	ER
29	1	20	II	TI
	1	52	II	SI
	3	35	II	Te
	4	12	II	Se
	19	46	III	Se
30	20	20	II	OD
	23	18	II	ER

MAY

d	h	m	Sat.	Phen.
4	1	36	I	OD
	22	56	I	TI
	23	20	I	SI
5	1	05	I	Te
	1	31	I	Se
	20	03	I	OD
	22	39	I	ER
6	3	35	II	TI
	19	41	III	TI
	19	59	I	Se
	21	26	III	SI
	21	44	III	Te
	23	44	III	Se
7	22	36	II	OD
8	1	54	II	ER
9	20	04	II	Se
11	3	21	I	OD
12	0	41	I	TI
	1	15	I	SI
	2	51	I	Te
	3	25	I	Se
	21	48	I	OD
13	0	33	I	ER
	19	43	I	SI
	21	17	I	Te
	21	54	I	Se
	23	00	III	TI
14	1	07	III	Te
	1	24	III	SI
15	0	53	II	OD
16	20	19	II	SI
	21	17	II	Te
	22	38	II	Se
19	2	27	I	TI
	23	33	I	OD
20	2	28	I	ER
	20	53	I	TI
	21	38	I	SI
	23	03	I	Te
20	23	48	I	Se
21	2	23	III	TI
	20	56	I	ER
23	21	19	II	TI
	22	54	II	SI
	23	37	II	Te

d	h	m	Sat.	Phen.
24	1	14	II	Se
	21	31	III	ER
25	20	23	II	ER
27	1	20	I	OD
	22	41	I	TI
	23	33	I	SI
28	0	51	I	Te
	1	43	I	Se
	22	51	I	ER
29	20	11	I	Se
30	23	39	II	TI
31	1	30	II	SI
	1	58	II	Te
	21	41	III	OR
	23	12	III	ED

JUNE

d	h	m	Sat.	Phen.
1	1	29	III	ER
	22	58	II	ER
4	0	29	I	TI
	1	28	I	SI
	21	35	I	OD
5	0	46	I	ER
	21	06	I	Te
	22	06	I	Se
7	22	57	III	OD
8	1	16	III	OR
	21	07	II	OD
11	23	25	I	OD
12	20	46	I	TI
	21	51	I	SI
	22	56	I	Te
13	0	00	I	Se
13	21	09	I	ER
15	23	33	II	OD
17	22	18	II	Se
18	21	20	III	SI
	23	34	III	Se
19	22	37	I	TI
	23	46	I	SI
20	0	46	I	Te
	23	04	I	ER
21	20	24	I	Se
24	20	10	II	TI
	22	32	II	Te
	22	37	II	SI
25	20	21	III	TI
	22	44	III	Te
27	21	35	I	OD
28	20	09	I	SI
	21	06	I	Te
	22	18	I	Se

JULY

d	h	m	Sat.	Phen.
1	22	42	II	TI
3	20	10	II	OR
	20	19	II	ED
	22	37	II	ER
4	23	28	I	OD
5	20	50	I	TI
	22	04	I	SI
	23	00	I	Te
6	21	23	III	ER
	21	23	I	ER
10	20	20	II	OD
	22	43	II	OD
10	24	54	II	ED
12	22	44	I	TI
13	20	21	III	OR
	23	08	III	ED
14	20	36	I	Se
17	22	55	II	OD
19	22	03	II	Se
20	21	46	I	OD
	21	51	III	OD
21	20	22	I	SI
	21	17	I	Te
	22	31	I	Se
26	22	11	II	Te
	22	22	II	SI
28	21	03	I	TI
	22	17	I	SI
29	21	37	I	ER
31	21	15	III	SI

AUGUST

d	h	m	Sat.	Phen.
4	19	53	II	OR
	19	57	II	ED
5	20	09	I	OD
6	20	49	I	Se
7	20	16	III	TI
11	20	10	II	OD
13	20	35	I	SI
14	19	56	I	ER
20	19	33	II	SI
	19	41	II	Te
27	20	03	II	TI
29	19	15	II	ER
	20	04	I	Te

SEPTEMBER

d	h	m	Sat.	Phen.
5	19	20	III	Se
	19	53	I	TI
13	19	05	I	OD
14	19	01	II	Se
	19	19	I	Se

Jupiter being near the sun, phenomena of the satellites are not given from Sept. 23 to Nov. 22.

NOVEMBER

d	h	m	Sat.	Phen.
27	6	30	I	OR
	6	33	III	OR

DECEMBER

d	h	m	Sat.	Phen.
4	5	51	I	ED
12	5	30	I	TI
15	5	36	III	Te
16	6	14	II	Te
19	6	47	I	SI
22	6	51	III	Se
23	5	12	II	SI
	6	45	II	TI
27	6	01	I	ED
28	5	18	I	Se
	6	08	I	Te

E—eclipse, O—occultation, T—transit, S—shadow, D—disappearance, R—reappearance, I—ingress, e—egress: 75th Meridian Civil Time. (For other times see p. 10.)

EPHEMERIS FOR PHYSICAL OBSERVATION OF THE MOON, 1958

The Sun's Selenographic Co-ordinates for Oh Greenwich Civil Time

	Colong. °	Lat. °		Colong. °	Lat. °		Colong. °	Lat. °
Jan. 1	35.9	+1.4	May 1	57.0	−0.2	Sept. 1	119.5	−1.1
Feb. 1	52.8	+1.5	June 1	75.5	−1.0	Oct. 1	125.6	−0.4
Mar. 1	33.5	+1.3	July 1	82.1	−1.5	Nov. 1	143.3	+0.5
Apr. 1	51.0	+0.6	Aug. 1	100.9	−1.5	Dec. 1	148.3	+1.2

The average *daily* change in the sun's selenographic colongitude is $+12.2^{\circ}$.

EPHEMERIS FOR THE PHYSICAL OBSERVATION OF THE SUN, 1958

For 0h Greenwich Civil Time

Date	P	B_0	L_0	Date	P	B_0	L_0
	°	°	°		°	°	°
Jan. 1	+ 2.25	−3.05	157.49	July 5	− 1.10	+3.32	235.76
6	− 0.18	−3.62	91.64	10	+ 1.17	+3.84	169.59
11	− 2.60	−4.16	25.79	15	+ 3.41	+4.34	103.42
16	− 4.97	−4.67	319.96	20	+ 5.62	+4.81	37.26
21	− 7.28	−5.14	254.12	25	+ 7.77	+5.24	331.11
26	− 9.50	−5.58	188.29	30	+ 9.85	+5.64	264.97
31	−11.63	−5.97	122.46	Aug. 4	+11.84	+6.00	198.84
Feb. 5	−13.65	−6.31	56.62	9	+13.74	+6.32	132.73
10	−15.55	−6.60	350.79	14	+15.53	+6.60	66.63
15	−17.31	−6.84	284.95	19	+17.21	+6.82	0.54
20	−18.94	−7.02	219.11	24	+18.78	+7.01	294.47
25	−20.41	−7.15	153.26	29	+20.21	+7.14	228.41
Mar. 2	−21.74	−7.23	87.40	Sept. 3	+21.51	+7.22	162.36
7	−22.90	−7.25	21.52	8	+22.67	+7.25	96.32
12	−23.91	−7.21	315.64	13	+23.68	+7.23	30.30
17	−24.75	−7.12	249.74	18	+24.54	+7.15	324.29
22	−25.41	−6.98	183.82	23	+25.24	+7.02	258.29
27	−25.90	−6.78	117.89	28	+25.77	+6.85	192.30
Apr. 1	−26.22	−6.54	51.94	Oct. 3	+26.14	+6.62	126.32
6	−26.36	−6.24	345.96	8	+26.33	+6.34	60.35
11	−26.31	−5.90	279.97	13	+26.34	+6.01	354.39
16	−26.08	−5.52	213.96	18	+26.16	+5.63	288.44
21	−25.67	−5.10	147.92	23	+25.80	+5.22	222.49
26	−25.07	−4.64	81.87	28	+25.24	+4.76	156.55
May 1	−24.29	−4.16	15.80	Nov. 2	+24.47	+4.27	90.62
6	−23.33	−3.64	309.71	7	+23.52	+3.74	24.70
11	−22.19	−3.10	243.60	12	+22.37	+3.18	318.77
16	−20.88	−2.54	177.47	17	+21.03	+2.60	252.86
21	−19.41	−1.96	111.34	22	+19.50	+1.99	186.95
26	−17.79	−1.37	45.18	27	+17.79	+1.37	121.05
31	−16.02	−0.77	339.02	Dec. 2	+15.93	+0.74	55.16
June 5	−14.13	−0.17	272.85	7	+13.91	+0.10	349.27
10	−12.13	+0.43	206.68	12	+11.47	−0.54	283.38
15	−10.03	+1.03	140.49	17	+ 9.52	−1.18	217.51
20	− 7.86	+1.63	74.31	22	+ 7.18	−1.80	151.64
25	− 5.63	+2.21	8.13	27	+ 4.79	−2.42	85.78
30	− 3.37	+2.77	301.94				

P —The position angle of the axis of rotation, measured eastward from the north point of the disk.

B_0—The heliographic latitude of the centre of the disk.

L_0—The heliographic longitude of the centre of the disk, from Carrington's solar meridian.

Carrington's Rotation Numbers—Greenwich date of commencement of synodic rotations, 1958

No.	Commences	No.	Commences	No.	Commences
1396	Jan. 12.96	1401	May 29.42	1406	Oct. 12.58
1397	Feb. 9.30	1402	June 25.61	1407	Nov. 8.87
1398	Mar. 8.64	1403	July 22.82	1408	Dec. 6.18
1399	Apr. 4.94	1404	Aug. 19.04		
1400	May 2.20	1405	Sept. 15.30		

ECLIPSES, 1958

In the year 1958 there will be three eclipses, two of the sun and one of the moon.

I. *An Annular Eclipse of the Sun,* April 19, 1958. The path of this eclipse is across the Indian Ocean, Indo China, Formosa, and into the Pacific.

II. *A Partial Eclipse of the Moon,* May 3, 1958. This eclipse is visible just before moonset on the morning of the 3rd in Western Canada, but in the east the moon will have already set before the eclipse takes place.

Circumstances of the Lunar Eclipse, May 3, 1958 (E.S.T.)

enters penumbra	5h 09.9m	leaves umbra	7h 26.1m
enters umbra	6 59.6	leaves penumbra	9 15.9
middle of eclipse	7 12.9		

III. *A Total Eclipse of the Sun,* October 12, 1958. The path of this eclipse is almost wholly in the South Pacific Ocean, beginning near New Guinea and ending in Argentina.

LUNAR OCCULTATIONS

When the moon passes between the observer and a star that star is said to be occulted by the moon and the phenomenon is known as a lunar occultation. The passage of the star behind the east limb of the moon is called the immersion and its appearance from behind the west limb the emersion. As in the case of eclipses, the times of immersion and emersion and the duration of the occultation are different for different places on the earth's surface. The tables given below, adapted from the 1958 Nautical Almanac, give the times of immersion or emersion or both for occultations of stars of magnitude 5.0 or brighter visible at Toronto and at Montreal at night. The terms a and b are for determining corrections to the times of the phenomena for stations within 300 miles of the standard stations. Thus if λ_0, ϕ_0, be the longitude and latitude of the standard station and λ, ϕ, the longitude and latitude of the neighbouring station then for the neighbouring station we have—

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

where $\lambda - \lambda_0$ and $\phi - \phi_0$ are expressed in degrees. The quantity P in the table is the position angle of the point of contact on the moon's disk reckoned from the north point towards the east. The table of occultations visible at Vancouver is adapted from the American Ephemeris for 1958.

LUNAR OCCULATIONS VISIBLE AT TORONTO AND MONTREAL, 1958

Date	Star	Mag.	I or E	Age of Moon	Toronto E.S.T.	Toronto a	Toronto b	Toronto P	Montreal E.S.T.	Montreal a	Montreal b	Montreal P
				d	h m	m	m	°	h m	m	m	°
Feb. 10	α Lib	2.9	I	21.5	5 07.3	—	—	38	No occ	..	..	..
Feb. 10	α Lib	2.9	E	21.5	5 34.6	—	—	358	No occ	..	..	..
Mar. 21	Mercury	−0.8	I	1.5	18 17.2	−0.7	+2.3	19	18 27.4	—	—	2
Mar. 21	Mercury	−0.8	E	1.5	18 57.8	0.0	−4.2	314	18 46.2	—	—	332
Mar. 25	68 Tau	4.2	I	5.7	21 59.1	0.0	−1.9	113	21 55.7	0.0	−1.7	103
Apr. 5	α Lib	2.9	I	16.8	Low	..	..	..	21 59.2	−0.1	−0.7	154
Apr. 5	α Lib	2.9	E	16.8	22 29.7	−1.9	+3.8	225	22 44.3	−1.5	+2.0	244
May 9	β Cap	3.2	I	20.2	1 54.8	−1.2	+2.4	41	2 06.4	−1.3	+2.4	36
May 9	β Cap	3.2	E	20.2	2 56.2	−1.5	+0.5	294	3 06.5	−1.8	+0.3	297
May 30	α Lib	2.9	E	12.2	Sun	..	..	..	19 36.8	−1.7	+1.9	245
Oct. 2	64 Tau	4.8	E	19.7	21 58.0	—	—	340	22 03.4	—	—	335
Oct. 30	δ Tau	3.9	I	17.5	5 01.3	−1.5	+0.1	59	5 10.0	−1.3	+0.3	49
Oct. 30	δ Tau	3.9	E	17.5	6 07.3	−0.6	−2.3	298	Sun	..	..	..
Dec. 23	64 Tau	4.8	I	13.2	Sun	..	..	..	16 49.5	+0.5	+3.1	24
Dec. 27	λ Gem	3.6	I	16.6	1 30.0	−1.4	−3.1	148	1 33.5	−1.4	−2.3	136
Dec. 27	λ Gem	3.6	E	16.6	2 28.4	−2.4	+1.1	237	2 41.4	−1.8	−0.1	250
Dec. 28	α Cnc	4.3	I	18.4	21 23.2	−0.4	+0.4	122	21 26.6	−0.5	+0.5	118
Dec. 28	α Cnc	4.3	E	18.4	22 22.6	−0.6	+1.7	261	22 29.7	−0.8	+1.5	266

LUNAR OCCULATIONS VISIBLE AT EDMONTON AND VANCOUVER, 1958

Date	Star	Mag.	I or E	Age of Moon	EDMONTON M.S.T.	EDMONTON a	EDMONTON b	EDMONTON P	VANCOUVER P.S.T.	VANCOUVER a	VANCOUVER b	VANCOUVER P
				d	h m	m	m	°	h m	m	m	°
Jan. 12	α Vir	1.2	I	22.4	9 02.0	−1.1	−1.0	80	7 52.6	−1.5	−0.8	90
Jan. 12	α Vir	1.2	E	22.4	10 01.4	−0.7	−1.9	317	9 00.1	−1.0	−1.8	310
Jan. 15	ν Sco	4.3	I	25.4	—	—	—	—	7 06.8	—	—	40
Feb. 2	λ Gem	3.6	I	13.6	5 20.3	+0.1	−1.4	97	4 27.4	+0.1	−1.6	109
Feb. 10	α Lib	2.9	E	21.5	3 07.3	−0.3	−0.4	334	Low	..	..	..
Mar. 14	ρ Sgr	4.0	I	23.9	—	—	—	—	4 54.8	−1.1	+1.6	72
Mar. 25	68 Tau	4.2	I	5.7	19 21.4	−1.0	−1.8	107	—	—	—	—
Mar. 28	λ Gem	3.6	I	8.9	—	—	—	—	23 34.9	−1.0	−0.4	53
Apr. 22	104 Tau	5.0	I	4.0	20 49.3	−1.0	+0.7	30	19 41.0	−0.9	−0.5	56
July 28	ρ Sgr	4.0	I	12.6	—	—	—	—	23 32.5	−1.4	+0.3	58
July 29	ρ Sgr	4.0	I	12.6	0 45.7	−1.1	−0.2	59	—	—	—	—
Aug. 9	δ Tau	3.9	I	23.8	—	—	—	—	3 14.8	−0.6	+1.7	79
Oct. 6	λ Gem	3.6	I	23.0	4 13.6	−1.0	+2.9	50	2 54.5	−0.7	+2.4	62
Oct. 6	λ Gem	3.6	E	23.0	5 04.9	−1.3	−1.5	324	3 54.9	−1.3	−0.4	309
Oct. 18	ρ Sgr	4.0	I	6.2	18 49.1	−1.9	−1.3	129	17 33.9	−2.0	−0.9	129
Oct. 19	β Cap	3.2	I	7.3	22 11.8	−0.6	−0.5	53	21 06.1	−0.9	−0.2	53
Oct. 19	β Cap	3.2	E	7.3	—	—	—	—	22 13.4	−0.9	−1.4	269
Oct. 30	δ Tau	3.9	I	17.5	2 24.1	—	—	18	0 57.4	−1.1	+3.4	31
Oct. 30	δ Tau	3.9	E	17.5	2 59.2	—	—	327	1 52.4	−2.1	−2.2	310
Oct. 30	64 Tau	4.8	E	17.6	4 01.3	−1.4	−1.5	287	2 50.0	−1.7	−0.6	274
Dec. 26	λ Gem	3.6	I	16.6	22 28.7	−1.1	+0.5	115	21 16.9	−0.9	+0.3	123
Dec. 26	λ Gem	3.6	E	16.6	23 38.6	−1.3	+1.3	258	22 19.6	−1.1	+2.1	246

METEORS, FIREBALLS AND METEORITES

BY PETER M. MILLMAN

Meteoroids are small solid particles moving in orbits about the sun. On entering the earth's atmosphere at velocities ranging from 10 to 45 miles per second they become luminous and appear as meteors or fireballs and, if large enough to avoid complete vapourization, in rare cases they may fall to the earth as meteorites.

Meteors are visible on any night of the year. At certain times of the year the earth encounters large numbers of meteors all moving together along the same orbit. Such a group is known as a meteor shower and the accompanying list gives the most important showers visible in 1958.

On the average an observer sees 7 meteors per hour which are not associated with any recognized shower. These have been included in the hourly rates listed in the table. The radiant is the position among the stars from which the meteors of a given shower seem to radiate. The appearance of any very bright fireball should be reported immediately to the nearest astronomical group or organization. If sounds are heard accompanying such a phenomenon there is a possibility that a meteorite may have fallen and the astronomers must rely on observations made by the general public to track it down.

During 1958 a special programme of visual meteor observation is being carried out in connection with the International Geophysical Year. Instructions and report forms are available, free of charge, to those interested in this work. For information write to

Meteor Centre, I.G.Y.,
National Research Council,
Ottawa, Ontario.

METEOR SHOWERS FOR 1958

Shower	Shower Maximum			Radiant				Single Observer Hourly Rate	Normal Duration to $\frac{1}{4}$ strength of Max.
	Date	E.S.T.	Moon	Position at Max. α	Position at Max. δ	Daily Motion α	Daily Motion δ		(days)
Quadrantids	Jan. 3	11^h	F.M.	230°	+50°			35	1
Aurigids	Feb. 10	04	L.Q.	75	+42			12	
Lyrids	Apr. 22	01	N.M.	273	+34			12	2
η Aquarids	May 5	05	F.M.	336	00	+53′	+22′	12	16
δ Aquarids	Jul. 29	13	F.M.	339	−17	+51	+10	20	10
Perseids	Aug. 12	08	N.M.	46	+58	+81	+07	50	4
Orionids	Oct. 20	20	F.Q.	95	+15	+74	+08	20	9
Taurids	Nov. 5	20	L.Q.	53	+14	+40	+08	12	40
Leonids	Nov. 16	19	F.Q.	152	+22	+42	−25	20	3
Geminids	Dec. 13	13	N.M.	113	+32	+63	−04	40	6
Ursids	Dec. 22	18	F.Q.	217	+76			15	1

THE BRIGHTEST STARS

By Donald A. MacRae

The 286 stars brighter than apparent magnitude 3.55.

Star. If the star is a visual double the letter *A* indicates that the data are for the brighter component. The brightness and separation of the second component *B* are given in the last column. Sometimes the double is too close to be conveniently resolved and the data refer to the combined light, *AB*; in interpreting such data the magnitudes of the two components must be considered.

Visual Magnitude (*V*). These magnitudes are based on *photoelectric observations*, with a few exceptions, which have been adjusted to match the yellow colour-sensitivity of the eye. The photometric system is that of Johnson and Morgan in *Ap. J.*, vol. 117, p. 313, 1953. It is as likely as not that the true magnitude is within 0.03 mag. of the quoted figure, on the average. Variable stars are indicated with a "v". The type of variability, range, *R*, in magnitudes, and period in days are given.

Colour index ($B-V$). The blue magnitude, *B*, is the brightness of a star as observed photoelectrically through a blue filter. The difference $B-V$ is therefore a measure of the colour of a star. The table reveals a close relaton between $B-V$ and spectral type. Some of the stars are slightly reddened by interstellar dust. The probable error of a value of $B-V$ is only 0.01 or 0.02 mag.

Type. The customary spectral (temperature) classification is given first. The Roman numerals are indicators of *luminosity class.* They are to be interpreted as follows: Ia—most luminous supergiants; Ib—less luminous supergiants; II—bright giants; III—normal giants; IV—subgiants; V—main sequence stars. Intermediate classes are sometimes used, e.g. Iab. Approximate absolute magnitudes can be assigned to the various spectral and luminosity class combinations. Other symbols used in this column are: p—a peculiarity; e—emission lines; v—the spectrum is variable; m—lines due to metallic elements are abnormally strong; f—the O-type spectrum has several broad emission lines; n or nn—unusually wide or diffuse lines. A composite spectrum, e.g. M1 Ib+B, shows up when a star is composed of two nearly equal but unresolved components. In the far southern sky, spectral types in italics were provided through the kindness of Prof. R. v. d. R. Woolley, Australian Commonwealth Observatory. Types in parentheses are less accurately defined (g—giant, d—dwarf, c-exceptionally high luminosity). All other types were very kindly provided especially for this table by Dr. W. W. Morgan, Yerkes Observatory.

Parallax (π). From "General Catalogue of Trigonometric Stellar Parallaxes" by Louise F. Jenkins, Yale Univ. Obs., 1952.

Absolute visual magnitude (M_V), and *distance in light-years* (D). If π is greater than 0.030″ the distance corresponds to this trigonometric parallax and the absolute magnitude was computed from the formula $M_V = V + 5 + 5 \log \pi$. Otherwise a generally more accurate absolute magnitude was obtained from the luminosity class. In this case the formula was used to *compute* π and the distance corresponds to this "spectroscopic" parallax. The formula is an expression of the inverse square law for decrease in light intensity with increasing distance. The effect of absorption of light by interstellar dust was neglected, except for three stars, ζ Per, ρ Sco and ζ Oph, which are significantly reddened and would therefore be about a magnitude brighter if they were in the clear.

Annual proper motion (μ), and *radial velocity* (R). From "General Catalogue of Stellar Radial Velocities" by R. E. Wilson, Carnegie Inst. Pub. 601, 1953. Italics indicate an average value of a variable radial velocity.

The star names are given for all the officially designated navigation stars and a few others. Throughout the table, a *colon* (:) indicates an uncertainty.

We are indebted to Dr. Daniel L. Harris, Yerkes Observatory, particularly for his compilation of the photometric data from numerous sources.

	Right Ascension	Declination	Visual Magnitude	Colour Index	Spectral Classification		Parallax	Absolute Magnitude	Distance light-years	Proper Motion	Radial Velocity		
Star	R.A. 1960	Dec.	V	$B-V$	Type		π	M_V	D	μ	R		
	h m	° ′					″		l.y.	″	km./sec.		
SUN			-26.89	+0.63	G2	V		+4.68					***Sun***
α And	00 06.3	+28 52	2.06	−0.08	B9p		0.024	−0.1	90	0.209	*−11.7*	Manganese star	*Alpheratz*
β Cas	07.0	+58 56	2.26	+0.34	F2	IV	0.072	+1.6	45	0.555	+11.8		*Caph*
γ Peg	11.2	+14 58	2.84v	−0.23	B2	IV	−.004	−3.4	570	0.010	+04.1	β CMa type, *R* in *V* 2.83–2.85, 0.15^d	
β Hyi	23.7	−77 29	2.78	+0.62	*G1*	*IV*	0.153	+3.7	21	2.255	+22.8		γ Peg = *Algenib*
α Phe	24.3	−42 31	2.39	+1.08	*K0*	*III*	0.035	+0.1	93	0.442	*+74.6*		*Ankaa*
δ And *A*	37.2	+30 39	3.25:	+1.26	K3	III	0.024	−0.2	160	0.161	−07.3	*B* 12^m 28″	
α Cas	38.2	+56 19	2.16	+1.18	K0	II–III	0.009	−1.1	150	0.058	−03.8	Var.?	*Schedar*
β Cet	41.6	−18 12	2.02	+1.03	K1	III	0.057	+0.8	57	0.234	+13.1		*Diphda*
η Cas *A*	46.7	+57 36	3.47	+0.56	G0	V	0.182	+4.8	18	1.221	+09.4	*B* 7.26^m 9″	
γ Cas *A*	54.3	+60 30	2.13v	−0.16v	B0	IV: pe	0.034	−0.3:	96:	0.026	−06.8	Var. *B* 8.18^m 2″	
β Phe *AB*	01 04.3	−46 56	3.30	+0.88	*G8*	*III*	0.017	+0.3	190	0.035	−01.1	*A* 4.1^m *B* 4.1^m 2″	
η Cet	06.6	−10 24	3.47	+1.16	K3	III	0.032	+1.0	102	0.250	+11.5		
β And	07.5	+35 25	2.02	+1.57	M0	III	0.043	+0.2	76	0.211	+00.3		*Mirach*
δ Cas	23.2	+60 02	2.67	+0.13	A5	V	0.029	+2.1	43	0.301	+06.7	Ecl.? *R* $0.08:^m$ 759^d	
γ Phe	26.6	−43 31	3.44	+1.56	*K5*	*Ib*	−.003	−4.6	1300	0.209	*+25.7*		
α Eri	36.2	−57 26	0.51	−0.16	*B5*	*IV:*	0.023	−2.3	118	0.098	+19		***Achernar***
τ Cet	42.2	−16 09	3.50	+0.72	G8	Vp	0.275	+5.70	12	1.921	−16.2		

Star	R.A. 1960	Dec.	V	$B-V$	Type	π	M_V	D	μ	R	
	h m	° ′				″		l.y.	″	km./sec.	
α Tri	01 50.8	+29 23	3.45	+0.46	F6 IV	0.050	+2.0	65	0.230	*−12.6*	
ε Cas	51.5	+63 28	3.33	−0.15	B3 IV: p	0.007	−2.7	520	0.038	−08.1	
β Ari	52.4	+20 37	2.68	+0.14	A5 V	0.063	+1.7	52	0.147	*−01.9*	
α UMi *A*	55.5	+89 05	1.99v	+0.60v	F8 Ib	0.003	−4.6	680	0.046	*−17.4*	Cep., R 0.11^m 4.0^d, B 8.9^m 18″ *Polaris*
α Hyi	57.5	−61 46	2.84	+0.28	*F0 V*		+2.9	31	0.265	+07	
γ And *A*	02 01.4	+42 08	2.14:	+1.16:	K3 II	0.005	−2.4	260	0.068	−11.7	γ And = *Almach* B 5.4^m C 6.2^m A–BC 10″ B–C 0.7″
α Ari	04.9	+23 16	2.00	+1.15	K2 III	0.043	+0.2	76	0.241	−14.3	*Hamal*
β Tri	07.2	+34 48	3.00	+0.13	A5 III	0.012	−0.1	140	0.156	*+09.9*	
ο Cet *A*	17.3	−03 09	2.0v		(gM6e)	0.013	−0.5	103	0.232	+63.8	LP, R 2.0–10.1, 332^d, B 10^m 1″ *Mira*
γ Cet *AB*	41.2	+03 04	3.48	+0.11	A2 V	0.048	+2.0	68	0.203	−05.1	A 3.57^m B 6.23^m 3″
θ Eri *AB*	56.7	−40 28	2.92	+0.13	*A3 V*	0.028	+1.7	65	0.061	*+11.9*	A 3.25^m B 4.36^m 8″ *Acamar*
α Cet	03 00.2	+03 56	2.54	+1.63	M2 III	0.003	−0.5	130	0.075	−25.9	*Menkar*
γ Per	01.9	+53 21	2.91:	+0.72:	G8III: +A3:	0.011	+0.3	113	0.004	*+02.5*	
ρ Per	02.6	+38 41	3.5v		M4 II–III	0.008	−1.0	260	0.172	+28.2	Irr. R 3.2–3.8
β Per	05.6	+40 48	2.06v	−0.07	B8 V	0.031	−0.5	105	0.006	*+04.0*	Ecl. R 2.06–3.28, 2.87^d *Algol*
α Per	21.5	+49 43	1.80	+0.48	F5 Ib	0.029	−4.4	570	0.035	−02.4	*Mirfak*
δ Per	40.1	+47 40	3.03	−0.14	B5 III	0.007	−3.3	590	0.046	−09	
η Tau	45.1	+23 59	2.86	−0.09	B7 III	0.005	−3.2	541	0.050	+10.1	in Pleiades *Alcyone*
γ Hyi	47.8	−74 22	3.30	+1.61	*M2 II–III*	−.001	−1.5	300	0.125	+16.0	
ζ Per *A*	51.6	+31 46	2.83	+0.13	B1 Ib	0.007	−6.1	1000	0.015	+20.6	B 9.36^m 13″
ε Per *A*	55.2	+39 54	2.88	−0.17	B0.5 V	−.001	−3.7	680	0.036	−01	B 7.99^m 9″
γ Eri	56.2	−13 37	3.01	+1.58	M0 III	0.003	−0.5	160	0.126	+61.7	
α Ret *A*	04 13.9	−62 34	3.33	+0.91	*G6 II*	0.008	−2.1	390	0.064	+35.6	B 12^m 49″
ε Tau	26.3	+19 06	3.54	+1.02	K0 III	0.018	+0.1	160	0.118	+38.6	
θ² Tau	26.4	+15 47	3.42	+0.17	A7 III	0.025	+0.2	140	0.108	*+39.5*	
α Dor	33.1	−55 08	3.28	−0.08	*A0 IIIp*	0.011	−1.2	260	0.051	+25.6	Silicon star
α Tau *A*	33.6	+16 26	0.86v	+1.52	K5 III	0.048	−0.7	68	0.202	+54.1	Irr.? R0.78–0.93, $B$$13^m$31″ **Aldebaran**
π³ Ori	47.7	+06 54	3.17	+0.45	F6 V	0.125	+3.65	26	0.468	+24.3	
ι Aur	54.4	+33 06	2.64:	+1.49	K3 II	0.015	−2.4	330	0.021	+17.5	

α UMi, *Polaris:* R.A. 1 h 53.6 m; Dec. +89° 04′ (1957).

Star	R.A. 1960	Dec.	V	$B-V$	Type	π	M_V	D	μ	R	
	h m	° ′				″		l.y.	″	km./sec.	
ϵ Aur	04 59.1	+43 46	3.0v	+0.50:	F0 Iap	0.004	−7.1	3400	0.008	*−02.5*	Ecl. *R* 0.81^m 9886^d
η Aur	05 03.7	+41 11	3.17	−0.18	B3 V	0.013	−2.1	370	0.077	+07.4	
ϵ Lep	03.8	−22 25	3.21	+1.46	*K5 III*	0.006	−0.4	170	0.077	+01.0	
β Eri	05.9	−05 08	2.79	+0.13	A3 III	0.042	+0.9	78	0.122	−08	
μ Lep	11.1	−16 15	3.29	−0.09	*B9 IIIp*	0.018	−2.1	390	0.049	+27.7	Manganese star
β Ori *A*	12.6	−08 15	0.14v	−0.04	B8 Ia	−.003	−7.1	900	0.001	*+20.7*	Irr.? *R* 0.08–0.20, *B* 6.65^m 9″ **Rigel**
α Aur	13.7	+45 58	0.05	+0.80	G8III: +F	0.073	−0.6	45	0.435	*+30.2*	**Capella**
η Ori *AB*	22.5	−02 26	3.32v	−0.18	B0.5 V	0.004	−3.7	940	0.008	*+19.8*	Ecl. *R* 3.32–3.50, 8.0^d, *A* 3.59^m *B* 4.98^m 1″
γ Ori	23.0	+06 19	1.64	−0.23	B2 III	0.026	−4.2	470	0.015	+18.2	*Bellatrix*
β Tau	23.8	+28 35	1.65	−0.13	B7 III	0.018	−3.2	300	0.178	+08.0	*Elnath*
β Lep *A*	26.5	−20 47	2.81	+0.82	G5 III	0.014	+0.1	113	0.090	−13.5	*B* 9.4^m 3″
δ Ori *A*	30.0	−00 20	2.20v	−0.20	O9.5 II	0.004	−6.1	1500	0.002	*+16.0*	Ecl. *R* 2.20–2.35 5.7^d, *B* 6.74^m 53″
α Lep	31.0	−17 51	2.58	+0.22	F0 Ib	0.002	−4.6	900	0.006	+24.7	
λ Ori *AB*	32.9	+09 55	3.40	−0.18	O8	0.006	−5.1	1800	0.006	+33.5	*A* 3.56^m *B* 5.54^m 4″ *C* 10.92^m 29″
ι Ori *AB*	33.5	−05 56	2.76	−0.24	O9 III	0.021	−6.1	2000	0.005	*+21.5*	*A* 2.78^m *B* 7.31^m 11″
ϵ Ori	34.2	−01 14	1.70	−0.19	B0 Ia	−.007	−6.8	1600	0.000	+26.1	*Alnilam*
ζ Tau	35.3	+21 07	3.07:	−0.13:	B2 III: p	−.002	−4.2	940	0.023	*+24.3*	Shell star
α Col *A*	38.2	−34 06	2.64	−0.11	*B8 Ve*	−.005	−0.6	140	0.026	+35	*B* 12^m 12″
ζ Ori *AB*	38.7	−01 58	1.79	−0.22	O9.5 Ib	0.022	−6.6	1600	0.004	+18.1	*A* 1.91^m *B* 4.05^m 3″
κ Ori	45.9	−09 41	2.06	−0.17	B0.5 Ia	0.009	−6.9	2100	0.004	+20.6	
β Col	49.5	−35 47	3.12	+1.16	(gK1)	0.023	+0.0	140	0.402	+89.4	
α Ori	53.0	+07 24	0.41v	+1.87:	M2 Iab	0.005	−5.6	520	0.028	*+21.0*	Irr.? *R* 0.06:–0.75:^{m} **Betelgeuse**
β Aur	56.6	+44 57	1.86	+0.06	A2 V	0.037	−0.3	88	0.051	*−18.2*	
θ Aur *AB*	57.0	+37 13	2.65	−0.07	B9.5pv	0.018	+0.1	108	0.097	+29.3	Silicon star *A* 2.67^m *B* 7.14^m 3″
η Gem *A*	06 12.5	+22 31	3.33v	+1.58	M3 III	0.013	−0.6	200	0.066	*+19.0*	*R* 0.27^m, *B* 6.70^m 1″
ζ CMa	18.8	−30 03	3.04	−0.18	B2.5 V	−.003	−2.4	390	0.004	*+32.2*	
μ Gem	20.5	+22 32	2.92v	+1.63	M3 III	0.021	−0.6	160	0.129	+54.8	*R* 0.14^m
β CMa	20.9	−17 56	1.96	−0.24	B1 II–III	0.014	−4.8	750	0.004	*+33.7*	β CMa type variable
α Car	23.1	−52 40	−0.72	+0.16	F0 Ib–II	0.018	−3.1	98	0.025	+20.5	**Canopus**
γ Gem	35.4	+16 26	1.93	0.00	A0 IV	0.031	−0.6	105	0.066	*−12.5*	

Star	R.A. 1960	Dec.	V	$B-V$	Type		π	M_V	D	μ	R		
	h m	° ′					″		l.y.	″	km./sec.		
ν Pup	06 36.5	−43 10	3.19	−0.10	*B7*	*III*		−3.2	620	0.010	+28.2		
ϵ Gem	41.5	+25 10	3.00	+1.39	G8	Ib	0.009	−4.6	1080	0.016	+09.9		
ξ Gem	43.0	+12 56	3.38	+0.43	F5	IV	0.051	+1.9	64	0.224	+25.3		
α CMa *A*	43.4	−16 40	−1.42	+0.01	A1	V	0.375	+1.45	8.7	1.324	*−07.6*	*B* 8.66^m 1960: 9″, θ = 90°	***Sirius***
α Pic	47.8	−61 54	3.27	+0.21	*A5*	*V*		+2.1	57	0.272	+20.6		
τ Pup	48.9	−50 34	2.97	+1.17	*K0*	*III*		+0.1	124	0.079	*+36.4*		
ϵ CMa *A*	57.1	−28 55	1.48:	−0.18:	B2	II		−5.1	680	0.004	+27.4	*B* 7.5^m 8″	***Adhara***
o^2 CMa	07 01.4	−23 46	3.02	−0.09	B3	Ia		−7.1	3400	0.000	+48.4		
δ CMa	06.8	−26 20	1.85	+0.65	F8	Ia	−.018	−7.1	2100	0.005	+34.3		
L_2 Pup	12.3	−44 34			(gM5e)		0.016	−3.1	650	0.342	+53.0	LP, *R* 3.4–6.2, 141^d	
π Pup	15.7	−37 01	2.81	+1.56:	(gK4)		0.023	−0.3	140	0.008	+15.8		
η CMa	22.5	−29 13	2.46	−0.08	B5	Ia		−7.1	2700	0.008	+41.1		
β CMi	25.0	+08 22	2.91	−0.09	B7	V	0.020	−1.1	210	0.065	+22		
σ Pup *A*	28.0	−43 13	3.28	+1.49	(gK5)		0.013	−0.4	180	0.195	*+88.1*	*B* 9.4^m 22″	
α Gem *A*	32.0	+31 59	1.97	+0.00:	A1	V	0.072	+1.3	45	0.199	+06.0	5″, *B−V*+0.02, *C* 9.08v^m 73″	*Castor*
α Gem *B*	32.0	+31 59	2.95	+0.07:	A5m		0.072	+2.3	45	0.199	−01.2		
α CMi *A*	37.2	+05 20	0.37	+0.41	F5	IV–V	0.288	+2.7	11.3	1.250	−03.2	*B* 10.7^m 5″	***Procyon***
β Gem	42.9	+28 07	1.16	+1.02	K0	III	0.093	+1.0	35	0.625	+03.3		***Pollux***
ξ Pup	47.6	−24 45	3.34	+1.23	G3	Ib	−.003	−4.6	1240	0.005	*+02.7*		
χ Car	55.8	−52 52	3.48	−0.18	(B3)			−2.1	430	0.039	+19.1		
ζ Pup	08 02.2	−39 53	2.23	−0.26	O5f			−7.1	2400	0.033	−24		
ρ Pup	05.8	−24 11	2.80v	+0.42	F6	IIp	0.031	+0.3:	105:	0.098	+46.6	Var. *R* 2.72–2.87	
γ Vel *A*	08.3	−47 14	1.88	−0.26	*WC7*			−4.1	520	0.011	+35	*B* 4.31^m 41″	
ϵ Car	21.7	−59 23	1.97	+1.14:	(K0 + B)			−3.1:	340	0.030	+11.5		*Avior*
o UMa *A*	27.0	+60 51	3.37	+0.83	G5	III	0.004	+0.1	150	0.171	+19.8	*B* 15^m 7″	
δ Vel *AB*	43.6	−54 34	1.95	+0.05	*A0*	*V*	0.043	+0.2	76	0.086	+02.2	*A* 2.0^m *B* 5.1^m 3″ *CD* 10^m 69″	
ϵ Hya *ABC*	44.7	+06 34	3.39	+0.68	G0	comp.	0.010	+0.6	140	0.198	*+36.4*	*A*3.7^m*B*5.2^{m}0.2″15^y, *C*6.8^{m}3″*D*12^{m}20″	
ζ Hya	53.3	+06 06	3.11	+1.00	K0	II–III	0.029	−1.1	220	0.101	+22.8		
ι UMa *A*	56.5	+48 12	3.12	+0.19	A7	V	0.066	+2.2	49	0.505	+12.2	*BC* 10.8^m 7″	

Star	R.A. 1960	Dec.	V	$B-V$	Type	π	M_V	D	μ	R		
	h m	° ′				″		l.y.	″	km./sec.		
λ Vel	09 06.5	−43 16	2.24	+1.64:	*K5 Ib*	0.015	−4.6	750	0.026	+18.4		*Suhail*
a Car	09.9	−58 48	3.43	−0.17	*B3 IV*		−2.9	590	0.028	+*23.3*		
β Car	12.8	−69 33	1.67	+0.01	*A0 III*	0.038	−0.4	86	0.183	−05		*Miaplacidus*
ι Car	16.0	−59 06	2.25	+0.17	*F0 Ib*		−4.6	750	0.019	+13.3		
α Lyn	18.6	+34 34	3.17	+1.54	M0 III	0.021	−0.5	180	0.217	+37.6		
κ Vel	20.9	−54 50	2.45	−0.15	*B2 IV*	0.007	−3.4	470	0.012	+*21.9*		
α Hya	25.6	−08 29	1.98	+1.44	K4 III	0.017	−0.3	94	0.034	−04.3		*Alphard*
N Vel	30.0	−56 51	3.19	+1.56	(gK5)	0.015	−0.4	170	0.036	−13.9		
θ UMa *A*	30.2	+51 52	3.19	+0.46	F6 IV	0.052	+1.8	63	1.094	+15.4	B 14^m 5″	
ε Leo	43.6	+23 58	2.99	+0.81	G0 II	0.002	−2.1	340	0.048	+05.0		
l Car	44.1	−62 19	4.1		(cG0)	0.019	−5.5	2700	0.016	+*04.0*	Cep. max. 3.4^m min. 4.8^m, 35.52^d	
υ Car *AB*	46.1	−64 53	2.95	+0.26	*A7 II*	0.020	−2.1	340	0.012	+13.6	A 3.02^m B 6.03^m 5″	
α Leo *A*	10 06.2	+12 10	1.36	−0.11	B7 V	0.039	−0.7	84	0.248	+03.5	B 8.1^m 177″	***Regulus***
ω Car	12.8	−69 50	3.33	−0.08	*B8.5 IV*		−1.5	300	0.029	+04		
ζ Leo	14.5	+23 37	3.46	+0.30	F0 III	0.009	+0.5	130	0.023	−15.0		
λ UMa	14.7	+43 07	3.45	+0.03	A2 IV	−.010	+0.1	150	0.170	+18.3		
q Car	15.8	−61 08	3.41v	+1.55	*K5 Ib*	0.018	−4.6	1300	0.023	+08.6	Var. R 3.38–3.44	
γ Leo *AB*	17.8	+20 03	1.99	+1.13	K0 IIIp	0.019	+0.1	90	0.350	−36.6	A 2.29^m B 3.54^m 4″	
μ UMa	20.0	+41 42	3.05	+1.55	M0 III	0.031	+0.5	105	0.086	−*20.5*		
p Car	30.6	−61 29	3.30v	−0.11	*B5 IVpe*		−2.3	430	0.021	+26.0	Var. R 3.22–3.39	
θ Car	41.5	−64 11	2.74	−0.22	*B0 Vp*		−4.0	710	0.018	+24		
μ Vel *AB*	45.0	−49 12	2.67	+0.89	*G5 III*		+0.1	108	0.085	+06.9	A 2.7^m B 7.2^m 2″	
ν Hya	47.6	−15 59	3.12	+1.25	K3 III	0.022	−0.2	150	0.221	−01.0		
β UMa	59.4	+56 36	2.37	−0.03	A1 V	0.042	+0.5	78	0.087	−12.0		*Merak*
α UMa *AB*	11 01.3	+61 58	1.81	+1.06	K0 III	0.031	−0.7	105	0.138	−08.9	A 1.88^m B 4.82^m 1″	*Dubhe*
ψ UMa	07.4	+44 43	3.00	+1.14	K1 III		+0.0	130	0.072	−03.8		
δ Leo	12.0	+20 45	2.57	+0.13	A4 V	0.040	+0.6	82	0.201	−20.6		
θ Leo	12.1	+15 39	3.34	0.00	A2 V	0.019	+1.1	90	0.104	+07.8		
λ Cen	33.9	−62 48	3.15	−0.05	*B9 III*		−2.1	370	0.039	+07.9		
β Leo	47.0	+14 48	2.14	+0.09	A3 V	0.076	+1.5	43	0.511	−00.1		*Denebola*

Star	R.A. 1960	Dec.	V	$B-V$	Type	π	M_V	D	μ	R		
	h m	° ′				″		l.y.	″	km./sec.		
γ UMa	11 51.7	+53 55	2.44	0.00	A0 V	0.020	+0.2	90	0.094	−12.9		*Phecda*
δ Cen	12 06.3	−50 30	2.59v	−0.15:	*B2 Ve*		−2.7	370	0.042	+09	Var. R 2.56–2.62	
ε Crv	08.1	−22 24	3.04	+1.33	K3 III		−0.2	140	0.069	+04.9		
δ Cru	13.0	−58 32	2.81v	−0.23	*B2 IV*		−3.4	570	0.041	+26.4	Var. R 2.78–2.84	
δ UMa	13.5	+57 15	3.30	+0.07	A3 V	0.052	+1.9	63	0.106	−12.9		*Megrez*
γ Crv	13.7	−17 19	2.59	−0.10	B8 III		−3.1	450	0.163	−04.2		*Gienah*
α Cru *A*	24.4	−62 53	1.39	−0.25	*B1 IV*		−3.9	370	0.042	*−11.2*	} 5″, C 4.90ᵐ 89″	**Acrux**
α Cru *B*	24.4	−62 53	1.86	−0.25	(B3)		−3.4	370	0.042	*−00.6*		
δ Crv *A*	27.8	−16 18	2.97	−0.04	B9.5 V: n	0.018	+0.1	124	0.255	+09	B 8.26ᵐ 24″	
γ Cru	28.9	−56 53	1.69	+1.55	*M3 II*		−2.5	220	0.274	+21.3		*Gacrux*
β Crv	32.3	−23 11	2.66	+0.89	G5 III	0.027	+0.1	108	0.059	−07.7		
α Mus	34.8	−68 55	2.70v	−0.20	*B3 IV*		−2.9	430	0.037	+18	Var. R 2.66–2.73	
γ Cen *AB*	39.3	−48 44	2.17	+0.00	*A0 IV:*	0.006	−0.5	160	0.197	−07.5	A 2.9ᵐ B 2.9ᵐ 1″	
γ Vir *AB*	39.6	−01 14	2.76	+0.34	F0 V	0.101	+3.5	32	0.567	−19.7	A 3.50ᵐ B 3.52ᵐ 4″	
β Mus *AB*	43.8	−67 53	3.06	−0.17:	*B3 V*		−2.1	470	0.041	+42	A 3.7ᵐ B 4.0ᵐ 1″	
β Cru	45.4	−59 28	1.28	−0.25	*B0 III*		−4.6	490	0.049	+20.0		***Beta Crucis***
ε UMa	52.3	+56 11	1.79	−0.03	A0pv	0.008	+0.2	68	0.113	−09.3	Chromium-europium star	*Alioth*
α CVn *A*	54.2	+38 32	2.90	−0.10	B9.5pv	0.023	+0.1	118	0.238	*−03.3*	Silicon-europium star. B 5.61ᵐ 20″	
ε Vir	13 00.2	+11 10	2.86	+0.93	G9 II–III	0.036	+0.6	90	0.274	−14.0		
γ Hya	16.7	−22 58	2.98	+0.92	G8 III	0.021	+0.3	113	0.086	−05.4		
ι Cen	18.3	−36 30	2.76	+0.05	*A2 V*	0.046	+1.1	71	0.351	+00.1		
ζ UMa *A*	22.3	+55 08	2.26	+0.02	A2 V	0.037	+1.1	88	0.127	*−09.0*	B 3.94ᵐ 14″	*Mizar*
α Vir	23.1	−10 57	0.91v	−0.24	B1 V	0.021	−3.3	220	0.054	*+01.0*	Ecl. R 0.91–1.01, 4.0ᵈ	***Spica***
ζ Vir	32.7	−00 24	3.40	+0.10	A3 Vn	0.035	+1.1	93	0.287	−13.2		
ε Cen	37.3	−53 16	2.33	−0.23	*B1 IV*		−3.9	570	0.033	+05.6		
η UMa	46.0	+49 31	1.87	−0.20	B3 V	0.004	−2.1	210	0.123	−10.9		*Alkaid*
ν Cen	47.1	−41 29	3.42	−0.22	B2 IV		−3.4	750	0.037	*+09.0*		
μ Cen	47.2	−42 17	3.12v	−0.13:	B2 V: pne		−2.7	470	0.032	+12.6	Var. R 3.08–3.17	
η Boo	52.8	+18 36	2.69	+0.59	G0 IV	0.102	+2.7	32	0.370	*−00.1*		
ζ Cen	53.0	−47 06	2.56	−0.23:	*B2 IV*		−3.4	520	0.076	*+06.5*		

Star	R.A. 1960	Dec.	V	$B-V$	Type	π	M_V	D	μ	R		
	h m	° ′				″		l.y.	″	km./sec.		
β Cen *AB*	14 01.0	−60 11	0.63	−0.23:	*B1 II:*	0.016	−5.2	490	0.035	*−12*	*A* 0.7ᵐ *B* 3.9ᵐ 1″	***Hadar***
π Hya	04.1	−26 29	3.25	+1.13	K2 III	0.039	+1.2	84	0.156	+27.2		
θ Cen	04.3	−36 10	2.04	+1.03	K0 III–IV	0.059	+0.9	55	0.738	+01.3		*Menkent*
α Boo	13.8	+19 23	−0.06	+1.23	K2 IIIp	0.090	−0.3	36	2.284	−05.2		***Arcturus***
γ Boo	30.5	+38 29	3.05	+0.19	A7 III	0.016	+0.2	118	0.186	−35.5		
η Cen	33.0	−41 59	2.39v	−0.21	B1.5 V:ne		−3.0	390	0.049	−00.2	Var. *R* 2.33–2.45	
α Cen *A*	36.9	−60 40	0.01	+0.68	*G2 V*	.751	+4.39	4.3	3.676	−24.6	18″	***Rigil Kentaurus***
α Cen *B*	36.9	−60 40	1.40:	+0.73:	(dK1)		+5.8	4.3		−20.7		
α Cir *AB*	39.2	−64 48	3.18	+0.25	*F0 Vp*	0.049	+1.6	66	0.308	+07.4	Strontium star. *A* 3.19ᵐ *B* 8.61ᵐ 16″	
α Lup	39.3	−47 13	2.32	−0.22	B1 V		−3.3	430	0.033	+07.3		
ε Boo *AB*	43.2	+27 14	2.37	+0.96	K1: III: + A	0.013	+0.0	103	0.051	−16.5	*A* 2.47ᵐ *B* 5.04ᵐ 3″	
α Lib *A*	48.5	−15 50	2.76	+0.15	A3m	0.049	+1.2	66	0.130	−10	*B* 5.15ᵐ 231″	*Zubenelgenubi*
β UMi	50.8	+74 19	2.04	+1.47	K4 III	0.031	−0.5	105	0.033	+16.9		*Kochab*
β Lup	55.9	−42 58	2.69	−0.23	B2 IV		−3.4	540	0.066	−00.3		
κ Cen	56.5	−41 57	3.15	−0.21	B2 V		−2.7	470	0.033	+09.1		
β Boo	15 00.4	+40 33	3.48	+0.95	G8 III	0.022	+0.3	140	0.059	−19.9		
σ Lib	01.7	−25 08	3.31	+1.65	M4 III	0.056	+2.0:	58:	0.089	−04.3		
ζ Lup *A*	09.4	−51 57	3.42	+0.90:	*K0 III*	0.036	+1.2	90	0.135	−09.7	*B* 7.8ᵐ 71″	
δ Boo *A*	13.9	+33 28	3.47	+0.95	G8 III	0.028	+0.3	140	0.148	−12.2	*B* 7.84ᵐ 105″	
β Lib	14.8	−09 14	2.61	−0.11	B8 V	−.012	−0.6	140	0.101	−35.2		
γ TrA	15.1	−68 32	2.94	−0.01	*A0 Vp*	0.005	+0.2	113	0.067	00	Europium star	
δ Lup	18.7	−40 30	3.24	−0.23	B2 IV		−3.4	680	0.032	+02		
γ UMi	20.8	+71 59	3.08	+0.06	A3 II-III	−.005	−1.5	270	0.026	*−03.9*		
ι Dra	24.0	+59 06	3.28	+1.18	K2 III	0.032	+0.8	102	0.012	−11.0		
γ Lup *AB*	32.5	−41 02	2.80	−0.22	B2 Vn		−2.7	570	0.037	+06	*A* 3.5ᵐ *B* 3.7ᵐ 1″	
α CrB	33.0	+26 51	2.23v	−0.02	A0 V	0.043	+0.4	76	0.154	*+01.7*	Ecl. *R* 0.11ᵐ, 17.4ᵈ	*Alphecca*
α Ser	42.3	+06 33	2.65	+1.17	K2 III	0.046	+1.0	71	0.139	+02.9		
β TrA	51.6	−63 19	2.87	+0.28:	*F2 V*	0.078	+2.3	42	0.448	−00.3		
π Sco	56.4	−26 00	2.92	−0.19	B1 V	0.005	−3.3	570	0.034	*−03*		
η Lup *AB*	57.5	−38 17	3.45	−0.23	B2 V		−2.7	570	0.042	+07	*A* 3.47ᵐ *B* 7.70ᵐ 15″	
δ Sco	58.0	−22 51	2.34	−0.13	B0 V		−4.0	590	0.032	−14		

Star	R.A. 1960	Dec.	V	$B-V$	Type	π	M_V	D	μ	R	
	h m	° ′				″		l.y.	″	km./sec.	
β Sco *AB*	16 03.1	−19 42	2.65	−0.09	B0.5 V	0.004	−3.7	650	0.027	*−06.6*	*A* 2.78^m *B* 5.04^m 1″, *C* 4.93^m 14″
δ Oph	12.2	−03 36	2.72	+1.59	M1 III	0.029	−0.5	140	0.156	−19.9	
ϵ Oph	16.2	−04 36	3.22	+0.97	G9 III	0.036	+1.0	90	0.089	−10.3	
σ Sco *A*	18.8	−25 30	2.86v	+0.14	B1 III		−4.4	570	0.030	*−00.4*	β CMa *R* 2.82–2.90, 0.25^d, *B* 8.49^m 20″
η Dra *A*	23.4	+61 36	2.71	+0.92	G8 III	0.043	+0.9	76	0.062	−14.3	*B* 8.7^m 6″
α Sco *A*	26.9	−26 21	0.92v	+1.84	M1 Ib+B	0.019	−5.1	520	0.029	−03.2	*A* 0.86^m–1.02^m *B* 5.07^m 3″ ***Antares***
β Her	28.5	+21 35	2.78	+0.92	G8 III	0.017	+0.3	103	0.105	*−25.5*	
τ Sco	33.4	−28 08	2.85	−0.25	B0 V		−4.0	750	0.030	−00.7	
ζ Oph	35.0	−10 29	2.57	+0.00	O9.5 V	−.007	−4.3	520	0.022	−19	
ζ Her *AB*	39.8	+31 40	2.81	+0.64	G0 IV	0.110	+3.1	30	0.608	*−69.9*	*A* 2.91^m *B* 5.46^m 1″
η Her	41.5	+39 00	3.46	+0.92	G7 III–IV	0.053	+2.1	62	0.097	+08.3	
α TrA	44.4	−68 57	1.93	+1.43	*K2 III*	0.024	−0.1	82	0.044	−03.6	*Atria*
ϵ Sco	47.6	−34 13	2.28	+1.16	*K2 III–IV*	0.049	+0.7	66	0.664	−02.5	
μ^1 Sco	49.2	−37 59	2.99v	−0.20	B1.5 V		−3.0	520	0.033	*−25*	Ecl. *R* 2.99–3.09, 1.4^d
ζ Ara	55.3	−55 56	3.16	+1.61	(gK5)	0.036	+0.9	90	0.042	−06.0	
κ Oph	55.8	+09 26	3.18	+1.15	K2 III	0.026	−0.1	150	0.293	−55.6	
η Oph *AB*	17 08.1	−15 41	2.46	+0.06	A2.5 V	0.047	+1.4	69	0.097	−00.9	*A* 3.0^m *B* 3.4^m 1″ *Sabik*
ζ Dra	08.7	+65 46	3.20	−0.12	B6 III	0.017	−3.2	620	0.026	−14.1	
η Sco	09.3	−43 11	3.33	+0.38	*F2 III*	0.063	+2.3	52	0.293	−28.4	
α Her *AB*	12.8	+14 26	3.10v	+1.41	M5 II	−.007	−2.3	410	0.032	−33.1	*A* 3.2^m ± 0.3 *B* 5.4^m 5″ *Ras-Algethi*
δ Her	13.4	+24 53	3.14	+0.09	A3 IV	0.034	+0.8	96	0.164	−41	
π Her	13.7	+36 51	3.13	+1.43	K3 II	0.020	−2.4	410	0.029	−25.7	
θ Oph	19.6	−24 58	3.29	−0.22	B2 IV		−3.4	710	0.025	−03.6	
β Ara	22.0	−55 30	2.90	+1.45:	*K3 Ib*	0.026	−4.6	1030	0.035	−00.4	
γ Ara *A*	22.0	−56 21	3.32	−0.16	*B1 V*		−3.3	680	0.017	−04	*B* 10^m 18″
υ Sco	28.0	−37 16	2.71	−0.22	*B2 IV*		−3.4	540	0.039	*+18*	
α Ara	28.7	−49 51	2.95	−0.18:	B2.5 V		−2.4	390	0.083	*−02*	
β Dra *A*	29.5	+52 20	2.77	+0.96	G2 II	0.009	−2.1	310	0.019	−20.0	*B* 11.49^m 4″
λ Sco	30.9	−37 05	1.60	−0.24	B1 V		−3.3	310	0.031	00	*Shaula*
α Oph	33.1	+12 35	2.09	+0.16	A5 III	0.056	+0.8	58	0.260	+12.7	*Rasalhague*
θ Sco	34.4	−42 58	1.86	+0.39	*F0 Ib*	0.020	−4.6	650	0.012	+01.4	

Star	R.A. 1960	Dec.	V	$B-V$	Type	π	M_V	D	μ	R	
	h m	° ′				″		l.y.	″	km./sec.	
κ Sco	17 39.7	−39 01	2.39	−0.21	*B2 IV*		−3.4	470	0.031	−10	
β Oph	41.5	+04 35	2.77	+1.16	K2 III	0.023	−0.1	124	0.160	−12.0	
ι^1 Sco	44.8	−40 07	2.99	+0.49	F2 Ia	0.013	−7.1	3400	0.004	*−27.6*	
μ Her *A*	44.9	+27 45	3.42	+0.75	G5 IV	0.108	+3.6	30	0.811	−15.6	*BC* 9.78^m 33″
G Sco	47.1	−37 02	3.21	+1.18	(gK1)	0.032	+0.7	102	0.064	+24.7	
γ Dra	55.7	+51 30	2.21	+1.52	K5 III	0.017	−0.4	108	0.026	−27.6	*Eltanin*
ν Oph	56.8	−09 46	3.32	+1.00	G9 III	0.015	+0.2	140	0.118	+12.4	
γ Sgr	18 03.2	−30 26	2.97	+1.00	*K0 III*	0.018	+0.1	124	0.200	*+22.1*	
η Sgr *A*	14.9	−36 47	3.17	+1.55	*M3 II*	0.038	+1.1:	86:	0.218	+00.5	*B* 10^m 4″
δ Sgr	18.4	−29 51	2.71	+1.39	*K2 III*	0.039	+0.7	84	0.050	−20.0	
η Ser	19.2	−02 55	3.23	+0.94	K0 III–IV	0.054	+1.9	60	0.894	+08.9	
ϵ Sgr	21.5	−34 24	1.81	−0.02	*B9 IV*	0.015	−1.1	124	0.135	−11	*Kaus Australis*
λ Sgr	25.5	−25 27	2.80	+1.05	*K2 III*	0.046	+1.1	71	0.194	−43.3	
α Lyr	35.6	+38 45	0.04	0.00	A0 V	0.123	+0.5	26.5	0.345	−13.9	***Vega***
ϕ Sgr	43.2	−27 02	3.20	−0.11	*B8 III*		−3.1	590	0.052	+21.5	
β Lyr *A*	48.6	+33 19	3.38v	−0.05:	Bpe	−.011	−4.6	1300	0.007	*−19.2*	Ecl. *R* 3.38–4.36, 12.9^d, *B* 7.8^m 46″
σ Sgr	52.8	−26 21	2.12	−0.21	B2 V		−2.7	300	0.059	−11	*Nunki*
ξ^2 Sgr	55.3	−21 10	3.51	+1.18:	(gK1)	0.006	+0.0	160	0.035	−19.9	
γ Lyr	57.4	+32 38	3.25	−0.05	B9 III	0.011	−2.1	370	0.007	−21.5	
ζ Sgr *AB*	19 00.1	−29 56	2.61	+0.08	*A2 IV*	0.020	+0.1	140	0.020	+22	*A* 3.3^m *B* 3.5^m 1″
ζ Aql *A*	03.6	+13 48	2.99	+0.01	A0 V: nn	0.036	+0.8	90	0.101	−26.3	*B* 12^m 5″
λ Aql	04.1	−04 57	3.44	−0.07	B9: V: n	0.025	−0.1	160	0.092	−14	
τ Sgr	04.4	−27 44	3.30	+1.18	(gK1)	0.038	+1.2	86	0.261	*+45.4*	
π Sgr *ABC*	07.4	−21 05	2.89	+0.35	F2 II–III	0.016	−0.7	250	0.040	−09.8	*A* 3.7^m *B* 3.8^m *C* 6.0^m $<$ 1″
δ Dra	12.6	+67 35	3.06	+1.00	G9 III	0.028	+0.2	124	0.130	+24.8	
δ Aql	23.5	+03 02	3.38	+0.31	F0 IV	0.062	+2.3	53	0.267	*−29.9*	
β Cyg *A*	29.1	+27 52	3.07	+1.12	K3 II: + B:	0.004	−2.4	410	0.009	−24.0	*B* 5.11^m 35″ *Albireo*
δ Cyg *AB*	43.7	+45 02	2.87	−0.03	B9.5 III	0.021	−1.7	270	0.060	−21	*A* 2.91^m *B* 6.44^m 2″
γ Aql	44.4	+10 31	2.67	+1.48	K3 II	0.006	−2.4	340	0.012	−02.1	
α Aql	48.8	+08 46	0.77	+0.22	A7 IV, V	0.198	+2.2	16.5	0.658	−26.3	***Altair***

Star	R.A. 1960	Dec.	V	$B-V$	Type	π	M_V	D	μ	R	
	h m	° ′				″		l.y.	″	km./sec.	
θ Aql	20 09.2	−00 56	3.31	−0.07	B9.5 III	0.008	−1.7	330	0.034	*−27.3*	
β Cap *A*	18.8	−14 55	3.06	+0.76	comp.	0.005	+0.1	130	0.039	−18.9	Type gK0: + late B; *B* 5.97^m 205″
γ Cyg	20.8	+40 08	2.22	+0.66	F8 Ib	−.006	−4.6	750	0.001	−07.5	
α Pav	22.5	−56 52	1.95	−0.20	*B3 IV*		−2.9	310	0.087	*+02.0*	*Peacock*
α Ind	34.8	−47 26	3.11	+1.00	*K0 III*	0.039	+1.1	84	0.082	−01.1	
α Cyg	40.1	+45 08	1.26	+0.09	A2 Ia	−.013	−7.1	1600	0.003	−04.6	***Deneb***
β Pav	41.4	−66 21	3.45	+0.16	*A5 III*	0.026	−0.1	160	0.046	+09.8	
η Cep	44.5	+61 41	3.41	+0.92	K0 IV	0.071	+2.7	46	0.825	−87.3	
ϵ Cyg	44.6	+33 49	2.46	+1.03	K0 III	0.044	+0.7	74	0.481	*−10.3*	
ζ Cyg	21 11.2	+30 04	3.25:		G8 II	0.021	−2.2	390	0.056	+17.4	
α Cep	17.6	+62 25	2.44	+0.24	A7 IV, V	0.063	+1.4	52	0.156	−10	*Alderamin*
β Cep	28.2	+70 23	3.15v	−0.22v	B2 III	0.005	−4.2	980	0.014	−08.2	β CMa *R* 3.14–3.16, 0.19^d
β Aqr	29.5	−05 45	2.86	+0.82	G0 Ib	0.000	−4.6	1030	0.017	+06.5	
ϵ Peg *A*	42.2	+09 41	2.31	+1.55	K2 Ib	−.005	−4.6	780	0.025	+04.7	*B* 11^m 82″ *Enif*
δ Cap	44.8	−16 19	2.92v	+0.29	A6m	0.065	+2.0	50	0.392	*−06.3*	Var. *R* 2.88–2.95
γ Gru	51.5	−37 33	3.03	−0.10	*B8 III:*	0.008	−3.1	540	0.102	−02.1	
α Aqr	22 03.7	−00 31	2.96	+0.96	G2 Ib	0.003	−4.6	1080	0.016	+07.5	
α Gru	05.7	−47 09	1.76	−0.14	*B5 V*	0.051	+0.3:	64:	0.194	+11.8	*Al Na'ir*
ζ Cep	09.5	+58 00	3.31	+1.55	K1 Ib	0.019	−4.6	1240	0.015	*−18.4*	
α Tuc	15.8	−60 28	2.87	+1.40	*K3 III–IV*	0.019	+1.5	62	0.079	*+42.2*	
δ Cep *A*	27.7	+58 13	3.96v	+0.66v	F5–G2 Ib	0.005	−4.0	1300	0.012	*−16.8*	Cep. *R* 3.51–4.42, 5.4^d, *B* 6.19^m 41″
ζ Peg	39.5	+10 37	3.40:	−0.08:	B8 V	−.004	−0.6	210	0.077	+07	
β Gru	40.3	−47 06	2.17v	+1.59	*M3 II*	0.003	−2.5	280	0.134	+01.6	Var. *R* 2.11–2.23
η Peg	41.1	+30 01	2.95	+0.85	G8 II: + F?	−.002	−2.2	360	0.027	*+04.3*	
δ Aqr	52.5	−16 02	3.28	+0.08	A3 V	0.039	+1.2	84	0.047	+18.0	
α PsA	55.4	−29 50	1.19	+0.10	A3 V	0.144	+2.0	22.6	0.367	+06.5	***Fomalhaut***
β Peg	23 01.8	+27 52	2.5 v	+1.67	M2 II–III	0.015	−1.5	210	0.234	+08.7	Var. *R* 2.4–2.7 *Scheat*
α Peg	02.8	+14 59	2.50	−0.03	B9.5 III	0.030	−0.1	109	0.071	−03.5	*Markab*
γ Cep	37.7	+77 25	3.20	+1.02	K1 IV	0.064	+2.2	51	0.168	−42.4	

TABLE OF PRECESSION FOR 50 YEARS

R.A.	Prec. in Dec.	Precession in Right Ascension														Prec. in Dec.	R.A.
		δ = +85°	+80°	+75°	+70°	+60°	+50°	+40°	+30°	+20°	+10°	0°	−10°	−20°	−30°		
h m	′	m	m	m	m	m	m	m	m	m	m	m	m	m	m	′	h m
0 00	+16.7	+ 2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	−16.7	12 00
0 30	+16.6	+ 4.22	3.38	3.10	2.96	2.81	2.73	2.68	2.64	2.61	2.59	2.56	2.53	2.51	2.48	−16.6	11 30
1 00	+16.1	+ 5.85	4.19	3.64	3.36	3.06	2.90	2.80	2.73	2.67	2.61	2.56	2.51	2.45	2.39	−16.1	11 00
1 30	+15.4	+ 7.43	4.98	4.15	3.73	3.30	3.07	2.92	2.81	2.72	2.64	2.56	2.49	2.40	2.31	−15.4	10 30
2 00	+14.5	+ 8.92	5.72	4.64	4.09	3.52	3.22	3.03	2.88	2.76	2.66	2.56	2.46	2.36	2.24	−14.5	10 00
2 30	+13.2	+10.31	6.40	5.09	4.42	3.73	3.37	3.13	2.95	2.81	2.68	2.56	2.44	2.31	2.17	−13.2	9 30
3 00	+11.8	+11.56	7.02	5.50	4.73	3.92	3.50	3.22	3.02	2.85	2.70	2.56	2.42	2.27	2.11	−11.8	9 00
3 30	+10.2	+12.66	7.57	5.86	4.99	4.09	3.61	3.30	3.07	2.88	2.72	2.56	2.40	2.24	2.05	−10.2	8 30
4 00	+ 8.3	+13.58	8.03	6.16	5.21	4.23	3.71	3.37	3.12	2.91	2.73	2.56	2.39	2.21	2.00	− 8.3	8 00
4 30	+ 6.4	+14.32	8.40	6.40	5.39	4.34	3.79	3.42	3.16	2.93	2.74	2.56	2.38	2.19	1.97	− 6.4	7 30
5 00	+ 4.3	+14.85	8.66	6.58	5.52	4.42	3.84	3.46	3.18	2.95	2.75	2.56	2.37	2.17	1.94	− 4.3	7 00
5 30	+ 2.2	+15.18	8.82	6.68	5.60	4.47	3.88	3.49	3.20	2.96	2.75	2.56	2.37	2.16	1.92	− 2.2	6 30
6 00	+ 0.0	+15.29	8.88	6.72	5.62	4.49	3.89	3.50	3.20	2.97	2.76	2.56	2.36	2.16	1.92	0.0	6 00
12 00	−16.7	+ 2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+2.56	+16.7	24 00
12 30	−16.6	+ 0.90	1.82	2.02	2.16	2.31	2.39	2.44	2.48	2.51	2.53	2.56	2.59	2.61	2.64	+16.6	23 30
13 00	−16.1	− 0.73	+0.93	1.48	1.77	2.06	2.22	2.32	2.39	2.45	2.51	2.56	2.61	2.67	2.73	+16.1	23 00
13 30	−15.4	− 2.31	+0.14	0.97	1.39	1.82	2.05	2.20	2.31	2.40	2.49	2.56	2.64	2.72	2.81	+15.4	22 30
14 00	−14.5	− 3.80	−0.60	+0.46	1.03	1.60	1.90	2.09	2.24	2.36	2.46	2.56	2.66	2.76	2.88	+14.5	22 00
14 30	−13.2	− 5.19	−1.28	+0.03	0.70	1.39	1.75	1.99	2.17	2.31	2.44	2.56	2.68	2.81	2.95	+13.2	21 30
15 00	−11.8	− 6.44	−1.90	−0.38	+0.40	1.20	1.62	1.90	2.11	2.27	2.42	2.56	2.70	2.85	3.02	+11.8	21 00
15 30	−10.2	− 7.54	−2.45	−0.74	+0.13	1.03	1.51	1.81	2.05	2.24	2.40	2.56	2.72	2.88	3.07	+10.2	20 30
16 00	− 8.3	− 8.46	−2.91	−1.04	−0.09	+0.89	1.41	1.75	2.00	2.21	2.39	2.56	2.73	2.91	3.12	+ 8.3	20 00
16 30	− 6.4	− 9.20	−3.27	−1.28	−0.27	+0.78	1.33	1.70	1.97	2.19	2.38	2.56	2.74	2.93	3.16	+ 6.4	19 30
17 00	− 4.3	− 9.73	−3.54	−1.45	−0.40	+0.70	1.28	1.66	1.94	2.17	2.37	2.56	2.75	2.95	3.18	+ 4.3	19 00
17 30	− 2.2	−10.06	−3.70	−1.56	−0.47	+0.65	1.25	1.63	1.92	2.16	2.37	2.56	2.75	2.96	3.20	+ 2.2	18 30
18 00	− 0.0	−10.17	−3.75	−1.60	−0.50	+0.63	1.23	1.62	1.92	2.16	2.36	2.56	2.76	2.97	3.20	+ 0.0	18 00

DOUBLE AND MULTIPLE STARS

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 1950 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

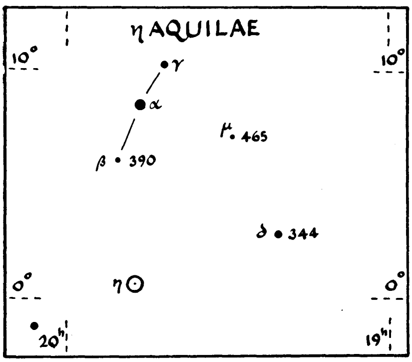
Star		α 1950	δ	Mag. and Spect.	d	D	Remarks
		h m	° ′		″	L.Y.	
π	And	00 34.2	+33 27	4.4B3; 8.5	36	470	†
η	Cas	00 46.0	+57 33	3.6F8; 7.2M0	8	18	526y; 66AU
α	UMi	01 48.8	+89 02	var. F8; 8.8	19	407	Polaris
γ	Ari	01 50.8	+19 03	4.8A0; 4.8A0	8.3	150	
α	Pis	01 59.4	+02 31	5.2A2; 4.3A2	2.4	130	††
γ	And	02 00.8	+42 05	2.3K0; 5.4A0; 6.6	10, 0.7	410	56y; 23AU
6	Tri	02 09.5	+30 04	5.4G4; 7.0F3	3.6	330	††
η	Per	02 47.0	+55 41	3.9K0; 8.5	28	540	
32	Eri	03 51.8	−03 06	5.0G5; 6.3A	6.7	300	
β	Ori	05 12.1	−08 15	0.3B8; 7.0	9	540	†
θ	Ori	05 32.8	−05 25	5.4;6.8; 6.8; 7.9; O	13, 17	540	Trapezium
β	Mon	06 26.4	−07 00	4.7B2; 5.2; 5.6	7, 25	470	†
12	Lyn	06 41.8	+59 30	5.3A2; 6.2; 7.4	1.7, 8	180	†
α	CMa	06 43.0	−16 39	−1.6A0; 8.5F	11	9	50y; 20AU
δ	Gem	07 17.1	+22 05	3.5F0; 8.0M0	6.8	58	†
α	Gem	07 31.4	+32 00	2.0A0; 2.8A0; 9M10	4, 70	47	340y; 79AU
ζ	Cnc	08 09.3	+17 48	5.6G0; 6.0; 6.2	1, 5	78	60y; 21AU
γ	Leo	10 17.2	+20 06	2.6K0; 3.8G5	4	160	400y
ξ	UMa	11 15.5	+31 48	4.4G0; 4.9G0	2	25	††60y; 20AU
ι	Leo	11 21.3	+10 48	4.1F3; 6.8F3	2	69	
γ	Vir	12 39.1	−01 10	3.6F0;3.7F0	6	34	171y;42AU
α	CVn	12 53.7	+38 35	2.9A0; 5.4A0	20	140	††
ζ	UMa	13 21.9	+55 11	2.4A2; 4.0A2	14	78	††
π	Boo	14 38.4	+16 38	4.9A0; 5.1A0	6	360	†
ε	Boo	14 42.8	+27 17	2.7K0; 5.1A0	3	220	
ξ	Boo	14 49.1	+19 18	4.8G5; 6.7	3	22	151y; 31AU
δ	Ser	15 32.4	+10 42	4.2F0; 5.2F0	4	170	
ξ	Sco	16 01.6	−11 14	5.1F3; 4.8; 7G7	1, 7	84	44.7y; 19AU
α	Her	17 12.4	+14 27	var.M5; 5.4G	5	540	†
δ	Her	17 13.0	+24 54	3.2A0; 8.1G2	11	100	† Optical
ε	Lyr	18 42.7	+39 37	5.1, 6.0A3; 5.1, 5.4A5	3, 2	200	Pairs 207″
β	Cyg	19 28.7	+27 51	3.2K0; 5.4B9	34	410	†
α	Cap	20 14.9	−12 40	3.8G5; 4.6G0	376		Optical
γ	Del	20 44.3	+15 57	4.5G5; 5.5F8	10	110	
61	Cyg	21 04.6	+38 30	5.6K5; 6.3K5	23	11	
β	Cep	21 28.1	+70 20	var.B1; 8.0A3	14	540	†
ζ	Aqr	22 26.2	−00 17	4.4F2; 4.6F1	3	140	
δ	Cep	22 27.3	+58 10	var.G0; 7.5A0	41	650	
8	Lac	22 33.6	+39 23	5.8B3; 6.5B5	22	1100	†
σ	Cas	23 56.5	+55 29	5.1B2; 7.2B3	3	820	

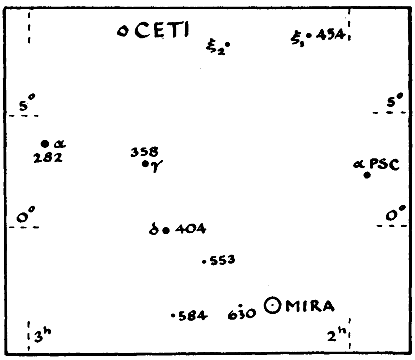
† or ††, one, or two of the components are themselves very close visual double or more generally, spectroscopic binaries.

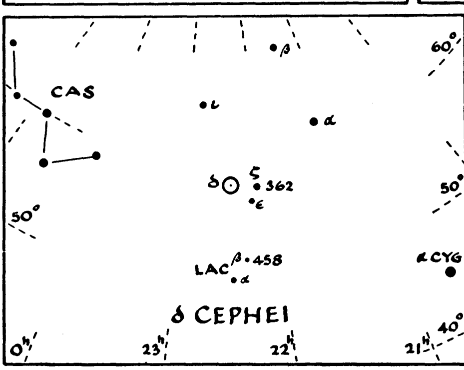
VARIABLE STARS

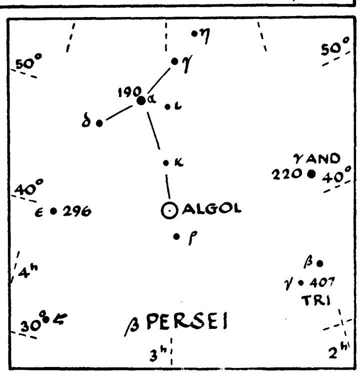
Maps of the fields of four bright variable stars are given below. In each case the magnitudes of several suitable comparison stars are given. Note that the decimal points are omitted: a star 362 is of mag. 3.62. Use two comparison stars, one brighter and one fainter than the variable, and estimate the brightness of the variable in terms of these two stars. Record the date and time of observation. When a number of observations have been made, a graph may be plotted showing the magnitude estimate as ordinates against the date (days and tenths of a day) as abscissae. Each type of variable has a distinctive shape of light curve.

In the tables the first column, the Harvard designation of the star, gives the 1900 position: the first four figures give the hours and minutes of R.A., the last two figures give the Dec. in degrees, italicised for southern declinations. The column headed *Max.* gives the mean maximum magnitude. The *Period* is in days. The *Epoch* gives the predicted date of the *earliest* maximum occurring this year; by adding the period to this epoch other dates of maximum may be found. The list of long-period variables has been prepared by the American Association of Variable Star Observers and includes the variables with maxima brighter than mag. 8.0, and north of Dec. −20°. These variables may reach maximum two or three weeks before or after the listed epoch and may remain at maximum for several weeks. The second table contains stars which are representative of other types of variable. The data are taken from "The General Catalogue of Variable Stars" by Kukarkin and Parenago.









LONG-PERIOD VARIABLE STARS

Variable	Max. m	Per. d	Epoch 1958	Variable	Max. m	Per. d	Epoch 1958
001755 T Cas	7.8	445	Nov. 22	142539 V Boo	7.9	260	Mar. 27
021143 W And	7.5	397	Aug. 21	143227 R Boo	7.3	224	Feb. 19
0214*03* o Cet	3.7	332	Sept. 25	151731 S CrB	7.5	361	June 17
0228*13* U Cet	7.5	235	Mar. 2	154639 V CrB	7.4	358	Mar. 13
023133 R Tri	6.3	266	July 17	154615 R Ser	6.8	357	Apr. 4
0455*14* R Lep	6.7	428	Oct. 14	162119 U Her	7.6	405	Aug. 14
050953 R Aur	7.8	458	Apr. 29	1621*12* V Oph	7.5	298	Sept. 18
054920a U Ori	6.6	372	Apr. 22	163266 R Dra	7.6	245	Aug. 7
0617*02* V Mon	7.1	334	Feb. 25	164715 S Her	7.6	307	Sept. 21
065355 R Lyn	7.9	378	Sept. 17	1702*15* R Oph	7.6	302	July 29
070122a R Gem	7.1	370	Mar. 27	171723 RS Her	8.0	219	June 9
072708 S CMi	7.5	335	Nov. 22	180531 T Her	8.0	165	Jan. 26
0728*20*b Z Pup	7.9	512	Sept. 11	181136 W Lyr	8.0	197	July 8
081112 R Cnc	6.8	361	Apr. 5	183308 X Oph	6.9	335	Sept. 26
081617 V Cnc	8.0	272	July 29	190108 R Aql	6.3	300	Feb.20
084803 S Hya	7.9	258	May 2	1910*19* R Sgr	7.2	269	May 24
0850*08* T Hya	7.7	289	June 22	193449 R Cyg	7.3	425	Sept. 23
093934 R LMi	7.2	372	Dec. 6	194048 RT Cyg	7.4	190	Jan. 18
094211 R Leo	5.9	313	July 23	194632 χ Cyg	5.3	406	Aug. 16
103769 R UMa	7.6	301	Feb. 18	200938 RS Cyg	7.4	420	Sept. 22
115158 Z UMa	6.6	198	Mar. 23	2044*05* T Aqr	7.9	202	Apr. 4
1214*18* R Crv	7.6	317	July 17	210868 T Cep	5.8	390	Nov. 1
122001 SS Vir	6.9	358	Aug. 12	230110 R Peg	7.9	377	June 24
123160 T UMa	7.9	257	Aug. 16	230759 V Cas	7.9	228	Feb.24
123307 R Vir	6.9	145	Jan. 23	231508 S Peg	8.0	320	May 16
123961 S UMa	7.9	226	Mar. 23	233451 SV Cas	6.8	278	Aug. 26
1327*06* S Vir	7.1	377	Aug. 10	235350 R Cas	6.5	430	May 22
134440 R CVn	7.7	326	May 25				

OTHER TYPES OF VARIABLE STARS

Variable	Max. m	Min. m	Type	Sp. Cl.	Period d	Epoch 1958 E.S.T.
005381 U Cep	6.8	9.8	Ecl	B8	2.4929005	Jan. 4.942*
025838 ρ Per	3.2	3.8	SemiR	M4	50	
035512 λ Tau	3.5	4.0	Ecl	B3	3.952952	Jan. 4.171*
051133 ARAur	5.8	6.5	Ecl	A0+A0	4.134606	Jan. 2.959*
060822 η Gem	3.1	3.9	SemiR	M3	234	July 14*
061907 T Mon	5.8	6.8	δ Cep	F7–K1	27.018	Jan. 13.71
065820 ζ Gem	3.7	4.1	δ Cep	F7–G3	10.153527	Jan. 2.674
154428 R CrB	5.8	14	R CrB	cG0ep		
171014 α Her	3.0	4.0	SemiR	M5	100	
1842*05* R Sct	5.0	8.4	RVTau	G0–M5	144	
184633 β Lyr	3.4	4.3	Ecl	B8	12.9308	Feb. 9.22*
192242 RRLyr	7.3	8.1	RRLyr	A2–F0	0.56683500	Jan. 2.095
194700 η Aql	3.7	4.4	δ Cep	F6–G4	7.176678	Jan. 1.876
201437a P Cyg	3.5	6.0	Nova	B1 eq		
222557 δ Cep	3.8	4.6	δ Cep	F5–G2	5.366306	Jan. 5.888

*Minima

STAR CLUSTERS

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

N.G.C.	M	Con.	α 1960 h m	δ ° ′	Cl.	Diam. ′	Mag. B.S.	No.	Int. mag.	Dist l.y.
869		h Per	02 16.2	+56 58	Op	30	7			4,300
884		χ Per	02 19.6	+56 56	Op	30	7			4,300
1039	34	Per	02 39.4	+42 37	Op	30	9	80		1,500
Pleiades	45	Tau	03 45.1	+23 59	Op	120	4.2	250		490
Hyades		Tau	04 18	+15 31	Op	400	4.0	100		120
1912	38	Aur	05 26.0	+35 48	Op	18	9.7	100		2,800
2099	37	Aur	05 49.7	+32 33	Op	24	9.7	150		2,700
2168	35	Gem	06 06.4	+24 21	Op	29	9.0	120		2,700
2287	41	C Ma	06 45.3	−20 42	Op	32	9	50		1,300
2632	44	Cnc	08 37.8	+20 07	Op	90	6.5	350		490
5139		ω Cen	13 24.3	−47 16	Gl	23	12.9		3	22,000
5272	3	C Vn	13 40.4	+28 35	Gl	10	14.2		4.5	40,000
5904	5	Ser	15 16.5	+02 13	Gl	13	14.0		3.6	35,000
6121	4	Sco	16 21.2	−26 26	Gl	14	13.9		5.2	24,000
6205	13	Her	16 40.2	+36 32	Gl	10	13.8		4.0	34,000
6218	12	Oph	16 45.2	−01 53	Gl	9	14.0		6.0	36,000
6254	10	Oph	16 55.0	−04 03	Gl	8	14.1		5.4	36,000
6341	92	Her	17 15.9	+43 11	Gl	8	13.9		5.1	36,000
6494	23	Sgr	17 54.6	−19 01	Op	27	10.2	120		2,200
6611	16	Ser	18 16.6	−13 48	Op	8	10.6	55		6,700
6656	22	Sgr	18 34.0	−23 57	Gl	17	12.9		3.6	22,000
7078	15	Peg	21 28.0	+11 59	Gl	7	14.3		5.2	43,000
7089	2	Aqr	21 31.4	−01 00	Gl	8	14.6		5.0	45,000
7092	39	Cyg	21 30.8	+48 15	Op	32	6.5	25		1,000
7654	52	Cas	23 22.4	+61 23	Op	13	11.0	120		4,400

GALACTIC NEBULAE

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

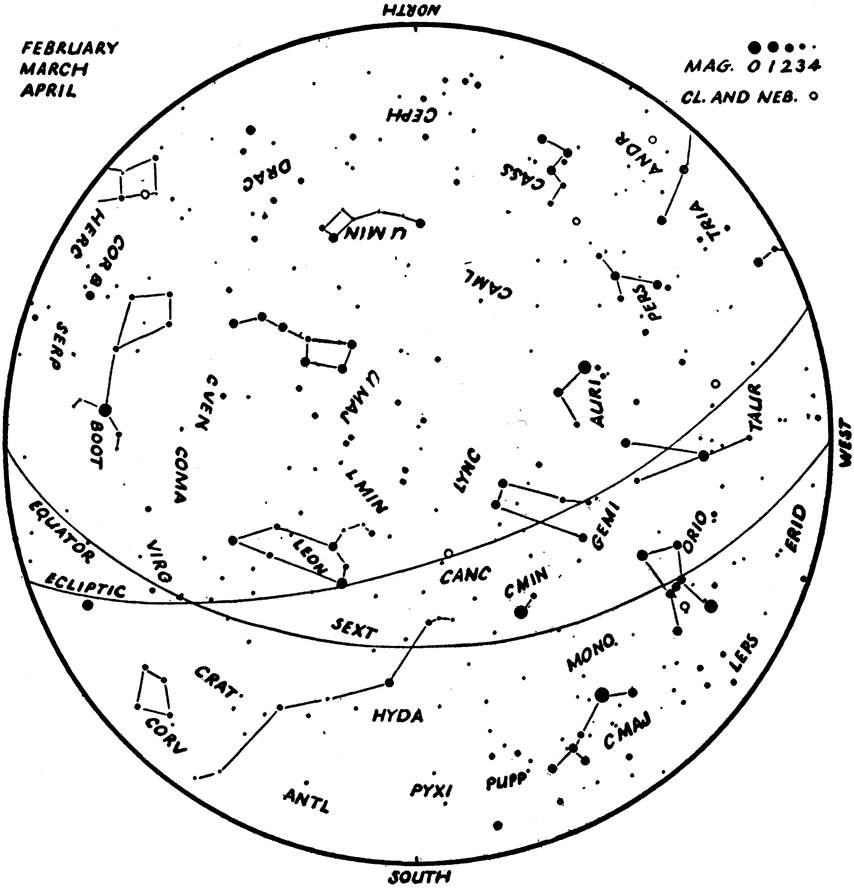
N.G.C.	M	Con	α 1960 h m	δ ° ′	Cl	Size ′	m n	m *	Dist. l.y.	Name
650	76	Per	01 39.7	+51 22	Pl	1.5	11	17	15,000	
1952	1	Tau	05 32.1	+22 00		6	11	16	4,100	Crab
1976	42	Ori	05 33.3	−05 25	Dif	30			1,800	Orion
B33		Ori	05 38.9	−02 29	Drk	4			300	Horsehead
2261		Mon	06 37.0	+08 46	Dif	2				Hubble's var.
2392		Gem	07 26.8	+21 00	Pl	0.3	8	10	2,800	
2440		Pup	07 40.1	−18 07	Pl	0.9	11	16	8,600	
3587	97	UMa	11 12.5	+55 14	Pl	3.3	11	14	12,000	Owl
		Cru	12 49	−63	Drk	300			300	Coalsack
6210		Her	16 42.8	+23 52	Pl	0.3	10	12	5,600	
B72		Oph	17 21.2	−23 35	Drk	20			400	S nebula
6514	20	Sgr	18 00.0	−23 02	Dif	24			3,200	Trifid
B86		Sgr	18 00.5	−27 53	Drk	5				
6523	8	Sgr	18 01.2	−24 23	Dif	50			3,600	Lagoon
6543		Dra	17 58.6	+66 37	Pl	0.4	9	11	3,500	
6572		Oph	18 10.2	+06 50	Pl	0.2	9	12	4,000	
B92		Sgr	18 13.2	−18 15	Drk	15				
6618	17	Sgr	18 18.5	−16 12	Dif	26			3,000	Horseshoe
6720	57	Lyr	18 52.1	+32 59	Pl	1.4	9	14	5,400	Ring
6826		Cyg	19 43.7	+50 26	Pl	0.4	9	11	3,400	
6853	27	Vul	19 57.9	+22 36	Pl	8	8	13	3,400	Dumb-bell
6960		Cyg	20 44.0	+30 34	Dif	60				Network
7000		Cyg	20 57.4	+44 10	Dif	100				N. America
7009		Aqr	21 02.0	−11 32	Pl	0.5	8	12	3,000	
7662		And	23 24.0	+42 19	Pl	0.3	9	13	3,900	

EXTERNAL GALAXIES

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

N.G.C.	M	Con	α 1960 h m	δ ° ′	Cl	Dimens. ′ ′	Mag.	Distance millions of l.y.	Vel. km / sec
221	32	And	00 40.5	+40 39	E	3×3	8.8	1.6	− 185
224	31	And	00 40.5	+41 03	Sb	160×40	5.0	1.6	− 220
SMC		Tuc	00 53	−72 35	I	220×220	1.5	0.17	+ 170
598	33	Tri	01 31.6	+30 28	Sc	60×40	7.0	1.4	− 70
LMC		Dor	05 21	−69 26	I	430×530	0.5	0.17	+ 280
3031	81	UMa	09 52.4	+69 16	Sb	16×10	8.3	4.8	− 30
3034	82	UMa	09 52.7	+69 53	I	7× 2	9.0	5.2	+ 290
3368	96	Leo	10 44.6	+12 02	Sa	7× 4	10.0	11.4	+ 940
3623	65	Leo	11 16.8	+13 19	Sb	8× 2	9.9	10.0	+ 800
3627	66	Leo	11 18.2	+13 13	Sb	8× 2	9.1	8.6	+ 650
4258		CVn	12 17.0	+47 32	Sb	20× 6	8.7	9.2	+ 500
4374	84	Vir	12 23.0	+13 06	E	3× 2	9.9	12.0	+1050
4382	85	Com	12 23.4	+18 25	E	4× 2	10.0	7.4	+ 500
4472	49	Vir	12 27.8	+08 13	E	5× 4	10.1	11.4	+ 850
4565		Com	12 34.4	+26 12	Sb	15× 1	11.0	15.2	+1100
4594		Vir	12 37.9	−11 24	Sa	7× 2	9.2	14.4	+1140
4649	60	Vir	12 41.7	+11 46	E	4× 3	9.5	15.0	+1090
4736	94	CVn	12 49.0	+41 20	Sb	5× 4	8.4	6.0	+ 290
4826	64	Com	12 54.8	+21 54	Sb	8× 4	9.2	2.6	+ 150
5005		CVn	13 09.0	+37 16	Sc	5× 2	11.1	13.2	+ 900
5055	63	CVn	13 14.0	+42 14	Sb	8× 3	9.6	7.2	+ 450
5194	51	CVn	13 28.2	+47 24	Sc	12× 6	7.4	6.0	+ 250
5236	83	Hya	13 34.8	−29 40	Sc	10× 8	8	5.8	+ 500
6822		Sgr	19 42.7	−14 52	I	20×10	11	2.0	− 150
7331		Peg	22 35.2	+34 12	Sb	9× 2	10.4	10.4	+ 500

STAR MAP I

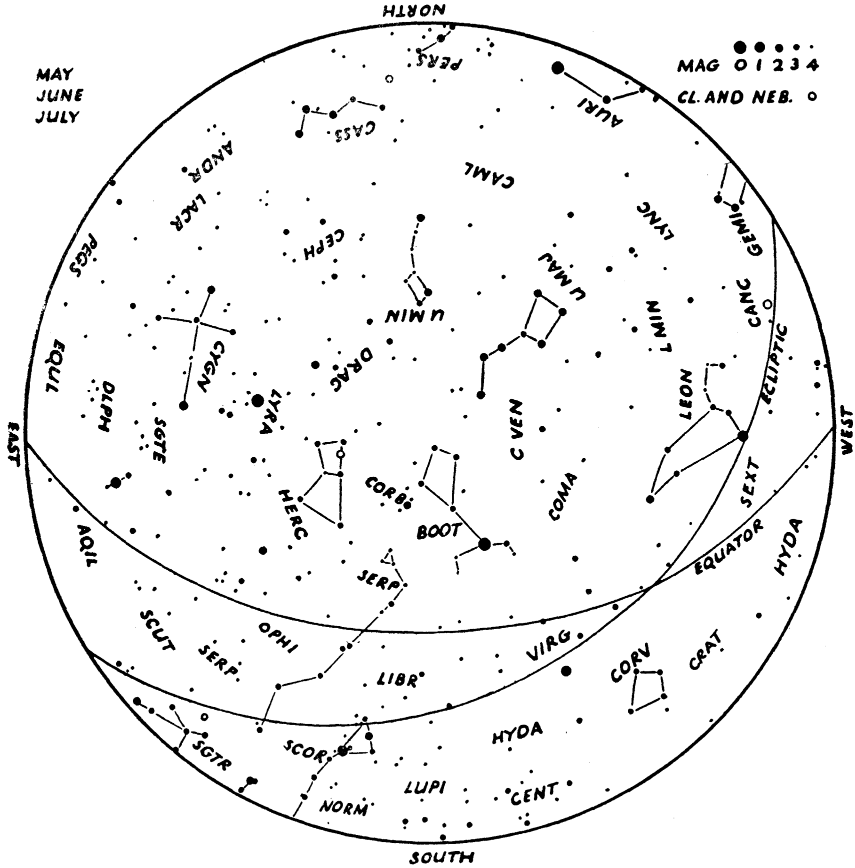


The above map represents the evening sky at

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

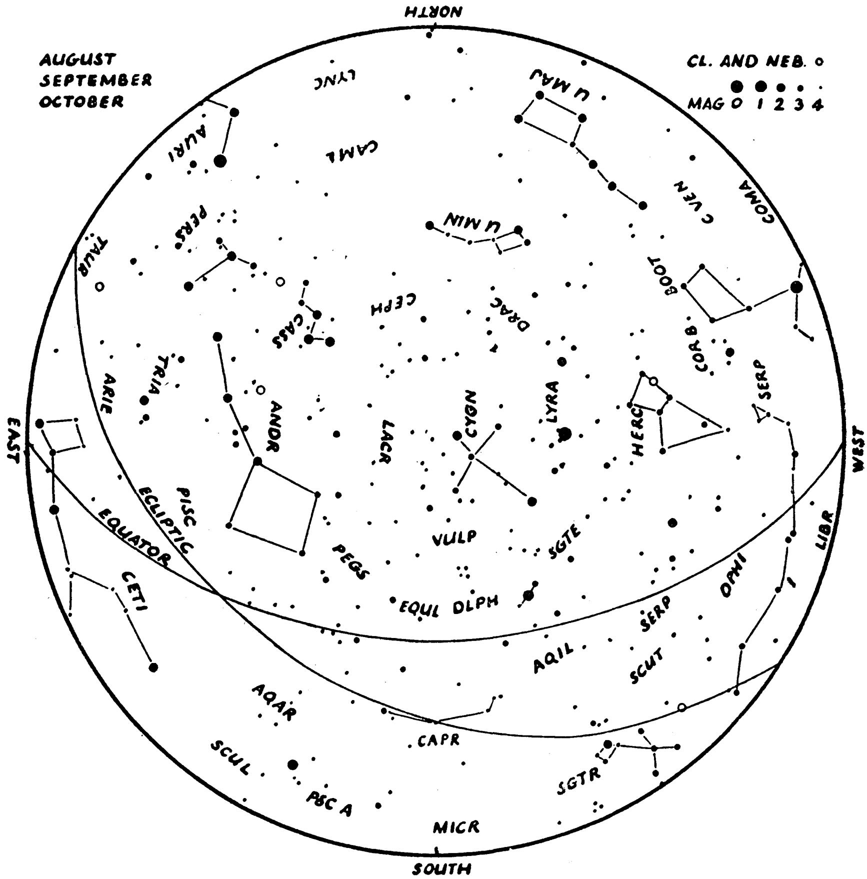


The above map represents the evening sky at

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

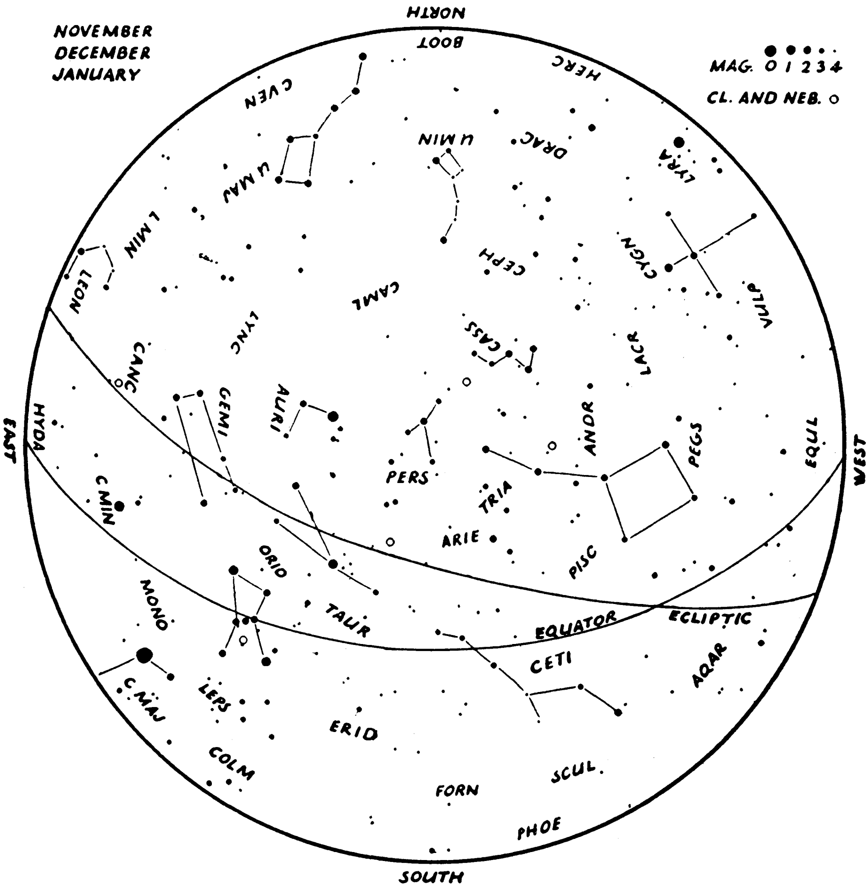


The above map represents the evening sky at

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

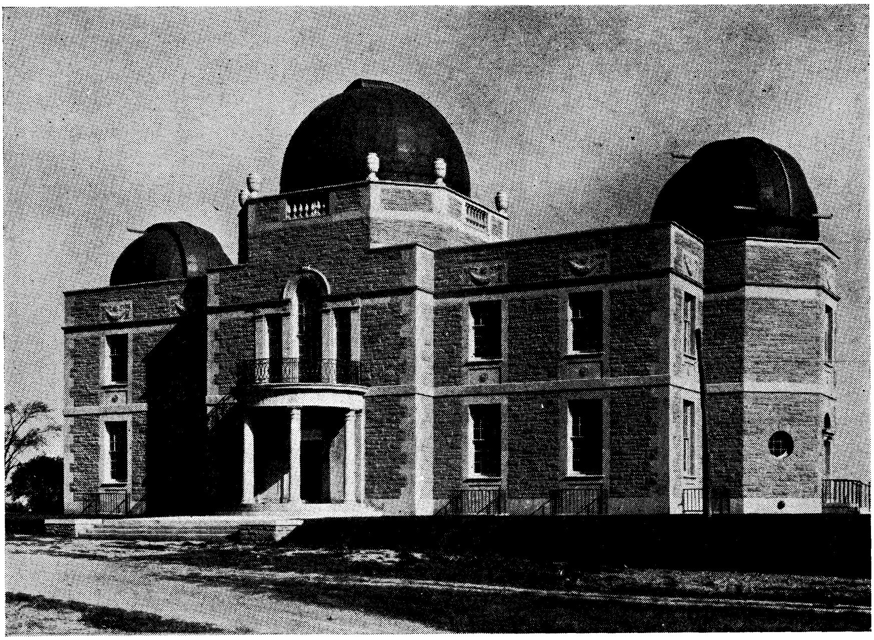


The above map represents the evening sky at

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.

VISITING HOURS AT SOME CANADIAN OBSERVATORIES



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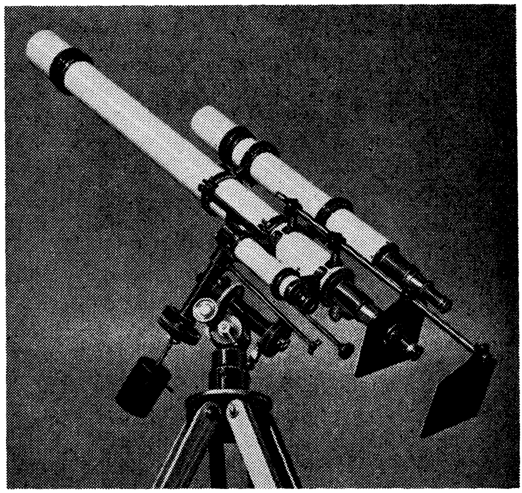

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23.5 mm, 6X	8.50

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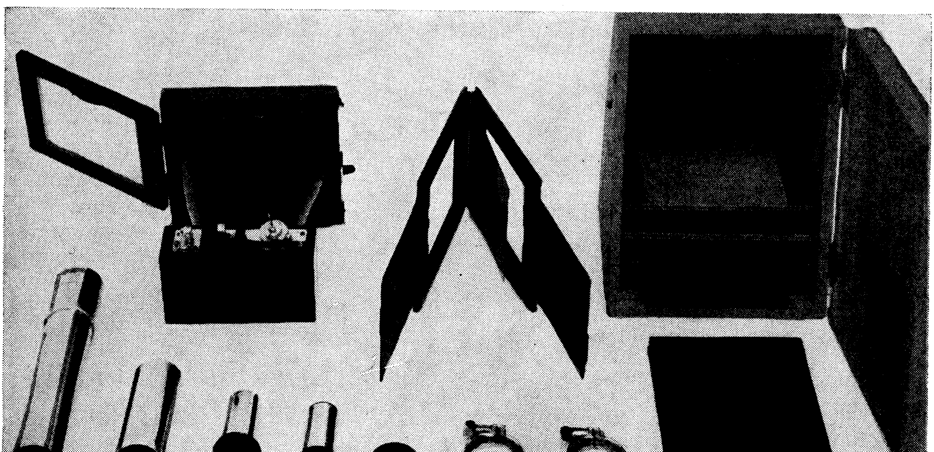
UNIHEX ROTARY EYEPIECE SELECTOR:

The old-fashioned method of fumbling with eyepieces in the dark has been outmoded by UNIHEX, UNITRON's new Rotary Eyepiece Selector. With UNIHEX, you always have 6 magnifications ready at your fingertips. To change power, merely rotate a new eyepiece into position while the object stays centered and in focus in the field of view. If through inaccurate tracking you should lose the object under observation, you need only rotate the lowest power eyepiece into position to convert your telescope into a giant view finder, recenter the object in the field of view and rotate back to the higher powers. Model A is designed to fit the UNITRON rack and pinion and is for UNITRONS only. Model B fits 1¼″ eyepiece holders. Complete with special clamping device and cabinet.

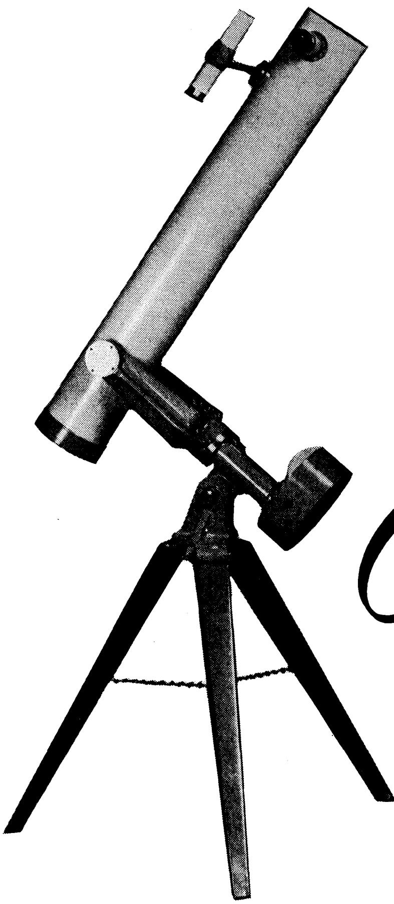
Model A or B **Only $24.75 postpaid**



ASTRO-CAMERA 220: The camera uses an air-operated curtain shutter of the Thornton-Pickard type, giving speeds of 1/10 to 1/90 second in addition to bulb and time. It may be positioned so that the plane of the film passes through the focal point of the objective or mirror which is then the only optical element. When magnification of the primary image is desired, an eyepiece can be inserted into the camera tube and an image projected on the film. Astro-Camera 220 comes complete with ground-glass back, 3 double plateholders for 3¼″ x 4¼″ plates or cut film, a 30mm.f.l. eyepiece, extension tubes and clamps to lock the camera firmly in place, air-operated bulb release, removable filter, and a fitted wooden cabinet. Model A is designed to fit the UNITRON rack and pinion replacing the customary drawtube and is for UNITRONS only. Model B fits 1¼″ eyepiece holders.

Model A or B **Only $69.50 postpaid**

United Scientific Co. 204-206 MILK STREET BOSTON 9, MASS.



CALENDAR 1958

Jan.

S	M	T	W	T	F	S
....	....	....	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	....

Feb.

S	M	T	W	T	F	S
....	....	....	....	....	....	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	....

Mar.

S	M	T	W	T	F	S
....	....	....	....	....	....	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	....	....	....	....	....

April

S	M	T	W	T	F	S
....	....	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	....	....	....

May

S	M	T	W	T	F	S
....	....	....	....	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

June

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	....	....	....	....	....

July

S	M	T	W	T	F	S
....	....	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	....	....

Aug.

S	M	T	W	T	F	S
....	....	....	....	....	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	....	....	....	....	....	....

Sept.

S	M	T	W	T	F	S
....	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	....	....	....	....

Oct.

S	M	T	W	T	F	S
....	....	....	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	....

Nov.

S	M	T	W	T	F	S
....	....	....	....	....	....	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	....	....	....	....	....	....

Dec.

S	M	T	W	T	F	S
....	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	....	....	....