THE
OBSERVER'S HANDBOOK
FOR 1956

PUBLISHED BY

The Royal Astronomical Society of Canada

C. A. CHANT, Editor
RUTH J. NORTHCOTT, Assistant Editor
DAVID DUNLAP OBSERVATORY

FORTY-EIGHTH YEAR OF PUBLICATION

Price 50 Cents

TORONTO
13 Ross Street
Printed for the Society
By the University of Toronto Press
1955

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

The Society was incorporated in 1890 as The Astronomical and Physical Society of Toronto, assuming its present name in 1903.

For many years the Toronto organization existed alone, but now the Society is national in extent, having active Centres in Halifax, N.S., Montreal and Quebec, P.Q.; Ottawa, Toronto, Hamilton, London, Windsor, Ont.; Winnipeg, Man.; Edmonton, Alta.; Vancouver and Victoria, B.C. As well as nearly 1500 members of these Canadian Centres, there are nearly 500 members not attached to any Centre, mostly resident in other nations, while some 300 additional institutions or persons are on the regular mailing list of our publications. The Society publishes a bi-monthly "Journal" and a yearly "Observer's Handbook". Single copies of the Journal are 50 cents, and of the Handbook, 50 cents.

Membership is open to anyone interested in astronomy. Annual dues, $3.00; life membership, $50.00. Publications are sent free to all members or may be subscribed for separately. Applications for membership or publications may be made to the National Secretary, 13 Ross St., Toronto 2B.

CALENDAR 1956

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	29	....	....	....

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	....	....	....	....	....

THE
OBSERVER'S HANDBOOK
FOR 1956

PUBLISHED BY

The Royal Astronomical Society of Canada

C. A. CHANT, EDITOR
RUTH J. NORTHCOTT, ASSISTANT EDITOR
DAVID DUNLAP OBSERVATORY

FORTY-EIGHTH YEAR OF PUBLICATION

PRICE 50 CENTS

TORONTO
13 ROSS STREET
PRINTED FOR THE SOCIETY
BY THE UNIVERSITY OF TORONTO PRESS
1955

CONTENTS

PRINTED IN CANADA

PREFACE

The HANDBOOK for 1956 is the 48th issue and its circulation is 6000. The Officers of the Society appreciated the increase in advertisements which will help to meet our mounting expense.

In this issue the number of pages has been increased by eight, and a number of changes have been made: predictions are given for the dates of maxima of representative variable stars; the material on meteor showers has been completely revised; the table of precession again appears; the table of the brightest stars has been completely revised, giving more information than before.

Celestial distances given herein are based on the standard value of 8.80″ for the sun's parallax, not on the more recent value 8.790″ determined by Sir Harold Spencer Jones; and the calculations for Algol are based on the epoch 2434576.5110 and period 2.86731 days as published in the 1954 International Supplement, Kracow Observatory.

We are indebted particularly to Dr. Daniel L. Harris of Yerkes Observatory for his compilation of the photometric data for the table of the brightest stars; to Dr. W. W. Morgan, also of Yerkes Observatory, and Prof. R. v. d. R. Wooley of the Australian Commonwealth Observatory, for spectral classifications for the same table. Special thanks are due Mrs. Margaret W. Mayall, A.A.V.S.O. Recorder, for the predictions of times of maxima of the long-period variables.

Cordial thanks are tendered to all those who assisted in preparing this volume, especially to the following: Gustav Bakos, Marion Burgess, Charles M. Good, Bernard Jones, John Morrison, Donald Morton, Arlyne Rosenblat, Isobel K. Williamson, G. Marcy Wiseman and Dorothy Yane.

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

C. A. CHANT

David Dunlap Observatory,
Richmond Hill, Ont., June 1955.

ANNIVERSARIES AND FESTIVALS, 1956

New Year's Day	Sun.	Jan. 1
Epiphany	Fri.	Jan. 6
Septuagesima Sunday		Jan. 29
Accession of Queen Elizabeth (1952)	Mon.	Feb. 6
Quinquagesima (Shrove Sunday)		Feb. 12
Ash Wednesday		Feb. 15
St. David	Thu.	Mar. 1
St. Patrick	Sat.	Mar. 17
Palm Sunday		Mar. 25
Good Friday		Mar. 30
Easter Sunday		Apr. 1
Birthday of Queen Elizabeth (1926)	Sat.	Apr. 21
St. George	Mon.	Apr. 23
Rogation Sunday		May 6
Ascension Day	Thu.	May 10
Pentecost (Whit Sunday)		May 20
Empire Day (Victoria Day)	Thu.	May 24
Trinity Sunday		May 27
Corpus Christi	Thu.	May 31
St. John Baptist (Mid-summer Day)	Sun.	June 24
Dominion Day	Sun.	July 1
Birthday of Queen Mother Elizabeth (1900)	Sat.	Aug. 4
Labour Day	Mon.	Sept. 3
Hebrew New Year (Rosh Hashanah)	Thu.	Sept. 6
St. Michael (Michaelmas Day)	Sat.	Sept. 29
All Saints' Day	Thu.	Nov. 1
Remembrance Day	Sun.	Nov. 11
St. Andrew	Fri.	Nov. 30
First Sunday in Advent	Sun.	Dec. 2
Christmas Day	Tue.	Dec. 25

Thanksgiving Day, date set by Proclamation

SYMBOLS AND ABBREVIATIONS

SIGNS OF THE ZODIAC

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

SUN, MOON AND PLANETS

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

ASPECTS AND ABBREVIATIONS

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

THE GREEK ALPHABET

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

THE CONFIGURATIONS OF JUPITER'S SATELLITES

In the Configurations of Jupiter's Satellites (pages 31, 33, etc.), O represents the disc of the planet, d signifies that the satellite is on the disc, * signifies that the satellite is behind the disc or in the shadow. Configurations are for an inverting telescope.

THE CONSTELLATIONS

Latin and English Names with Abbreviations

Andromeda, (*Chained Maiden*)	And	Andr
Antlia, *Air Pump*	Ant	Antl
Apus, *Bird of Paradise*	Aps	Apus
Aquarius, *Water-bearer*	Aqr	Aqar
Aquila, *Eagle*	Aql	Aqil
Ara, *Altar*	Ara	Arae
Aries, *Ram*	Ari	Arie
Auriga, (*Charioteer*)	Aur	Auri
Bootes, (*Herdsman*)	Boo	Boot
Caelum, *Chisel*	Cae	Cael
Camelopardalis, *Giraffe*	Cam	Caml
Cancer, *Crab*	Cnc	Canc
Canes Venatici, *Hunting Dogs*	CVn	CVen
Canis Major, *Greater Dog*	CMa	CMaj
Canis Minor, *Lesser Dog*	CMi	CMin
Capricornus, *Sea-goat*	Cap	Capr
Carina, *Keel*	Car	Cari
Cassiopeia, (*Lady in Chair*)	Cas	Cass
Centaurus, *Centaur*	Cen	Cent
Cepheus, (*King*)	Cep	Ceph
Cetus, *Whale*	Cet	Ceti
Chamaeleon, *Chamaeleon*	Cha	Cham
Circinus, *Compasses*	Cir	Circ
Columba, *Dove*	Col	Colm
Coma Berenices, *Berenice's Hair*	Com	Coma
Corona Australis, *Southern Crown*	CrA	CorA
Corona Borealis, *Northern Crown*	CrB	CorB
Corvus, *Crow*	Crv	Corv
Crater, *Cup*	Crt	Crat
Crux, (*Southern*) *Cross*	Cru	Cruc
Cygnus, *Swan*	Cyg	Cygn
Delphinus, *Dolphin*	Del	Dlph
Dorado, *Swordfish*	Dor	Dora
Draco, *Dragon*	Dra	Drac
Equuleus, *Little Horse*	Equ	Equl
Eridanus, *River Eridanus*	Eri	Erid
Fornax, *Furnace*	For	Forn
Gemini, *Twins*	Gem	Gemi
Grus, *Crane*	Gru	Grus
Hercules, (*Kneeling Giant*)	Her	Herc
Horologium, *Clock*	Hor	Horo
Hydra, *Water-snake*	Hya	Hyda
Hydrus, *Sea-serpent*	Hyi	Hydi
Indus, *Indian*	Ind	Indi
Lacerta, *Lizard*	Lac	Lacr
Leo, *Lion*	Leo	Leon
Leo Minor, *Lesser Lion*	LMi	LMin
Lepus, *Hare*	Lep	Leps
Libra, *Scales*	Lib	Libr
Lupus, *Wolf*	Lup	Lupi
Lynx, *Lynx*	Lyn	Lync
Lyra, *Lyre*	Lyr	Lyra
Mensa, *Table* (*Mountain*)	Men	Mens
Microscopium, *Microscope*	Mic	Micr
Monoceros, *Unicorn*	Mon	Mono
Musca, *Fly*	Mus	Musc
Norma, *Square*	Nor	Norm
Octans, *Octant*	Oct	Octn
Ophiuchus, *Serpent-bearer*	Oph	Ophi
Orion, (*Hunter*)	Ori	Orio
Pavo, *Peacock*	Pav	Pavo
Pegasus, (*Winged Horse*)	Peg	Pegs
Perseus, (*Champion*)	Per	Pers
Phoenix, *Phoenix*	Phe	Phoe
Pictor, *Painter*	Pic	Pict
Pisces, *Fishes*	Psc	Pisc
Piscis Australis, *Southern Fish*	PsA	PscA
Puppis, *Poop*	Pup	Pupp
Pyxis, *Compass*	Pyx	Pyxi
Reticulum, *Net*	Ret	Reti
Sagitta, *Arrow*	Sge	Sgte
Sagittarius, *Archer*	Sgr	Sgtr
Scorpius, *Scorpion*	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 = 1.60935×10^{5} cm. = 1.60935 km.
1 astronomical unit = 1.49504×10^{13} cm. = 92,897,416 miles
1 light year = 9.463×10^{17} cm. = 5.880×10^{12} miles = 0.3069 parsecs
1 parsec = 30.84×10^{17} cm. = 19.16×10^{12} miles = 3.259 l.y.
1 megaparsec = 30.84×10^{23} cm. = 19.16×10^{18} miles = 3.259×10^{6} l.y.

Units of Time

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

The Earth

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

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

Earth's Orbital Motion

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

Solar Motion

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

The Galactic System

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

Extra-galactic Nebulae

Red shift = +265 km./sec./megaparsec = +50 miles /sec./million l.y.

Radiation Constants

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

Miscellaneous

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

1 radian = 57°.2958 = 3437′.75 = 206,265″
π = 3.141,592,653,6
No. of square degrees in the sky = 41,253

1956 EPHEMERIS OF THE SUN AT 0h GREENWICH CIVIL TIME

Date 1956	Apparent R.A.	Corr. to Sun-dial	Apparent Dec.
	h m s	m s	° ′
Jan. 1	18 41 32	+ 3 00	−23 06.1
4	18 54 46	+ 4 25	−22 50.8
7	19 07 57	+ 5 46	−22 31.5
10	19 21 04	+ 7 03	−22 08.2
13	19 34 07	+ 8 16	−21 41.0
16	19 47 04	+ 9 23	−21 10.0
19	19 59 54	+10 24	−20 35.3
22	20 12 38	+11 19	−19 57.2
25	20 25 16	+12 06	−19 15.7
28	20 37 46	+12 46	−18 31.0
31	20 50 08	+13 20	−17 43.3
Feb. 3	21 02 24	+13 45	−16 52.7
6	21 14 32	+14 04	−15 59.5
9	21 26 33	+14 15	−15 03.8
12	21 38 27	+14 20	−14 05.8
15	21 50 14	+14 17	−13 05.7
18	22 01 55	+14 08	−12 03.7
21	22 13 28	+13 52	−11 00.0
24	22 24 56	+13 30	− 9 54.8
27	22 36 18	+13 03	− 8 48.2
Mar. 1	22 47 35	+12 30	− 7 40.4
4	22 58 48	+11 53	− 6 31.7
7	23 09 57	+11 12	− 5 22.1
10	23 21 02	+10 28	− 4 11.8
13	23 32 04	+ 9 40	− 3 01.1
16	23 43 04	+ 8 50	− 1 50.0
19	23 54 01	+ 7 58	− 0 38.9
22	0 04 57	+ 7 04	+ 0 32.2
25	0 15 52	+ 6 10	+ 1 43.1
28	0 26 47	+ 5 15	+ 2 53.7
31	0 37 42	+ 4 20	+ 4 03.7
Apr. 3	0 48 38	+ 3 26	+ 5 13.1
6	0 59 35	+ 2 34	+ 6 21.6
9	1 10 34	+ 1 43	+ 7 29.2
12	1 21 35	+ 0 55	+ 8 35.7
15	1 32 39	+ 0 09	+ 9 40.8
18	1 43 46	− 0 34	+10 44.5
21	1 54 57	− 1 13	+11 46.6
24	2 06 11	− 1 48	+12 47.0
27	2 17 29	− 2 20	+13 45.4
30	2 28 52	− 2 46	+14 41.8
May 3	2 40 20	− 3 08	+15 36.1
6	2 51 53	− 3 25	+16 28.0
9	3 03 31	− 3 37	+17 17.5
12	3 15 14	− 3 43	+18 04.4
15	3 27 03	− 3 44	+18 48.5
18	3 38 56	− 3 41	+19 29.8
21	3 50 54	− 3 32	+20 08.1
24	4 02 57	− 3 19	+20 43.3
27	4 15 04	− 3 01	+21 15.3
30	4 27 16	− 2 39	+21 44.0
June 2	4 39 32	− 2 13	+22 09.4
5	4 51 51	− 1 43	+22 31.2
8	5 04 14	− 1 10	+22 49.5
11	5 16 39	− 0 35	+23 04.2
14	5 29 06	+ 0 02	+23 15.2
17	5 41 34	+ 0 41	+23 22.6
20	5 54 02	+ 1 19	+23 26.2
23	6 06 31	+ 1 58	+23 26.1
26	6 18 59	+ 2 36	+23 22.3
29	6 31 25	+ 3 13	+23 14.8

Date 1956	Apparent R.A.	Corr. to Sun-dial	Apparent Dec.
	h m s	m s	° ′
July 2	6 43 50	+ 3 49	+23 03.7
5	6 56 13	+ 4 22	+22 48.9
8	7 08 33	+ 4 52	+22 30.5
11	7 20 49	+ 5 19	+22 08.7
14	7 33 02	+ 5 41	+21 43.4
17	7 45 09	+ 5 59	+21 14.8
20	7 57 12	+ 6 13	+20 42.9
23	8 09 10	+ 6 21	+20 07.9
26	8 21 03	+ 6 24	+19 29.9
29	8 32 50	+ 6 22	+18 49.0
Aug. 1	8 44 32	+ 6 14	+18 05.2
4	8 56 09	+ 6 01	+17 18.8
7	9 07 41	+ 5 43	+16 29.9
10	9 19 07	+ 5 20	+15 38.6
13	9 30 28	+ 4 51	+14 45.0
16	9 41 44	+ 4 17	+13 49.4
19	9 52 55	+ 3 39	+12 51.7
22	10 04 01	+ 2 55	+11 52.3
25	10 15 04	+ 2 08	+10 51.1
28	10 26 02	+ 1 17	+ 9 48.4
31	10 36 58	+ 0 23	+ 8 44.2
Sept. 3	10 47 51	− 0 33	+ 7 38.8
6	10 58 42	− 1 32	+ 6 32.3
9	11 09 30	− 2 33	+ 5 24.8
12	11 20 18	− 3 36	+ 4 16.5
15	11 31 04	− 4 40	+ 3 07.6
18	11 41 49	− 5 44	+ 1 58.1
21	11 52 35	− 6 48	+ 0 48.3
24	12 03 21	− 7 51	− 0 21.8
27	12 14 09	− 8 53	− 1 32.0
30	12 24 59	− 9 53	− 2 42.1
Oct. 3	12 35 51	−10 50	− 3 51.9
6	12 46 46	−11 44	− 5 01.4
9	12 57 45	−12 36	− 6 10.2
12	13 08 47	−13 23	− 7 18.4
15	13 19 54	−14 05	− 8 25.6
18	13 31 06	−14 43	− 9 31.8
21	13 42 23	−15 16	−10 36.7
24	13 53 46	−15 43	−11 40.2
27	14 05 16	−16 03	−12 42.1
30	14 16 52	−16 16	−13 42.2
Nov. 2	14 28 35	−16 22	−14 40.5
5	14 40 26	−16 21	−15 36.5
8	14 52 24	−16 13	−16 30.3
11	15 04 30	−15 57	−17 21.5
14	15 16 43	−15 34	−18 10.0
17	15 29 03	−15 03	−18 55.7
20	15 41 31	−14 25	−19 38.4
23	15 54 06	−13 39	−20 17.8
26	16 06 49	−12 46	−20 53.9
29	16 19 38	−11 46	−21 26.5
Dec. 2	16 32 34	−10 40	−21 55.4
5	16 45 36	− 9 29	−22 20.5
8	16 58 42	− 8 12	−22 41.7
11	17 11 52	− 6 51	−22 58.9
14	17 25 06	− 5 27	−23 12.1
17	17 38 22	− 4 00	−23 21.0
20	17 51 41	− 2 32	−23 25.8
23	18 05 00	− 1 02	−23 26.3
26	18 18 19	+ 0 27	−23 22.6
29	18 31 37	+ 1 56	−23 14.7

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 9.

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

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, 1956

J.D. 2,435,000 plus the following:

Jan. 1.....474	May 1.....595	Sept. 1.....718
Feb. 1.....505	June 1.....626	Oct. 1.....748
Mar. 1.....534	July 1.....656	Nov. 1.....779
Apr. 1.....565	Aug. 1.....687	Dec. 1.....809

The Julian Day commences at noon. Thus J.D. 2,435,474.0 = Jan. 1.5 G.C.T.

TIMES OF SUNRISE AND SUNSET

In the tables on pages 11 to 16 are given the times of sunrise and sunset for places in latitudes 32°, 36°, 40°, 44°, 46°, 48°, 50°, and 54°. The times are given in Local Mean Time, and in the table below are given corrections to change from Local Mean to Standard Time for the cities and towns named.

The time of sunrise and sunset at a given place, in local mean time, varies from day to day, and depends principally upon the declination of the sun. Variations in the equation of time, the apparent diameter of the sun and atmospheric refraction at the points of sunrise and sunset also affect the final result. These quantities, as well as the solar declination, do not have precisely the same values on corresponding days from year to year, and so the table gives only approximately average values. The times are for the rising and setting of the upper limb of the sun, and are corrected for refraction. It must also be remembered that these times are computed for the sea horizon, which is only approximately realised on land surfaces.

The Standard Times for Any Station

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

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 11 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°		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
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° 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
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°		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
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 10. The entry —— in the above table indicates that at such dates and latitudes, twilight lasts all night. This table, taken from the American Ephemeris, is computed for *astronomical* twilight, i.e. for the time at which the sun is 108° from the zenith (or 18° below the horizon).

TIME OF MOONRISE AND MOONSET, 1956. (Local Mean Time)

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

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

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

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

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

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

THE PLANETS FOR 1956

By C. A. CHANT

THE SUN

It was reported in June 1954, that the solar activity in January of that year was at the lowest level in 21 years. Only one very minute spot was visible in the whole month and that for less than a day. Since then sun-spot activity has been steadily increasing as spots belonging to the new cycle have begun to appear in increasing numbers.

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 1956

Elong. East—Evening Star			Elong. West—Morning Star		
Date	Distance	Mag.	Date	Distance	Mag.
Jan. 11	19°	−0.3	Feb. 21	27°	+0.3
May 2	21°	+0.3	June 20	23°	+0.7
Aug. 31	27°	+0.5	Oct. 11	18°	−0.3
Dec. 24	20°	−0.3			

The most favourable elongations to observe are: in the evening, Jan. 11 and May 2, in the morning, June 20 and Oct. 11. At these times Mercury is about 80 million miles from the earth and in a telescope looks like a half-moon about 7″ in diameter.

VENUS

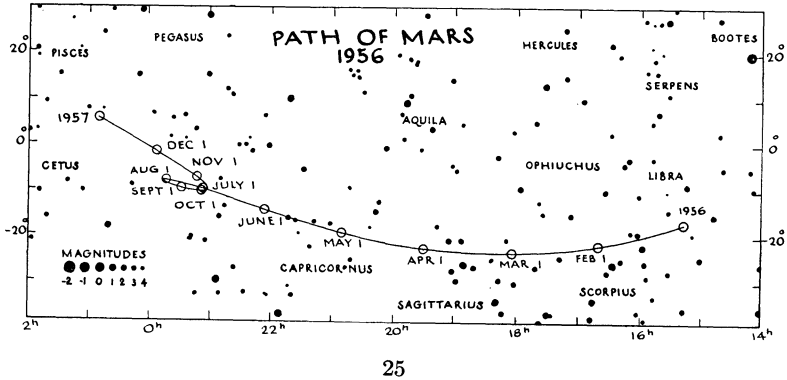
Venus is the next planet in order from the sun. In size and mass it is almost a twin of the earth. Venus being within the earth's orbit, its apparent motion is similar to Mercury's but much slower and more stately. The orbit of Venus is almost circular with radius of 67 million miles, and its orbital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

On Jan. 1, 1956, Venus crosses the meridian 2 h. 08 m. after the sun. It is in declination −20°. Its stellar magnitude is −3.4 and it is a good evening star, but to observers in Canada it will appear low in the sky. By April 12 it reaches greatest elongation east and is 45° 47′ from the sun. Its stellar mag. is now −3.9 and its declination is +25° and it transits the meridian 3 h. after the sun. On May 15 it attains greatest brilliancy, with stellar mag. −4.2. It moves quickly in towards the sun and on June 22 reaches inferior conjunction with it. It now becomes a morning star. It attains greatest brilliancy on July 28 and greatest elongation west, 45° 55′, on Aug. 31, and it is a morning star for the rest of the year. On Dec. 31 it is in declination −21° and it transits the meridian 2 h. before 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. The planet was in opposition on May 1, 1952; then on June 24, 1954; but there was no opposition in 1955. The next opposition is on Sept. 10, 1956, although Mars is nearest the earth on Sept. 7. On that date the distance between the two bodies is 35,120,000 miles, and the planet's stellar magnitude is −2.6.

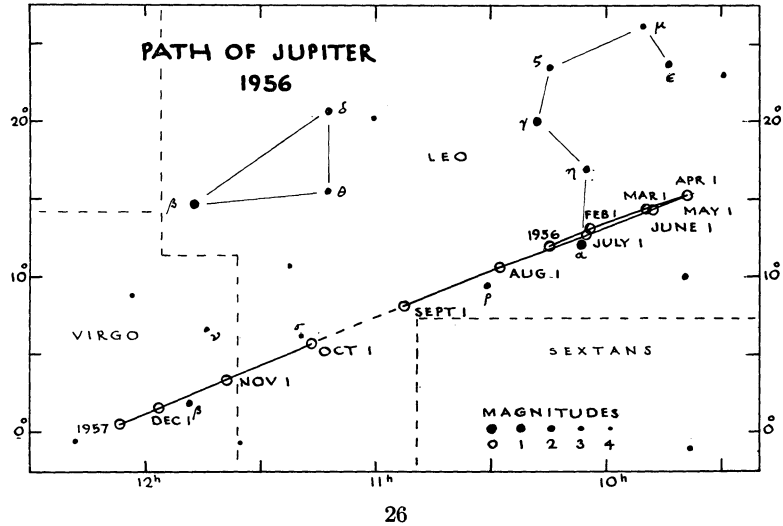
On Jan. 1, 1956, the planet is in Libra. It moves eastward in the sky until it becomes stationary in R.A. on Aug. 11. Then it retrogrades through opposition and becomes stationary in R.A. on Oct. 12. For the rest of the year it moves eastward, and on Dec. 31 it is in Pisces. See the map.

JUPITER

Jupiter is the giant of the family of the sun. Its mean diameter is 87,000 miles and its mass is 2½ 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. 59). 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. 15, 1955, Jupiter came into opposition with the sun and it reaches that position again on Feb. 16, 1956. Between these two positions it makes a synodic revolution, which in this case is 397 days in length. When the two bodies



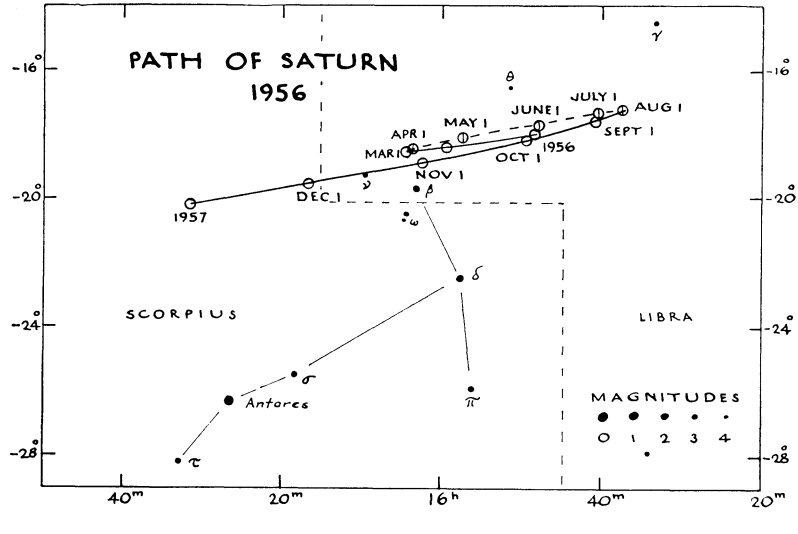
are in opposition, at midnight the sun is on the meridian below while the planet is on the meridian above. On Feb. 16 the sun is in declination −13°, and, the planet being approximately in the ecliptic plane, it is in declination +14°, is high in the sky and is visible all night. Its stellar magnitude is then −2.1.

When in opposition the planet is retrograding and it continues to do so until April 17, when it reaches a stationary point; then it begins to move direct, or eastward among the stars. The sun appears to us to be moving continually eastward along the ecliptic and it comes into conjunction with the planet on Sept. 4, half a synodic period from opposition.

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. For the next few years they will be gradually opening out.

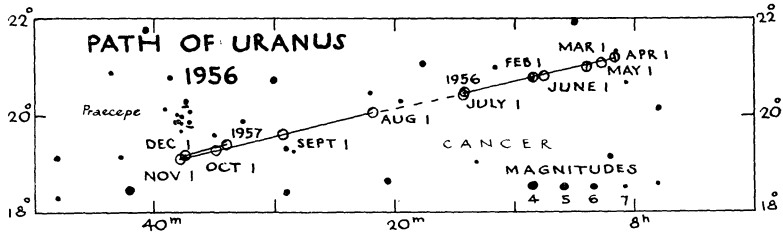
On Jan. 1, 1956, the planet is in the constellation Libra. It is moving eastward and in a month it enters Scorpius (see map). On March 12 it reaches a stationary point and begins to move westward, or retrograde. On May 20 it is in opposition to the sun, and although its declination is −18° it is visible most of the night. Its stellar magnitude is then +0.2. It retrogrades until July 31 when it becomes stationary and begins to move eastward again. On Nov. 27 it comes into conjunction with the sun.



URANUS

Uranus was discovered in 1781 by Sir William Herschel by means of a 6¼-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. 59).

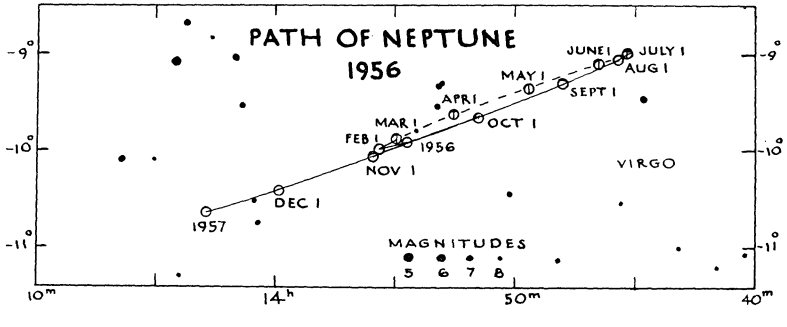
As shown by the map, Uranus in 1956 is in Cancer where it will remain for some years. On Jan. 21 it is in opposition to the sun; on July 25 it is in conjunction with it.



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 2800 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 1956 Neptune is still in the constellation Virgo. It is in opposition to the sun on April 18. Its stellar magnitude is +7.7 and hence it is too faint for the naked eye. In the telescope it shows a greenish tint and a diameter of 2″.5. It is in conjunction with the sun on Oct. 23.



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. 16, at which its astrometric position is R.A. $10^h\ 14^m$, Dec. $+22°\ 41'$.

[NOTE.—This revision of the above account of the planets in 1956 was completed on May 31, 1955, the writer's ninetieth birthday.—C.A.C.]

ECLIPSES, 1956

In 1956 there will be four eclipses, two of the sun and two of the moon.

I. *A Partial Eclipse of the Moon*, May 24, 1956, invisible in North America. Generally it is visible in Asia, the Pacific Ocean, Australia and Antarctica.

II. *A Total Eclipse of the Sun*, June 8, 1956, invisible in North America. The path of totality traverses the South Pacific Ocean from a point east of Australia to a point west of South America. The only important land mass traversed is the South Island of New Zealand; here the eclipse is only partial.

III. *A Total Eclipse of the Moon*, November 17–18, 1956, visible generally in the Americas, the Arctic regions, the Atlantic Ocean, Europe and north-western Africa.

Circumstances of the Lunar Eclipse, November 17–18, 1956 (E.S.T.)

☾ Enters penumbra	22h 59.9m	Total eclipse ends	2h 27.3m
☾ enters umbra	0 02.6	☾ leaves umbra	3 32.7
Total eclipse begins	1 08.0	☾ leaves penumbra	4 35.3
Middle of eclipse	1 47.6	Magnitude of eclipse	1.323

IV. *A Partial Eclipse of the Sun*, December 2, 1956, invisible in North America, visible generally in most of Europe and Asia.

THE SKY MONTH BY MONTH

By J. F. HEARD

THE SKY FOR JANUARY, 1956

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

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

The Sun—During January the sun's R.A. increases from 18h 42m to 20h 54m and its Decl. changes from 23° 06′ S. to 17° 27′ S. The equation of time changes from −3m 00s to −13m 29s. The earth is in perihelion or nearest the sun on the 2nd. For changes in the length of the day, see p. 11.

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. 18.

Mercury on the 15th is in R.A. 20h 59m, Decl. 17° 04′ S. and transits at 13h 24m. Early in the month it is an evening star, but seen on and about the 11th when it is approximately 12 degrees above the south-western horizon at sunset. It is in inferior conjunction on the 27th.

Venus on the 15th is in R.A. 21h 58m, Decl. 14° 08′ S. and transits at 14h 25m. It is prominent in the south-western sky for several hours after sunset.

Mars on the 15th is in R.A. 15h 54m, Decl. 19° 49′ S. and transits at 8h 20m. It is in Libra, moving into Scorpius and may be seen after midnight low in the south-east not far from Antares. At this time it is not at all bright, its stellar magnitude being about +1.6. It is in fairly close conjunction with Saturn on the 14th, passing to the south of it.

Jupiter on the 15th is in R.A. 10h 11m, Decl. 12° 23′ N. and transits at 2h 36m. It is in Leo near Regulus, rising several hours after sunset and visible for the rest of the night. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 54.

Saturn on the 15th is in R.A. 15h 54m, Decl. 18° 15′ S. and transits at 8h 18m. In Scorpius, it is a morning star rising a few hours before the sun. (See Mars.)

Uranus on the 15th is in R.A. 8h 12m, Decl. 20° 37′ N. and transits at 0h 37m.

Neptune on the 15th is in R.A. 13h 55m, Decl. 9° 59′ S. and transits at 6h 20m.

Pluto—For information in regard to this planet, see p. 29.

By Ruth J. Northcott

JANUARY 75th Meridian Civil Time				Min. of Algol	Phen. of Jupiter's Sat. 2h 45m
d	h	m		h m	
Sun. 1	18	24	☌♀☾ ♀ 6° 33′ N.	6 24	4320I
Mon. 2	8		⊕ in Perihelion. Dist. from ☉, 91,342,000 mi.		4203*
Tue. 3			Quadrantid meteors		4102З
Wed. 4	17	41	☾ Last Quarter	3 14	0123*
Thu. 5					2103Ч
Fri. 6	5	22	☌♆☾ ♆ 5° 47′ N.		3014*
Sat. 7				0 03	3102Ч
Sun. 8	6	14	☌♂☾ ♂ 2° 25′ N.		3201Ч
	13	20	☌♄☾ ♄ 3° 35′ N.		
Mon. 9				20 52	2103Ч
Tue. 10					d0234
Wed. 11	3		Moon in Apogee. Dist. from ⊕, 252,500 mi.		01243
	13		☿ Greatest elongation E., 19° 01′		
Thu. 12	22	01	● New Moon	17 41	2104З
Fri. 13					3420I
Sat. 14	13		☿ in ♌		4310Ż
	16		☌♂♄ ♂ 1° 33′ S.		
	17	11	☌☿☾ ☿ 4° 27′ S.		
Sun. 15				14 31	4320I
Mon. 16	3	37	☌♀☾ ♀ 7° 03′ S.		4210*
Tue. 17					d402З
Wed. 18	0		☿ Stationary in R.A.	11 20	4012З
Thu. 19	4		☿ in Perihelion		4210З
Fri. 20	17	58	☽ First Quarter		4320I
Sat. 21	4		☍♁☉ Dist. from ⊕, 1,635,000,000 mi.	8 09	3104Ż
	6		□♆☉ W.		
Sun. 22					d3014
Mon. 23					2104*
Tue. 24				4 58	0123Ч
Wed. 25					0234*
Thu. 26	8		Moon in Perigee. Dist. from ⊕, 222,900 mi.		2103Ч
Fri. 27	0	37	☌♁☾ ♁ 4° 18′ N.	0 48	2301Ч
	9		☌☿☉ Inferior		
	9	40	☍ Full Moon		
Sat. 28					3102Ч
Sun. 29	1	03	☌♀☾ ♀ 6° 28′ N.	22 37	d3021
	10		☿ Greatest Hel. Lat. N.		
Mon. 30					4213O
Tue. 31					4012З

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

THE SKY FOR FEBRUARY, 1956

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 54m to 22h 48m and its Decl. changes from 17° 27′ S. to 7° 40′ S. The equation of time changes from −13m 29s to a minimum of −14m 20s on the 12th and then to −12m 30s at the end of the month. For changes in the length of the day, see p. 11.

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. 18.

Mercury on the 15th is in R.A. 20h 07m, Decl. 18° 56′ S. and transits at 10h 30m. It is a morning star, but even at greatest western elongation on the 21st it will not be easily seen, being less than 10 degrees above the south-eastern horizon at sunrise.

Venus on the 15th is in R.A. 0h 17m, Decl. 1° 20′ N. and transits at 14h 41m. It is very prominent in the west for several hours after sunset.

Mars on the 15th is in R.A. 17h 21m, Decl. 23° 02′ S. and transits at 7h 44m. It is in Scorpius, moving into Sagittarius later in the month. It rises several hours before the sun and may be found low in the south-east just before sunrise.

Jupiter on the 15th is in R.A. 9h 57m, Decl. 13° 43′ N. and transits at 0h 21m. It rises at about sunset and is visible for the rest of the night. Opposition is on the 16th. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 54.

Saturn on the 15th is in R.A. 16h 02m, Decl. 18° 35′ S. and transits at 6h 25m. It is not far from Antares, rising about midnight and coming to the meridian at about dawn. Quadrature is on the 21st.

Uranus on the 15th is in R.A. 8h 06m, Decl. 20° 53′ N. and transits at 22h 26m.

Neptune on the 15th is in R.A. 13h 56m, Decl. 9° 58′ S. and transits at 4h 18m.

Pluto—For information in regard to this planet, see p. 29.

FEBRUARY

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Phen. of Jupiter's Sat. 1h 15m
Wed.	1	19		♆ Stationary in R.A.	19 26	41O23
Thu.	2	13	03	☌♆☾ ♆ 5° 36′ N.		d42O3
Fri.	3	11	08	☾ Last Quarter		423O1
Sat.	4				16 16	431O2
Sun.	5	0	01	☌♄☾ ♄ 3° 16′ N.		34O21
Mon.	6	2	01	☌☌☾ ♂ 0° 15′ N.		2314O
Tue.	7	14		Moon in Apogee. Dist. from ⊕, 252,100 mi.	13 05	O143*
Wed.	8	0		☿ Stationary in R.A.		1O234
Thu.	9	16	43	☌☿☾ ☿ 1° 09′ S.		2O134
Fri.	10				9 54	d2O4*
Sat.	11	16	38	● New Moon		31O24
Sun.	12					3O124
Mon.	13				6 44	231O4
Tue.	14					2O314
Wed.	15	6	03	☌♀☾ ♀ 5° 32′ S.		14O23
Thu.	16	0		☍☭☉ Dist. from ⊕, 407,000,000 mi.	3 33	42O13
		20		☍♇☉ Dist. from ⊕, 3,141,000,000 mi.		
Fri.	17					42O3*
Sat.	18					431O2
Sun.	19	4	21	☽ First Quarter	0 22	43O12
Mon.	20					4321O
Tue.	21	1		♂ in ♉	21 11	42O31
		5		☿ Greatest elongation W., 26° 34′		
		20		☿ in ♉		
		23		□♄☉ W.		
Wed.	22	8		♀ in ♌		41O23
Thu.	23	8	55	☌♁☾ ♁ 4° 18′ N.		dO13*
		13		Moon in Perigee. Dist. from ⊕, 225,900 mi.		
Fri.	24				18 01	21O34
Sat.	25	5	57	☌☭☾ ☭ 6° 22′ N.		d3O24
		20	41	☺ Full Moon		
Sun.	26					3O124
Mon.	27				14 50	321O4
Tue.	28					2O14*
Wed.	29	21	36	☌♆☾ ♆ 5° 24′ N.		1O234

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

THE SKY FOR MARCH, 1956

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 48m to 0h 41m and its Decl. changes from 7° 40′ S. to 4° 27′ N. The equation of time changes from −12m 30s to −4m 02s. On the 20th at 10h 21m. 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. 12.

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. 19.

Mercury on the 15th is in R.A. 22h 33m, Decl. 11° 31′ S. and transits at 11h 04m. It is too close to the sun for observation.

Venus on the 15th is in R.A. 2h 21m, Decl. 15° 36′ N. and transits at 14h 51m It is a brilliant object in the western sky at sunset and does not set until late evening.

Mars on the 15th is in R.A. 18h 43m, Decl. 23° 28′ S. and transits at 7h 12m. It is in Sagittarius and may be seen low in the south-east for a few hours before sunrise. It has now brightened to first magnitude.

Jupiter on the 15th is in R.A. 9h 44m, Decl. 14° 54′ N. and transits at 22h 09m. It is well up in the east at sunset and sets a few hours before sunrise. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 54.

Saturn on the 15th is in R.A. 16h 05m, Decl. 18° 37′ S. and transits at 4h 33m. It rises before midnight and is past the meridian at sunrise. On the 12th it is stationary in right ascension and begins to retrograde, i.e., move westward among the stars.

Uranus on the 15th is in R.A. 8h 03m, Decl. 21° 03′ N. and transits at 20h 28m.

Neptune on the 15th is in R.A. 13h 54m, Decl. 9° 47′ S. and transits at 2h 23m.

Pluto—For information in regard to this planet, see p. 29.

MARCH

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Phen. of Jupiter's Sat. 0h 15m
Thu.	1			.....	11 39	O2143
Fri.	2			.....		21043
Sat.	3	3		☿ in Aphelion.....		4301*
		9	44	☌ ♄ ☾ ♄ 2° 59′ N.....		
Sun.	4	6	53	☾ Last Quarter.....	8 29	4302*
Mon.	5			.....		43210
Tue.	6	0	11	☌ ♂ ☾ ♂ 2° 06′ S.....		4201*
		8		Moon in Apogee. Dist. from ⊕, 251,500 mi..		
Wed.	7			.....	5 18	41023
Thu.	8			.....		40213
Fri.	9			.....		42103
Sat.	10	18	56	☌ ☿ ☾ ☿ 7° 26′ S.....	2 07	4301*
Sun.	11			.....		31042
Mon.	12	6		♄ Stationary in R.A.....	22 56	d3204
		8	36	● New Moon.....		
Tue.	13			.....		23014
Wed.	14			.....		10234
Thu.	15	22	41	☌ ♀ ☾ ♀ 1° 07′ S.....	19 46	O2134
Fri.	16			.....		21034
Sat.	17			.....		32014
Sun.	18			.....	16 35	31042
Mon.	19	12	13	☽ First Quarter.....		d3240
Tue.	20	10	21	☉ enters ♈. Spring commences. Long. of ☉, 0°		42301
Wed.	21	15	11	☌ ♁ ☾ ♁ 4° 27′ N.....	13 24	41023
		19		Moon in Perigee. Dist. from ⊕, 229,200 mi..		
Thu.	22			.....		40123
Fri.	23	9	41	☌ ♃ ☾ ♃ 6° 22′ N.....		42103
		11		☿ Greatest Hel. Lat. S.....		
Sat.	24			.....	10 13	d4201
Sun.	25			.....		43102
Mon.	26	8	11	☍ Full Moon.....		d3401
Tue.	27	0		☿ in Perihelion.....	7 03	2340*
Wed.	28	6	02	☌ ♆ ☾ ♆ 5° 17′ N.....		10234
Thu.	29			.....		O1234
Fri.	30	17	55	☌ ♄ ☾ ♄ 2° 50′ N.....	3 52	21034
Sat.	31			.....		20314

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

THE SKY FOR APRIL, 1956

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 41m to 2h 33m and its Decl. changes from 4° 27′ N. to 15° 00′ N. The equation of time changes from −4m 02s to +2m 54s, being zero on the 15th; that is, the apparent sun moves from east to west of the mean sun on that date. For changes in the length of the day, see p. 12.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 19.

Mercury on the 15th is in R.A. 2h 09m, Decl. 13° 40′ N. and transits at 12h 39m. It is in superior conjunction on the 5th and becomes an evening star. By the end of the month it should be seen easily just after sunset low in the western sky not far from Aldebaran.

Venus on the 15th is in R.A. 4h 34m, Decl. 25° 31′ N. and transits at 15h 02m. It is at greatest eastern elongation on the 12th; accordingly it is at its highest in the western sky at sunset during this month. Seen in a telescope it is now rapidly approaching crescent phase.

Mars on the 15th is in R.A. 20h 10m, Decl. 21° 14′ S. and transits at 6h 37m. It is moving during this month from Sagittarius into Capricornus. It is visible low in the south-east for a few hours before sunrise and it is becoming steadily brighter.

Jupiter on the 15th is in R.A. 9h 37m, Decl. 15° 24′ N. and transits at 20h 00m. It is nearly to the meridian at sunset and sets soon after midnight. On the 17th 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. 54.

Saturn on the 15th is in R.A. 16h 01m, Decl. 18° 22′ S. and transits at 2h 27m. Not far from Antares in Scorpius, it rises in the late evening and is visible for the rest of the night.

Uranus on the 15th is in R.A. 8h 02m, Decl. 21° 05′ N. and transits at 18h 26m.

Neptune on the 15th is in R.A. 13h 51m, Decl. 9° 30′ S. and transits at 0h 18m.

Pluto—For information in regard to this planet, see p. 29.

			APRIL 75th Meridian Civil Time	Min. of Algol	Phen. of Jupiter's Sat. 23h 30m
d	h	m		h m	
Sun. 1			.....		3O214
Mon. 2			.....	0 41	2310*4
Tue. 3	3	06	☾ Last Quarter.....		dO34*
	5		Moon in Apogee. Dist. from ⊕, 251,100 mi. ..		
	23	56	☌♂☾ ♂ 4° 27′ S.....		
Wed. 4			.....	21 30	4O123
Thu. 5	8		♁ Stationary in R.A.....		4213*3
	23		☌☿☉ Superior.....		
Fri. 6			.....		42O31
Sat. 7			.....	18 19	4312*2
Sun. 8			.....		43O21
Mon. 9			.....		4321O
Tue. 10	21	39	● New Moon.....	15 09	4O1**
Wed. 11	11	31	☌☿☾ ☿ 3° 32′ S.....		4O23*
	12		☿ in ♌.....		
Thu. 12	13		☿ Greatest elongation E., 45° 47′.....		21O43
Fri. 13			.....	11 58	2O134
Sat. 14	9	01	☌♀☾ ♀ 3° 36′ N.....		31O24
Sun. 15	17		Moon in Perigee. Dist. from ⊕, 229,300 mi. ..		3O214
Mon. 16	3		☿ in Perihelion.....	8 47	3210*4
Tue. 17	14		♃ Stationary in R.A.....		2O14*
	18	28	☽ First Quarter.....		
	20		☿ Greatest Hel. Lat. N.....		
	20	42	☌♁☾ ♁ 4° 39′ N.....		
Wed. 18	4		□♁☉ E.....		O234*
	22		☍♆☉ Dist. from ⊕, 2,724,000,000 mi.		
Thu. 19	14	15	☌♃☾ ♃ 6° 27′ N.....	5 36	21O43
Fri. 20			.....		2O413
Sat. 21			Lyrid meteors.....		413O2
Sun. 22			.....	2 25	43O12
Mon. 23			.....		4321O
Tue. 24	13	11	☌♆☾ ♆ 5° 19′ N.....	23 14	423O1
	20	40	○ Full Moon.....		
Wed. 25			.....		41O23
Thu. 26	9		☿ Greatest Hel. Lat. N.....		dd4O3
	23	51	☌♄☾ ♄ 2° 53′ N.....		
Fri. 27			.....	20 03	42O13
Sat. 28			.....		413O2
Sun. 29	11		□♂☉ W.....		3O12*
Mon. 30			.....	16 52	3210*4

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

THE SKY FOR MAY, 1956

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 33m to 4h 35m and its Decl. changes from 15° 00′ N. to 22° 01′ N. The equation of time changes from +2m 54s to a maximum of +3m 44s on the 14th and then to +2m 22s 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. There is a partial eclipse of the moon on the 24th, invisible in North America.

Mercury on the 15th is in R.A. 4h 28m, Decl. 23° 03′ N. and transits at 12h 54m. On and about the 2nd when it reaches greatest eastern elongation it is a good evening star to be seen low in the west near Aldebaran just after sunset. By the 25th it has reached inferior conjunction.

Venus on the 15th is in R.A. 6h 19m, Decl. 27° 13′ N. and transits at 14h 47m. It is a spectacular object in the west for several hours after sunset. Greatest brilliancy is on the 15th, and in a telescope the planet appears distinctly crescent shaped.

Mars on the 15th is in R.A. 21h 27m, Decl. 17° 08′ S. and transits at 5h 56m. It moves from Capricornus into Aquarius and is to be seen in the south-east for several hours before sunrise. It is now becoming very prominent, reaching zero magnitude during this month.

Jupiter on the 15th is in R.A. 9h 41m, Decl. 14° 59′ N. and transits at 18h 07m. It is past the meridian at sunset and sets before midnight. Quadrature is on the 13th. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 15h 53m, Decl. 17° 57′ S. and transits at 0h 21m. It rises at about sunset and sets at about sunrise. Opposition is on the 20th.

Uranus on the 15th is in R.A. 8h 05m, Decl. 20° 56′ N. and transits at 16h 31m.

Neptune on the 15th is in R.A. 13h 48m, Decl. 9° 14′ S. and transits at 22h 13m.

Pluto—For information in regard to this planet, see p. 29.

MAY

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Phen. of Jupiter's Sat. 23h 00m
Tue.	1	0		Moon in Apogee. Dist. from ⊕, 251,300 mi. . .		23O14
Wed.	2	17		☿ Greatest elongation E., 20° 56′		1O324
		21	55	☾ Last Quarter		
		23	19	☌♂☾ ♂ 6° 39′ S.		
Thu.	3			. . . . .	13 41	O2134
Fri.	4			Eta Aquarid meteors		2O34*
Sat.	5			. . . . .		13O4*
Sun.	6			. . . . .	10 30	3O124
Mon.	7			. . . . .		d312O
Tue.	8			. . . . .		4230I
Wed.	9			. . . . .	7 19	41O32
Thu.	10	8	04	● New Moon		4O213
Fri.	11	14	40	☌☿☾ ☿ 1° 56′ N.		42O3*
Sat.	12	20		Moon in Perigee. Dist. from ⊕, 226,300 mi. . .	4 08	d41O*
Sun.	13	2		□♃☉ E.		43O12
		8	11	☌♀☾ ♀ 6° 10′ N.		
Mon.	14	18		☿ Stationary in R.A.		3412O
Tue.	15	3	42	☌♁☾ ♁ 4° 49′ N.	0 57	3240I
		21		♀ Greatest brilliancy, magnitude −4.2. .		
Wed.	16	21	59	☌♃☾ ♃ 6° 34′ N.		1O342
Thu.	17	0	15	☽ First Quarter	21 46	O1234
Fri.	18			. . . . .		21O34
Sat.	19	20		☿ in ♉		d2O34
Sun.	20	9		☍♄☉ Dist. from ⊕, 832,300,000 mi.	18 35	3O124
Mon.	21	18	42	☌♆☾ ♆ 5° 24′ N.		312O4
Tue.	22			. . . . .		32O14
Wed.	23			. . . . .	15 24	1O24*
Thu.	24			Partial eclipse of ☾. See p. 29		4O123
		3	34	☌♄☾ ♄ 3° 04′ N.		
		10	26	☺ Full Moon		
Fri.	25	19		☌☿☉ Inferior		421O3
Sat.	26			. . . . .	12 13	42O13
Sun.	27			. . . . .		43O2*
Mon.	28	16		Moon in Apogee. Dist. from ⊕, 251,900 mi. . .		d431O
Tue.	29			. . . . .	9 02	4320I
Wed.	30	3		☿ in Aphelion		41O2*
Thu.	31	7		♀ Stationary in R.A.		4O123
		19	28	☌♂☾ ♂ 8° 27′ S.		

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

THE SKY FOR JUNE, 1956

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 35m to 6h 40m and its Decl. changes from 22° 01′ N. to 23° 27′ N. at the solstice on the 21st at 5h 24m E.S.T. and then to 23° 08′ N. at the end of the month. The equation of time changes from +2m 22s to zero on the 13th to −3m 37s at the end of the month. There is a total eclipse of the sun, on the 8th, invisible in North America, visible in the South Pacific Ocean. 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 on moonrise and moonset are given on p. 20.

Mercury on the 15th is in R.A. 4h 05m, Decl. 16° 44′ N. and transits at 10h 31m. On the 20th it reaches greatest western elongation and may be seen about this time low in the east just before sunrise.

Venus on the 15th is in R.A. 6h 22m, Decl. 22° 55′ N. and transits at 12h 45m. It is now rapidly approaching the sun. Early in the month it may still be seen low in the west after sunset, but by the 22nd it is in inferior conjunction.

Mars on the 15th is in R.A. 22h 37m, Decl. 12° 14′ S. and transits at 5h 03m. It is in Aquarius, prominent in the south-eastern sky from about midnight onwards.

Jupiter on the 15th is in R.A. 9h 55m, Decl. 13° 44′ N. and transits at 16h 19m. It is near Regulus and is well down in the west by sunset, setting a few hours later. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 15h 44m, Decl. 17° 31′ S. and transits at 22h 06m. Now in Libra, it is well up in the south-east at sunset and is visible until nearly dawn.

Uranus on the 15th is in R.A. 8h 10m, Decl. 20° 38′ N. and transits at 14h 34m.

Neptune on the 15th is in R.A. 13h 46m, Decl. 9° 02′ S. and transits at 20h 09m.

Pluto—For information in regard to this planet, see p. 29.

JUNE

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Phen. of Jupiter's Sat. 22h 15m
Fri.	1	14	13	☾ Last Quarter	5 50	21403
Sat.	2					20134
Sun.	3					31024
Mon.	4				2 39	d3024
Tue.	5					32014
Wed.	6	23		☿ Stationary in R.A.	23 28	1304*
Thu.	7	13	10	☌☿☾ ☿ 4° 48′ S.		01234
Fri.	8			Total eclipse of ☉. See p. 29		12043
		16	29	● New Moon		
Sat.	9	22		Moon in Perigee. Dist. from ⊕, 223,500 mi.	20 17	20143
		23	35	☌♀☾ ♀ 3° 14′ N.		
Sun.	10					41302
Mon.	11	13	34	☌♁☾ ♁ 4° 53′ N.		43012
Tue.	12	22		♀ in ♉	17 06	4320*
Wed.	13	10	08	☌♃☾ ♃ 6° 36′ N.		4310*
Thu.	14					40132
Fri.	15	6	56	☽ First Quarter	13 54	41203
Sat.	16					42013
Sun.	17	23	27	☌♆☾ ♆ 5° 24′ N.		d4102
Mon.	18				10 43	3012*
Tue.	19	10		☿ Greatest Hel. Lat. S.		3204*
Wed.	20	3		☿ Greatest elongation W., 22° 46′		32104
		6	12	☌♄☾ ♄ 3° 10′ N.		
Thu.	21	5	24	☉ enters ♋, Summer commences. Long. of ☉, 90°	7 32	01324
Fri.	22	1		☌♀☉ Inferior		12034
Sat.	23	1	13	○ Full Moon		20134
Sun.	24				4 21	10324
Mon.	25	3		Moon in Apogee. Dist. from ⊕, 252,300 mi.		30124
Tue.	26					32104
Wed.	27				1 09	d3420
Thu.	28					40132
Fri.	29	8	37	☌♂☾ ♂ 9° 50′ S.	21 58	d4103
Sat.	30					42013

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

THE SKY FOR JULY, 1956

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 40m to 8h 45m and its Decl. changes from 23° 08′ N. to 18° 05′ N. The equation of time changes from −3m 37s to a minimum of −6m 24s on the 26th and then to −6m 14s at the end of the month. On the 4th the earth is at aphelion or farthest from the sun. 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. 7h 13m, Decl. 23° 27′ N. and transits at 11h 45m. It is poorly placed all month for observation, being in superior conjunction on the 19th.

Venus on the 15th is in R.A. 5h 29m, Decl. 17° 57′ N. and transits at 9h 55m. It is now a morning star and in the latter part of the month may be seen rising in the east just before the sun. On the 28th it is at greatest brilliancy.

Mars on the 15th is in R.A. 23h 27m, Decl. 8° 37′ S. and transits at 3h 55m. It is in Aquarius, rising before midnight and reaching the meridian before sunrise. It is now becoming very bright.

Jupiter on the 15th is in R.A. 10h 15m, Decl. 11° 55′ N. and transits at 14h 41m. It is low in the west at sunset and sets an hour or so later. Early in the month it passes very close to Regulus. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 15h 38m, Decl. 17° 19′ S. and transits at 20h 03m. It is nearly at the meridian at sunset and sets soon after midnight. On the 31st it is stationary in right ascension and resumes direct, or eastward, motion among the stars.

Uranus on the 15th is in R.A. 8h 17m, Decl. 20° 16′ N. and transits at 12h 44m.

Neptune on the 15th is in R.A. 13h 45m, Decl. 9° 01′ S. and transits at 18h 10m.

Pluto—For information in regard to this planet, see p. 29.

JULY 75th Meridian Civil Time				Min. of Algol	Phen. of Jupiter's Sat. 21h 30m
	d	h	m	h m	
Sun.	1	3	40	☾ Last Quarter	41023
Mon.	2			18 47	43012
Tue.	3	15		☌☿♀ ☿ 3° 21′ N	43210
Wed.	4	20		⊕ in Aphelion. Dist. from ☉, 94,455,000 mi.	34201
Thu.	5			15 35	042**
Fri.	6	12	12	☌♀☾ ♀ 3° 16′ S	10243
		23	32	☌☿☾ ☿ 1° 44′ N	
Sat.	7	23	37	● New Moon	20134
Sun.	8	6		Moon in Perigee. Dist. from ⊕, 222,100 mi.	12 24 1034*
		11		☿ in ♌	
Mon.	9	1	59	☌♁☾ ♁ 4° 55′ N	30124
		17		♆ Stationary in R.A.	
Tue.	10				31204
Wed.	11	2	26	☌♃☾ ♃ 6° 33′ N	9 13 32014
Thu.	12				31024
Fri.	13	2		☿ in Perihelion	d0423
		15		♀ Stationary in R.A.	
Sat.	14	15	46	◑ First Quarter	6 01 24013
Sun.	15	5	04	☌♆☾ ♆ 5° 15′ N	4103*
Mon.	16				43012
Tue.	17	9	45	☌♄☾ ♄ 3° 05′ N	2 50 43120
		12		♀ in Aphelion	
Wed.	18				43201
Thu.	19	16		☌☿☉ Superior	23 38 43102
Fri.	20	6		□♆☉ E	d4023
Sat.	21				2403*
Sun.	22	1		☌☿♁ ☿ 1° 11′ N	20 27 12043
		6		Moon in Apogee. Dist. from ⊕, 252,500 mi.	
		16	29	○ Full Moon	
Mon.	23	9		☿ Greatest Hel. Lat. N.	30124
Tue.	24				d3104
Wed.	25	10		☌♁☉	17 16 32014
Thu.	26				31024
Fri.	27	2		♂ Greatest Hel. Lat. S.	01324
		9	28	☌♂☾ ♂ 10° 59′ S	
Sat.	28			δ Aquarid meteors	14 04 2034*
		19		♀ Greatest brilliancy, magnitude −4.2	
Sun.	29				
Mon.	30	14	31	☾ Last Quarter	
Tue.	31	5		♄ Stationary in R.A.	10 53

Jupiter being near the sun, phenomena of the satellites are not given from July 29 to September 21.

THE SKY FOR AUGUST, 1956

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 45m to 10h 41m and its Decl. changes from 18° 05′ N. to 8° 23′ N. The equation of time changes from −6m 14s to −0m 05s. 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. 11h 04m, Decl. 6° 08′ N. and transits at 13h 32m. It is an evening star all month, greatest eastern elongation being on the 31st. However, this is an unfavourable elongation and the planet is too low in the west after sunset for early observation.

Venus on the 15th is in R.A. 6h 32m, Decl. 19° 01′ N. and transits at 8h 58m. It is a spectacular object in the east for several hours before sunrise. Seen in a telescope it is crescent shaped. On the 31st it is at greatest western elongation.

Mars on the 15th is in R.A. 23h 46m, Decl. 8° 07′ S. and transits at 2h 11m. It is in Aquarius and is stationary in right ascension on the 11th and begins to retrograde. It rises a few hours after sunset and is a spectacularly brilliant object visible all the rest of the night.

Jupiter on the 15th is in R.A. 10h 39m, Decl. 9° 36′ N. and transits at 13h 03m. It is too low in the west at sunset for easy observation.

Saturn on the 15th is in R.A. 15h 38m, Decl. 17° 26′ S. and transits at 18h 01m. It is well past the meridian at sunset and sets before midnight.

Uranus on the 15th is in R.A. 8h 25m, Decl. 19° 50′ N. and transits at 10h 49m.

Neptune on the 15th is in R.A. 13h 47m, Decl. 9° 10′ S. and transits at 16h 10m.

Pluto—For information in regard to this planet, see p. 29.

AUGUST

75th Meridian Civil Time

	d	h	m		Min. of Algol h m
Wed.	1			.....	
Thu.	2			.....	
Fri.	3	7	40	☌☿☾ ☿ 2° 58′ S.....	7 41
Sat.	4			.....	
Sun.	5	15	30	☌♁☾ ♁ 5° 00′ N.....	
		16		Moon in Perigee. Dist. from ⊕, 222,400 mi...	
Mon.	6	6	25	● New Moon.....	4 30
Tue.	7	17	24	☌☿☾ ☿ 6° 30′ N.....	
		21	34	☌♃☾ ♃ 6° 27′ N.....	
Wed.	8	18		☿ Greatest Hel. Lat. S.....	
Thu.	9	13		☌☿♃ ☿ 0° 10′ S.....	1 18
Fri.	10			.....	
Sat.	11	12	49	☌♆☾ ♆ 4° 58′ N.....	22 07
		13		♂ Stationary in R.A.....	
Sun.	12			Perseid meteors.....	
Mon.	13	3	45	◑ First Quarter.....	
		16	05	☌♄☾ ♄ 2° 45′ N.....	
Tue.	14			.....	18 55
Wed.	15	19		☿ in ♉.....	
Thu.	16			.....	
Fri.	17			.....	15 44
Sat.	18	11		Moon in Apogee. Dist. from ⊕, 252,200 mi...	
Sun.	19	7		□♄☉ E.....	
Mon.	20			.....	12 33
Tue.	21	5		☌♇☉	
		7	38	○ Full Moon.....	
		11		♂ in Perihelion.....	
Wed.	22			.....	
Thu.	23	16	05	☌♂☾ ♂ 11° 47′ S.....	9 21
Fri.	24			.....	
Sat.	25			.....	
Sun.	26	2		☿ in Aphelion.....	6 10
Mon.	27			.....	
Tue.	28	23	13	☾ Last Quarter.....	
Wed.	29			.....	2 58
Thu.	30			.....	
Fri.	31	0		☿ Greatest elongation E., 27° 13′.....	23 47
		13		☿ Greatest elongation W., 45° 55′.....	

Jupiter being near the sun, phenomena of the satellites are not given from July 29 to September 21.

THE SKY FOR SEPTEMBER, 1956

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 41m to 12h 29m and its Decl. changes from 8° 23′ N. to 3° 05′ S. The equation of time changes from −0m 05s to +10m 12s, the apparent sun passing to the west of the mean sun on the 1st. On the 22nd at 20h 36m 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. 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. 12h 38m, Decl. 8° 29′ S. and transits at 12h 59m. It is poorly placed for observation, inferior conjunction coming on the 26th.

Venus on the 15th is in R.A. 8h 35m, Decl. 17° 04′ N. and transits at 9h 00m. It is a spectacular morning star visible in the east for several hours before sunrise.

Mars on the 15th is in R.A. 23h 21m, Decl. 10° 23′ S. and transits at 23h 40m. This is the month of the long-awaited most favourable opposition of Mars. The opposition is on the 10th, but Mars is closest to the earth on the 7th. The planet rises about at sunset and is visible all night as a spectacular reddish object of magnitude −2.6.

Jupiter on the 15th is in R.A. 11h 04m, Decl. 7° 05′ N. and transits at 11h 26m. Conjunction is on the 4th and the planet is too close to the sun for observation this month. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 15h 44m, Decl. 17° 53′ S. and transits at 16h 05m. Well down in the south-west at sunset, it sets a few hours later.

Uranus on the 15th is in R.A. 8h 32m, Decl. 19° 27′ N. and transits at 8h 54m.

Neptune on the 15th is in R.A. 13h 49m, Decl. 9° 28′ S. and transits at 14h 11m.

Pluto—For information in regard to this planet, see p. 29.

	d	h	m	SEPTEMBER 75th Meridian Civil Time	Min. of Algol	Phen. of Jupiter's Sat. 6h 15m
					h m	
Sat.	1	7	29	☌☿☾ ☿ 1° 08′ N.		
Sun.	2	4	09	☌♁☾ ♁ 5° 12′ N.		
		23		Moon in Perigee. Dist. from ⊕, 224,300 mi.		
Mon.	3				20 35	
Tue.	4	11		☌♃☉		
		13	57	● New Moon		
		17	49	☌♃☾ ♃ 6° 22′ N.		
Wed.	5					
Thu.	6	12	19	☌☿☾ ☿ 0° 45′ N.	17 24	
Fri.	7	0		☌ nearest ⊕. Dist. from ⊕, 35,120,000 mi.		
		22	52	☌♆☾ ♆ 4° 40′ N.		
Sat.	8					
Sun.	9				14 13	
Mon.	10	2	01	☌♄☾ ♄ 2° 16′ N.		
		17		☍☌☉ Dist. from ⊕, 35,220,000 mi.		
Tue.	11	19	13	◑ First Quarter		
Wed.	12				11 01	
Thu.	13	3		☿ Stationary in R.A.		
Fri.	14	1		☌☿♁ ☿ 2° 15′ S.		
Sat.	15	0		Moon in Apogee. Dist. from ⊕, 251,700 mi.	7 50	
		10		☿ Greatest Hel. Lat. S.		
Sun.	16					
Mon.	17					
Tue.	18				4 38	
Wed.	19	9	02	☌☌☾ ☌ 11° 03′ S.		
		22	19	♍ Full Moon. Harvest Moon		
Thu.	20					
Fri.	21				1 27	43120
Sat.	22	20	36	☉ enters ♎, Autumn commences. Long. of ☉, 180°		43012
Sun.	23				22 16	41023
Mon.	24					42013
Tue.	25					41023
Wed.	26	8		☌☿☉ Inferior	19 04	d4032
Thu.	27	6	25	☾ Last Quarter		34201
Fri.	28					32104
Sat.	29	14	18	☌♁☾ ♁ 5° 27′ N.	15 53	30124
Sun.	30	20	51	☌♀☾ ♀ 5° 09′ N.		10324
		21		Moon in Perigee. Dist. from ⊕, 227,400 mi.		

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

THE SKY FOR OCTOBER, 1956

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 29m to 14h 25m and its Decl. changes from 3° 05′ S. to 14° 21′ S. The equation of time changes from +10m 12s to +16m 21s. 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. 12h 18m, Decl. 0° 08′ N. and transits at 10h 45m. It is a morning star, greatest western elongation occurring on the 11th. This elongation is favourable and the planet may be seen on and about this time low in the east just before sunrise.

Venus on the 15th is in R.A. 10h 48, Decl. 8° 24′ N. and transits at 9h 14m. It is a good morning star visible in the east for a few hours before sunrise. There is a close conjunction of Venus and Jupiter on the 25th; on that morning and for a few mornings before and after, the two planets will be a fine sight.

Mars on the 15th is in R.A. 23h 04m, Decl. 9° 47′ S. and transits at 21h 26m. It is in Aquarius, well up in the east at sunset and visible until after midnight. It is fading somewhat but still spectacularly bright. On the 12th it is stationary in right ascension and resumes direct motion.

Jupiter on the 15th is in R.A. 11h 27m, Decl. 4° 40′ N. and transits at 9h 51m. It is a morning star rising an hour or two ahead of the sun. (See Venus.) For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 15h 55m, Decl. 18° 32′ S. and transits at 14h 18m. It is very low in the south-west at sunset and sets soon after.

Uranus on the 15th is in R.A. 8h 37m, Decl. 19° 11′ N. and transits at 7h 01m.

Neptune on the 15th is in R.A. 13h 53m, Decl. 9° 50′ S. and transits at 12h 17m.

Pluto—For information in regard to this planet, see p. 29.

OCTOBER

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Phen. of Jupiter's Sat. 6h 00m
Mon.	1			.....		2O134
Tue.	2	13	19	☌♃☾ ♃ 6° 18′ N.....	12 41	1O34*
Wed.	3	4	08	☌☿☾ ☿ 4° 26′ N.....		O1324
		23	24	🌑 New Moon.....		
Thu.	4	1		♀ in ♌.....		32O4*
		10		☿ in ♌.....		
		16		☿ Stationary in R.A.....		
Fri.	5	10	10	☌♆☾ ♆ 4° 27′ N.....	9 30	321O4
Sat.	6			.....		3O412
Sun.	7	14	58	☌♄☾ ♄ 1° 47′ N.....		41O2*
Mon.	8			.....	6 19	42O13
Tue.	9	2		☿ in Perihelion.....		41O3*
Wed.	10			.....		4O132
Thu.	11	13	44	☽ First Quarter.....	3 07	432O*
		21		☿ Greatest elongation W., 18° 04′.....		
Fri.	12	18		Moon in Apogee. Dist. from ⊕, 251,300 mi...		4321O
		18		♂ Stationary in R.A.....		
Sat.	13			.....	23 56	43O12
Sun.	14			.....		14O2*
Mon.	15			.....		2O413
Tue.	16	10	29	☌♂☾ ♂ 9° 00′ S.....	20 45	12O43
Wed.	17			.....		O1324
Thu.	18			.....		d31O4
Fri.	19	8		☿ Greatest Hel. Lat. N.....	17 34	d32O4
		12	24	🌕 Full Moon. Hunter's Moon.....		
Sat.	20			.....		3O124
Sun.	21			.....		31O24
Mon.	22			Orionid meteors.....	14 22	2O134
Tue.	23	9		☌♆☉		d12O3
Wed.	24			.....		4O123
Thu.	25	9		☌♀♃ ♀ 0° 13′ N.....	11 11	d41O2
Fri.	26	13	02	☾ Last Quarter.....		432O1
		21	30	☌♁☾ ♁ 5° 40′ N.....		
Sat.	27	1		Moon in Perigee. Dist. from ⊕, 230,000 mi...		43O2*
Sun.	28			.....	8 00	431O2
Mon.	29			.....		42O13
Tue.	30	4		□♁☉ W.....		421O3
		6	25	☌♃☾ ♃ 6° 15′ N.....		
		15	35	☌♀☾ ♀ 6° 25′ N.....		
Wed.	31	12		☌☿♆ ☿ 0° 29′ S.....	4 49	O123*

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

THE SKY FOR NOVEMBER, 1956

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 25m to 16h 28m and its Decl. changes from 14° 21′ S. to 21° 46′ S. The equation of time changes from +16m 21s to a maximum of +16m 23s on the 3rd and then to +11m 03s at the end of the month. For changes in the length of the day, see p. 16.

The Moon—For its phases, perigee and apogee times and distances, and its conjunctions with the planets, see opposite page. Times of moonrise and moonset are given on p. 23. There is a total eclipse of the moon on the night of the 17th–18th, visible in North America.

Mercury on the 15th is in R.A. 15h 25m, Decl. 19° 04′ S. and transits at 11h 51m. It is poorly placed for observation, superior conjunction occurring on the 12th.

Venus on the 15th is in R.A. 13h 06m, Decl. 5° 02′ S. and transits at 9h 30m. It is a morning star visible in the east for about two hours before sunrise.

Mars on the 15th is in R.A. 23h 27m, Decl. 5° 03′ S. and transits at 19h 49m. It is in Aquarius, well up in the east at sunset and visible until after midnight. It is now fading perceptibly.

Jupiter on the 15th is in R.A. 11h 48m, Decl. 2° 30′ N. and transits at 8h 10m. It has moved from Leo into Virgo, and it rises a few nours after midnight. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 16h 09m, Decl. 19° 16′ S. and transits at 12h 30m. It is too close to the sun for observation, conjunction being on the 27th.

Uranus on the 15th is in R.A. 8h 38m, Decl. 19° 07′ N. and transits at 5h 00m.

Neptune on the 15th is in R.A. 13h 58m, Decl. 10° 14′ S. and transits at 10h 19m.

Pluto—For information in regard to this planet, see p. 29.

NOVEMBER

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Phen. of Jupiter's Sat. 5h 45m
Thu.	1	21	00	☌☿☾ ☿ 4° 21′ N.		10324
Fri.	2	1	09	☌☿☾ ☿ 3° 29′ N.		32014
		11	43	● New Moon		
Sat.	3				1 38	304**
Sun.	4	5	22	☌♄☾ ♄ 1° 23′ N.		d3024
Mon.	5				22 26	20134
Tue.	6	22		☿ in Perihelion		21034
Wed.	7					01234
Thu.	8				19 15	10324
Fri.	9	14		Moon in Apogee. Dist. from ⊕, 251,300 mi.		23401
Sat.	10			Taurid meteors		3410*
		10	09	☽ First Quarter		
Sun.	11	18		☿ in ♍	16 04	d4302
Mon.	12	7		♁ Stationary in R.A.		42031
		16		☌☿⊙ Superior		
Tue.	13	6	34	☌♂☾ ♂ 6° 54′ S.		42103
Wed.	14				12 53	40213
Thu.	15					41032
Fri.	16			Leonid Meteors		42301
Sat.	17				9 42	31240
Sun.	18			Total eclipse of ☾. See p. 29		30142
		1	44	○ Full Moon		
Mon.	19					d304*
Tue.	20				6 31	21034
Wed.	21	12		Moon in Perigee. Dist. from ⊕, 228,000 mi.		02134
Thu.	22	1		☿ in Aphelion		10234
		1		☌☿♄ ☿ 2° 50′ S.		
Fri.	23	3	10	☌♁☾ ♁ 5° 45′ N.	3 20	23014
Sat.	24	20	12	☾ Last Quarter		32104
Sun.	25					30142
Mon.	26	10		☌♀♆ ♀ 0° 11′ N.	0 09	402**
		20	06	☌⚳☾ ⚳ 6° 10′ N.		
Tue.	27			Bielid meteors		d4203
		10		☌♄⊙		
Wed.	28	13		☿ Greatest Hel. Lat. N.	20 58	40213
Thu.	29	5	55	☌♆☾ ♆ 4° 17′ N.		41023
		12	25	☌♀☾ ♀ 4° 07′ N.		
Fri.	30					42301

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

THE SKY FOR DECEMBER, 1956

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 28m to 18h 45m and its Decl. changes from 21° 46′ S. to 23° 27′ S. at the solstice on the 21st at 16h 00m E.S.T. and then to 23° 03′ S. at the end of the month. The equation of time changes from +11m 03s to zero on the 25th and then to −3m 23s at the end of the month. There is a partial eclipse of the sun on the 2nd, invisible in North America, visible in most of Europe and Asia. 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. 18h 44m, Decl. 25° 20′ S. and transits at 13h 12m. It is an evening star, greatest eastern elongation occurring on the 24th. On and about this time it may be seen low in the south-west just after sunset.

Venus on the 15th is in R.A. 15h 28m, Decl. 17° 16′ S. and transits at 9h 54m. It is a morning star which may be seen low in the south-east just before sunrise.

Mars on the 15th is in R.A. 0h 16m, Decl. 1° 33′ N. and transits at 18h 40m. It has now moved into Pisces and is nearly to the meridian at sunset and sets about at midnight. It has now declined to zero magnitude.

Jupiter on the 15th is in R.A. 12h 03m, Decl. 1° 03′ N. and transits at 6h 27m. It rises at about midnight and passes the meridian before sunrise. Quadrature is on the 22nd. For the configuration of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 55.

Saturn on the 15th is in R.A. 16h 24, Decl. 19° 54′ S. and transits at 10h 47m. It is now a morning star but too close to the sun for easy observation.

Uranus on the 15th is in R.A. 8h 36m, Decl. 19° 15′ N. and transits at 3h 01m.

Neptune on the 15th is in R.A. 14h 01m, Decl. 10° 32′ S. and transits at 8h 25m.

Pluto—For information in regard to this planet, see p. 29.

	d	h	m	DECEMBER 75th Meridian Civil Time	Min. of Algol h m	Phen. of Jupiter's Sat. 5h 15m
Sat.	1	19	25	☌♄☾ ♄ 1° 03′ N	17 47	43210
Sun.	2			Partial eclipse of ☉. See p. 29		43012
		3	12	● New Moon		
Mon.	3	2	13	☌☿☾ ☿ 4° 04′ S		43102
Tue.	4				14 36	2013*
Wed.	5					043**
Thu.	6					10234
Fri.	7	11		Moon in Apogee. Dist. from ⊕, 251,800 mi	11 25	d2014
Sat.	8					32104
Sun.	9					30124
Mon.	10	6	51	◑ First Quarter	8 14	31024
Tue.	11	14	41	☌♂☾ ♂ 4° 58′ S		20134
Wed.	12			Geminid meteors		2043*
		9		☿ Greatest Hel. Lat. S		
Thu.	13				5 03	41023
Fri.	14					42031
Sat.	15					43210
Sun.	16				1 52	43021
Mon.	17	14	06	○ Full Moon		43102
Tue.	18				22 41	42031
Wed.	19	8		Moon in Perigee. Dist. from ⊕, 224,500 mi		42103
Thu.	20	9	42	☌♁☾ ♁ 5° 40′ N		d4023
Fri.	21	7		♂ in ♌	19 30	d0413
		16	00	☉ enters ♑. Winter commences. Long. of ☉, 270°		
Sat.	22	12		□♃☉ W		23104
Sun.	23					30214
Mon.	24				16 20	31024
		5	10	☾ Last Quarter		
		6	32	☌♃☾ ♃ 6° 02′ N		
		19		☿ Greatest elongation E., 19° 53′		
Tue.	25					2014*
Wed.	26	12	48	☌♆☾ ♆ 4° 10′ N		21034
		16		☌♀♄ ♀ 0° 30′ S		
Thu.	27				13 09	01234
Fri.	28					0234*
Sat.	29	7	54	☌♄☾ ♄ 0° 44′ N		23104
		14	17	☌♀☾ ♀ 0° 10′ S		
Sun.	30				9 58	34021
Mon.	31	10		☿ in ♌		43102
		21	13	● New Moon		

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

JANUARY

d	h	m	Sat.	Phen.
1	3	48	I	SI
	4	46	I	TI
	6	05	I	Se
	21	45	III	OR
2	0	54	I	ED
	4	10	I	OR
	22	16	I	SI
	23	12	I	TI
3	0	33	I	Se
	1	29	I	Te
	21	24	IV	ER
	22	36	I	OR
4	1	33	IV	OD
	5	59	II	SI
	6	09	IV	OR
5	4	24	III	SI
6	1	07	II	ED
	5	47	II	OR
7	22	09	II	Se
	23	52	II	Te
8	5	41	I	SI
	6	32	I	TI
9	1	14	III	OR
	2	48	I	ED
	5	56	I	OR
10	0	09	I	SI
	0	59	I	TI
	2	27	I	Se
	3	15	I	Te
	21	16	I	ED
11	0	23	I	OR
	20	55	I	Se
	21	42	I	Te
12	1	31	IV	SI
	6	15	IV	Se
13	3	42	II	ED
14	21	51	II	SI
	23	20	II	TI
15	0	44	II	Se
	2	12	II	Te
	22	13	III	ED
16	4	41	III	OR
	4	42	I	ED
	21	15	II	OR
17	2	03	I	SI
	2	44	I	TI
	4	20	I	Se
	5	01	I	Te
	23	10	I	ED
18	2	08	I	OR
	20	31	I	SI
	21	10	I	TI
	22	48	I	Se
	23	27	I	Te
19	20	35	I	OR
20	6	16	II	ED
	21	10	IV	OR
22	0	26	II	SI
	1	38	II	TI
	3	20	II	Se
	4	30	II	Te
23	2	11	III	ED
	6	35	I	ED
	23	31	II	OR
24	3	56	I	SI
	4	29	I	TI
	6	14	I	Se
	6	46	I	Te
25	1	04	I	ED
	3	53	I	OR
	22	25	I	SI
	22	55	I	TI
26	0	42	I	Se
	1	12	I	Te
26	19	54	III	Se
	21	49	III	Te
	22	19	I	OR
27	19	38	I	Te
28	23	37	IV	TI
29	0	12	IV	Se
	3	01	II	SI
	3	54	II	TI
	4	07	IV	Te
	5	55	II	Se
	6	46	II	Te
30	6	10	III	ED
	22	08	II	ED
31	1	46	II	OR
	5	50	I	SI
	6	13	I	TI

FEBRUARY

d	h	m	Sat.	Phen.
1	2	58	I	ED
	5	37	I	OR
	19	13	II	Se
	19	55	II	Te
2	0	18	I	SI
	0	39	I	TI
	2	36	I	Se
	2	56	I	Te
	20	16	III	SI
	21	26	I	ED
	21	35	III	TI
	23	52	III	Se
3	0	03	I	OR
	1	07	III	Te
	19	05	I	TI
	21	04	I	Se
	21	22	I	Te
5	5	37	II	SI
	6	09	II	TI
6	4	32	IV	ED
7	0	42	II	ED
	4	00	II	OR
8	4	52	I	ED
	18	55	II	SI
	19	17	II	TI
	21	49	II	Se
	22	10	II	Te
9	2	12	I	SI
	2	22	I	TI
	4	29	I	Se
	4	39	I	Te
	23	20	I	ED
10	0	14	III	SI
	0	52	III	TI
	1	47	I	OR
	3	51	III	Se
	4	24	III	Te
	20	40	I	SI
	20	48	I	TI
	22	58	I	Se
	23	05	I	Te
11	20	13	I	OR
14	3	16	II	ED
	6	14	II	OR
	18	21	IV	Te
15	21	31	II	SI
	21	32	II	TI
16	0	25	II	Se
	0	25	II	Te
	4	06	I	SI
	4	06	I	TI
	6	23	I	Se
	6	23	I	Te
17	1	13	I	OD
	3	33	I	ER
	4	07	III	TI
17	4	13	III	SI
	19	26	II	ER
	22	32	I	TI
	22	34	I	SI
18	0	49	I	Te
	0	52	I	Se
	19	39	I	OD
	22	02	I	ER
19	19	14	I	Te
	19	20	I	Se
20	21	41	III	ER
21	5	36	II	OD
22	20	59	IV	OD
	23	47	II	TI
23	0	07	II	SI
	2	40	II	Te
	3	02	II	Se
	3	21	IV	ER
	5	49	I	TI
	6	00	I	SI
24	2	57	I	OD
	5	27	I	ER
	18	42	II	OD
	22	00	II	ER
25	0	15	I	TI
	0	28	I	SI
	2	32	I	Te
	2	46	I	Se
	21	23	I	OD
	23	56	I	ER
26	18	41	I	TI
	18	57	I	SI
	20	58	I	Te
	21	14	I	Se
27	20	54	III	OD
28	1	40	III	ER

MARCH

d	h	m	Sat.	Phen.
1	2	02	II	TI
	2	44	II	SI
	4	56	II	Te
	5	38	II	Se
2	4	01	IV	TI
	4	41	I	OD
	20	56	II	OD
3	0	34	II	ER
	1	59	I	TI
	2	23	I	SI
	4	16	I	Te
	4	40	I	Se
	23	07	I	OD
4	1	51	I	ER
	18	56	II	Se
	20	26	I	TI
	20	51	I	SI
	22	42	I	Te
	23	08	I	Se
5	20	19	I	ER
6	0	13	III	OD
8	4	19	II	TI
9	19	43	III	Se
	23	12	II	OD
10	3	08	II	ER
	3	44	I	TI
	4	17	I	SI
	21	20	IV	ER
11	0	53	I	OD
	3	45	I	ER
	20	21	II	Te
	21	33	II	Se
	22	11	I	TI
	22	45	I	SI
12	0	27	I	Te
	1	02	I	Se
12	19	19	I	OD
	22	14	I	ER
13	3	34	III	OD
	18	54	I	Te
	19	31	I	Se
16	20	08	III	SI
	20	54	III	Te
	23	42	III	Se
17	1	29	II	OD
18	2	39	I	OD
	19	47	II	TI
	21	16	II	SI
	22	40	II	Te
	23	14	IV	Te
	23	56	I	TI
19	0	10	II	Se
	0	40	I	SI
	1	25	IV	SI
	2	13	I	Te
	2	56	I	Se
	21	05	I	OD
20	0	09	I	ER
	19	00	II	ER
	19	08	I	SI
	20	40	I	Te
	21	25	I	Se
23	20	47	III	TI
24	0	07	III	SI
	0	20	III	Te
	3	40	III	Se
	3	47	II	OD
25	22	08	II	TI
	23	53	II	SI
26	1	02	II	Te
	1	43	I	TI
	2	34	I	SI
	2	47	II	Se
	22	53	I	OD
27	2	04	I	ER
	2	09	IV	OD
	20	10	I	TI
	21	03	I	SI
	21	34	II	ER
	22	27	I	Te
	23	19	I	Se
28	20	33	I	ER
31	0	18	III	TI

APRIL

d	h	m	Sat.	Phen.
2	0	32	II	TI
	2	31	II	SI
	3	25	II	Te
3	0	41	I	OD
	19	19	II	OD
	21	34	III	ER
	21	58	I	TI
	22	57	I	SI
4	0	09	II	ER
	0	15	I	Te
	1	14	I	Se
	19	08	I	OD
	19	26	IV	SI
	22	28	I	ER
	23	59	IV	Se
5	19	42	I	Se
9	2	58	II	TI
10	2	31	I	OD
	21	10	III	OR
	21	43	II	OD
	22	00	III	ED
	23	48	I	TI
11	0	52	I	SI
	1	34	III	ER
	2	04	I	Te

d	h	m	Sat.	Phen.
11	2	43	II	ER
	20	58	I	OD
12	0	23	I	ER
	19	21	I	SI
	20	32	I	Te
	21	20	II	Se
	21	37	I	Se
	22	44	IV	OR
17	21	16	III	OD
18	0	09	II	OD
	0	52	III	OR
	1	38	I	TI
	1	59	III	ED
	22	49	I	OD
19	20	06	I	TI
	21	05	II	SI
	21	15	I	SI
	21	35	II	Te
	22	22	I	Te
	23	31	I	Se
	23	58	II	Se
20	20	47	I	ER
21	19	35	III	Se
25	1	03	III	OD
26	0	41	I	OD
	21	13	II	TI
	21	58	I	TI
	23	10	I	SI
	23	43	II	SI
27	0	07	II	Te
	0	14	I	Te
	1	26	I	Se
	22	43	I	ER
28	19	54	I	Se
	20	03	III	SI
	21	09	II	ER
	23	33	III	Se
29	22	46	IV	ED

MAY

d	h	m	Sat.	Phen.
3	23	47	II	TI
	23	51	I	TI
4	1	05	I	SI
	21	03	I	OD
5	0	38	I	ER
	20	35	I	Te
	21	49	I	Se
	22	29	III	Te
	23	44	II	ER
6	0	02	III	SI
8	0	14	IV	Te
11	22	58	I	OD
12	20	13	I	TI
	20	57	II	OD
12	21	28	I	SI
	22	29	I	Te
	22	51	III	TI
	23	44	I	Se
13	21	02	I	ER
14	21	09	II	Se
16	21	21	IV	ER
	21	31	III	ER
19	22	08	I	TI
	23	23	I	SI
	23	32	II	OD
20	22	57	I	ER
21	20	07	I	Se
	20	55	II	SI
	21	14	II	Te
	23	46	II	Se
23	20	26	III	OR
	21	58	III	ED
27	21	19	I	OD
28	20	49	I	Te
	21	01	II	TI
	22	02	I	Se
	23	32	II	SI
30	20	46	II	ER
	20	56	III	OD

JUNE

d	h	m	Sat.	Phen.
1	23	00	IV	OD
3	23	17	I	OD
4	20	30	I	TI
	21	41	I	SI
	22	46	I	Te
5	21	17	I	ER
11	22	27	I	TI
13	20	20	I	Se
	20	49	II	OD
15	20	57	II	Se
19	21	44	I	OD
20	21	12	I	Te
	22	15	I	Se
22	20	44	II	SI
	21	27	II	Te
27	20	54	I	TI
	21	53	I	SI
28	21	26	III	ER
	21	31	I	ER
29	21	21	II	TI

JULY

d	h	m	Sat.	Phen.
1	20	23	II	ER
5	20	18	I	OD
6	20	35	I	Se
13	20	11	I	SI
17	20	42	II	Se
24	20	28	II	SI

Jupiter being near the sun, phenomena of the satellites are not given from July 29 to September 21.

OCTOBER

d	h	m	Sat.	Phen.
6	5	14	IV	Se
11	4	46	II	Te
	5	18	I	ED
12	4	44	I	Se
	5	21	I	Te
14	5	36	III	ED
18	4	47	II	TI
19	4	22	I	SI
	5	04	I	TI
20	4	38	I	OR
25	5	58	II	SI
27	4	49	II	OR
28	3	50	I	Te
31	5	16	IV	ED

NOVEMBER

d	h	m	Sat.	Phen.
1	3	35	III	SI
3	5	26	I	ED
4	3	33	I	TI
	4	54	I	Se
	5	49	I	Te
10	5	34	II	ED
11	4	32	I	SI
	5	32	I	TI
12	3	05	II	Se
	4	45	III	OR
	5	01	II	Te
	5	02	I	OR
17	2	42	IV	ER
19	2	55	II	SI
	3	40	I	ED
	4	42	III	ER
	5	02	II	TI
	5	38	II	Se
	5	49	III	OD
20	3	10	I	Se
	4	14	I	Te
21	2	26	II	OR
26	5	22	III	ED
	5	28	II	SI
	5	33	I	ED
27	2	48	I	SI
	3	56	I	TI
27	5	03	I	Se
	6	11	I	Te
28	3	24	I	OR
	5	08	II	OR
30	3	17	III	Te

DECEMBER

d	h	m	Sat.	Phen.
4	4	42	I	SI
	5	11	IV	OD
	5	52	I	TI
5	1	54	I	ED
	2	39	II	ED
	5	20	I	OR
6	2	36	I	Te
7	2	17	II	Te
	2	39	III	Se
	4	21	III	TI
11	6	35	I	SI
12	1	27	IV	SI
	3	47	I	ED
	4	36	IV	Se
	5	15	II	ED
13	2	17	I	TI
	3	19	I	Se
	4	30	I	Te
14	1	43	I	OR
	2	15	II	TI
	2	31	II	Se
	3	23	III	SI
	4	52	II	Te
	6	36	III	Se
18	1	19	III	OR
19	5	40	I	ED
20	2	57	I	SI
	4	11	I	TI
	5	12	I	Se
	6	25	I	Te
21	1	19	IV	OR
	2	22	II	SI
	3	36	I	OR
	4	49	II	TI
	5	04	II	Se
22	0	53	I	Te
23	2	22	II	OR
25	2	16	III	OD
	5	15	III	OR
27	4	51	I	SI
	6	04	I	TI
28	2	01	I	ED
	4	55	II	SI
	5	28	I	OR
29	0	32	I	TI
	1	34	I	Se
	2	46	I	Te
30	4	56	II	OR

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

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 1956 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 1956.

LUNAR OCCULTATIONS VISIBLE AT TORONTO AND MONTREAL, 1956

Date	Star	Mag.	I or E	Age of Moon	Toronto				Montreal			
					E.S.T.	a	b	P	E.S.T.	a	b	P
				d	h m	m	m	°	h m	m	m	°
Feb. 20	o Tau	4.8	I	9.1	Sun	.....	.....	.....	17 24.4	−1.8	−1.3	134
Mar. 20	ν Gem	4.1	I	7.7	1 08.5	+0.4	−1.9	134	Low	.....	.....	.....
Apr. 14	ι Tau	4.7	I	3.9	20 42.1	−0.4	−1.2	87	20 42.2	−0.3	−1.0	77
Apr. 18	α Cnc	4.3	I	7.9	19 32.6	−2.0	−0.2	93	19 44.3	−2.1	+0.1	79
Aug. 31	ν Gem	4.1	I	24.9	Low	.....	.....	.....	1 48.7	+0.8	+3.4	29
Aug. 31	ν Gem	4.1	E	24.9	2 12.1	−0.9	−1.2	334	2 15.5	−1.0	−1.1	332
Sept. 25	ω Tau	4.8	E	20.6	4 53.5	−1.9	−0.5	275	Sun	.....	.....	.....
Oct. 24	χ^1 Ori	4.6	E	20.1	0 30.7	−0.6	+2.6	230	0 39.7	−0.8	+2.6	232
Oct. 24	χ^2 Ori	4.7	E	20.2	5 52.4	−2.0	+0.7	239	Sun	.....	.....	.....

LUNAR OCCULATIONS VISIBLE AT VANCOUVER, 1956

Date	Star	Mag.	I or E	Age of Moon	P.S.T.	a	b	P
				d	h m	m	m	°
Jan. 17	κ Psc	4.9	I	5.0	18 46.8	——	——	131
Feb. 24	α Cnc	4.3	I	12.6	3 36.6	−0.5	−1.4	89
Mar. 18	o Tau	4.8	I	6.6	21 40.4	——	——	28
July 5	ω Tau	4.8	E	26.6	3 03.2	+0.4	+1.8	227
Aug. 30	ζ Tau	3.0	I	24.0	2 41.4	−0.1	+2.5	48
Aug. 30	ζ Tau	3.0	E	24.0	3 30.7	−1.1	+0.2	306
Oct. 23	χ^1 Ori	4.6	E	20.1	21 28.6	0.0	+1.0	284
Oct. 24	χ^2 Ori	4.7	E	20.2	1 45.4	−1.2	+1.7	251
Nov. 7	d Sgr	5.0	I	5.4	17 50.6	−1.3	−0.2	64
Nov. 20	χ^1 Ori	4.6	E	17.8	6 32.3	−0.3	−1.7	289

EPHEMERIS FOR THE PHYSICAL OBSERVATION OF THE SUN, 1956

For 0h Greenwich Civil Time

Date	P	B_0	L_0	Date	P	B_0	L_0
	°	°	°		°	°	°
Jan. 1	+ 2.50	−2.99	85.78	July 4	− 1.33	+3.27	164.09
6	+ 0.06	−3.56	19.93	9	+ 0.94	+3.79	97.92
11	− 2.35	−4.11	314.09	14	+ 3.19	+4.29	31.75
16	− 4.73	−4.62	248.25	19	+ 5.40	+4.76	325.59
21	− 7.04	−5.10	182.42	24	+ 7.55	+5.20	259.44
26	− 9.28	−5.54	116.58	29	+ 9.64	+5.60	193.29
31	−11.42	−5.93	50.75	Aug. 3	+11.64	+5.97	127.17
Feb. 5	−13.45	−6.28	344.92	8	+13.55	+6.29	61.05
10	−15.36	−6.57	279.09	13	+15.36	+6.57	354.95
15	−17.14	−6.82	213.25	18	+17.05	+6.80	288.86
20	−18.78	−7.01	147.41	23	+18.63	+6.99	222.78
25	−20.28	−7.14	81.56	28	+20.07	+7.13	156.72
Mar. 1	−21.62	−7.22	15.70	Sept. 2	+21.38	+7.21	90.67
6	−22.80	−7.25	309.83	7	+22.56	+7.25	24.64
11	−23.82	−7.22	243.95	12	+23.58	+7.23	318.62
16	−24.67	−7.13	178.05	17	+24.46	+7.16	252.60
21	−25.35	−6.99	112.13	22	+25.18	+7.04	186.60
26	−25.87	−6.80	46.20	27	+25.73	+6.86	120.61
31	−26.20	−6.56	340.25	Oct. 2	+26.12	+6.64	54.63
Apr. 5	−26.35	−6.27	274.28	7	+26.33	+6.36	348.67
10	−26.33	−5.94	208.29	12	+26.35	+6.04	282.70
15	−26.12	−5.56	142.28	17	+26.19	+5.67	216.75
20	−25.72	−5.14	76.25	22	+25.85	+5.26	150.80
25	−25.14	−4.69	10.19	27	+25.30	+4.81	84.87
30	−24.38	−4.21	304.12	Nov. 1	+24.56	+4.32	18.93
May 5	−23.44	−3.69	238.03	6	+23.63	+3.79	313.00
10	−22.32	−3.15	171.92	11	+22.50	+3.24	247.08
15	−21.03	−2.59	105.80	16	+21.17	+2.66	181.17
20	−19.57	−2.02	39.67	21	+19.66	+2.05	115.26
25	−17.96	−1.43	333.52	26	+17.98	+1.43	49.36
30	−16.21	−0.83	267.35	Dec. 1	+16.13	+0.80	343.46
June 4	−14.33	−0.23	201.18	6	+14.12	+0.16	277.57
9	−12.34	+0.38	135.01	11	+11.99	−0.48	211.69
14	−10.25	+0.98	68.83	16	+ 9.75	−1.11	145.81
19	− 8.08	+1.57	2.64	21	+ 7.42	−1.74	79.94
24	− 5.87	+2.15	296.46	26	+ 5.04	−2.36	14.08
29	− 3.61	+2.72	230.27	31	+ 2.61	−2.96	308.22

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, 1956

No.	Commences	No.	Commences	No.	Commences
1369	Jan. 7.51	1374	May 23.00	1379	Oct. 6.14
1370	Feb. 3.85	1375	June 19.20	1380	Nov. 2.44
1371	Mar. 2.19	1376	July 16.40	1381	Nov. 29.75
1372	Mar. 29.50	1377	Aug. 12.62	1382	Dec. 27.07
1373	Apr. 25.77	1378	Sept. 8.87		

PRINCIPAL ELEMENTS OF THE SOLAR SYSTEM

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

Planet	Mean Distance from Sun (a)		Period of Revolution		Eccentricity (e)	Inclination (i)	Long. of Node (☊)	Long. of Peri. helion (π)	Mean Long. of Planet
	⊕ = 1	millions of miles	Sidereal (P)	Mean Synodic					
				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*	Mass*	Mean Density*	Axial Rotation	Mean Surface Gravity*	Albedo*	Magnitude at Greatest Brilliancy
		miles	⊕ = 1	water = 1		⊕ = 1		
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	
SATTELITES 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
SATELLITE OF NEPTUNE									
Triton	13	16		220,000	5	21	03	3000?	Lassell, 1846
Nereid	19	260		3,460,000	359			200?	Kuiper, 1949

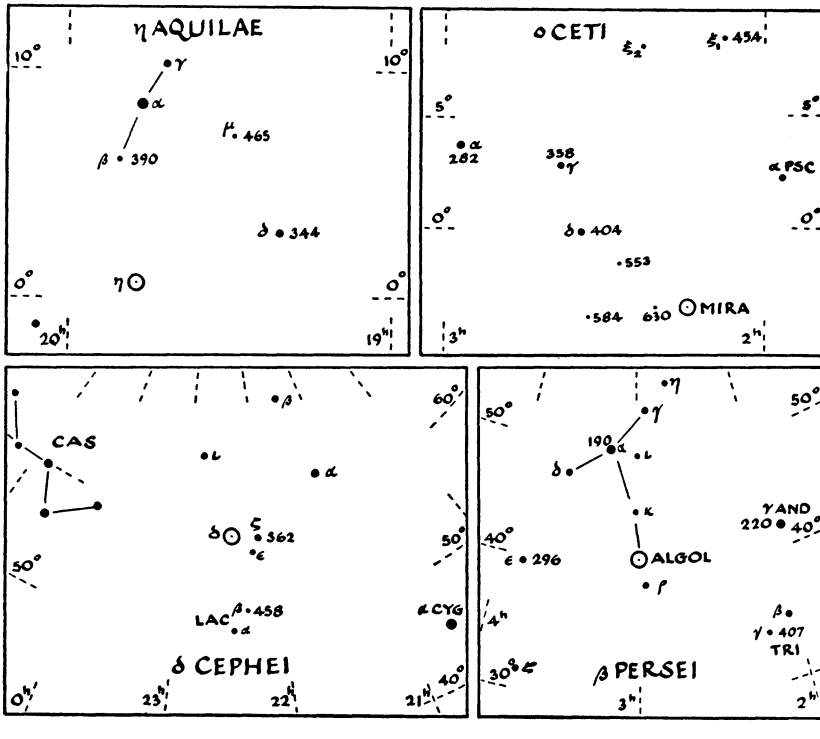
*As seen from the sun.

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

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 1956	Variable	Max. m	Per. d	Epoch 1956
001755 T Cas	7.8	445	June 8	143227 R Boo	7.3	223	Apr. 22
001838 R And	7.0	409	Oct. 29	151731 S CrB	7.5	360	June 17
021143 W And	7.5	397	June 17	154615 R Ser	6.8	357	May 4
021403 o Cet	3.7	331	Jan. 10	154639 V CrB	7.4	358	Mar. 23
022813 U Cet	7.5	236	Mar. 23	162112 V Oph	7.5	298	Mar. 24
023133 R Tri	6.3	266	May 21	162119 U Her	7.6	405	June 9
045514 R Lep	6.7	432	June 17	163266 R Dra	7.6	245	July 29
054920a U Ori	6.6	373	Apr. 3	164715 S Her	7.6	309	Mar. 14
061702 V Mon	7.1	334	Apr. 24	170215 R Oph	7.6	302	Feb. 12
065355 R Lyn	7.9	378	Aug. 8	171723 RS Her	8.0	219	Jan. 28
070122a R Gem	7.1	370	Apr. 11	180531 T Her	8.0	165	Apr. 4
072708 S CMi	7.5	334	Feb. 6	181136 W Lyr	8.0	196	Feb. 11
081112 R Cnc	6.8	362	Apr. 12	183308 X Oph	6.9	334	Nov. 24
084803 S Hya	7.9	255	Mar. 29	190108 R Aql	6.3	300	July 5
085008 T Hya	7.7	287	Feb. 1	191019 R Sgr	7.2	268	Mar. 3
093934 R LMi	7.2	373	Nov. 25	193449 R Cyg	7.3	426	May 17
094211 R Leo	5.9	313	Aug. 31	194048 RT Cyg	7.4	191	July 9
103769 R UMa	7.6	301	June 19	194632 χ Cyg	5.3	409	June 1
115158 Z UMa	6.6	198	Feb. 6	200938 RS Cyg	7.4	419	May 28
121418 R Crv	7.6	315	Oct. 22	201647 U Cyg	7.6	463	Sept. 21
122001 SS Vir	6.9	356	Aug. 30	204405 T Aqr	7.9	201	Jan. 21
123160 T UMa	7.9	257	July 6	210868 T Cep	5.8	393	Oct. 14
123307 R Vir	6.9	145	Feb. 4	230110 R Peg	7.9	379	May 14
123961 S UMa	7.9	226	May 28	230759 V Cas	7.9	232	May 10
132706 S Vir	7.1	378	July 9	231508 S Peg	8.0	320	Aug. 4
134440 R CVn	7.7	326	July 31	233815 R Aqr	7.3	386	Dec. 17
142539 V Boo	7.9	259	Nov. 4	235350 R Cas	6.5	430	Jan. 14

OTHER TYPES OF VARIABLE STARS

Variable	Max. m	Min. m	Type	Sp. Cl.	Period d	Epoch 1956 E.S.T.
005381 U Cep	6.8	9.8	Ecl	B8	2.4929005	Jan. 4.106*
025838 ρ Per	3.2	3.8	SemiR	M4	50	
035512 λ Tau	3.5	4.0	Ecl	B3	3.952952	Jan. 3.874*
045443 ϵ Aur	3.7	4.5	Ecl	F2	9883	May 14*
054907 α Ori	0.4	1.3	SemiR	cM2	2070	Feb. 6*
060822 η Gem	3.1	3.9	SemiR	M3	234	Aug. 10*
065820 ζ Gem	3.7	4.1	δ Cep	F7–G3	10.153527	Jan. 12.774
154428 R CrB	5.8	14	R CrB	cG0ep		
171014 α Her	3.0	4.0	SemiR	M5	100	
184205 R Sct	5.0	8.4	RVTau	G0–M5	144	
184633 β Lyr	3.4	4.3	Ecl	B8	12.9308	Jan. 15.220*
192242 RRLyr	7.3	8.1	RR Lyr	A2–F0	0.56683500	Jan. 1.310
194700 η Aql	3.7	4.4	δ Cep	F6–G4	7.176678	Jan. 8.032
201437a P Cyg	3.5	6.0	Nova	B1 eq		
222557 δ Cep	3.8	4.6	δ Cep	F5–G2	5.366306	Jan. 1.704

*Minima

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 h m	δ ° ′	Mag. and Spect.	d ″	D L.Y.	Remarks
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.

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.

Star	Right Ascension 1960	Declination	Visual Magnitude	Colour Index	Spectral Classification	Parallax	Absolute Magnitude	Distance light-years	Proper Motion	Radial Velocity	
	h m	° ′	V	$B-V$	Type	π	M_V	D	μ	R	
						″		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 h m	Dec. ° ′	V	$B-V$	Type	π ″	M_V	D l.y.	μ ″	R 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 = *Almach*
γ And *A*	02 01.4	+42 08	2.14:	+1.16:	K3 II	0.005	−2.4	260	0.068	−11.7	*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*	
o 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	
θ^2 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.? *R*0.78–0.93, *B*13^{m}31″ ***Aldebaran***
π^3 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 52.9 m; Dec. +89° 04′ (1956).

Star	R.A. 1960 h m	Dec. ° ′	V	$B-V$	Type	π	M_V	D	μ	R	
						″		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, A3.59^m B4.98^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 h m	Dec. ° ′	V	$B-V$	Type	π ″	M_V	D l.y.	μ ″	R 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 h m	Dec. ° ′	V	$B-V$	Type	π	M_V	D	μ	R	
						″		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* 4.90^m 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* 8.26^m 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* 2.9^m *B* 2.9^m 1″
γ Vir *AB*	39.6	−01 14	2.76	+0.34	F0 V	0.101	+3.5	32	0.567	−19.7	*A* 3.50^m *B* 3.52^m 4″
β Mus *AB*	43.8	−67 53	3.06	−0.17:	*B3 V*		−2.1	470	0.041	+42	*A* 3.7^m *B* 4.0^m 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* 5.61^m 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* 3.94^m 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, 4.0^d ***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	0.066	+1.8	49	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 0.7^m B 3.9^m 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 3.19^m B 8.61^m 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 2.47^m B 5.04^m 3″	
α Lib A	48.5	−15 50	2.76	+0.15	A3m	0.049	+1.2	66	0.130	−10	B 5.15^m 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 7.8^m 71″	
δ Boo A	13.9	+33 28	3.47	+0.95	G8 III	0.028	+0.3	140	0.148	−12.2	B 7.84^m 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 3.5^m B 3.7^m 1″	
α CrB	33.0	+26 51	2.23v	−0.02	A0 V	0.043	+0.4	76	0.154	*+01.7*	Ecl. R 0.11^m, 17.4^d	*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 3.47^m B 7.70^m 15″	
δ Sco	58.0	−22 31	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* 9.78m 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* 10m 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, 12.9d, *B* 7.8m 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* 3.3m *B* 3.5m 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* 12m 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* 3.7m *B* 3.8m *C* 6.0m < 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* 5.11m 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* 2.91m *B* 6.44m 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 h m	Dec. ° ′	V	$B-V$	Type	π ″	M_V	D l.y.	μ ″	R 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	0.013	−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.
		$\delta = +85°$	$+80°$	$+75°$	$+70°$	$+60°$	$+50°$	$+40°$	$+30°$	$+20°$	$+10°$	$0°$	$-10°$	$-20°$	$-30°$		
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

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 1956. It has been adapted from a list published in the JOURNAL of the R.A.S.C., vol. 48, p. 194, 1954.

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.

METEOR SHOWERS FOR 1956

Shower	Shower Maximum			Radiant				Single Observer Hourly Rate	Normal Duration (days)
	Date	E.S.T.	Moon	Position at Max. α	δ	Daily Motion α	δ		
Quadrantids	Jan. 3	23^h	L.Q.	231°	+50°			35	1
Aurigids	Feb. 10		N.M.	75	+42			12	
Lyrids	Apr. 21	12	F.M.	273	+34			12	2
η Aquarids	May 4	17	L.Q.	336	0	+53′	+22′	12	10
Draconids	June 28		L.Q.	220	+58			12	
δ Aquarids	July 30		L.Q.	340	−15	+52	+12	20	15
Perseids	Aug. 11	20	F.Q.	46	+57	+81	+ 8	50	20
Orionids	Oct. 20	7	F.M.	95	+15	+74	+ 8	20	10
Taurids	Oct. 31		N.M.	54	+17	+35	+ 8	12	30
N. Arietids	Nov. 12		F.Q.	50	+22			12	
Leonids	Nov. 16	7	F.M.	152	+22	+42	−25	20	5
Geminids	Dec. 13	0	F.Q.	113	+32	+63	− 4	40	5
Ursids	Dec. 22	6	L.Q.	207	+80			15	1

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 1950 h m	δ ° ′	Cl.	Diam. ′	Mag. B.S.	No.	Int. mag.	Dist l.y.
869		hPer	02 15.5	+56 55	Op	30	7			4,300
884		χPer	02 18.9	+56 53	Op	30	7			4,300
1039	34	Per	02 38.3	+42 35	Op	30	9	80		1,500
Pleiades	45	Tau	03 44.5	+23 58	Op	120	4.2	250		490
Hyades		Tau	04 17	+15 30	Op	400	4.0	100		120
1912	38	Aur	05 25.3	+35 48	Op	18	9.7	100		2,800
2099	37	Aur	05 49.0	+32 33	Op	24	9.7	150		2,700
2168	35	Gem	06 05.7	+24 21	Op	29	9.0	120		2,700
2287	41	C Ma	06 44.9	−20 42	Op	32	9	50		1,300
2632	44	Cnc	08 37.2	+20 10	Op	90	6.5	350		490
5139		ωCen	13 23.7	−47 03	Gl	23	12.9		3	22,000
5272	3	C Vn	13 39.9	+28 38	Gl	10	14.2		4.5	40,000
5904	5	Ser	15 15.9	+02 16	Gl	13	14.0		3.6	35,000
6121	4	Scr	16 20.5	−26 24	Gl	14	13.9		5.2	24,000
6205	13	Her	16 39.9	+36 33	Gl	10	13.8		4.0	34,000
6218	12	Oph	16 44.6	−01 51	Gl	9	14.0		6.0	36,000
6254	10	Oph	16 54.5	−04 02	Gl	8	14.1		5.4	36,000
6341	92	Her	17 15.6	+43 12	Gl	8	13.9		5.1	36,000
6494	23	Sgr	17 54.0	−19 01	Op	27	10.2	120		2,200
6611	16	Ser	18 16.0	−13 48	Op	8	10.6	55		6,700
6656	22	Sgr	18 33.3	−23 57	Gl	17	12.9		3.6	22,000
7078	15	Peg	21 27.6	+11 57	Gl	7	14.3		5.2	43,000
7089	2	Aqr	21 30.9	−01 04	Gl	8	14.6		5.0	45,000
7092	39	Cyg	21 30.5	+48 13	Op	32	6.5	25		1,000
7654	52	Cas	23 22.0	+61 19	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.

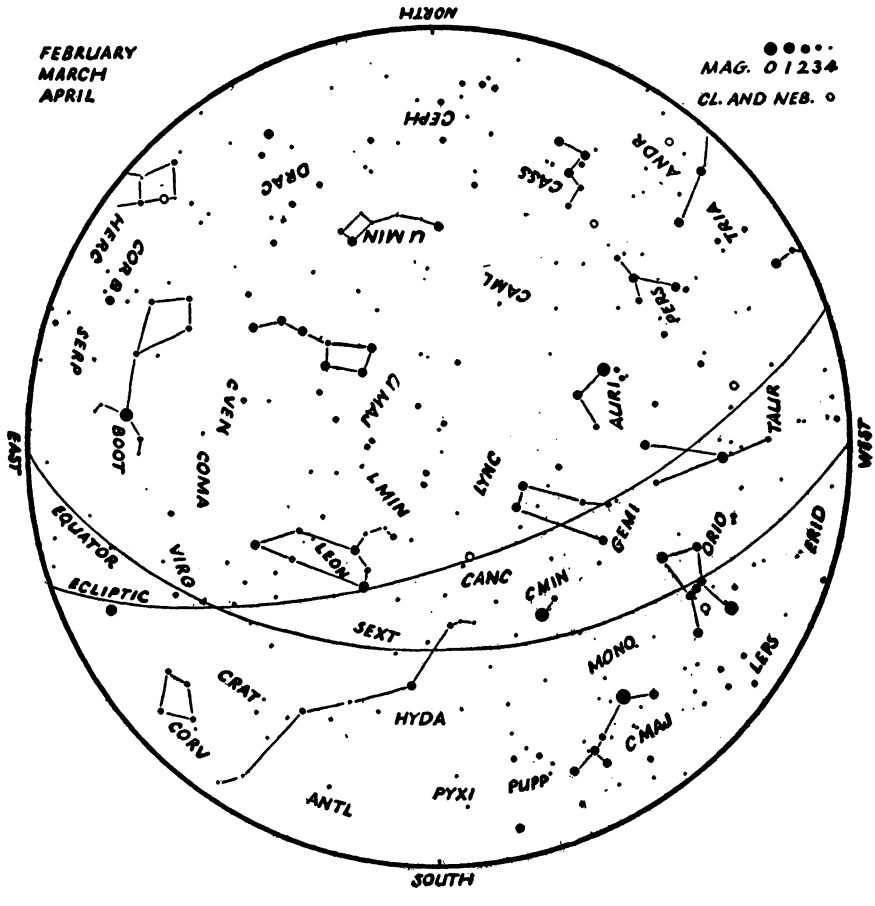
N.G.C.	M	Con	α 1950 h m	δ ° ′	Cl	Size ′	m n	m *	Dist. l.y.	Name
650	76	Per	01 38.3	+51 20	Pl	1.5	11	17	15,000	
1952	1	Tau	05 31.5	+21 59	Pl	6	11	16	4,100	Crab
1976	42	Ori	05 32.5	−05 25	Dif	30			1,800	Orion
B33		Ori	05 38.0	−02 29	Drk	4			300	Horsehead
2261		Mon	06 36.4	+08 47	Dif	2				Hubble's var
2392		Gem	07 26.2	+21 02	Pl	0.3	8	10	2,800	
2440		Pup	07 39.6	−18 05	Pl	0.9	11	16	8,600	
3587	97	UMa	11 11.8	+55 17	Pl	3.3	11	14	12,000	Owl
		Cru	12 48	−63	Drk	300			300	Coalsack
6210		Her	16 42.4	+23 54	Pl	0.3	10	12	5,600	
B72		Oph	17 20.5	−23 36	Drk	20			400	S nebula
6514	20	Sgr	17 59.3	−23 02	Dif	24			3,200	Trifid
B86		Sgr	17 59.9	−27 52	Drk	5				
6523	8	Sgr	18 00.6	−24 23	Dif	50			3,600	Lagoon
6543		Dra	17 58.6	+66 38	Pl	0.4	9	11	3,500	
6572		Oph	18 10.2	+06 50	Pl	0.2	9	12	4,000	
B92		Sgr	18 12.7	−18 15	Drk	15				
6618	17	Sgr	18 18.0	−16 12	Dif	26			3,000	Horseshoe
6720	57	Lyr	18 52.0	+32 58	Pl	1.4	9	14	5,400	Ring
6826		Cyg	19 43.5	+50 24	Pl	0.4	9	11	3,400	
6853	27	Vul	19 57.4	+22 35	Pl	8	8	13	3,400	Dumb-bell
6960		Cyg	20 43.6	+30 32	Dif	60				Network
7000		Cyg	20 57.0	+44 07	Dif	100				N. America
7009		Aqr	21 01.4	−11 34	Pl	0.5	8	12	3,000	
7662		And	23 23.4	+42 12	Pl	0.3	9	13	3,900	

EXTRA-GALACTIC NEBULAE

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

N.G.C.	M	Con	α 1950 h m	δ ° ′	Cl	Dimens. ′ ′	Mag.	Distance millions of l.y.	Vel. km / sec
221	32	And	00 39.9	+40 36	E	3×3	8.8	1.6	− 185
224	31	And	00 40.0	+41 00	Sb	160×40	5.0	1.6	− 220
SMC		Tuc	00 53	−72 38	I	220×220	1.5	0.17	+ 170
598	33	Tri	01 31.0	+30 24	Sc	60×40	7.0	1.4	− 70
LMC		Dor	05 21	−69 27	I	430×530	0.5	0.17	+ 280
3031	81	UMa	09 51.5	+69 18	Sb	16×10	8.3	4.8	− 30
3034	82	UMa	09 51.8	+69 58	I	7× 2	9.0	5.2	+ 290
3368	96	Leo	10 44.1	+12 05	Sa	7× 4	10.0	11.4	+ 940
3623	65	Leo	11 16.3	+13 22	Sb	8× 2	9.9	10.0	+ 800
3627	66	Leo	11 17.6	+13 16	Sb	8× 2	9.1	8.6	+ 650
4258		CVn	12 16.5	+47 34	Sb	20× 6	8.7	9.2	+ 500
4374	84	Vir	12 22.5	+13 09	E	3× 2	9.9	12.0	+1050
4382	85	Com	12 22.9	+18 28	E	4× 2	10.0	7.4	+ 500
4472	49	Vir	12 27.2	+08 16	E	5× 4	10.1	11.4	+ 850
4565		Com	12 33.9	+26 16	Sb	15× 1	11.0	15.2	+1100
4594		Vir	12 37.4	−11 20	Sa	7× 2	9.2	14.4	+1140
4649	60	Vir	12 41.1	+11 50	E	4× 3	9.5	15.0	+1090
4736	94	CVn	12 48.6	+41 24	Sb	5× 4	8.4	6.0	+ 290
4826	64	Com	12 54.3	+21 57	Sb	8× 4	9.2	2.6	+ 150
5005		CVn	13 08.6	+37 20	Sc	5× 2	11.1	13.2	+ 900
5055	63	CVn	13 13.6	+42 18	Sb	8× 3	9.6	7.2	+ 450
5194	51	CVn	13 27.8	+47 27	Sc	12× 6	7.4	6.0	+ 250
5236	83	Hya	13 34.2	−29 36	Sc	10× 8	8	5.8	+ 500
6822		Sgr	19 42.4	−14 53	I	20×10	11	2.0	− 150
7331		Peg	22 34.8	+33 59	Sb	9× 2	10.4	10.4	+ 500

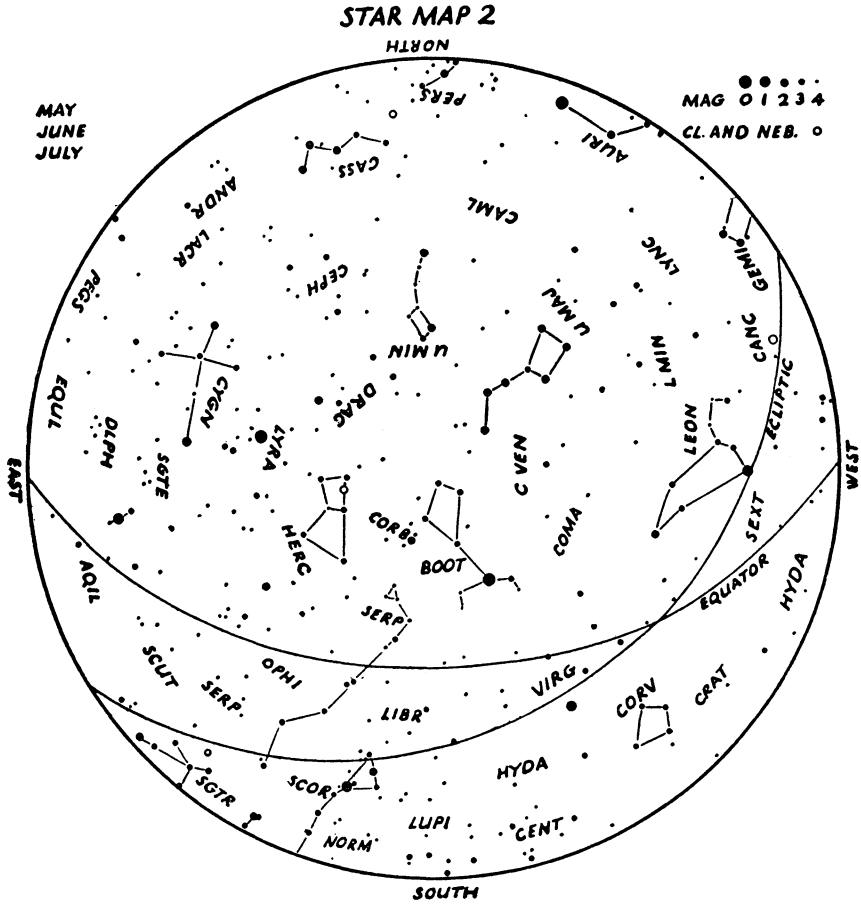
STAR MAP I



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

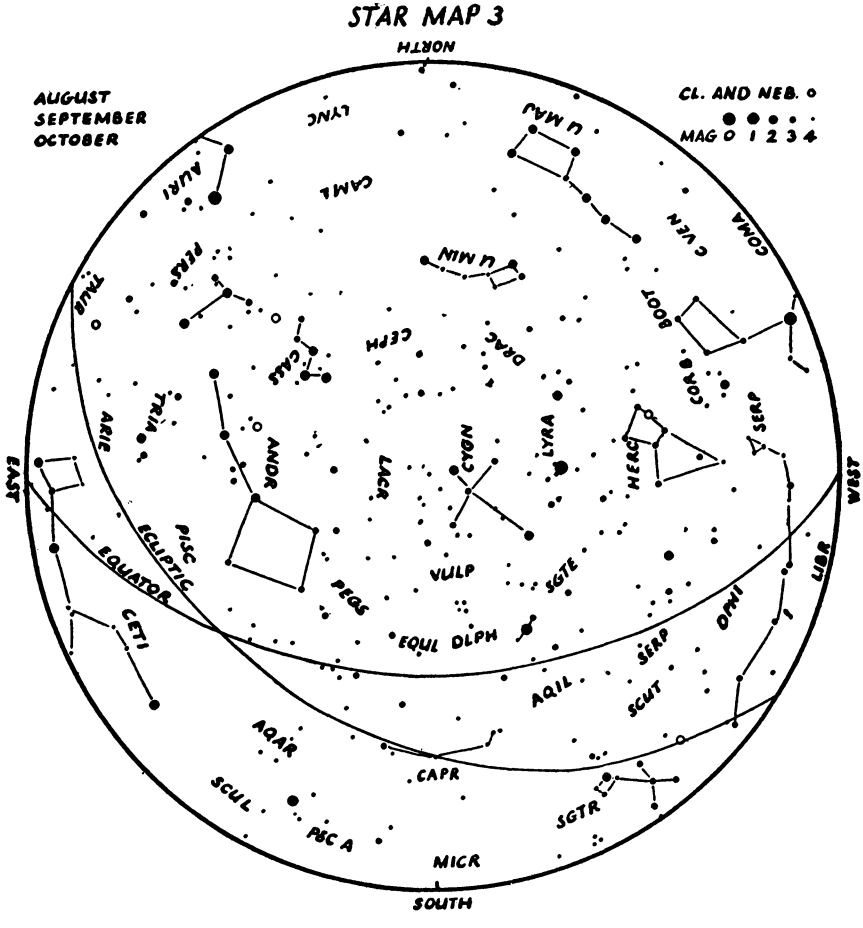
The centre of the map is the zenith, the circumference the horizon. To identify the stars hold the map so that the part of the horizon you are facing is down.



The above map represents the evening sky at

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

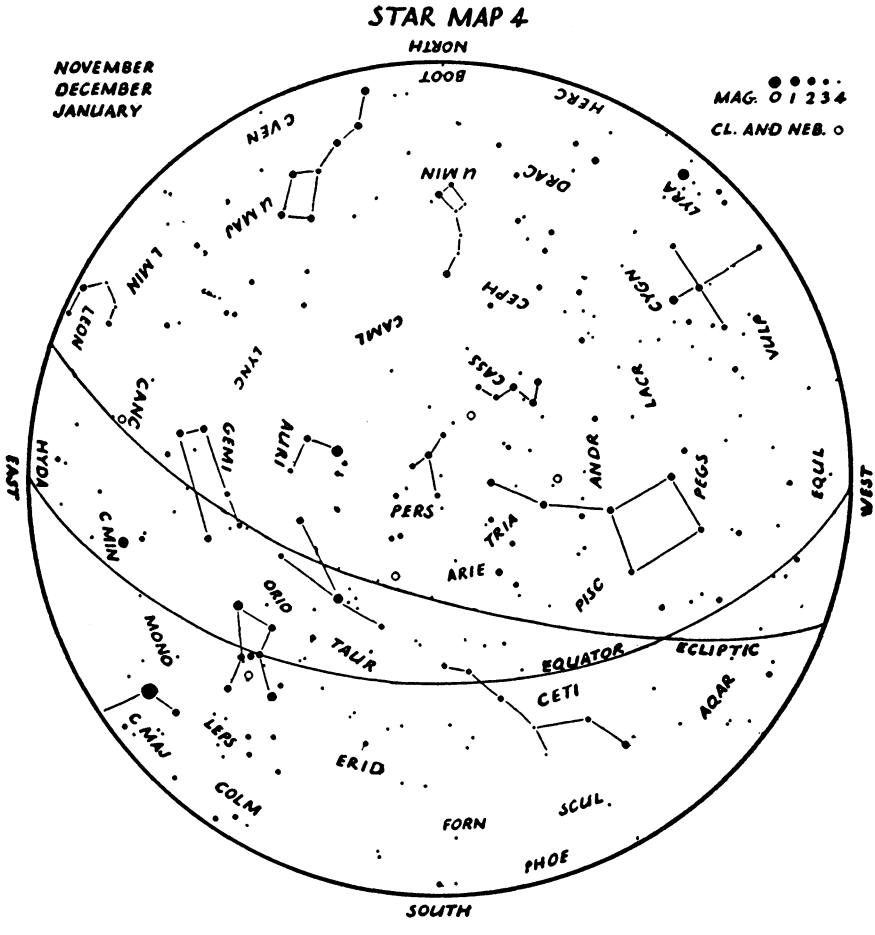
The centre of the map is the zenith, the circumference the horizon. To identify the stars hold the map so that the part of the horizon you are facing is down.



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.



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.

A BIG YEAR FOR ADDED SERVICES

These listings cover only half of the slide sets we have added in 1955; therefore you will want to write for a circular listing three new slide sets in addition to the ones listed here.

Slide Set Five

The June 30th, 1954 solar eclipse

97—Partial (minus 25 min.) R. Rustab, Jr.
98—Partial (minus 20 min.) R. Rustab, Jr.
99—Partial (minus 15 min.) R. Rustab, Jr.
100—Partial (minus 10 min.) R. Rustab, Jr.
101—Partial (minus 5 min.) R. Rustab, Jr.
102—Diamond Ring (minus 3 sec.) R. Rustab, Jr.
103—Corona ..... R. Rustab, Jr.
104—Prominences ..... R. Rustab, Jr.
105—Getting ready for action, A. W. Horst
106—Moon's shadow starts ..... A. W. Horst
107—Moon's shadow advances, A. W. Horst
108—The corona ..... A. W. Horst
109—Diamond Ring ..... A. W. Horst
110—Totality (short exposure) A. W. Horst
111—Corona (short exposure) ..... A. W. Horst
112—Corona ..... A. W. Horst
113—Diamond Ring ..... Obrien & Boyer
114—Extended corona ..... Bob Wright
115—Corona (short exposure) Chas. Cuevas
116—Corona ..... Chas. Cuevas
117—Prominences ..... Chas. Cuevas
118—Corona ..... Dan Davis, Jr.
119—Corona (Infra-red) by German expedition in Sweden.
120—Graph of corona intrinsic brightness—also prominence data by Dr. Rolf Muller (Wendelstein Observatory—Germany)

Slide Set Seven The Moon and Sun

145—Moon 3 and 5 days old—100″ photo
146—Moon—8 days—100″ photo
147—Moon 8 days—Caucasus Mountains and Alpine Valley
148—Moon—11 days old—100″ photo
149—Moon—14 days old—100″ photo
150—Moon—17 days old—100″ photo
151—Moon—20 days old—100″ photo
152—Moon—23 and 26 days old—100″ photo
153—Moon—Central Part—Ptolemy and Eratosthenes
154—Moon—Ptolemasus to Tycho—100″ photo
155—Moon—Ptolemasus to limb—100″ photo
156—Moon—Copernicus to limb—100″ photo
157—Sun—Prominences—80,000 mi. high; hydrogen light—August 21, 1909
158—Sun—Prominences—132,000 mi. high, calcium light,—August 18, 1947
159—Sun—whole sun edge—calcium K line—December 9, 1929
160—Sun—red hydrogen—August 24, 1918
161—Sun—ordinary-hydrogen—Calcium spectroheliogram—hydrogen spectrum
162—Sun—ordinary and red hydrogen light—August 12, 1917
163—Sun—whole disk—spots—and enlarged spot —April 7, 1947
164—Sun—large spots—fine structure—July 31, 1949
165—Sun—4 photos—Section in red hydrogen—3, 5, 7, 9,—August 1915
166—Sun—27 photos—Great sun-spot of 1947 —2 solar rotations
167—Sun—sun-spot groups—near maximum—July 13, 1937
168—Sun—3 views—in white light—flare 5 min. later—August 8, 1937

Slide Set Six

A miscellaneous collection

121—Venus—6 views—100″ photo
122—Pluto—2 views—200″ photo
123—Mars—4 views A, B, C, in red shows rotation—"D" in blue
124—Jupiter—4 views—200″ photo
125—Jupiter, Saturn, Mars (100″) and Pluto 200″ photo
126—Head of Halley's Comet—May 8, 1910 (60″ reflector)
127—Halley's Comet—14 views—April 26 to June 11, 1910
128—Comet Cunningham—5″ Ross lens—December 21, 1940
129—Constellation Orion—Tessar lens— (10″ focal length)
130—Orion—Great Nebula, red light—18″ Schmidt
131—Nebulosity—Orion—IC 434 (Great Nebula bottom right)
132—North American Nebula (Cygnus)—South part—N.G.C. 7000
133—Filamentary Nebula—Cygnus—whole loop—18″ Schmidt
134—N.G.C. 6960 Fill. Neb. Cygnus—100″
135—N.G.C. 6960 Fill. Neb.—north part
136—N.G.C. 6960 Fill. Neb.—south part
137—Spiral Nebula (Pegasus) N.G.C. 7331—100″ photo
138—Spiral Nebula (Pegasus) N.G.C. 7217—200″ photo
139—Pleiades, Nebulosity around Merope, in red —18″ Schmidt
140—Pelican Nebula—Cygnus—100″ photo
141—Great Nebula—N.G.C. 224 Andromeda plus N.G.C. 205 and 221—48″ Schmidt
142—Andromeda Nebula—Central Part N.G.C. 224—100″ photo
143—Whole Nebula——Monoceros—N.G.C. 2237, in red—48″ Schmidt
144—Enlarged section of above—Monoceros—N.G.C. 2237

BOOKS

Pictorial Astronomy, Alter & Cleminshaw	$5.00
Field Book of the Skies, Olcott; new ed.	$5.00
Introduction to Astronomy, Gaposchkin	$8.00
Galaxies, Harlow Shapley	$3.50
Our Sun, Donald H. Menzel	$4.75
Flying Saucers, Donald H. Menzel	$4.75
The Milky Way, Bart Bok and Priscilla Bok	$3.50
Earth, Moon and Planets, Fred L. Whipple	$4.75
Story of Variable Stars, Campbell & Jacchia	$3.50
Stars in the Making, Gaposchkin	$4.25
History of Astronomy, J. L. E. Dreyer —paper	$1.95
—cloth	$3.95
Principles of Physical Optics, Mach —paper	$1.75
—cloth	$3.50
Nature of Light and Color in the Open Air, —paper	$1.95
—cloth	$3.95
Discover the Stars, Johnson	$0.75
Bible and the Stars, Ralph A. Wright—mimeographed (with question service)	$5.00

Phone Worcester PL 5-6992

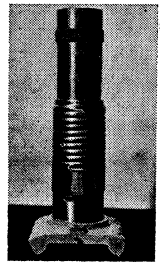
ASTRONOMY CHARTED

33 WINFIELD STREET, WORCESTER 10, MASS., U.S.A.

PRECISE FOCUSING MECHANISM

With Spiral Thread For Reflectors or Refractors

Takes Standard 1¼" Eyepiece



Full 1¼" of fine focusing motion with 3" of extension tube. One revolution of knurled knob produces 0.163" motion along optical axis. Absolute centering guaranteed. No play. Will not bind or lock. No rack-and-pinion to strip. Precision manufacture allows smooth, easy positive focusing. Adapted to every type of telescope construction. Drilled to hold diagonal mirror support. Of brass throughout.

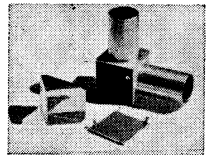
Weight 1 lb. **$18.50**

50X ACHROMATIC TELESCOPE EYEPIECES

Improved Hastings-Ross Formula. 1/5" (5 mm.) E.F.L. cemented triplet (solid) positive type. Highest light transmission through minimum glass thickness. Medium wide field, sharp to the very edge. Excellent color correction. Mounted in non-reflecting cap of fall-away type. O.D. 1¼"

Each $15.50

STAR DIAGONAL

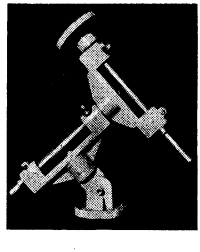


For the convenient observation of stars near the zenith, a prism is indispensable. It is placed before the eyepiece to direct the pencil of light rays so that the axis of the eye-lens is at right angles to the axis of the telescope. Our "Star Diagonal" is especially manufactured for this purpose. Fits standard 1¼" eyepiece holder and takes standard 1¼" eyepieces. Price, including fine quality light flint glass fluoride coated 1⅜" prism: **$15.50**

Equivalent straight-tube length 4"
Prism easily removed for cleaning.

EQUATORIAL MOUNTING

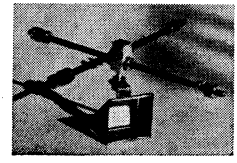
Aluminum and steel



Weight 6 pounds. Height 12", width 13". Finished in grey lacquer. Will handle any telescope up to 6" mirror with 7" or 8" diameter tube. All ¾" dia. steel bearings guaranteed against play. Every motion of the instrument will feel as smooth as silk.
The polar axis is adjustable. The telescope can be moved north-south in declination and east-west in time or right ascension to any part of the sky. There is enough extension on the shafts to attach Clock-Drive or Verniers.

Complete $35.00 plus parcel post

4-ARM DIAGONAL FOR REFLECTING TELESCOPES



Prism in metal mounting. Spider mount to fit 5-6-7 or 8" tube. Light flint glass prism, fluoride coated, 1⅝" x 1⅝" face. Metal connecting arms present little obstruction to path of light. Prism centering easily adjusted to every difference of tube diameter or optical placement. Complete **$10.00** plus postage. Specify your tube size.

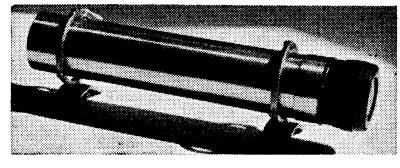
BRASS TUBING—TELESCOPING

Your requests and purchases have made it possible for us to secure and supply this fine seamless brass smoothly telescoping tubing for making your own telescope parts such as oculars and focusing fittings.

1¼" O.D. wall .030" length 10" **$1.50**
1¼" I.D. wall .030" length 10" **$1.50**
Add 35c per length for postage

STAR FINDER TELESCOPE

Uses a very fine objective and eyepiece. No crosshair. High eye relief. 6 power. Weight 2 lbs., 10 oz. Diameter 2⅛" x 12" long. Complete with optics. **$30.00 plus postage**



FINDER BRACKETS

Brass rings 2⅜" inside, with three centering set screws set in circumference, have feet attached which can be secured to outside of telescope tube. Per set of 2 **$5.00**

SAFETY SUN FILTERS

The SAFE AND SANE way to look at the sun—use our Special Safety Sun Filters. Each one is 50 mm. (2") diameter and 2 mm. (1/16") thick; polished flat on both sides.
This Special Safety Sun Filter can be used in any of the following three ways:

1. View the sun *directly* by looking through filter with unaided eyes.
2. Place filter at the *eyepoint* of the ocular and observe with any power after limiting the objective (with a diaphragm) to less than 2".
3. Use filter as a limiting diaphragm in front of the objective of the telescope.

For Winter sunlight use No. WF12
For Summer sunlight use No. SF14

Only $2.00 each or $3.00 per set of 2 (containing one of each of above).

Remit with order. Include postage. No C.O.D.

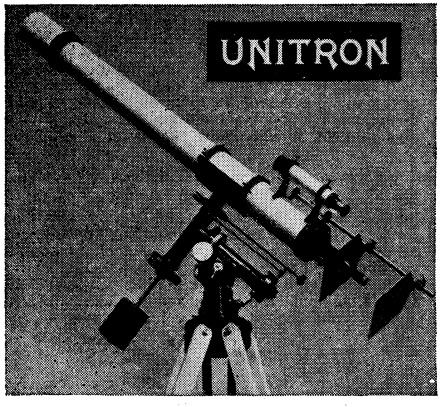
HARRY ROSS

Telescopes - Microscopes

Comprehensive Catalog—$1.00

70 West Broadway, New York 7, N.Y.

UNITRON Leads in Value and Quality



UNITRON Refractors have been chosen by the Canadian Dept. of Defence, the U.S. Air Force, leading universities such as Harvard, Columbia, Stanford etc., and active amateurs the world over.

- LENSES are FULLY CORRECTED for spherical and chromatic aberration and are COATED for maximum brilliance and clarity of image. AIR-SPACED CELL insures freedom from "clouding" with age.
- EYEPIECES of the HIGHEST QUALITY . . . Orthoscopic, Achromatized Symmetrical, Kellner, Huygens.
- FINEST MATERIALS throughout DURALUMINUM TUBE. Moving parts of BRASS carefully machined to close tolerances, and finished in CHROMIUM.
- MODERN DESIGN based on time-tested engineering principles. HANDSOME APPEARANCE to which no illustrations can do justice.
- STURDY TRIPOD may be folded.
- EQUATORIAL MODELS have slow-motion controls for both declination and right ascension.
- ALTAZIMUTH MODELS have slow motions for both altitude and azimuth.
- VIEWFINDER with crosshair eyepiece.
- RACK-AND-PINION FOCUSING.
- SUNGLASS for solar observation.
- UNIHEX Rotary Eyepiece Selector (see the back cover of the HANDBOOK).
- STAR DIAGONAL for easy observing at all altitudes.
- ERECTING PRISM SYSTEM for TERRESTRIAL OBSERVATION may be used with any of the eyepieces to give the same complete range of terrestrial magnifications as for celestial observation.
- FITTED WOODEN CABINETS.

MANY MODELS TO CHOOSE FROM!

1.6″ ALTAZIMUTH	$ 75
2.4″ ALTAZIMUTH	125
2.4″ EQUATORIAL	225
3″ ALTAZIMUTH	265
3″ EQUATORIAL	435
3″ PHOTOGRAPIC EQUATORIAL	550
4″ ALTAZIMUTH	465
4″ EQUATORIAL	785
4″ PHOTOGRAPHIC EQUATORIAL	890

Prices F.O.B. Boston

By the time you receive this Handbook we will also have available the new UNITRON 4″ Photo-Equatorial models with fixed pier, clock drive, astro-camera and many other new features and accessories. The new UNITRON 6″ Equatorial will also be announced very shortly. Write for complete specifications and prices.

TELESCOPE MAKERS COMPONENTS

Viewfinders with mounting brackets

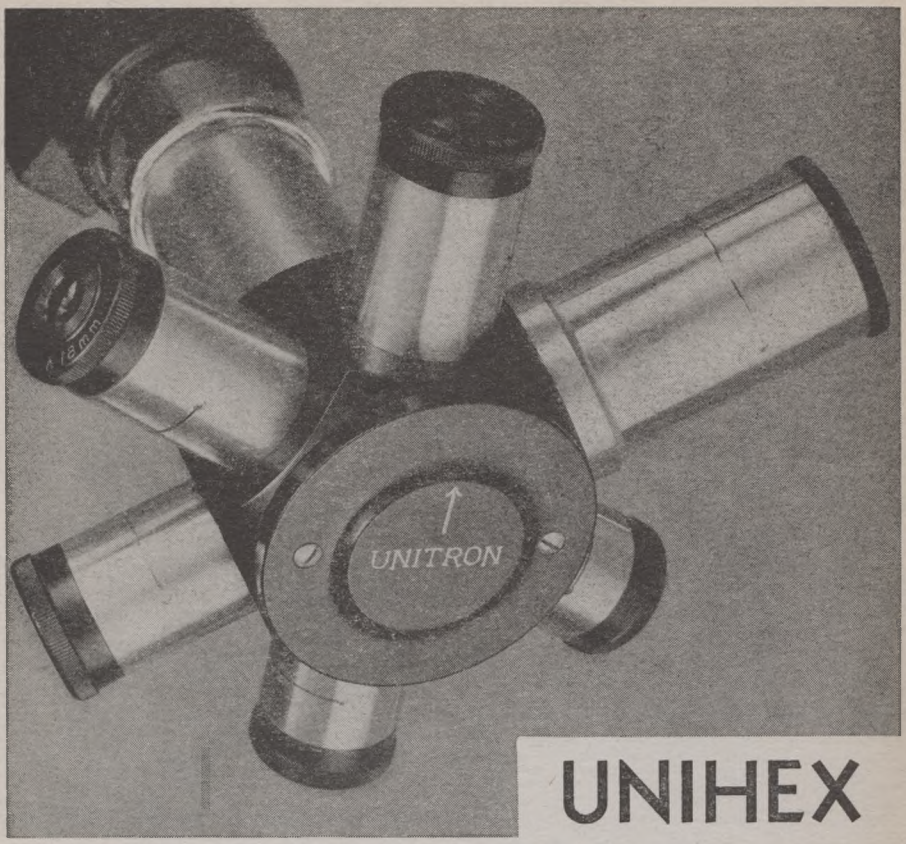
42 mm, 10X, coated objective	$18.00
30 mm, 8X, coated objective	10.75
23.5 mm, 6X	8.50

Postpaid in U.S. Add 50c for Canadian orders. Also available are equatorial mountings, guide telescopes, objectives, eyepieces, sunscreen apparatus, clock drives, astro-cameras and many new items not ready for announcement as this issue goes to press. Full information is given in the free catalog offered below.

WRITE FOR FREE CATALOG

In order to help you choose a telescope, we have assembled our "Telescope Buyer's Kit" which is a veritable goldmine of valuable information. A special section tells you how to choose a telescope and explains important telescope terminology. All UNITRON models are illustrated and fully described. Learn about all the new UNITRON accessories to modernize your present telescope. Read actual observation reports from UNITRON owners. This literature is required reading not only for telescope buyers but for all astronomers who want to find out more about the famous UNITRONS—the telescopes that are playing a leading role in astronomy today.

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



UNIHEX

How do you change magnification in your telescope?

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. Think how much this valuable aid can contribute to your increased comfort and relaxation while observing.

Now you may obtain a UNIHEX with your UNITRON as standard equipment at no increase over the regular purchase price. On request, we will substitute UNIHEX in place of the star diagonal and erecting prism system (in all models except No. 127). Either or both of these accessories may be purchased separately, if desired, at any time.

Present UNITRON owners may bring their telescopes up to date with UNIHEX-A designed to replace the customary 36.8 mm O.D. drawtube in the UNITRON rack and pinion focusing sleeve. Owners of other telescopes may obtain UNIHEX-B which fits into 1¼" eyepiece holders.

UNIHEX

Model A or B **Only $24.75**

Postpaid in U.S.A. Add $1.00 for Canadian orders.

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