THE
OBSERVER'S HANDBOOK
FOR 1953

PUBLISHED BY

The Royal Astronomical Society of Canada

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

FORTY-FIFTH YEAR OF PUBLICATION

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1952

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, 3 Willcocks St., Toronto.

CALENDAR 1953

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 1953 is the 45th issue and its circulation is 5000. The Officers of the Society appreciate the increase in advertisements which will help to meet our mounting expense. With regret the price has been raised to 50 cents.

In this issue the tables for sunrise, sunset, twilight, moonrise and moonset are given for latitude 54°N. instead of 52°N. The range now covers the latitudes of all the centres. 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 Carol Henderson, Frank E. J. Cariou, Eric Harvest, Malcolm Lennox, Donald Morton and Peter Saxton. Our deep indebtedness to the British *Nautical Almanac* and the *American Ephemeris* is thankfully acknowledged.

C. A. CHANT

David Dunlap Observatory,
Richmond Hill, Ont., November 1952.

ANNIVERSARIES AND FESTIVALS, 1953

New Year's Day	Thu.	Jan. 1
Epiphany	Tue.	Jan. 6
Septuagesima Sunday		Feb. 1
Accession of Queen Elizabeth (1952)	Fri.	Feb. 6
Quinquagesima (Shrove Sunday)		Feb. 15
Ash Wednesday		Feb. 18
St. David	Sun.	Mar. 1
St. Patrick	Tue.	Mar. 17
Palm Sunday		Mar. 29
Good Friday		Apr. 3
Easter Sunday		Apr. 5
Birthday of Queen Elizabeth (1926)	Tue.	Apr. 21
St. George	Thu.	Apr. 23
Rogation Sunday		May 10
Ascension Day	Thu.	May 14
Empire Day (Victoria Day)	Sun.	May 24
Pentecost (Whit Sunday)		May 24
Birthday of Dowager Queen Mary (1867)	Sat.	May 30
Trinity Sunday		May 31
Corpus Christi	Thu.	June 4
St. John Baptist (Midsummer Day)	Wed.	June 24
Dominion Day	Wed.	July 1
Birthday of Queen Mother Elizabeth (1900)	Tue.	Aug. 4
Labour Day	Mon.	Sept. 7
Hebrew New Year (Rosh Hashanah)	Thu.	Sept. 10
St. Michael (Michaelmas Day)	Tue.	Sept. 29
All Saints' Day	Sun.	Nov. 1
Remembrance Day	Wed.	Nov. 11
First Sunday in Advent		Nov. 29
St. Andrew	Mon.	Nov. 30
Christmas Day	Fri.	Dec. 25

Thanksgiving Day, date set by Proclamation.

SYMBOLS AND ABBREVIATIONS

SIGNS OF THE ZODIAC

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

SUN, MOON AND PLANETS

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

ASPECTS AND ABBREVIATIONS

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

THE GREEK ALPHABET

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

THE CONFIGURATIONS OF JUPITER'S SATELLITES

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

THE CONSTELLATIONS

Latin and English Names with Abbreviations

Andromeda, (*Chained Maiden*)	And	Andr
Antlia, *Air Pump*	Ant	Antl
Apus, *Bird of Paradise*	Aps	Apus
Aquarius, *Water-bearer*	Aqr	Aqar
Aquila, *Eagle*	Aql	Aqil
Ara, *Altar*	Ara	Arae
Aries, *Ram*	Ari	Arie
Auriga, (*Charioteer*)	Aur	Auri
Bootes, (*Herdsman*)	Boo	Boot
Caelum, *Chisel*	Cae	Cael
Camelopardalis, *Giraffe*	Cam	Caml
Cancer, *Crab*	Cnc	Canc
Canes Venatici, *Hunting Dogs*	CVn	CVen
Canis Major, *Greater Dog*	CMa	CMaj
Canis Minor, *Lesser Dog*	CMi	CMin
Capricornus, *Sea-goat*	Cap	Capr
Carina, *Keel*	Car	Cari
Cassiopeia, (*Lady in Chair*)	Cas	Cass
Centaurus, *Centaur*	Cen	Cent
Cepheus, (*King*)	Cep	Ceph
Cetus, *Whale*	Cet	Ceti
Chamaeleon, *Chamaeleon*	Cha	Cham
Circinus, *Compasses*	Cir	Circ
Columba, *Dove*	Col	Colm
Coma Berenices, *Berenice's Hair*	Com	Coma
Corona Australis, *Southern Crown*	CrA	CorA
Corona Borealis, *Northern Crown*	CrB	CorB
Corvus, *Crow*	Crv	Corv
Crater, *Cup*	Crt	Crat
Crux, (*Southern*) *Cross*	Cru	Cruc
Cygnus, *Swan*	Cyg	Cygn
Delphinus, *Dolphin*	Del	Dlph
Dorado, *Swordfish*	Dor	Dora
Draco, *Dragon*	Dra	Drac
Equuleus, *Little Horse*	Equ	Equl
Eridanus, *River Eridanus*	Eri	Erid
Fornax, *Furnace*	For	Forn
Gemini, *Twins*	Gem	Gemi
Grus, *Crane*	Gru	Grus
Hercules, (*Kneeling Giant*)	Her	Herc
Horologium, *Clock*	Hor	Horo
Hydra, *Water-snake*	Hya	Hyda
Hydrus, *Sea-serpent*	Hyi	Hydi
Indus, *Indian*	Ind	Indi
Lacerta, *Lizard*	Lac	Lacr
Leo, *Lion*	Leo	Leon
Leo Minor, *Lesser Lion*	LMi	LMin
Lepus, *Hare*	Lep	Leps
Libra, *Scales*	Lib	Libr
Lupus, *Wolf*	Lup	Lupi
Lynx, *Lynx*	Lyn	Lync
Lyra, *Lyre*	Lyr	Lyra
Mensa, *Table* (*Mountain*)	Men	Mens
Microscopium, *Microscope*	Mic	Micr
Monoceros, *Unicorn*	Mon	Mono
Musca, *Fly*	Mus	Musc
Norma, *Square*	Nor	Norm
Octans, *Octant*	Oct	Octn
Ophiuchus, *Serpent-bearer*	Oph	Ophi
Orion, (*Hunter*)	Ori	Orio
Pavo, *Peacock*	Pav	Pavo
Pegasus, (*Winged Horse*)	Peg	Pegs
Perseus, (*Champion*)	Per	Pers
Phoenix, *Phoenix*	Phe	Phoe
Pictor, *Painter*	Pic	Pict
Pisces, *Fishes*	Psc	Pisc
Piscis Australis, *Southern Fish*	PsA	PscA
Puppis, *Poop*	Pup	Pupp
Pyxis, *Compass*	Pyx	Pyxi
Reticulum, *Net*	Ret	Reti
Sagitta, *Arrow*	Sge	Sgte
Sagittarius, *Archer*	Sgr	Sgtr
Scorpius, *Scorpion*	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 $= 6.6 \times 10^{21}$ tons; velocity of escape from $\oplus$ = 6.94 miles/sec.

Earth's Orbital Motion

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

Solar Motion

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

The Galactic System

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

Extragalactic Nebulae

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

Radiation Constants

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

Miscellaneous

Constant of gravitation, $G = 6.670 \times 10^{-8}$ c.g.s. units
Mass of the electron, $m = 9.035 \times 10^{-28}$ 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 $= 2.705 \times 10^{19}$ 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	$\pi = 3.141{,}592{,}653{,}6$
= 3437′.75	No. of square degrees in the sky
= 206,265″	$= 41{,}253$

1953 EPHEMERIS OF THE SUN AT 0h GREENWICH CIVIL TIME

Date 1953	Apparent R.A.	Corr. to Sun-dial	Apparent Dec.	Date 1953	Apparent R.A.	Corr. to Sun-dial	Apparent Dec.
	h m s	m s	° ′		h m s	m s	° ′
Jan. 1	18 44 45	+03 22	−23 02.9	July 3	06 46 50	+03 57	+23 00.6
4	18 57 59	+04 45	−22 46.7	6	06 59 12	+04 29	+22 44.9
7	19 11 09	+06 06	−22 26.4	9	07 11 31	+04 58	+22 25.7
10	19 24 14	+07 22	−22 02.1	12	07 23 47	+05 24	+22 03.0
13	19 37 15	+08 33	−21 34.0	15	07 35 58	+05 46	+21 36.9
16	19 50 11	+09 39	−21 02.1	18	07 48 05	+06 03	+21 07.5
19	20 03 00	+10 39	−20 26.5	21	08 00 07	+06 16	+20 34.8
22	20 15 43	+11 31	−19 47.5	24	08 12 04	+06 23	+19 59.1
25	20 28 18	+12 17	−19 05.2	27	08 23 55	+06 24	+19 20.4
28	20 40 46	+12 56	−18 19.8	30	08 35 41	+06 21	+18 38.8
31	20 53 07	+13 27	−17 31.4				
				Aug. 2	08 47 22	+06 12	+17 54.4
Feb. 3	21 05 21	+13 51	−16 40.2	5	08 58 57	+05 58	+17 07.4
6	21 17 27	+14 08	−15 46.4	8	09 10 28	+05 38	+16 17.8
9	21 29 26	+14 17	−14 50.1	11	09 21 53	+05 13	+15 25.9
12	21 41 19	+14 20	−13 51.6	14	09 33 12	+04 44	+14 31.8
15	21 53 04	+14 15	−12 51.0	17	09 44 27	+04 09	+13 35.6
18	22 04 43	+14 05	−11 48.6	20	09 55 37	+03 29	+12 37.5
21	22 16 15	+13 47	−10 44.5	23	10 06 43	+02 45	+11 37.6
24	22 27 42	+13 24	−09 38.9	26	10 17 44	+01 57	+10 36.1
27	22 39 03	+12 55	−08 32.0	29	10 28 42	+01 05	+09 33.0
Mar. 2	22 50 18	+12 22	−07 24.0	Sept. 1	10 39 37	+00 10	+08 28.6
5	23 01 30	+11 43	−06 15.0	4	10 50 29	−00 47	+07 22.9
8	23 12 37	+11 01	−05 05.2	7	11 01 19	−01 47	+06 16.1
11	23 23 42	+10 16	−03 54.9	10	11 12 07	−02 48	+05 08.4
14	23 34 43	+09 27	−02 44.0	13	11 22 54	−03 51	+03 59.9
17	23 45 42	+08 37	−01 32.9	16	11 33 40	−04 55	+02 50.8
20	23 56 39	+07 44	−00 21.8	19	11 44 26	−05 59	+01 41.2
23	00 07 35	+06 51	+00 49.3	22	11 55 12	−07 03	+00 31.2
26	00 18 30	+05 56	+02 00.2	25	12 05 58	−08 06	−00 38.8
29	00 29 25	+05 01	+03 10.6	28	12 16 46	−09 07	−01 49.0
Apr. 1	00 40 20	+04 06	+04 20.5	Oct. 1	12 27 37	−10 07	−02 59.0
4	00 51 15	+03 12	+05 29.7	4	12 38 29	−11 04	−04 08.8
7	01 02 13	+02 20	+06 38.0	7	12 49 25	−11 57	−05 18.1
10	01 13 12	+01 30	+07 45.3	10	13 00 25	−12 47	−06 26.9
13	01 24 14	+00 42	+08 51.5	13	13 11 28	−13 33	−07 34.8
16	01 35 19	−00 03	+09 56.3	16	13 22 37	−14 15	−08 41.8
19	01 46 27	−00 45	+10 59.7	19	13 33 50	−14 52	−09 47.7
22	01 57 38	−01 23	+12 01.4	22	13 45 08	−15 23	−10 52.3
25	02 08 54	−01 57	+13 01.3	25	13 56 33	−15 48	−11 55.4
28	02 20 13	−02 27	+13 59.3	28	14 08 04	−16 07	−12 56.9
				31	14 19 41	−16 19	−13 56.6
May 1	02 31 37	−02 53	+14 55.2				
4	02 43 06	−03 14	+15 48.9	Nov. 3	14 31 26	−16 23	−14 54.3
7	02 54 40	−03 30	+16 40.2	6	14 43 19	−16 20	−15 49.9
10	03 06 19	−03 40	+17 29.1	9	14 55 19	−16 10	−16 43.0
13	03 18 04	−03 45	+18 15.4	12	15 07 26	−15 52	−17 33.6
16	03 29 53	−03 45	+18 58.9	15	15 19 41	−15 27	−18 21.5
19	03 41 48	−03 40	+19 39.4	18	15 32 04	−14 54	−19 06.5
22	03 53 48	−03 30	+20 17.0	21	15 44 34	−14 14	−19 48.4
25	04 05 52	−03 16	+20 51.5	24	15 57 11	−13 27	−20 27.0
28	04 18 00	−02 57	+21 22.7	27	16 09 55	−12 32	−21 02.3
31	04 30 13	−02 34	+21 50.6	30	16 22 45	−11 31	−21 34.0
June 3	04 42 30	−02 07	+22 15.1	Dec. 3	16 35 43	−10 24	−22 02.0
6	04 54 50	−01 37	+22 36.1	6	16 48 45	−09 11	−22 26.2
9	05 07 13	−01 03	+22 53.5	9	17 01 53	−07 53	−22 46.4
12	05 19 39	−00 27	+23 07.3	12	17 15 04	−06 31	−23 02.7
15	05 32 06	+00 11	+23 17.5	15	17 28 19	−05 06	−23 14.8
18	05 44 34	+00 49	+23 23.9	18	17 41 36	−03 39	−23 22.7
21	05 57 03	+01 29	+23 26.7	21	17 54 54	−02 10	−23 26.5
24	06 09 32	+02 07	+23 25.7	24	18 08 13	−00 41	−23 26.0
27	06 21 59	+02 45	+23 21.0	27	18 21 32	+00 49	−23 21.2
30	06 34 26	+03 22	+23 12.6	30	18 34 50	+02 17	−23 12.3

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, 1953

J.D. 2,434,000 plus the following:

Jan. 1	379	May 1	499	Sept. 1	622
Feb. 1	410	June 1	530	Oct. 1	652
Mar. 1	438	July 1	560	Nov. 1	683
Apr. 1	469	Aug. 1	591	Dec. 1	713

The Julian Day commences at noon. Thus J.D. 2,434,379 = 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 52°. The times are given in Local Mean Time, and in the table below are given corrections to change from Local Mean to Standard Time for the cities and towns named.

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
February	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
	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°		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
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
June	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
	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).

TIME OF MOONRISE AND MOONSET, 1953. (Local Mean Time)

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

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

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

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

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

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

THE PLANETS FOR 1953

By C. A. CHANT

THE SUN

The maximum of sun-spot activity in the present sun-spot cycle occurred about March 1947. There have been spotless days during 1952 and the minimum of solar activity is to be expected in 1954 or 1955.

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 1953

Elong. East—Evening Star			Elong. West—Morning Star		
Date	Distance	Mag.	Date	Distance	Mag.
Mar. 2	18°	−0.2	Apr. 15	28°	+0.7
June 27	26°	+0.6	Aug. 13	19°	+0.1
Oct. 23	24°	+0.1	Dec. 1	20°	−0.3

The most favourable elongations to observe are: in the evening, Mar. 2; in the morning, Aug. 13. 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, 1953, Venus is an evening star, crossing the meridian about 3 hours after the sun. Its declination is then 15° south. It continues to separate from the sun until Jan. 31 when it reaches its greatest elongation east. It now moves in towards the sun, reaches greatest brilliancy on Mar. 7 and comes to inferior conjunction with the sun on April 13, after which it is a morning star.

It attains greatest brilliancy again on May 19 and reaches greatest elongation on June 22. It continues a morning star the rest of the year, crossing the meridian half an hour before the sun on Dec. 31.

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.

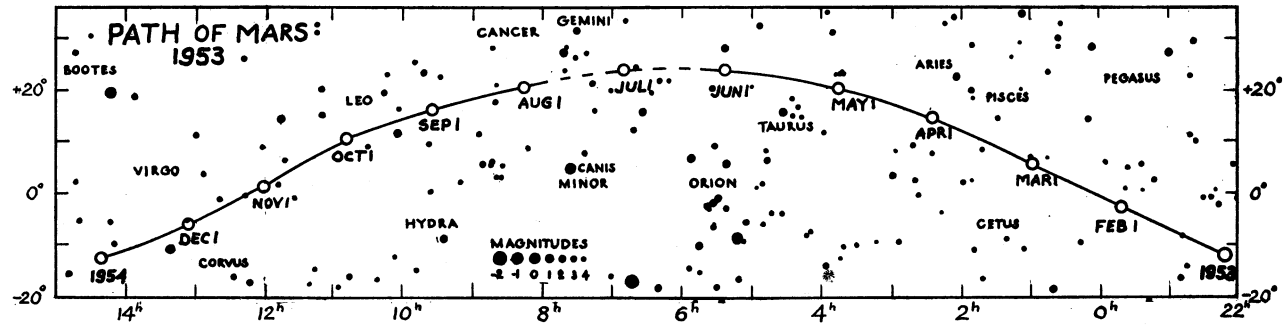
MARS

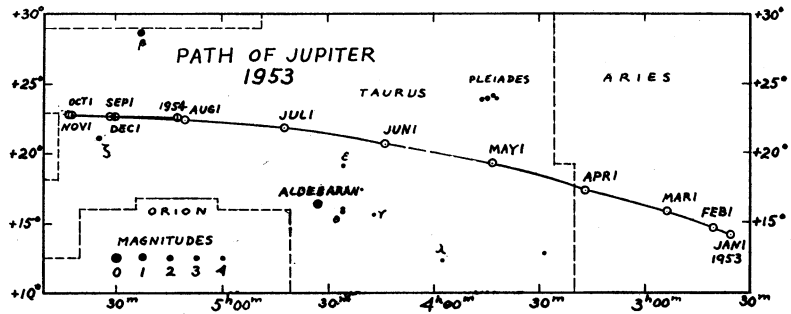
The orbit of Mars is outside that of the earth and consequently its planetary phenomena are quite different from those of the two inferior planets discussed above. Its mean distance from the sun is 141 million miles and the eccentricity of its orbit is 0.093, and a simple computation shows that its distance 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 Mar. 23, 1950; the last opposition was on May 1, 1952, and the following one will be on Sept. 10, 1956. On Jan. 1 it is about as bright as Spica (1.2) and during the rest of the year it is fainter. In November its stellar magnitude is 1.9. For its position among the stars see the map.

JUPITER

Jupiter is the giant of the family of the sun. Its mean diameter is 87,000 miles and its mass is 2½ times that of all the rest of the planets combined! Its mean distance is 483 million miles and the revolution period is 11.9 years. This planet is known to possess 12 satellites, the last discovered in 1951 (see p. 59). Not so long ago it was generally believed that the planet was still cooling down.


PATH OF MARS:
1953
BOOTES
CANCER
GEMINI
LEO
VIRGO
CANIS
MINOR
ORION
TAURUS
ARIES
PISCES
PEGASUS
HYDRA
CETUS
CORVUS
MAGNITUDES
-2 -1 0 1 2 3 4
1954
1953
DEC1
NOV1
OCT1
SEP1
AUG1
JUL1
JUN1
MAY1
APR1
MAR1
FEB1
+20°
0°
-20°
14h
12h
10h
8h
6h
4h
2h
0h
22h


PATH OF JUPITER
1953
TAURUS
PLEIADES
ARIES
ORION
ALDEBARAN
MAGNITUDES
0 1 2 3 4
OCT1
SEP1
1954
AUG1
NOV1
DEC1
JUL1
JUN1
MAY1
APR1
MAR1
FEB1
JAN1
1953
+30°
+25°
+20°
+15°
+10°
30m
5h00m
30m
4h00m
30m
3h00m
30m

from its original high temperature, but from actual measurements of the radiation from it to the earth it has been deduced that the surface is at about −200°F. The spectroscope shows that its atmosphere is largely ammonia and methane.

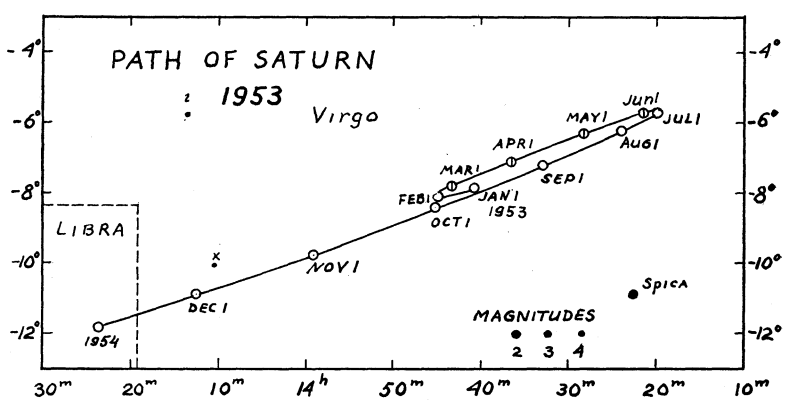
Jupiter is a fine object for the telescope. Many details of the surface as well as the flattening of the planet, due to its short rotation period, are visible, and the phenomena of its satellites provide a continual interest.

On Jan. 1, 1953, Jupiter crosses the meridian at 7.50 p.m. and is an evening star in the constellation Aries (see map). The sun moves over to the planet and they are in conjunction on May 24, and Jupiter becomes a morning star. It then separates from the sun until Dec. 13 when it comes to opposition and is on the meridian at midnight. At this time its distance from the earth is 391,900,000 mi. (see p. 53) and its stellar magnitude −2.3. On Dec. 31 it crosses the meridian at about 10.31 p.m.

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.

The planet is in the constellation Virgo (see map). On April 14 it is in opposition to the sun and is visible all night. Its stellar magnitude then is +0.4, slightly less bright than Rigel. On Oct. 23 it is in conjunction with the sun.

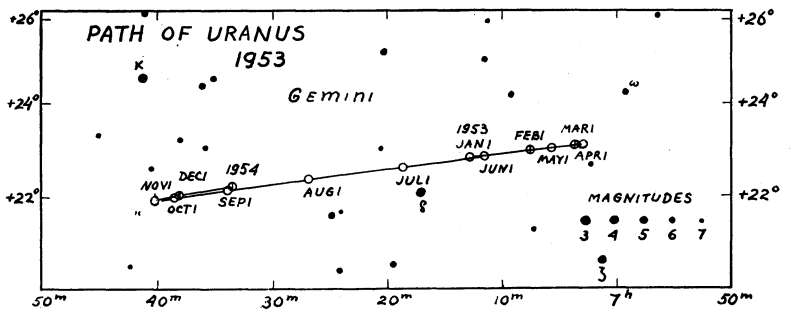


URANUS

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

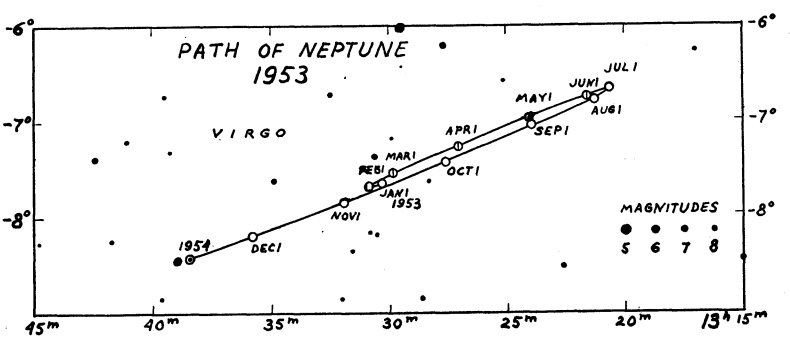
assumed it to be a comet. He could not believe that it was a new planet. However, computation later showed that it was a planet nearly twice as far from the sun as Saturn. Its period of revolution is 84 years and it rotates on its axis in about 11 hours. Its five satellites are visible only in a large telescope. The fifth satellite was discovered by G. P. Kuiper in 1948 at the McDonald Observatory (see p. 59).

As shown by the chart, Uranus in 1953 is in Gemini. On Jan. 6, it is in opposition with the sun; on July 11 in conjunction.



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 1953 Neptune is still in the constellation Virgo. It is in opposition to the sun on April 12. 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. 17.

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 Cancer. It is in opposition to the sun on Feb. 10, 1953, at which time its astrometric position is R.A. $9^h\ 51^m$, Dec. $+23°\ 16'$.

ECLIPSES, 1953

In 1953 there will be five eclipses, three of the sun and two of the moon.

I. *A Total Eclipse of the Moon*, January 29, 1953, the beginning visible in the north-eastern part of North America, the ending visible generally in North America except the extreme north-western part. The whole eclipse is visible generally in Europe, Africa, the Atlantic Ocean and the Arctic; the beginning is not visible in western North America because the moon is below the eastern horizon at this time.

Circumstances of the Lunar Eclipse, January 29, 1953 (E.S.T.)

☾ enters penumbra	15 h	40.1 m	☾ leaves umbra	20 h	40.4 m
☾ enters umbra	16	54.1	☾ leaves penumbra	21	54.5
Middle of eclipse	18	47.3	Magnitude of eclipse		1.337

II. *A Partial Eclipse of the Sun*, February 13–14, 1953, invisible in North America. This eclipse is visible generally over eastern Asia and the western Pacific Ocean.

III. *A Partial Eclipse of the Sun*, July 10–11, 1953, visible in western and far northern Canada and in Greenland. In the western provinces the eclipse takes place just before sunset. The magnitude of greatest eclipse is 0.201.

IV. *A Total Eclipse of the Moon*, July 26, 1953, the beginning visible in North America except the eastern and north-eastern parts, the ending invisible in North America except in the north-western tip. The whole eclipse is visible generally in the Pacific Ocean, Australia and Antarctica; the eclipse is only partly visible in North America because the moon is on the point of setting in these parts at the time of the eclipse.

Circumstances of the Lunar Eclipse, July 26, 1953 (E.S.T.)

☾ enters penumbra	4 h	35.9 m	☾ leaves umbra	9 h	08.8 m
☾ enters umbra	5	32.5	☾ leaves penumbra	10	05.3
Middle of eclipse	7	20.6	Magnitude of eclipse		1.869

V. *A Partial Eclipse of the Sun*, August 9, 1953, invisible in North America. This eclipse is visible generally in the southern tip of South America, the South Pacific and Antarctica.

TRANSIT OF MERCURY

A Transit of Mercury over the sun's disk, November 14, 1953, both the ingress and egress being visible in North America except the extreme north-western part. Within a fraction of a minute the times of ingress and egress are the same all across Canada, namely 10 h 37 m and 13 h 12 m E.S.T. The position angles of ingress and egress are 51° and 356° respectively.

THE SKY MONTH BY MONTH

By J. F. HEARD

THE SKY FOR JANUARY, 1953

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 45m to 20h 57m and its Decl. changes from 23° 03′ S. to 17° 15′ S. The equation of time changes from −3m 22s to −13m 36s. 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. There is a total eclipse of the moon on the evening of the 29th, at least partly visible in North America except extreme north-western regions, see p. 29.

Mercury on the 15th is in R.A. 18h 56m, Decl. 24° 00′ S. and transits at 11.21. Early in the month it is a morning star seen low in the south-east just before sunrise.

Venus on the 15th is in R.A. 22h 50m, Decl. 8° 20′ S. and transits at 15.14. It is an evening star prominent in the south-west for about four hours after sunset. A close conjunction with Mars occurs during the evening of the 17th.

Mars on the 15th is in R.A. 22h 53m, Decl. 7° 58′ S. and transits at 15.16. Moving from Aquarius into Pisces it is low in the south-west during the evening. (See Venus.)

Jupiter on the 15th is in R.A. 2h 36m, Decl. 14° 11′ N. and transits at 18.56. It is well up at sunset and sets a few hours after midnight. On the 5th it is stationary in R.A. and then resumes its eastward motion among the stars. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 54.

Saturn on the 15th is in R.A. 13h 43m, Decl. 8° 03′ S. and transits at 6.05. It is in Virgo east of Spica, rising in the south-east shortly after midnight.

Uranus on the 15th is in R.A. 7h 10m, Decl. 22° 54′ N. and transits at 23.29.

Neptune on the 15th is in R.A. 13h 31m, Decl. 7° 41′ S. and transits at 5.52.

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

By Ruth J. Northcott

JANUARY 75th Meridian Civil Time				Min. of Algol	Phen. of Jupiter's Sat. 21h 45m
d	h	m		h m	
Thu. 1			.....		42013
Fri. 2	1		⊕ in Perihelion. Dist. from ☉, 91,341,000 mi. .		4103*
Sat. 3			Quadrantid meteors.....	19 21	43012
Sun. 4	6		☿ in ♉.....		43210
	17		Moon in Apogee. Dist. from ⊕, 251,800 mi....		
Mon. 5	14		♃ Stationary in R.A.....		d4320
Tue. 6	21		☌♁☉ Dist. from ⊕, 1,651,000,000 mi.	16 10	43012
Wed. 7			.....		41023
Thu. 8	5	09	☾ Last Quarter.....		24013
	21	57	☌♆☾ ♆ 7° 13′ N.....		
Fri. 9	3	57	☌♄☾ ♄ 8° 08′ N.....	12 59	1043*
Sat. 10			.....		30124
Sun. 11			.....		32104
Mon. 12			.....	9 48	32014
Tue. 13			.....		3024*
Wed. 14	3		□♆☉		10234
	12	02	☌☿☾ ☿ 1° 32′ N.....		
	13		☿ in Aphelion.....		
Thu. 15	9	08	● New Moon.....	6 38	20134
Fri. 16	18		Moon in Perigee. Dist. from ⊕, 223,700 mi....		12043
Sat. 17	4		□♄☉		d4012
	21		☌♀♂ ♀ 0° 12′ N.....		
Sun. 18	19	31	☌♂☾ ♂ 4° 02′ S.....	3 27	43120
	20	01	☌♀☾ ♀ 3° 48′ S.....		
Mon. 19			.....		43201
Tue. 20			.....		43102
Wed. 21			.....	0 16	41032
Thu. 22	0	43	☽ First Quarter.....		42013
	21	23	☌♃☾ ♃ 6° 37′ S.....		
Fri. 23			.....	21 05	41203
Sat. 24	20		♀ in ♌.....		40312
Sun. 25	11		♆ Stationary in R.A.....		d3140
Mon. 26			.....	17 55	32014
Tue. 27	18	07	☌♁☾ ♁ 1° 59′ S.....		31024
Wed. 28			.....		d024*
Thu. 29			Total eclipse of ☾. See p. 29.....	14 44	20134
	18	44	☾ Full Moon.....		
Fri. 30			.....		21034
Sat. 31	10		♀ Greatest elongation E., 46° 54′.....		03124

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

THE SKY FOR FEBRUARY, 1953

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 altitudes are for an observer in latitude 45° N.

The Sun—During February the sun's R.A. increases from 20h 57m to 22h 47m and its Decl. changes from 17° 15′ S. to 7° 47′ S. The equation of time changes from −13m 36s to a maximum of −14m 20s on the 12th and then to −12m 34s at the end of the month. On the 13th there is a partial eclipse of the sun visible at sunset in Alaska, see p. 29. 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. 22h 31m, Decl. 10° 45′ S. and transits at 12.54. It is an evening star, seen late in the month low in the west just after sunset. On the 2nd it is in superior conjunction.

Venus on the 15th is in R.A. 0h 41m, Decl. 6° 55′ N. and transits at 15.01. It is an evening star, prominent in the south-west for about four hours after sunset.

Mars on the 15th is in R.A. 0h 20m, Decl. 1° 43′ N. and transits at 14.40. It is in Pisces, low in the south-west during the evening. It is now quite faint.

Jupiter on the 15th is in R.A. 2h 46m, Decl. 15° 05′ N. and transits at 17.04. It is west of the meridian at sunset, setting about midnight. It is second to Venus in brightness. 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. 13h 45m, Decl. 8° 02′ S. and transits at 4.04. It is in Virgo east of Spica, rising just about midnight. On the 5th it is stationary in R.A. and begins to retrograde, or move westward among the stars.

Uranus on the 15th is in R.A. 7h 05m, Decl. 22° 03′ N. and transits at 21.22.

Neptune on the 15th is in R.A. 13h 31m, Decl. 7° 38′ S. and transits at 3.50.

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

FEBRUARY 75th Meridian Civil Time				Min. of Algol	Phen. of Jupiter's Sat. 21h 30m
	d	h	m	h m	
Sun.	1	4	□♃☉	11 33	31O24
		7	Moon in Apogee. Dist. from ⊕, 252,300 mi.		
Mon.	2	18	☌☿☉ Superior		32O41
Tue.	3	21	☿ Greatest Hel. Lat. S		341O*
Wed.	4			8 23	4O312
Thu.	5	5	33 ☌♆☾ ♆ 7° 18′ N		42O3*
		12	52 ☌♄☾ ♄ 8° 19′ N		
		21	♄ Stationary in R.A.		
Fri.	6	23	09 ☾ Last Quarter		421O3
Sat.	7			5 12	4O132
Sun.	8				431O2
Mon.	9				432O1
Tue.	10	20	☌♇☉ Dist. from ⊕, 3211,000,000 mi.	2 01	341O*
Wed.	11				3O412
Thu.	12			22 51	21O34
Fri.	13		Partial eclipse of ☉. See p. 29		21O34
		20	10 ● New Moon		
Sat.	14	5	Moon in Perigee. Dist. from ⊕, 221,900 mi.		O1234
		14	16 ☌☿☾ ☿ 3° 48′ S		
Sun.	15			19 40	13O24
Mon.	16	17	41 ☌♂☾ ♂ 5° 12′ S		32O14
Tue.	17	3	51 ☌♀☾ ♀ 2° 14′ S		312O4
Wed.	18			16 29	3O124
Thu.	19	8	45 ☌♃☾ ♃ 6° 26′ S		12O43
Fri.	20	12	44 ☽ First Quarter		d24O3
Sat.	21			13 19	4O23*
Sun.	22	22	☿ in ♌		413O2
Mon.	23	22	13 ☌♁☾ ♁ 2° 02′ S		432O1
Tue.	24			10 08	4312O
Wed.	25				43O12
Thu.	26				d41O3
Fri.	27	13	☿ in Perihelion	6 57	24O13
		15	♀ in Perihelion		
Sat.	28	9	Moon in Apogee. Dist. from ⊕, 252,500 mi.		O243*
		13	59 ☍ Full Moon		

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

THE SKY FOR MARCH, 1953

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 47m to 0h 40m and its Decl. changes from 7° 47′ S. to 4° 20′ N. The equation of time changes from −12m 33s to −4m 6s. On the 20th at 17h 13m 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. 23h 57m, Decl. 3° 34′ N. and transits at 12.23. It is at greatest eastern elongation on the 2nd and may be seen at this time as an evening star low in the west just after sunset. On the 18th it is at inferior conjunction.

Venus on the 15th is in R.A. 1h 43m, Decl. 17° 15′ N. and transits at 14.11. It is an evening star, very bright, seen low in the west for about three hours after sunset.

Mars on the 15th is in R.A. 1h 37m, Decl. 10° 03′ N. and transits at 14.07. It moves from Pisces into Aries. It is low in the west in the early evening.

Jupiter on the 15th is in R.A. 3h 03m, Decl. 16° 27′ N. and transits at 15.32. It is prominent in the west after sunset for about four hours, being second to Venus in brightness. 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. 13h 41m, Decl. 7° 32′ S. and transits at 2.10. It is in Virgo, east of Spica, rising about three hours after sunset.

Uranus on the 15th is in R.A. 7h 03m, Decl. 23° 06′ N. and transits at 19.30.

Neptune on the 15th is in R.A. 13h 29m, Decl. 7° 26′ S. and transits at 1.58.

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

MARCH

75th Meridian Civil Time

	d	h	m			Min. of Algol h m	Phen. of Jupiter's Sat. 21h 00m
Sun.	1						d1O24
Mon.	2	3		☿	Greatest elongation E., 18° 10′	3 47	32O14
Tue.	3						312O4
Wed.	4	10	57	☌♆☾	♆ 7° 14′ N		3O124
		17	47	☌♄☾	♄ 8° 20′ N		
Thu.	5					0 36	1O234
Fri.	6						2O134
Sat.	7	19		♀	Greatest brilliancy, magnitude −4.3	21 25	1O43*
Sun.	8	11		☿	Stationary in R.A.		dO432
		13	26	☾	Last Quarter		
Mon.	9	19		☿	Greatest Hel. Lat. N.		342O1
Tue.	10					18 14	4321O
Wed.	11						43O12
Thu.	12						41O2*
Fri.	13					15 04	42O13
Sat.	14	18		Moon in Perigee. Dist. from ⊕, 222,100 mi.			41O3*
Sun.	15	6	05	●	New Moon		4O132
		14	54	☌☿☾	☿ 0° 18′ S		
Mon.	16					11 53	342O*
Tue.	17	14	58	☌♂☾	♂ 5° 25′ S		321O4
		15	06	☌♀☾	♀ 1° 34′ N		
		18		☌♀♂	♀ 7° 00′ N		
Wed.	18	8		☌☿☉	Inferior		3O124
		10		♂	in ♌		
Thu.	19	1	08	☌♃☾	♃ 6° 06′ S	8 42	1O24*
Fri.	20	17	01	☉ enters ♈, Spring commences. Long. of ☉, 0°.			2O134
Sat.	21	8		♀	Greatest Hel. Lat. N.		12O34
		23		♀	Stationary in R.A.		
Sun.	22	0		♄	Greatest Hel. Lat. N.	5 31	O1324
		3	10	☽	First Quarter		
		18		♁	Stationary in R.A.		
Mon.	23	3	57	☌♁☾	♁ 1° 55′ S		321O4
Tue.	24						321O4
Wed.	25					2 21	34O12
Thu.	26						413O2
Fri.	27	13		Moon in Apogee. Dist. from ⊕, 252,300 mi.		23 10	42O13
Sat.	28						412O3
Sun.	29						4O132
Mon.	30	7	55	○	Full Moon	19 59	d431O
		19		☿	Stationary in R.A.		
Tue.	31	15	29	☌♆☾	♆ 7° 08′ N		d4320
		20	22	☌♄☾	♄ 8° 16′ N		

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

THE SKY FOR APRIL, 1953

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 40 m to 2h 32m and its Decl. changes from 4° 20′ N. to 14° 55′ N. The equation of time changes from − 4m 06s to + 2m 53s, being zero on the 15th; that is, the apparent sun moves from east to west of the mean sun on that date. For changes in the length of the day, see p. 12.

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

Mercury on the 15th is in R.A. 23h 53m, Decl. 3° 07′ S. and transits at 10.22. It is at greatest western elongation on the 15th. A morning star now, but it is too low at sunrise for easy observation.

Venus on the 15th is in R.A. 1h 11m, Decl. 14° 46′ N. and transits at 11.36. It is at inferior conjunction on the 13th and too near the sun for observation.

Mars on the 15th is in R.A. 3h 04m, Decl. 17° 38′ N. and transits at 13.32. Moving from Aries into Taurus, it is seen low in the west just after sunset.

Jupiter on the 15th is in R.A. 3h 29m, Decl. 18° 11′ N. and transits at 13.55. It is seen low in the west for a short time after sunset. 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. 13h 32 m, Decl. 6° 42′ S. and transits at 0.00 and 23.56. On the 14th it is in opposition. Rising about sunset, it is in Virgo just east of Spica.

Uranus on the 15th is in R.A. 7h 04m, Decl. 23° 04′ N. and transits at 17.29.

Neptune on the 15th is in R.A. 13h 26m, Decl. 7° 08′ S. and transits at 23.49.

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

APRIL 75th Meridian Civil Time				Min. of Algol	Phen. of Jupiter's Sat. 20h 45m
d	h	m		h m	
Wed. 1	...		.....		34O12
Thu. 2	5		☿ in ♉	16 48	314O2
Fri. 3			.....		2O134
Sat. 4	9		□♁☉		12O34
Sun. 5			.....	13 38	O1234
Mon. 6	23	58	☾ Last Quarter		d1O24
Tue. 7			.....		32O14
Wed. 8			.....	10 27	3O4**
Thu. 9			.....		31O24
Fri. 10			.....		2O134
Sat. 11	20	31	☌☿☾ ☿ 6° 02′ S	7 16	214O3
Sun. 12	2		Moon in Perigee. Dist. from ⊕, 224,100 mi...		4O123
	12		☿ in Aphelion		
	13		☍♆☉ Dist. from ⊕, 2722,000,000 mi.		
Mon. 13	3		☌☿☉ Inferior		41O32
	12	36	☌☿☾ ☿ 2° 14′ N		
	15	09	● New Moon		
Tue. 14	0		☍♄☉ Dist. from ⊕, 808,800,000 mi..	4 05	432O1
Wed. 15	5		☿ Greatest elongation W., 27° 36′		431O*
	11	03	☌♂☾ ♂ 4° 48′ S		
	20	37	☌♃☾ ♃ 5° 42′ S		
Thu. 16			.....		d43O2
Fri. 17			.....	0 54	42O13
Sat. 18			.....		421O3
Sun. 19	12	24	☌♁☾ ♁ 1° 39′ S	21 43	4O123
Mon. 20	19	40	☽ First Quarter		1O324
Tue. 21			Lyrid meteors		32O14
Wed. 22			.....	18 32	312O4
Thu. 23			.....		3O124
Fri. 24	3		Moon in Apogee. Dist. from ⊕, 251,800 mi...		204**
Sat. 25			.....	15 21	21O34
Sun. 26			.....		O2134
Mon. 27	11		☌♂♃ ♂ 1° 09′ N		1O432
	16		☌☿♀ ☿ 7° 14′ S		
	20	40	☌♆☾ ♆ 7° 07′ N		
	23	00	☌♄☾ ♄ 8° 14′ N		
Tue. 28	23	20	♋ Full Moon	12 10	234O1
Wed. 29			.....		3412O
Thu. 30			.....		43O12

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

THE SKY FOR MAY, 1953

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 32m to 4h 34m and its Decl. changes from 14° 55′ N. to 21° 59′ N. The equation of time changes from +2m 53s to a maximum of +3m 46s on the 14th and then to +2m 25s 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. 2h 43m, Decl. 14° 32′ N. and transits at 11.16. On the 24th it is at superior conjunction and is too near the sun for observation.

Venus on the 15th is in R.A. 1h 02m, Decl. 6° 55′ N. and transits at 9.31. It is a morning star seen low in the east just before sunrise.

Mars on the 15th is in R.A. 4h 31m, Decl. 22° 28′ N. and transits at 13.00. It is too low in the west at sunset for easy observation.

Jupiter on the 15th is in R.A. 3h 57m, Decl. 19° 46′ N. and transits at 12.25. On the 24th it is in conjunction and too near the sun for observation.

Saturn on the 15th is in R.A. 13h 25m, Decl. 5° 57′ S. and transits at 21.50. It is in Virgo just north of Spica and well up in the east at sunset.

Uranus on the 15th is in R.A. 7h 08m, Decl. 22° 57′ N. and transits at 15.35.

Neptune on the 15th is in R.A. 13h 23m, Decl. 6° 51′ S. and transits at 21.49.

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

MAY

75th Meridian Civil Time

	d	h	m		Min. of Algol h m
Fri.	1	21		☿ Stationary in R.A.	9 00
Sat.	2	20		☿ Greatest Hel. Lat. S.	
Sun.	3				
Mon.	4			Eta Aquarid meteors	5 49
Tue.	5				
Wed.	6	7	21	☾ Last Quarter	
Thu.	7				2 38
Fri.	8				
Sat.	9				23 27
Sun.	10	0		Moon in Perigee. Dist. from ⊕, 227,200 mi.	
		14	14	☌☿☾ ☿ 4° 01′ S.	
Mon.	11				
Tue.	12	3	31	☌☿☾ ☿ 6° 59′ S.	20 16
Wed.	13	0	06	● New Moon	
		17	01	☌♃☾ ♃ 5° 18′ S.	
Thu.	14	6	13	☌♂☾ ♂ 3° 39′ S.	
Fri.	15				17 05
Sat.	16	10		☿ in ♉	
		23	07	☌♁☾ ♁ 1° 20′ S.	
Sun.	17				
Mon.	18				13 53
Tue.	19	1		☿ Greatest brilliancy, magnitude −4.2	
Wed.	20	13	20	☽ First Quarter	
Thu.	21	21		Moon in Apogee. Dist. from ⊕, 251,200 mi.	10 42
		21		☿ in ♌	
Fri.	22				
Sat.	23				
Sun.	24	8		☌☿☉ Superior	7 31
		16		☌☿♃ ☿ 1° 09′ N.	
		23		☌♃☉	
Mon.	25	3	14	☌♆☾ ♆ 7° 13′ N.	
		3	32	☌♄☾ ♄ 8° 16′ N.	
Tue.	26	12		☿ in Perihelion	
Wed.	27				4 20
Thu.	28	12	03	☺ Full Moon	
Fri.	29				
Sat.	30				1 09
Sun.	31	6		☌♄♆ ♄ 1° 02′ N.	

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

Jupiter being near the sun, phenomena of the satellites are not given from May 1 to June 20.

THE SKY FOR JUNE, 1953

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 34m to 6h 39m and its Decl. changes from 21° 59′ N. to 23° 27′ N. at the solstice on the 21st and then to 23° 09′ N. at the end of the month. The equation of time changes from 2m 25s to −3m 34s, being zero on the 14th; that is the apparent sun changes from being west of the mean sun to being east of it. 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. 7h 06m, Decl. 24° 31′ N. and transits at 13.37. Late in the month it is an evening star which may be seen low in the west just after sunset. On the 27th it is at greatest eastern elongation.

Venus on the 15th is in R.A. 2h 27m, Decl. 11° 35′ N. and transits at 8.55. It is a morning star seen low in the east for about two hours before sunrise.

Mars on the 15th is in R.A. 6h 02m, Decl. 24° 15′ N. and transits at 12.30. It is too low in the west at sunset for easy observation.

Jupiter on the 15th is in R.A. 4h 27m, Decl. 21° 07′ N. and transits at 10.54. It is too near the sun for observation until the end of the month. 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. 13h 20m, Decl. 5° 37′ S. and transits at 19.44. It is in Virgo just north of Spica and near the meridian at sunset. On the 24th it is stationary in R.A. and resumes its eastward motion among the stars.

Uranus on the 15th is in R.A. 7h 15m, Decl. 22° 45′ N. and transits at 13.40.

Neptune on the 15th is in R.A. 13h 21m, Decl. 6° 41′ S. and transits at 19.45.

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

JUNE

75th Meridian Civil Time

	d	h	m		h m	Phen. of Jupiter's Sat. 4h 45m
Mon.	1			.....	21 58	
Tue.	2	5		☌☿☌ ☿ 0° 57′ N.....		
Wed.	3			.....		
Thu.	4	12	35	☾ Last Quarter.....	18 47	
Fri.	5	9		Moon in Perigee. Dist. from ⊕, 229,700 mi....		
		18		☿ Greatest Hel. Lat. N.....		
Sat.	6			.....		
Sun.	7			.....	15 35	
Mon.	8	3	22	☌♀☾ ♀ 8° 04′ S.....		
Tue.	9			.....		
Wed.	10	12	33	☌♃☾ ♃ 4° 56′ S.....	12 24	
Thu.	11	9	55	● New Moon.....		
Fri.	12	1	00	☌♂☾ ♂ 2° 11′ S.....		
Sat.	13	2	05	☌☿☾ ☿ 0° 08′ N.....	9 13	
		10	41	☌♁☾ ♁ 1° 05′ S.....		
Sun.	14			.....		
Mon.	15			.....		
Tue.	16	2		☌☿♁ ☿ 1° 27′ N.....	6 02	
Wed.	17			.....		
Thu.	18	16		Moon in Apogee. Dist. from ⊕, 251,100 mi....		
Fri.	19	7	01	☽ First Quarter.....	2 51	
		23		♀ in Aphelion.....		
Sat.	20			.....		43102
Sun.	21	10	34	☌♄☾ ♄ 8° 19′ N.....	23 39	4201*
		11	00	☌♆☾ ♆ 7° 22′ N.....		
		12	00	☉ enters♋, Summer commences. Long. of ☉, 90°		
Mon.	22	5		♀ Greatest elongation W., 45° 46′.....		4203*
Tue.	23			.....		41023
Wed.	24	14		♄ Stationary in R.A.....	20 28	40213
Thu.	25			.....		42130
Fri.	26	22	29	○ Full Moon.....		34021
Sat.	27	12		☿ Greatest elongation E., 25° 31′.....	17 17	31042
Sun.	28			.....		23014
Mon.	29	5		☿ in♉.....		21034
Tue.	30	19		Moon in Perigee. Dist. from ⊕, 228, 300 mi...	14 05	d0234

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

THE SKY FOR JULY, 1953

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 39m to 8h 43m and its Decl. changes from 23° 09′ N. to 18° 09′ N. The equation of time changes from −3m 34s to a maximum of −6m 24s on the 26th and then to −6m 15s at the end of the month. On the 5th the earth is in aphelion or farthest from the sun. On the 11th there is a partial eclipse of the sun visible in the north-western part of North America, see p. 29. 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. There is a total eclipse of the moon early in the morning of the 26th, visible in the northern part of North America, see p. 29.

Mercury on the 15th is in R.A. 8h 38m, Decl. 14° 45′ N. and transits at 13.03. Early in the month it is an evening star but later it is too close to the sun for observation. Inferior conjunction is on the 25th.

Venus on the 15th is in R.A. 4h 27m, Decl. 18° 54′ N. and transits at 8.57. It is a brilliant morning star seen in the east for about three hours before sunrise.

Mars on the 15th is in R.A. 7h 29m, Decl. 22° 52′ N. and transits at 11.58. It is in conjunction on the 8th and too near the sun for observation.

Jupiter on the 15th is in R.A. 4h 56m, Decl. 22° 01′ N. and transits at 9.24. It is a morning star seen in the east for about three hours before sunrise. It is second to Venus in brightness. 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. 13h 21m, Decl. 5° 52′ S. and transits at 17.47. It is in Virgo just north of Spica, being visible in the south-west for a few hours after sunset.

Uranus on the 15th is in R.A. 7h 22m, Decl. 22° 31′ N. and transits at 11.50.

Neptune on the 15th is in R.A. 13h 21m, Decl. 6° 41′ S. and transits at 17.47.

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

JULY

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Phen. of Jupiter's Sat. 4h 00m
Wed.	1			.....		O1234
Thu.	2			.....		213O4
Fri.	3	7		♆ Stationary in R.A.	10 54	3O14*
		17	03	☾ Last Quarter		
Sat.	4			.....		31O42
Sun.	5	13		⊕ in Aphelion. Dist. from ☉,94,450,000 mi.		32401
Mon.	6			.....	7 43	421O3
Tue.	7	7	44	☌♀☾ ♀ 7° 45′ S.		4O123
Wed.	8	6	15	☌♃☾ ♃ 4° 36′ S.		4O23*
		16		☌♂☉		
Thu.	9	11		☿ in Aphelion	4 31	421O3
Fri.	10	17		☿ Stationary in R.A.		43201
		19		☌♄♆ ♄ 0° 53′ N.		
		20	01	☌♂☾ ♂ 0° 27′ S.		
		21	28	● New Moon. Partial eclipse. See p. 29..		
		21	43	☌♁☾ ♁ 0° 55′ S.		
Sat.	11	4		☌♁☉		431O2
Sun.	12	6		♀ Greatest Hel. Lat. S.	1 19	43201
		8		☌♂♁ ♂ 0° 33′ N.		
		10	15	☌☿☾ ☿ 2° 48′ S.		
Mon.	13	9		□♄☉		214O3
		16		□♆☉		
Tue.	14			.....	22 08	O1243
Wed.	15			.....		1O234
Thu.	16	10		Moon in Apogee. Dist. from ⊕, 251,600 mi....		d2O34
Fri.	17			.....	18 56	32O14
Sat.	18	19	18	☌♆☾ ♆ 7° 26′ N.		31O24
		19	43	☌♄☾ ♄ 8° 17′ N.		
		23	47	☽ First Quarter		
Sun.	19			.....		d3O14
Mon.	20			.....	15 45	21O34
Tue.	21			.....		O2143
Wed.	22	17		☌♀♃ ♀ 1° 55′ S.		14O23
Thu.	23			.....	12 33	42O13
Fri.	24			.....		432O*
Sat.	25	4		☌☿☉ Inferior		431O2
Sun.	26	7	20	☻ Full Moon. Total eclipse of ☾. See p. 29	9 22	43O21
Mon.	27			.....		421O*
Tue.	28			Delta Aquarid meteors		4O13*
		0		☌☿♂ ☿ 6° 01′ S.		
		9		Moon in Perigee. Dist. from ⊕, 225,200 mi....		
Wed.	29	19		☿ Greatest Hel. Lat. S.	6 11	41O23
Thu.	30			.....		24O13
Fri.	31			.....		23O4*

THE SKY FOR AUGUST, 1953

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

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

The Sun—During August the sun's R.A. increases from 8h 43m to 10h 40m and its Decl. changes from 18° 09′ N. to 8° 29′ N. The equation of time changes from − 6m 15s to − 0m 10s. On the 9th there is a partial eclipse of the sun invisible in North America, see p. 29. 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. 21.

Mercury on the 15th is in R.A. 8h 21m, Decl. 18° 44′ N. and transits at 10.50. It is at greatest western elongation on the 13th, being at this time a good morning star low in the east just before sunrise.

Venus on the 15th is in R.A. 6h 54m, Decl. 21° 33′ N. and transits at 9.22. It is a morning star dominating the eastern sky for about three hours before sunrise.

Mars on the 15th is in R.A. 8h 53m, Decl. 18° 42′ N. and transits at 11.18. It is a morning star but not well placed for observation.

Jupiter on the 15th is in R.A. 5h 21m, Decl. 22° 33′ N. and transits at 7.47. It is a morning star seen in the east before sunrise. It is higher than Venus, but not so bright. 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. 13h 28m, Decl. 6° 38′ S. and transits at 15.52. It is in Virgo just north of Spica, being visible low in the south-west for a few hours after sunset.

Uranus on the 15th is in R.A. 7h 30m, Decl. 22° 16′ N. and transits at 9.56.

Neptune on the 15th is in R.A. 13h 22m, Decl. 6° 53′ S. and transits at 15.47.

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

AUGUST

75th Meridian Civil Time

	d	h	m		Min. of Algol h m	Phen. of Jupiter's Sat. 3h 30m
Sat.	1	22	16	☾ Last Quarter	3 00	31O24
Sun.	2					3O124
Mon.	3				23 49	213O4
Tue.	4	6		☿ Stationary in R.A.		O134*
		21	40	☌ ♃ ☾ ♃ 4° 16′ S		
Wed.	5	21	10	☌ ♀ ☾ ♀ 4° 33′ S		1O234
Thu.	6				20 37	2O134
Fri.	7	7	26	☌ ♁ ☾ ♁ 0° 47′ S		213O4
		21	16	☌ ☿ ☾ ☿ 3° 14′ S		
Sat.	8	15	39	☌ ♂ ☾ ♂ 1° 28′ N		d34O2
Sun.	9			Partial eclipse of ☉. See p. 29	17 26	34O12
		11	10	♋ New Moon		
Mon.	10					42310
Tue.	11					42O13
Wed.	12			Perseid meteors	14 14	41O23
Thu.	13	2		Moon in Apogee. Dist. from ⊕, 252,200 mi.		d4O13
		4		☿ Greatest elongation W., 18° 49′		
Fri.	14					d421O
Sat.	15	3	25	☌ ♆ ☾ ♆ 7° 23′ N	11 03	34O12
		6	13	☌ ♄ ☾ ♄ 8° 09′ N		
		20		☌ ♇ ☉		
Sun.	16					3O42*
Mon.	17	15	08	☽ First Quarter		321O4
		20		☿ in ♌		
Tue.	18				7 52	2O134
Wed.	19					1O234
Thu.	20					O2134
Fri.	21				4 40	21O34
Sat.	22	11		☿ in Perihelion		3O214
		12		☌ ♀ ♁ ♀ 1° 19′ S		
Sun.	23	9		☌ ☿ ♂ ☿ 0° 06′ S		3O24*
Mon.	24	15	21	♋ Full Moon	1 29	d32O4
Tue.	25	13		Moon in Perigee. Dist. from ⊕, 222,700 mi.		42O31
Wed.	26				22 17	41O23
Thu.	27					4O213
Fri.	28					421O3
Sat.	29				19 06	43O1*
Sun.	30					431O2
Mon.	31	5	46	☾ Last Quarter		d432O

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

THE SKY FOR SEPTEMBER, 1953

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 40m to 12h 28m and its Decl. changes from 8° 29′ N. to 2° 59′ S. The equation of time changes from −0m 10s to +10m 7s, the apparent sun passing to the west of the mean sun on the 1st. On the 23rd at 3h 07m 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. 11h 56m, Decl. 1° 40′ N. and transits at 12.23. It is at superior conjunction on the 7th and too near the sun for observation.

Venus on the 15th is in R.A. 9h 26m, Decl. 15° 33′ N. and transits at 9.52. It is a morning star dominating the eastern sky for several hours before sunrise.

Mars on the 15th is in R.A. 10h 11m, Decl. 12° 33′ N. and transits at 10.35. It is very close to Regulus in Leo, rising about two hours before the sun.

Jupiter on the 15th is in R.A. 5h 38m, Decl. 22° 46′ N. and transits at 6.02. It rises about midnight and is prominent in the east until sunrise. It is not as bright as Venus. 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. 13h 38m, Decl. 7° 47′ S. and transits at 14.01. It is in Virgo north-east of Spica, almost too low in the south-west at sunset to be seen.

Uranus on the 15th is in R.A. 7h 36m, Decl. 22° 03′ N. and transits at 8.00.

Neptune on the 15th is in R.A. 13h 26m, Decl. 7° 13′ S. and transits at 13.48.

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

SEPTEMBER

75th Meridian Civil Time

	d	h	m		Min. of Algol	Phen. of Jupiter's Sat. 3h 00m
					h m	
Tue.	1	10	50	☌♃☾ ♃ 3° 53′ S	15 54	2401*
		17		☿ Greatest Hel. Lat. N		
Wed.	2					1O423
Thu.	3	15	52	☌♇☾ ♇ 0° 35′ S		O2143
Fri.	4	22	23	☌♀☾ ♀ 1° 19′ N	12 43	21O34
Sat.	5					3O14*
Sun.	6	11	51	☌♂☾ ♂ 3° 25′ N		31O24
		13		♀ in ♌		
Mon.	7	4		☌☿☉ Superior	9 32	32O14
Tue.	8	2	47	● New Moon		23O4*
		10	17	☌☿☾ ☿ 5° 48′ N		
Wed.	9	11		Moon in Apogee. Dist. from ⊕, 252,600 mi.		1O234
Thu.	10				6 20	O4123
Fri.	11	11	08	☌♆☾ ♆ 7° 15′ N		421O3
		17	25	☌♄☾ ♄ 7° 56′ N		
Sat.	12					4230I
Sun.	13				3 09	4310Z
Mon.	14					d43O1
Tue.	15				23 57	4231O
Wed.	16	4	49	☽ First Quarter		d4O23
Thu.	17					4O123
Fri.	18	8		□♃☉	20 46	24IO3
Sat.	19	8		☌ Greatest Hel. Lat. N		23O41
Sun.	20					31O24
Mon.	21				17 35	3O214
Tue.	22	23		Moon in Perigee. Dist. from ⊕, 221,700 mi.		231O4
		23	15	♍ Full Moon. Harvest Moon		
Wed.	23	3	07	☉ enters ♎, Autumn commences. Long. of ☉, 180°		O1234
Thu.	24				14 23	O234*
Fri.	25	4		☿ in ♍		21O34
Sat.	26					2O314
Sun.	27				11 12	314O2
Mon.	28	21	56	☌♃☾ ♃ 3° 30′ S		34O21
Tue.	29	16	51	☾ Last Quarter		4231O
Wed.	30	9		☌☿♆ ☿ 2° 26′ S	8 00	4O13*
		23	42	☌♇☾ ♇ 0° 17′ S		

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

THE SKY FOR OCTOBER, 1953

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 28m to 14h 24m and its Decl. changes from 2° 59′ S. to 14° 16′ S. The equation of time changes from +10m 7s to +16m 21s. For changes in the length of the day, see p. 15.

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

Mercury on the 15th is in R.A. 14h 44m, Decl. 18° 14′ S. and transits at 13.12. It is an evening star but poorly placed for easy observation. On the 23rd it is at greatest eastern elongation.

Venus on the 15th is in R.A. 11h 46m, Decl. 3° 08′ N. and transits at 10.13. It is a morning star seen low in the east just before sunrise.

Mars on the 15th is in R.A. 11h 22m, Decl. 5° 30′ N. and transits at 9.48. It is in Leo east of Regulus and is seen in the morning sky for about three hours before sunrise.

Jupiter on the 15th is in R.A. 5h 45m, Decl. 22° 49′ N. and transits at 4.10. Rising late in the evening, it is the brightest object until Venus comes up. On the 15th it is stationary in R.A. and begins to retrograde, or move westward among the stars. For the configurations of Jupiter's satellites see opposite page, and for their eclipses, etc., see p. 54.

Saturn on the 15th is in R.A. 13h 51m, Decl. 9° 03′ S. and transits at 12.16. It is in conjunction on the 23rd and too close to the sun for observation.

Uranus on the 15th is in R.A. 7h 40m, Decl. 21° 56′ N. and transits at 6.05.

Neptune on the 15th is in R.A. 13h 30m, Decl. 7° 37′ S. and transits at 11.54.

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

	d	h	m	OCTOBER 75th Meridian Civil Time	Min. of Algol h m	Phen. of Jupiter's Sat. 2h 30m
Thu.	1			.....		4O23*
Fri.	2			.....		42IO3
Sat.	3	20		☌☿♄ ☿ 3° 32′ S.....	4 49	42O31
Sun.	4	1		☌♀♂ ♀ 0° 02′ S.....		43IO2
Mon.	5	8	13	☌♂☾ ♂ 5° 09′ N.....		34O21
		10	04	☌♀☾ ♀ 5° 14′ N.....		
		11		☿ in Aphelion.....		
Tue.	6	13		Moon in Apogee. Dist. from ⊕, 252,600 mi....	1 38	32IO4
Wed.	7	19	40	● New Moon.....		O314*
Thu.	8	18	49	☌♆☾ ♆ 7° 08′ N.....	22 26	1O234
Fri.	9	5	15	☌♄☾ ♄ 7° 45′ N.....		d2O34
		20	16	☌☿☾ ☿ 3° 23′ N.....		
Sat.	10	6		♀ in Perihelion.....		2O134
Sun.	11			.....	19 15	31O24
Mon.	12			.....		3O124
Tue.	13			.....		32IO4
Wed.	14	22		♃ Stationary in R.A.....	16 04	42O1*
Thu.	15	16	44	◑ First Quarter.....		41O23
Fri.	16	12		□♁☉		d4O13
Sat.	17	2		☌♆☉	12 53	42O3*
Sun.	18			.....		43IO2
Mon.	19			.....		43O12
Tue.	20			.....	9 41	4321O
Wed.	21	11		Moon in Perigee. Dist. from ⊕, 222,600 mi....		423O1
Thu.	22			Orionid meteors.....		1O423
		7	56	♉ Full Moon. Hunter's Moon.....		
Fri.	23	11		☿ Greatest elongation E., 24° 18′.....	6 30	O2143
		16		☌♄☉		
Sat.	24			.....		2O34*
Sun.	25	19		☿ Greatest Hel. Lat. S.....		31O24
		20		♂ in Aphelion.....		
Mon.	26	6	56	☌♃☾ ♃ 3° 14′ S.....	3 19	3O124
Tue.	27			.....		32IO4
Wed.	28	7	47	☌♁☾ ♁ 0° 02′ N.....		23O14
Thu.	29	8	09	☾ Last Quarter.....	0 08	1O234
		12		♁ Stationary in R.A.....		
Fri.	30			.....		O2413
Sat.	31			.....	20 57	24IO3

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

THE SKY FOR NOVEMBER, 1953

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 24m to 16h 27m and its Decl. changes from 14° 16′ S. to 21° 44′ S. The equation of time changes from +16m 21s to a maximum of +16m 23s on the 3rd and then to +11m 09s 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.

Mercury on the 15th is in R.A. 15h 17m, Decl. 17° 52′ S. and transits at 11.36. On the 14th it is at inferior conjunction. At the end of the month it is a morning star visible low in the south-east just before sunrise. A transit of Mercury across the disk of the sun occurs on Nov. 14, visible over most of North America, see p. 29.

Venus on the 15th is in R.A. 14h 09m, Decl. 11° 32′ S. and transits at 10.34. It is a morning star seen very low in the south-east just before sunrise. A close conjunction with Saturn occurs during the evening of the 13th.

Mars on the 15th is in R.A. 12h 33m, Decl. 2° 08′ S. and transits at 8.56. It is in Virgo, visible in the south-east for some hours before sunrise.

Jupiter on the 15th is in R.A. 5h 38m, Decl. 22° 47′ N. and transits at 2.02. It rises about two hours after sunset and dominates the sky 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. 14h 05m, Decl. 10° 20′ S. and transits at 10.28. It is a morning star in Virgo just east of Spica. It may be seen low in the south-east just before sunrise. (See Venus.)

Uranus on the 15th is in R.A. 7h 40m, Decl. 21° 57′ N. and transits at 4.03.

Neptune on the 15th is in R.A. 13h 34m, Decl. 8° 02′ S. and transits at 9.56.

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

NOVEMBER 75th Meridian Civil Time				Min. of Algol	Phen. of Jupiter's Sat. 1h 45m
	d	h	m	h m	
Sun.	1	1	♀ Greatest Hel. Lat. N		d43O*
Mon.	2	21	Moon in Apogee. Dist. from ⊕, 252,200 mi.		43O12
Tue.	3	4	14 ☌☌☾ ♂ 6° 22′ N	17 45	43120
		22	☿ Stationary in R.A.		
Wed.	4	21	55 ☌♀☾ ♀ 7° 04′ N		423O1
Thu.	5	3	06 ☌♆☾ ♆ 7° 09′ N		41O32
		17	52 ☌♄☾ ♄ 7° 41′ N		
Fri.	6	12	58 ● New Moon	14 34	4O213
Sat.	7	2	☌♀♆ ♀ 0° 07′ S		241O3
		19	56 ☌☿☾ ☿ 2° 26′ N		
Sun.	8				dO14*
Mon.	9			11 23	3O24*
Tue.	10		Taurid meteors		321O4
Wed.	11				23O14
Thu.	12			8 12	1O324
Fri.	13	19	☿ in ♌		O1234
		23	☌♀♄ ♀ 0° 52′ S		
Sat.	14		Transit of ☿. See p. 29		21O34
		2	52 ☽ First Quarter		
		12	☌☿☉ Inferior		
Sun.	15			5 01	2O314
Mon.	16		Leonid meteors		314O2
Tue.	17				dd34O
Wed.	18	10	☿ in Perihelion	1 50	432O1
		18	Moon in Perigee. Dist. from ⊕, 225,200 mi.		
Thu.	19				41O32
Fri.	20	18	12 ☍ Full Moon	22 39	4O123
Sat.	21				421O3
Sun.	22	13	34 ☌♃☾ ♃ 3° 12′ S		42O13
Mon.	23	12	☌☿♀ ☿ 1° 12′ N	19 28	431O2
		14	☿ Stationary in R.A.		
Tue.	24	16	23 ☌♁☾ ♁ 0° 16′ N		d34O2
Wed.	25				32O14
Thu.	26			16 17	1O324
Fri.	27				O1234
Sat.	28	3	16 ☾ Last Quarter		21O34
		17	☿ Greatest Hel. Lat. N		
Sun.	29			13 06	2O134
Mon.	30	13	Moon in Apogee. Dist. from ⊕, 251,600 mi.		31O24

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

THE SKY FOR DECEMBER, 1953

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 27m to 18h 44m and its Decl. changes from 21° 44′ S. to 23° 27′ S. at the solstice on the 22nd and then to 23° 04′ S. at the end of the month. The equation of time changes from +11m 09s to zero on the 25th and then to −3m 15s 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.

Mercury on the 15th is in R.A. 16h 18m, Decl. 20° 28′ S. and transits at 10.46. On the 1st it is at greatest western elongation. At the beginning of the month it is a morning star visible low in the south-east just before sunrise.

Venus on the 15th is in R.A. 16h 41m, Decl. 21° 42′ S. and transits at 11.09. It is a morning star seen very low in the south-east just before sunrise.

Mars on the 15th is in R.A. 13h 41m, Decl. 9° 10′ S. and transits at 8.06. It is in Virgo, visible in the south-east for some hours before sunrise.

Jupiter on the 15th is in R.A. 5h 22m, Decl. 22° 39′ N. and transits at 23.43. On the 13th it is at opposition. Rising about sunset, it dominates the sky all 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. 14h 18m, Decl. 11° 21′ S. and transits at 8.42. It is a morning star in Virgo east of Spica. It may be seen in the south-east a few hours before sunrise.

Uranus on the 15th is in R.A. 7h 36m, Decl. 22° 06′ N. and transits at 2.02.

Neptune on the 15th is in R.A. 13h 37m, Decl. 8° 20′ S. and transits at 8.02.

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

DECEMBER 75th Meridian Civil Time				Min. of Algol	Phen. of Jupiter's Sat. 0h 30m
d	h	m		h m	
Tue. 1	13		☿ Greatest elongation W., 20° 21′		30124
	23	29	☌☌☾ ♂ 6° 52′ N		
Wed. 2	12	16	☌♆☾ ♆ 7° 17′ N	9 55	3204*
Thu. 3	7	15	☌♄☾ ♄ 7° 44′ N		410**
Fri. 4	16	01	☌☿☾ ☿ 6° 48′ N		40123
Sat. 5	4	33	☌♀☾ ♀ 5° 08′ N	6 44	41203
Sun. 6	5	48	● New Moon		42013
Mon. 7					41302
Tue. 8				3 33	43012
Wed. 9					43210
Thu. 10					d4320
Fri. 11				0 22	04123
Sat. 12			Geminid meteors		12043
Sun. 13	3		☌☌♆ ♂ 0° 29′ S	21 11	20134
	11	30	☽ First Quarter		
	12		☍☌☉ Dist. from ⊕, 391,900,000 mi		
Mon. 14					13024
Tue. 15					30124
Wed. 16	9		Moon in Perigee. Dist. from ⊕, 228,700 mi	18 00	32104
Thu. 17					32014
Fri. 18					0324*
Sat. 19	17	44	☌☌☾ ☌ 3° 23′ S	14 49	12043
Sun. 20	6	43	○ Full Moon		24013
Mon. 21	22	32	☉ enters ♑, Winter commences. Long. of ☉, 270°		41302
Tue. 22	0	42	☌♇☾ ♇ 0° 18′ N	11 38	43012
	3		☿ in ♈		
Wed. 23					43210
Thu. 24					43201
Fri. 25				8 28	4032*
Sat. 26					d4103
Sun. 27	3		♀ in ♈		24013
Mon. 28	0	43	☾ Last Quarter	5 17	d1024
	10		Moon in Apogee. Dist. from ⊕, 251,300 mi		
Tue. 29	21	46	☌♆☾ ♆ 7° 26′ N		30124
Wed. 30	17	36	☌☌☾ ♂ 6° 38′ N		32104
	20	31	☌♄☾ ♄ 7° 50′ N		
Thu. 31				2 06	32014

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

JANUARY

d	h	m	Sat.	Phen.
1	01	17	II	SI
	01	20	II	Te
2	21	48	II	ER
3	19	35	III	Se
4	23	38	I	OD
5	20	46	I	TI
	21	58	I	SI
	22	55	I	Te
6	00	06	I	Se
	18	06	I	OD
	21	29	I	ER
7	18	35	I	Se
8	01	26	II	TI
9	19	32	II	OD
	21	56	II	OR
	22	04	II	ED
10	00	25	II	ER
	18	35	III	Te
	21	31	III	SI
	23	38	III	Se
11	19	33	II	Se
12	01	30	I	OD
	22	38	I	TI
	23	53	I	SI
13	00	47	I	Te
	19	58	I	OD
	23	24	I	ER
14	18	22	I	SI
	19	15	I	Te
	20	31	I	Se
15	17	53	I	ER
16	22	03	II	OD
17	00	28	II	OR
	00	41	II	ED
	20	15	III	TI
	22	26	III	Te
18	19	36	II	Te
	19	50	II	SI
	22	10	II	Se
20	00	31	I	TI
	21	51	I	OD
21	17	51	III	ER
	19	00	I	TI
	20	18	I	SI
	21	09	I	Te
	22	27	I	Se
22	19	49	I	ER
24	00	37	II	OD
25	00	08	III	TI
	19	47	II	TI
	22	10	II	Te
	22	28	II	SI
27	19	00	II	ER
	23	45	I	OD
28	19	43	III	ED
	20	55	I	TI
	21	53	III	ER
	22	14	I	SI
	23	05	I	Te
29	00	23	I	Se
	18	14	I	OD
	21	44	I	ER
30	18	52	I	SE

FEBRUARY

d	h	m	Sat.	Phen.
1	22	23	II	TI
3	18	57	II	OR
	19	16	II	ED
	21	38	II	ER
4	18	15	III	OD
	20	34	III	OR
	22	50	I	TI
4	23	45	III	ED
5	20	10	I	OD
	23	40	I	ER
6	18	39	I	SI
	19	28	I	Te
	20	47	I	Se
7	18	09	I	ER
10	19	11	II	OD
	21	37	II	OR
	21	55	II	ED
11	22	20	III	OD
12	19	18	II	Se
	22	06	I	OD
13	19	16	I	TI
	20	35	I	SI
	21	25	I	Te
	22	43	I	Se
14	20	04	I	ER
15	19	48	III	Se
17	21	52	II	OD
19	19	25	II	Te
	19	36	II	SI
	21	55	II	Se
20	21	14	I	TI
	22	30	I	SI
21	18	33	I	OD
	22	00	I	ER
22	18	49	III	Te
	19	08	I	Se
	21	42	III	SI
26	19	43	II	TI
	22	07	II	Te
	22	12	II	SI
28	18	52	II	ER
	20	32	I	OD

MARCH

d	h	m	Sat.	Phen.
1	18	55	I	SI
	19	52	I	TE
	20	43	III	TI
	21	04	I	Se
5	22	26	II	TI
7	21	30	II	ER
8	19	42	I	TI
	20	51	I	SI
	21	52	I	Te
9	20	19	I	ER
12	19	52	III	ED
	22	05	III	ER
14	19	31	II	OD
15	21	42	I	TI
16	19	01	I	OD
	19	01	II	Se
17	19	25	I	Se
19	19	37	III	OD
23	19	18	II	SI
	19	44	II	Te
	21	01	I	OD
	21	37	II	Se
24	19	11	I	SI
	20	24	I	Te
	21	21	I	Se
30	20	02	III	Se
	20	06	II	TI
31	20	14	I	TI
	21	07	I	SI

APRIL

d	h	m	Sat.	Phen.
1	20	33	I	ER
8	19	33	I	OD
9	19	42	I	Se
15	20	19	II	OD
16	19	27	I	SI

Jupiter being near the Sun, phenomena of the satellites are not given from May 1 to June 20.

JUNE

d	h	m	Sat.	Phen.
30	03	35	I	SI
	04	10	I	TI

JULY

d	h	m	Sat.	Phen.
1	03	32	I	OR
12	03	19	II	Te
16	04	03	I	Se
19	03	43	II	TI
	04	20	II	Se
23	03	47	I	SI
24	04	02	I	OR
27	02	25	III	ER
	03	53	III	OD
28	04	07	II	OR
31	02	48	I	ED

AUGUST

d	h	m	Sat.	Phen.
1	02	20	I	Se
	03	22	I	Te
3	03	56	III	ED
4	02	17	II	ED
7	04	42	I	ED
8	02	03	I	SI
	03	10	I	TI
	04	13	I	Se
9	02	30	I	OR
13	01	23	II	TI
	01	25	II	Se
	03	47	II	Te
14	02	41	III	TI
15	03	57	I	SI
16	01	04	I	ED
	04	28	I	OR
17	01	47	I	Te
20	01	38	II	SI
	04	01	II	Se
	04	06	II	TI
21	01	57	III	SI
	04	26	III	Se
22	01	40	II	OR
23	02	58	I	ED
24	01	34	I	TI
	02	29	I	Se
	03	44	I	Te
25	00	54	I	OR
27	04	14	II	SI
29	01	45	II	ER
	01	55	II	OD
	04	20	II	OR
30	04	52	I	ED
31	02	13	I	SI
	03	30	I	TI
	04	23	I	Se

SEPTEMBER

d	h	m	Sat.	Phen.
1	01	09	III	OD
	02	51	I	OR
	03	47	III	OR
2	00	09	I	Te
5	01	55	II	ED
	04	20	II	ER
	04	33	II	OD
7	01	12	II	Te
	04	07	I	SI
	23	52	III	ED
8	01	14	I	ED
	02	26	III	ER
	04	46	I	OR
	23	54	I	TI
9	00	45	I	Se
	02	04	I	Te
12	04	30	II	ED
14	01	07	II	Se
	01	26	II	TI
	03	51	II	Te
15	03	08	I	ED
	03	52	III	ED
16	00	29	I	SI
	01	48	I	TI
	02	39	I	Se
	03	58	I	Te
17	01	10	I	OR
18	23	19	III	TI
19	01	56	III	Te
21	01	20	II	SI
	03	43	II	Se
	04	02	II	TI
22	05	02	I	ED
	23	01	II	OD
23	01	26	II	OR
	02	23	I	SI
	03	41	I	TI
	04	32	I	Se
	23	30	I	ED
24	03	03	I	OR
	23	01	I	Se
25	00	20	I	Te
26	00	27	III	Se
	03	14	III	TI
28	03	56	II	SI
29	22	56	II	ED
30	01	21	II	ER
	01	32	II	OD
	03	58	II	OR
	04	16	I	SI

OCTOBER

d	h	m	Sat.	Phen.
1	01	24	I	ED
	04	55	I	OR
	22	44	I	SI
2	00	01	I	TI
	00	54	I	Se
	02	11	I	Te
	23	23	I	OR
3	01	52	III	SI
	04	26	III	Se
6	23	40	III	OR
7	01	30	II	ED
	03	55	II	ER
	04	01	II	OD
8	03	18	I	ED
	22	15	II	Se
	22	24	II	TI
9	00	38	I	SI
	00	49	II	Te
	01	52	I	TI
	02	48	I	Se
	04	02	I	Te
10	01	15	I	OR
	22	30	I	Te
13	22	27	III	ER
14	00	44	III	OD
	03	24	III	OR
	04	04	II	ED
15	05	12	I	ED
	22	27	II	SI
16	00	52	II	Se
	00	53	II	TI
	02	31	I	SI

OCTOBER

d	h	m	Sat.	Phen.
16	03	18	II	Te
	03	42	I	TI
	04	41	I	Se
	23	40	I	ED
17	03	04	I	OR
	22	06	II	OR
	22	09	I	TI
	23	10	I	Se
18	00	19	I	Te
	21	32	I	OR
20	23	48	III	ED
21	02	27	III	ER
	04	24	III	OD
23	01	03	II	SI
	03	19	II	TI
	03	29	II	Se
	04	24	I	SI
	05	30	I	TI
	05	45	II	Te
24	01	34	I	ED
	04	53	I	OR
	20	51	III	Te
	22	53	I	SI
	23	57	I	TI
25	00	29	II	OR
	01	03	I	Se
	02	07	I	Te
	23	20	I	OR
28	03	47	III	ED
30	03	40	II	SI
	05	43	II	TI
31	03	29	I	ED
	20	27	III	Se
	21	45	III	TI
	22	29	II	ED

NOVEMBER

d	h	m	Sat.	Phen.
1	00	23	III	Te
	00	46	I	SI
	01	44	I	TI
	02	50	II	OR
	02	57	I	Se
	03	54	I	Te
	21	57	I	ED
2	01	08	I	OR
	21	20	II	Te
	21	25	I	Se
	22	21	I	Te
7	05	23	I	ED
	21	46	III	SI
8	00	27	III	Se
	01	03	II	ED
	01	13	III	TI
	02	40	I	SI
8	03	30	I	TI
	03	51	III	Te
	04	51	I	Se
	05	09	II	OR
	05	40	I	Te
	23	51	I	ED
9	02	54	I	OR
	21	08	I	SI
	21	15	II	TI
	21	56	I	TI
	22	02	II	Se
	23	19	I	Se
	23	40	II	Te
10	00	07	I	Te
	21	21	I	OR
15	01	45	III	SI
	03	37	II	ED
	04	27	III	Se
	04	33	I	SI
	04	36	III	TI
	05	15	I	TI
16	01	46	I	ED
	04	39	I	OR
	22	12	II	SI
	23	01	I	SI
	23	33	II	TI
	23	41	I	TI
17	00	39	II	Se
	01	13	I	Se
	01	51	I	Te
	01	59	II	Te
	20	14	I	ED
	23	06	I	OR
18	19	41	I	Se
	20	18	I	Te
	20	33	II	OR
	20	59	III	OR
22	05	44	III	SI
	06	11	II	ED
	06	27	I	SI
23	03	40	I	ED
	06	24	I	OR
24	00	49	II	SI
	00	55	I	SI
	01	25	I	TI
	01	50	II	TI
	03	07	I	Se
	03	17	II	Se
	03	36	I	Te
	04	17	II	Te
	22	09	I	ED
25	00	50	I	OR
	19	24	I	SI
	19	28	II	ED
	19	46	III	ED
	19	51	I	TI
	21	35	I	Se
25	22	02	I	Te
26	22	47	II	OR
	00	18	III	OR
	19	16	I	OR
30	05	35	I	ED

DECEMBER

d	h	m	Sat.	Phen.
1	02	49	I	SI
	03	08	I	TI
	03	26	II	SI
	04	06	II	TI
	05	01	I	Se
	05	19	I	Te
	05	55	II	Se
	06	32	II	Te
2	00	04	I	ED
	02	34	I	OR
	21	17	I	SI
	21	34	I	TI
	22	02	II	ED
	23	29	I	Se
	23	45	I	Te
	23	46	III	ED
3	01	01	II	OR
	03	35	III	OR
	18	32	I	ED
	21	00	I	OR
4	17	58	I	Se
	18	11	I	Te
	19	14	II	Se
	19	41	II	Te
8	04	43	I	SI
	04	51	I	TI
	06	03	II	SI
	06	21	II	TI
9	01	58	I	ED
	04	18	I	OR
	23	11	I	SI
	23	17	I	TI
10	00	37	II	ED
	01	23	I	Se
	01	29	I	Te
	03	14	II	OR
	03	45	III	ED
	20	27	I	ED
	22	44	I	OR
11	17	40	I	SI
	17	43	I	TI
	19	23	II	SI
	19	29	II	TI
	19	52	I	Se
	19	54	I	Te
	21	51	II	Se
	21	56	II	Te
13	17	43	III	SI
13	17	44	III	TI
	20	24	III	Te
	20	29	III	Se
15	06	35	I	TI
16	03	49	I	OD
	06	06	I	ER
17	01	00	I	TI
	01	06	I	SI
	03	01	II	OD
	03	12	I	Te
	03	18	I	Se
	03	39	II	ER
	22	15	I	OD
18	00	35	I	ER
	19	26	I	TI
	19	34	I	SI
	21	38	I	Te
	21	44	II	TI
	21	46	I	Se
	22	00	II	SI
19	00	11	II	Te
	00	29	II	Se
	19	04	I	ER
20	18	56	II	ER
	20	59	III	TI
	21	42	III	SI
	23	39	III	Te
21	00	30	III	Se
23	05	33	I	OD
24	02	44	I	TI
	03	00	I	SI
	04	55	I	Te
	05	12	I	Se
	05	14	II	OD
	23	59	I	OD
25	02	30	I	ER
	21	10	I	TI
	21	29	I	SI
	23	21	I	Te
	23	41	I	Se
	23	59	II	TI
26	00	38	II	SI
	02	26	II	Te
	03	07	II	Se
	18	25	I	OD
	20	59	I	ER
27	17	47	I	Te
	18	09	I	Se
	18	21	II	OD
	21	32	II	ER
28	00	14	III	TI
	01	42	III	SI
	02	55	III	Te
	04	31	III	Se
31	04	28	I	TI
	04	55	I	SI
	18	35	III	ER

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.)

From June to November Jupiter's satellites I, II and III are eclipsed on the west side of the planet; from January to April and in December, on the east side of the planet. In general the disappearance only of satellites I and II is visible from June to November, and the reappearance only from January to April and in December. Both disappearance and reappearance of satellite III are visible from January to March and from July to December.

At the beginning of the year the satellites reappear some distance from the planet, the place of reappearance getting closer to the disk in April. In December, the place of reappearance is very close to the disk. There are no eclipses of satellite IV during 1953.

LUNAR OCCULTATIONS

Prepared by IAN HALLIDAY

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 1953 Nautical Almanac, give the times of immersion or emersion or both for occultations of stars of magnitude 4.5 or brighter visible at Toronto and at Montreal and also at Vancouver and Calgary, at night. 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.

LUNAR OCCULTATIONS VISIBLE AT TORONTO AND MONTREAL, 1953

Date	Star	Mag.	I or E	Age of Moon	Toronto				Montreal			
					E.S.T.	a	b	P	E.S.T.	a	b	P
				d	h m	m	m	°	h m	m	m	°
Jan. 24	q Tau	4.4	I	8.7	2 22.6	+0.2	−1.3	94	Low	..	..	..
Feb. 25	δ Cnc	4.2	I	12.0	19 48.2	−1.4	−0.2	123	19 56.6	−1.5	0.0	115
May 6	θ Cap	4.2	E	22.5	2 46.9	−1.1	+2.5	199	2 57.1	−1.0	+2.2	201
July 7	η Tau	3.0	I	25.7	Low	..	..	..	2 11.8	+0.4	+1.6	58
7	23 Tau	4.2	E	25.7	2 32.6	+0.3	+1.4	254	2 33.9	+0.2	+1.5	251
7	27 Tau	3.8	I	25.8	2 46.2	+0.1	+1.2	91	2 48.3	−0.1	+1.2	94
7	η Tau	3.0	E	25.7	3 01.5	0.0	+1.3	270	3 04.3	−0.1	+1.4	267
7	27 Tau	3.8	E	25.8	3 37.9	+0.2	+1.8	234	Sun	..	..	..
21	π Scr	3.0	I	11.0	20 32.7	−2.0	−0.1	94	20 43.4	−1.9	−0.4	88
21	π Scr	3.0	E	11.0	21 56.3	−1.8	−1.1	289	22 03.9	−1.6	−1.3	290
Sep. 26	23 Tau	4.2	I	18.8	21 15.0	+0.9	+2.4	18	21 14.8	+0.7	+2.3	23
26	23 Tau	4.2	E	18.8	21 45.3	−0.6	+0.4	308	21 50.0	−0.7	+0.7	302
26	27 Tau	3.8	I	18.9	22 11.1	+0.3	+2.0	45	22 13.6	+0.1	+2.0	48
26	27 Tau	3.8	E	18.9	23 02.1	−0.6	+1.1	279	23 08.2	−0.7	+1.2	274
Nov. 8	α Scr*	1.2	I	2.0	12 37.4	−1.8	+0.3	100	12 48.7	−1.9	+0.1	94
8	α Scr*	1.2	E	2.0	14 04.2	−2.0	−0.4	278	14 14.4	−1.8	−0.7	281
14	θ Aqr	4.3	I	8.4	22 45.7	−0.4	+0.1	45	22 48.1	−0.3	+0.1	44

*Daytime occultation.

LUNAR OCCULTATIONS VISIBLE AT VANCOUVER AND CALGARY, 1953

Date	Star	Mag.	I or E	Age of Moon	Vancouver				Calgary			
					P.S.T.	a	b	P	M.S.T.	a	b	P
				d	h m	m	m	°	h m	m	m	°
Jan. 23–24	q Tau	4.4	I	8.7	23 03.5	−0.7	−2.7	120	0 06.2	−0.5	−2.1	109
24	20 Tau	4.0	I	8.7	No occ.	..	..	..	0 36.0	+0.2	−4.0	143
27	ϵ Gem	3.2	I	11.9	3 53.2	+0.3	−2.1	137	4 47.8	+0.3	−1.9	125
27	ϵ Gem	3.2	E	11.9	4 42.5	−0.1	−1.2	255	5 40.1	+0.2	−1.3	265
May 27–28	π Scr	3.0	I	15.1	23 28.0	−1.5	−0.2	116	0 41.6	−1.5	−0.5	110
28	π Scr	3.0	E	15.1	0 45.8	−1.6	−0.5	269	Low	..	..	..
Aug. 3	17 Tau	3.8	I	23.4	3 53.5	−0.9	+1.5	81	Sun	..	..	..
Dec. 18	23 Tau	4.2	I	12.0	2 41.6	−0.9	−0.1	47	3 50.0	−1.0	+0.6	29
18	27 Tau	3.8	I	12.0	4 01.1	−1.0	+0.9	25	Graze	..	..	..

EPHEMERIS FOR THE PHYSICAL OBSERVATION OF THE SUN, 1953

For 0 h Greenwich Civil Time

Date	P	B_0	L_0	Date	P	B_0	L_0
	°	°	°		°	°	°
Jan. 1	+ 2.14	−3.08	138.48	July 5	− 1.00	+3.35	216.74
6	− 0.29	−3.65	72.63	10	+ 1.27	+3.87	150.56
11	− 2.71	−4.19	6.79	15	+ 3.52	+4.37	84.40
16	− 5.08	−4.70	300.95	20	+ 5.72	+4.83	18.24
21	− 7.38	−5.17	235.12	25	+ 7.87	+5.27	312.09
26	− 9.61	−5.60	169.28	30	+ 9.94	+5.66	245.95
31	−11.73	−5.99	103.45	Aug. 4	+11.93	+6.02	179.82
Feb. 5	−13.75	−6.32	37.62	9	+13.83	+6.34	113.71
10	−15.64	−6.61	331.78	14	+15.62	+6.61	47.61
15	−17.40	−6.85	265.95	19	+17.30	+6.84	341.52
20	−19.02	−7.03	200.10	24	+18.85	+7.02	275.45
25	−20.49	−7.16	134.25	29	+20.28	+7.15	209.39
Mar. 2	−21.81	−7.23	68.39	Sept. 3	+21.57	+7.22	143.34
7	−22.96	−7.25	2.51	8	+22.73	+7.25	77.31
12	−23.96	−7.21	296.63	13	+23.73	+7.23	11.29
17	−24.79	−7.12	230.73	18	+24.58	+7.15	305.28
22	−25.45	−6.97	164.81	23	+25.28	+7.02	239.28
27	−25.93	−6.77	98.88	28	+25.81	+6.83	173.29
Apr. 1	−26.24	−6.52	32.92	Oct. 3	+26.17	+6.60	107.31
6	−26.37	−6.22	326.95	8	+26.35	+6.32	41.34
11	−26.32	−5.88	260.95	13	+26.35	+5.99	335.38
16	−26.08	−5.50	194.94	18	+26.16	+5.61	269.43
21	−25.66	−5.08	128.91	23	+25.79	+5.19	203.48
26	−25.05	−4.62	62.85	28	+25.22	+4.73	137.54
May 1	−24.26	−4.13	356.78	Nov. 2	+24.45	+4.24	71.61
6	−23.29	−3.61	290.68	7	+23.48	+3.71	5.69
11	−22.15	−3.07	224.58	12	+22.32	+3.15	299.77
16	−20.83	−2.51	158.45	17	+20.97	+2.56	233.85
21	−19.35	−1.93	92.31	22	+19.43	+1.96	167.95
26	−17.72	−1.34	26.16	27	+17.72	+1.34	102.04
31	−15.95	−0.74	320.00	Dec. 2	+15.85	+0.71	36.15
June 5	−14.05	−0.14	253.83	7	+13.82	+0.07	330.26
10	−12.04	+0.47	187.65	12	+11.67	−0.58	264.38
15	− 9.94	+1.07	121.47	17	+ 9.42	−1.21	198.50
20	− 7.77	+1.66	55.29	22	+ 7.08	−1.84	132.63
25	− 5.54	+2.24	349.10	27	+ 4.69	−2.45	66.77
30	− 3.28	+2.80	282.92	32	+ 2.26	−3.05	0.92

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

No.	Commences	No.	Commences	No.	Commences
1328	1952 Dec. 15.18	1333	1953 Apr. 30.76	1338	1953 Sept. 13.86
1329	1953 Jan. 11.52	1334	May 27.98	1339	Oct. 11.13
1330	Feb. 7.86	1335	June 24.18	1340	Nov. 7.43
1331	Mar. 7.19	1336	July 21.38	1341	Dec. 4.74
1332	Apr. 3.50	1337	Aug. 17.60	1342	1954 Jan. 1.07

PRINCIPAL ELEMENTS OF THE SOLAR SYSTEM

ORBITAL ELEMENTS (1944, Dec. 31, 12^h)

Planet	Mean Distance from Sun (a) ⊕ =1	Mean Distance from Sun (a) millions of miles	Period (P)	Eccentricity (e)	Inclination (i)	Long. of Node (☊)	Long. of Perihelion (π)	Mean Long. of Planet
					°	°	°	°
Mercury.....	.387	36.0	88.0days	.206	7.0	47.6	76.5	120.5
Venus.....	.723	67.2	224.7	.007	3.4	76.1	130.7	36.0
Earth.....	1.000	92.9	365.3	.017	....	.....	101.9	99.8
Mars.....	1.524	141.5	687.0	.093	1.9	49.1	334.9	267.4
Jupiter.....	5.203	483.3	11.86yrs.	.048	1.3	99.8	13.3	164.4
Saturn.....	9.54	886.	29.46	.056	2.5	113.1	91.8	97.1
Uranus.....	19.19	1783.	84.0	.047	0.8	73.7	169.7	76.8
Neptune.....	30.07	2793.	164.8	.009	1.8	131.1	44.1	184.0
Pluto.....	39.46	3666.	247.7	.249	17.1	109.5	223.4	158.3

PHYSICAL ELEMENTS

Object	Symbol	Mean Diameter miles	Mass ⊕ =1	Density water =1	Axial Rotation	Mean Surface Gravity ⊕ =1	Albedo Bond's	Magnitude at Opposition or Elongation
Sun.....	☉	864,000	332,000	1.4	$24^d.7$ (equatorial)	27.9		− 26.7
Moon.....	☾	2,160	.0123	3.3	$27^d\ 7.7^h$	.16	.07	− 12.6
Mercury....	☿	3,010	.056	3.8	88^d	.27	.07	0±
Venus.....	♀	7,580	.82	4.9	30^d ?	.85	.59	− 4±
Earth.....	⊕	7,918	1.00	5.5	$23^h\ 56^m$	1.00	.29	
Mars.....	♂	4,220	.108	4.0	$24^h\ 37^m$	.38	.15	− 2±
Jupiter.....	♃	87,000	318.	1.3	$9^h\ 50^m$±	2.6	.56?	− 2±
Saturn.....	♄	72,000	95.	.7	$10^h 15^m$±	1.2	.63?	0±
Uranus.....	♅	31,000	14.6	1.3	$10^h.8$±	.9	.63?	+ 5.7
Neptune....	♆	33,000	17.2	1.3	16^h ?	1.0	.73?	+ 7.6
Pluto.....	♇	4,000?	.8 ?					+ 14

SATELLITES OF THE SOLAR SYSTEM

Name	Stellar Mag.	Mean Dist. from Planet			Revolution Period			Diameter Miles	Discoverer
		"	*	Miles	d	h	m		
SATELLITE OF THE EARTH									
Moon	−12.6	530		238,857	27	07	43	2160	
SATELLITES OF MARS									
Phobos	12	8		5,800	0	07	39	10?	Hall, 1877
Deimos	13	21		14,600	1	06	18	5?	Hall, 1877
SATELLITES OF JUPITER									
V	13	48		112,600	0	11	57	100?	Barnard, 1892
Io	5	112		261,800	1	18	28	2300	Galileo, 1610
Europa	6	178		416,600	3	13	14	2000	Galileo, 1610
Ganymede	5	284		664,200	7	03	43	3200	Galileo, 1610
Callisto	6	499		1,169,000	16	16	32	3200	Galileo, 1610
VI	14	3037		7,114,000	250	16		100?	Perrine, 1904
VII	16	3113		7,292,000	260	01		40?	Perrine, 1905
X	18	3116		7,300,000	260			15?	Nicholson, 1938
XI	18	5990		14,000,000	692			15?	Nicholson, 1938
VIII	16	6240		14,600,000	739			40?	Melotte, 1908
IX	17	6360		14,900,000	758			20?	Nicholson, 1914
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

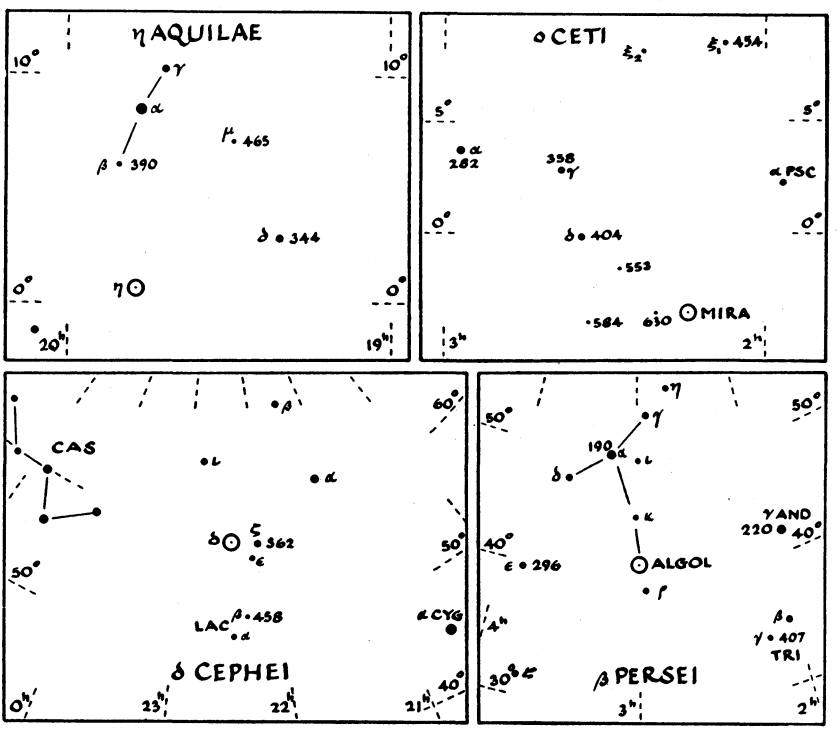
*As seen from the sun.

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.



REPRESENTATIVE BRIGHT VARIABLE STARS

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*o3*	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*o5*	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).

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 h m	δ ° ′	Mag. and Spect.	d ″	D L.Y.	Remarks
π And	00 34.2	+33 27	4.4B3; 8.5	36	470	†
η Cas	00 46.0	+57 33	3.6F8; 7.2M0	8	18	526y; 66AU
α UMi	01 48.8	+89 02	var. F8; 8.8	19	407	Polaris
γ Ari	01 50.8	+19 03	4.8A0; 4.8A0	8.3	150	
α Pis	01 59.4	+02 31	5.2A2; 4.3A2	2.4	130	††
γ And	02 00.8	+42 05	2.3K0; 5.4A0; 6.6	10, 0.7	410	56y; 23AU
6 Tri	02 09.5	+30 04	5.4G4; 7.0F3	3.6	330	††
η Per	02 47.0	+55 41	3.9K0; 8.5	28	540	
32 Eri	03 51.8	−03 06	5.0A; 6.3G5	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 48 thus indicated there are 12 others on the list with faint companions but for these it is not thought that there is any physical connection. In the case of the 20 stars variable in light this fourth column shows their maximum and minimum magnitudes. The 19 first magnitude stars are set up in bold face type.

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

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

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

Of the 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*
‖ο 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 50.8m; Dec. + 89° 03′ (1953)

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^5 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		χ Per	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		ω Cen	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.

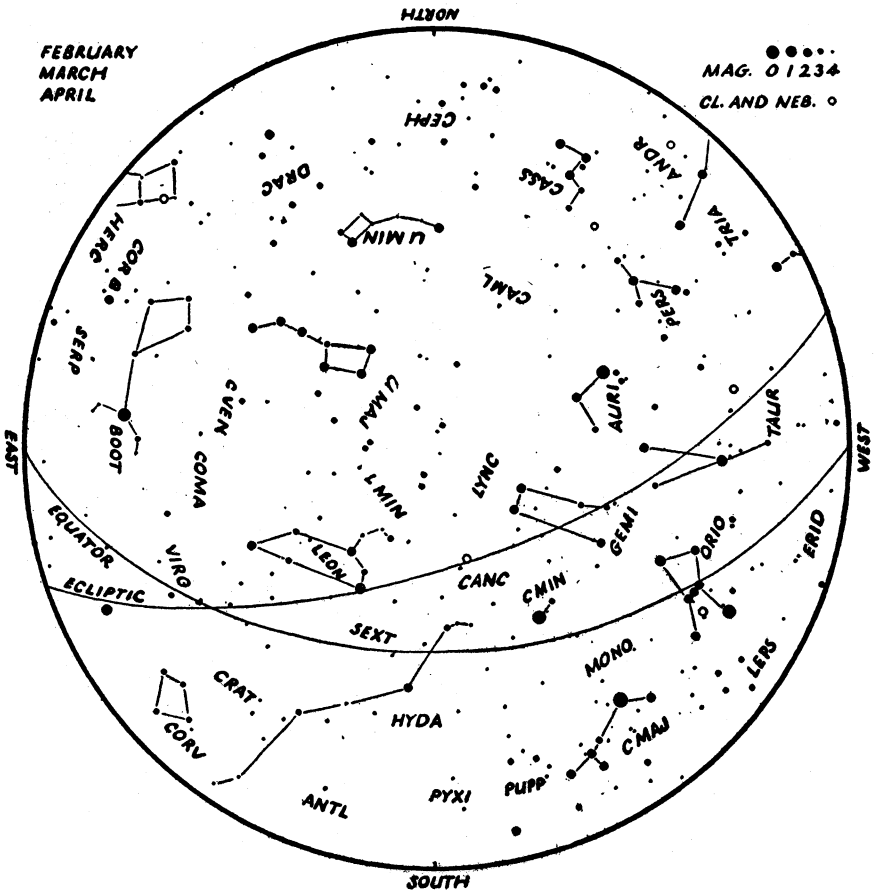
N.G.C.	M	Con	α 1950 h m	δ ° ′	Cl	Size ′	m n	m *	Dist. l.y.	Name
650	76	Per	01 38.3	+51 20	Pl	1.5	11	17	15,000	
1952	1	Tau	05 31.5	+21 59	Pl	6	11	16	10,000	Crab
1976	42	Ori	05 32.5	−05 25	Dif	30			1,800	Orion
B33		Ori	05 38.0	−02 29	Drk	4			300	Horsehead
2261		Mon	06 36.4	+08 47	Dif	2				Hubble's var
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 l.y.	Vel. km/sec
221	32	And	00 39.9	+40 36	E	3×3	8.8	800,000	− 185
224	31	And	00 40.0	+41 00	Sb	160×40	5.0	800,000	− 220
SMC		Tuc	00 53	−72 38	I	220×220	1.5	100,000	+ 170
598	33	Tri	01 31.0	+30 24	Sc	60×40	7.0	700,000	− 70
LMC		Dor	05 21	−69 27	I	430×530	0.5	90,000	+ 280
3031	81	UMa	09 51.5	+69 18	Sb	16×10	8.3	2,400,000	− 30
3034	82	UMa	09 51.8	+69 58	I	7× 2	9.0	2,600,000	+ 290
3368	96	Leo	10 44.1	+12 05	Sa	7× 4	10.0	5,700,000	+ 940
3623	65	Leo	11 16.3	+13 22	Sb	8× 2	9.9	5,000,000	+ 800
3627	66	Leo	11 17.6	+13 16	Sb	8× 2	9.1	4,300,000	+ 650
4258		CVn	12 16.5	+47 34	Sb	20× 6	8.7	4,600,000	+ 500
4374	84	Vir	12 22.5	+13 09	E	3× 2	9.9	6,000,000	+1050
4382	85	Com	12 22.9	+18 28	E	4× 2	10.0	3,700,000	+ 500
4472	49	Vir	12 27.2	+08 16	E	5× 4	10.1	5,700,000	+ 850
4565		Com	12 33.9	+26 16	Sb	15× 1	11.0	7,600,000	+1100
4594		Vir	12 37.4	−11 20	Sa	7× 2	9.2	7,200,000	+1140
4649	60	Vir	12 41.1	+11 50	E	4× 3	9.5	7,500,000	+1090
4736	94	CVn	12 48.6	+41 24	Sb	5× 4	8.4	3,000,000	+ 290
4826	64	Com	12 54.3	+21 57	Sb	8× 4	9.2	1,300,000	+ 150
5005		CVn	13 08.6	+37 20	Sc	5× 2	11.1	6,600,000	+ 900
5055	63	CVn	13 13.6	+42 18	Sb	8× 3	9.6	3,600,000	+ 450
5194	51	CVn	13 27.8	+47 27	Sc	12× 6	7.4	3,000,000	+ 250
5236	83	Hya	13 34.2	−29 36	Sc	10× 8	8	2,900,000	+ 500
6822		Sgr	19 42.4	−14 53	I	20×10	11	1,000,000	− 150
7331		Peg	22 34.8	+33 59	Sb	9× 2	10.4	5,200,000	+ 500

STAR MAP I

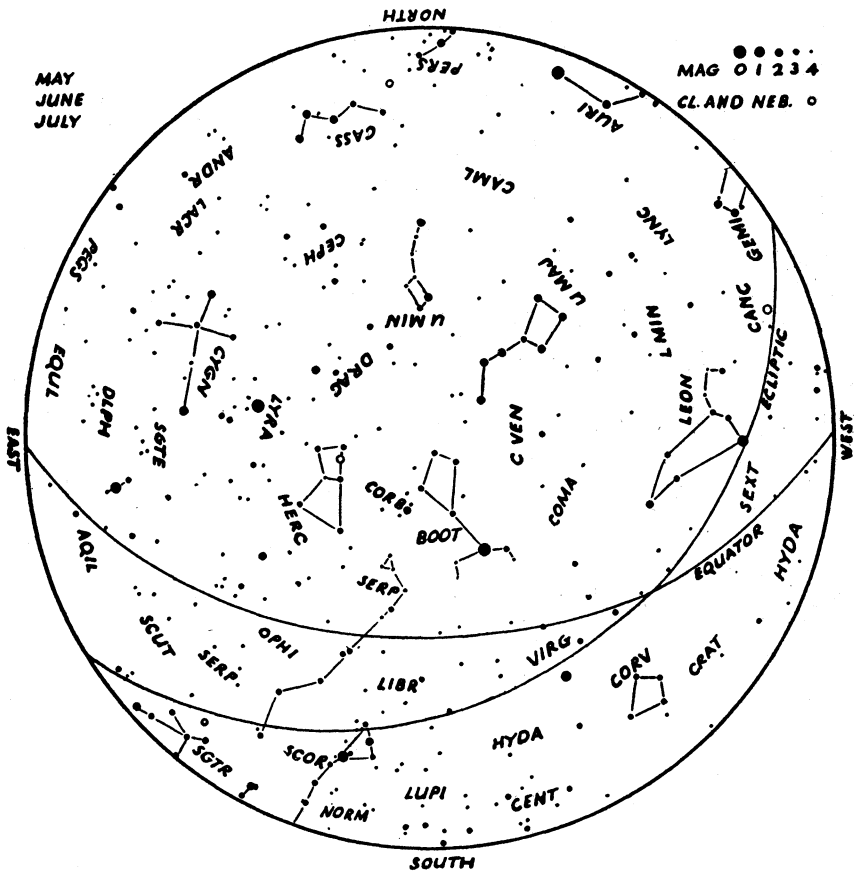


The above map represents the evening sky at

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

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

STAR MAP 2

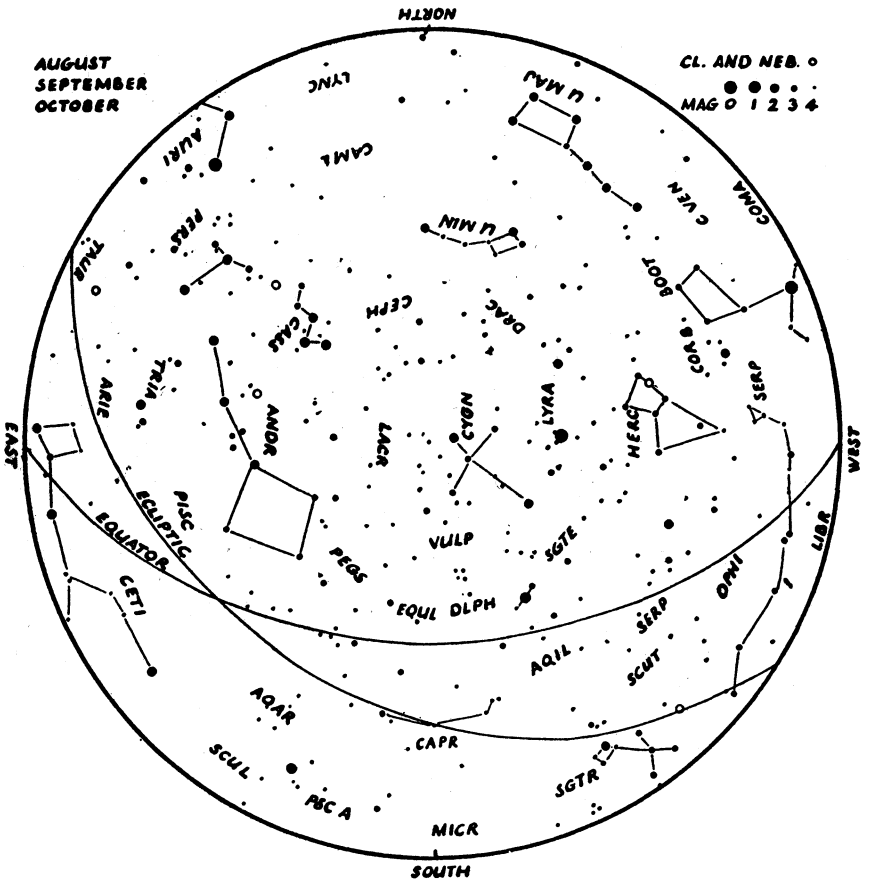


The above map represents the evening sky at

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

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

STAR MAP 3

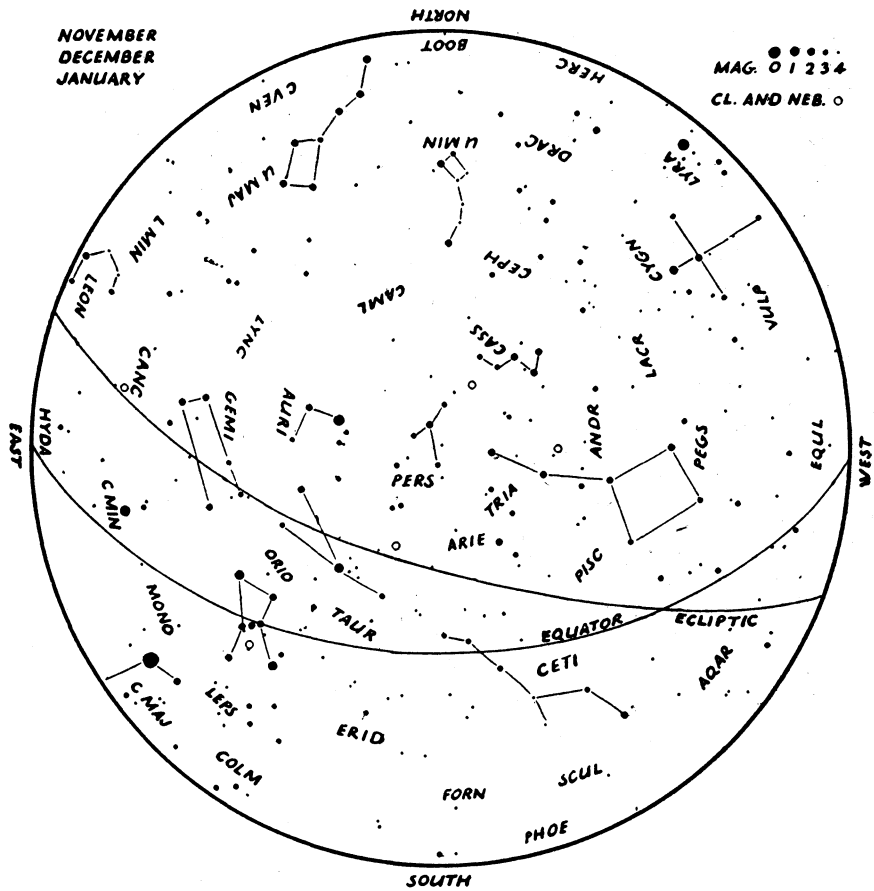


The above map represents the evening sky at

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

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

STAR MAP 4



The above map represents the evening sky at

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

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

PRINCIPAL METEOR SHOWERS FOR THE NORTHERN HEMISPHERE

Shower	Approx. Radiant		Current Maximum Date	Spectacular Displays	Hourly Number (all meteors)	Duration (in days)	Abbreviations (for use in observing records)
	α	δ					
Quadrantids....	232°	+52°	Jan. 3		20	4	Q
Lyrids.....	280	+37	Apr. 21		10	4	Y
Eta Aquarids...	336	− 1	May 4		10	8	E
Delta Aquarids .	340	−17	July 28		20	12	D
Perseids.....	47	+57	Aug. 12		50	25	P
Giacobinids.....	267	+55	Oct. 9	1933, 1946		1	J
Orionids.....	96	+15	Oct. 22		20	14	O
Taurids.....	56	+16	Nov. 10?			30	T
Leonids.....	152	+22	Nov. 16	1799, 1833, 1866, 1867	20	14	L
Bielids.....	25	+45	Nov. 27	1872, 1885			B
Geminids.....	110	+33	Dec. 12		30	14	G

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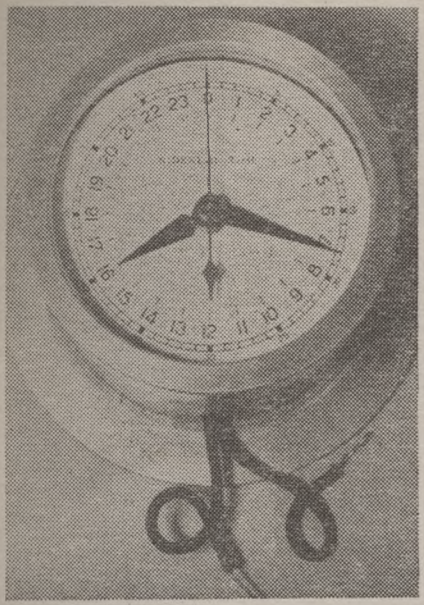

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(1) 8 p.m.	20h	00m	00s
(2) Long. C.S.T. zone	6	00	00
(3) Greenwich time (1) + (2)	26	00	00
(4) Sid. advance in 26h (p. 8)		04	16
(5) G. sid. time at 0h (p. 7)	0	49	33
(6) G. sid. time (3) + (4) + (5)	26	53	49
(7) Long. of Omaha	6	24	00
(8) Omaho sid. time (6) − (7)	20	29	49

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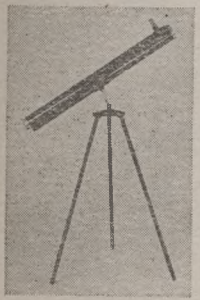

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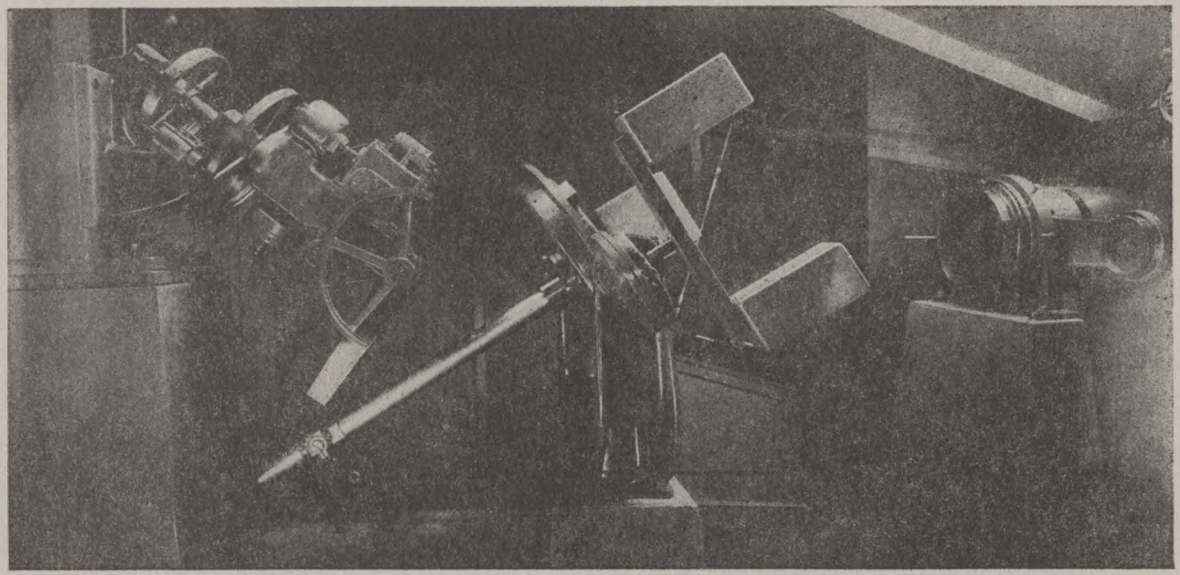

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