THE
OBSERVER'S HANDBOOK
FOR 1955

PUBLISHED BY

The Royal Astronomical Society of Canada

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

FORTY-SEVENTH YEAR OF PUBLICATION

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1954

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 Montreal and Quebec, P.Q.; Ottawa, Toronto, Hamilton, London, and Windsor, Ontario; Winnipeg, Man.; Saskatoon, Sask.; Edmonton, Alta.; Vancouver and Victoria, B.C. As well as nearly 1000 members of these Canadian Centres, there are nearly 400 members not attached to any Centre, mostly resident in other nations, while some 200 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, $40.00. 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 1955

Jan.

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

Feb.

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

Mar.

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

April

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

May

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

June

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

July

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

Aug.

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

Sept.

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

Oct.

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

Nov.

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

Dec.

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

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CONTENTS

TABLES IN RECENT OBSERVER'S HANDBOOKS

PRINTED IN CANADA

PREFACE

The HANDBOOK for 1955 is the 47th issue and its circulation is 5500. The Officers of the Society appreciate the increase in advertisements which will help to meet our mounting expense.

In this issue the tables of the principal elements of the solar system have been revised. Four circular star maps 9 inches in diameter at a price of two cents each and a set of four maps plotted on equatorial co-ordinates at a price of twenty cents are obtainable from the Director of University Extension, University of Toronto, Toronto 5.

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 Jones; and the calculations for Algol are based on Olin J. Eggen's epoch 2432520.6303 and period 2.86731525 d., as published in the *Astrophysical Journal*, 1948.

Cordial thanks are tendered to those who assisted in preparing this volume, especially to the staff of the David Dunlap Observatory, and also Miss Olga Mracek, John Crawford, Basil Kerr, Malcolm Lennox, Donald Morton and Ghislain Roy. Our deep indebtedness to the British *Nautical Almanac* and the *American Ephemeris* is thankfully acknowledged.

C. A. CHANT

David Dunlap Observatory,
Richmond Hill, Ont., October 1954.

ANNIVERSARIES AND FESTIVALS, 1955

Festival	Day	Date
New Year's Day	Sat.	Jan. 1
Epiphany	Thu.	Jan. 6
Accession of Queen Elizabeth (1952)	Sun.	Feb. 6
Septuagesima Sunday		Feb. 6
Quinquagesima (Shrove Sunday)		Feb. 20
Ash Wednesday		Feb. 23
St. David	Tue.	Mar. 1
St. Patrick	Thu.	Mar. 17
Palm Sunday		Apr. 3
Good Friday	Fri.	Apr. 8
Easter Sunday		Apr. 10
Birthday of Queen Elizabeth (1926)	Thu.	Apr. 21
St. George	Sat.	Apr. 23
Rogation Sunday		May 15
Ascension Day	Thu.	May 19
Empire Day (Victoria Day)	Tue.	May 24
Pentecost (Whit Sunday)		May 29
Trinity Sunday		June 5
Corpus Christi	Thu.	June 9
St. John Baptist (Midsummer Day)	Fri.	June 24
Dominion Day	Fri.	July 1
Birthday of Queen Mother Elizabeth (1900)	Thu.	Aug. 4
Labour Day	Mon.	Sept. 5
Hebrew New Year (Rosh Hashanah)	Sat.	Sept. 17
St. Michael (Michaelmas Day)	Thu.	Sept. 29
All Saints' Day	Tue.	Nov. 1
Remembrance Day	Fri.	Nov. 11
First Sunday in Advent		Nov. 27
St. Andrew	Wed.	Nov. 30
Christmas Day	Sun.	Dec. 25

Thanksgiving Day, date set by Proclamation

SYMBOLS AND ABBREVIATIONS

SIGNS OF THE ZODIAC

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

SUN, MOON AND PLANETS

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

ASPECTS AND ABBREVIATIONS

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

THE GREEK ALPHABET

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

THE CONFIGURATIONS OF JUPITER'S SATELLITES

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

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

MISCELLANEOUS ASTRONOMICAL DATA

Units of Length

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

Units of Time

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

The Earth

Equatorial radius, a = 3963.35 miles; flattening, c = $(a-b)/a = 1/297.0$
Polar radius, b = 3950.01 miles
1° of latitude = $69.057 - 0.349 \cos 2\phi$ miles (at latitude ϕ)
1° of longitude = $69.232 \cos \phi - 0.0584 \cos 3\phi$ miles
Mass of earth = 6.6×10^{21} tons; velocity of escape from ⊕ = 6.94 miles/sec.

Earth's Orbital Motion

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

Solar Motion

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

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

1955 EPHEMERIS OF THE SUN AT 0h GREENWICH CIVIL TIME

Date 1955	Apparent R.A.	Corr. to Sun-dial	Apparent Dec.
	h m s	m s	° ′
Jan. 1	18 42 37	+ 3 08	− 23 05.0
4	18 55 51	+ 4 32	− 22 49.4
7	19 09 02	+ 5 53	− 22 29.8
10	19 22 08	+ 7 10	− 22 06.2
13	19 35 10	+ 8 22	− 21 38.7
16	19 48 06	+ 9 28	− 21 07.4
19	20 00 56	+ 10 28	− 20 32.4
22	20 13 40	+ 11 23	− 19 54.0
25	20 26 17	+ 12 10	− 19 12.2
28	20 38 46	+ 12 50	− 18 27.2
31	20 51 09	+ 13 23	− 17 39.3
Feb. 3	21 03 24	+ 13 48	− 16 48.5
6	21 15 31	+ 14 06	− 15 55.1
9	21 27 31	+ 14 16	− 14 59.2
12	21 39 24	+ 14 20	− 14 01.1
15	21 51 11	+ 14 16	− 13 00.9
18	22 02 50	+ 14 06	− 11 58.7
21	22 14 24	+ 13 50	− 10 54.9
24	22 25 52	+ 13 28	− 9 49.5
27	22 37 14	+ 13 01	− 8 42.7
Mar. 2	22 48 31	+ 12 28	− 7 34.8
5	22 59 43	+ 11 51	− 6 26.0
8	23 10 51	+ 11 09	− 5 16.4
11	23 21 56	+ 10 24	− 4 06.1
14	23 32 57	+ 9 36	− 2 55.4
17	23 43 56	+ 8 45	− 1 44.4
20	23 54 54	+ 7 53	− 0 33.2
23	0 05 50	+ 7 00	+ 0 37.9
26	0 16 45	+ 6 05	+ 1 48.9
29	0 27 40	+ 5 11	+ 2 59.4
Apr. 1	0 38 35	+ 4 16	+ 4 09.4
4	0 49 31	+ 3 22	+ 5 18.7
7	1 00 28	+ 2 30	+ 6 27.2
10	1 11 27	+ 1 39	+ 7 34.6
13	1 22 28	+ 0 50	+ 8 41.0
16	1 33 32	+ 0 05	+ 9 46.0
19	1 44 40	− 0 38	+ 10 49.6
22	1 55 51	− 1 16	+ 11 51.6
25	2 07 06	− 1 51	+ 12 51.8
28	2 18 25	− 2 21	+ 13 50.1
May 1	2 29 48	− 2 48	+ 14 46.4
4	2 41 16	− 3 09	+ 15 40.4
7	2 52 49	− 3 26	+ 16 32.2
10	3 04 27	− 3 37	+ 17 21.4
13	3 16 11	− 3 44	+ 18 08.1
16	3 27 59	− 3 45	+ 18 52.0
19	3 39 53	− 3 41	+ 19 33.1
22	3 51 52	− 3 31	+ 20 11.1
25	4 03 56	− 3 17	+ 20 46.1
28	4 16 04	− 2 59	+ 21 17.9
31	4 28 16	− 2 36	+ 21 46.3
June 3	4 40 32	− 2 10	+ 22 11.3
6	4 52 52	− 1 40	+ 22 32.9
9	5 05 14	− 1 07	+ 22 50.9
12	5 17 39	− 0 32	+ 23 05.3
15	5 30 06	+ 0 05	+ 23 16.0
18	5 42 34	+ 0 44	+ 23 23.1
21	5 55 03	+ 1 23	+ 23 26.4
24	6 07 32	+ 2 02	+ 23 26.0
27	6 20 00	+ 2 41	+ 23 21.9
30	6 32 27	+ 3 18	+ 23 14.1

Date 1955	Apparent R.A.	Corr. to Sun-dial	Apparent Dec.
	h m s	m s	° ′
July 3	6 44 52	+ 3 53	+ 23 02.6
6	6 57 14	+ 4 25	+ 22 47.6
9	7 09 33	+ 4 55	+ 22 28.9
12	7 21 49	+ 5 21	+ 22 06.8
15	7 34 00	+ 5 43	+ 21 41.2
18	7 46 08	+ 6 01	+ 21 12.3
21	7 58 11	+ 6 14	+ 20 40.2
24	8 10 09	+ 6 22	+ 20 04.9
27	8 22 02	+ 6 25	+ 19 26.6
30	8 33 49	+ 6 23	+ 18 45.5
Aug. 2	8 45 30	+ 6 15	+ 18 01.6
5	8 57 06	+ 6 01	+ 17 15.0
8	9 08 37	+ 5 42	+ 16 25.9
11	9 20 02	+ 5 18	+ 15 34.4
14	9 31 23	+ 4 48	+ 14 40.6
17	9 42 38	+ 4 14	+ 13 44.8
20	9 53 49	+ 3 36	+ 12 46.9
23	10 04 56	+ 2 53	+ 11 47.3
26	10 15 58	+ 2 05	+ 10 46.0
29	10 26 57	+ 1 14	+ 9 43.2
Sept. 1	10 37 52	+ 0 20	+ 8 38.9
4	10 48 44	− 0 38	+ 7 33.5
7	10 59 34	− 1 37	+ 6 26.9
10	11 10 22	− 2 39	+ 5 19.4
13	11 21 09	− 3 41	+ 4 11.0
16	11 31 56	− 4 45	+ 3 02.0
19	11 42 42	− 5 49	+ 1 52.4
22	11 53 28	− 6 52	+ 0 42.5
25	12 04 14	− 7 55	− 0 27.6
28	12 15 02	− 8 57	− 1 37.7
Oct. 1	12 25 52	− 9 57	− 2 47.7
4	12 36 44	− 10 55	− 3 57.5
7	12 47 39	− 11 49	− 5 06.9
10	12 58 37	− 12 40	− 6 15.7
13	13 09 40	− 13 27	− 7 23.8
16	13 20 48	− 14 09	− 8 31.0
19	13 32 00	− 14 47	− 9 37.1
22	13 43 18	− 15 18	− 10 41.9
25	13 54 42	− 15 44	− 11 45.3
28	14 06 12	− 16 04	− 12 47.0
31	14 17 48	− 16 17	− 13 47.0
Nov. 3	14 29 32	− 16 23	− 14 45.0
6	14 41 23	− 16 22	− 15 40.9
9	14 53 21	− 16 13	− 16 34.5
12	15 05 27	− 15 57	− 17 25.5
15	15 17 41	− 15 33	− 18 13.8
18	15 30 03	− 15 01	− 18 59.3
21	15 42 32	− 14 21	− 19 41.7
24	15 55 08	− 13 35	− 20 20.9
27	16 07 51	− 12 42	− 20 56.7
30	16 20 40	− 11 42	− 21 29.0
Dec. 3	16 33 36	− 10 36	− 21 57.6
6	16 46 37	− 9 24	− 22 22.4
9	16 59 44	− 8 07	− 22 43.3
12	17 12 55	− 6 46	− 23 00.2
15	17 26 09	− 5 21	− 23 13.0
18	17 39 26	− 3 54	− 23 21.6
21	17 52 45	− 2 25	− 23 26.0
24	18 06 04	− 0 55	− 23 26.2
27	18 19 23	+ 0 34	− 23 22.2
30	18 32 41	+ 2 02	− 23 13.9

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.

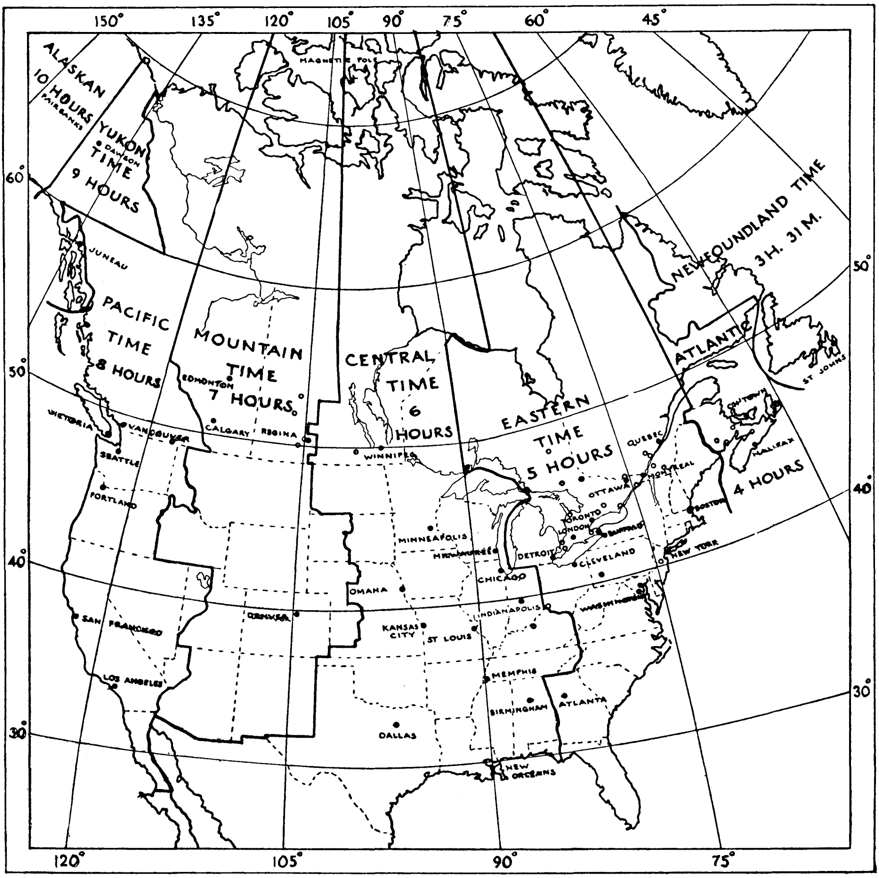
4. *Standard Time*—In everyday life we use still another kind of time. A moment's thought will show that in general two places will not have the same mean time; indeed, difference in longitude between two places is determined from their difference in time. But in travelling it is very inconvenient to 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, 1955

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

Jan. 1............109	May 1...........229	Sept. 1...........352
Feb. 1............140	June 1...........260	Oct. 1...........382
Mar. 1............168	July 1...........290	Nov. 1...........413
Apr. 1............199	Aug. 1...........321	Dec. 1...........443

The Julian Day commences at noon. Thus J.D. 2,435,109.0 = 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° Sunrise	Latitude 32° Sunset	Latitude 36° Sunrise	Latitude 36° Sunset	Latitude 40° Sunrise	Latitude 40° Sunset	Latitude 44° Sunrise	Latitude 44° Sunset	Latitude 46° Sunrise	Latitude 46° Sunset	Latitude 48° Sunrise	Latitude 48° Sunset	Latitude 50° Sunrise	Latitude 50° Sunset	Latitude 54° Sunrise	Latitude 54° Sunset
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
September	2	5 35	6 23	5 31	6 27	5 27	6 31	5 23	6 36	5 20	6 38	5 18	6 41	5 15	6 44	5 08	6 50
	4	5 36	6 22	5 33	6 24	5 29	6 28	5 25	6 32	5 23	6 34	5 20	6 37	5 18	6 40	5 12	6 46
	6	5 38	6 19	5 34	6 22	5 31	6 25	5 27	6 28	5 25	6 31	5 23	6 33	5 21	6 35	5 15	6 41
	8	5 39	6 17	5 36	6 19	5 33	6 22	5 30	6 25	5 28	6 27	5 26	6 29	5 24	6 31	5 19	6 36
	10	5 41	6 13	5 38	6 16	5 35	6 18	5 32	6 21	5 31	6 23	5 29	6 25	5 27	6 27	5 22	6 31
	12	5 42	6 10	5 39	6 13	5 37	6 15	5 34	6 17	5 33	6 19	5 31	6 21	5 30	6 22	5 26	6 26
	14	5 43	6 09	5 41	6 10	5 39	6 12	5 36	6 14	5 35	6 15	5 34	6 16	5 33	6 18	5 30	6 21
	16	5 44	6 05	5 42	6 07	5 41	6 08	5 39	6 10	5 38	6 11	5 37	6 12	5 36	6 13	5 33	6 16
	18	5 46	6 02	5 44	6 04	5 43	6 05	5 41	6 07	5 41	6 07	5 40	6 08	5 39	6 09	5 37	6 11
	20	5 46	6 01	5 46	6 01	5 45	6 02	5 44	6 03	5 44	6 03	5 43	6 04	5 42	6 05	5 40	6 06
	22	5 48	5 57	5 47	5 58	5 47	5 58	5 46	5 59	5 46	5 59	5 45	6 00	5 45	6 00	5 44	6 01
	24	5 49	5 56	5 49	5 55	5 49	5 55	5 48	5 55	5 48	5 55	5 48	5 56	5 48	5 56	5 47	5 56
	26	5 51	5 52	5 51	5 52	5 51	5 52	5 51	5 52	5 51	5 52	5 51	5 51	5 51	5 51	5 51	5 51
	28	5 52	5 49	5 52	5 49	5 52	5 49	5 53	5 48	5 53	5 48	5 54	5 47	5 54	5 47	5 55	5 46
	30	5 54	5 46	5 53	5 46	5 54	5 46	5 55	5 44	5 56	5 44	5 57	5 43	5 57	5 43	5 58	5 41
October	2	5 54	5 44	5 55	5 44	5 56	5 43	5 57	5 41	5 58	5 40	5 59	5 39	6 00	5 38	6 02	5 36
	4	5 56	5 41	5 56	5 41	5 58	5 40	5 59	5 37	6 01	5 36	6 02	5 35	6 03	5 34	6 06	5 31
	6	5 57	5 39	5 58	5 38	6 00	5 36	6 02	5 34	6 03	5 32	6 04	5 31	6 06	5 29	6 09	5 26
	8	5 58	5 36	5 59	5 35	6 02	5 33	6 04	5 30	6 06	5 28	6 07	5 27	6 09	5 25	6 13	5 21
	10	6 00	5 34	6 01	5 32	6 04	5 30	6 07	5 27	6 08	5 25	6 10	5 23	6 12	5 21	6 17	5 17
	12	6 00	5 33	6 03	5 30	6 06	5 27	6 09	5 24	6 11	5 21	6 13	5 19	6 15	5 17	6 20	5 12
	14	6 03	5 29	6 04	5 27	6 08	5 24	6 11	5 20	6 14	5 18	6 16	5 15	6 19	5 13	6 24	5 07
	16	6 04	5 27	6 06	5 25	6 10	5 21	6 14	5 17	6 17	5 14	6 19	5 11	6 22	5 09	6 28	5 02
	18	6 05	5 25	6 08	5 22	6 12	5 18	6 17	5 13	6 19	5 11	6 22	5 08	6 25	5 05	6 32	4 58
	20	6 07	5 22	6 10	5 19	6 15	5 15	6 20	5 10	6 22	5 07	6 25	5 04	6 28	5 01	6 36	4 53
	22	6 09	5 20	6 12	5 17	6 17	5 12	6 22	5 07	6 25	5 04	6 28	5 00	6 31	4 57	6 39	4 49
	24	6 10	5 18	6 14	5 14	6 19	5 09	6 25	5 04	6 28	5 00	6 31	4 57	6 35	4 53	6 43	4 44
	26	6 12	5 16	6 16	5 12	6 21	5 06	6 27	5 01	6 31	4 57	6 35	4 53	6 38	4 49	6 47	4 40
	28	6 13	5 14	6 18	5 09	6 24	5 03	6 30	4 57	6 34	4 53	6 38	4 49	6 42	4 45	6 51	4 36
	30	6 15	5 12	6 20	5 07	6 26	5 00	6 33	4 55	6 37	4 50	6 41	4 46	6 45	4 42	6 55	4 32

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

BEGINNING OF MORNING AND ENDING OF EVENING TWILIGHT

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

The above table gives the local mean time of the beginning of morning twilight, and of the ending of evening twilight, for various latitudes. To obtain the corresponding standard time, the method used is the same as for correcting the sunrise and sunset tables, as described on page 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).

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

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

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

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

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

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

THE PLANETS FOR 1955

By C. A. CHANT

THE SUN

The precise time when the solar activity in the old cycle was at a minimum or when the first activity of the new cycle became evident may not be finally determined until 1955. But it has been reported (June 1954) that solar activity in January 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. The first high-latitude spot of the new cycle was observed by Clifford Bennett and Helen Dodson of the McMath-Hulbert Observatory on Aug. 13, 1953. Babcock at Mount Wilson confirmed this discovery by testing its polarity.

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 1955

Elong. East—Evening Star			Elong. West—Morning Star		
Date	Distance	Mag.	Date	Distance	Mag.
Jan. 28	18°	−0.3	Mar. 10	27°	+0.4
May 21	22°	+0.5	July 9	21°	+0.5
Sept. 18	27°	+0.3	Oct. 29	19°	−0.2

The most favourable elongations to observe are: in the evening, Jan. 28 and May 21; in the morning, July 9 and Oct. 29. 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, 1955, Venus crosses the meridian three hours before the sun. It is in south declination 15° and is a fine morning star, its stellar magnitude being −4.3. On Jan. 25 it attains its greatest elongation west, 46° 57′. It continues to be a morning star until Sept. 1, when it comes into superior conjunction with the sun. Then it is to be seen east of the sun and it is an evening star for the rest of the year. On Dec. 31 it is in south declination 20° and it transits the meridian 2 h. 11 m. after the sun. It is a good evening star, having stellar magnitude −3.4, but it is in the far south and to observers in Canada will appear low in the sky.

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

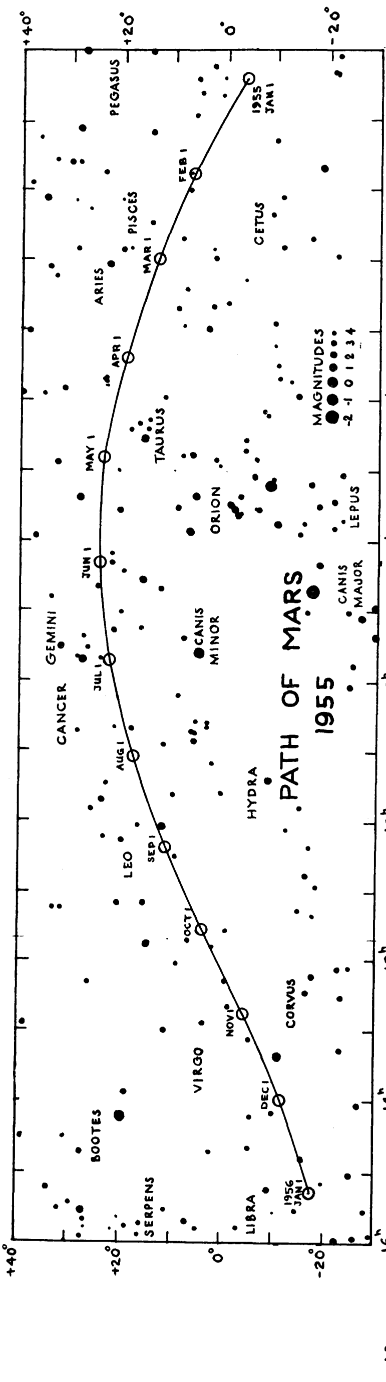
The orbit of Mars is outside that of the earth and consequently its planetary phenomena are quite different from those of the two inferior planets discussed above. Its mean distance from the sun is 141 million miles and the eccentricity of its orbit is 0.093, and a simple computation shows that its distance 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.

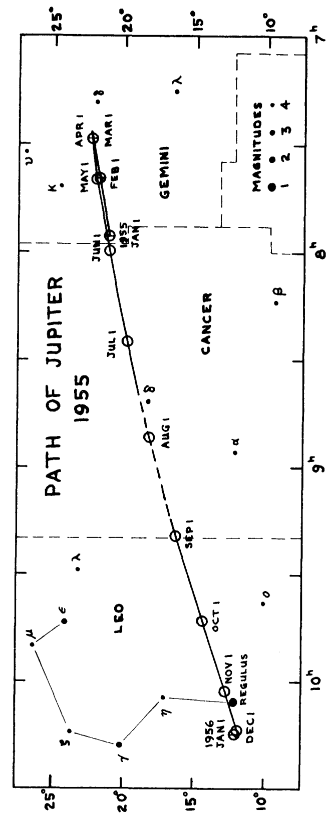
The sidereal, or true mechanical, period of revolution of Mars is 687 days; and the synodic period (for example, the interval from one opposition to the next one) is 780 days. This is the average value; it may vary from 764 to 810 days. The planet was in opposition on May 1, 1952; then on June 24, 1954; and the next opposition will be on Sept. 10, 1956. There will not be an opposition in 1955.

On Jan. 1, 1955, the planet is in Pisces and its stellar magnitude is +0.9, slightly brighter than Spica which is +1.2. On Dec. 31, Mars is in Libra and its stellar magnitude is +1.7. For its position throughout the year 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


PATH OF MARS
1955
MAGNITUDES
-2 -1 0 1 2 3 4
1955 JAN 1
FEB 1
MAR 1
APR 1
MAY 1
JUN 1
JUL 1
AUG 1
SEP 1
OCT 1
NOV 1
DEC 1
1956 JAN 1
PEGASUS
PISCES
ARIES
CETUS
TAURUS
ORION
LEPUS
GEMINI
CANIS MINOR
CANIS MAJOR
CANCER
HYDRA
LEO
CORVUS
VIRGO
BOOTES
SERPENS
LIBRA


PATH OF JUPITER
1955
MAGNITUDES
1 2 3 4
1955 JAN 1
FEB 1
MAR 1
APR 1
MAY 1
JUN 1
JUL 1
AUG 1
SEP 1
OCT 1
NOV 1
DEC 1
1956 JAN 1
REGULUS
GEMINI
CANCER
LEO

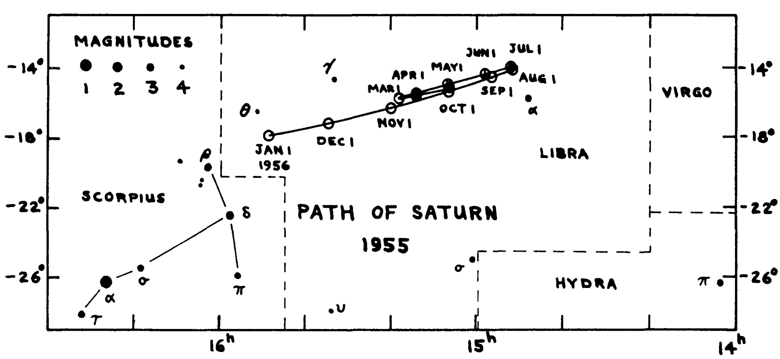
planet is known to possess 12 satellites, the last discovered in 1951 (see p. 59). Not so long ago it was generally believed that the planet was still cooling down from its original high temperature, but from actual measurements of the radiation from it to the earth it has been deduced that the surface 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 is in opposition to the sun and is on the meridian at midnight. At that time the sun's declination is about 21° south, and of course the planet will be about 21° north of the celestial equator, and it will be visible all night. Its stellar magnitude then will be −2.2. It will be retrograding until March 16 when it will reach a stationary point in its course and will begin to move direct, or eastward, among the stars again. The sun, of course, is always moving eastward along the ecliptic and it will come into conjunction with the planet on Aug. 4.

SATURN

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

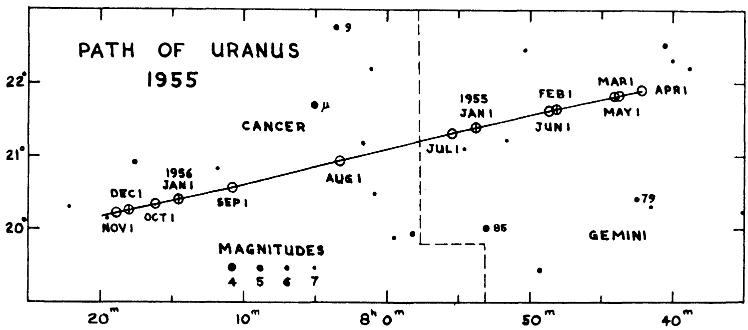


On Jan. 1 the planet is in the constellation Libra (see map) and is moving eastward. On Mar. 1 it reaches a stationary point and begins to move westward or retrograde. On May 9 it is in opposition to the sun and is visible all night. It continues to retrograde until July 19 when it becomes stationary and begins to move eastward again. On Nov. 16 it comes into conjunction with the sun.

URANUS

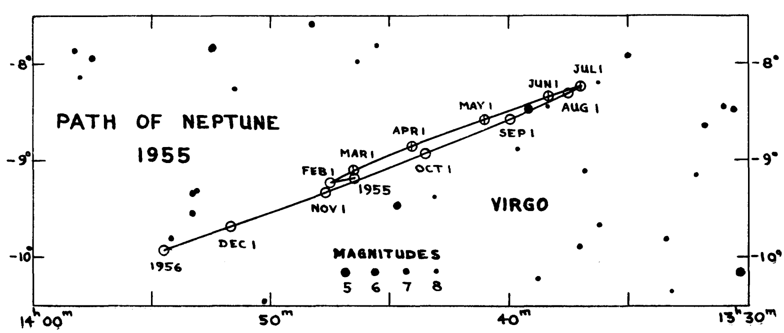
Uranus was discovered in 1781 by Sir William Herschel by means of a 6¼-in. mirror-telescope made by himself. The object did not look just like a star and he observed it again four days later. It had moved amongst the stars, and he assumed it to be a comet. He could not believe that it was a new planet. 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 1955 is at first in Gemini. Then it moves into Cancer where it will remain for some years. On Jan. 16 it is in opposition to the sun; on July 21 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 1955 Neptune is still in the constellation Virgo. It is in opposition to the sun on April 17. 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. 21.

PLUTO

Pluto, the most distant known planet, was discovered at the Lowell Observatory in 1930. Its mean distance from the sun is 3666 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. 14, when its astrometric position is R.A. $10^h\ 06^m$, Dec. $+20°\ 54'$.

ECLIPSES, 1955

In 1955 there will be three eclipses, two of the sun and one of the moon.

I. *A Total Eclipse of the Sun*, June 20, 1955, invisible in North America. This eclipse begins in the Indian Ocean, crosses Siam and Indo-China and ends in the Pacific Ocean north of New Zealand.

II. *A Partial Eclipse of the Moon*, November 29, 1955, invisible in North America except in the extreme northern parts of Canada. Generally it is visible in Europe, Africa, Asia and Australia.

Circumstances of the Lunar Eclipse, November 29, 1955 (E.S.T.)

☾ enters penumbra	9h 51.1m	☾ leaves umbra	12h 37.4m
☾ enters umbra	11 21.4	☾ leaves penumbra	14 07.7
Middle of eclipse	11 59.4	Magnitude of eclipse	0.125

III. *An Annular Eclipse of the Sun*, December 14, 1955, invisible in North America. This eclipse begins in Northern Africa, crosses the Indian Ocean, Siam, Indo-China, and ends in the Pacific just east of Formosa.

THE SKY MONTH BY MONTH

By J. F. Heard

THE SKY FOR JANUARY, 1955

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 43m to 20h 55m and its Decl. changes from 23° 05′ S. to 17° 23′ S. The equation of time changes from −3m 08s to −13m 32s. 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 38m, Decl. 20° 27′ S. and transits at 13h 06m. It is at greatest eastern elongation on the 28th and is to be seen as a good evening star low in the south-west after sunset towards the end of the month.

Venus on the 15th is in R.A. 16h 26m, Decl. 17° 41′ S. and transits at 8h 52m. It is a morning star dominating the south-eastern sky for a few hours before sunrise. Greatest western elongation is on the 25th.

Mars on the 15th is in R.A. 0h 00m, Decl. 0° 22′ S. and transits at 16h 24m. It is in Pisces to be seen in the west until about midnight.

Jupiter on the 15th is in R.A. 7h 48m, Decl. 21° 32′ N. and transits at 0h 13m. It rises about at sunset and is visible all night. Opposition is on the 15th. 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 11m, Decl. 15° 27′ S. and transits at 7h 34m. It is a morning star rising after midnight and reaching the meridian at dawn.

Uranus on the 15th is in R.A. 7h 51m, Decl. 21° 32′ N. and transits at 0h 16m.

Neptune on the 15th is in R.A. 13h 47m. Decl. 9° 14′ S. and transits at 6h 11m.

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

ASTRONOMICAL PHENOMENA MONTH BY MONTH

By Ruth J. Northcott

JANUARY

75th Meridian Civil Time

d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 1h 00m
Sat. 1	15	29	☽ First Quarter		23O14
Sun. 2	15		♀ in Perihelion	2 30	1O234
Mon. 3			Quadrantid meteors		O2134
Tue. 4	7		⊕ in Perihelion. Dist. from ☉, 91,342,000 mi.	23 19	21O34
Wed. 5					3O14*
Thu. 6	4		Moon in Perigee. Dist. from ⊕, 225,600 mi.		3O24*
	13		☌ ♃ ♅ ♃ 0° 09′ S.		
Fri. 7				20 08	321O4
Sat. 8	7	44	🌕 Full Moon		23O14
	15		☿ Greatest Hel. Lat. S.		
	22	21	☌ ♃ ☾ ♃ 2° 18′ N.		
	22	43	☌ ♅ ☾ ♅ 2° 28′ N.		
Sun. 9					14O23
Mon. 10				16 57	4O213
Tue. 11					421O3
Wed. 12					d42O1
Thu. 13				13 47	431O2
Fri. 14					d432O
Sat. 15	15		☍ ♃ ☉ Distance from ⊕, 395,400,000 mi.		423O1
	17	13	☾ Last Quarter		
Sun. 16	4	34	☌ ♆ ☾ ♆ 6° 56′ N.	10 36	41O23
	9		☍ ♅ ☉ Distance from ⊕, 1,640,000,000 mi.		
Mon. 17	22		Moon in Apogee. Dist. from ⊕, 251,600 mi.		O123*
	22	25	☌ ♄ ☾ ♄ 6° 08′ N.		
Tue. 18	21		□ ♆ ☉ West		21O43
Wed. 19	18	38	☌ ♀ ☾ ♀ 5° 53′ N.	7 25	d2O14
Thu. 20					31O24
Fri. 21					dd3O4
Sat. 22				4 14	23O14
Sun. 23	20	06	🌑 New Moon		1O234
Mon. 24	11		♀ Greatest Hel. Lat. N.		O1243
Tue. 25	10		♀ Greatest elongation W., 46° 57′	1 04	21O43
	11	20	☌ ☿ ☾ ☿ 4° 42′ S.		
Wed. 26					42O31
Thu. 27	16		☿ in ☊	21 53	431O2
Fri. 28	3		☿ Greatest elongation E., 18° 26′		43O21
	23	37	☌ ♂ ☾ ♂ 5° 42′ S.		
Sat. 29					432O*
Sun. 30	8		♆ Stationary in R.A.	18 42	41O23
Mon. 31	0	05	☽ First Quarter		4O123

Explanation of symbols and abbreviations on p. 4, of ti me on p. 8.

THE SKY FOR FEBRUARY, 1955

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 55m to 22h 45m and its Decl. changes from 17° 23′ S. to 7° 58′ S. The equation of time changes from −13m 32s to a maximum of −14m 20s on the 12th and then to 12m 40s 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. 21h 28m, Decl. 11° 04′ S. and transits at 11h 45m. Except for the first few days (see January) it is too close to the sun for observation. Inferior conjunction is on the 12th.

Venus on the 15th is in R.A. 18h 42m, Decl. 20° 39′ S. and transits at 9h 05m. It is a morning star prominent in the southern sky before sunrise.

Mars on the 15th is in R.A. 1h 21m, Decl. 8° 43′ N. and transits at 15h 43m. It is visible in the south-west during the evening, moving from Pisces to Aries at the end of the month.

Jupiter on the 15th is in R.A. 7h 32m, Decl. 22° 13′ N. and transits at 21h 51m. It is in Gemini, well up at sunset and visible most 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 17m, Decl. 15° 45′ S. and transits at 5h 38m. It is in Libra, rising just after midnight and visible low in the southern sky for the rest of the night.

Uranus on the 15th is in R.A. 7h 46m, Decl. 21° 46′ N. and transits at 22h 04m.

Neptune on the 15th is in R.A. 13h 47m, Decl. 9° 12′ S. and transits at 4h 09m.

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

			FEBRUARY 75th Meridian Civil Time	Min. of Algol	Config. of Jupiter's Sat. 0h 00m
d	h	m		h m	
Tue. 1	7		☿ in Perihelion		42103
Wed. 2	14		Moon in Perigee. Dist. from ⊕, 229,100 mi. ...	15 32	24031
Thu. 3	2		☿ Stationary in R.A.		31042
	8		♂ in ☊		
Fri. 4			....		30214
Sat. 5	1	54	☌ ♃ ☾ ♃ 2° 03′ N.	12 21	32104
	6	21	☌ ♅ ☾ ♅ 2° 23′ N.		
Sun. 6	20	43	🌕 Full Moon		d04**
Mon. 7			....		01234
Tue. 8			....	9 10	12034
Wed. 9			....		20134
Thu. 10	4		□ ♄ ☉ West		31024
Fri. 11	13		☿ Greatest Hel. Lat. N.	6 00	34021
Sat. 12	12	50	☌ ♆ ☾ ♆ 6° 47′ N.		34210
	14		☌ ☿ ☉ Inferior		
Sun. 13			....		43201
Mon. 14	8	58	☌ ♄ ☾ ♄ 5° 58′ N.	2 49	4023*
	14	40	☾ Last Quarter		
	19		Moon in Apogee. Dist. from ⊕, 251,200 mi. ...		
	20		☍ ♇ ☉ Dist. from ⊕, 3,164,000,000 mi.		
Tue. 15			....		41203
Wed. 16			....	23 38	42013
Thu. 17			....		41302
Fri. 18	15	58	☌ ♀ ☾ ♀ 1° 18′ N.		34012
Sat. 19			....	20 27	32140
Sun. 20			....		32014
Mon. 21	3	09	☌ ☿ ☾ ☿ 0° 29′ S.		0324*
Tue. 22	10	54	🌑 New Moon	17 17	d1034
Wed. 23			....		20134
Thu. 24	15		☿ Stationary in R.A.		13024
Fri. 25			....	14 06	30124
Sat. 26	14	51	☌ ♂ ☾ ♂ 4° 24′ S.		32104
Sun. 27	8		Moon in Perigee. Dist. from ⊕, 229,500 mi. ...		32014
Mon. 28			....	10 56	41032

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

THE SKY FOR MARCH, 1955

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 45m to 0h 39m and its Decl. changes from 7° 58′ S. to 4° 09′ N. The equation of time changes from −12m 40s to −4m 16s. On the 21st at 4h 36m 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. 21h 57m, Decl. 13° 50′ S. and transits at 10h 30m. It is at greatest western elongation on the 10th and so might be seen as a morning star at that time. However, it is very close to the horizon at sunrise at this elongation.

Venus on the 15th is in R.A. 20h 56m, Decl. 16° 50′ S. and transits at 9h 30m. It is a morning star prominent in the south-east before sunrise.

Mars on the 15th is in R.A. 2h 36m, Decl. 15° 47′ N. and transits at 15h 07m. It is in Aries visible in the south-west during the early evening.

Jupiter on the 15th is in R.A. 7h 26m, Decl. 22° 27′ N. and transits at 19h 54m. It is nearly to the meridian at sunset and is visible till well after midnight. 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 17m, Decl. 15° 40′ S. and transits at 3h 48m. It rises before midnight and is visible low in the southern sky for the rest of the night.

Uranus on the 15th is in R.A. 7h 43m, Decl. 21° 53′ N. and transits at 20h 11m.

Neptune on the 15th is in R.A. 13h 46m, Decl 9° 01′ S. and transits at 2h 17m.

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

MARCH

75th Meridian Civil Time

d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 23h 30m
Tue. 1	7	40	☽ First Quarter........................		42O13
	14		♄ Stationary in R.A..................		
Wed. 2			....		d41O2
Thu. 3			....	7 45	43O12
Fri. 4	5	04	☌ ♃ ☾ ♃ 2° 01′ N..................		4321O
	11	55	☌ ⛢ ☾ ⛢ 2° 25′ N..................		
Sat. 5			....		432O1
Sun. 6	23		☿ in ♉..............................	4 34	41O32
Mon. 7			....		O4123
Tue. 8	10	41	🌕 Full Moon........................		2O43*
Wed. 9			....	1 23	1O34*
Thu. 10	19		☿ Greatest elongation W., 27° 27′......		3O124
Fri. 11	20	23	☌ ♆ ☾ ♆ 6° 37′ N..................	22 13	312O4
Sat. 12			....		32O14
Sun. 13	17	07	☌ ♄ ☾ ♄ 5° 48′ N..................		1O324
Mon. 14	16		Moon in Apogee. Dist. from ⊕, 251,300 mi....	19 02	O1243
Tue. 15			....		2O43*
Wed. 16	11	36	☾ Last Quarter........................		41O3*
	15		♃ Stationary in R.A..................		
Thu. 17	6		☿ in Aphelion........................	15 51	43O12
Fri. 18			....		4312O
Sat. 19			....		432O1
Sun. 20	21	08	☌ ♀ ☾ ♀ 3° 56′ S..................	12 41	41O2*
Mon. 21	4	36	☉ enters ♈. Spring commences. Long. of ☉, 0°		4O123
	12		♀ in ♉..............................		
Tue. 22	6	01	☌ ☿ ☾ ☿ 7° 09′ S..................		421O3
Wed. 23	22	42	● New Moon........................	9 30	d42O3
Thu. 24			....		3O12*
Fri. 25			....		312O4
Sat. 26	11		Moon in Perigee. Dist. from ⊕, 226,400 mi....	6 19	32O14
Sun. 27	5	34	☌ ♂ ☾ ♂ 2° 40′ S..................		1O24*
Mon. 28			....		O1234
Tue. 29			....	3 08	21O34
Wed. 30	15	10	☽ First Quarter........................		2O134
Thu. 31	10	42	☌ ♃ ☾ ♃ 2° 17′ N..................	23 57	3O24*
	16	49	☌ ⛢ ☾ ⛢ 2° 37′ N..................		

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

THE SKY FOR APRIL, 1955

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 39m to 2h 30m and its Decl. changes from 4° 09′ N. to 14° 46′ N. The equation of time changes from −4m 16s to +2m 48s, being zero on the 16th; 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. 0h 59m, Decl. 4° 35′ N. and transits at 11h 32m. It is too close to the sun for observation, superior conjunction being on the 22nd.

Venus on the 15th is in R.A. 23h 20m, Decl. 5° 42′ S. and transits at 9h 51m. It is a morning star to be seen low in the east before sunrise.

Mars on the 15th is in R.A. 4h 02m, Decl. 21° 29′ N. and transits at 14h 32m. It is in Taurus visible in the west during the early evening. A night-time occultation of Mars occurs on the 24th.

Jupiter on the 15th is in R.A. 7h 32m, Decl. 22° 16′ N. and transits at 17h 59m. It is past the meridian at sunset and it sets after midnight. 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 11m, Decl. 15° 13′ S. and transits at 1h 41m. It rises late in the evening and is visible low in the southern sky for the rest of the night.

Uranus on the 15th is in R.A. 7h 43m, Decl. 21° 53′ N. and transits at 18h 09m.

Neptune on the 15th is in R.A. 13h 43m. Decl. 8° 44′ S. and transits at 0h 12m.

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

APRIL

75th Meridian Civil Time

	d	h	m			Min. of Algol h	m	Config. of Jupiter's Sat. 22h 45m
Fri.	1	10		♅	Stationary in R.A.			d3102
Sat.	2							34201
Sun.	3					20	47	41302
Mon.	4							40123
Tue.	5							42103
Wed.	6	14		☿	Greatest Hel. Lat. S.	17	36	42013
Thu.	7	1	35	🌕	Full Moon			43102
Fri.	8	2	37	☌ ♆ ☾	♆ 6° 33′ N.			d3402
Sat.	9	22	23	☌ ♄ ☾	♄ 5° 46′ N.	14	25	32401
Sun.	10							1304*
Mon.	11	9		Moon in Apogee.	Dist. from ⊕, 251,800 mi.			01324
		9		□ ♃ ☉	East			
Tue.	12					11	14	12034
Wed.	13							20134
Thu.	14	4		□ ♅ ☉	East			d1024
Fri.	15	6	00	☾	Last Quarter	8	03	d3024
Sat.	16							3204*
Sun.	17	11		☍ ♆ ☉	Dist. from ⊕, 2,723,000,000 mi.			3104*
Mon.	18					4	52	40312
Tue.	19							41203
Wed.	20	0	20	☌ ♀ ☾	♀ 7° 04′ S.			42013
Thu.	21			Lyrid Meteors		1	41	41032
Fri.	22	8	06	🌑	New Moon			43012
		10	00	☌ ☿ ☾	☿ 5° 03′ S.			
		23		☌ ☿ ☉	Superior			
Sat.	23	14		Moon in Perigee.	Dist. from ⊕, 223,500 mi.	22	31	4320*
Sun.	24	20	51	☌ ♂ ☾	♂ 0° 45′ S.			43210
		23		♀	in Aphelion			
Mon.	25	15		☿	in ☊			40312
Tue.	26					19	20	d103*
Wed.	27	21	01	☌ ♃ ☾	♃ 2° 45′ N.			20143
		23	26	☌ ♅ ☾	♅ 2° 53′ N.			
Thu.	28	23	23	☽	First Quarter			10324
Fri.	29					16	09	30124
Sat.	30	6		☿	in Perihelion			32104

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

THE SKY FOR MAY, 1955

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 30m to 4h 32m and its Decl. changes from 14° 46′ N. to 21° 55′ N. The equation of time changes from +2m 48s to a maximum of +3m 45s on the 15th and then to +2m 28s at the end of the month. For changes in the length of the day, see p. 13.

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

Mercury on the 15th is in R.A. 4h 50m, Decl. 24° 53′ N. and transits at 13h 24m. Greatest eastern elongation is on the 21st, to Mercury may be seen about this time some 15° above the western horizon just after sunset.

Venus on the 15th is in R.A. 1h 33m, Decl. 7° 53′ N. and transits at 10h 06m. It is a morning star to be seen low in the east before sunrise.

Mars on the 15th is in R.A. 5h 28m, Decl. 24° 13′ N. and transits at 13h 59m. It is in Taurus visible low in the west just after sunset.

Jupiter on the 15th is in R.A. 7h 48m, Decl. 21° 39′ N. and transits at 16h 17m. It is moving into Cancer, well past the meridian at sunset and setting about at 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. 15h 03m, Decl. 14° 38′ S. and transits at 23h 30m. It rises about at sunset and is visible low in the southern sky for the rest of the night. Opposition is on the 9th.

Uranus on the 15th is in R.A. 7h 46m, Decl. 21° 45′ N. and transits at 16h 15m.

Neptune on the 15th is in R.A. 13h 40m, Decl. 8° 27′ S. and transits at 22h 07m.

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

MAY

75th Meridian Civil Time

d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 22h 15m
Sun. 1			....		d3204
Mon. 2			....	12 58	03124
Tue. 3			....		10234
Wed. 4			Eta Aquarid meteors..........................		20413
Thu. 5	7	39	☌ ♆ ☾ ♆ 6° 36′ N..................	9 47	1403*
Fri. 6	17	14	🌕 Full Moon..........................		43012
Sat. 7	1	22	☌ ♄ ☾ ♄ 5° 53′ N..................		43210
Sun. 8	19		Moon in Apogee. Dist. from ⊕, 252,300 mi....	6 36	43201
Mon. 9	1		☍ ♄ ☉ Dist. from ⊕, 825,900,000 mi........		4302*
Tue. 10	12		☿ Greatest Hel. Lat. N................		
	16		☌ ♃ ♅ ♃ 0° 01′ S..................		41023
Wed. 11			....	3 25	42013
Thu. 12			....		4103*
Fri. 13			....		30412
Sat. 14	20	42	☾ Last Quarter........................	0 14	31204
Sun. 15			....		32014
Mon. 16			....	21 03	3024*
Tue. 17	9		♀ Greatest Hel. Lat. S................		10234
Wed. 18			....		20134
Thu. 19	20	43	☌ ♀ ☾ ♀ 6° 19′ S..................	17 52	12034
Fri. 20			....		30124
Sat. 21	15	58	🌑 New Moon........................		31204
	17		☿ Greatest elongation E., 22° 25′.......		
	23		Moon in Perigee. Dist. from ⊕, 222,100 mi....		
Sun. 22			....	14 40	32401
Mon. 23	5	26	☌ ☿ ☾ ☿ 1° 46′ N..................		43102
	13	07	☌ ♂ ☾ ♂ 1° 11′ N..................		
Tue. 24			....		d4023
Wed. 25	9	08	☌ ♅ ☾ ♅ 3° 07′ N..................	11 29	42013
	12	16	☌ ♃ ☾ ♃ 3° 16′ N..................		
Thu. 26			....		41203
Fri. 27			....		d4012
Sat. 28	9	01	☽ First Quarter.......................	8 18	d4310
Sun. 29			....		32401
Mon. 30			....		31042
Tue. 31			....	5 07	01324

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

THE SKY FOR JUNE, 1955

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

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

The Sun—During June the sun's R.A. increases from 4h 32m to 6h 37m and its Decl. changes from 21° 55′ N. to 23° 27′ N. at the solstice on the 21st at 23h 32m E.S.T., and then to 23° 11′ N. at the end of the month. The equation of time changes from +2m 28s to 0 on the 14th to −3m 30s at the end of the month. There is a total eclipse on the 20th G.C.T., invisible in North America. For changes in the length of the day, see p. 13.

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

Mercury on the 15th is in R.A. 5h 39m, Decl. 20° 07′ N. and transits at 12h 04m. It is too close to the sun for observation, inferior conjunction being on the 16th.

Venus on the 15th is in R.A. 4h 01m, Decl. 19° 29′ N. and transits at 10h 31m It is a morning star to be seen very low in the east just before sunrise.

Mars on the 15th is in R.A. 6h 57m, Decl. 23° 53′ N. and transits at 13h 26m. It is in Gemini, very low in the west at sunset.

Jupiter on the 15th is in R.A. 8h 11m, Decl. 20° 35′ N. and transits at 14h 38m. It is low in the west at sunset and is visible for about two hours. 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. 14h 55m, Decl. 14° 07′ S. and transits at 21h 20m. It is well up in the south-east at sunset and is visible the rest of the night.

Uranus on the 15th is in R.A. 7h 52m, Decl. 21° 29′ N. and transits at 14h 19m.

Neptune on the 15th is in R.A. 13h 38m, Decl. 8° 16′ S. and transits at 20h 03m.

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

			JUNE 75th Meridian Civil Time	Min. of Algol	Config. of Jupiter's Sat. 21h 45m
d	h	m		h m	
Wed. 1	12	21	☌ ♆ ☾ ♆ 6° 42′ N..................		2O34*
Thu. 2	23		☿ in ♉............................		21O34
Fri. 3	3	40	☌ ♄ ☾ ♄ 6° 01′ N..................	1 56	O3124
	19		☿ Stationary in R.A..................		
Sat. 4	22		Moon in Apogee. Dist. from ⊕, 252,400 mi. ...		31O24
Sun. 5	9	08	Full Moon........................	22 45	32O14
Mon. 6			....		31O4*
Tue. 7			....		O412*
Wed. 8			....	19 34	421O3
Thu. 9			....		d42O3
Fri. 10			....		4O132
Sat. 11			....	16 22	431O2
Sun. 12			....		432O1
Mon. 13	6		☿ in Aphelion......................		431O*
	7	37	☾ Last Quarter......................		
Tue. 14			....	13 11	4O12*
Wed. 15			....		421O3
Thu. 16	1		☌ ☿ ☉ Inferior....................		2O143
Fri. 17			....	10 00	O234*
Sat. 18	13	51	☌ ♀ ☾ ♀ 2° 46′ S..................		31O24
Sun. 19	9		Moon in Perigee. Dist. from ⊕, 222,400 mi. ...		32O14
	14	37	☌ ☿ ☾ ☿ 4° 31′ S..................		
	23	12	New Moon; Total Eclipse of ☉. See p. 29.		
Mon. 20			....	6 49	312O4
Tue. 21	6	23	☌ ♂ ☾ ♂ 3° 02′ N..................		3O124
	21	25	☌ ♅ ☾ ♅ 3° 15′ N..................		
	23	32	☉ enters ♋, Summer commences. Long. of ☉, 90°		
Wed. 22	7	07	☌ ♃ ☾ ♃ 3° 46′ N..................		12O34
Thu. 23			....	3 37	2O143
Fri. 24			....		dO23*
Sat. 25			....		431O2
Sun. 26	20	44	☽ First Quarter......................	0 26	432O1
Mon. 27	19		☿ Stationary in R.A..................		4312O
Tue. 28	17	57	☌ ♆ ☾ ♆ 6° 43′ N..................	21 15	43O12
Wed. 29			....		d41O3
Thu. 30	3		☌ ☿ ♀ ☿ 3° 50′ S..................		42O13
	7	16	☌ ♄ ☾ ♄ 6° 03′ N..................		

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

THE SKY FOR JULY, 1955

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 37m to 8h 42m and its Decl. changes from 23° 11′ N. to 18° 16′ N. The equation of time changes from −3m 30s to a maximum of −6m 25s on the 27th and then to −6m 18s 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. 6h 08m, Decl. 21° 43′ N. and transits at 10h 41m. May be seen around about the 9th (when it is at greatest western elongation) as a morning star some 12° above the eastern horizon just before sunrise.

Venus on the 15th is in R.A. 6h 37m, Decl. 23° 15′ N. and transits at 11h 10m. It is a morning star rising just before the sun in the north-east.

Mars on the 15th is in R.A. 8h 19m, Decl. 20° 45′ N. and transits at 12h 50m. It is too close to the sun for observation.

Jupiter on the 15th is in R.A. 8h 37m, Decl. 19° 09′ N. and transits at 13h 06m. It is barely to be seen on the western horizon at sunset. 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. 14h 51m, Decl. 13° 58′ S. and transits at 19h 19m. It is about on the meridian at sunset and is visible in the south-west until about midnight.

Uranus on the 15th is in R.A. 7h 59m, Decl. 21° 09′ N. and transits at 12h 28m.

Neptune on the 15th is in R.A. 13h 37m, Decl. 8° 15′ S. and transits at 18h 05m.

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

JULY

75th Meridian Civil Time

	d	h	m		Min. of Algol (h m)	Config. of Jupiter's Sat. 21h 15m
Fri.	1			....	18 03	41O23
Sat.	2	4		Moon in Apogee. Dist. from ⊕, 252,200 mi. ...		dd4O2
Sun.	3	13		☿ Greatest Hel. Lat. S.		32O14
Mon.	4	17		⊕ in Aphelion. Dist. from ☉, 94,448,000 mi.	14 52	321O4
Tue.	5	0	28	🌕 Full Moon		
Wed.	6	10		☌ ♂ ♅ ♂ 0° 38′ N.		
Thu.	7			....	11 41	
Fri.	8	6		♆ Stationary in R.A.		
Sat.	9	6		☿ Greatest elongation W., 21° 10′		
Sun.	10			....	8 29	
Mon.	11			....		
Tue.	12	15		♀ in ☊		
		15	31	☾ Last Quarter		
Wed.	13			....	5 18	
Thu.	14			....		
Fri.	15			....		
Sat.	16			....	2 07	
Sun.	17	15		Moon in Perigee. Dist. from ⊕, 224,400 mi. ...		
		22	45	☌ ☿ ☾ ☿ 0° 05′ S.		
Mon.	18	9	41	☌ ♀ ☾ ♀ 1° 46′ N.	22 55	
		17		□ ♆ ☉ East		
Tue.	19	6	34	🌑 New Moon		
		10	40	☌ ♅ ☾ ♅ 3° 23′ N.		
		22		♄ Stationary in R.A.		
Wed.	20	0	13	☌ ♂ ☾ ♂ 4° 41′ N.		
		3	40	☌ ♃ ☾ ♃ 4° 14′ N.		
Thu.	21	8		☌ ♅ ☉	19 44	
Fri.	22	14		☿ in ☊		
Sat.	23			....		
Sun.	24	17		☌ ♂ ♃ ♂ 0° 37′ N.	16 32	
Mon.	25			....		
Tue.	26	1	17	☌ ♆ ☾ ♆ 6° 35′ N.		
		10	59	☽ First Quarter		
Wed.	27	5		☿ in Perihelion	13 21	
		13	38	☌ ♄ ☾ ♄ 5° 51′ N.		
		20		☌ ☿ ♀ ☿ 0° 20′ N.		
Thu.	28			Delta Aquarid meteors		
Fri.	29	17		Moon in Apogee. Dist. from ⊕, 251,600 mi. ...		
		17		☌ ☿ ♅ ☿ 0° 41′ N.		
Sat.	30			....	10 10	
Sun.	31	2		☌ ♀ ♅ ♀ 0° 12′ N.		

Jupiter being near the sun, phenomena of the satellites are not given from July 5 to August 21.

THE SKY FOR AUGUST, 1955

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 42m to 10h 38m and its Decl. changes from 18° 16′ N. to 8° 39′ N. The equation of time changes from −6m 18s to −0m 20s. 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. 10h 14m, Decl. 12° 38′ N. and transits at 12h 46m. It is too close to the sun for observation, being in superior conjunction on the 5th.

Venus on the 15th is in R.A. 9h 18m, Decl. 16° 56′ N. and transits at 11h 48m. It is a morning star but too close to the sun for easy observation.

Mars on the 15th is in R.A. 9h 39m, Decl. 15° 14′ N. and transits at 12h 08m. It is too close to the sun for observation, conjunction being on the 16th.

Jupiter on the 15th is in R.A. 9h 04m, Decl. 17° 21′ N. and transits at 11h 32m. It is too close to the sun for observation, being in conjunction on the 4th. 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. 14h 53m, Decl. 14° 16′ S. and transits at 17h 19m. It is well down in the south-west at sunset and is visible for a few hours thereafter.

Uranus on the 15th is in R.A. 8h 07m, Decl. 20° 46′ N. and transits at 10h 34m.

Neptune on the 15th is in R.A. 13h 38m, Decl. 8° 24′ S. and transits at 16h 04m.

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

			AUGUST 75th Meridian Civil Time	Min. of Algol	Config. of Jupiter's Sat. 5h 30m
d	h	m		h m	
Mon. 1			....		
Tue. 2			....	6 58	
Wed. 3	14	30	○ Full Moon..........................		
Thu. 4	1		☌ ♃ ☉		
	18		☌ ☿ ♃ ☿ 1° 10′ N.................		
Fri. 5	12		☌ ☿ ☉ Superior.....................	3 47	
Sat. 6	12		☿ Greatest Hel. Lat. N................		
Sun. 7	7		♂ Greatest Hel. Lat. N................		
	22		□ ♄ ☉ East........................		
	23		☌ ☿ ♂ ☿ 0° 39′ N.................		
Mon. 8			....	0 35	
Tue. 9			....		
Wed. 10	21	33	☾ Last Quarter.........................	21 24	
Thu. 11	12		☌ ♀ ♃ ♀ 0° 30′ N.................		
Fri. 12			Perseid meteors............................		
Sat. 13			....	18 12	
Sun. 14	13		Moon in Perigee. Dist. from ⊕, 227,400 mi....		
Mon. 15	7		♀ in Perihelion.....................		
	23	00	☌ ♅ ☾ ♅ 3° 33′ N.................		
Tue. 16	22		☌ ♂ ☉	15 01	
Wed. 17	0	05	☌ ♃ ☾ ♃ 4° 43′ N.................		
	10	59	☌ ♀ ☾ ♀ 5° 46′ N.................		
	14	58	● New Moon..........................		
	18	04	☌ ♂ ☾ ♂ 5° 56′ N.................		
Thu. 18	19	19	☌ ☿ ☾ ☿ 6° 40′ N.................		
Fri. 19			....	11 50	
Sat. 20	1		☌ ♇ ☉		
Sun. 21			....		40123
Mon. 22	10	21	☌ ♆ ☾ ♆ 6° 19′ N.................	8 38	d4102
Tue. 23	18		☌ ♀ ♂ ♀ 0° 11′ N.................		d3204
	23	09	☌ ♄ ☾ ♄ 5° 26′ N.................		
Wed. 24			....		30124
Thu. 25	3	51	☽ First Quarter.....................	5 27	31024
Fri. 26	10		Moon in Apogee. Dist. from ⊕, 251,200 mi....		20134
Sat. 27			....		21034
Sun. 28			....	2 15	01234
Mon. 29	22		☿ in ☋............................		10324
Tue. 30			....	23 04	32014
Wed. 31			....		304**

Jupiter being near the sun, phenomena of the satellites are not given from July 5 to August 21.

THE SKY FOR SEPTEMBER, 1955

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 38m to 12h 26m and its Decl. changes from 8° 39′ N. to 2° 48′ S. The equation of time changes from −0m 20s to +9m 57s, the apparent sun passing to the west of the mean sun on the 2nd. On the 23rd at 14h 42m 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. 13h 01m, Decl. 8° 56′ S. and transits at 13h 29m. Greatest eastern elongation on the 18th is unfavourable, Mercury being very low in the west after sunset at this time.

Venus on the 15th is in R.A. 11h 44m, Decl. 3° 13′ N. and transits at 12h 12m. It is too close to the sun for observation, superior conjunction being on the 1st.

Mars on the 15th is in R.A. 10h 55m, Decl. 8° 10′ N. and transits at 11h 21m. It is a morning star in Leo but too close to the sun for easy observation.

Jupiter on the 15th is in R.A. 9h 31m, Decl. 15° 25′ N. and transits at 9h 56m. It is in Leo visible low in the east just before sunrise. 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 01m, Decl. 14° 57′ S. and transits at 15h 25m. It is well down in the south-west at sunset and sets about two hours later.

Uranus on the 15th is in R.A. 8h 14m, Decl. 20° 27′ N. and transits at 8h 39m.

Neptune on the 15th is in R.A. 13h 41m, Decl. 8° 43′ S. and transits at 14h 06m.

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

			SEPTEMBER 75th Meridian Civil Time	Min. of Algol	Config. of Jupiter's Sat. 5h 15m
d	h	m		h m	
Thu. 1	2		☌ ♀ ☉ Superior......................		34102
Fri. 2	2	59	🌕 Full Moon.........................	19 52	42031
Sat. 3			....		42103
Sun. 4			....		40123
Mon. 5			....	16 41	41032
Tue. 6	4		♀ Greatest Hel. Lat. N................		42301
Wed. 7			....		3410*
Thu. 8			....	13 30	d3402
Fri. 9	2	59	☾ Last Quarter......................		20314
	5		☿ in Aphelion.......................		
	20		Moon in Perigee. Dist. from ⊕, 229,800 mi....		
Sat. 10			....		21034
Sun. 11			....	10 18	02134
Mon. 12	9	04	☌ ♅ ☾ ♅ 3° 49′ N.................		10234
	22		♂ in Aphelion.......................		
Tue. 13	18	49	☌ ♃ ☾ ♃ 5° 13′ N.................		23014
Wed. 14			....	7 07	32104
Thu. 15	11	25	☌ ♂ ☾ ♂ 6° 35′ N.................		30124
Fri. 16	1	19	🌑 New Moon.........................		d014*
	14	46	☌ ♀ ☾ ♀ 6° 53′ N.................		
Sat. 17			....	3 55	d2103
Sun. 18	6	57	☌ ☿ ☾ ☿ 1° 48′ N.................		40213
	11		☿ Greatest elongation E., 26° 33′.......		
	20	21	☌ ♆ ☾ ♆ 6° 04′ N.................		
Mon. 19			....		41023
Tue. 20	11	06	☌ ♄ ☾ ♄ 4° 56′ N.................	0 44	42301
Wed. 21			....		43210
Thu. 22			....	21 33	43012
Fri. 23	6		Moon in Apogee. Dist. from ⊕, 251,200 mi....		4302*
	14	42	☉ enters ♎, Autumn commences. Long. of ☉, 180°		
	22	40	☽ First Quarter.....................		
Sat. 24			....		42103
Sun. 25			....	18 21	0213*
Mon. 26			....		10423
Tue. 27			....		23014
Wed. 28			....	15 10	32104
Thu. 29	12		☿ Greatest Hel. Lat. S................		30124
Fri. 30			....		31024

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

THE SKY FOR OCTOBER, 1955

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

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

The Sun—During October the sun's R.A. increases from 12h 26m to 14h 22m and its Decl. changes from 2° 48′ S. to 14° 07′ S. The equation of time changes from +9m 57s to +16m 20s. 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. 13h 06m, Decl. 8° 23′ S. and transits at 11h 30m. Early in the month it is too close to the sun for observation, inferior conjunction being on the 13th. However, greatest western elongation is on the 29th and about this time it is well seen as a morning star near Spica low in the south-east before sunrise.

Venus on the 15th is in R.A. 14h 02m, Decl. 11° 41′ S. and transits at 12h 32m. It is an evening star but too close to the sun for easy observation.

Mars on the 15th is in R.A. 12h 05m, Decl. 0° 34′ N. and transits at 10h 33m. It is in Virgo rising about two hours before the sun.

Jupiter on the 15th is in R.A. 9h 52m, Decl. 13° 39′ N. and transits at 8h 20m. It is very close to Regulus, rising about two hours 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. 15h 12m, Decl. 15° 49′ S. and transits at 13h 39m. It is too close to the sun for easy observation.

Uranus on the 15th is in R.A. 8h 18m, Decl. 20° 14′ N. and transits at 6h 45m.

Neptune on the 15th is in R.A. 13h 45m, Decl. 9° 06′ S. and transits at 12h 12m.

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

				OCTOBER 75th Meridian Civil Time		Min. of Algol	Config. of Jupiter's Sat. 5h 00m
	d	h	m			h m	
Sat.	1	9		☿	Stationary in R.A..................	11 59	d2O34
		14	17	🌕	Full Moon. Harvest Moon.........		
Sun.	2				....		O134*
Mon.	3				....		1O423
Tue.	4				....	8 47	d24O1
Wed.	5	6		Moon in Perigee. Dist. from ⊕, 228,200 mi....			4321O
Thu.	6				....		43O12
Fri.	7				....	5 36	431O2
Sat.	8	4		☌ ☿ ♀	☿ 4° 18′ S..................		42O13
		9	04	☾	Last Quarter......................		
Sun.	9	16	39	☌ ♅ ☾	♅ 4° 08′ N..................		4O3**
Mon.	10				....	2 25	41O23
Tue.	11	3		☌ ♀ ♆	♀ 0° 55′ S..................		42O31
		10	50	☌ ♃ ☾	♃ 5° 44′ N..................		
Wed.	12				....	23 13	3214O
Thu.	13	16		☌ ☿ ☉	Inferior....................		3O214
Fri.	14	4	03	☌ ♂ ☾	♂ 6° 30′ N..................		31O24
Sat.	15	9	38	☌ ☿ ☾	☿ 3° 36′ N..................	20 02	2O314
		14	32	🌑	New Moon......................		
Sun.	16	6	08	☌ ♆ ☾	♆ 5° 54′ N..................		2O34*
		18	39	☌ ♀ ☾	♀ 4° 18′ N..................		
Mon.	17				....		1O234
Tue.	18	0	16	☌ ♄ ☾	♄ 4° 28′ N..................	16 51	dO134
		13		☿	in ☊........................		
Wed.	19				....		231O4
Thu.	20				....		3O214
Fri.	21	1		Moon in Apogee. Dist. from ⊕, 251,600 mi....		13 39	314O2
		23		☌ ♆ ☉	....		
Sat.	22			Orionid meteors..........................			42O1*
		1		☿	Stationary in R.A..................		
Sun.	23	5		☿	in Perihelion......................		421O3
		18	04	☽	First Quarter......................		
Mon.	24				....	10 28	d4O23
Tue.	25				....		4O123
Wed.	26	6		□ ♅ ☉	West		4231O
Thu.	27				....	7 17	43O21
Fri.	28				....		341O2
Sat.	29	6		☿	Greatest elongation W., 18° 33′......		2O1**
Sun.	30	17		☌ ♀ ♄	♀ 1° 58′ S..................	4 06	21O43
Mon.	31	1	04	🌕	Full Moon. Hunter's Moon.........		O1234

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

THE SKY FOR NOVEMBER, 1955

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 22m to 16h 25m and its Decl. changes from 14° 07′ S. to 21° 39′ S. The equation of time changes from +16m 20s to a maximum of +16m 24s on the 4th and then to +11m 21s 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 partial eclipse of the moon on the 29th, invisible in North America except in the far north.

Mercury on the 15th is in R.A. 14h 34m, Decl. 13° 49′ S. and transits at 11h 03m. During the first few days of the month it may be seen as a morning star near Spica low in the south-east just before sunrise.

Venus on the 15th is in R.A. 16h 38m, Decl. 22° 41′ S. and transits at 13h 06m. It is an evening star which may be glimpsed near the south-western horizon just after sunset.

Mars on the 15th is in R.A. 13h 19m, Decl. 7° 19′ S. and transits at 9h 44m. It is in Virgo near Spica visible in the south-east for a few hours before sunrise.

Jupiter on the 15th is in R.A. 10h 09m, Decl. 12° 19′ N. and transits at 6h 34m. It rises about at midnight and is visible the rest of the night. It is 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 27m, Decl. 16° 47′ S. and transits at 11h 51m. It is too close to the sun for observation, conjunction being on the 16th.

Uranus on the 15th is in R.A. 8h 19m, Decl. 20° 12′ N. and transits at 4h 44m.

Neptune on the 15th is in R.A. 13h 50m, Decl. 9° 30′ S. and transits at 10h 14m.

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

NOVEMBER

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Config. of Jupiter's Sat. 4h 30m
Tue.	1	5		♀ in ☋		O234*
		22		Moon in Perigee. Dist. from ⊕, 224,900 mi.		
Wed.	2	11		☿ Greatest Hel. Lat. N.	0 55	23104
Thu.	3					3014*
Fri.	4				21 44	31024
Sat.	5	23	01	☌ ♅ ☾ ♅ 4° 24′ N.		32014
Sun.	6	16	56	☾ Last Quarter		21043
Mon.	7	2		☌ ☿ ♆ ☿ 0° 18′ N.	18 32	40123
		23	47	☌ ♃ ☾ ♃ 6° 11′ N.		
Tue.	8	9		♅ Stationary in R.A.		4023*
Wed.	9					dd420
Thu.	10			Taurid meteors	15 21	4301*
Fri.	11	20	12	☌ ♂ ☾ ♂ 5° 42′ N.		43102
Sat.	12	14	51	☌ ♆ ☾ ♆ 5° 52′ N.		43201
Sun.	13	8	21	☌ ☿ ☾ ☿ 4° 52′ N.	12 10	42103
Mon.	14	7	01	● New Moon		40213
		13	25	☌ ♄ ☾ ♄ 4° 07′ N.		
Tue.	15					10423
Wed.	16			Leonid meteors	8 59	20134
		1	49	☌ ♀ ☾ ♀ 0° 12′ S.		
		18		☌ ♄ ☉		
Thu.	17	18		Moon in Apogee. Dist. from ⊕, 252,300 mi.		32014
Fri.	18					31024
Sat.	19				5 48	d3014
Sun.	20					21034
Mon.	21					02134
Tue.	22	12	29	☽ First Quarter	2 37	10243
Wed.	23	10		□ ♃ ☉ West		20143
		21		☌ ☿ ♄ ☿ 1° 46′ S.		
Thu.	24				23 26	3420*
Fri.	25	21		☿ in ☋		43102
Sat.	26					43021
Sun.	27			Bielid meteors	20 15	42103
Mon.	28	6		☌ ♂ ♆ ♂ 0° 54′ S.		40213
Tue.	29			Partial eclipse of ☾. See p. 29		41023
		11	50	○ Full Moon		
Wed.	30	6		Moon in Perigee. Dist. from ⊕, 222,300 mi.	17 04	42013

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

THE SKY FOR DECEMBER, 1955

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

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

The Sun—During December the sun's R.A. increases from 16h 25m to 18h 42m and its Decl. changes from 21° 39′ S. to 23° 27′ S. at the solstice on the 22nd at 10h 12m E.S.T. and then to 23° 06′ S. at the end of the month. The equation of time changes from +11m 21s to zero on the 25th and then to −3m 00s at the end of the month. There is an annular eclipse on the 14th, invisible in North America. 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. 17h 51m, Decl. 25° 13′ S. and transits at 12h 22m. It is too close to the sun for observation, superior conjunction being on the 4th.

Venus on the 15th is in R.A. 19h 21m, Decl. 23° 44′ S. and transits at 13h 51m. It is an evening star easily seen low in the south-west just after sunset.

Mars on the 15th is in R.A. 14h 33m, Decl. 14° 14′ S. and transits at 9h 00m. It is in Libra, visible in the south-east for a few hours before sunrise.

Jupiter on the 15th is in R.A. 10h 15m, Decl. 11° 50′ N. and transits at 4h 42m. It rises before midnight and is visible the rest of the night. 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 41m, Decl. 17° 37′ S. and transits at 10h 07m. It is a morning star rising in the south-east about an hour before the sun.

Uranus on the 15th is in R.A. 8h 17m, Decl. 20° 20′ N. and transits at 2h 44m.

Neptune on the 15th is in R.A. 13h 53m, Decl. 9° 49′ S. and transits at 8h 20m.

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

	d	h	m	DECEMBER 75th Meridian Civil Time	Min. of Algol h m	Config. of Jupiter's Sat. 4h 00m
Thu.	1			....		23410
Fri.	2			....		d3042
Sat.	3	6	10	☌ ♅ ☾ ♅ 4° 29′ N..................	13 53	30124
Sun.	4	9		☌ ☿ ☉ Superior....................		2104*
Mon.	5	10	04	☌ ♃ ☾ ♃ 6° 29′ N..................		0134*
		15		♀ in Aphelion........................		
Tue.	6	3	35	☾ Last Quarter........................	10 42	10234
		4		☿ in Aphelion........................		
Wed.	7			....		20134
Thu.	8			....		23104
Fri.	9	22	19	☌ ♆ ☾ ♆ 5° 52′ N..................	7 31	30124
Sat.	10	12	35	☌ ♂ ☾ ♂ 4° 18′ N..................		d302*
Sun.	11			....		4210*
Mon.	12			Geminid meteors.........................	4 20	42013
		1	50	☌ ♄ ☾ ♄ 3° 51′ N..................		
Tue.	13			....		41023
Wed.	14			Annular eclipse of ☉. See p. 29..............		42013
		2	07	● New Moon........................		
		14	41	☌ ☿ ☾ ☿ 2° 44′ S..................		
Thu.	15	2		Moon in Apogee. Dist. from ⊕, 252,600 mi....	1 09	42130
Fri.	16	15	03	☌ ♀ ☾ ♀ 4° 38′ S..................		43012
Sat.	17			....	21 58	3402*
Sun.	18	12		♃ Stationary in R.A..................		23410
Mon.	19			....		20143
Tue.	20			....	18 48	10234
Wed.	21			....		d0134
Thu.	22	4	39	☽ First Quarter......................		d2104
		10	12	☉ enters ♑. Winter commences. Long. of ☉, 270°		
Fri.	23			....	15 37	30214
Sat.	24			....		31024
Sun.	25			....		d2304
Mon.	26	12		☿ Greatest Hel. Lat. S.................	12 25	20143
Tue.	27			....		14023
Wed.	28	1		♀ Greatest Hel. Lat. S.................		40213
		19		Moon in Perigee. Dist. from ⊕, 221,500 mi....		
		22	44	○ Full Moon........................		
Thu.	29			....	9 14	42103
Fri.	30	15	03	☌ ♅ ☾ ♅ 4° 25′ N..................		43021
Sat.	31			....		43102

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

JANUARY

d	h	m	Sat.	Phen.
1	3	13	III	ED
3	4	40	II	SI
	5	18	II	TI
4	5	19	I	ED
	20	45	III	Se
	21	52	III	Te
	23	33	II	ED
5	2	36	I	SI
	2	51	II	OR
	2	52	I	TI
	4	53	I	Se
	5	08	I	Te
	23	47	I	ED
6	2	20	I	OR
	18	25	II	TI
	20	46	II	Se
	21	05	I	SI
	21	14	II	Te
	21	18	I	TI
	23	21	I	Se
	23	34	I	Te
7	18	16	I	ED
	20	45	I	OR
8	19	24	IV	Te
11	21	14	III	SI
	21	36	III	TI
12	0	45	III	Se
	1	07	III	Te
	2	07	II	ED
	4	30	I	SI
	4	35	I	TI
	5	04	II	OR
	6	47	I	Se
	6	52	I	Te
13	1	42	I	ED
	4	03	I	OR
	20	35	II	SI
	20	40	II	TI
	22	59	I	SI
	23	01	I	TI
	23	24	II	Se
	23	29	II	Te
14	1	15	I	Se
	1	17	I	Te
	20	11	I	ED
	22	29	I	OR
15	18	10	II	ER
	19	43	I	Te
	19	44	I	Se
16	21	36	IV	OD
17	1	57	IV	ER
19	0	51	III	TI
	1	13	III	SI
	4	23	III	Te
	4	30	II	OD
	4	44	III	Se
	6	19	I	TI
	6	24	I	SI
20	3	29	I	OD
	5	54	I	ER
	22	55	II	TI
	23	12	II	SI
21	0	44	I	TI
	0	53	I	SI
	1	44	II	Te
	2	01	II	Se
	3	01	I	Te
	3	09	I	Se
	21	56	I	OD
22	0	23	I	ER
	18	42	III	ER
	19	10	I	TI
	19	21	I	SI
	20	44	II	ER
22	21	27	I	Te
	21	38	I	Se
23	18	52	I	ER
25	5	31	IV	TI
26	4	07	III	TI
	5	12	III	SI
27	5	14	I	OD
28	1	11	II	TI
	1	50	II	SI
	2	28	I	TI
	2	47	I	SI
	4	00	II	Te
	4	39	II	Se
	4	44	I	Te
	5	03	I	Se
	23	40	I	OD
29	2	18	I	ER
	19	50	II	OD
	20	54	I	TI
	21	15	I	SI
	22	42	III	ER
	23	10	I	Te
	23	19	II	ER
	23	32	I	Se
30	18	06	I	OD
	20	46	I	ER
31	17	58	II	Se
	18	00	I	Se

FEBRUARY

d	h	m	Sat.	Phen.
2	20	05	IV	ER
4	3	28	II	TI
	4	12	I	TI
	4	27	II	SI
	4	41	I	SI
5	1	25	I	OD
	4	13	I	ER
	21	03	III	OD
	22	05	II	OD
	22	39	I	TI
	23	10	I	SI
6	0	55	I	Te
	1	26	I	Se
	1	53	II	ER
	2	43	III	ER
	19	51	I	OD
	22	42	I	ER
7	19	21	I	Te
	19	26	II	Te
	19	55	I	Se
	20	35	II	Se
10	19	57	IV	TI
	23	54	IV	Te
11	1	49	IV	SI
12	3	10	I	OD
13	0	21	II	OD
	0	24	I	TI
	0	25	III	OD
	1	04	I	SI
	2	40	I	Te
	3	20	I	Se
	4	28	II	ER
	21	37	I	OD
14	0	37	I	ER
	18	51	I	TI
	18	57	II	TI
	19	33	I	SI
	20	24	II	SI
	21	06	I	Te
	21	45	II	Te
	21	49	I	Se
	23	13	II	Se
15	19	05	I	ER
16	20	42	III	Se
19	2	25	IV	OD
20	2	10	I	TI
	2	39	II	OD
	2	59	I	SI
	3	51	III	OD
	4	26	I	Te
	23	23	I	OD
21	2	32	I	ER
	20	37	I	TI
	21	18	II	TI
	21	27	I	SI
	22	53	I	Te
	23	01	II	SI
	23	43	I	Se
22	0	06	II	Te
	1	51	II	Se
	21	01	I	ER
23	20	21	II	ER
	21	05	III	Te
	21	09	III	SI
24	0	42	III	Se
27	3	58	I	TI
	19	49	IV	SI
	23	58	IV	Se
28	1	11	I	OD
	22	25	I	TI
	23	22	I	SI
	23	41	II	TI

MARCH

d	h	m	Sat.	Phen.
1	0	40	I	Te
	1	38	I	Se
	1	39	II	SI
	2	29	II	Te
	19	39	I	OD
	22	56	I	ER
2	19	08	I	Te
	20	07	I	Se
	21	07	III	TI
	22	56	II	ER
3	0	37	III	Te
	1	09	III	SI
6	18	43	III	ER
7	3	01	I	OD
	21	58	IV	OR
8	0	14	I	TI
	1	17	I	SI
	2	07	II	TI
	2	29	I	Te
	21	28	I	OD
9	0	51	I	ER
	18	41	I	TI
	19	45	I	SI
	20	34	II	OD
	20	57	I	Te
	22	01	I	Se
10	0	44	III	TI
	1	31	II	ER
	19	20	I	ER
11	20	25	II	Se
13	19	08	III	ED
	22	43	III	ER
15	2	04	I	TI
	23	19	I	OD
16	2	47	I	ER
	20	31	I	TI
	21	40	I	SI
	22	47	I	Te
	23	00	II	OD
	23	56	I	Se
17	21	16	I	ER
18	20	13	II	SI
	20	37	II	Te
	23	02	II	Se
20	21	49	III	OR
	23	09	III	ED
23	1	11	I	OD
	22	23	I	TI
	23	35	I	SI
24	0	38	I	Te
	1	28	II	OD
	1	51	I	Se
	19	39	I	OD
	22	09	IV	ED
	23	11	I	ER
25	19	06	I	Te
	20	19	I	Se
	20	21	II	TI
	22	51	II	SI
	23	08	II	Te
26	1	40	II	Se
27	19	59	II	ER
	22	07	III	OD
28	1	38	III	OR
31	0	16	I	TI
	1	30	I	SI
	20	41	III	Se
	21	32	I	OD

APRIL

d	h	m	Sat.	Phen.
1	1	07	I	ER
	19	59	I	SI
	20	10	IV	TI
	20	59	I	Te
	22	14	I	Se
	22	55	II	TI
2	0	07	IV	Te
	1	28	II	SI
	1	42	II	Te
	19	36	I	ER
3	22	35	II	ER
7	19	27	III	Te
	21	07	III	SI
	23	26	I	OD
8	0	41	III	Se
	20	38	I	TI
	21	54	I	SI
	22	53	I	Te
9	0	09	I	Se
	21	31	I	ER
10	19	49	II	OD
	20	39	IV	ER
11	1	11	II	ER
12	20	14	II	Se
14	19	56	III	TI
	23	27	III	Te
15	22	33	I	TI
	23	49	I	SI
16	0	48	I	Te
	19	51	I	OD
	23	26	I	ER
17	19	17	I	Te
	20	33	I	Se
	22	24	II	OD
19	20	02	II	SI
	20	16	II	Te
	22	52	II	Se
22	0	00	III	TI
23	0	29	I	TI
	21	47	I	OD
24	20	12	I	SI
	21	13	I	Te
	22	28	I	Se
25	19	50	I	ER
	22	45	III	ER
26	20	09	II	TI
	22	22	IV	OD

d	h	m	Sat.	Phen.
26	22	39	II	SI
	22	56	II	Te
28	19	40	II	ER
30	23	45	I	OD

MAY

d	h	m	Sat.	Phen.
1	20	55	I	TI
	22	07	I	SI
	23	10	I	Te
2	21	45	III	OR
	21	46	I	ER
	23	08	III	ED
3	22	50	II	TI
5	19	54	IV	SI
	22	16	II	ER
8	22	53	I	TI
9	20	12	I	OD
	22	24	III	OD
10	20	47	I	Se
12	19	44	II	OD
13	20	42	III	Se
	21	42	IV	OR
14	20	01	II	Se
16	22	11	I	OD
17	20	26	I	SI
	21	37	I	Te
	22	43	I	Se
18	20	05	I	ER
19	22	28	II	OD
20	20	18	III	Te
	21	06	III	SI
21	20	28	II	Te
	22	38	II	Se
24	21	19	I	TI
	22	21	I	SI
25	22	00	I	ER
27	21	02	III	TI
28	20	25	II	TI
	22	24	II	SI

JUNE

d	h	m	Sat.	Phen.
1	20	40	I	OD
2	20	06	I	Te
	21	02	I	Se
9	20	40	I	SI
10	20	18	I	ER
13	20	09	II	OD
16	21	08	IV	ER
22	20	59	II	Te
25	20	38	I	Te
	20	42	III	Se

JULY

d	h	m	Sat.	Phen.
2	20	22	I	TI

Jupiter being near the sun, phenomena of the satellites are not given from July 6 to August 21.

AUGUST

d	h	m	Sat.	Phen.
29	4	56	III	SI

SEPTEMBER

d	h	m	Sat.	Phen.
7	5	04	II	ED
9	4	52	III	OR
15	4	55	I	SI
16	3	40	II	TI
	5	07	I	OR
	5	11	II	Se
23	4	02	I	ED
	4	53	II	SI
24	3	35	I	Se
	4	23	I	Te
25	4	09	II	OR
	4	35	IV	ED
27	3	53	III	Te

OCTOBER

d	h	m	Sat.	Phen.
1	3	11	I	SI
	4	05	I	TI
	5	29	I	Se
2	3	35	I	OR
4	3	12	IV	Te
	4	28	III	Se
	4	34	III	TI
8	5	05	I	SI
9	4	46	II	ED
	5	33	I	OR
10	2	51	I	Te
11	4	05	II	Te
	4	48	III	SI
12	3	28	IV	ER
15	2	34	III	OR
16	4	10	I	ED
17	2	31	I	TI
	3	45	I	Se
	4	49	I	Te
18	3	56	II	TI
	4	40	II	Se
22	2	19	III	ER
	3	10	III	OD
24	3	22	I	SI
	4	29	I	TI
	5	39	I	Se
25	3	57	I	OR
	4	23	II	SI
27	4	32	II	OR
29	2	37	III	ED
	3	48	IV	OD
31	5	15	I	SI

NOVEMBER

d	h	m	Sat.	Phen.
1	2	24	I	ED
	5	53	I	OR
2	2	01	I	Se
	3	12	I	Te
3	1	52	II	ED
5	1	26	II	Te
6	1	44	IV	SI
8	4	18	I	ED
9	1	37	I	SI
	1	40	III	TI
	2	50	I	TI
	3	55	I	Se
	5	07	I	Te
	5	15	III	Te
10	2	17	I	OR
	4	28	II	ED
12	1	12	II	TI
	1	37	II	Se
	4	03	II	Te
15	3	24	IV	OR
	6	11	I	ED
16	0	40	III	SI
	3	31	I	SI
	4	17	III	Se
	4	45	I	TI
	5	43	III	TI
	5	48	I	Se
17	0	39	I	ED
	4	11	I	OR
18	1	30	I	Te
19	1	19	II	SI
	3	48	II	TI
	4	11	II	Se
21	1	47	II	OR
23	0	27	IV	Se
	4	37	III	SI
	5	24	I	SI
24	2	32	I	ED
	6	05	I	OR
25	1	07	I	TI
	2	10	I	Se
	3	24	I	Te
26	0	33	I	OR
	3	53	II	SI
	6	21	II	TI
27	3	09	III	OR
28	4	21	II	OR

DECEMBER

d	h	m	Sat.	Phen.
1	4	25	I	ED
	4	32	IV	ED
2	1	46	I	SI
	3	00	I	TI
	4	03	I	Se
	5	16	I	Te
3	2	25	I	OR
	6	26	II	SI
	23	44	I	Te
4	2	04	III	ER
	3	27	III	OD
5	1	31	II	ED
7	0	59	II	Te
8	6	18	I	ED
9	3	40	I	SI
	4	51	I	TI
	5	56	I	Se
10	0	46	I	ED
	0	53	IV	TI
	4	16	I	OR
	5	27	IV	Te
	23	19	I	TI
11	0	25	I	Se
	1	35	I	Te
	2	24	III	ED
	6	02	III	ER
12	4	06	II	ED
14	0	37	II	TI
	1	09	II	Se
	3	28	II	Te
15	0	47	III	Te
16	5	33	I	SI
	6	41	I	TI
17	2	40	I	ED
	6	06	I	OR
	22	32	IV	ED
18	0	01	I	SI
	1	09	I	TI
	2	18	I	Se
	3	25	IV	ER
	3	25	I	Te
	6	21	III	ED
19	0	33	I	OR
	6	40	II	ED
21	0	51	II	SI
	3	04	II	TI
	3	44	II	Se
	5	55	II	Te
22	0	05	III	Se
	0	57	III	TI
	4	29	III	Te
23	1	02	II	OR
24	4	33	I	ED
25	1	54	I	SI
	2	58	I	TI
	4	11	I	Se
	5	14	I	Te
	23	01	I	ED
26	2	22	I	OR
	21	54	IV	Te
	22	40	I	Se
	23	41	I	Te
28	3	25	II	SI
	5	28	II	TI
	6	18	II	Se
29	0	26	III	SI
	4	03	III	Se
	4	34	III	TI
	22	33	II	ED
30	3	26	II	OR
31	6	26	I	ED

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 1955 Nautical Almanac, give the times of immersion or emersion or both for occultations of stars of magnitude 4.5 or brighter visible at Toronto and at Montreal 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 1955.

LUNAR OCCULTATIONS VISIBLE AT TORONTO AND MONTREAL, 1955

Date	Star	Mag.	I or E	Age of Moon	Toronto E.S.T.	Toronto a	Toronto b	Toronto P	Montreal E.S.T.	Montreal 1	Montreal b	Montreal P
				d	h m	m	m	°	h m	m	m	°
Jan. 7	1 Gem	4.3	I	13.0	4 15.0	−0.2	−1.5	102	4 13.6	−0.2	−1.3	92
Mar. 3	μ Gem	3.2	I	8.6	2 27.1	+0.1	−1.1	84	Low	.....	.....	.....
Mar. 31	ζ Gem	4.0	I	7.0	0 32.5	+0.1	−1.6	115	0 28.9	+0.1	−1.5	106
Apr. 24	υ Tau	4.4	I	2.4	Sun	.....	.....	...	18 52.1	−0.3	−1.7	110
Apr. 24	Mars	1.8	I	2.5	21 35.3	+0.4	−1.3	103	21 30.8	+0.4	−1.1	94
Aug. 26	b Oph	4.3	I	9.3	21 10.0	−1.7	−0.6	78	21 17.7	−1.4	−0.9	80
Sept. 8	A Tau	4.5	I	21.6	4 10.3	−1.8	+0.3	95	4 21.2	−1.8	+0.1	93
Nov. 2	κ Tau	4.4	I	17.5	2 29.8	−1.7	+0.5	73	2 40.6	−1.6	+0.5	66
Nov. 2	κ Tau	4.4	E	17.5	3 43.5	−1.5	−1.1	280	3 48.8	−1.2	−1.6	289
Dec. 25	δ Ari	4.5	I	11.8	20 06.8	−2.1	−0.4	110	20 17.7	−2.0	−0.6	110
Dec. 27	κ Tau	4.4	I	12.9	1 19.3	−1.4	+0.2	56	1 28.2	−1.4	+0.7	42

LUNAR OCCULTATIONS VISIBLE AT VANCOUVER, 1955

Date	Star	Mag.	I or E	Age of Moon	Vancouver P.S.T.	Vancouver a	Vancouver b	Vancouver P
					h m	m	m	°
Jan. 7	1 Gem	4.3	I	13.0	0 38.2	−1.0	−2.3	135
Mar. 2	μ Gem	3.2	I	8.6	23 07.9	−0.6	−2.0	119
3	μ Gem	3.2	E	8.6	0 09.6	−0.6	−1.4	270
30	ζ Gem	4.0	I	7.0	21 14.0	−0.3	−3.1	156
Apr. 24	Mars	1.8	I	2.5	18 28.0	−0.3	−2.8	134
24	Mars	1.8	E	2.5	19 15.0	−0.8	−0.3	231
July 16	τ Tau	4.3	E	26.3	3 04.2	−0.1	+0.9	295
Aug. 12	υ Tau	4.4	I	24.1	3 46.6	−0.4	+2.4	48
Sept. 8	A Tau	4.5	I	21.6	0 42.4	+0.2	+2.7	31
8	A Tau	4.5	E	21.6	1 26.7	−1.2	+0.4	302
Nov. 1	κ Tau	4.4	I	17.5	22 54.9	——	——	12
1	κ Tau	4.4	E	17.5	23 20.7	——	——	327
Dec. 25	δ Ari	4.5	I	11.8	16 32.0	−0.1	+2.1	45
26	κ Tau	4.4	I	12.9	21 19.9	−1.1	+2.7	37
31	α Cnc	4.3	I	17.3	5 31.9	−0.9	−1.4	102
31	α Cnc	4.3	E	17.3	6 32.3	−0.4	−1.9	309

EPHEMERIS FOR THE PHYSICAL OBSERVATION OF THE SUN, 1955

For 0h Greenwich Civil Time

Date	P	B_0	L_0	Date	P	B_0	L_0
	°	°	°		°	°	°
Jan. 1	+ 2.38	−3.02	223.35	July 5	− 1.22	+3.29	301.64
6	− 0.06	−3.59	157.50	10	+ 1.05	+3.82	235.47
11	− 2.47	−4.14	91.66	15	+ 3.30	+4.32	169.30
16	− 4.84	−4.65	25.82	20	+ 5.51	+4.78	103.14
21	− 7.16	−5.12	319.98	25	+ 7.66	+5.22	36.99
26	− 9.39	−5.56	254.15	30	+ 9.74	+5.62	330.85
31	−11.53	−5.95	188.32	Aug. 4	+11.74	+5.99	264.72
Feb. 5	−13.55	−6.29	122.49	9	+13.64	+6.31	198.61
10	−15.46	−6.59	56.65	14	+15.44	+6.58	132.50
15	−17.23	−6.83	350.82	19	+17.14	+6.82	66.42
20	−18.86	−7.02	284.97	24	+18.70	+7.00	0.34
25	−20.35	−7.15	219.13	29	+20.15	+7.13	294.28
Mar. 2	−21.68	−7.23	153.27	Sept. 3	+21.45	+7.22	228.23
7	−22.85	−7.25	87.39	8	+22.62	+7.25	162.19
12	−23.87	−7.22	21.51	13	+23.64	+7.23	96.17
17	−24.71	−7.13	315.61	18	+24.50	+7.16	30.16
22	−25.39	−6.99	249.69	23	+25.21	+7.03	324.16
27	−25.89	−6.79	183.76	28	+25.76	+6.85	258.17
Apr. 1	−26.21	−6.55	117.81	Oct. 3	+26.13	+6.63	192.19
6	−26.36	−6.26	51.84	8	+26.33	+6.35	126.22
11	−26.32	−5.92	345.84	13	+26.35	+6.02	60.26
16	−26.10	−5.54	279.83	18	+26.18	+5.65	354.31
21	−25.70	−5.12	213.80	23	+25.83	+5.24	288.36
26	−25.11	−4.67	147.75	28	+25.28	+4.78	222.42
May 1	−24.34	−4.18	81.68	Nov. 2	+24.53	+4.29	156.49
6	−23.39	−3.66	15.59	7	+23.58	+3.76	90.56
11	−22.26	−3.13	309.48	12	+22.44	+3.21	24.64
16	−20.96	−2.57	243.35	17	+21.11	+2.63	318.73
21	−19.50	−1.99	177.22	22	+19.59	+2.02	252.82
26	−17.88	−1.40	111.07	27	+17.89	+1.40	186.92
31	−16.12	−0.80	44.91	Dec. 2	+16.03	+0.77	121.02
June 5	−14.24	−0.20	338.74	7	+14.03	+0.13	55.13
10	−12.24	+0.41	272.56	12	+11.89	−0.51	349.25
15	−10.15	+1.01	206.37	17	+ 9.64	−1.15	283.37
20	− 7.98	+1.60	140.19	22	+ 7.31	−1.78	217.51
25	− 5.75	+2.18	74.01	27	+ 4.92	−2.39	151.64
30	− 3.49	+2.75	7.83	Jan. 1	+ 2.50	−2.99	85.78

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, 1955

No.	Commences	No.	Commences	No.	Commences
1356	Jan. 17.96	1361	June 3.39	1365	Sept. 20.28
1357	Feb. 14.30	1362	June 30.59	1366	Oct. 17.57
1358	Mar. 13.63	1363	July 27.80	1367	Nov. 13.87
1359	Apr. 9.93	1364	Aug. 24.03	1368	Dec. 11.18
1360	May 7.18				

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

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

SATELLITES OF THE SOLAR SYSTEM

Name	Stellar Mag.	Mean Dist. from Planet		Revolution Period			Diameter Miles	Discoverer
		" *	Miles	d	h	m		
Satellite of the Earth								
Moon	−12.6	530	238,857	27	07	43	2160	
Satellites of Mars								
Phobos	12	8	5,800	0	07	39	10?	Hall, 1877
Deimos	13	21	14,600	1	06	18	5?	Hall, 1877
Satellites of Jupiter								
V	13	48	112,600	0	11	57	100?	Barnard, 1892
Io	5	112	261,800	1	18	28	2300	Galileo, 1610
Europa	6	178	416,600	3	13	14	2000	Galileo, 1610
Ganymede	5	284	664,200	7	03	43	3200	Galileo, 1610
Callisto	6	499	1,169,000	16	16	32	3200	Galileo, 1610
VI	14	3037	7,114,000	250	16		100?	Perrine, 1904
VII	16	3113	7,292,000	260	01		40?	Perrine, 1905
X	18	3116	7,300,000	260			15?	Nicholson, 1938
XI	18	5990	14,000,000	692			15?	Nicholson, 1938
VIII	16	6240	14,600,000	739			40?	Melotte, 1908
IX	17	6360	14,900,000	758			20?	Nicholson, 1914
XII	18	—	—		—		15?	Nicholson, 1951
Satellites of Saturn								
Mimas	12	27	115,000	0	22	37	400?	W. Herschel, 1789
Enceladus	12	34	148,000	1	08	53	500?	W. Herschel, 1789
Tethys	11	43	183,000	1	21	18	800?	G. Cassini, 1684
Dione	11	55	234,000	2	17	41	700?	G. Cassini, 1684
Rhea	10	76	327,000	4	12	25	1100?	G. Cassini, 1672
Titan	8	177	759,000	15	22	41	2600?	Huygens, 1655
Hyperion	13	214	920,000	21	06	38	300?	G. Bond, 1848
Iapetus	11	515	2,210,000	79	07	56	1000?	G. Cassini, 1671
Phoebe	14	1870	8,034,000	550			200?	W. Pickering, 1898
Satellites of Uranus								
Miranda	17	9	81,000	1	09	56		Kuiper, 1948
Ariel	16	14	119,000	2	12	29	600?	Lassell, 1851
Umbriel	16	19	166,000	4	03	28	400?	Lassell, 1851
Titania	14	32	272,000	8	16	56	1000?	W. Herschel, 1787
Oberon	14	42	364,000	13	11	07	900?	W. Herschel, 1787
Satellite of Neptune								
Triton	13	16	220,000	5	21	03	3000?	Lassell, 1846
Nereid	19	260	3,460,000	359			200?	Kuiper, 1949

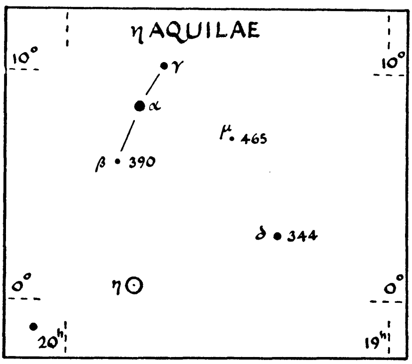
*As seen from the sun.

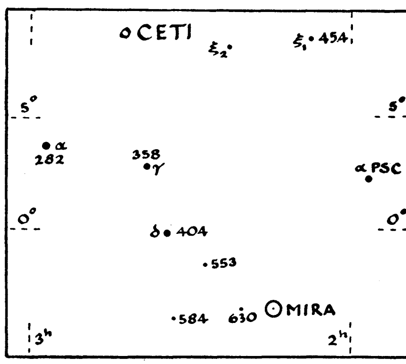
Satellites Io, Europa, Ganymede, Callisto are usually denoted I, II, III, IV respectively, in order of distance from the planet.

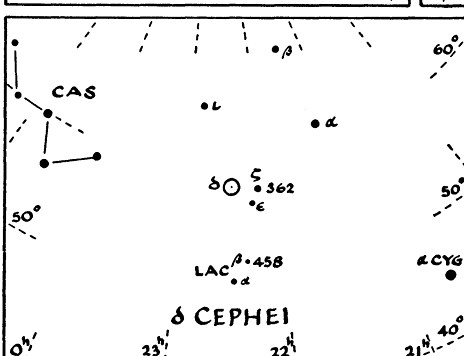
VARIABLE STARS

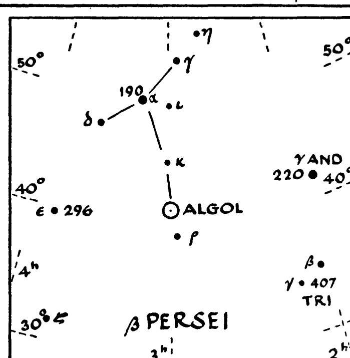
Much pleasure may be derived from the estimation of the brightness of variable stars. Maps of the fields of four bright variable stars are given below. In each case the magnitudes of several suitable comparison stars are given. These magnitudes are given as magnitudes, tenths and hundredths, with the decimal point omitted. Thus a star 362 is of magnitude 3.62. To determine the brightness of the variable at any time, carefully estimate the brightness as some fraction of the interval between two comparison stars, one brighter and one fainter than the variable. The result may then be expressed in magnitudes and tenths. Record the magnitude 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. Such studies of naked-eye estimates of brightness will at once reveal the differences in variation between the different kinds of variable. For each short period variable the observations made on any one cycle may be carried forward one, two or any number of periods to form a combined light curve.

For the two cepheids, good mean curves may be readily found by observing the variables once a night on as many nights as possible. For Algol, which changes rapidly for a few hours before and after minimum, estimates should be made at quarter or half hour intervals around the times of minimum as tabulated on pages 31–53. Mira may be observed for a couple of months as it rises from the naked-eye limit to 2nd or 3rd magnitude maximum and fades again.









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

[1]oCet (Mira); [2]αOri (Betelgeuse); [3]βPer (Algol); [4]αUMi (Polaris).

*ε Aurigae is predicted to enter eclipse on June 6, 1955; the eclipse will last about two years.

The designation (Harvard) gives the 1900 position of the variable; here the first two figures give the hours, and the next two figures the minutes of R.A., while the last two figures give the declination in degrees, italicised for southern declinations. Thus the position of the fourth star of the list, δ Cep (222557) is R.A. 22h 25m, Dec. + 57°. The period is in days and decimals of a day. The type is based on the classification of Gaposchkin and Gaposchkin's comprehensive text-book, *Variable Stars*. The abbreviations here used are: Ecl, Eclipsing Binaries; LPV, Long Period Variables; Semi R, Semiregular; Cep, Cepheids; Clus, cluster type; Nova; SS Cyg and R Cr B, irregular variables of which SS Cygni and R Coronae Borealis are prototypes; and Irr, other irregular variables.

DOUBLE AND MULTIPLE STARS

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

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

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

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

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

The accompanying table provides a list of double stars, selected on account of their brightness, suitability for small telescopes, or particular astrophysical interest. The data are taken chiefly from Aitken's *New General Catalogue of Double Stars*, and from the Yale *Catalogue of Bright Stars*. Successive columns give the star, its 1950 equatorial coordinates, the magnitudes and spectral classes of its components, their separation, in seconds of arc, and the approximate distance of the double star in light years. The last column gives, for binary stars of well determined orbits, the period in years, and the mean separation of the components in astronomical units. For stars sufficiently bright to show colour differences in the telescope used, the spectral classes furnish an indication of the colour. Thus O and B stars are bluish white, A and F white, G yellow, K orange and M stars reddish.

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

REPRESENTATIVE DOUBLE STARS

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

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

THE BRIGHTEST STARS†

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

The accompanying table contains the principal facts regarding 259 stars brighter than apparent magnitude 3.51 which it is thought may be of interest to our amateur members. The various columns should be self-explanatory but some comments may be in order.

The first column gives the name of the star and if it is preceded by the sign || such means that the star is a visual double and the combined magnitude is entered in the fourth column. Besides the 43 thus indicated there are 12 others on the list with faint companions but for these it is not thought that there is any physical connection. In the case of the 20 stars variable in light this fourth column shows their maximum and minimum magnitudes. The 19 first magnitude stars are set up in bold face type.

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

The parallaxes are taken from the Yale Catalogue of Stellar Parallaxes 1935, the mean of the trigonometric and spectroscopic being adopted. The few negative trigonometric parallaxes were adjusted by Dyson's tables before being combined with the spectroscopic. The distance is given also in light years in the eighth column as to the lay mind that seems a fitting unit. The absolute magnitudes in the ninth column are the magnitudes the stars would have if all were at a uniform distance of 32.6 light years ($\pi = 0.''1$). At that distance the sun would appear as a star of magnitude 4.8.

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

Of the 259 stars or star systems here listed 146 are south and 113 north of the equator. This is to be expected from the fact that the northern half of the sky includes less of the Milky Way than the southern.

The number in each spectral class, apart from the one marked peculiar, is as follows: O, 3; B, 74; A, 55; F, 22; G, 43, K, 42 and M, 19. The B-stars are intrinsically luminous and appear in this list out of all proportion to their total number. The stars in Classes A and K are by far the most numerous but the revision of types throws many originally labelled K back into the G group.

From the last column we see that 98 velocities are starred, indicating that 38 per cent of the bright stars, or at least one in every three, are binary in character. For visual binaries the proportion has usually been listed as one in nine. Our list shows one in six but it is only natural to expect that we would observe a higher proportion among the nearby stars, such as these are on the average.

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

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

Star	R.A. 1950	Decl. 1950	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
α Andr........	0 6	+28 49	2.2	A1	.217	.034	96	−0.1	−13.0*
β Cass........	6	+58 52	2.4	F2	.561	.080	41	1.9	+11.4
γ Pegs........	11	+14 54	2.9	B2	.015	.005	652	−3.6	+ 5.0*
β Hydi........	23	−77 32	2.9	G0	2.243	.162	21	4.0	+22.8
α Phoe........	24	−42 35	2.4	G5	.448	.040	81	0.4	+74.6*
δ Andr........	37	+30 35	3.5	K3	.167	.026	125	0.6	− 7.1*
α Cass........	38	+56 16	2.2–2.8	G8	.062	.018	181	−1.5	− 3.8
β Ceti........	41	−18 16	2.2	G7	.233	.052	63	0.8	+13.1
‖γ Cass........	54	+60 27	2.2	B0e	.031	.035	93	−0.1	− 6.8
‖β Phoe........	1 04	−46 59	3.4	G4	.043	.020	163	−0.1	− 1.2
β Andr........	07	+35 21	2.4	M0	.219	.041	79	0 5	+ 0.1
δ Cass........	23	+59 59	2.8–2.9	A3	.308	.050	65	1.3	+ 6.8
γ Phoe........	26	−43 34	3.4	M1	.223	.008	407	−2.1	+25.7*
α Erid........	36	−57 29	0.6	B9	.093	.046	71	−1.1	+19.
‖α U Min......	49	+89 02	2.3–2.4	F7	.043	.008	407	−3.4	−17.4*
ε Cass........	51	+63 25	3.4	B5	.043	.011	296	−1.4	− 8.1
β Arie........	52	+20 34	2.7	A3	.150	.066	49	1.8	− 0.6*
α Hydi........	57	−61 49	3.0	A7	.255	.080	41	2.5	+ 7.0*
‖γ Andr........	2 01	+42 05	2.3	K0	.073	.020	163	−1.2	−11.7
α Arie........	04	+23 14	2.2	K2	.242	.045	72	0.5	−14.3
β Tria........	07	+34 45	3.1	A6	.161	.029	112	0.4	+10.4*
‖o Ceti........	17	− 3 12	1.7–9.6	M6e	.239	.013	251	−2.7	+57.8*
‖θ Erid........	56	−40 30	3.4	A2	.068	.032	102	0.9	+11.9*
α Ceti........	3 00	+ 3 54	2.8	M1	.080	.018	181	−0.9	−25.7
γ Pers........	01	+53 19	3.1	F9	.012	.017	192	−0.7	+ 1.0*
ρ Pers........	02	+38 39	3.3–4.1	M6	.176	.024	136	0.3	+28.2
β Pers........	05	+40 46	2.1–3.2	B8	.011	.033	99	−0.3	+ 5.7*
α Pers........	21	+49 41	1.9	F4	.041	.017	192	−2.0	− 2.4
δ Pers........	39	+47 38	3.1	B5	.047	.012	272	−1.5	−10. *
‖η Taur........	45	+23 57	3.0	B5p	.053	.014	233	−1.3	+10.3
γ Hydi........	48	−74 24	3.2	M3	.124	.008	407	−2.3	+16.0
ζ Pers........	51	+31 44	2.9	B1	.023	.008	407	−2.6	+20.9
‖ε Pers........	54	+39 52	3.0	B2	.041	.006	543	−3.1	− 6 *
γ Erid........	56	−13 39	3.2	M0	.133	.012	272	−1.6	+61.7
λ Taur........	58	+12 21	3.8–4.2	B3	.015	.008	407	−2.2	+13.0*
α Reti........	4 14	−62 36	3.4	G5	.070	.016	204	−0.6	+35.6

α U Min, *Polaris:* R.A. 1h 52.5m; Dec. + 89° 03′ (1955)

Star	R.A. 1950	Decl. 1950	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
α **Taur**.......	4 33	+16 24	1.1	K8	.205	.060	54	0.0	+54.1
α Dora.......	33	−55 09	3.5	A0p	......	...	.....	......	+25.6
π^3 Orio........	47	+ 6 52	3.3	F5	.474	.124	26	3.8	+24.6
ι Auri........	54	+33 05	2.9	K4	.030	.020	163	−0.6	+17.6
ε Auri........	58	+43 45	3.1–3.8	F2	.015	.006	543	−2.7	−4.1 *
η Auri........	5 03	+41 10	3.3	B3	.082	013	251	−1.1	+ 7.8
ε Leps........	03	−22 26	3.3	K5	.074	.016	204	−0.7	+ 1.0
β Erid........	05	− 5 09	2.9	A1	.117	.055	59	1.6	− 7
μ Leps........	11	−16 16	3.3	A0p	.053	.020	163	−0.2	+27.7
‖β **Orio**........	12	− 8 15	0.3	B8p	.005	.006	543	−5.8	+23.6*
‖α **Auri**........	13	+45 57	0.2	G1	.439	.078	42	−0.3	+30.2
‖η Orio........	22	− 2 26	3.4	B0	.009	.006	543	−2.7	+19.5*
γ Orio........	22	+ 6 18	1.7	B2	.019	.015	217	−2.4	+18.0
β Taur........	23	+28 34	1.8	B8	.180	.028	116	−1.0	+ 8.0
β Leps........	26	−20 48	3.0	G2	.095	.018	181	−0.7	−13.5
‖δ Orio........	29	− 0 20	2.4–2.5	B0	.006	.007	466	−3.4	+19.9*
α Leps........	31	−17 51	2.7	F6	.006	.012	272	−2.1	+24.7
ι Orio........	33	− 5 56	2.9	O8	.007	.021	155	−0.5	+21.5*
ε Orio........	34	− 1 14	1.8	B0	.004	.008	407	−3.7	+25.8
ζ Taur........	35	+21 07	3.0	B3e	.028	.010	326	−2.0	+16.4*
‖ζ Orio........	38	− 1 58	1.8	B0	.012	.011	296	−3.0	+18.8
α Colm.......	38	−34 06	2.8	B8	.036	.022	148	−0.6	+34.6
κ Orio........	45	− 9 41	2.2	B0	.009	.006	543	−3.9	+20.1
β Colm.......	49	−35 47	3.2	K0	.397	.026	125	0.3	+89.4
α **Orio**........	52	+ 7 24	0.5–1.1	M2	.032	.012	272	−4.1	+21.0*
β Auri........	56	+44 57	2.1–2.2	A0p	.046	.052	63	0.7	−18.1*
‖θ Auri........	56	+37 13	2.7	A1	.106	.029	112	0.0	+28.6
η Gemi.......	6 12	+22 31	3.2–4.2	M2	.062	.014	233	−1.1	+21.4*
ζ C Maj......	18	−30 02	3.1	B3	.012	.013	251	−0.7	+33.1*
μ Gemi.......	20	+22 32	3.2	M3	.129	.016	204	−0.8	+54.8
β C Maj......	20	−17 56	2.0	B1	.003	.014	233	−2.3	+34.4*
α **Cari**........	23	−52 40	−0.9	F0	.022	.005	652	−7.4	+20.5
γ Gemi.......	35	+16 27	1.9	A2	.066	.050	65	0.4	−11.3*
ν Pupp.......	36	−43 09	3.2	B8	.021	.023	148	0.0	+28.2*
ε Gemi.......	41	+25 12	3.2	G9	.020	.009	362	−2.0	+ 9.9
ξ Gemi.......	42	+12 57	3.4	F5	.230	.054	60	2.1	+25.1
‖α **C Maj**......	43	−16 39	−1.6	A2	1.315	.386	8	1.3	− 7.5*
α Pict........	48	−61 53	3.3	A5	.271	.....	.....	......	+20.6

Star	R.A. 1950	Decl. 1950	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
τ Pupp..	6 49	−50 33	2.8	G8	.091	.025	130	−0.2	+36 4*
‖ε C Maj.	57	−28 54	1.6	B1	.005	.010	326	−3.4	+27.4
ζ Gemi.......	7 01	+20 39	3.7–4.3	G0p	.007	.005	652	−2.8	+ 6.7*
o^2 C Maj......	01	−23 45	3.1	B5p	.006	.007	466	−2.7	+48.6
δ C Maj......	06	−26 19	2.0	G4p	.003	.006	543	−4.1	+34.3*
L^2 Pupp.......	12	−44 33	3.4–6.2	M5e	.332	.018	181	−0.3	+53.0
π Pupp.......	15	−37 00	2.7	K5	.004	.018	181	−1.0	+15.8
η C Maj......	22	−29 12	2.4	B5p	.007	.012	272	−2.2	+40.4
β C Min......	24	+ 8 23	3.1	B8	.063	.022	148	−0.2	+23 *
σ Pupp.......	28	−43 12	3.3	M0	.191	.016	204	−0.7	+88.1*
α_1 Gemi.......	31	+32 00	2.0	A2	.201	.074	44	1.4	+ 6.0*
α_2 Gemi.......	31	+32 00	2.8	A0	.209	.074	44	2.2	− 1.2*
‖**α C Min**......	37	+5 21	0.5	F5	1.242	.316	10	3.0	− 3.0*
β **Gemi**.......	42	+28 09	1.2	G9	.623	.105	31	1.3	+ 3.3
ξ Pupp.......	47	−24 44	3.5	K1	.004	.006	543	−2.6	+ 3.7*
ζ Pupp.......	8 02	−39 52	2.3	O8	.032	.004	815	−4.7	−24.
ρ Pupp.......	05	−24 10	2.9	F6	.097	.025	130	−0.1	+46.6
γ Velr.........	08	−47 12	2.2	OW9	.002	.....	.....	......	+ 3.5
‖ε Cari........	21	−59 21	1.7	K0	.030	.010	326	−3.3	+11.5
o U Maj......	26	+60 53	3.5	G2	.166	.014	233	−0.8	+19.8
‖δ Velr........	43	−54 32	2.0	A0	.093	.030	109	−0.6	+ 2.2
‖ε Hyda.......	44	+ 6 36	3.5	F9	.193	.012	272	−1.1	+36.8*
ζ Hyda.......	53	+ 6 08	3.3	G7	.101	.026	125	0.3	+22.6
‖ι U Maj......	56	+48 14	3.1	A4	.500	.060	54	2.0	+12.6
λ Velr........	9 06	−43 14	2.2	K4	.024	.016	204	−1.8	+18.4
β Cari........	13	−69 31	1.8	A0	.192	.....	.....	......	− 5.
ι Cari........	16	−59 04	2.2	F0	.023	.....	.....	......	+13.3
α Lync.......	18	+34 36	3.3	K8	.214	.022	148	0.0	+37.4
κ Velr........	21	−54 48	2.6	B3	.017	.017	192	−1.2	+21.7*
α Hyda.......	25	− 8 26	2.2	K4	.036	.018	181	−1.5	− 4.4
θ U Maj......	30	+51 54	3.3	F7	1.096	.072	45	2.6	+15.8
N Velr........	30	−56 49	3.4–4.2	K5	.038	.022	148	0.1	−13.9
ε Leon........	43	+24 00	3.1	G0	.045	.009	362	−2.1	+ 5.1
‖υ Cari........	46	−64 50	3.1	F0	.019	.....	.....	......	+13.6
α **Leon**.......	10 06	+12 13	1.3	B6	.244	.046	71	−0.4	+ 2.6
q Cari........	15	−61 05	3.4	K5	.043	.014	233	−0.9	+ 8.6

Star	R.A. 1950	Decl. 1950	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′				″	″		km./sec.
‖γ Leo.........	10 17	+20 06	2.3	G8	.347	.024	136	−0.8	−36.8
μ U Maj......	19	+41 45	3.2	K4	.082	.031	105	0.7	−20.3*
θ Cari........	41	−64 08	3.0	B0	.022	.007	466	−2.8	+24. *
η Cari........	43	−59 25	1.0–7.4	Pec	.007	.....	.....	......	−25.0
‖μ Velr........	45	−49 09	2.8	G5	.079	.033	99	0 4	+ 6.9
ν Hyda.......	47	−15 56	3.3	K3	.218	.020	163	−0.2	− 1.0
β U Maj......	59	+56 39	2.4	A3	.089	.045	72	0.7	−12.1*
α U Maj......	11 01	+62 01	2.0	G5	.137	.036	91	−0.2	− 8.6*
ψ U Maj......	07	+44 46	3.2	K0	.067	.035	93	0.9	− 3.6
δ Leon........	11	+20 47	2.6	A2	208	.058	56	1.4	−23.2
θ Leon........	12	+15 42	3.4	A2	.103	.025	130	0.4	+ 7.8
λ Cent........	33	−62 45	3.3	B9	.045	.031	105	0.8	+ 7.9
β Leon........	47	+14 51	2.2	A2	.507	.084	39	1.8	− 2.3
γ U Maj......	51	+53 58	2.5	A0	.095	.035	93	0.2	−11.1
δ Cent........	12 06	−50 27	2.9	B3e	.040	.015	217	−1.2	+ 9.
ε Corv........	08	−22 30	3.2	K2	.063	.024	136	0.1	+ 4.9
δ Cruc........	12	−58 28	3.1	B3	.045	.017	192	−0.7	+26.4
δ U Maj......	13	+57 19	3.4	A0	.113	.050	65	1.9	−12.
γ Corv........	13	−17 16	2.8	B8	.159	.024	136	−0.3	− 4.2*
α^1 Cruc........	24	−62 49	1.6	B1	.048	.022	148	−1.7	−12.2*
α^2 Cruc........	24	−62 49	2.1	B3	.048	.022	148	−1.2	+ 0.3*
‖δ Corv........	27	−16 14	3.1	A0	.249	.026	125	0.2	+ 8.7
γ Cruc........	28	−56 50	1.5	M4	.270	.....	.....	......	+21.3
β Corv........	32	−23 07	2.8	G5	.059	.027	121	0.0	− 7.7
α Musc.......	34	−68 52	2.9	B5	.040	.015	217	−1.2	+18.
‖γ Cent........	39	−48 41	2.4	A0	.200	.032	102	−0.1	− 7.5
‖γ Virg........	39	− 1 10	2.9	F0	.561	.080	41	2.4	−19.6
‖β Musc.......	43	−67 50	3.3	B3	.039	.011	296	−1.5	+42. *
β Cruc........	45	−59 25	1.5	B1	.054	.007	466	−4.3	−20. *
ε U Maj......	52	+56 14	1.7	A2	.117	.067	49	0.8	−11.9*
‖α^2 C. Ven......	54	+38 35	2.8	A1	.233	.030	109	0.2	− 3.5
ε Virg........	13 00	+11 14	3.0	G6	.270	.037	88	0.8	−14.0
γ Hyda.......	16	−22 54	3.3	G7	.085	.028	116	0.5	− 5.4
ι Cent........	18	−36 27	2.9	A2	.351	.049	67	1.4	+ 0.1
‖ζ^1 U Maj......	22	+55 11	2.4	A2p	.131	.042	78	0.5	− 9.9*
α **Virg**........	23	−10 54	1.2	B2	.051	.018	181	−2.5	+ 1.6*
ζ Virg........	32	− 0 20	3.4	A2	.285	.038	86	1.3	−13.1

Star	R.A. 1950	Decl. 1950	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec
ε Cent........	13 37	−53 13	2.6	B2	.039	.012	272	−2.0	− 5.6
η U. Maj......	46	+49 34	1.9	B3	.116	.015	217	−2.2	−10 9
μ Cent	47	−42 13	3.3	B3e	.026	.009	362	−1.9	+12.6
ζ Cent........	52	−47 02	3.1	B3	.080	.013	251	−1.3	*
η Boot........	52	+18 39	2.8	G1	.370	.100	33	2.8	− 0.2*
β Cent.......	14 00	−60 08	0.9	B3	.039	.026	125	−2.0	−12. *
π Hyda.......	04	−26 26	3.5	K3	.164	.037	88	1.3	+27.2
θ Cent........	04	−36 07	2.3	G8	.745	.056	58	1.0	+ 1.3
α Boot.......	13	+19 26	0.2	K0	2.287	.102	32	0.2	− 5.1
γ Boot........	30	+38 32	3.0	A3	.182	.063	52	2.0	−35.5
η Cent........	32	−41 56	2.6	B3	.046	.012	272	−2.0	− 0.2*
‖**α Cent**.......	36	−60 38	0.1	G0	3.682	.768	4	4.5	−22.2*
α Circ........	38	−64 46	3.4	F0	.308	.063	52	2.4	+ 7.4
α Lupi........	39	−46 10	2.9	B2	.033	.009	362	−2.3	+ 7.3*
‖ε Boot........	43	+27 17	2.7	G8	.045	.019	172	−0.9	−16.4
‖α^2 Libr........	48	−15 47	2.9	F1	.128	.056	58	1.6	−10. *
β U. Min......	51	+74 22	2.2	K4	.028	.030	109	−0.4	+16.9
β Lupi........	55	−42 56	2.8	B3	.067	.012	272	−1.8	− 0.3*
κ Cent........	56	−41 54	3.4	B2	.034	.011	296	−1.4	+ 9.1*
σ Libr........	15 01	−25 05	3.4	M4	.091	.020	163	−0.1	− 4.3
ζ Lupi........	09	−51 55	3.5	G5	.125	.027	121	0.7	− 9.7
γ Tr. Au......	14	−68 30	3.1	A0	.064	.....	.....	......	0.
β Libr........	14	− 9 12	2.7	B8	.100	.015	217	−1.4	−37. *
δ Lupi........	18	−40 28	3.4	B3	.031	.012	272	−1.2	+ 1.6
γ U. Min......	21	+72 01	3.1	A2	.016	.022	148	−0.2	− 3.9*
ι Drac........	24	+59 08	3.5	K3	.010	.030	109	0.9	−11.1
‖γ Lupi........	32	−41 00	3.0	B3	.038	.013	251	−1.4	+ 6.
α Cor. B......	33	+26 53	2.3	A0	.160	.054	60	1.0	+ 1.0*
α Serp........	42	+ 6 35	2.8	K3	.142	.043	76	1.0	+ 3.0
β Tr. Au......	51	−63 17	3.0	F0	.436	.096	34	2.9	− 0.3
π Scor........	56	−25 58	3.0	B3	.037	.012	272	−1.6	− 3.0*
δ Scor........	57	−22 29	2.5	B1	.039	.011	296	−2.3	−16. *
‖β Scor........	16 03	−19 40	2.8	B3	.029	.016	204	−1.2	− 9.3*
δ Ophi........	12	− 3 34	3.3	K8	.159	.030	109	0.7	−19.8
ε Ophi........	16	− 4 34	3.3	G9	.088	.031	105	0.8	−10.3
‖σ Scor........	18	−25 28	3.1	B1	.033	.009	362	−2.1	− 0.4*
‖η Drac........	23	+61 38	2.9	G5	.062	.038	86	0.8	−14.3

Star	R.A. 1950	Decl. 1950	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	°			″	″			km./sec.
||α **Scor**	16 26	−26 19	1.2	M1	.032	.019	172	−2.4	− 3.2*
β Herc	28	+21 36	2.8	G4	.104	.020	163	−0.7	−25.8*
τ Scor	33	−28 07	2.9	B1	.037	.009	362	−2.3	+ 0.6
ζ Ophi	34	−10 28	2.7	B0	.023	.008	407	−2.8	−19. *
||ζ Herc	39	+31 42	3.0	G0	.601	.105	31	3.1	−70.8*
α Tr. Au	43	−68 56	1.9	K5	.031	.025	130	−1.1	− 3.7
ε Scor	47	−34 12	2.4	G9	.665	.038	86	0.3	− 2.5
μ^1 Scor	48	−37 58	3.1	B3p	.030	.011	296	−1.7	*
ζ Arae	54	−55 55	3.1	K5	.046	.028	116	0.3	− 6.0
κ Ophi	55	+ 9 27	3.1–4.0	K3	290	.042	78	1.2	−55.6
||η Ophi	17 08	−15 40	2.6	A2	.095	.047	69	1.0	− 1.0
η Scor	08	−43 11	3.4	A7	.294	.066	49	2.5	−28.4
ζ Drac	09	+65 47	3.2	B8	.023	.028	116	0.4	−14.1
||α^1 Herc	12	+14 27	3.1–3.9	M7	.030	.008	407	−2.4	−32.5
δ Herc	13	+24 54	3.2	A2	.164	.036	91	1.0	−39. *
π Herc	13	+36 52	3.4	K3	.021	.018	181	−0.3	−25.7
θ Ophi	19	−24 57	3.4	B2	.031	.008	407	−2.1	− 3.6
β Arae	21	−55 29	2.8	K1	.036	.023	142	−0.4	− 0.4
υ Scor	27	−37 15	2.8	B3	.042	.010	326	−2.2	+18. *
α Arae	28	−49 50	3.0	B3e	.090	.015	217	−1.1	− 2.2
β Drac	29	+52 20	3.0	G0	.012	.007	466	−2.8	−20.1
λ Scor	30	−37 04	1.7	B2	.036	.016	204	−2.3	0. *
α Ophi	33	+12 35	2.1	A0	.264	.060	54	1.0	+15. *
θ Scor	34	−42 58	2.0	F0	.012	.024	136	−1.1	+ 1.4
κ Scor	39	−39 00	2.5	B3	.028	.009	362	−2.7	−10. *
β Ophi	41	+ 4 35	2.9	K2	.157	.030	109	0.3	−11.9
ι^1 Scor	44	−40 06	3.1	F8	.004	.008	407	−2.4	−27.6*
||μ Herc	44	+27 45	3.5	G5	.817	.114	28	3.8	−16.1
G Scor	46	−37 02	3.2	K2	.069	.029	112	0.5	+24.7
ν Ophi	56	− 9 46	3.5	G7	.118	.022	148	0.2	+12.4
γ Drac	55	+51 30	2.4	K5	.026	.026	125	−0.5	−27.8
γ Sgtr	18 03	−30 26	3.1	K0	.202	.030	109	0.5	+22.3*
η Sgtr	14	−36 47	3.2	M4	.216	.030	109	0.6	+ 0.5
δ Sgtr	18	−29 51	2.8	K4	.052	.033	99	0.4	−20.0
η Serp	19	− 2 55	3.4	G9	.898	.050	65	1.9	+ 8.9
ε Sgtr	21	−34 25	2.0	A0	.139	.020	163	−1.5	−10.8
λ Sgtr	25	−25 27	2.9	K1	.196	.036	91	0.7	−43.3
α **Lyra**	35	+38 44	0.1	A1	.348	.140	23	0.8	−13.8

Star	R.A. 1950	Decl. 1950	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
ϕ Sgtr........	18 43	−27 03	3.3	B8	.150	.015	217	−0.8	+21.5*
‖β Lyra........	48	+33 18	3.4–4.1	B2p	.011	.006	543	−2.7	−19.0*
σ Sgtr........	52	−26 22	2.1	B3	.067	.021	155	−1.3	−10.7
γ Lyra........	57	+32 37	3.3	B9p	.008	.016	204	−0.7	−21.5*
‖ζ Sgtr........	59	−29 57	2.7	A2	.019	.035	93	0.4	+22.1
ζ Aqil.........	19 03	+13 47	3.0	A0	.103	.038	86	0.9	−25. *
τ Sgtr........	04	−27 45	3.4	K0	.268	.036	91	1.2	+45.4*
π Sgtr........	07	−21 06	3.0	F2	.041	.017	192	−0.8	− 9.8
δ Drac........	13	+67 34	3.2	G8	.135	.028	116	0.4	+24.8
δ Aqil........	23	+ 3 01	3.4	A3	.267	.052	63	2.0	−32.3*
‖β^1 Cygn.......	29	+27 51	3.2	K0	.010	.010	326	−1.8	−23.9*
‖δ Cygn.......	43	+45 00	3.0	A1	.067	.023	116	0.2	−20.
γ Aqil........	44	+10 29	2.8	K3	.018	.018	181	−0.9	− 2.0
α **Aqil**........	48	+ 8 44	0.9	A2	.659	.184	18	2.2	−26.1
θ Aqil........	20 09	− 0 58	3.4	A0	.035	.018	181	−0.3	−28.6*
‖β Capr........	18	−14 56	3.2	F8	.042	.022	148	−0.1	−19.0*
γ Cygn.......	20	+40 06	2.3	F8	.006	.008	407	−3.2	− 7.6
α Pavo.......	22	−56 54	2.1	B3	.087	.014	233	−2.2	+ 1.8*
α Indi........	34	−47 28	3.2	G2	.072	.034	96	0.9	− 1.1
α **Cygn**.......	40	+45 06	1.3	A2p	.004	.002	1630	−7.2	− 6.3*
ϵ Cygn.......	44	+33 47	2.6	G7	.485	.040	81	0.6	−10.5*
ζ Cygn.......	21 11	+30 01	3.4	G6	.061	.018	181	−0.3	+16.9*
α Ceph.......	17	+62 22	2.6	A2	.163	.076	43	2.0	− 8.
β Ceph.......	28	+70 20	3.3–3.4	B1	.013	.006	543	−2.8	− 7.2
β Aqar........	29	− 5 48	3.1	G1	.020	.008	407	−2.4	+ 6.7
ϵ Pegs........	42	+ 9 39	2.5	K2	.028	.014	233	−1.8	+ 5.2
δ Capr........	44	−16 21	3.0	A3	.395	.062	53	2.0	− 6.4*
γ Grus........	51	−37 36	3.2	B8	.114	.020	163	−0.3	− 2.1
α Aqar........	22 03	− 0 34	3.2	G0	.019	.006	543	−2.9	+ 7.6
α Grus........	05	−47 12	2.2	B5	.202	.036	91	0.0	+11.8
α Tucn.......	15	−60 31	2.9	K5	.088	.019	172	−0.7	+42.2*
β Grus........	40	−47 09	2.2	M6	.131	.010	326	−2.8	+ 1.6
η Pegs........	41	+29 58	3.1	G1	.039	.016	204	−0.9	+ 4.4*
α **Psc. A**......	55	−29 53	1.3	A3	.367	.118	28	1.7	+ 6.5
β Pegs........	23 01	+27 49	2.6	M3	.235	.020	163	−0.9	+ 8.6
α Pegs........	02	+14 56	2.6	A0	.077	.033	99	0.2	− 4. *
γ Ceph.......	37	+77 21	3.4	K1	.167	.062	53	2.4	−42.0

STAR CLUSTERS

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

N.G.C.	M	Con.	α 1950 h m	δ ° ′	Cl.	Diam. ′	Mag. B.S.	No.	Int. mag.	Dist l.y.
869		h Per	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 nebulae is added for the better known objects.

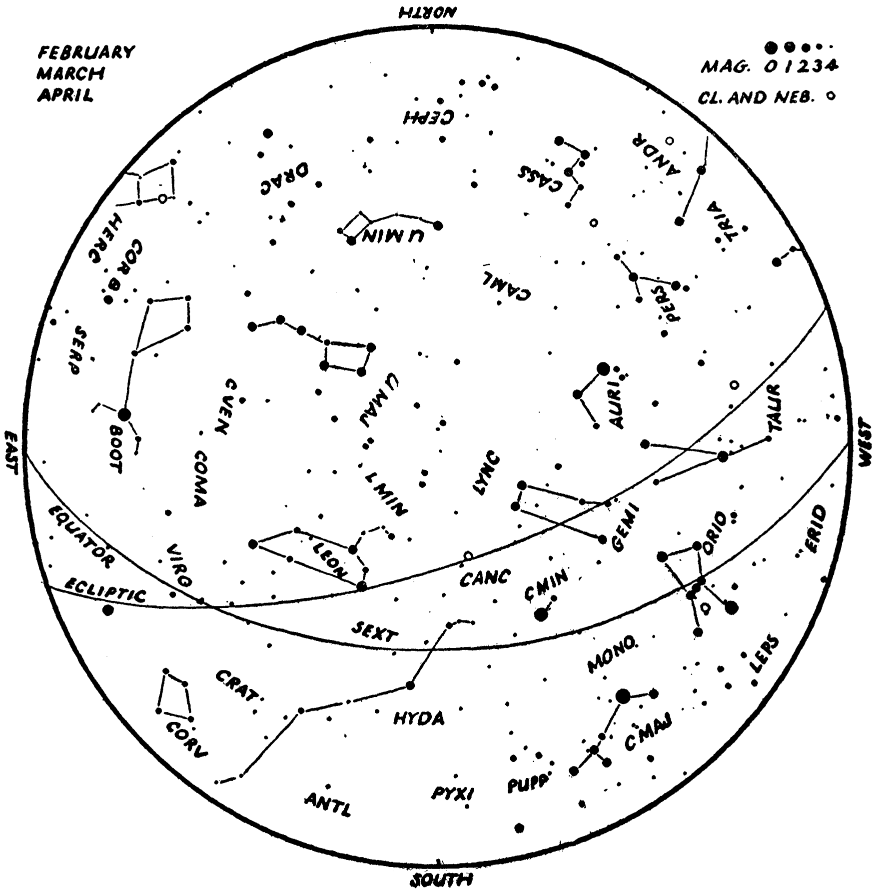
N.G.C.	M	Con	α 1950 h m	δ ° ′	Cl	Size ′	m n	m *	Dist. l.y.	Name
650	76	Per	01 38.3	+51 20	Pl	1.5	11	17	15,000	
1952	1	Tau	05 31.5	+21 59	Pl	6	11	16	4,100	Crab
1976	42	Ori	05 32.5	−05 25	Dif	30			1,800	Orion
B33		Ori	05 38.0	−02 29	Drk	4			300	Horsehead
2261		Mon	06 36.4	+08 47	Dif	2				Hubble's var
2392		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

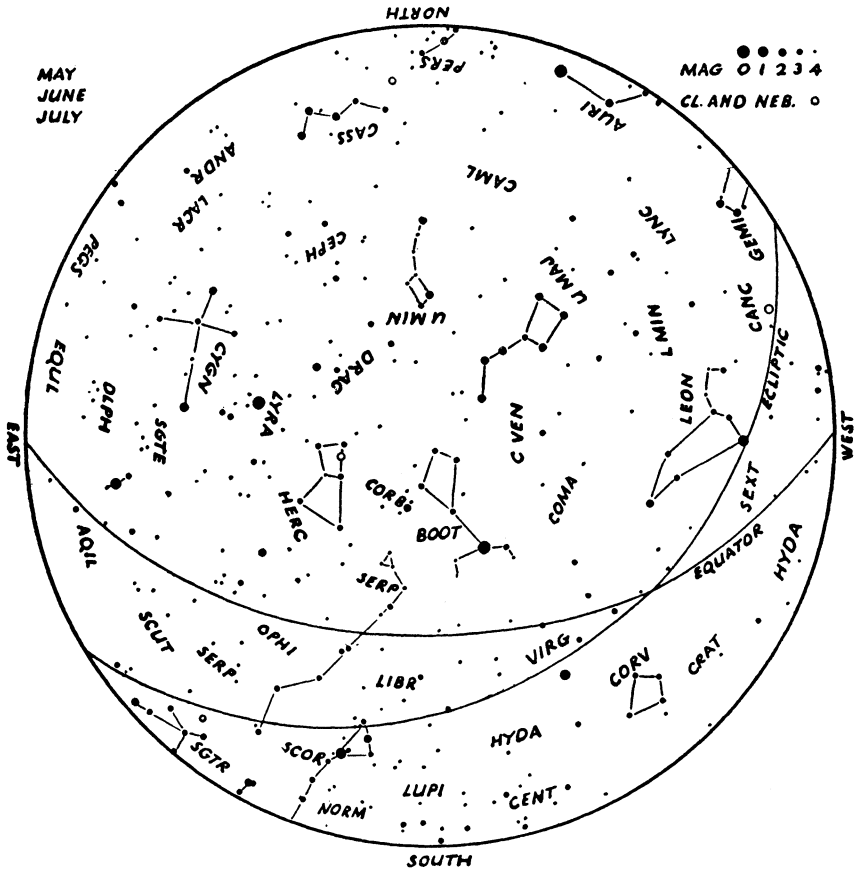


The above map represents the evening sky at

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.

STAR MAP 2

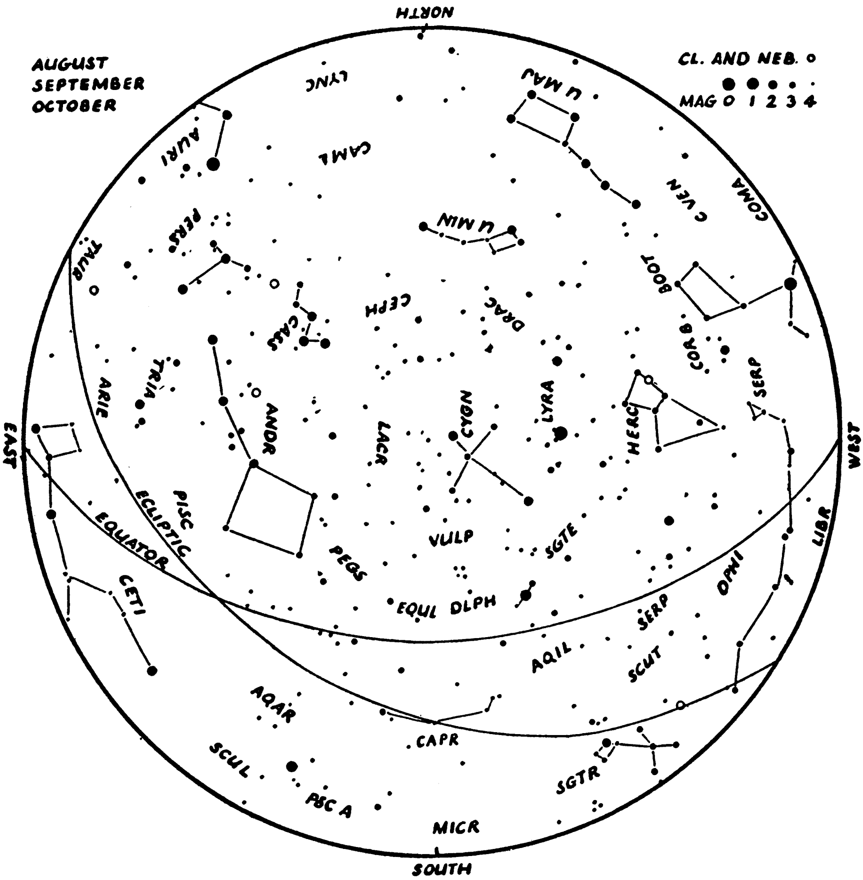


The above map represents the evening sky at

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

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

STAR MAP 3

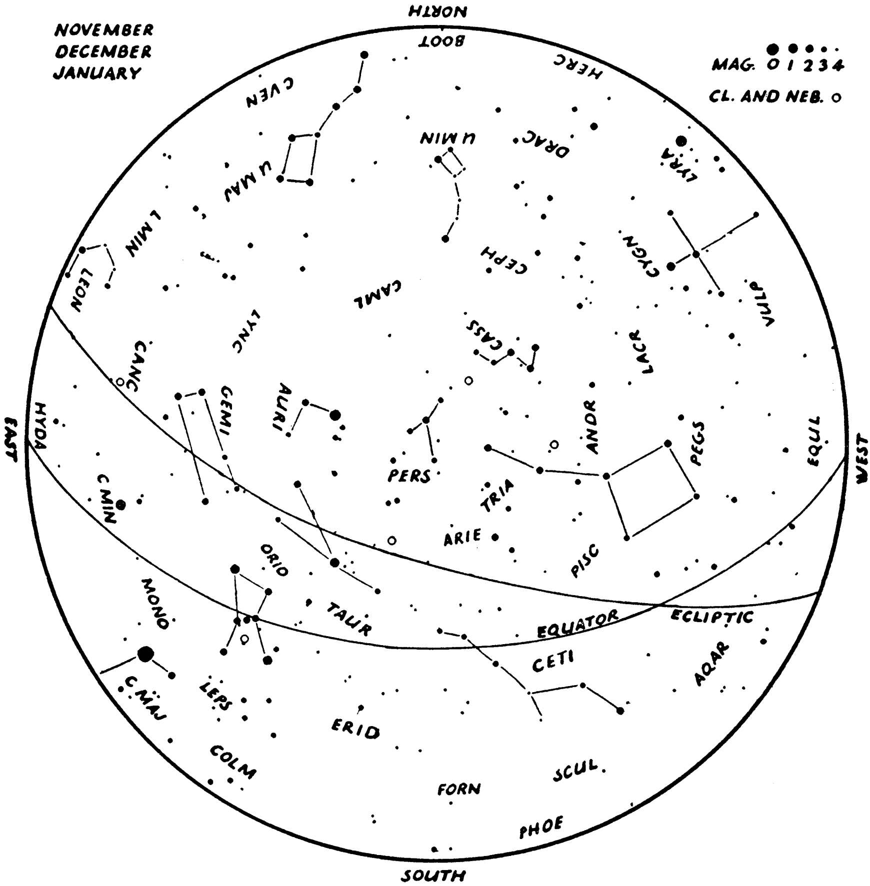


The above map represents the evening sky at

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

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

STAR MAP 4



The above map represents the evening sky at

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

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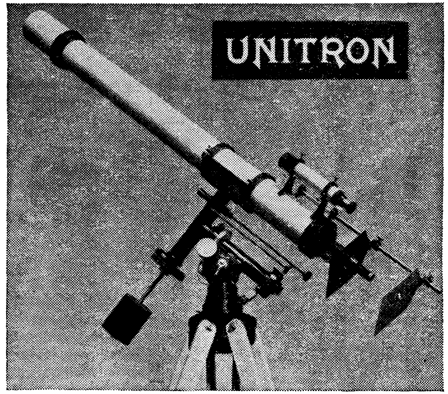

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(SLIDE SET FOUR)

73. Spiral Nebula (Canes Venatici) N.G.C. 4631—edge on
74. Spiral Nebula (Canes Venatici) N.G.C. 4244—edge on
75. Spiral Nebula (Ursa Major) N.G.C. 2681*
76. Spiral Nebula (Canes Venatici) N.G.C. 4736
77. Spiral Nebula (Ursa Major) N.G.C. 2976
78. Spiral Nebula (Leo) N.G.C. 2903
79. Spiral Nebula (Ursa Major) N.G.C. 2841
80. Spiral Nebula (Ursa Major) N.G.C. 3031*
81. Spiral Nebula (Virgo) N.G.C. 5364*
82. Spiral Nebula (Pisces) N.G.C. 628
83. Spiral Nebula (Ursa Major) N.G.C. 5457
84. Spiral Nebula (Virgo) N.G.C. 4595 —edge on*
85. Barred Spiral Nebula (Coma Berenices) N.G.C. 4314
86. Barred Spiral Nebula (Ursa Major) N.G.C. 2685
87. Satellite Nebula (Andromeda) N.G.C. 205
88. Planetary Nebula (Hydra) N.G.C. 3242
89. Globular Star Cluster (Serpens) N.G.C. 5904
90. Whirlpool Nebula (Canes Venatici) N.G.C. 5194-5195
91. Trifid Nebula (Sagittarius) N.G.C. 6514*
92. Ring (planetary) nebula (Lyra) N.G.C. 6720*
93. Crab Nebula (Taurus) N.G.C. 1952*
94. Horsehead Nebula (Orion) Barnard 33*
95. Faint Dwarf Nebula and Stellar System (Sextans)
96. Expanding Nebulosity around Nova Persei (in 1901)

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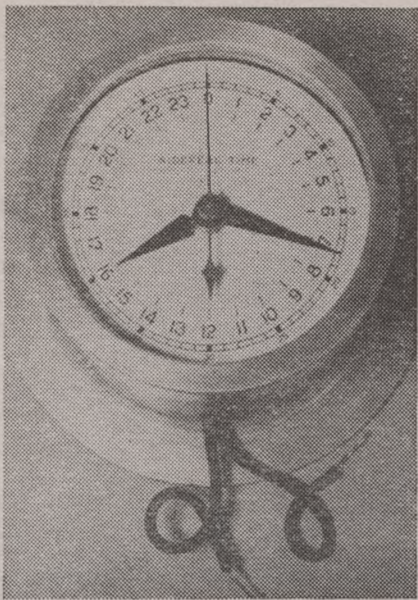

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(2)	Long. C.S.T. zone	6	00	00
(3)	Greenwich time (1) + (2)	27	30	00
(4)	Sid. advance in 27h 30m (p. 8)	4		30
(5)	G. sid. time at 0h (p. 7)	13	09	48
(6)	G. sid. time (3) + (4) + (5)	16	44	18
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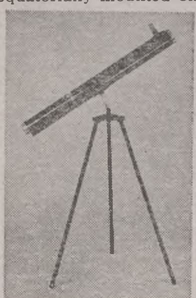

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