The CANADIAN ASTRONOMICAL HANDBOOK for 1907

PUBLISHED BY THE

ROYAL ASTRONOMICAL SOCIETY
OF CANADA

Edited by C. A. CHANT

First Year of Publication

TORONTO
198 COLLEGE ST.
Printed for the Society
1906

The Observer's Handbook for 1907

Introduction by Roy Bishop, August 2009

Paper and ink have enabled the first edition of the *Observer's Handbook* to survive for more than a century, and digital technology now makes it accessible to anyone.

Clarence Augustus Chant (1865-1956), professor of Physics at the University of Toronto and regarded as "the Father of Canadian Astronomy", conceived the *Observer's Handbook* and served as its editor for 50 years. As Chant states in his Preface to the first edition (page 6):

> *The object has been to produce a companion which the observer would wish always to have in his pocket or on the table before him.*

It was the first annual guide for observational astronomy to be published in Canada. Titled *The Canadian Astronomical Handbook for 1907*, a second edition followed for 1908, but for the next two years most of the information that would have appeared was published instead in installments in the *Journal of the Royal Astronomical Society of Canada.* The Council of the Society decided to return to a separate publication for 1911 with a new name, the *Observer's Handbook*, and it has been published annually ever since. Thus the 2008 edition was the 100th. Chant's continuing creation is now one of Canada's oldest scientific publications.

Exclusive of pages devoted to a list of officers and by-laws of the Society, the first edition has 100 pages. Not until the 1968 edition, when Ruth Northcott was editor, did the number of pages devoted

to astronomy again reach 100. In subsequent years the page count has more than tripled. The Handbook also increased in page size. The first two editions are small, only 12.5 x 17 cm. With the 1911 edition the Handbook reached its current dimensions: 14 x 22 cm, too large for the average pocket!

Chant assembled five "Contributors" in addition to himself to provide material for the 1907 Handbook. Among these was Andrew Elvins (1823-1918) who contributed the section "Observing the Sun, Moon, and Planets" (pages 40-44). Elvins, then 83 years of age, had been the guiding spirit of Canada's first astronomical society, The Toronto Astronomical Club, that began in 1868 and eventually became the Royal Astronomical Society of Canada. Chant regarded Elvins as "the true father of the incorporated society". Through Elvins, the *Observer's Handbook* has a link going back more than 140 years to the origin of the RASC. The *Observer's Handbook* owes its character and success to Chant's system of contributors. The 2009 edition represents the efforts of 54 contributors (40 from Canada, 14 from other countries), plus the Editor and his 3 assistants.

In addition to its emphasis on astronomical phenomena of the year 1907, other aspects of the first edition reflect that Edwardian era. As Chant mentions in his Preface: "Our country is still young . . ." The Titanic, Vimy Ridge, and income tax were still in the future. Among the list of dates on page 8 is "Accession of King Edward VII . . . Jan. 22", the event that marked the end of the Victorian era only six years earlier. Edward VII was particularly prominent in the Society's thoughts for he had granted the Society its royal designation in 1903. Astronomy has advanced dramatically since that first edition. For example, in 1907 no one knew what made the stars shine. Atomic spectra were a mystery. There was no Hertzsprung-Russell diagram. Galaxies were not part of

cosmology. In J. Miller Barr's long article on variable stars (pages 58-69), the term "supernova" does not appear, although some are included in his list of "New Stars".

Although the Society was based in Toronto and its first Centre was then being planned in Ottawa, Chant had all of Canada in mind when he assembled the 1907 Handbook. "Geographical Positions" (page 34) span Halifax to Victoria, and include two places north of latitude 60˚N: Fort Simpson and Herschel Island. Tables for the rising and setting of Sun and Moon (pages 10-33) include Halifax and Saint John, Quebec City, Toronto, Winnipeg, Vancouver and Victoria. (It would be another 42 years before Newfoundland became part of Canada.) Nevertheless, because nearly all Handbook users (mostly Society members) then resided in southern Ontario, Chant gave the times of events, such as eclipses, in "75th Meridian Time" (Eastern Standard Time). Not until 75 years later with the 1982 edition was the Handbook switched to Universal Time (UT).

The list of planets (page 45) is up-to-date! Pluto was discovered nearly a quarter of a century later, but a century later Pluto was officially recognized as being but one of countless smaller bodies composing the Kuiper Belt. However, Mercury and Venus were thought, incorrectly, to have rotation periods equal to their orbital periods, and the rotation periods of Uranus and Neptune were unknown.

In contrast to the unchanged number of planets, the number of known satellites of the planets (page 46) has exploded. For Jupiter the number has gone from 7 in 1907 to more than 60 today. For Neptune the relative increase is even more dramatic, from 1 to 13 (as of 2009). As one would expect, the satellites listed in the 1907 Handbook include all that are visible in a small telescope.

An example of the more informal approach to scientific topics a century ago occurs on pages 70 and 71 where "The Most Beautiful" double stars are listed. They are presented in two categories: the most luminous pairs as "Diamonds", and the finest coloured pairs as "Rubies, Garnets, Sapphires, Topazes, Emeralds", with colours given by various terms such as Lilac, Golden, Azure, and Rose. That terminology certainly is more generally appealing, albeit less informative, than the cryptic spectral classification scheme developed in the following decades. Moving forward a century, I am pleased to see that a "new" section, *COLOURED DOUBLE STARS*, appeared in the *2009 Observer's Handbook*, thanks to a new contributor Michel Duval and the support of Editor Patrick Kelly. Not surprisingly, the 1907 and 2009 lists have many stars in common. Duval's list will be particularly useful for those showing the public the night sky.

As a former Editor of the *Observer's Handbook*, I had 19 unsuccessful attempts at producing an error-free edition. Thus I empathize with Chant for errors I spotted in his first edition (for example, on page 7, 360˚ should be 330˚; on page 45, 0.75 should be 0.075).

Enjoy this significant document of Canadian astronomy, reflect on how much our understanding of the universe has advanced since 1907, and appreciate the vision of that outstanding member of the RASC, Clarence Augustus Chant.

Thomas Carlyle once wrote:

> *In books lies the soul of the whole Past Time: the articulate audible voice of the Past, when the body and material substance of it has altogether vanished like a dream.*☆

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PREFACE

For a number of years, in several foreign countries astronomical annuals, designed chiefly for the use of amateur observers, have been regularly published, and have been very effective in extending the interest in Astronomy. The present HANDBOOK aims to do a similar service for Canada.

Our country is still young and, as we might expect, the advance in Astronomy has not been so marked as in some other branches of knowledge; and yet in every part of the land are to be found those who have a profound interest in the celestial bodies above and in the natural phenomena about them.

The Royal Astronomical Society of Canada aims to unite in a common bond of interest all such students of nature. The object of the present work is to furnish, in a form understood by all, concise information regarding the chief astronomical phenomena to be observed in 1907; and it is hoped that the work will find its way into the hands of many who will add their names to the Society's roll of membership. Any one interested in Astronomy, Astronomical Physics or allied subjects is eligible for membership.

In preparing the work the Editor has received valued assistance from several members of the Society.

The summary of the values of the Magnetic Elements for the last five years was obtained from papers supplied by Director Stupart of the Canadian Meteorological Service.

In the Calendar are to be found the Equation of Time, the Sun's Declination, the co-ördinates of Polaris,

and in addition the times of rising and setting of the Sun and the Moon for five well-distributed points in Canada, namely, midway between Halifax and St. John, Quebec, Winnipeg, and midway between Vancouver and Victoria. For the calculations in the latter we are indebted to Mr. F. L. Blake, of the Toronto Meteorological Observatory.

In the article on "Observing the Sun, Moon and Planets," by Mr. Andrew Elvins, are hints gleaned from the experience of an honored life of eighty-three years.

The notes on the Planets will enable ordinary observers to follow their courses throughout the year. Exceptionally interesting observations will be possible with Mercury, Mars and Saturn, and observers everywhere are urged to send notes of their work to the Society.

The study of Variable Stars is a field in which the amateur can do really valuable service, and the admirable paper of Mr. J. Miller Barr should lead others to embark in this fascinating work.

The table of Meteor Showers was courteously supplied by our Corresponding Fellow, Mr. W. F. Denning, of Bristol, England.

The star-maps are borrowed from that valuable annual, "Knowledge Diary and Scientific Handbook."

In conclusion, let it be said, the object has been to produce a companion which the observer would wish always to have in his pocket or on the table before him. This is the first issue, and it is put forward with much diffidence. Those who use it are earnestly requested to send any suggestions which may come to them regarding methods of improving it. All such will be seriously considered.

THE EDITOR.

TORONTO, December, 1906.

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.....360°

SUN AND MOON

☉ The Sun.	☽ Full Moon.	☾ Last Quarter.
☾ New Moon.	☽ First Quarter.	☾ The Moon generally.

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.

CHRONOLOGICAL ERAS AND CYCLES

The year 1907 of the Gregorian Calendar (established in October, 1582) corresponds to
" " 6620 of the Julian Period, which commences on Jan. 14;
" " 5667-5668 of the Jewish Era, the year 5668 commencing at sunset on Sept. 8;
" " 1325 of the Hegira, the Turkish Calendar, which commences on Feb. 14, 1907.

Dominical Letter...F. Epact...16. Solar Cycle...12.
Roman Indiction...5. Lunar Cycle or Golden Number..8.

FIXED AND MOVABLE FESTIVALS, ANNIVERSARIES, &c.

New Year's Day, Tuesday	Jan.	1	Ascension Day, Holy Thursday	May	9
Epiphany	"	6	Pentecost, Whit-Sunday	"	19
Accession of King Edward VII	"	22	Victoria Day	"	24
SeptuagesimaSunday	"	27	Trinity Sunday	"	26
Shrove Sunday	Feb.	10	Corpus Christi	"	30
Ash Wednesday	"	13	St. John Baptist	June	24
First Sunday in Lent	"	17	Dominion Day, Monday	July	1
St. David	Mar.	1	Labor Day	Sept.	2
St. Patrick	"	17	Michaelmas Day	"	29
Palm Sunday	"	24	King's Birthday	Nov.	9
Annunci'n, Lady Day	"	25	St. Andrew	"	30
Good Friday	"	29	Queen's Birthday	Dec.	1
Easter Sunday	"	31	First Sunday in Advent	"	1
Low Sunday	April	7	St. Thomas	"	21
St. George	"	23	Christmas Day, Wed.	"	25
Rogation Sunday	May	5			

STANDARD TIME

On account of the great extent of Canada, it is necessary to use five belts of Standard Time, as follows :—

60th	Meridian	or	Atlantic	Time,	4	hrs.	west of Greenwich.
75th	"	"	Eastern	"	5	"	" "
90th	"	"	Central	"	6	"	" "
105th	"	"	Mountain	"	7	"	" "
120th	"	"	Pacific	"	8	"	" "

The 60th Meridian passes through Sydney, N.S., and North-West River, Labrador; the 75th is about 30 mls. east of Ottawa, and passes through Philadelphia; the 90th passes through St. Louis, and crosses the west end of Lake Superior about 40 mls. west of Port Arthur; the 105th goes through Denver, and passes about 20 mls. west of Regina; the 120th passes about 20 mls. east of Kamloops, B.C., and 100 mls. east of San Francisco.

In these places local and standard time will be the same. At places east of the meridian the time shown by a standard clock will be slow of local time; at places west it will be fast of local time.

CALENDAR FOR 1907

In the tables on the following pages the times of the rising and setting of the Sun and the Moon are given for points midway between Halifax and St. John, Vancouver and Victoria, and for Quebec, Toronto, and Winnipeg, standard time being used throughout, hours numbering from midnight.

For the rising and setting of the Sun the times are given for the upper limb, and are corrected for refraction.

For the Moon the times are for her centre, and are not corrected for refraction.

The Moon's Phases are given in the monthly predictions, near the end of this volume.

Day of Year	Day of Month	Day of Week	Greenwich M. Noon: Sun's Declination	Equation of Time to be subtracted from Mean Time	Halifax... Lat. 45° 0′ / St. John... Long. 64 50: Sun Rises	Sun Sets	Moon Rises	Moon Sets	Quebec..... Lat. 46° 48′ / Long. 71 13: Sun Rises	Sun Sets	Moon Rises	Moon Sets
			S.	m. s.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
1	1	Tues.	23° 4′ 38″	3 18.12	7.58	16.48	18.40	9.12	7.30	16.06	17.59	8.45
2	2	Wed..	22 59 51	3 46.51	7.58	16.49	19.36	9.50	7.30	16.07	19.01	9.22
3	3	Thur.	22 54 35	4 14.58	7.58	16.50	20.39	10.24	7.30	16.08	20.03	9.55
4	4	Frid.	22 48 52	4 42.31	7.58	16.51	21.45	10.57	7.30	16.09	21.10	10.26
5	5	Sat..	22 42 42	5 9.66	7.58	16.51	22.50	11.26	7.30	16.10	22.16	10.51
6	6	Sun.	22 36 5	5 36.62	7.58	16.52	23.56	11.53	7.30	16.11	23.25	11.19
7	7	Mon.	22 29 2	6 3.15	7.58	16.53	a.m.	12.21	7.30	16.12	a.m.	11.42
8	8	Tues.	22 21 31	6 29.23	7.57	16.54	1.06	12.52	7.29	16.13	0.37	12.11
9	9	Wed.	22 13 35	6 54.83	7.57	16.55	2.17	13.26	7.29	16.15	1.50	12.41
10	10	Thur.	22 5 12	7 19.93	7.57	16.56	3.32	14.00	7.29	16.16	3.04	13.14
11	11	Frid.	21 56 23	7 44.50	7.57	16.58	4.48	14.41	7.29	16.17	4.21	13.56
12	12	Sat..	21 47 9	8 8.50	7.56	16.59	6.00	15.34	7.28	16.18	5.38	14.50
13	13	Sun.	21 37 29	8 31.92	7.56	17.00	7.10	16.34	7.28	16.20	6.45	15.51
14	14	Mon.	21 27 24	8 54.72	7.56	17.01	8.11	17.42	7.27	16.21	7.34	17.00
15	15	Tues.	21 16 54	9 16.88	7.55	17.02	9.02	18.52	7.27	16.22	8.26	18.14
16	16	Wed.	21 5 59	9 38.37	7.55	17.03	9.43	20.07	7.26	16.23	9.10	19.28
17	17	Thur.	20 54 41	9 59.18	7.54	17.04	10.16	21.18	7.25	16.25	9.43	20.43
18	18	Frid.	20 42 58	10 19.27	7.54	17.05	10.46	22.24	7.24	16.26	10.12	21.52
19	19	Sat..	20 30 52	10 38.63	7.53	17.07	11.13	23.30	7.24	16.27	10.36	22.59
20	20	Sun.	20 18 23	10 57.25	7.52	17.08	11.40	a.m.	7.23	16.29	11.01	a.m.
21	21	Mon.	20 5 30	11 15.09	7.51	17.10	12.04	0.36	7.22	16.30	11.24	0.06
22	22	Tues.	19 52 16	11 32.17	7.50	17.11	12.32	1.36	7.21	16.32	11.50	1.07
23	23	Wed.	19 38 39	11 48.47	7.49	17.12	13.01	2.37	7.20	16.33	12.18	2.09
24	24	Thur.	19 24 40	12 3.47	7.49	17.13	13.34	3.35	7.19	16.35	12.50	3.10
25	25	Frid.	19 10 20	12 18.66	7.48	17.15	14.10	4.35	7.19	16.36	13.25	4.08
26	26	Sat..	18 55 39	12 35.56	7.47	17.16	14.53	5.30	7.18	16.38	14. 9	5.05
27	27	Sun.	18 40 37	12 45.64	7.46	17.18	15.40	6.21	7.17	16.39	14.58	5.55
28	28	Mon.	18 25 14	12 57.92	7.45	17.19	16.33	7.18	7.16	16.41	15.52	6.42
29	29	Tues.	18 9 32	13 9.36	7.44	17.20	17.30	7.51	7.15	16.42	16.53	7.21
30	30	Wed.	17 53 31	13 19.99	7.43	17.22	18.34	8.26	7.13	16.44	17.55	7.57
31	31	Thur.	17 37 10	13 29.82	7.42	17.23	19.37	9. 0	7.12	16.45	18.59	8.28

Standard Time.—The rising and setting of the Sun and

Toronto... Lat. 43° 40′ Long. 79 24				Winnipeg Lat. 49° 53′ Long. 97 7				Vancouver Victoria... Lat. 49° 0′ Long. 123 12				R.A. of Polaris	Decl. of Polaris
Sun		Moon		Sun		Moon		Sun		Moon			
Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets		
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.	° ′
												1 25 8848	
7.51	16.51	18.45	9.07	8.28	16.36	18.38	9.39	8.07	16.25	18.27	9.28	58s	50″
7.51	16.52	19.44	9.46	8.28	16.37	19.40	10.16	8.07	16.26	19.26	10.04	57	50
7.51	16.53	20.45	10.21	8.28	16.38	20.44	10.49	8.07	16.27	20.33	10.36	55	51
7.51	16.54	21.49	10.54	8.28	16.39	21.52	11.19	8.07	16.28	21.38	11.07	54	51
7.51	16.54	22.53	11.22	8.27	16.40	23.01	11.41	8.06	16.29	22.46	11.32	53	51
7.51	16.55	23.59	11.51	8.27	16.41	a.m.	12.07	8.06	16.30	23.57	11.56	52	51
7.51	16.56	a.m.	12.18	8.27	16.42	0.12	12.28	8.06	16.31	a.m.	12.22	51	51
7.50	16.57	1.08	12.48	8.26	16.43	1.26	12.14	8.06	16.32	1.07	12.50	50	51
7.50	16.58	2.19	13.20	8.26	16.44	2.42	13.21	8.05	16.33	2.24	13.19	49	51
7.50	16.59	3.31	13.57	8.25	16.45	3.58	13.53	8.05	16.34	3.43	13.53	48	51
7.50	17.01	4.45	14.42	8.25	16.47	5.17	14.35	8.05	16.36	5.03	14.37	48	51
7.49	17.02	6.00	15.36	8.24	16.48	6.35	15.26	8.04	16.37	6.20	15.22	47	51
7.49	17.03	7.07	16.37	8.24	16.50	7.43	16.27	8.04	16.39	7.30	16.22	45	51
7.49	17.04	7.56	17.46	8.23	16.51	8.31	17.37	8.04	16.40	8.29	17.30	44	51
7.48	17.05	8.45	18.58	8.23	16.53	9.17	18.54	8.03	16.42	9.17	18.44	43	52
7.48	17.06	9.36	20.09	8.22	16.54	10.03	20.08	8.03	16.43	9.54	19.58	42	52
7.47	17.07	10.12	21.21	8.21	16.56	10.35	21.26	8.02	16.45	10.28	21.11	41	52
7.47	17.08	10.43	22.28	8.20	16.57	11.02	22.37	8.01	16.46	10.51	22.23	40	52
7.46	17.10	11.10	23.23	8.19	16.59	11.24	23.47	8.00	16.48	11.16	23.31	39	52
7.46	17.11	11.37	a.m.	8.18	17.00	11.49	a.m.	7.59	16.49	11.38	a.m.	37	52
7.45	17.13	12.02	0.37	8.17	17.02	12.11	0.56	7.58	16.51	12.01	0.38	36	52
7.44	17.14	12.30	1.36	8.16	17.03	12.35	1.59	7.57	16.52	12.24	1.28	35	52
7.43	17.15	13.01	2.36	8.15	17.05	13.02	3.03	7.56	16.54	12.52	2.46	35	52
7.43	17.17	13.34	3.35	8.14	17.06	13.32	4.05	7.55	16.55	13.21	3.48	34	52
7.42	17.18	14.11	4.32	8.13	17.08	14.05	5.05	7.54	16.57	13.58	4.48	33	52
7.41	17.20	14.55	5.27	8.12	17.10	14.46	6.03	7.53	16.58	14.38	5.47	32	52
7.40	17.21	15.44	6.17	8.11	17.12	15.34	6.53	7.52	16.59	15.25	6.38	31	51
7.39	17.22	16.38	7.04	8.10	17.13	16.28	7.40	7.51	17.00	16.20	7.24	29	51
7.38	17.24	17.37	7.45	8.08	17.15	17.28	8.18	7.49	17.02	17.20	8.06	28	51
7.37	17.25	18.38	8.22	8.07	17.16	18.32	8.52	7.48	17.03	18.42	8.38	27	51
7.36	17.26	19.42	8.56	8.05	17.18	19.40	9.22	7.46	17.05	19.29	9.10	26	51

Moon are given in standard time for the places named.

Day of Year	Day of Month	Day of Week	Greenwich M. Noon: Sun's Declination	Greenwich M. Noon: Equation of Time to be subtracted from Mean Time	Halifax... Lat. 45° 0′ / St. John... Long. 64 50: Sun Rises	Sun Sets	Moon Rises	Moon Sets	Quebec..... Lat. 46° 48 / Long. 71 13: Sun Rises	Sun Sets	Moon Rises	Moon Sets
			S.	m. s.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
32	1	Frid.	17°20′31″	13 38.83	7.41	17.24	20.42	9.29	7.11	16.46	20.08	8.55
33	2	Sat.	17 3 33	13 47.03	7.40	17.25	21.49	9.57	7.10	16.47	21.15	9.23
34	3	Sun.	16 46 17	13 54.42	7.38	17.27	22.56	10.26	7.08	16.49	22.27	9.47
35	4	Mon.	16 28 43	14 1.01	7.37	17.28	a.m.	10.53	7.07	16.50	23.39	10.13
36	5	Tues.	16 10 52	14 6.81	7.36	17.30	0.06	11.23	7.06	16.52	a.m.	10.42
37	6	Wed.	15 52 45	14 11.81	7.35	17.31	1.17	11.56	7.04	16.53	0.47	11.14
38	7	Thur.	15 34 21	14 16.01	7.33	17.33	2.29	12.35	7.03	16.55	2.01	11.52
39	8	Frid.	15 15 41	14 19.45	7.32	17.34	3.42	13.24	7.01	16.56	3.14	12.36
40	9	Sat.	14 56 45	14 22.10	7.31	17.36	4.50	14.16	7.00	16.58	4.26	13.33
41	10	Sun.	14 37 34	14 23.96	7.29	17.38	5.53	15.19	6.58	16.58	5.27	14.36
42	11	Mon.	14 18 9	14 25.06	7.28	17.39	6.48	16.28	6.57	17.01	6.20	15.48
43	12	Tues.	13 58 29	14 25.37	7.26	17.41	7.33	17.39	6.55	17.03	7.06	17.03
44	13	Wed.	13 38 36	14 24.93	7.25	17.42	8.12	18.52	6.54	17.05	7.42	18.17
45	14	Thur.	13 18 29	14 23.72	7.23	17.43	8.43	20.03	6.52	17.06	8.11	19.29
46	15	Frid.	12 58 9	14 21.75	7.22	17.45	9.14	21.13	6.50	17.08	8.39	20.40
47	16	Sat.	12 37 36	14 19.05	7.20	17.46	9.41	22.18	6.49	17.09	9.04	21.48
48	17	Sun.	12 16 52	14 15.59	7.19	17.47	10.06	23.21	6.47	17.11	9.30	22.53
49	18	Mon.	11 55 55	14 11.41	7.17	17.48	10.34	a.m.	6.46	17.12	9.53	23.57
50	19	Tues.	11 34 48	14 6.51	7.16	17.50	11.01	0.25	6.44	17.14	10.21	a.m.
51	20	Wed.	11 13 29	14 0.91	7.14	17.51	11.31	1.27	6.43	17.15	10.49	0.59
52	21	Thur.	10 52 1	13 54.62	7.13	17.53	12.06	2.26	6.41	17.17	11.24	1.58
53	22	Frid.	10 30 22	13 47.65	7.11	17.54	12.47	3.21	6.40	17.18	12.03	2.57
54	23	Sat.	10 8 33	13 40.03	7.10	17.56	13.32	4.14	6.38	17.20	12.50	3.49
55	24	Sun.	9 46 35	13 31.77	7.08	17.57	14.23	5.03	6.36	17.21	13.42	4.36
56	25	Mon.	9 24 29	13 22.88	7.07	17.59	15.19	5.46	6.34	17.23	14.40	5.18
57	26	Tues.	9 2 14	13 13.40	7.05	18.00	16.21	6.26	6.32	17.24	15.41	5.54
58	27	Wed.	8 39 51	13 3.33	7.03	18.02	17.24	7.00	6.30	17.26	16.46	6.28
59	28	Thur.	8 17 20	12 52.70	7.01	18.03	18.30	7.32	6.28	17.27	17.56	6.59

Standard Time.—The rising and setting of the Sun and

Toronto... Lat. 43° 40′ Long. 79 24				Winnipeg Lat. 49° 53′ Long. 97 7				Vancouver Victoria... Lat. 49° 0′ Long. 123 12				R.A. of Polaris	Decl. of Polaris
Sun		Moon		Sun		Moon		Sun		Moon			
Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets		
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. 1 24	° ′ 88 48
7.35	17.27	20.47	9.25	8.04	17.20	20.53	9.42	7.45	17.07	20.38	9.39	85s.	51″
7.34	17.28	21.51	9.56	8.03	17.22	22.01	10.08	7.44	17.09	21.49	10.02	84	51
7.32	17.30	22.59	10.21	8.01	17.23	23.15	10.24	7.42	17.10	22.57	10.27	83	51
7.31	17.31	a.m.	10.50	8.00	17.25	a.m.	10.53	7.41	17.12	a.m.	10.52	82	51
7.30	17.33	0.09	11.21	7.58	17.27	0.30	11.21	7.39	17.14	0.12	11.19	81	51
7.29	17.34	1.17	11.56	7.57	17.28	1.43	11.55	7.38	17.15	1.27	11.50	80	51
7.28	17.36	2.29	12.36	7.55	17.30	2.59	12.30	7.36	17.17	2.43	12.25	79	51
7.27	17.37	3.39	13.22	7.54	17.32	4.12	13.13	7.35	17.19	3.58	13.11	78	50
7.26	17.38	4.49	14.19	7.52	17.34	5.25	14.09	7.32	17.21	5.09	14.03	77	50
7.24	17.40	5.49	15.22	7.51	17.36	6.25	15.13	7.31	17.23	6.13	15.07	76	50
7.23	17.41	6.42	16.33	7.49	17.37	7.15	16.27	7.30	17.24	7.06	16.17	75	50
7.21	17.43	7.29	17.46	7.47	17.39	7.59	17.44	7.28	17.26	7.48	17.34	74	50
7.20	17.44	8.07	18.56	7.45	17.41	8.33	18.58	7.26	17.28	8.21	18.46	73	50
7.18	17.45	8.39	20.06	7.44	17.42	9.00	20.13	7.25	17.29	8.52	20.01	72	50
7.17	17.47	9.09	21.14	7.42	17.44	9.25	21.26	7.23	17.31	9.18	21.13	71	50
7.15	17.48	9.36	22.20	7.40	17.46	9.46	22.37	7.22	17.33	9.42	22.20	70	49
7.14	17.49	10.05	23.23	7.38	17.48	10.12	23.44	7.20	17.35	10.03	23.27	69	49
7.12	17.50	10.30	a.m.	7.36	17.50	10.33	a.m.	7.18	17.37	10.28	a.m.	68	49
7.11	17.52	11.00	0.25	7.34	17.51	10.59	0.50	7.16	17.38	10.55	0.34	68	49
7.09	17.53	11.31	1.25	7.32	17.53	11.27	1.55	7.14	17.40	11.22	1.38	67	49
7.08	17.54	12.08	2.22	7.30	17.55	12.01	2.55	7 12	17.42	11.56	2.40	66	48
7.06	17.56	12.49	3.19	7.28	17.56	12.39	3.54	7.10	17.43	12.35	3.37	65	48
7.05	17.57	13.36	4.11	7.26	17.58	13.26	4.47	7.08	17.45	13.17	4.31	65	48
7.03	17.59	14.25	4.58	7.24	18.00	14.19	5.34	7.06	17.47	14.09	5.20	64	48
7.02	18.00	15.26	5.41	7.22	18.02	15.19	6.16	7.04	17.49	15.08	6.03	63	48
7.00	18.01	16.27	6.19	7.20	18.03	16.23	6.49	7.02	17.50	16.11	6.39	62	47
6.59	18.02	17.29	6.55	7.18	18.05	17.29	7.22	7.00	17.52	17.18	7.10	61	47
6.57	18.04	18.37	7.26	7.16	18.07	18.42	7.50	6.58	17.54	18.26	7.40	60	47
....	....	....	....	....	....	....	....	....	....	....	....	....	....
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Moon are given in standard time for the places named.

Day of Year	Day of Month	Day of Week	Greenwich M. Noon: Sun's Declination	Greenwich M. Noon: Equation of Time to be subtracted from Mean Time	Halifax... Lat. 45° 0′ / St. John... Long. 64 50: Sun Rises	Sun Sets	Moon Rises	Moon Sets	Quebec..... Lat. 46° 48′ / Long. 71 13: Sun Rises	Sun Sets	Moon Rises	Moon Sets
			S.	m. s.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
60	1	Frid.	7° 54′ 43″	12 41.52	6.59	18.05	19.38	8.02	6.26	17.29	19.07	7.25
61	2	Sat.	7 31 58	12 29.83	6.57	18.07	20.47	8.29	6.24	17.30	20.18	7.50
62	3	Sun.	7 9 7	12 17.65	6.55	18.09	21.59	8.57	6.23	17.32	21.29	8.18
63	4	Mon.	6 46 9	12 4.98	6.53	18.10	23.07	9.26	6.21	17.33	22.42	8.46
64	5	Tues.	6 23 6	11 51.86	6.52	18.11	a.m.	9.58	6.19	17.34	23.55	9.16
65	6	Wed.	5 59 58	11 38.31	6.50	18.12	0.21	10.35	6.17	17.36	a.m.	9.51
66	7	Thur.	5 36 44	11 24.35	6.49	18.14	1.32	11.17	6.15	17.37	1.06	10.32
67	8	Frid.	5 13 26	11 10.00	6.47	18.15	2.41	12.07	6.13	17.38	2.17	11.24
68	9	Sat.	4 50 4	10 55.26	6.45	18.16	3.46	13.05	6.11	17.40	3.18	12.24
69	10	Sun.	4 26 38	10 40.18	6.43	18.17	4.41	14.10	6.09	17.41	4.14	13.28
70	11	Mon.	4 3 8	10 24.76	6.41	18.19	5.29	15.18	6.07	17.43	4.57	14.39
71	12	Tue.	3 39 36	10 9.01	6.40	18.20	6.06	16.30	6.05	17.44	5.35	15.53
72	13	Wed.	3 16 0	9 52.96	6.38	18.21	6.41	17.42	6.03	17.46	6.06	17.08
73	14	Thur.	2 52 23	9 36.62	6.37	18.23	7.11	18.50	6.01	17.47	6.35	18.19
74	15	Frid.	2 28 43	9 20.01	6.35	18.24	7.39	19.58	6.00	17.49	7.00	19.28
75	16	Sat.	2 5 2	9 3.12	6.33	18.25	8.05	21.04	5.58	17.50	7.26	20.37
76	17	Sun.	1 41 20	8 46.01	6.31	18.26	8.32	22.09	5.56	17.51	7.52	21.42
77	18	Mon.	1 17 37	8 28.68	6.29	18.27	8.44	23.25	5.54	17.53	8.17	22.46
78	19	Tue.	0 53 54	8 11.13	6.27	18.28	9.16	a.m.	5.52	17.54	8.46	23.47
79	20	Wed.	0 30 11	7 53.41	6.25	18.30	9.53	0.24	5.50	17.56	9.18	a.m.
80	21	Thur.	S. 6 28	7 35.51	6.23	18.32	10.36	1.18	5.47	17.58	9.57	0.48
81	22	Frid.	N. 17 14	7 17.47	6.22	18.33	11.24	2.06	5.45	17.59	10.40	1.40
82	23	Sat.	0 40 55	6 59.30	6.20	18.35	12.13	2.57	5.44	18.00	11.25	2.30
83	24	Sun.	1 4 34	6 41.04	6.19	18.36	13.07	3.41	5.42	18.02	12.26	3.13
84	25	Mon.	1 28 11	6 22.67	6.17	18.37	14.05	4.24	5.40	18.03	13.29	3.51
85	26	Tue.	1 51 46	6 4.26	6.15	18.38	15.09	4.58	5.38	18.04	14.32	4.29
86	27	Wed.	2 15 19	5 45.81	6.13	18.39	16.15	5.31	5.36	18.05	15.40	4.57
87	28	Thur.	2 38 48	5 27.34	6.12	18.40	17.22	6.00	5.34	18.07	16.50	5.25
88	29	Frid.	3 2 14	5 8.88	6.10	18.41	18.32	6.29	5.32	18.08	18.15	5.52
89	30	Sat.	3 25 37	4 50.44	6.08	18.43	19.43	6.57	5.30	18.10	19.15	6.16
90	31	Sun.	3 48 56	4 32.07	6.05	18.43	20.57	7.26	5.28	18.11	20.29	6.46

Standard Time.—The rising and setting of the Sun and

Toronto... Lat. 43° 40′ Long. 79 24				Winnipeg Lat. 49° 53′ Long. 97 7				Vancouver Victoria... Lat. 49° 0′ Long. 123 12				R.A. of Polaris	Decl. of Polaris
Sun		Moon		Sun		Moon		Sun		Moon			
Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets		
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.	° ′
												1.24	8848
6.55	18.05	19.43	7.56	7.14	18.08	19.53	8.10	6.57	17.55	19.37	8.06	59s.	47″
6.54	18.06	20.52	8.24	7.12	18.10	21.08	8.33	6.55	17.56	20.48	8.30	59	46
6.52	18.08	22.00	8.54	7.10	18.11	22.20	8.58	6.53	17.58	22.02	8.57	58	46
6.50	18.09	23.10	9.24	7.08	18.13	23.34	9.24	6.51	18.00	23.19	9.22	57	46
6.49	18.10	a.m.	9.57	7.06	18.15	a.m.	9.53	6.49	18.02	a.m.	9.52	57	46
6.47	18.11	0.21	10.35	7.04	18.10	0.51	10.26	6.48	18.03	0.33	10.25	56	45
6.46	18.13	1.30	11.18	7.02	18.18	2.03	11.08	6.46	18.05	1.48	11.06	56	45
6.44	18.14	2.39	12.10	7.00	18.19	3.15	12.01	6.44	18.07	2.58	11.55	55	45
6.42	18.15	3.40	13.10	6.57	18.21	4.16	13.01	6.42	18.09	4.03	12.53	55	45
6.40	18.16	4.36	14.14	6.55	18.22	5.12	14.10	6.40	18.10	4.58	13.58	54	45
6.38	18.18	5.21	15.23	6.53	18.24	5.53	15.23	6.38	18.12	5.42	15.10	53	44
6.37	18.19	6.02	16.34	6.51	18.26	6.29	16.39	6.36	18.14	6.18	16.24	53	44
6.35	18.20	6.35	17.46	6.49	18.28	6.58	17.56	6.34	18.16	6.52	17.37	52	44
6.34	18.22	7.06	18.55	6.47	18.29	7.25	19.11	6.32	18.18	7.12	18.50	51	43
6.32	18.23	7.34	20.02	6.45	18.31	7.48	20.21	6.30	18.20	7.41	19.59	51	43
6.30	18.24	8.02	21.08	6.42	18.32	8.11	21.32	6.28	18.21	8.05	21.09	50	43
6.28	18.25	8.30	22.10	6.40	18.34	8.34	22.38	6.25	18.23	8.27	22.16	50	43
6.26	18.26	8.58	23.12	6.38	18.36	8.58	23.44	6.23	18.24	8.35	23.38	50	42
6.24	18.27	9.29	a.m.	6.36	18.37	9.25	a.m.	6.21	18.25	9.03	a.m.	49	42
6.22	18.29	10.03	0.11	6.33	18.39	9.56	0.46	6.19	18.26	9.40	0.39	49	42
6.20	18.31	10.43	1.10	6.31	18.40	10.34	1.46	6.16	18.27	10.22	1.34	49	41
6.19	18.30	11.27	2.02	6.29	18.42	11.17	2.38	6.14	18.28	11.10	2.22	48	41
6.17	18.32	12.11	2.52	6.27	18.44	12.01	3.27	6.12	18.30	11.59	3.13	48	41
6.16	18.33	13.12	3.35	6.24	18.46	13.03	4.08	6.10	18.33	12.54	3.57	47	41
6.14	18.35	14.13	4.15	6.22	18.48	14.07	4.45	6.07	18.34	13.55	4.37	47	40
6.12	18.36	15.14	4.54	6.20	18.50	15.13	5.19	6.05	18.35	15.00	5.12	47	40
6.10	18.37	16.19	5.25	6.18	18.51	16.22	5.46	6.03	18.36	16.07	5.40	46	40
6.09	18.38	17.27	5.55	6.16	18.52	13.34	6.11	6.01	18.37	17.19	6.07	46	39
6.07	18.39	18.34	6.24	6.13	18.54	18.47	6.34	5.59	18.38	18.33	6.32	46	39
6.06	18.40	19.46	6.51	6.11	18.56	20.04	6.57	5.56	18.39	19.47	6.58	45	39
6.03	18.41	20.58	7.23	6.09	18.57	21.21	7.24	5.54	18.40	21.04	7.25	45	38

Moon are given in standard time for the places named.

Day of Year	Day of Month	Day of Week	Greenwich M. Noon: Sun's Declination	Greenwich M. Noon: Equation of Time to be subtracted / added to Mean Time	Halifax... Lat. 45° 0′ St. John... Long. 64 50: Sun Rises	Sun Sets	Moon Rises	Moon Sets	Quebec..... Lat. 46° 48′ Long. 71 13: Sun Rises	Sun Sets	Moon Rises	Moon Sets
			N.	m. s.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
91	1	Mon.	4° 12′ 11″	4 13.77	6.02	18.45	22.09	7.59	5.26	18.12	21.42	7.16
92	2	Tues.	4 35 21	3 55.57	6.01	18.46	23.22	8.35	5.24	18.13	22.58	7.50
93	3	Wed.	4 58 26	3 37.51	5.59	18.47	a.m.	9.15	5.22	18.15	a.m.	8.31
94	4	Thur.	5 21 26	3 19.59	5.57	18.49	0.35	10.03	5.20	18.16	0.11	9.19
95	5	Frid.	5 44 20	3 1.84	5.55	18.50	1.41	10.59	5.18	18.17	1.14	10.16
96	6	Sat.	6 7 9	2 44.27	5.53	18.51	2.38	12.01	5.16	18.19	2.10	11.20
97	7	Sun.	6 29 51	2 26.90	5.51	18.52	3.28	13.07	5.14	18.20	2.58	12.29
98	8	Mon.	6 52 27	2 9.76	5.49	18.53	4.08	14.17	5.12	18.22	3.38	13.40
99	9	Tues.	7 14 55	1 52.86	5.47	18.55	4.43	15.28	5.10	18.23	4.12	14.52
100	10	Wed.	7 37 17	1 36.19	5.46	18.56	5.13	16.36	5.08	18.24	4.40	16.05
101	11	Thur.	7 59 31	1 19.80	5.44	18.58	5.40	17.44	5.06	18.26	5.06	17.12
102	12	Frid.	8 21 37	1 3.69	5.43	18.59	6.07	18.50	5.05	18.27	5.29	18.21
103	13	Sat.	8 43 54	0 47.86	5.41	19.00	6.32	19.54	5.03	18.28	5.54	19.26
104	14	Sun.	9 5 23	0 32.35	5.40	19.01	7.00	20.58	5.01	18.30	6.19	20.31
105	15	Mon.	9 27 3	0 17.15	5.38	19.03	7.27	22.01	4.59	18.31	6.48	21.34
106	16	Tues.	9 48 33	0 2.28	5.36	19.04	8.00	23.01	4.57	18.33	7.20	22.34
107	17	Wed.	10 9 54	0 12.26	5.34	19.05	8.35	23.56	4.55	18.34	7.54	23.32
108	18	Thur.	10 31 4	0 26.43	5.33	19.06	9.16	a.m.	4.54	18.35	8.34	a.m.
109	19	Frid.	10 52 4	0 40.23	5.31	19.08	10.03	0.50	4.52	18.37	9.21	0.23
110	20	Sat.	11 12 54	0 53.66	5.29	19.09	10.55	1.32	4.50	18.38	10.13	1.13
111	21	Sun.	11 33 32	1 6.68	5.27	19.11	11.51	2.19	4.48	18.39	11.10	1.52
112	22	Mon.	11 53 58	1 19.29	5.26	19.12	12.50	2.58	4.47	18.41	12.11	2.26
113	23	Tues.	12 14 13	1 31.49	5.24	19.13	13.55	3.29	4.45	18.42	13.16	2.57
114	24	Wed.	12 34 16	1 43.25	5.23	19.14	15.02	4.00	4.43	18.44	14.26	3.25
115	25	Thur.	12 54 6	1 54.57	5.21	19.15	16.10	4.28	4.41	18.45	15.36	3.52
116	26	Frid.	13 13 43	2 5.42	5.20	19.16	17.28	4.56	4.40	18.46	16.49	4.18
117	27	Sat.	13 33 7	2 15.79	5.18	19.17	18.35	5.25	4.38	18.48	18.05	4.45
118	28	Sun.	13 52 18	2 25.67	5.17	19.19	19.49	5.56	4.36	18.49	19.22	5.15
119	29	Mon.	14 11 15	2 35.04	5.15	19.20	21.07	6.32	4.34	18.50	20.39	5.46
120	30	Tues.	14 29 59	2 43.90	5.13	19.22	22.22	7.10	4.33	18.52	21.55	6.24
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Standard Time.—The rising and setting of the Sun and

TORONTO... Lat. 43° 40′ Long. 79 24				WINNIPEG Lat. 49° 53′ Long. 97 7				VANCOUVER VICTORIA... Lat. 49° 0′ Long. 123 12				R.A. OF POLARIS	DECL. OF POLARIS
SUN		MOON		SUN		MOON		SUN		MOON			
Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets		
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.	° ′
												1 24	88 48
6.01	18.43	22.09	7.56	6.07	18.59	22.36	7.52	5.52	18.42	22.20	7.52	45s.	38″
6.00	18.44	23.22	8.33	6.05	19.00	23.54	8.26	5.51	18.43	23.39	8.26	45	38
5.58	18.45	a.m.	9.17	6.03	19.02	a.m.	9.07	5.49	18.45	a.m.	9.05	45	37
5.56	18.47	0.33	10.05	6.01	19.03	1.09	9.55	5.47	18.46	0.52	9.51	45	37
5.54	18.48	1.36	11.02	5.59	19.04	2.12	10.52	5.45	18.47	2.00	10.46	45	37
5.52	18.49	2.32	12.06	5.57	19.06	3.08	12.00	5.43	18.49	2.57	11.48	44	37
5.50	18.50	3.20	13.13	5.55	19.07	3.53	13.12	5.41	18.50	3.43	12.57	44	36
5.48	18.51	4.02	14.22	5.53	19.09	4.32	14.25	5.39	18.52	4.21	14.09	44	36
5.46	18.52	4.37	15.31	5.50	19.10	5.02	15.39	5.36	18.53	4.51	15.22	44	36
5.45	18.53	5.08	16.40	5.48	19.12	5.29	16.53	5.34	18.55	5.20	16.33	44	35
5.43	18.55	5.36	17.46	5.46	19.13	5.52	18.04	5.32	18.56	5.43	17.44	44	35
5.42	18.56	6.01	18.52	5.44	19.15	6.11	19.14	5.30	18.58	6.07	18.52	44	35
5.40	18.57	6.29	19.56	5.42	19.17	6.35	20.22	5.28	19.00	6.29	20.01	44	34
5.39	18.58	6.56	20.58	5.40	19.18	6.58	21.29	5.26	19.01	6.53	21.07	44	34
5.37	19.00	7.27	21.59	5.38	19.20	7.25	22.32	5.24	19.03	7.19	22.13	45	34
5.35	19.01	8.02	22.58	5.36	19.21	7.56	23.34	5.22	19.04	7.49	23.15	45	33
5.33	19.02	8.38	23.54	5.34	19.23	8.29	a.m.	5.20	19.06	8.23	a.m.	45	33
5.32	19.03	9.20	a.m.	5.32	19.24	9.10	0.31	5.18	19.07	9.02	0.14	46	33
5.30	19.05	10.07	0.45	5.30	19.26	9.56	1.21	5.16	19.09	9.48	1.08	46	32
5.28	19.06	10.59	1.33	5.28	19.27	10.49	2.08	5.14	19.10	10.40	1.55	46	32
5.26	19.07	11.56	2.14	5.26	19.29	11.49	2.44	5.12	19.12	11.39	2.36	46	32
5.25	19.08	12.57	2.51	5.24	19.30	12.53	3.18	5.10	19.13	12.41	3.10	46	32
5.23	19.09	13.59	3.24	6.22	19.32	14.00	3.47	5.08	19.15	13.48	3.39	46	31
5.22	19.10	15.06	3.54	5.20	19.33	15.11	4.12	5.06	19.16	14.58	4.08	46	31
5.20	19.11	16.14	4.23	5.18	19.35	16.24	4.36	5.04	19.18	16.10	4.35	47	30
5.19	19.12	17.25	4.52	5.16	19.36	17.41	5.00	5.02	19.19	17.23	4.58	47	30
5.17	19.13	18.38	5.22	5.14	19.38	18.59	5.25	5.00	19.21	18.41	5.25	48	30
5.16	19.15	19.52	5.54	5.12	19.39	20.18	5.53	4.58	19.22	20.00	5.52	48	29
5.14	19.16	21.07	6.29	5.10	19.41	21.37	6.23	4.56	19.24	21.21	6.25	49	29
5.13	19.18	22.20	7.08	5.09	19.43	22.55	6.58	4.55	19.26	22.39	7.00	49	29
....	....	....	....	....	....	....	....	....	....	....	....	...	...

Moon are given in standard time for the places named.

Day of Year	Day of Month	Day of Week	Greenwich M. Noon: Sun's Declination	Greenwich M. Noon: Equation of Time to be added to Mean Time	Halifax... / St. John... (Lat. 45° 0′, Long 64 50): Sun Rises	Sun Sets	Moon Rises	Moon Sets	Quebec..... (Lat. 46°48′, Long. 71 13): Sun Rises	Sun Sets	Moon Rises	Moon Sets
			N.	m. s.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
121	1	Wed.	14°48′ 28″	2 52.21	5.10	19.23	23.33	7.56	4.31	18.53	23.08	7.15
122	2	Thur.	15 6 42	2 59.99	5.09	19.25	a.m.	8.50	4.30	18.54	a.m.	8.10
123	3	Frid.	15 24 41	3 7.20	5.08	19.26	0.35	9.52	4.28	18.55	0.07	9.14
124	4	Sat.	15 42 26	3 13.85	5.06	19.27	1.27	11.00	4.26	18.57	0.59	10.23
125	5	Sun.	15 59 55	3 19.93	5.05	19.28	2.10	12.09	4.25	18.58	1.40	11.35
126	6	Mon.	16 17 8	3 25.43	5.03	19.29	2.47	13.17	4.23	18.59	2.14	12.46
127	7	Tues.	16 34 5	3 30.36	5.02	19.31	3.16	14.26	4.22	19.01	2.43	13.56
128	8	Wed.	16 50 45	3 34.70	5.01	19.32	3.45	15.43	4.20	19.02	3.10	15.04
129	9	Thur.	17 7 9	3 38.47	4.59	19.33	4.10	16.38	4.19	19.03	3.34	16.11
130	10	Frid.	17 23 16	3 41.64	4.58	19.35	4.35	17.40	4.18	19.05	3.58	17.17
131	11	Sat.	17 39 5	3 44.24	4.57	19.36	5.01	18.47	4.16	19.06	4.23	18.22
132	12	Sun.	17 54 37	3 46.27	4.56	19.37	5.35	19.50	4.15	19.07	4.49	19.25
133	13	Mon.	18 9 51	3 47.72	4.54	19.38	5.59	20.52	4.14	19.09	5.19	20.26
134	14	Tues.	18 24 46	3 48.59	4.53	19.39	6.30	21.47	4.12	19.10	5.53	21.25
135	15	Wed.	18 39 22	3 48.90	4.52	19.41	7.12	22.43	4.11	19.11	6.32	22.19
136	16	Thur.	18 53 41	3 48.65	4.51	19.42	7.57	23.33	4.10	19.12	7.17	23.08
137	17	Frid.	19 7 39	3 47.84	4.50	19.43	8.46	a.m.	4.09	19.13	8.08	23.50
138	18	Sat.	19 21 19	3 46.48	4.49	19.44	9.41	0.17	4.08	19.15	9.03	a.m.
139	19	Sun.	19 34 39	3 44.57	4.48	19.45	10.38	0.57	4.06	19.16	10.03	0.27
140	20	Mon.	19 47 39	3 42.14	4.47	19.46	11.40	1.29	4.05	19.17	11.16	1.00
141	21	Tues.	20 0 17	3 39.17	4.46	19.47	12.44	2.00	4.04	19.18	12.12	1.28
142	22	Wed.	20 12 36	3 35.67	4.45	19.48	13.49	2.28	4.03	19.19	13.21	1.55
143	23	Thur.	20 24 34	3 31.66	4.44	19.49	14.58	2.56	4.02	19.20	14.30	2.21
144	24	Frid.	20 36 11	3 27.14	4.43	19.50	16.10	3.23	4.01	19.22	15.42	2.45
145	25	Sat.	20 47 27	3 22.11	4.42	19.51	17.14	3.52	4.00	19.23	16.59	3.13
146	26	Sun.	20 58 21	3 16.59	4.42	19.52	18.42	4.24	4.00	19.24	18.18	3.44
147	27	Mon.	21 8 54	3 10.57	4.41	19.53	20.00	5.02	3.59	19.25	19.34	4.21
148	28	Tues.	21 19 5	3 4.08	4.40	19.54	21.13	5.44	3.58	19.26	20.50	5.04
149	29	Wed.	21 28 53	2 57.11	4.39	19.55	22.22	6.37	3.57	19.27	21.57	5.57
150	30	Thur.	21 38 20	2 49.67	4.39	19.55	23.22	7.38	3.56	19.28	22.53	6.58
151	31	Frid.	21 47 24	2 41.76	4.38	19.56	a.m.	8.48	3.56	19.29	23.39	8.08

Standard Time.—The rising and setting of the Sun and

Toronto... Lat. 43° 40′ Long. 79 24				Winnipeg Lat. 49° 53′ Long. 97 7				Vancouver Victoria... Lat. 49° 0′ Long. 123 12				R.A. of Polaris	Decl. of Polaris
Sun		Moon		Sun		Moon		Sun		Moon			
Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets		
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.	° ′
												1 24	8848
5.11	19.19	23.31	7.58	5.07	19.44	a.m.	7.49	4.53	19.27	23.51	7.45	49s.	29″
5.10	19.20	a.m.	8.55	5.05	19.46	0.07	8.44	4.52	19.28	a.m.	8.37	50	29
5.08	19.21	0.30	9.57	5.03	19.48	1.06	9.47	4.50	19.30	0.54	9.40	50	28
5.07	19.22	1.22	11.06	5.01	19.49	1.56	10.59	4.48	19.31	1.45	10.48	50	28
5.05	19.23	2.05	12.15	5.00	19.51	2.35	12.12	4.47	19.33	2.24	11.59	51	28
5.04	19.24	2.40	13.24	4.58	19.52	3.06	13.25	4.45	19.34	2.57	13.12	51	27
5.03	19.26	3.12	14.32	4.56	19.54	3.33	14.38	4.43	19.35	3.24	14.23	52	27
5.01	19.27	3.41	15.38	4.55	19.55	3.57	15.48	4.42	19.36	3.49	15.33	52	27
5.00	19.28	4.07	16.42	4.53	19.57	4.19	16.57	4.40	19.38	4.11	16.40	53	27
4.59	19.29	4.33	17.47	4.52	19.58	4.40	18.06	4.39	19.39	4.33	17.45	54	26
4.58	19.30	5.01	18.50	4.50	19.59	5.03	19.13	4.37	19.40	4.57	18.56	54	26
4.56	19.31	5.29	19.51	4.48	20.01	5.27	20.19	4.36	19.41	5.23	20.01	55	26
4.55	19.32	6.00	20.50	4.47	20.02	5.55	21.22	4.35	19.42	5.48	21.05	56	26
4.54	19.33	6.36	21.48	4.46	20.04	6.27	22.22	4.34	19.44	6.21	22.05	56	25
4.53	19.35	7.15	22.40	4.44	20.05	7.04	23.16	4.32	19.45	6.59	23.01	57	25
4.52	19.36	8.02	23.29	4.43	20.07	7.50	a.m.	4.31	19.47	7.42	23.50	58	25
4.51	19.37	8.51	a.m.	4.41	20.08	8.40	0.05	4.29	19.48	8.32	a.m.	58	25
4.50	19.38	9.46	0.13	4.40	20.09	9.37	0.47	4.28	19.49	9.26	0.34	59	25
4.49	19.39	10.45	0.51	4.39	20.11	10.38	1.23	4.27	19.51	10.26	1.10	59	24
4.48	19.40	11.46	1.26	4.38	20.12	11.43	1.54	4.26	19.52	11.31	1.42	60	24
4.47	19.41	12.50	1.56	4.36	20.13	12.52	2.20	4.24	19.53	12.37	2.09	60	24
4.46	19.42	13.56	2.25	4.35	20.15	14.03	2.44	4.23	19.55	13.46	2.35	61	24
4.45	19.43	15.03	2.52	4.34	20.16	15.15	3.07	4.21	19.56	14.59	2.59	62	23
4.44	19.44	16.13	3.19	4.33	20.17	16.31	3.30	4.20	19.57	16.12	3.24	63	23
4.44	19.45	17.27	3.49	4.32	20.19	17.50	3.55	4.19	19.59	17.42	3.49	64	23
4.43	19.46	18.44	4.22	4.31	20.20	19.12	4.23	4.18	20.00	18.53	4.19	65	23
4.42	19.47	19.58	5.02	4.30	20.21	20.31	4.58	4.17	20.01	20.15	4.54	66	23
4.41	19.48	21.13	5.47	4.29	20.22	21.49	5.39	4.16	20.02	21.32	5.34	66	23
4.41	19.49	22.18	6.42	4.28	20.23	22.56	6.31	4.15	20.03	22.42	6.26	67	22
4.40	19.49	23.16	7.43	4.27	20.24	23.51	7.32	4.14	20.05	23.40	7.26	68	22
4.40	19.50	a.m.	8.51	4.26	20.25	a.m.	8.42	4.13	20.06	a.m.	8.34	69	22

Moon are given in standard time for the places named.

Day of Year	Day of Month	Day of Week	Greenwich M. Noon: Sun's Declination	Greenwich M. Noon: Equation of Time to be added to / subtracted from Mean Time	Halifax... Lat. 45° 0′ St. John... Long. 64 50: Sun Rises	Sun Sets	Moon Rises	Moon Sets	Quebec..... Lat. 46° 48′ Long. 71 13: Sun Rises	Sun Sets	Moon Rises	Moon Sets
			N.	m. s.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
152	1	Sat.	21° 56′ 5″	2 33.42	4.37	19.57	0.10	9.56	3.55	19.30	a.m.	9.22
153	2	Sun.	22 4 24	2 24.62	4.36	19.58	0.49	11.08	3.54	19.31	0.17	10.35
154	3	Mon.	22 12 19	2 15.42	4.36	19.59	1.22	12.19	3.54	19.32	0.48	10.47
155	4	Tues.	22 19 51	2 5.81	4.36	20.00	1.50	13.25	3.53	19.32	1.16	12.56
156	5	Wed.	22 27 00	1 55.81	4.35	20.00	2.16	14.33	3.53	19.33	1.40	14.02
157	6	Thur.	23 33 46	1 45.44	4.35	20.01	2.40	15.36	3.52	19.34	2.03	15.09
158	7	Frid.	22 40 08	1 34.74	4.34	20.02	3.06	16.40	3.52	19.35	2.28	16.12
159	8	Sat.	22 46 06	1 23.70	4.34	20.03	3.32	17.42	3.51	19.36	2.53	17.17
160	9	Sun.	22 51 40	1 12.38	4.34	20.03	4.01	18.44	3.51	19.36	3.21	18.18
161	10	Mon.	22 56 50	1 0.78	4.34	20.04	4.33	19.43	3.51	19.37	3.54	19.19
162	11	Tues.	23 01 36	0 48.93	4.33	20.04	5.10	20.39	3.51	19.38	4.30	20.14
163	12	Wed.	23 05 58	0 36.86	4.33	20.05	5.53	21.30	3.50	19.38	5.12	21.05
164	13	Thur.	23 09 55	0 24.57	4.33	20.05	6.40	22.16	3.50	19.39	6.01	21.49
165	14	Frid.	23 13 28	0 12.11	4.33	20.06	7.32	22.57	3.50	19.39	6.55	22.29
166	15	Sat.	23 16 36	0 0.48	4.32	20.06	8.29	23.33	3.50	19.40	7.54	23.02
167	16	Sun.	23 19 20	0 13.22	4.32	20.07	9.29	a.m.	3.50	19.40	8.55	23.31
168	17	Mon.	23 21 38	0 26.04	4.32	20.07	10.31	0.04	3.50	19.41	7.59	23.59
169	18	Tues.	23 23 32	0 38.94	4.32	20.08	11.36	0.41	3.50	19.41	11.04	a.m.
170	19	Wed.	23 25 02	0 51.89	4.32	20.08	12.41	0.58	3.50	19.42	12.11	0.23
171	20	Thur.	23 26 06	1 4.87	4.32	20.08	13.49	1.24	3.50	19.42	13.22	0.47
172	21	Frid.	23 26 46	1 17.85	4.32	20.09	14.58	1.51	3.50	19.42	14.34	1.14
173	22	Sat.	23 27 01	1 30.80	4.33	20.09	16.12	2.20	3.51	19.42	15.49	1.41
174	23	Sun.	23 26 51	1 43.72	4.33	20.09	17.29	2.54	3.51	19.43	17.08	2.13
175	24	Mon.	23 26 16	1 56.57	4.33	20.09	18.47	3.33	3.51	19.43	18.24	2.53
176	25	Tues.	23 25 16	2 9.33	4.33	20.09	20.01	4.21	3.51	19.43	19.37	3.40
177	26	Wed.	23 23 52	2 22.00	4.34	20.09	21.06	5.18	3.52	19.43	20.40	4.38
178	27	Thur.	23 22 03	2 34.57	4.34	20.09	22.01	6.24	3.52	19.43	21.32	5.47
179	28	Frid.	23 19 50	2 46.98	4.35	20.09	22.47	7.34	3.53	19.43	22.15	7.02
180	29	Sat.	23 17 11	2 09.25	4.35	20.09	23.23	8.52	3.53	19.43	22.48	8.16
181	30	Sun.	23 14 09	3 11.35	4.35	20.09	23.53	10.04	3.53	19.43	23.19	9.31

Standard Time.—The rising and setting of the Sun and

Toronto... Lat. 43° 40′ Long. 79 24				Winnipeg Lat. 49° 53′ Long. 97 7				Vancouver Victoria... Lat. 49° 0′ Long. 123 12				R.A. of Polaris	Decl. of Polaris
Sun		Moon		Sun		Moon		Sun		Moon			
Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets		
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.	° ′
												1.25	8848
4.39	19.51	0.03	10.03	4.25	20.27	0.36	9.58	4.13	20.07	0.26	9.47	9s.	22″
4.38	19.52	0.43	11.15	4.25	20.28	1.10	11.13	4.13	20.08	1.02	11.02	9	22
4.38	19.53	1.16	12.24	4.24	20.29	1.38	12.27	4.12	20.09	1.32	12.13	10	22
4.38	19.54	1.46	13.31	4.23	20.29	2.04	13.39	4.11	20.09	1.55	13.23	11	22
4.37	19.54	2.13	14.35	4.23	20.30	2.26	14.48	4.11	20.10	2.18	14.32	12	22
4.37	19.55	2.38	15.39	4.22	20.31	2.46	15.57	4.10	20.11	2.40	15.40	13	21
4.36	19.56	3.05	16.40	4.22	20.32	3.09	17.02	4.10	20.12	3.02	16.46	14	21
4.36	19.57	3.31	17.43	4.21	20.33	3.31	18.10	4.09	20.13	3.25	17.51	15	21
4.36	19.57	4.02	18.42	4.21	20.34	3.58	19.13	4.09	20.14	3.53	18.57	16	21
4.36	19.58	4.36	19.42	4.20	20.35	4.28	20.15	4.08	20.15	4.22	19.58	17	21
4.35	19.58	5.13	20.37	4.20	20.35	5.03	21.12	4.08	20.15	4.56	20.57	18	21
4.35	19.59	5.57	21.26	4.20	20.36	5.45	22.03	4.08	20.16	5.38	21.48	19	21
4.35	19.59	6.46	22.12	4.20	20.37	6.34	22.47	4.08	20.17	6.25	22.34	20	21
4.35	20.00	7.38	22.52	4.19	20.37	7.28	23.25	4.07	20.17	7.19	23.13	20	21
4.35	20.00	8.36	23.27	4.19	20.38	8.28	23.56	4.07	20.18	8.18	23.45	21	20
4.35	20.01	9.35	23.57	4.19	20.38	9.31	a.m.	4.07	20.18	9.19	a.m.	22	20
4.35	20.01	10.37	a.m.	4.19	20.39	10.37	0.23	4.07	20.19	10.24	0.14	23	20
4.35	20.02	11.40	0.27	4.19	20.39	11.45	0.49	4.07	20.19	11.29	0.39	24	20
4.35	20.02	12.45	0.54	4.19	20.39	12.55	1.11	4.07	20.19	12.40	0.52	25	20
4.35	20.02	13.54	1.20	4.19	20.40	14.08	1.32	4.07	20.20	13.50	1.25	26	20
4.35	20.03	15.04	1.49	4.20	20.40	15.24	1.57	4.08	20.20	15.04	1.50	27	20
4.36	20.03	16.17	2.19	4.20	20.40	16.42	2.22	4.08	20.20	16.23	2.17	28	20
4.36	20.03	17.33	2.53	4.20	20.41	18.03	2.51	4.08	20.21	17.44	2.48	29	20
4.36	20.03	18.47	3.35	4.20	20.41	19.22	3.28	4.08	20.21	19.04	3.25	30	20
4.36	20.03	19.58	4.23	4.21	20.41	20.35	4.14	4.09	20.21	20.20	4.09	31	20
4.37	20.03	21.01	5.23	4.21	20.41	21.38	5.11	4.09	20.21	21.27	5.07	32	20
4.37	20.03	21.55	6.30	4.21	20.41	22.29	6.20	4.09	20.21	22.19	6.12	33	20
4.38	20.03	22.40	7.44	4.22	20.41	23.10	7.37	4.10	20.21	23.01	7.25	34	20
4.38	20.03	23.16	8.56	4.22	20.41	23.41	8.54	4.10	20.21	23.33	8.42	35	20
4.38	20.03	23.49	10.09	4.23	20.41	a.m.	10.11	4.11	20.21	a.m.	9.58	36	20
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Moon are given in standard time for the places named.

Day of Year	Day of Month	Day of Week	Greenwich M. Noon: Sun's Declination	Greenwich M. Noon: Equation of Time to be subtracted from Mean Time	Halifax... Lat. 45° 0′ St. John... Long. 64 50: Sun Rises	Sun Sets	Moon Rises	Moon Sets	Quebec.... Lat. 46° 48′ Long. 71 13: Sun Rises	Sun Sets	Moon Rises	Moon Sets
			N.	m. s.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
182	1	Mon.	23° 10′ 42″	3 23.26	4.36	20.09	a.m.	11.14	3.54	19.43	23.45	10.44
183	2	Tues.	23 6 50	3 34.95	4.36	20.09	0.20	12.22	3.55	19.42	a.m.	11.53
184	3	Wed.	23 2 35	3 46.41	4.37	20.09	0.47	13.28	3.55	19.42	0.09	13.00
185	4	Thur.	22 57 55	3 57.61	4.38	20.09	1.11	14.32	3.56	19.42	0.33	14.05
186	5	Frid.	22 52 51	4 8.55	4.38	20.08	1.37	15.35	3.57	19.42	0.58	15.09
187	6	Sat.	22 47 23	4 19.17	4.39	20.08	2.05	16.37	3.57	19.41	1.26	16.13
188	7	Sun.	22 41 32	4 29.47	4.40	20.08	2.35	17.36	3.58	19.41	1.56	17.12
189	8	Mon.	22 35 17	4 39.43	4.40	20.07	3.10	18.33	3.59	19.40	2.30	18.09
190	9	Tues.	22 28 38	4 49.01	4.41	20.07	3.51	19.26	4.00	19.40	3.11	19.02
191	10	Wed.	22 21 36	4 58.21	4.42	20.06	4.37	20.14	4.00	19.39	3.57	19.49
192	11	Thur.	22 14 11	5 7.01	4.42	20.06	5.28	20.58	4.01	19.39	4.50	20.29
193	12	Frid.	22 6 23	5 15.37	4.43	20.06	6.23	21.34	4.02	19.38	5.46	21.05
194	13	Sat.	21 58 12	5 23.27	4.44	20.05	7.22	22.06	4.03	19.38	6.47	21.35
195	14	Sun.	21 49 39	5 30.72	4.45	20.04	8.23	22.35	4.04	19.37	7.50	22.03
196	15	Mon.	21 40 43	5 37.66	4.46	20.04	9.26	23.01	4.05	19.36	8.56	22.28
197	16	Tues.	21 31 25	5 44.11	4.47	20.03	10.30	23.28	4.06	19.35	10.00	22.52
198	17	Wed.	21 21 45	5 50.03	4.47	20.03	11.35	23.54	4.07	19.35	11.08	23.16
199	18	Thur.	21 11 43	5 55.43	4.48	20.02	12.41	a.m.	4.08	19.34	12.16	23.42
200	19	Frid.	21 1 20	6 0.29	4.49	20.01	13.52	0.20	4.09	19.33	13.29	a.m.
201	20	Sat.	20 50 35	6 4.58	4.50	20.00	15.03	0.51	4.10	19.32	14.42	0.11
202	21	Sun.	20 39 29	6 8.30	4.51	19.59	16.21	1.27	4.11	19.31	15.58	0.45
203	22	Mon.	20 28 3	6 11.45	4.52	19.59	17.35	2.07	4.12	19.30	17.12	1.27
204	23	Tues.	20 16 15	6 14.03	4.53	19.58	18.44	2.59	4.13	19.29	18.20	2.18
205	24	Wed.	20 4 8	6 16.02	4.54	19.57	19.46	4.00	4.14	19.28	19.18	3.21
206	25	Thur.	19 51 40	6 17.43	4.55	19.56	20.36	5.10	4.15	19.27	20.06	4.34
207	26	Frid.	19 38 53	6 18.26	4.56	19.55	21.18	6.25	4.17	19.26	20.45	5.51
208	27	Sat.	19 25 46	6 18.50	4.57	19.54	21.52	7.40	4.18	19.25	21.18	7.08
209	28	Sun.	19 12 20	6 18.16	4.58	19.53	22.22	8.56	4.19	19.24	21.46	8.24
210	29	Mon.	18 58 34	6 17.24	4.59	19.52	22.54	10.07	4.20	19.22	22.12	9.38
211	30	Tues.	18 44 30	6 15.74	5.01	19.51	23.15	11.15	4.21	19.21	22.37	10.47
212	31	Wed.	18 30 8	6 13.66	5.03	19.49	23.32	12.21	4.22	19.19	23.00	11.54

Standard Time.—The rising and setting of the Sun and

Toronto... Lat. 43° 40′ Long. 79 24				Winnipeg Lat. 49° 53′ Long. 97 7				Vancouver Victoria... Lat. 49° 0′ Long. 123 12				R.A. of Polaris	Decl. of Polaris
Sun		Moon		Sun		Moon		Sun		Moon			
Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets		
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.	° ′
												1. 25	8848
4.39	20.03	a.m.	11.19	4.23	20.40	0.08	11.26	4.12	20.20	0.00	11.11	37s.	20″
4.39	20.03	0.16	12.26	4.24	20.40	0.31	12.38	4.13	20.20	0.23	12.21	38	20
4.40	20.03	0.43	13.31	4.25	20.40	0.53	13.47	4.14	20.20	0.48	13.30	39	20
4.41	20.03	1.09	14.34	4.26	20.39	1.15	14.55	4.15	20.19	1.10	14.38	40	20
4.41	20.02	1.36	15.35	4.26	20.39	1.37	16.01	4.15	20.19	1.31	15.44	41	20
4.42	20.02	2.06	16.38	4.27	20.39	2.03	17.07	4.16	20.19	1.58	16.47	42	20
4.43	20.02	2.38	17.35	4.28	20.38	2.31	18.08	4.17	20.18	2.24	17.50	43	20
4.43	20.01	3.13	18.32	4.29	20.38	3.03	19.07	4.18	20.18	2.59	18.50	45	20
4.44	20.01	3.55	19.23	4.30	20.37	3.43	20.00	4.19	20.17	3.36	19.43	46	20
4.45	20.00	4.42	20.10	4.31	20.36	4.29	20.46	4.20	20.16	4.22	20.32	47	20
4.45	20.00	5.33	20.52	4.31	20.36	5.22	21.26	4.20	20.16	5.14	21.13	48	20
4.46	20.00	6.29	21.19	4.32	20.35	6.20	22.00	4.21	20.15	6.10	21.48	49	20
4.47	19.59	7.28	22.01	4.33	20.34	7.23	22.28	4.22	20.14	7.12	22.18	49	20
4.48	19.58	8.30	22.31	4.35	20.34	8.28	22.54	4.23	20.13	8.16	22.43	50	20
4.49	19.58	9.33	22.58	4.36	20.33	9.36	23.16	4.24	20.12	9.21	23.07	51	20
4.50	19.57	10.35	23.24	4.37	20.32	10.43	23.38	4.25	20.11	10.27	23.30	52	21
4.50	19.57	11.41	23.51	4.38	20.31	11.53	a.m.	4.26	20.10	11.37	23.55	53	21
4.51	19.56	12.47	a.m.	4.39	20.30	13.04	0.00	4.27	20.09	12.47	a.m.	54	21
4.52	19.55	13.57	0.18	4.40	20.29	14.20	0.23	4.28	20.08	14.01	0.18	56	21
4.53	19.54	15.08	0.49	4.41	20.28	15.36	0.50	4.29	20.07	15.17	0.44	57	21
4.54	19.53	16.22	1.26	4.43	20.27	16.55	1.22	4.31	20.06	16.37	1.17	58	21
4.55	19.53	17.35	2.10	4.44	20.26	18.09	2.02	4.32	20.05	17.53	1.58	59	21
4.56	19.52	18.41	3.03	4.45	20.24	19.18	2.52	4.33	20.03	19.04	2.47	60	21
4.57	19.51	19.41	4.06	4.46	20.23	20.17	3.55	4.34	20.02	20.05	3.48	61	21
4.58	19.50	20.30	5.17	4.48	20.22	21.03	5.08	4.36	20.01	20.53	4.58	62	22
4.59	19.49	21.11	6.32	4.49	20.21	21.39	6.28	4.37	20.00	21.31	6.15	63	22
5.00	19.48	21.46	7.47	4.50	20.19	22.09	7.48	4.38	19.58	22.02	7.34	64	22
5.01	19.47	22.17	9.00	4.51	20.18	22.34	9.05	4.39	19.57	22.28	8.50	65	22
5.02	19.46	22.45	10.12	4.53	20.17	22.57	10.22	4.41	19.56	22.55	10.07	66	22
5.03	19.45	23.12	11.19	4.54	20.15	23.19	11.33	4.42	19.56	23.13	11.16	67	22
5.04	19.43	23.38	12.24	4.56	20.14	23.40	12.43	4.43	19.55	23.36	12.26	68	22

Moon are given in standard time for the places named.

Day of Year	Day of Month	Day of Week	Greenwich M. Noon: Sun's Declination	Greenwich M. Noon: Equation of Time to be subtracted from Mean Time	Halifax... Lat. 45° 0′ St. John... Long. 64 50: Sun Rises	Halifax: Sun Sets	Halifax: Moon Rises	Halifax: Moon Sets	Quebec..... Lat. 46° 48′ Long. 71 13: Sun Rises	Quebec: Sun Sets	Quebec: Moon Rises	Quebec: Moon Sets
			N.	m. s.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
213	1	Thur.	18° 15′ 27″	6 10.98	5.03	19.48	a.m.	13.26	4.24	19.18	23.28	12.59
214	2	Frid.	18 0 28	6 7.73	5.04	19.47	0.08	14.28	4.25	19.17	23.57	14.04
215	3	Sat.	17 45 11	6 3.87	5.05	19.46	0.37	15.29	4.26	19.16	a.m.	15.04
216	4	Sun.	17 29 37	5 59.45	5.07	19.45	1.10	16.28	4.27	19.14	0.31	16.03
217	5	Mon.	17 13 46	5 54.42	5.08	19.43	1.50	17.22	4.29	19.13	1.10	16.58
218	6	Tues.	16 57 38	5 48.82	5.09	19.42	2.34	18.12	4.30	19.12	1.53	17.46
219	7	Wed.	16 41 13	5 42.16	5.10	19.41	3.23	18.56	4.31	19.10	2.45	18.29
220	8	Thur.	16 24 33	5 35.83	5.11	19.39	4.17	19.37	4.32	19.09	3.40	19.07
221	9	Frid.	16 7 36	5 28.45	5.12	19.38	5.14	20.09	4.34	19.07	4.41	19.39
222	10	Sat.	15 50 24	5 20.49	5.13	19.36	6.17	20.39	4.35	19.06	5.43	20.06
223	11	Sun.	15 32 57	5 11.95	5.14	19.35	7.19	21.05	4.36	19.04	6.46	20.32
224	12	Mon.	15 15 14	5 2.82	5.15	19.33	8.24	21.33	4.37	19.02	7.52	20.57
225	13	Tues.	14 57 17	4 53.12	5.17	19.31	9.28	21.58	4.39	19.01	9.00	21.21
226	14	Wed.	14 39 06	4 42.85	5.18	19.30	10.34	22.23	4.40	18.59	10.07	21.45
227	15	Thur.	14 20 41	4 32.02	5.19	19.28	11.41	22.52	4.41	18.57	11.16	22.12
228	16	Frid.	14 2 2	4 20.62	5.20	19.26	12.51	23.33	4.43	18.56	12.29	22.44
229	17	Sat.	13 43 9	4 8.68	5.21	19.24	14.04	a.m.	4.44	18.54	13.41	23.21
230	18	Sun.	13 24 4	3 56.19	5.22	19.23	15.17	0.01	4.45	18.52	14.54	a.m.
231	19	Mon.	13 4 46	3 43.19	5.23	19.21	16.25	0.47	4.47	18.51	16.02	0.07
232	20	Tues.	12 45 16	3 29.65	5.24	19.19	17.28	1.42	4.48	18.49	17.05	1.01
233	21	Wed.	12 25 33	3 15.63	5.26	19.17	18.24	2.47	4.49	18.47	17.55	2.10
234	22	Thur.	12 5 39	3 1.13	5.27	19.16	19.10	3.56	4.50	18.45	18.38	3.23
235	23	Frid.	11 45 34	2 46.14	5.28	19.14	19.48	5.14	4.52	18.44	19.13	4.40
236	24	Sat.	11 25 17	2 30.73	5.29	19.12	20.18	6.30	4.53	18.42	19.44	5.58
237	25	Sun.	11 4 49	2 14.88	5.30	19.11	20.48	7.44	4.54	18.40	20.12	7.14
238	26	Mon.	10 44 11	1 58.62	5.31	19.09	21.15	8.55	4.56	18.38	20.37	8.27
239	27	Tues.	10 23 23	1 41.96	5.32	19.07	21.42	10.05	4.57	18.36	21.02	9.37
240	28	Wed.	10 2 24	1 24.94	5.33	19.06	22.18	11.12	4.58	18.34	21.29	10.46
241	29	Thur.	9 41 16	1 7.54	5.35	19.04	22.37	12.16	4.59	18.32	21.57	11.52
242	30	Frid.	9 19 59	0 49.81	5.36	19.02	23.09	13.20	5.01	18.31	22.31	12.54
243	31	Sat.	8 58 32	0 31.75	5.38	19.00	23.47	14.20	5.02	18.29	23.07	13.56

Standard Time.—The rising and setting of the Sun and

Toronto... Lat. 43° 40′ Long. 79 24				Winnipeg Lat. 49° 53′ Long. 97 7				Vancouver Victoria... Lat. 49° 0′ Long. 123 12				R.A. of Polaris	Decl. of Polaris
Sun		Moon		Sun		Moon		Sun		Moon			
Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets		
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.	° ′
												1.26	8848
5.05	19.42	a.m.	13.27	4.57	20.12	a.m.	13.50	4.44	19.54	a.m.	13.34	9s.	23″
5.06	19.41	0.08	14.30	4.58	20.11	0.06	14.58	4.45	19.53	0.01	14.38	10	23
5.07	19.40	0.38	15.28	5.00	20.09	0.33	16.00	4.46	19.52	0.27	15.44	11	23
5.09	19.39	1.14	16.26	5.01	20.08	1.05	17.00	4.47	19.51	0.59	16.44	12	23
5.10	19.37	1.53	17.19	5.03	20.06	1.42	17.55	4.49	19.49	1.36	17.40	13	23
5.11	19.36	2.38	18.07	5.04	20.04	2.25	18.44	4.50	19.47	2.19	18.29	14	24
5.12	19.35	3.29	18.52	5.06	20.03	3.17	19.26	4.52	19.46	3.09	19.14	15	24
5.13	19.32	4.23	19.31	5.07	20.01	4.13	20.03	4.53	19.44	4.03	19.50	16	24
5.14	19.32	5.23	20.04	5.08	19.59	5.16	20.32	4.54	19.42	5.03	20.21	16	24
5.15	19.31	6.23	20.34	5.10	19.58	6.20	20.58	4.56	19.41	6.07	20.47	17	24
5.16	19.30	7.24	21.01	5.11	19.56	7.26	21.21	4.57	19.39	7.12	21.13	18	25
5.17	19.28	8.28	21.28	5.13	19.54	8.34	21.44	4.59	19.37	8.20	21.36	19	25
5.19	19.26	9.33	21.54	5.14	19.52	9.44	22.05	5.00	19.35	9.27	21.58	20	25
5.20	19.25	10.38	22.21	5.16	19.51	10.54	22.27	5.02	19.34	10.37	22.26	21	25
5.21	19.23	11.45	22.50	5.17	19.49	12.07	22.52	5.03	19.32	11.48	22.47	22	25
5.22	19.22	12.55	23.54	5.19	19.47	13.22	23.22	5.05	19.30	13.02	23.17	23	25
5.23	19.20	14.06	a.m.	5.20	19.45	14.37	23.56	5.06	19.28	14.08	23.52	24	26
5.24	19.19	15.17	0.03	5.22	19.43	15.52	a.m.	5.08	19.26	15.34	a.m.	25	26
5.25	19.17	16.23	0.50	5.23	19.41	17.00	0.40	5.09	19.24	16.46	0.37	26	26
5.26	19.16	17.26	1.46	5.25	19.39	18.03	1.34	5.11	19.22	17.48	1.30	26	27
5.28	19.14	18.18	2.53	5.26	19.37	18.52	2.43	5.12	19.20	18.42	2.33	27	27
5.29	19.13	19.03	4.05	5.28	19.35	19.33	3.58	5.14	19.18	19.24	3.47	28	27
5.30	19.11	19.41	5.20	5.29	19.33	20.06	5.18	5.15	19.16	19.56	5.05	29	27
5.31	19.09	20.14	6.36	5.31	19.31	20.34	6.39	5.17	19.14	20.26	6.23	29	28
5.32	19.08	20.44	7.49	5.32	19.29	20.58	7.56	5.18	19.12	20.51	7.41	30	28
5.33	19.06	21.12	9.00	5.34	19.27	21.21	9.12	5.20	19.10	21.15	8.54	31	28
5.34	19.04	21.38	10.08	5.35	19.25	21.43	10.25	5.21	19.08	21.39	10.10	32	28
5.35	19.03	22.07	11.14	5.37	19.23	22.07	11.36	5.23	19.06	22.00	11.19	32	29
5.37	19.01	22.37	12.18	5.38	19.21	22.33	12.45	5.24	19.04	22.29	12.26	33	29
5.38	18.59	23.13	13.18	5.39	19.19	23.05	13.49	5.25	19.02	22.58	13.44	34	29
5.39	18.57	23.50	14.19	5.41	19.17	23.40	14.53	5.27	19.00	23.32	14.34	35	30

Moon are given in standard time for the places named.

Day of Year	Day of Month	Day of Week	Greenwich M. Noon: Sun's Declination	Greenwich M. Noon: Equation of Time to be subtracted / added to Mean Time	Halifax... St. John... Lat. 45° 0′ Long. 64 50: Sun Rises	Sun Sets	Moon Rises	Moon Sets	Quebec..... Lat. 46° 48′ Long. 71 13: Sun Rises	Sun Sets	Moon Rises	Moon Sets
			N.	m. s.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
244	1	Sun.	8° 36′ 57″	0 13.37	5.40	18.59	a.m.	15.16	5.03	18.27	23.46	14.50
245	2	Mon.	8 15 14	0 5.29	5.41	18.57	0.29	16.07	5.04	18.25	a.m.	15.40
246	3	Tues.	7 53 22	0 24.24	5.42	18.55	1.17	16.54	5.06	18.23	0.35	16.25
247	4	Wed.	7 31 23	0 43.47	5.43	18.53	2.09	17.34	5.07	18.21	1.29	17.06
248	5	Thur.	7 9 16	1 2.93	5.44	18.51	3.05	18.10	5.08	18.19	2.27	17.37
249	6	Frid.	6 47 3	1 22.64	5.45	18.49	4.07	18.42	5.10	18.17	3.30	18.07
250	7	Sat.	6 24 42	1 42.57	5.47	18.47	5.11	19.10	5.11	18.15	4.36	18.34
251	8	Sun.	6 2 15	2 2.70	5.48	18.45	6.14	19.35	5.13	18.13	5.42	19.00
252	9	Mon.	5 39 42	2 23.03	5.49	18.43	7.20	20.02	5.14	18.11	6.48	19.25
253	10	Tues.	5 17 4	2 43.53	5.50	18.41	8.22	20.27	5.15	18.09	7.57	19.46
254	11	Wed.	4 54 20	3 4.19	5.51	18.39	9.34	20.55	5.17	18.07	9.08	20.13
255	12	Thur.	4 31 31	3 25.01	5.52	18.37	10.44	21.25	5.18	18.05	10.18	20.42
256	13	Frid.	4 8 38	3 45.95	5.53	18.35	11.54	22.00	5.19	18.03	11.31	21.17
257	14	Sat.	3 45 40	4 7.00	5.54	18.33	13.07	22.42	5.20	18.01	12.43	21.57
258	15	Sun.	3 22 38	4 28.15	5.56	18.31	14.16	23.33	5.22	17.59	13.50	22.49
259	16	Mon.	2 59 33	4 49.37	5.57	18.30	15.19	a.m.	5.23	17.57	14.52	23.50
260	17	Tues.	2 36 24	5 10.64	5.58	18.28	16.15	0.31	5.24	17.55	15.48	a.m.
261	18	Wed.	2 13 12	5 31.94	6.00	18.26	17.03	1.38	5.26	17.53	16.31	0.58
262	19	Thur.	1 49 58	5 53.26	6.01	18.24	17.43	2.54	5.27	17.51	17.10	2.13
263	20	Frid.	1 26 41	6 14.55	6.02	18.22	18.15	4.05	5.28	17.49	17.41	3.31
264	21	Sat.	1 3 23	6 35.81	6.04	18.21	18.47	5.20	5.29	17.47	18.09	4.47
265	22	Sun.	0 40 3	6 57.00	6.06	18.19	19.13	6.33	5.30	17.45	18.35	6.01
266	23	Mon.	N. 16 41	7 18.11	6.07	18.17	19.41	7.26	5.32	17.43	18.58	7.14
267	24	Tues.	S. 6 41	7 39.09	6.08	18.15	20.07	8.53	5.33	17.41	19.26	8.24
268	25	Wed.	0 30 5	7 59.94	6.09	18.13	20.35	10.00	5.35	17.39	19.52	9.33
269	26	Thur.	0 53 28	8 20.63	6.10	18.11	21.07	11.06	5.36	17.37	20.25	10.41
270	27	Frid.	1 16 53	8 41.15	6.11	18.10	21.42	12.10	5.37	17.35	20.57	11.44
271	28	Sat.	1 40 15	9 1.45	6.12	18.08	22.22	13.07	5.38	17.33	21.38	12.41
272	29	Sun.	2 3 39	9 21.52	6.13	18.06	23.08	14.00	5.40	17.31	22.25	13.35
273	30	Mon.	2 27 1	9 41.35	6.15	18.04	a.m.	14.49	5.41	17.29	23.17	14.22

Standard Time.—The rising and setting of the Sun and

Toronto... Lat. 43° 40′ Long. 79 24				Winnipeg Lat. 49° 53′ Long. 97 7				Vancouver Victoria... Lat. 49° 0′ Long. 123 12				R.A. of Polaris	Decl. of Polaris
Sun		Moon		Sun		Moon		Sun		Moon			
Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets		
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.	° ′
												1.26	8848
5.40	18.56	a.m.	15.12	5.42	19.15	a.m.	15.49	5.28	18.58	a.m.	15.33	36s.	30″
5.41	18.54	0.33	16.02	5.43	19.13	0.22	16.39	5.29	18.57	0.14	16.32	37	30
5.42	18.52	1.22	16.47	5.45	19.11	1.11	17.23	5.30	18.55	1.01	17.11	37	31
5.43	18.51	2.15	17.28	5.46	19.09	2.05	18.03	5.31	18.53	1.55	17.51	38	31
5.44	18.49	3.13	18.02	5.48	19.06	3.06	18.32	5.32	18.51	2.54	18.23	38	31
5.45	18.47	4.13	18.34	5.49	19.04	4.09	19.01	5.33	18.49	3.57	18.52	39	32
5.47	18.45	5.16	19.03	5.51	19.02	5.17	19.26	5.35	18.47	5.03	19.18	40	32
4.48	18.43	6.19	19.31	5.52	19.00	6.25	19.49	5.36	18.45	6.09	19.39	40	32
5.49	18.41	7.23	19.57	5.54	18.58	7.33	20.10	5.38	18.43	7.19	20.03	41	32
5.50	18.39	8.30	20.23	5.55	18.56	8.46	20.31	5.39	18.41	8.28	20.26	41	33
5.51	18.37	9.38	20.52	5.57	18.54	9.59	20.55	5.41	18.39	9.40	20.51	42	33
5.52	18.36	10.46	21.24	5.58	18.51	11.11	21.23	5.42	18.36	10.53	21.18	43	33
5.53	18.34	11.56	22.01	6.00	18.49	12.26	21.55	5.44	18.34	12.08	21.50	43	34
5.54	18.32	13.05	22.48	6.01	18.47	13.40	22.33	5.45	18.32	13.23	22.30	44	34
5.56	18.30	14.12	23.36	6.03	18.45	14.49	23.25	5.47	18.30	14.34	23.20	45	34
5.57	18.29	15.14	a.m.	6.04	18.43	15.51	a.m.	5.48	18.28	15.38	a.m.	45	35
5.58	18.27	16.10	0.37	6.06	18.40	16.46	0.26	5.50	18.25	16.34	0.18	46	35
5.59	18.25	16.55	1.44	6.07	18.38	17.27	1.35	5.51	18.23	17.18	1.27	46	35
6.00	18.23	17.36	2.57	6.09	18.36	18.04	2.53	5.53	18.20	17.54	2.41	47	36
6.01	18.21	18.10	4.12	6.10	18.34	18.33	4.12	5.55	18.18	18.25	3.59	47	36
6.02	18.20	18.40	5.25	6.12	18.31	18.58	5.30	5.57	18.16	18.51	5.15	48	37
6.04	18.18	19.09	6.37	6.14	18.29	19.22	6.47	5.58	18.15	19.14	6.32	48	37
6.05	18.16	19.35	7.47	6.15	18.27	19.42	8.03	5.59	18.13	19.39	7.26	48	37
6.06	18.14	20.05	8.54	6.17	18.25	20.08	9.15	6.01	18.11	20.01	8.59	49	38
6.07	18.12	20.34	10.01	6.18	18.23	20.33	10.27	6.02	18.09	20.29	10.10	49	38
6.08	18.10	21.09	11.06	6.20	18.20	21.03	11.36	6.04	18.06	20.56	11.18	50	38
6.09	18.09	21.43	12.07	6.21	18.18	21.34	12.42	6.05	18.04	21.29	12.23	50	39
6.10	18.07	22.25	13.03	6.23	18.16	22.14	13.39	6.07	18.02	22.08	13.23	51	39
6.11	18.05	23.12	13.57	6.24	18.14	23.01	14.34	6.08	18.00	22.52	14.19	51	39
6.13	18.03	a.m.	14.44	6.26	18.12	23.53	15.21	6.10	17.58	23.44	15.07	52	40

Moon are given in standard time for the places named.

Day of Year	Day of Month	Day of Week	Greenwich M. Noon: Sun's Declination	Greenwich M. Noon: Equation of Time to be added to Mean Time	Halifax... / St. John... (Lat. 45° 0′, Long. 64 50): Sun Rises	Sun Sets	Moon Rises	Moon Sets	Quebec..... (Lat. 46° 48′, Long. 71 13): Sun Rises	Sun Sets	Moon Rises	Moon Sets
			S.	m. s.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
274	1	Tues.	2° 50′ 21″	10 0.92	6.16	18.02	0.00	15.32	5.42	17.27	a.m.	15.06
275	2	Wed.	3 13 41	10 20.20	6.17	18.00	0.53	16.08	5.43	17.25	0.15	15.40
276	3	Thur.	3 36 58	10 39.17	6.18	17.58	1.55	16.41	5.45	17.23	1.14	16.10
277	4	Frid.	4 0 12	10 57.82	6.20	17.56	2.56	17.12	5.46	17.21	2.19	16.38
278	5	Sat.	4 23 24	11 16.13	6.21	17.54	4.01	17.38	5.48	17.19	3.25	17.05
279	6	Sun.	4 46 33	11 34.09	6.22	17.52	5.06	18.03	5.49	17.17	4.34	17.28
280	7	Mon.	5 9 39	11 51.66	6.24	17.50	6.13	18.29	5.50	17.15	5.42	17.52
281	8	Tues.	5 32 40	12 8.85	6.25	17.49	7.21	18.55	5.52	17.14	6.52	18.18
282	9	Wed.	5 55 37	12 25.64	6.26	17.47	8.32	19.25	5.53	17.12	8.05	18.46
283	10	Thur.	6 18 30	12 41.99	6.28	17.46	9.46	20.00	5.54	17.10	9.20	19.19
284	11	Frid.	6 41 18	12 57.91	6.29	17.44	10.59	20.41	5.56	17.08	10.33	19.57
285	12	Sat.	7 3 60	13 13.37	6.30	17.43	12.09	21.28	5.57	17.06	11.43	20.44
286	13	Sun.	7 26 36	13 28.38	6.31	17.41	13.14	22.23	5.59	17.04	12.48	21.42
287	14	Mon.	7 49 6	13 42.88	6.32	17.39	14.12	23.32	6.00	17.02	13.44	22.47
288	15	Tues.	8 11 30	13 56.88	6.33	17.37	15.00	a.m.	6.01	17.00	14.31	23.58
289	16	Wed.	8 33 46	14 10.37	6.34	17.35	15.42	0.36	6.03	16.59	15.12	a.m.
290	17	Thur.	8 55 55	14 23.30	6.36	17.33	16.16	1.49	6.04	16.57	15.44	1.11
291	18	Frid.	9 17 56	14 35.66	6.37	17.31	16.46	3.03	6.06	16.55	16.14	2.25
292	19	Sat.	9 39 50	14 47.45	6.38	17.29	17.15	4.13	6.07	16.53	16.37	3.41
293	20	Sun.	10 1 34	14 58.63	6.39	17.28	17.39	5.25	6.09	16.52	17.02	4.52
294	21	Mon.	10 23 10	15 9.17	6.41	17.26	18.06	6.33	6.10	16.50	17.26	6.04
295	22	Tues.	10 44 37	15 19.08	6.42	17.25	18.33	7.44	6.12	16.48	17.53	7.14
296	23	Wed.	11 5 54	15 28.32	6.43	17.23	19.04	8.50	6.13	16.46	18.21	8.23
297	24	Thur.	11 27 1	15 36.88	6.45	17.21	19.37	9.55	6.15	16.44	18.53	9.28
298	25	Frid.	11 47 58	15 44.72	6.46	17.20	20.16	10.56	6.16	16.42	19.31	10.30
299	26	Sat.	12 8 44	15 51.85	6.48	17.18	20.59	11.52	6.18	16.41	20.16	11.28
300	27	Sun.	12 29 19	15 58.25	6.49	17.17	21.48	12.43	6.19	16.39	21.06	12.16
301	28	Mon.	12 49 42	16 3.90	6.51	17.15	22.42	13.28	6.20	16.38	22.02	13.01
302	29	Tues.	13 9 54	16 8.78	6.52	17.14	23.39	14.08	6.21	16.36	23.00	13.39
303	30	Wed.	13 29 53	16 12.89	6.54	17.12	a.m.	14.42	6.23	16.34	a.m.	14.13
304	31	Thur.	13 49 40	16 16.21	6.55	17.11	0.41	15.12	6.24	16.32	0.01	14.41

Standard Time.—The rising and setting of the Sun and

Toronto... Lat. 43° 40′ Long. 79 24				Winnipeg Lat. 49° 53′ Long. 97 7				Vancouver Victoria... Lat. 49° 0′ Long. 123 12				R.A. of Polaris	Decl. of Polaris
Sun		Moon		Sun		Moon		Sun		Moon			
Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets		
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.	° ′
												1.26	88 48
6.14	18.01	a.m.	15.28	6.28	18.09	a.m.	16.04	6.12	17.55	a.m.	15.49	52	41
6.15	17.59	1.01	16.02	6.29	18.07	0.50	16.34	6.13	17.53	0.42	16.24	52	41
6.16	17.58	2.00	16.34	6.30	18.05	1.51	17.02	6.14	17.51	1.44	16.54	52	41
6.17	17.56	3.03	17.04	6.32	18.03	2.59	17.28	6.16	17.49	2.48	17.20	53	41
6.19	17.54	4.07	17.33	6.33	18.01	4.06	17.53	6.17	17.47	3.55	17.43	53	42
6.20	17.52	5.12	17.59	6.35	17.59	5.16	18.15	6.19	17.45	5.04	18.05	53	42
6.21	17.50	6.18	18.25	6.37	17.56	6.27	18.35	6.21	17.42	6.14	18.29	53	42
6.22	17.49	7.26	18.54	6.38	17.54	7.40	18.59	6.22	17.40	7.26	18.54	54	43
6.24	17.47	8.36	19.24	6.40	17.52	8.55	19.24	6.23	17.38	7.42	19.19	54	43
6.25	17.46	9.48	20.00	6.41	17.50	10.12	19.56	6.24	17.36	9.57	19.51	54	43
6.26	17.44	10.59	20.41	6.43	17.48	11.27	20.32	6.25	17.35	11.14	20.30	54	44
6.27	17.43	12.07	21.30	6.44	17.46	12.40	21.19	6.26	17.33	12.27	21.15	55	44
6.28	17.41	13.10	22.28	6.46	17.44	13.46	22.17	6.28	17.31	13.35	22.09	55	45
6.29	17.39	14.06	23.34	6.47	17.42	14.43	23.24	6.29	17.29	14.32	23.13	55	45
6.30	17.37	14.53	a.m.	6.49	17.40	15.30	a.m.	6.31	17.27	15.19	a.m.	55	45
6.31	17.36	15.34	0.44	6.50	17.38	16.09	0.38	6.32	17.25	15.55	0.27	55	46
6.33	17.34	16.09	1.55	6.52	17.36	16.39	1.53	6.34	17.23	16.25	1.41	55	46
6.34	17.32	16.42	3.08	6.54	17.34	17.07	3.11	6.36	17.21	16.52	2.56	55	47
6.35	17.30	17.07	4.20	6.56	17.31	17.27	4.29	6.38	17.18	17.15	4.11	55	47
6.36	17.29	17.35	5.29	6.57	17.29	17.50	5.43	6.39	17.16	17.47	5.16	55	47
6.38	17.27	18.02	6.38	6.59	17.28	18.12	6.57	6.41	17.15	18.03	6.39	55	48
6.39	17.26	18.31	7.45	7.00	17.26	18.36	8.09	6.42	17.13	18.27	7.51	55	48
6.40	17.24	19.02	8.51	7.02	17.24	19.02	9.19	6.44	17.11	18.54	9.01	55	48
6.42	17.23	19.37	9.54	7.03	17.22	19.33	10.27	6.45	17.09	19.26	10.09	55	49
6.43	17.21	20.17	10.54	7.05	17.20	20.09	11.30	6.47	17.07	20.01	11.12	56	49
6.45	17.19	21.03	11.50	7.07	17.18	20.52	12.27	6.49	17.05	20.44	12.11	56	50
6.46	17.18	21.53	12.38	7.09	17.16	21.42	13.15	6.51	17.03	21.32	13.03	56	50
6.47	17.16	22.49	13.23	7.10	17.14	22.38	14.00	6.52	17.01	22.27	13.46	55	50
6.48	17.15	23.46	14.01	7.12	17.12	23.36	14.36	6.54	16.59	23.28	14.23	55	51
6.49	17.13	a.m.	14.35	7.14	17.11	a.m.	15.05	6.56	16.58	a.m.	14.55	55	51
6.51	17.12	0.47	15.06	7.16	17.09	0.40	15.32	6.58	16.56	0.30	15.21	55	52

Moon are given in standard time for the places named.

Day of Year	Day of Month	Day of Week	Greenwich M. Noon: Sun's Declination	Greenwich M. Noon: Equation of Time to be added to Mean Time	Halifax... / St. John... (Lat. 45° 0′, Long. 64 50): Sun Rises	Sun Sets	Moon Rises	Moon Sets	Quebec..... (Lat. 46° 48′, Long. 71 13): Sun Rises	Sun Sets	Moon Rises	Moon Sets
			S.	m. s.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
305	1	Frid.	14° 9′ 14″	16 18.74	6.57	17.09	1.43	15.39	6.26	16.31	1.09	15.04
306	2	Sat.	14 28 33	16 20.46	6.58	17.08	2.49	16.04	6.27	16.29	2.16	15.28
307	3	Sun.	14 47 39	16 21.38	7.00	17.07	3.55	16.30	6.29	16.28	3.24	15.53
308	4	Mon.	15 6 31	16 21.47	7.01	17.05	5.03	16.57	6.30	16.26	4.34	16.17
309	5	Tues.	15 25 8	16 20.74	7.02	17.04	6.14	17.25	6.32	16.25	5.49	16.44
310	6	Wed.	15 43 30	16 19.18	7.04	17.02	7.27	17.56	6.33	16.23	7.03	17.16
311	7	Thur.	16 1 36	16 16.80	7.05	17.01	8.43	18.36	6.35	16.22	8.21	17.50
312	8	Frid.	16 19 26	16 13.58	7.07	17.00	9.54	19.21	6.36	16.20	9.34	18.38
313	9	Sat.	16 36 60	16 9.55	7.08	16.58	11.08	20.16	6.38	16.19	10.42	19.33
314	10	Sun.	16 54 16	16 4.67	7.10	16 57	12.10	21.19	6.39	16.17	11.42	20.38
315	11	Mon.	17 11 15	15 58.98	7.11	16.55	13.01	22.27	6.41	16.16	12.31	21.46
316	12	Tues.	17 27 57	15 52.45	7.12	16.54	13.45	23.39	6.42	16.15	13.13	23.02
317	13	Wed.	17 44 21	15 45.09	7.13	16.53	14.20	a.m.	6.44	16.14	13.45	a.m.
318	14	Thur.	18 0 26	15 36.90	7.15	16.52	14.49	0.51	6.45	16.13	14.13	0.16
319	15	Frid.	18 16 11	15 27.89	7.16	16.51	15.17	2.02	6.47	16.12	14.39	1.29
320	16	Sat.	18 31 38	15 18.05	7.17	16.50	15.42	3.10	6.48	16.11	15.03	2.42
321	17	Sun.	18 46 44	15 7.37	7.18	16.49	16.09	4.20	6.49	16.10	15.26	3.51
322	18	Mon.	19 1 31	14 55.87	7.20	16.48	16.34	5.29	6.50	16.09	15.52	4.59
323	19	Tues.	19 15 58	14 43.53	7.21	16.47	17.03	6.34	6.52	16.08	16.17	6.09
324	20	Wed.	19 30 4	14 30.38	7.22	16.46	17.34	7.42	6.53	16.07	16.49	7.14
325	21	Thur.	19 43 48	14 16.40	7.23	16.46	18.12	8.43	6.55	16.06	17.27	8.20
326	22	Frid.	19 57 11	14 1.60	7.24	16.45	18.52	9.43	6.56	16.05	18.07	9.18
327	23	Sat.	20 10 12	13 46.00	7.26	16.44	19.39	10.38	6.58	16.04	18.56	10.11
328	24	Sun.	20 22 51	13 29.58	7.27	16.44	20.31	11.25	6.59	16.03	19.51	10.58
329	25	Mon.	20 35 7	13 12.39	7.29	16.43	21.28	12.06	7.01	16.03	20.48	11.40
330	26	Tues.	20 47 00	12 54.41	7.30	16.43	22.27	12.43	7.02	16.02	21.49	12.11
331	27	Wed.	20 58 31	12 35.67	7.32	16.42	23.26	13.13	7.04	16.01	22.51	12.41
332	28	Thur.	21 9 37	12 16.16	7.33	16.41	a.m.	13.40	7.05	16.01	23.57	13.08
333	29	Frid.	21 20 20	11 55.92	7.34	16.41	0.32	14.06	7.06	16.00	a.m.	13.30
334	30	Sat.	21 30 40	11 34.96	7.35	16.40	1.34	14.30	7.07	15.59	1.04	13.54
...	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Standard Time.—The rising and setting of the Sun and

Toronto... Lat. 43° 40′ Long. 79 24				Winnipeg Lat. 49° 53′ Long. 97 7				Vancouver Victoria... Lat. 49° 0′ Long. 123 12				R.A. of Polaris	Decl. of Polaris
Sun		Moon		Sun		Moon		Sun		Moon			
Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets		
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.	° ′
												1. 26	8848
6.52	17.10	1.49	15.34	7.17	17.07	1.51	15.56	6.59	16.54	1.36	15.47	54s.	52″
6.53	17.09	2.53	16.00	7.19	17.05	2.57	16.17	7.00	16.53	2.45	16.09	54	52
6.55	17.08	4.00	16.27	7.21	17.04	4.06	16.40	7.02	16.52	3.55	16.31	54	53
6.56	17.06	5.07	16.54	7.22	17.02	5.17	17.01	7.03	16.50	5.06	16.55	54	53
6.57	17.05	6.19	17.23	7.24	17.00	6.36	17.25	7.05	16.48	6.21	17.20	54	54
6.59	17.04	7.31	17.59	7.25	16.59	7.53	17.59	7.06	16.47	7.38	17.51	54	54
7.00	17.03	8.45	18.36	7.27	16.58	9.12	18.29	7.07	16.46	8.58	18.26	53	54
7.02	17.02	9.56	19.24	7.29	16.56	10.28	19.15	7.09	16.44	10.16	19.09	53	55
7.03	17.00	11.04	20.20	7.31	16.54	11.40	20.08	7.11	16.43	11.29	20.02	53	55
7.05	16.59	12.04	21.25	7.32	16.53	12.41	21.14	7.12	16.42	12.31	21.07	53	56
7.06	16.58	12.53	22.32	7.34	16.52	13.30	22.23	7.14	16.41	13.20	22.15	52	56
7.07	16.57	13.37	23.45	7.35	16.50	14.13	23.41	7.15	16.39	14.00	23.31	52	56
7.08	16.56	14.12	a.m.	7.37	16.48	14.44	a.m.	7.17	16.37	14.31	a.m.	51	57
7.10	16.55	14.40	0.56	7.38	16.47	15.10	0.57	7.18	16.36	14.58	0.45	51	57
7.11	16.54	15.11	2.06	7.40	06.46	15.33	2.12	7.20	16.35	15.20	1.59	50	57
7.12	16.53	15.38	3.16	7.42	16.44	15.55	3.27	7.22	16.33	15.43	3.11	50	58
7.13	16.52	16.03	4.23	7.44	16.43	16.14	4.40	7.24	16.31	16.07	4.22	49	58
7.15	16.51	16.31	5.29	7.45	16.42	16.37	5.51	7.25	16.30	16.28	5.35	49	58
7.16	16.50	17.00	6.36	7.47	16.40	17.02	7.02	7.27	16.28	16.55	6.44	49	59
7.17	16.49	17.34	7.39	7.48	16.39	17.32	8.09	7.28	16.27	17.23	7.53	48	59
7.18	16.49	18.13	8.42	7.50	16.38	18.06	9.17	7.30	16.26	17.58	8.58	48	59
7.19	16.48	18.54	9.40	7.51	16.37	18.44	10.17	7.31	16.25	18.37	10.01	47	60
7.21	16.47	19.43	10.33	7.53	16.36	19.31	11.11	7.33	16.24	19.23	10.55	47	60
7.22	16.47	20.38	11.20	7.54	16.35	20.26	11.57	7.34	16.23	20.16	11.43	46	60
7.23	16.46	21.34	12.02	7.56	16.34	21.23	12.38	7.36	16.23	21.13	12.24	46	61
7.24	16.46	22.33	12.35	7.57	16.33	22.24	13.07	7.37	16.22	22.15	12.56	45	61
7.26	16.45	23.33	13.07	7.59	16.32	23.29	13.35	7.39	16.21	23.20	13.25	44	61
7.27	16.44	a.m.	13.36	8.00	16.32	a.m.	14.00	7.40	16.21	a.m.	13.44	43	62
7.28	16.44	0.35	14.01	8.02	16.31	0.35	14.23	7.42	16.20	0.25	14.14	43	62
7.29	16.43	1.40	14.27	8.03	16.30	1.44	14.43	7.43	16.19	1.31	14.32	42	62
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Moon are given in standard time for the places named.

Day of Year	Day of Month	Day of Week	Greenwich M. Noon: Sun's Declination	Greenwich M. Noon: Equation of Time to be added to / subtracted from Mean Time	Halifax... Lat. 45° 0′ / St. John... Long. 64 50: Sun Rises	Sun Sets	Moon Rises	Moon Sets	Quebec..... Lat. 46° 48′ / Long. 71 13: Sun Rises	Sun Sets	Moon Rises	Moon Sets
			S.	m. s.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
335	1	Sun.	21° 40′ 34″	11 13.29	7.36	16.40	2.40	14.55	7.08	15.59	2.10	14.19
336	2	Mon.	21 50 4	10 50.95	7.37	16.40	3.50	15.24	7.09	15.59	3.21	14.44
337	3	Tues.	21 59 8	10 27.96	7.38	16.39	5.03	15.54	7.11	15.58	4.35	15.11
338	4	Wed.	22 7 47	10 4.33	7.39	16.39	6.18	16.29	7.12	15.58	5.54	15.44
339	5	Thur.	22 16 0	9 40.10	7.40	16.39	7.35	17.12	7.13	15.57	7.12	16.27
340	6	Frid.	22 23 48	9 15.30	7.41	16.39	8.49	18.04	7.14	15.57	8.24	17.19
341	7	Sat.	22 31 9	8 49.96	7.42	16.38	9.58	19.04	7.15	15.57	9.33	18.22
342	8	Sun.	22 38 4	8 24.11	7.43	16.38	10.57	20.13	7.16	15.57	10.28	19.33
343	9	Mon.	22 44 32	7 57.77	7.44	16.38	11.34	21.26	7.17	15.56	11.13	20.48
344	10	Tues.	22 50 34	7 31.00	7.45	16.38	12.23	22.40	7.18	15.56	11.50	22.04
345	11	Wed.	22 56 8	7 3.81	7.46	16.38	12.54	23.53	7.19	15.56	12.21	23.20
346	12	Thur.	23 1 15	6 36.23	7.47	16.38	13.23	a.m.	7.20	15.56	12.46	a.m.
347	13	Frid.	23 5 55	6 8.28	7.48	16.38	13.48	1.03	7.21	15.56	13.09	0.32
348	14	Sat.	23 10 7	5 40.02	7.49	16.37	14.13	2.12	7.22	15.56	13.32	1.42
349	15	Sun.	23 13 51	5 11.47	7.49	16.37	14.40	3.18	7.23	15.56	13.57	2.51
350	16	Mon.	23 17 8	4 42.64	7.50	16.37	15.06	4.24	7.24	15.56	14.22	3.59
351	17	Tues.	23 19 57	4 13.57	7.51	16.38	15.36	5.30	7.25	15.57	14.49	5.05
352	18	Wed.	23 22 17	3 44.30	7.52	16.38	16.09	6.34	7.25	15.57	15.24	6.08
353	19	Thur.	23 24 10	3 14.84	7.52	16.39	16.48	7.33	7.26	15.58	16.03	7.11
354	20	Frid.	23 25 34	2 45.24	7.53	16.39	17.33	8.31	7.26	15.58	16.51	8.04
355	21	Sat.	23 26 30	2 15.52	7.54	16.40	18.23	9.21	7.27	15.58	17.43	8.53
356	22	Sun.	23 26 58	1 45.70	7.54	16.41	19.18	10.06	7.27	15.59	18.42	9.36
357	23	Mon.	23 26 58	1 15.83	7.54	16.41	20.15	10.48	7.28	15.59	19.40	10.13
358	24	Tues.	23 26 30	0 45.94	7.54	16.42	21.17	11.15	7.28	16.00	20.41	10.44
359	25	Wed.	23 25 33	0 16.05	7.54	16.43	22.19	11.44	7.29	16.00	21.44	11.10
360	26	Thur.	23 24 18	0 13.80	7.54	16.43	23.20	12.09	7.29	16.01	22.49	11.32
361	27	Frid.	23 22 14	0 43.59	7.55	16.44	a.m.	12.34	7.30	16.02	23.53	11.56
362	28	Sat.	23 19 53	1 13.27	7.55	16.45	0.24	12.57	7.30	16.02	a.m.	12.19
363	29	Sun.	23 17 4	1 42.81	7.55	16.45	1.30	13.22	7.30	16.03	1.00	12.43
364	30	Mon.	23 13 46	2 12.18	7.56	16.45	2.38	13.50	7.30	16.04	2.10	13.09
365	31	Tues.	23 10 1	2 41.35	7.56	16.47	3.50	14.22	7.30	16.05	3.23	13.39

Standard Time.—The rising and setting of the Sun and

Toronto... Lat. 43° 40′ Long. 79 24				Winnipeg Lat. 49° 53′ Long. 97 7				Vancouver Victoria... Lat. 49° 0′ Long. 123 12				R.A. of Polaris	Decl. of Polaris
Sun		Moon		Sun		Moon		Sun		Moon			
Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets	Rises	Sets		
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.	° ′
												1.26	8849
7.30	16.43	2.44	14.55	8.05	16.30	2.53	15.03	7.45	16.19	2.42	14.55	41s.	2″
7.31	16.43	5.32	15.22	8.07	16.29	4.06	15.27	7.47	16.19	3.54	15.21	41	3
7.32	16.42	5.03	15.52	8.08	16.28	5.22	15.52	7.48	16.18	5.12	15.47	40	3
7.33	16.42	6.19	16.28	8.09	16.28	6.43	16.22	7.49	16.18	6.30	16.21	40	3
7.34	16.42	7.34	17.13	8.10	16.28	8.04	17.03	7.50	16.18	7.50	16.59	39	4
7.35	16.42	7.46	18.06	8.12	16.27	9.21	17.54	7.52	16.18	9.09	17.50	38	4
7.36	16.41	9.54	19.09	8.13	16.27	10.31	18.57	7.53	16.17	10.19	18.52	38	4
7.37	16.41	10.50	20.19	8.14	16.27	11.28	20.09	7.54	16.17	11.15	20.01	37	4
7.38	16.41	11.37	21.32	8.15	16.26	12.14	21.26	7.55	16.16	12.00	21.16	36	5
7.39	16.41	12.16	22.46	8.16	16.26	12.49	22.46	7.56	16.16	12.37	22.34	35	5
7.40	16.41	12.49	23.59	8.17	16.26	13.17	a.m.	7.57	16.16	13.05	23.48	34	5
7.41	16.41	13.17	a.m.	8.18	16.26	13.41	0.03	7.58	16.16	13.28	a.m.	33	6
7.42	16.41	13.43	1.08	8.19	16.26	14.02	1.18	7.59	16.16	13.49	1.02	32	6
7.43	16.40	14.09	2.15	8.20	16.26	14.22	2.31	8.00	16.16	14.12	2.13	32	6
7.43	16.40	14.36	3.22	8.21	16.26	14.44	3.43	8.01	16.16	14.34	3.23	31	6
7.44	16.41	15.04	4.27	8.22	16.26	15.07	4.52	8.02	16.16	14.59	4.33	30	6
7.45	16.41	15.33	5.30	8.22	16.26	15.32	6.00	8.02	16.16	15.26	5.41	29	7
7.46	16.42	16.10	6.32	8.23	16.26	16.06	7.05	8.03	16.16	15.58	6.47	29	7
7.46	16.42	16.50	7.33	8.23	16.27	16.41	8.09	8.03	16.17	16.34	7.52	28	7
7.46	16.43	17.38	8.26	8.24	16.27	17.27	9.03	8.04	16.17	17.19	8.50	27	7
7.47	16.43	18.30	9.15	8.24	16.28	18.17	9.52	8.04	16.17	18.07	9.39	26	7
7.48	16.44	19.28	9.58	8.25	16.28	19.17	10.34	8.05	16.18	19.04	10.22	25	8
7.48	16.44	20.24	10.36	8.26	16.29	20.14	11.10	8.06	16.19	20.05	10.58	24	8
7.49	16.45	21.24	11.09	8.26	16.29	21.18	11.39	8.06	16.19	21.08	11.27	23	8
7.49	16.46	22.23	11.38	8.27	16.30	22.21	12.04	8.07	16.20	22.09	11.52	22	8
7.49	16.46	23.26	12.02	8.27	16.30	23.28	12.24	8.07	16.20	23.17	12.15	21	8
7.50	16.47	a.m.	12.28	8.28	16.31	a.m.	12.45	8.07	16.21	a.m.	12.37	20	8
7.50	16.48	0.28	12.53	8.28	16.32	0.34	13.05	8.07	16.22	0.24	12.58	19	9
7.50	16.48	1.32	13.20	8.28	16.33	1.42	13.27	8.07	16.23	1.32	13.20	18	9
7.51	16.49	2.40	13.48	8.28	16.34	2.56	13.50	8.07	16.24	2.43	13.44	17	9
7.51	16.50	3.50	14.22	8.28	16.34	4.12	14.20	8.07	16.24	3.59	14.14	16	9

Moon are given in standard time for the places named.

GEOGRAPHICAL POSITIONS OF SOME POINTS IN CANADA

Name	Latitude N.			Longitude W.			Feet above Sea Level
	°	′	″	°	′	″	
Banff, Alta	51	10		115	35		4542
Barrie, Ont	44	23		79	41		839
Battleford, Sask	52	41		108	20		1620
Brandon, Man	49	51		99	57		1176
Calgary, Alta	51	02	39.21	7	36	15.1	3428
Charlottetown, P.E.I	46	14		63	10		38
Collingwood, Ont	44	30		80	15		595
Edmonton, Alta	53	31	58.81	113	30	27.0	2188
Father Point, Que	48	31		68	19		20
Fort Churchill	58	51		94	11		....
Fort Simpson	61	52		121	43		....
Fredericton, N.B	45	57		66	36		164
Golden, B.C	51	16		116	55		2550
Gravenhurst, Ont	44	54		79	20		770
Guelph, Ont	43	32	43.7	80	15	09.0	1063
Halifax, N.S	44	39		63	36		97
Hamilton, Ont	43	16		79	54		303
Herschel Is	69	30		139	15		....
Kingston, Ont	44	13		76	29		285
London, Ont	42	59		81	13		808
Medicine Hat	50	1		110	37		2161
Moncton, N.B	46	9		64	45		50
Montreal, Que	45	30	17.0	73	34	39.45	187
New Westminster, B.C	49	13		122	54		330
No. West River, Ungava	53	31	31.45	60	10	17.85	....
Ottawa, Ont	45	23	38	75	42	58.20	273.4
Owen Sound, Ont	44	33	56.42	80	56	40.5	585
Peterborough, Ont	44	17		78	19		722
Portage la Prairie, Man	49	58		98	17		830
Port Simpson, B.C	54	34		130	26		26
Prince Albert, Sask	53	10		106	0		1432
Quebec, Que	46	48		71	13		296
Regina, Sask	50	27		104	37		1885
Revelstoke, B.C	51	00	11.25	7	52	49.8	1503
Rose Point, Ont	45	19	00.73	80	02	28.5	602
St. Catharines, Ont	43	10		79	17		347
St. John, N.B	45	17		66	4		70
St. Johns, Nfd	47	34		52	42		125
Stratford, Ont	43	23		81	00		1191
Toronto, Ont	43	39	35.9	79	23	39.75	350
Vancouver, B.C	49	17	48.0	123	07	05.52	11
Victoria, B.C	48	25	31.38	123	21	42.0	55
Windsor, Ont	42	20		83	4		625
Winnipeg, Man	49	53	51.53	97	08	28.53	751
York Factory	57	00		92	28		55

ASTRONOMICAL STATIONS

CALGARY: 1 chain 56 links south of centre line of C.P.R. main line, and 2 chains 49 links north of north-east corner of lot No. 11, in block 69.

EDMONTON: 70.2 feet south-east of Dominion Lands Survey Station; azimuth 120°.07.

GUELPH: 150 feet west of Norfolk Street, and 85 feet north of Paisley Street, Nelson Crescent.

MONTREAL: McGill College Observatory.

NORTH-WEST RIVER: Pier on site occupied by Government Eclipse Expedition, 1905.

OTTAWA: Dominion Astronomical Observatory, centre of dome. Altitude is of lowest step at front entrance.

OWEN SOUND: 215.96 feet on the course, making an angle of 57° 33′ with the westerly side of Poulett Street, from the intersection of that side of Poulett Street with the southerly side of Baker Street.

REVELSTOKE: 134 ft. 10 in. north of centre line of C.P.R., and 128 ft. 8 in. on a course north 37° 29′ east from C.P.R. traverse station No. 1,064 of the year 1886.

ROSE POINT: South-east corner of garden of Rose Point Hotel.

TORONTO: The Dominion Meteorological Observatory.

VANCOUVER: Brockton Point, close to and south-east of lighthouse.

VICTORIA: North-west corner of garden of Driard Hotel.

WINNIPEG: On Dominion Government lot between Princess and King Streets, east of Notre Dame Street.

The altitudes for these stations are usually only approximate results.

MAGNETIC ELEMENTS FOR THE AGINCOURT STATION OF THE TORONTO OBSERVATORY, 1901-1905

Mean values for the Months named.

The Horizontal Force is in millionths of a dyne.

Date		Declination West		Dip.		Horizontal Force
		°	′	°	′	
1901	January	5	28.4	74	32.7	0.165071
	July	5	29.4	74	31.9	0.165036
1902	January	5	30.5	74	32.4	0.164924
	July	5	31.6	74	32.1	0.164868
1903	January	5	33.1	74	32.7	0.164883
	July	5	33.7	74	32.1	0.164716
1904	January	5	37.0	74	32.6	0.164492
	July	5	38.1	74	31.9	0.164544
1905	January	5	40.2	74	34.4	0.164325
	July	5	42.3	74	34.5	0.164328

ECLIPSES OF THE SUN AND MOON, AND TRANSIT OF MERCURY

In the year 1907 there will be two Eclipses of the Sun, two of the Moon, and a Transit of Mercury.

I. A total Eclipse of the Sun, January 13, invisible in Canada. The path of totality is across the middle of Asia.

II. A partial Eclipse of the Moon, January 28-29; the beginning visible generally in North America, the Pacific Ocean, central and eastern Asia, and Australia; the end visible in north-west North America, the Pacific Ocean, Asia, Australia, central and eastern Europe.

	h	m	
Moon enters penumbra Jan. 29.....	5	45.9	75th Meridian Time.
Moon enters shadow.....	7	6.3	
Middle of eclipse.....	8	38.1	
Moon leaves shadow.....	10	9.9	
Moon leaves penumbra.....	11	30.2	

Magnitude of eclipse 0.715 (Moon's diameter=1.)

III. An annular Eclipse of the Sun, July 10, invisible in Canada. The central path crosses South America in approximately 20° S. Latitude.

IV. A partial Eclipse of the Moon, July 24; the beginning visible generally in central and western Europe, Africa, South America and North America, except the north-west portion; the end visible generally in western Africa, South America and North America, except the peninsula of Alaska.

	h	m	
Moon enters penumbra July 24.....	8	58.7	75th Meridian Time.
Moon enters shadow.....	10	3.7	
Middle of eclipse.....	11	22.4	
Moon leaves shadow.....	12	41.1	
Moon leaves penumbra.....	13	46.2	

Magnitude of eclipse 0.620 (Moon's diameter=1).

V. A Transit of Mercury, November 14. A Transit of Mercury over the northerly portion of the Sun's disc,

partly visible in Canada, the Sun rising with Mercury on its disc. The ingress will be visible generally in Europe, Africa, western and central Asia, western Australia and South America; the egress in Europe, except the northern portion, Africa, western Asia, South America and North America, except the north-west portion.

	h	m	s	
Ingress, exterior contact, Nov. 14....	7	23	40	75th Meridian Time.
Ingress, interior contact.....	7	26	19	
Least distance of centres, 12′ 38″.4...	8	6	48	
Egress, interior contact.....	9	47	18	
Egress, exterior contact.....	9	49	58	

On Nov. 14 the Sun rises at Halifax 7.15; at Quebec, 6.45; at Toronto, 7.10; at Winnipeg, 7.38; at Vancouver, 7.18.

OCCULTATIONS OF STARS BY THE MOON

The angles are counted from the north point towards the east, and the hours are numbered from midnight, 75th Meridian Time.

Date	The Star's Name	Mag.	Immersion Time	Immersion Angle	Emersion Time	Emersion Angle	Duration of Occultation
			h m	°	h m	°	h m
Jan. 1	δ Cancri.....	4.1	22 44	116	23 58	256	1 14
17	ψ^2 Aquarii.....	4.6	17 8	91	18 13	212	1 5
24	m Tauri.....	5.0	0 48	103	1 56	249	1 8
25	χ^1 Orionis.....	4.5	22 40	45	23 48	307	1 8
26	χ^2 Orionis.....	4.7	4 8	70	5 0	294	0 52
Feb. 23	56 Geminorum.	5.2	23 53	91	1 8	290	1 15
28	l Leonis.....	5.3	0 30	69	1 25	347	0 55
Mar. 5	49 Libræ.....	5.4	23 19	138	0 8	262	0 49
9	o Sagittarii...	3.9	1 40	125	2 28	248	0 48
23	ζ Geminorum.	4.0	0 12	111	1 12	266	1 0
24	85 Geminorum.	5.2	0 17	88	1 19	300	1 2
24	δ Cancri.....	4.1	22 55	128	0 8	270	1 13
Apl. 2	θ Libræ	4.4	4 11	127	5 26	271	1 15
17	χ^1 Orionis.....	4.5	23 11	106	0 3	256	0 52
23	ι Leonis.....	5.3	17 26	159	18 17	242	0 51
30	χ Ophiuchi....	4.9	0 57	69	1 55	331	0 58
May 26	θ Librae.....	4.4	21 26	131	22 36	278	1 10
June 23	χ Ophiuchi....	4.9	21 41	58	22 29	341	0 48
July 20	θ Libræ	4.4	17 34	169	18 16	241	0 42
27	ψ^3 Aquarii.....	5.2	23 3	352	23 17	328	0 14
Aug. 1	μ Ceti.....	4.3	1 51	24	2 43	283	0 53
Apl. 18	58 Ophiuchi....	4.8	23 1	77	0 7	285	1 6
Sept. 14	ξ Ophiuchi....	4.4	20 22	53	21 16	317	0 54
20	ψ^3 Aquarii.....	5.2	18 55	23	19 39	297	0 44
Oct. 15	η Capricorni..	4.8	16 55	115	17 58	222	1 3
24	δ^3 Tauri.....	4.3	6 32	98	7 37	245	1 5
27	a Geminorum.	5.2	0 5	125	0 57	217	0 52
Nov. 21	ζ Tauri.....	3.0	21 59	47	23 6	279	1 7
23	δ Geminorum.	3.5	21 4	103	22 3	245	0 59
Dec. 17	δ^1 Tauri.....	3.9	17 36	83	18 37	232	1 1
17	δ^3 Tauri.....	4.3	19 8	53	20 20	259	1 12
21	δ Geminorum.	3.5	7 3	79	7 57	301	0 54

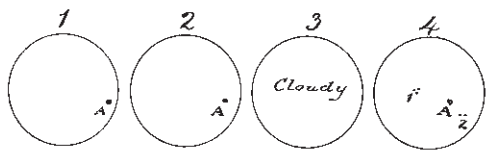
OBSERVING THE SUN, MOON, AND PLANETS

By Andrew Elvins

THE SUN

First, a word of caution. Never look at the Sun without a dark glass or mica screen.

To record the observations I take a drawing book and make 14 circles, drawn around a 1-cent piece.

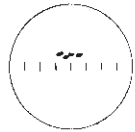


Form of sketches in note-book.
The figures above denote the day of the year.

Above the circles is marked the day of the year, in the figure being shown those for January 1-4. On day 1, on looking through the telescope I see a spot, and I mark it as at A, near the limb. Next day I see the same spot a little further from the limb. The next day may be cloudy and I mark it such. On the 4th day it is still further on and getting nearer the centre, and I see two new groups which I mark 1 and 2.

By watching spot A we find it crosses the disc in 13 or 14 days, and its direction shows us the Sun's equator; the poles are on a line at right angles to this direction.

Sometimes we wish to find roughly the length of a group. The Sun is 800,000 miles across. Let us divide the diameter of a circle into 8 equal parts and view the spot when it is near the centre. As each division is 100,000 miles, it will not be difficult to find the size of the group. The one in the drawing is about 200,000 miles long.



How to measure the length of a Spot-group.

When there are large spots it is well to draw the spot on a larger scale. I draw the penumbra with pencil first, and put in the umbra with ink. If a large single spot is on the disc, draw the penumbra as correctly as possible when near the limb.

To be useful these observations must be kept up. Our Mr. G. G. Pursey has a record for ten years past, and Mr. Weatherbe has made such drawings daily for years. They are as reliable as photographs. Such observations are interesting, and may be important.

Another phenomenon should be carefully examined. Portions brighter than the general surface of the Sun may usually be seen in the neighborhood of the spots, and are doubtless part of the same disturbance. These are known as faculae, and look like billows of bright liquid. They are best seen when near the limb, but they exist in two zones, one on each side of the equator, just like the two spot-zones, and have been photographed right across the Sun. To draw these a gray drawing paper is useful, the faculae being put in with a white pencil.

THE MOON

Unlike the Sun, the Moon is changeless. It is covered with spots of different shapes and shades, but they are permanent.

We find a low power most useful to begin with, so that the whole Moon may be seen, until we become acquainted with its surface. Commencing with the new Moon as early as possible we find it a fine crescent, with the bright edge pointing sunward.

The Moon, March 3. 1906.
(Photograph by Rev. Dr. Marsh.)

Observing each evening, we soon find an oval spot near the limb whose shade is a little darker than the general surface; it has been named the Mare Crisium or Sea of Crises, and we notice a rather brighter border surrounding the objects farthest from the limb. These are mountains, and will be seen to cast a shadow on the plain when the Moon is 6 or 7 days old.

At this place two cavities may be seen when the Moon is about 4 days old; black shadows fall into them toward the Moon's centre. They are Picard and Peirce. The large dark plains called *Maria* or *Seas* are to be learned first, and any book on Astronomy will give the beginner their positions and names. Elger's "Moon" has excellent maps and a description of all the interesting features on the Moon's surface.

I would recommend the student to draw the formations as he sees them. Black and white crayon on cream-colored paper answers well, and it rivets the particulars on the memory.

Bright rays may be seen passing out from some of the craters and running hundreds of miles. At the top of the Moon (as seen in the telescope) is one, Tycho, which is very distinct at full moon. If this spot were ever a lunar pole the chief dark seas were then on the lunar equator.

Members of the R.A.S.C. should examine the Lick, Paris and Pickering atlases. These are the best in existence and are in our Library.

THE PLANETS

"Are planets peopled like the Earth,
And do the people come by birth?
Do they resemble people here,
Or are they only half as queer?
When old do they renew their youth?
Does *falsehood* pass for more than *truth*?"

I don't know. The question of morals on earth seems hard to understand at present. There are many physical subjects which are less puzzling, and we will look at some of these.

In many things do the other planets resemble the Earth. They are solid bodies with an enveloping atmosphere in which clouds float. Mars shows white patches at the poles which look like snow, and some observers think they see signs of water and vegetation on it.

With a 3-inch refractor and a power of about 100 or more, Mercury and Venus can be well seen. They have phases like the Moon. Mercury must be looked for as soon as the light is getting faint, near where the Sun has set. It is never very far from the horizon, and is hard to catch.

Venus is a brilliant object, too brilliant for easy observation when an evening star, but the changes in its apparent size are very striking. When the planet is in superior conjunction it is round and small, but when near

inferior conjunction it is a beautiful large crescent. It is useful to cut off its light with a darkish glass screen, but I have seen it best in daylight. I find it before sunrise and keep looking until full daylight. I have had my best views this way.

Mars has two moons, but they are to be seen only with large telescopes. The inner one revolves far more rapidly than the planet rotates, a rather difficult result to reconcile with the nebular hypothesis. We may refer to the works of Percival Lowell and W. H. Pickering for the latest news of Mars.

At opposition Jupiter is a splendid object. Its shape is quite oval, being much flattened at the poles. It has a dense atmosphere and clouds lie in bands on each side of the equator. Spots are often seen on the belts, and it is very interesting to notice how fast they move, going from the limb to the centre in three hours. Small telescopes show four moons, and they often cast round black spots on the disc as they pass before it. The hollow in the belt where the red spot was seen in 1878 and after years is still visible, but the red spot is gone.

Mr. Barnard discovered a small moon near the planet fourteen years ago, and two others were more recently discovered.

Saturn is the finest object to observe. A high power is best. Its wonderful ring and its satellites are a beautiful sight.

Webb's "Celestial Objects" should be consulted by every observer, and all should read The "English Mechanic." It contains each week letters on every new subject.

This paper is designed only for beginners, and I hope it may be a help to such.

PRINCIPAL ELEMENTS OF THE SOLAR SYSTEM

Name	Mean Distance from Sun		Sidereal Period		Mean Diam't'r Miles	Mass	Density	Volume	Axial Rotation
	⊕ = 1	Millions of Miles	Mean Solar Days	Years		⊕ = 1	Water = 1	⊕ = 1	
☿ Mercury...	0.387	36.0	87.97	0.24	3030	0.476	4.7(?)	0.056	88^d
♀ Venus.....	0.723	67.2	224.70	0.62	7700	0.82	4.94	0.92	225^d
⊕ Earth.....	1.000	92.9	365.26	1.00	7917.6	1.00	5.55	1.00	$23^h\ 56^m\ 4^s$
♂ Mars.....	1.524	141.5	686.95	1.88	4230	0.108	3.92	0.152	$24^h\ 37^m\ 23^s$
♃ Jupiter....	5.203	483.3	4332.58	11.86	86500	317.7	1.32	1309	$9^h\ 55^m \pm$
♄ Saturn.....	9.539	886.0	10759.2	29.46	73000	94.8	0.72	760	$10^h\ 14^m \pm$
♅ Uranus....	19.183	1781.9	30686.8	84.02	31900	14.6	1.22	65	?
♆ Neptune...	30.055	2971.6	60181.1	164.78	34800	17.0	1.11	85	?
☉ Sun.....	....	....	....	....	866400	332.000	1.39	1300000	$25^d\ 7^h\ 48^m \pm$
☾ Moon.....	From ⊕ 238,840 mls		27.32	0.75	2163	1/81.5	3.39	0.020	$27^d\ 7^h\ 43^m$

SATELLITES OF THE SOLAR SYSTEM

Name	Stellar Magnitude	Mean Distance in Miles	Sidereal Period d. h. m. s.	Discoverer	Date
THE EARTH					
The Moon..	..	238,840	27 7 43 11		
MARS					
1. Phobos.....	14	5,850	7 39 15	Asaph Hall....	Aug. 17, 1877
2. Deimos....	13	14,650	1 6 17 54	Asaph Hall....	Aug. 11, 1877
JUPITER					
5. (Nameless).	13	112,500	11 57 23	Barnard.....	Sept. 9, 1892
1. Io.....	6½	261,000	1 18 27 33	Galileo.....	Jan. 7, 1610
2. Europa....	6½	415,000	3 13 13 42	Galileo.....	Jan. 8, 1610
3. Ganymede.	6	664,000	7 3 42 33	Galileo.....	Jan. 7, 1610
4. Callisto....	7	1,167,000	16 16 32 11	Galileo.....	Jan. 7, 1610
6. (Nameless).	14	7,000,000	250 d.	Perrine.....	Dec. 1904
7. (Nameless).	16	7,300,000	265 d.	Perrine.....	Jan. 1905
SATURN					
1. Mimas.....	15	117,000	22 37 6	W. Herschel...	July 18, 1789
2. Enceladus..	14	157,000	1 8 53 7	W. Herschel...	Aug. 29, 1789
3. Tethys.....	11	186,000	1 21 18 26	J. D. Cassini...	Mar. 21, 1684
4. Dione.....	11	238,000	2 17 41 9	J. D. Cassini...	Mar. 21, 1684
5. Rhea.....	10	332,000	4 12 25 12	J. D. Cassini...	Dec. 23, 1672
6. Titan.....	9	771,000	15 22 41 23	Huygens.....	Mar. 25, 1655
7. Hyperion...	16	934,000	21 6 39 27	G. P. Bond....	Sept. 16, 1848
8. Iapetus....	11	2,225,000	79 7 54 17	J. D. Cassini...	Oct. 25, 1671
9. Phoebe.....	17	8,000,000	546.5 d.	W.H.Pickering	1898
10. Themis.....	17	906,000	20 20 24 0	W.H.Pickering	1905
URANUS					
1. Ariel.....	15	120,000	2 12 29 21	Lassell.....	Oct. 24, 1851
2. Umbriel....	16	167,000	4 3 27 37	Lassell.....	Oct. 24, 1851
3. Titania.....	13	273,000	8 16 56 29	W. Herschel...	Jan. 11, 1787
4. Oberon.....	14	365,000	13 11 7 6	W. Herschel...	Jan. 11, 1787
NEPTUNE					
1. (Nameless).	13	221,500	5 21 2 44	Lassell.....	Oct. 10, 1846

THE PLANETS IN 1907

In the following notes on the Planets the most interesting phenomena connected with their motions are given, and it is hoped that their courses can be intelligently followed throughout the year. For the five outer planets maps showing the paths among the stars are given. Exceptionally interesting observations will be possible with Mercury, Mars and Saturn in 1907.

MERCURY

Mercury is always so near the sun that it is comparatively seldom seen with the naked eye, but when not far from its greatest elongation, which, however, never exceeds 28°, it is easily visible as a star of the first magnitude. It is usually visible for about a fortnight at each elongation, and is best seen in the evening at such eastern elongations as occur in March or April.

The phases of the planet succeed in the following order:

Feb.	2	Superior Conjunction	
Mar.	1	Greatest Elongation E., 18° 10′	Evening Star
Mar.	18	Inferior Conjunction	
April	14	Greatest Elongation W., 27° 36′	
May	24	Superior Conjunction	Morning Star
June	27	Greatest Elongation E., 25° 29′	
July	24	Inferior Conjunction	
Aug.	12	Greatest Elongation W., 18° 51′	Evening Star
Sept.	6	Superior Conjunction	
Oct.	23	Greatest Elongation E., 24° 20′	
Nov.	14	Inferior Conjuction	Morning Star
Nov.	30	Greatest Elongation W., 20° 20′	

Usually the planet at the time of conjunction passes north or south of the Sun, but at the inferior conjunction of Nov. 14 the planet is very near its line of nodes, and will cross the Sun's disc, being visible as a black spot. The times of the transit are given on page 37. These transits must occur in May and November, those in the latter month being more than twice as numerous as those in the former. The last transit, visible in Canada, was on Nov. 7, 1894; the next will be on Nov. 6, 1914, To observe the transit a small telescope is necessary.

VENUS

At the beginning of 1907 Venus is west of the Sun and is therefore a morning star. On Jan. 4 it attains its greatest brilliance, which then steadily diminishes until September, when it begins slowly to rise again. Maximum Elongation W. 46° 53′, occurs on Feb. 9, and Superior Conjunction on Sept. 14, after which date the planet is the evening star.

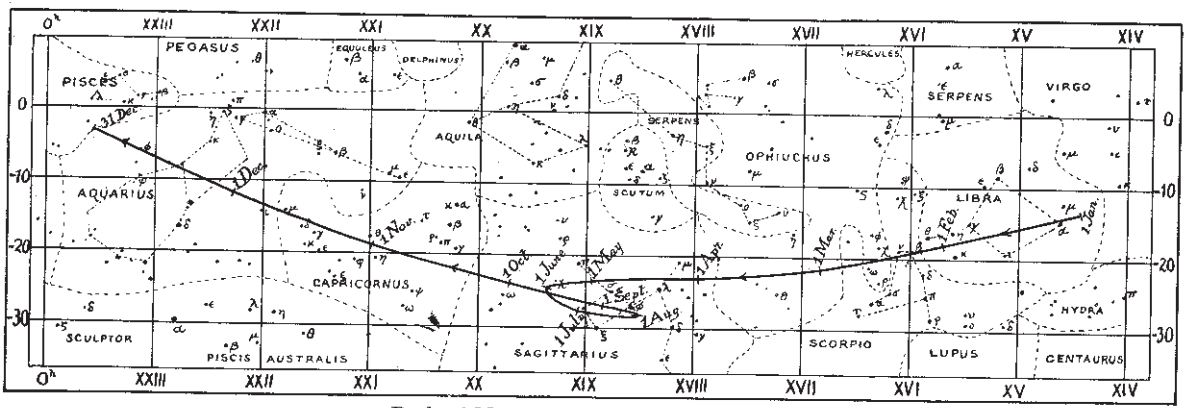
The phases of Venus are easily seen with a small telescope. When about midway between greatest elongation and inferior conjunction the planet has an apparent diameter of 40″, and with a magnifying power of only 45 it looks exactly like the Moon when four days old, and of precisely the same apparent size.

The surface markings are not conspicuous but are deserving of careful study, as observations on them may lead to a determination of the period of rotation of the planet. Some observers give it as 23 h. 21 m., but the stronger evidence favors 225 days, i.e., the planet's orbital period. In this case the planet will always present the same face to the Sun, just as our Moon does to the Earth.

MARS

This planet is a most interesting object to study, and during 1907 will be well-placed for observation. Its sidereal period is 687 days and synodic period 780 days, and hence its oppositions occur a little over two years apart. It will be in opposition on July 6, but it comes nearest to the Earth on July 13, at which time it will be 37,800,000 miles distant. As the average distance at time of opposition is 48,600,000 miles and the least possible is 35,050,000 miles, it will be seen that the opposition of this year will be very good for observation. These favorable oppositions occur at intervals of 15 or 17 years, the last one having been in 1892. Fifteen years before this, in 1877, the two minute moons of the planet were discovered by Asaph Hall, at Washington. These satellites, remarkable for the rapidity of their revolution about the planet can be seen only with very powerful telescopes.

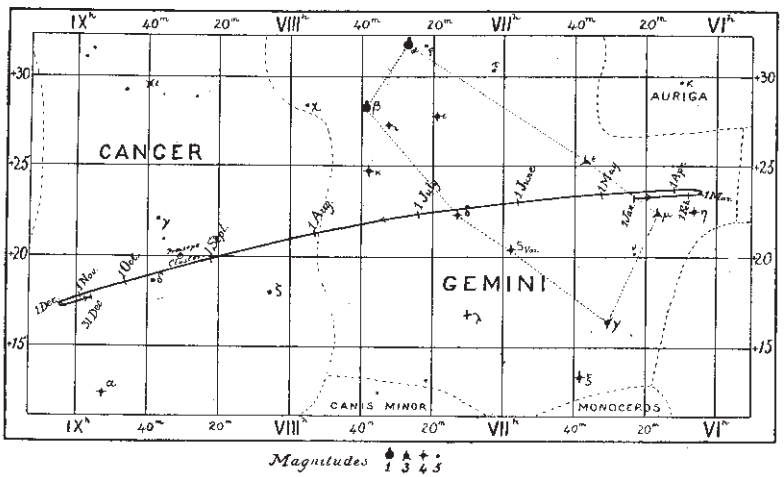
In the accompanying diagram on page 49 is shown the path of Mars amongst the stars in 1907.



Path of Mars among the Stars in 1907.

JUPITER

Jupiter is the greatest of all the planets, and his brightness, superior to any of the fixed stars, is surpassed by Venus only. Even a small telescope will show an appreciable disc, and the motions of the four earliest discovered moons can easily be followed by the amateur astronomer. At present Jupiter is known to have seven satellites. Four were dfscovered by Galileo in 1610, the



Path of Jupiter among the Stars in 1907.

fifth by Barnard at the Lick Observatory in 1892, and the sixth and seventh were discovered by photography by Perrine of the same Observatory in December, 1904, and January, 1905. The configurations of the satellites at times suitable for observing are given in the adjoining double-page table, and the times of all the eclipses visible in Canada are given in the monthly predictions at the end of this volume.

On December 28, 1906, Jupiter is in opposition, and as the synodic period is 399 days the next opposition will

CONFIGURATIONS OF THE SATELLITES OF JUPITER

For an Inverting Telescope, 75th Meridian Time, hours counting from midnight.

Day	Jan. 23h 38m	Feb. 22h 38m	March 22h 8m	April 21h 38m	May 21h 8m	June 20h 38m	Jupiter being near the Sun the Satellites are not visible from June 17 to Aug. 15.	Aug. 4h 8m	Sept. 4h 8m	Oct. 3h 8m	Nov. 2h 38m	Dec. 2h 8m	Day
1	43102	4201●	23014	12043	4103●	43201		.....	32014	34021	42103	41023	1
2	43201	41023	10234	20134	43012	4310●		.....	31204	3102●	40213	ϒ4013	2
3	4230●	ϒ4203	02134	31024	34120	40312		.....	30124	20134	41023	42310	3
4	41023	42013	21034	30124	3201●	41203		.....	ϒ1034	12034	42301	43021	4
5	40123	43102	ϒ2014	32104	1024●	42013		.....	ϒ2034	01234	3210●	43102	5
6	42103	43021	3042●	ϒ3204	01234	41032		.....	01243	0234●	30124	4201●	6
7	23041	43210	34210	01234	2034●	ϒ302●		.....	10432	32104	30214	4203●	7
8	31024	4201●	42301	12043	12034	32014		.....	43201	30214	21034	1023●	8
9	ϒ3014	14023	41023	24013	30124	31204		.....	43120	31024	02134	02143	9
10	23104	ϒ0143	40213	41302	31204	0124●		.....	43012	20314	10234	21304	10
11	ϒ0234	2034●	42103	43012	32014	ϒ1034		.....	4102●	21403	ϒ2014	30214	11
12	01234	31024	42031	43210	13042	20134		.....	42013	40123	32104	31024	12
13	21034	30124	43102	43201	40123	10234		.....	403●●	41023	30142	23014	13
14	23014	32104	ϒϒ340	4032●	42103	30124		.....	41032	ϒ4230	3402●	21●34	14
15	31042	23014	32014	ϒ4103	ϒ4203	3204●		.....	43201	4301●	42103	ϒ0243	15
16	34021	10234	1024●	42013	43012	34210		01234	32104	43102	4013●	02143	16
17	42310	02143	02134	ϒ1402	ϒ4310	.....		13024	30124	4201●	41023	21430	17
18	40123	24103	21034	30124	43201	.....		32014	1 24●	42103	42031	3401●	18
19	4023●	4310●	20314	32104	41203	.....		3104●	20134	40123	43210	43102	19
20	42103	43012	31024	32014	40123	.....		31240	034●●	10234	43012	43201	20
21	ϒ4201	43210	30214	10324	21043	.....		2043●	ϒ0234	23014	3402●	42103	21
22	43102	42301	3204●	10234	20134	.....		42103	32014	304●●	ϒ2043	40123	22
23	34021	41023	ϒ103●	20134	ϒ024●	.....		40123	32104	31024	0143●	40123	23
24	23104	40213	40123	1034●	31024	.....		41032	ϒ3012	23014	10234	ϒ4210	24
25	0134●	24103	42103	30412	32014	.....		4301	41302	21034	20314	301●●	25
26	0234●	ϒ304●	42031	32140	1304●	.....		43120	42013	01234	32104	31024	26
27	21034	3024●	43102	43201	01324	.....		43012	41203	10423	30124	32014	27
28	20314	32104	43021	4102●	12043	.....		4203●	ϒ4023	24301	31024	21034	28
29	31024	.....	4320●	ϒϒ023	20413	.....		24103	ϒϒ401	4320●	2014●	01234	29
30	30214	.....	4130●	42013	4032●	.....		04123	43210	43102	ϒ2013	0234●	30
31	23104	.....	40123	.....	43102	.....		10324	.....	ϒ4301	.....	21034	31

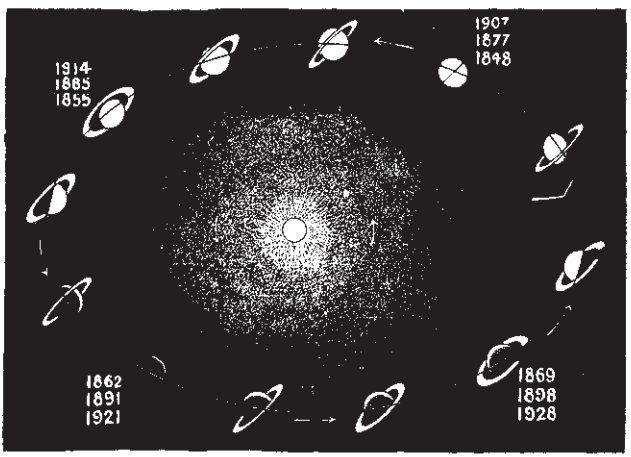
The circle ○ represents Jupiter; ϒ signifies that the satellite is on the disc; ● signifies that the satellite is behind the disc or in the shadow.

be in February, 1908, that is, there will be no opposition in 1907 at all. The planet will be very brilliant throughout the entire night at the beginning of the year. On March 23 it will be in quadrature, on July 16 in conjunction, and on Nov. 6 in quadrature to the west of the Sun, being then morning star.

In the diagram on page 50 the path of the planet amongst the stars in 1907 is shown.

SATURN

In the telescope a magnificent spectacle is presented by this planet, surrounded by its unique ring-system and its numerous satellites.

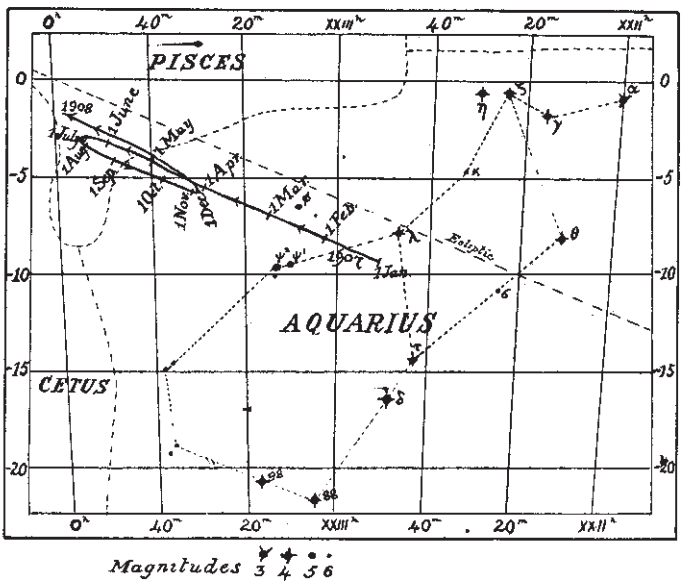


Phases of Saturn's Rings.

At the beginning of the year Saturn will be an evening star, gradually approaching the Sun until on March 9 it will be in conjunction. After this it will be a morning star, being in quadrature on June 19 and reaching opposition on September 17. After this it will be an evening star again.

On account of the fact that the ring-system remains always parallel to itself, as shown in the accompanying figure, it will happen that twice in the planet's revolution in 29½ years the edge of the rings will be turned to the Sun or the Earth, in which case they will not be seen. This very interesting event will take place in 1907.

The circumstances which determine the invisibility of the ring are: 1st, when its plane passes through the centre



Path of Saturn among the Stars in 1907.

of the Sun; 2nd, when it passes through the centre of the Earth; 3rd, when the Sun and the Earth are on different sides of the plane of the ring, for the Earth in this case will have the unilluminated side of the ring turned towards it. The first condition is fulfilled on July 27, the second on April 9 and October 4; and the third during most of the months of May, June, July, October, November and

December. In August and September the elevation of the plane of the ring above the Sun and the Earth will be so small that even then it will be almost, if not quite, invisible in ordinary telescopes.

Saturn is now known to have ten satellites, the ninth having been discovered in 1898 by W. H. Pickering, and the tenth by the same astronomer in 1905. The latter is a very small object. The largest of all is Titan, which, according to Webb, may be seen with a telescope of 1-inch aperture. Its mean synodic period is 15 d. 23.3 h., and times for eastern elongation are given in the following table:—

Eastern Elongations of Titan

(75th Meridian Time.)

	d.	h.		d.	h.		d.	h.
May	26	8.6	Aug.	14	2.1	Nov.	1	13.7
June	11	8.1	Aug.	29	23.9	Nov.	17	12.1
June	27	7.3	Sept.	14	21.1	Dec.	3	10.8
July	13	6.2	Sept.	30	18.5	Dec.	19	9.9
July	29	4.2	Oct.	16	15.9			

The position of the satellite at any other time can easily be calculated.

The outer ring has an exterior diameter of 168,000 miles, while the thickness probably does not exceed 100 miles. If a model of the rings were constructed on a scale of 10,000 miles to the inch, the outer ring would have a diameter of nearly 17 inches, and the thickness would be that of an ordinary sheet of writing paper.

It has been demonstrated that the rings are composed of a swarm of separate particles, each pursuing its own path about the planet.

In the diagram on page 53 is shown the path of Saturn amongst the stars in 1907.

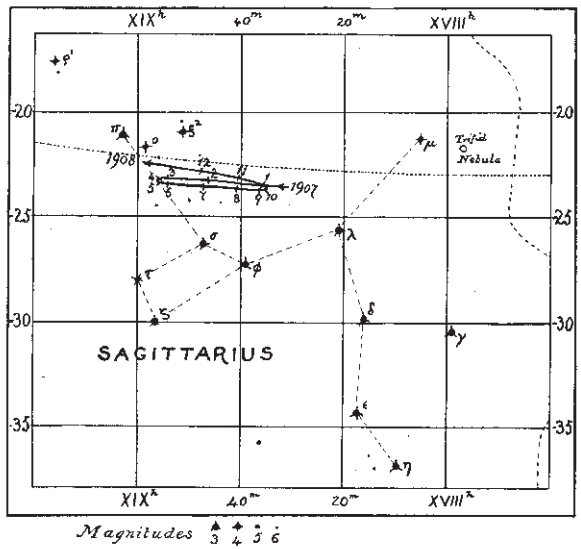
URANUS

Uranus, the planet discovered by the elder Herschel in 1781, appears to the naked eye on a dark night as a small star of the sixth magnitude. During the year it

will be in the constellation Sagittarius. It will be in opposition on July 3, in quadrature April 3, and Oct. 3, and in conjunction Dec. 31, 1906, and Jan. 4, 1908.

Uranus has four satellites, inaccessible, however, to telescopes of small aperture.

The accompanying diagram exhibits the path of the planet in 1907.



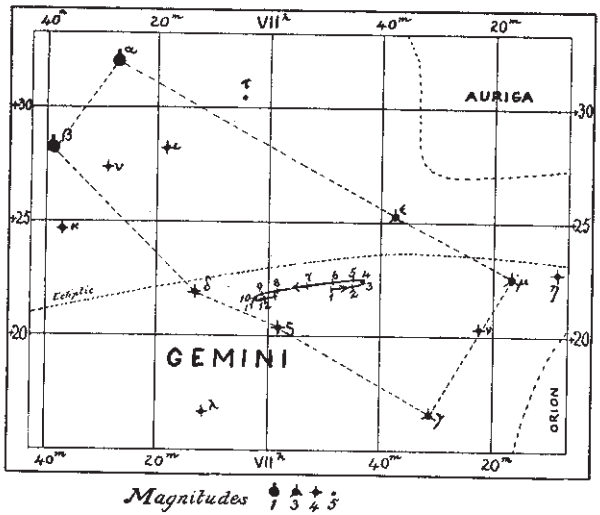
Path of Uranus among the Stars in 1907.

NEPTUNE

The planet Neptune is the most distant member of the solar system, being 2,800 millions of miles from the Sun, and requiring 165 years to complete a revolution. In 1907 it will be in the constellation Gemini, and the accompanying diagram shows its path during the year. It appears as a star of the eighth magnitude and so cannot be seen with the naked eye.

It will be in opposition January 2, in conjunction July 5, and in quadrature on March 31 and October 9. Its single satellite can be seen only in large instruments.

The accompanying diagram exhibits the path of Neptune in 1907.



Path of Neptune among the Stars in 1907.

MERIDIAN PASSAGE AND DECLINATION OF FIVE PLANETS ON THE 1st AND 15th OF EACH MONTH

The times are local mean time (approximately); the variation of this from the Standard time for any place must be allowed for. Hours number from midnight. The declination is that at Greenwich mean noon on the days named.

1907	Mercury ☿		Venus ♀		Mars ♂		Jupiter ♃		Saturn ♄	
	Mer. Pass.	Decl.	Mer. Pass.	Decl.	Mer. Pass.	Decl.	Mer. Pass.	Decl.	Mer. Pass.	Decl.
	h. m.	° ′	h. m.	° ′	h. m.	° ′	h. m.	° ′	h. m.	° ′
Jan. 1	10 45	S. 22 50	9 23	S. 16 21	7 48	S. 13 33	21 45	N. 23 15	16 10	S. 9 25
" 15	11 22	24 2	9 3	17 28	7 26	16 9	22 38	23 21	15 20	8 56
Feb. 1	12 13	19 35	8 57	19 23	7 0	18 49	21 24	23 25	14 19	8 14
" 15	12 55	10 35	9 1	20 7	6 38	20 35	20 25	23 28	13 30	7 36
March 1	13 17	N. 0 31	9 10	19 24	6 17	21 56	19 30	23 29	12 41	6 57
" 15	12 22	2 55	9 20	17 0	5 55	22 52	18 37	23 31	11 53	6 17
April 1	10 43	S. 4 17	9 32	12 2	5 25	23 32	17 36	23 31	10 53	5 30
" 15	10 22	3 19	9 39	6 37	4 58	23 47	16 49	23 30	10 4	4 53
May 1	10 37	N. 4 35	9 47	N. 0 24	4 22	23 58	15 57	23 24	9 8	4 16
" 15	11 17	14 45	9 54	6 42	3 44	24 14	15 13	23 16	8 17	3 48
June 1	12 40	24 38	10 5	13 50	2 49	24 58	14 20	23 1	7 15	3 22
" 15	13 37	24 29	10 17	18 37	1 52	26 3	13 38	22 43	6 23	3 9
July 1	13 49	18 56	10 35	22 13	0 35	27 33	12 50	22 17	5 21	3 2
" 15	13 2	14 57	10 54	23 14	23 17	28 34	12 8	21 50	4 26	3 5
Aug. 1	11 16	16 40	11 17	21 31	21 55	28 53	11 17	21 11	3 18	3 18
" 15	10 50	18 56	11 33	17 51	21 0	28 33	10 35	20 36	2 20	3 37
Sept. 1	11 43	12 17	11 49	11 14	20 8	27 40	9 43	19 52	1 10	4 5
" 15	12 24	1 32	11 58	4 37	19 36	26 34	8 59	19 15	0 11	4 32
Oct. 1	12 54	S. 10 13	12 8	S. 3 27	19 6	24 47	8 8	18 36	22 59	5 1
" 15	13 12	18 15	12 18	10 20	18 44	22 41	7 21	18 5	22 1	5 23
Nov. 1	13 7	22 46	12 33	17 36	18 20	19 27	6 21	17 37	20 51	5 42
" 15	11 34	7 8	12 50	21 58	18 1	16 15	5 30	17 22	19 54	5 49
Dec. 1	10 28	14 54	13 14	24 25	17 39	12 6	4 29	17 19	18 51	5 47
" 15	10 46	20 32	13 35	23 59	17 20	8 10	3 32	17 28	17 57	5 37

THE STUDY OF VARIABLE STARS

By *J. Miller Barr.*

No department of Astronomy is more attractive than that which deals with the wonderful phenomena of stellar variation. It may, further, be claimed for this study that it is peculiarly adapted to the needs of amateurs, since a great number of known variables (including all the brighter and more interesting objects) can be well observed with small instruments. Indeed, an ordinary field-glass will suffice, not merely for the study of many known variables, but for the discovery of new ones. It is hoped that the present imperfect review of this subject will not be devoid of interest to amateur observers.

EARLY OBSERVATIONS

The earliest known observations on the brightness of the stars are those recorded in Ptolemy's *Almagest.** There is some uncertainty as to the origin of Ptolemy's star-magnitudes; but they are probably due to Hipparchus, whose catalogue of stars (the first on record) was prepared more than 2,000 years ago. Of greater value are the careful estimates of stellar magnitude made by the Persian astronomer Al-Sufi, about the middle of the tenth century.† Our present knowledge regarding the "secular variation" of certain stars‡ is based largely upon a comparison of Ptolemy's and Al-Sufi's magnitudes with those determined by modern astronomers.

Thus the well-known star β Leonis (whose present magnitude is about 2.2) was rated as of the *first* magnitude

*The *Almagest* was written in the second century of our era.

†Al-Sufi's "Description of the Fixed Stars" has become known to us chiefly through Schjellerup's translation, published in 1875.

‡Much valuable information on this subject will be found in Mr. Gore's papers on "Changes in the Stellar Heavens" (*Observatory*, Oct. 1900 to Jan. 1901, also Jan. 1902), and "The Secular Variation of Starlight" (*Ibid*, Nov. 1903).

by Ptolemy, Al-Sufi and Tycho Brahe (16th century). A case yet more remarkable is that of θ Eridani, which Al-Sufi placed in the first rank, though it is now of the third magnitude only. Among the stars which "have probably increased in brightness since Al-Sufi's time" are α Ophiuchi, β Eridani, and δ Sagittæ.

NEW STARS

Although the so-called "new" or temporary stars differ much from ordinary variables, they are properly classed with the latter, and are hence included in our more extensive lists of these objects. The outbursts of such bodies, as recorded in ancient times, represent, therefore, the beginnings of that branch of Astronomy with which we are concerned.

The following list includes all known objects of this class. For stars revealed by photography* the constellation name is printed in italics; the date in each case being that of discovery.

134 B.C.....Scorpio.	1860.....Scorpio.
123 A.D....Ophiuchus.	1866.....Corona.
173.....Centaurus.	1876.....Cygnus.
386.....Sagittarius.	1885.....Andromeda.
389.....Aquila.	1890.....*Perseus.*
393.....Scorpio.	1892.....Auriga.
827.....Scorpio.	1893.....*Norma.*
1012.....Aries.	1895.....*Carina.*
1203.....Scorpio.	1895.....*Centaurus.*
1230.....Ophiuchus.	1899.....*Sagittarius.*
1572.....Cassiopeia.	1900.....*Aquila.*
1604.....Ophiuchus.	1901.....Perseus.
1670.....Vulpecula.	1903.....*Gemini.*
1848.....Ophiuchus.	1905..... *Aquila.*

Three celebrated objects are included in this list, viz., the "star of Hipparchus" (134 B.C.), Tycho Brahe's star (1572), and Kepler's Nova of 1604.

*With one exception, these stars were discovered by Mrs. Fleming, at Harvard. The exception is *Nova Geminorum*, discovered by Prof. Turner at Oxford in 1903.

In the famous "Pilgrim Star" of 1572 we have the most striking instance of stellar variation on record. In November, 1572, this star rivalled Venus in brightness, and was distinctly visible in the daytime. It remained in view for about sixteen months, its color changing from white through yellow and red to a bluish tint. The great star of 1604 equalled Jupiter in brilliancy, and faded to invisibility in 14 or 15 months.

The story of *Nova Persei*, 1901—the great new star of the 20th century—is doubtless familiar to many of my readers. At the time of its discovery by Dr. Anderson of Edinburgh (Feb. 22, 1901), this star was between the second and third magnitude. On the evening of Feb. 23 it was brighter than Capella, but soon faded, becoming invisible to the naked eye in the course of a few months. The changes in its spectrum were most interesting, and a similar remark will apply to the *periodical* fluctuations observed in its light. It will suffice to add here that the study of this star, and of the wonderful nebula which surrounded it, has afforded much light on the complex problems presented by the Novæ.

VARIABLES OF LONG PERIOD

The typical star of this class is the famous variable o Ceti (Mira), whose fluctuations were first noticed by Fabricius in 1596. In the 17th century these light-changes were carefully watched by several observers, and their *periodicity* was fully established. Boulliaud, in 1667, found the star's period to be 334 days. This is a fair approximation to the *mean* period, as given in recent catalogues, viz., 331.69 days.

Like other stars of its class, Mira Ceti varies through a wide range—the *maxima* being more sharply defined than the *minima*. At maximum brightness it reaches the third, and sometimes the second, magnitude; descending to 9.5 mag. at minimum. Its usual color is a rich orange-yellow, becoming paler near maximum; the spectrum showing dark bands and bright lines, such as are found in many objects of this class. This spectrum (as

photographed at the Lick Observatory) has been carefully studied by Prof. Campbell.* Spectrograms taken at considerable intervals reveal striking changes, which (apart from other evidence) point clearly to the physical nature of the star's light-variation. The "underlying cause" is still unknown.

The variables of long period form a numerous and important class. Many red stars, with banded spectra, are found among them; a notable instance being the "crimson" variable R Leporis. Their light-changes are always more or less irregular; the rise to maximum being usually more rapid than the fall to minimum. In some cases the deviations from regularity are very conspicuous: the well-known variable R Coronæ (discovered by Pigott in 1795) is an example of this kind.

A far more striking instance of irregularity is afforded by the wonderful southern variable η Argûs.† This star has been happily described as a "connecting link" between the "new" stars and ordinary variables. Its fluctuations were first noticed by the traveller Burchell in 1827. Although now invisible to the naked eye, it outshone Rigel in 1837-38, and was nearly or quite equal to Sirius in April, 1843. It is located in the great Argo nebula, in one of the richest regions of the sky.

VARIABLES OF SHORT PERIOD

The discovery of *rapidly-recurring* changes in stellar lustre was one of the notable achievements of the 18th century. Goodricke, in 1783, found that the fluctuations in the light of Algol were thus periodic;‡ and he pointed out that these changes were such as would result from the intervention of a dark body revolving about the star.

Astrophysical Journal, Jan. 1899, p. 31.

†Otherwise known as η Carinæ.

‡Montanari in 1669 discovered the light-changes of Algol, but failed to recognize their *periodicity*. The Arabic name Al-gol (the Spirit or Demon) suggests that these changes had been detected at a much earlier period.

The period of Algol, as given by Goodricke (viz., 2 d. 20 h. 48 m.), differs from the true value by less than one minute.

To the same observer we owe the discovery, in 1784, of the light-changes of β Lyræ and δ Cephei—the chief representatives of two diverse types. Both stars are regularly variable; the former in a period of about 12 d. 21 h. 59 m., the latter in 5 d. 8 h. 48 m. The light-curve of β Lyræ is nearly symmetrical. It exhibits two unequal minima, such as would result from the mutual eclipses of two suns, unequal in size and brightness, and revolving nearly in contact with one another.* The light-curve of δ Cephei resembles those of some long-period variables—the *increase* of light being more rapid than the *decrease*. Variation of this kind can only be attributed to physical changes—depending in some way upon the action of a close revolving satellite. A similar remark may apply to the Antalgol or "cluster" variables, which remain at or near minimum brightness for a large part of each period. The star 14.1904 Cygni (discovered by Blajko in 1904) is a highly interesting example of this type: the interval between successive maxima being only about 3 h. 14 m.

Stars of the Algol and β Lyræ types have been conveniently designated as "eclipse-variables." Many interesting objects of this class have been brought to light in recent years. Among them is W Ursæ Majoris—noted for its short period of 4 h. 0.2 m.; and the Algol stars RW Tauri and 78.1906 Sagittarii. The last-mentioned star (whose period is 2.08 d.) has a light-range of more than seven magnitudes !

With few exceptions, the eclipse-variables are white stars of Secchi's first type; while those of the δ Cephei class are yellow stars with second-type spectra. As regards distribution, the eclipse-stars are met with in all parts of the sky. On the other hand, stars of the δ Cephei class are (like the temporary stars) found chiefly in the Galaxy and its immediate vicinity.

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*Cf. Myers, "The System of β Lyræ," *Astrophysical Journal*, 1898, p. 1.

Sir Wm. Herschel was the first to determine with accuracy the relative brightness of the stars.* The "method of Argelander," now so familiar to astronomers, is in fact but a modification of Herschel's original plan—the chief difference being in the system of notation.

Argelander's method may be thus described:—Let v denote a known or suspected variable, a an adjacent "comparison-star." The comparison is effected by glancing back and forth, from one star to the other, several times. If they are judged to be equal, the observation is recorded as

$$av \text{ or } va,$$

either form denoting equality. If one of the stars appears very slightly—just perceptibly—brighter than the other, the interval may be called *one step* or *grade*, and the observation is written

$$a1v \text{ or } v1a,$$

according as a or v is the brighter. If one star appears very slightly, but quite distinctly, brighter than the other, the interval may be called *two grades* (or steps), and the observation is recorded

$$a2v \text{ or } v2a,$$

the brighter star being named first. Successively increasing intervals are designated as *three grades*, *four grades*, etc., and are similarly recorded.

It is necessary to point out that fluctuations, more or less evident, in the relative light of a and v will occur, owing to atmospheric waves or inequalities. If, however, the stars are fairly close together (say less than 1° apart), these changes will, under good conditions, be scarcely perceptible. In any case the stars should be compared repeatedly—not less than ten or twelve times—the mean or general result of the observations being then recorded, in the manner already described.

*Herschel's observations of the Flamsteed stars have been reduced and published at Harvard Observatory (H.C.O. *Annals*, Vols. XIV. and XXIII.)

The "step" or "grade" is of course an arbitrary quantity, but with practice one may acquire a fairly uniform scale. In general, this scale will vary for different observers, and also, with the same observer, for bright or faint stars. The value of a grade may, in any given case, be found from a comparison of the observations with the photometric magnitudes of the stars observed. Various methods of reduction are available, of which the details cannot with advantage be given here.*

Much will depend upon the choice of suitable comparison-stars. In general, several stars should be used, some a little brighter, some a little fainter, than the variable. Light-intervals not exceeding four grades may be estimated with considerable precision, and for such intervals fractions of a grade should be recorded. The accuracy of the comparisons diminishes rapidly with increasing light intervals, and also with increasing angular separation of the stars compared. If the latter are unlike in color, this will also tend to diminish the precision of the observations.

As regards instruments, a three-inch refractor will suffice for the observation of stars as faint as magnitude $9\frac{1}{2}$; a six-inch for stars down to the 11th mag. The brighter variables, such as Algol, Betelgeuse, etc., are best observed with the naked eye. For fainter stars—say from mag. 4 to mag. 7 or $7\frac{1}{2}$—an opera or field-glass will give better results than a telescope.

The following hints are based upon the writer's experience with an ordinary binocular:—Each star-image in turn, is brought *quickly* to the centre of the field, and held steadily for about 5 to 10 seconds, during which time it is viewed with close attention. Special care should be taken to observe each star (of the pair under comparison) in the *same manner: e.g.*, if the eyes are directed a little to one side of star *a* (which is often advantageous, especially

* For further information the reader may consult Mr. Yendell's valuable papers "On the Observation of Variable Stars," (*Popular Astronomy*, Oct., 1905, Nov. and Dec., 1906). The second and third of these papers give full details concerning the reduction and discussion of observations.

with faint stars), they should be *similarly directed* with reference to star *b*. Attention to these details will add much to the value of the observations.

Many observers have been troubled with a subjective source of error, depending upon the relative position of the stars compared. If the comparison-stars are well distributed, such errors will be nearly eliminated from the final result. But suitable comparison-stars are not always to be found, especially for variables having a small light-range. Much better results might be secured with the aid of a specially-constructed binocular, fitted with two double eyepieces—one giving an *erect*, the other an *inverted*, image. These eyepieces (with the help of suitable devices) would be used alternately: the mean result of the observations would then be free from systematic error. Other special devices are available for the same purpose, and also for the comparison of stars differing widely in brightness. It is hoped that the new methods here referred to will form the subject of a future communication to the Royal Astronomical Society of Canada.

Photometric work on the stars has hitherto been left in the hands of professional astronomers. But I should like to emphasize the fact that a small telescope, fitted with a good photometer, would serve for the *accurate* observation of all stars within effective range of the instrument. The "photographic method" is also available for many amateurs. Its capabilities are shown by recent discoveries in this field, as described below.

PHOTOGRAPHIC METHODS

During recent years the progress in this branch of Astronomy has been most rapid and striking. The application of photography—more especially at Harvard—has led to the wholesale discovery of new variables. These are, with few exceptions, faint telescopic stars. They are especially numerous in the great nebulous regions of Scorpio, Ophiuchus, and Orion, and in the Small Magellanic Cloud. The latter is the richest region in the heavens hitherto examined; about 1,000 variables having been found within its boundaries. More than 500 of these objects have been

found by Prof. Bailey in some of the globular star-clusters. The great cluster ω Centauri—the finest in the heavens—alone contains 128 variables.

These discoveries (which bring the number of known variables up to more than 3,000) have suggested an ambitious plan for a "Durchmusterung of variable stars."* This would include all variables down to the sixteenth magnitude (maximum brightness). The scheme, if carried into effect, will involve the co-operation of many astronomers, and the scrutiny of some fifty million star-images on photographic plates taken for the purpose.

Results of equal importance have been secured in the field of spectrum-photography. The orbital motion of Algol was demonstrated in 1888 by the periodic oscillation of dark lines in its spectrum—as photographed at Potsdam. This spectrographic method has since been applied to β Lyræ, δ Cephei, and other short-period variables of various types. In each case, the variable has proved to be a close binary system in rapid motion.†

ORIGIN OF BINARY STARS

The discoveries just cited bring us into touch with one of the most interesting problems of modern Astronomy—that of the genesis of stellar systems. The theory of tidal evolution, as propounded by Darwin and extended by See, affords a satisfactory solution of the problem.‡ According to that theory, the components of each revolving pair were formerly united; their separation having been brought about by the rapid rotation of the original mass, due to its gradual condensation. Owing to tidal friction, the bodies thus formed by disruption of the parent mass would, in course of time, become more and more widely separated. Thus the closer spectroscopic binaries, such as β Lyræ or

H. C. O. Circular, No. 116; *Popular Astronomy*, Oct. 1906.

†A similar remark will apply to certain irregular variables—e.g., *u* Herculis.

‡See Darwin's masterly address on "Cosmical Evolution," delivered before the British Association at the meeting in South Africa, 1905 (*Observatory*, Sept., Oct. and Nov., 1905).

Algol, represent early stages in the evolutionary process; while the visual pairs (whose periods range from a few years to several centuries) exemplify much later stages in the same process. An important confirmation of this theory is afforded by recent researches on the period and light-curve of β Lyræ.*

CATALOGUES OF VARIABLE STARS

Schönfeld's first catalogue of variable stars—prepared in 1865—included 113 objects. This was revised and extended in 1875, the second list containing 143 variables. Chandler's first catalogue of 225 variables appeared in 1888. It was followed a few months later by the publication at Harvard of an "Index to Observations of Variable Stars" (H.C.O. *Annals*, vol. XVIII., No. viii.). This work contained "a catalogue of 225 variable stars, and references to 125,720 observations of them, made during the years 1838 to 1888." Chandler's second and third catalogues of these objects appeared in 1893 and 1896 repectively. The later list contains descriptions of 393 stars.

A well-known amateur astronomer, Mr. J. E. Gore, has given special attention to the unconfirmed or suspected objects of this nature. Such cases were brought together, in 1885, in his "Catalogue of Suspected Variable Stars."

Within the past few years, two notable additions to the literature of this subject have appeared, viz., the Harvard "Provisional Catalogue of Variable Stars," and Father Hagen's *Atlas Stellarum Variabilium*. The last-mentioned work is a *magnum opus*, of great value to all students of the subject.

Passing over the catalogues and ephemerides of variables which appear annually in different countries, I may refer to two very important works which have been in course of preparation for years, and will soon appear—one in Europe, the other in America. The American

*"Note on the Increasing Period of β Lyræ," by Dr. Alex. W. Roberts (*Observatory*, Feb. 1906, p. 98). See also the *Observatory* for Nov. 1905, p. 407. The period of β Lyræ, as given in the present paper, corresponds to the epoch 1900.0.

work, under the title "A Bibliography of Variable Stars," will appear as a volume of the Harvard *Annals*. It will contain references to more than three thousand objects, with ample details, such as will render it invaluable to all astronomers. The European catalogue, it is understood, will be equally comprehensive. It is being prepared by a committee of the Astronomische Gesellschaft, consisting of four eminent astronomers—Dunér, Hartwig, Müller and Oudemans.

CLASSIFICATION

Several attempts have been made to classify the variable stars; but a scientific system of classification, in harmony with the chief deductions of theory, as well as the facts of observation, is still wanting. The best-known system is that formulated by Prof. E. C. Pickering in 1880, and reproduced (with slight additions) in his "Provisional Catalogue of Variable Stars" (1903). This includes five classes, two of which are subdivided, as follows:—

		EXAMPLES
I. New or temporary stars		Nova, 1572
II. Variables of long period;		
a. Ordinary stars of this class	*o*	Ceti.
b. Stars subject to "occasional sudden and irregular outbursts of light which gradually diminishes"	U	Geminorum.
III. "Variables of small range or irregular variation, according to laws as yet unknown"	*a*	Orionis.
IV. Variables of short period;		
a. "Ordinary" cases	*δ*	Cephei.
b. Stars with "minima successively bright and faint"	*β*	Lyræ.
V. Stars of the Algol type	*β*	Persei.

The leading star of each class is here mentioned. Some of the recently-discovered Algol stars exhibit *secondary minima*: such stars should evidently form a sub-division of Class V. Class IV. should be further sub-divided: one new division would include the Antalgol or "cluster" variables, another would contain those stars for which the *decrease* in light is more rapid than the *increase*. The inclusion of *all* variables of small range in Class III. is clearly illogical.

A SHORT LIST OF VARIABLE STARS

I give below a list of the more interesting variables—such as can be studied with advantage by amateur observers. The periods and other data are derived chiefly from the Harvard "Provisional Catalogue," already cited. This work, which gives the positions and elements of 1227 stars, should be in the hands of every amateur

Most of the stars in this list may be identified with the aid of a good Star-Atlas. The times of maximum and minimum brightness, for a majority of these stars, may be found from the monthly ephemerides in *Popular Astronomy*, or from the similar tables in the annual "Companion to the *Observatory*."

Name	Limiting Mags.	Period			Class	Discoverer	
		d.	h.	m.			
U Cephei	7.0– 9.2	2	11	49.6	V.	W. Ceraski	1880
o Ceti	1.7– 9.5	331.7			II.	Fabricius	1596
ρ Persei	3.4– 4.2	Irr.			III.	Schmidt	1854
6.1904 Cephei	8.6– 9.1	32.3			V.	Blajko	1904
β Persei (Algol)	2.1– 3.2	2	20	48.9	V.	Montanari	1669
λ Tauri	3.3– 4.2	3	22	52.2	V.	Baxendell	1848
W Eridani	8.1–<12.5	369			II.	Fleming	1898
RW Tauri	8–11	2	18	27.2	V.	Fleming	1905
R Leporis	6–8 ?	436.1			II.	Schmidt	1855
α Orionis	1– 1.4	Irr.			III.	J. Herschel	1840
U Orionis	5.8–12.3	375			II.	Gore	1885
η Geminorum	3.2– 4.2	231.4			III.	Schmidt	1865
T Monocerotis	5.7– 6.8	27.0			IV.	Gould	1871
ζ Geminorum	3.8– 4.3	10	3	41.5	IV.	Schmidt	1847
R Geminorum	6.6–13.3	370.2			II.	Hind	1848
R Canis Maj	5.7– 6.3	1	3	15.8	V.	Sawyer	1887
S Cancri	8.0–10.2	9	11	37.8	V.	Hind	1848
S Antliæ	6.3– 6.8	0	7	46.8	IV.	Paul	1888
W Ursæ Maj	7.9– 8.6	0	4	0.2	V.?	Müller & Kempf	1903
R Leonis	4.6–10.5	312.8			II.	Koch	1782
R Hydræ	3.5– 9.7	425.1			II.	Montanari	1670
δ Libræ	5.0– 6.2	2	7	51.4	V.	Schmidt	1859
α Herculis	3.1– 3.9	Irr.			III.	W. Herschel	1795
U Ophiuchi	6.0– 6.7	0	20	7.7	V.	Gould	1871
X Sagittarii	4.4– 5.4	7	0	17.1	IV.	Schmidt	1866
R Scuti	4.8– 7.8	Irr.			III.	Pigott	1795
β Lyræ	3.4– 4.1	12	21	59.2	IV.	Goodricke	1784
χ Cygni	4.5–13.5	406.0			II.	Kirch	1686
η Aquilæ	3.7– 4.5	7	4	14.0	IV.	Pigott	1784
S Sagittæ	5.5– 6.1	8	9	11.8	IV.	Gore	1885
14.1904 Cygni	10.7–11.6	0	3	14.2	IV.	Ceraski	1904
Y Cygni	7.1– 7.9	1	11	57.5	V.	Chandler	1886
δ Cephei	3.7– 4.6	5	8	47.7	IV.	Goodricke	1784
U Pegasi	9.3– 9.9	0	8	59.7	IV.	Chandler	1894

St. Catharines, Ontario, Oct. 31, 1906.

Even with telescopes of small aperture it is possible to resolve a comparatively large number of double stars, and hence this kind of observation has much interest for the amateur. It permits one, also, to determine the optical value of the instrument he employs, as the power to separate the images is directly proportional to the diameter of the objective.

The usual test of excellence is that an objective of one-inch diameter should be able to separate star images at a distance of 4″.56 between their centres. This power should vary according to the following table:—

		″
An objective of diam.	2 in. should separate stars distant	2.28
An objective of diam.	3 in. should separate stars distant	1.52
An objective of diam.	4 in. should separate stars distant	1.14
An objective of diam.	5 in. should separate stars distant	0.91
An objective of diam.	6 in. should separate stars distant	0.76
An objective of diam.	10 in. should separate stars distant	0.45
An objective of diam.	20 in. should separate stars distant	0.23
An objective of diam.	40 in. should separate stars distant	0.114

and so on.

In choosing a double-star for testing a telescope care should be taken that a binary, with varying distance between the components, be not selected.

THE MOST BEAUTIFUL DOUBLE STARS FOR TELESCOPES OF ORDINARY POWER

I. THE MOST LUMINOUS PAIRS

"Diamonds"

Star	Mags.	Dist. ″	Star	Mags.	Dist. ″
Mizar....	2.4, 4.0	14.5	γ Leonis....	2.5, 4.0	3.0
Castor...	2.5, 3.0	5.6	β Scorpii...	2.5, 5.5	13.0
γ Virginis .	3.0, 3.2	5.0	θ Serpentis.	4.4, 6.0	21.0
γ Arietis...	4.2, 4.5	8.9	44i Boötis....	5.0, 6.0	4.8
ζ Aquarii..	3.5, 4.4	3.5	π Boötis....	4.3, 6.0	6.0

II. THE FINEST COLORED PAIRS

"Rubies, Garnets, Sapphires, Topazes, Emeralds"

Star	Magnitudes	Distance ″	Colors
γ Andromedæ	2.2, 5.5	10	Orange, Green.
α Canum Venat.	3.2, 5.7	20	Golden, Lilac.
β Cygni	3.3, 5.5	34	Golden, Sapphire.
ε Boötis	2.4, 6.5	2.9	Golden, Sapphire.
95 Herculis	5.5, 5.8	6	Golden, Azure.
α Herculis	4, 5.5	4.7	Ruby, Emerald.
γ Delphini	3.4, 5	11	Golden, Bluish Green.
32 Eridani	4.7, 7	6.7	Topaz, Bright Green.
ε Hydræ	3.5, 7.5	3.5	Yellow, Blue.
ζ Lyræ	4.5, 5.5	44	Yellow, Green.
ι Cancri	4.5, 5	30	Pale Orange, Blue.
ο Cygni	4.3, 7.5, 5.5	337.8, 106.8	Yellow, Blue.
24 Coma Beren.	5.6, 7	21	Orange, Lilac.
ο Cephei	5.4, 8	2.5	Golden, Azure.
94 Aquarii	5.5, 7.5	11	Rose, Greenish.
39 Ophiuchi	5.7, 7.5	12	Yellow, Blue.
41 Aquarii	5.8, 8.5	4.8	Yellow Topaz, Blue.
2 Canum Venat	6, 9	11	Golden, Azure.
52 Cygni	4.6, 9	7	Orange, Blue.
55 Piscium	6, 9	6	Orange, Blue.
κ Geminorum	3.8, 9	9	Orange, Blue.
ρ Orionis	5.1, 9	6.8	Orange, Blue.
54 Hydræ	5.2, 8	9	Yellow, Violet.
η Persei	4.2, 8.5	28	Yellow, Blue.
φ Draconis	4.8, 6	31	Yellow, Lilac.
ο Draconis	4.7, 8.5	32	Golden, Lilac.
η Cassiopeiæ	4.7, 7	5.7	Golden, Purple.
23 Orionis	5.4, 7	32	White, Blue.
δ Herculis	3.6, 8	18	White, Violet.
ο Capricorni	6.3, 7	22	Bluish.
17 Virginis	6.5, 7	20	Rose.
ξ Boötis	4.5, 6.5	4.2	Reddish Yellow.

The colors given above are according to Flammarion. For slight variations and also for a much longer list consult Webb's "Celestial Objects."

MEAN PLACES OF FIXED STARS, JANUARY 1, 1907

	Name of Star	Mag.	Right Ascension			Declination		
			h.	m.	s.	°	′	″
β	Cassiopeiæ	2.4	0	4	12.6	+58	38	12.7
α	Cassiopeiæ (var.)	2.3	0	35	13.4	+56	1	38.7
γ	Cassiopeiæ	2.3	0	51	5.3	+60	12	47.8
β	Andromedæ	2.2	1	4	31.3	+35	7	39.5
α	Ursae Min. (Polaris)	2.2	1	25	34.8	+88	48	37.6
α	Eridani (Achernar)	0.4	1	34	15.1	−57	42	32.9
α	Arietis	2.1	2	1	55.7	+23	1	22.8
β	Persei (Algol) (var.)	2.3	3	2	6.8	+40	35	52.2
α	Persei	1.9	3	17	40.7	+49	31	50.6
α	Tauri (Aldebaran)	1.0	4	30	35.0	+16	19	22.2
α	Aurigæ (Capella)	0.1	5	9	49.0	+45	54	14.7
β	Orionis (Rigel)	0.3	5	10	4.1	− 8	18	31.0
β	Tauri	1.8	5	20	24.7	+28	31	46.1
ϵ	Orionis	1.8	5	31	29.6	− 1	15	38.9
α	Orionis (var.)	0.9	5	50	8.2	+ 7	23	24.8
β	Aurigæ	2.0	5	52	42.4	+44	56	19.2
α	Argus (Canopus)	−0.8	6	21	53.2	−52	38	40.9
γ	Geminorum	2.0	6	32	20.4	+16	28	45.0
α	Can. Maj. (Sirius)	−1.4	6	41	3.0	−16	35	17.4
ϵ	Canis Majoris	1.5	6	54	58.2	−28	50	42.3
α^2	Geminorum (Castor)	1.9	7	28	40.1	+32	5	35.8
α	Can. Min. (Procyon)	0.5	7	34	26.0	+ 5	27	49.2
β	Geminorum (Pollux)	1.2	7	39	37.6	+28	15	4.8
β	Argus	2.0	9	12	11.0	−69	20	2.7
α	Hydræ	2.1	9	23	1.1	− 8	15	18.4
α	Leonis (Regulus)	1.3	10	3	25.2	+12	25	19.2
α	Ursæ Majoris	2.0	10	57	59.8	+62	15	11.6
β	Leonis	2.2	11	44	19.0	+15	5	31.1
γ	Ursæ Majoris	2.4	11	48	56.6	+54	12	42.7
α^1	Crucis	0.9	12	21	25.1	−62	35	1.5
α	Virginis (Spica)	1.1	13	20	17.5	−10	40	33.7
η	Ursæ Majoris	1.9	13	43	52.7	+49	46	37.9
β	Centauri	0.7	13	57	15.2	−59	55	28.6
α	Boötis (Arcturus)	0.2	14	11	25.1	+19	39	58.7
α^2	Centauri	0.2	14	33	16.5	−60	27	6.9
α	Corona Borealis	2.3	15	30	45.0	+27	1	38.2
α	Scorpii (Antares)	1.2	16	23	42.2	−26	13	33.9
α	Ophiuchi	2.2	17	30	37.0	+12	37	37.9
α	Lyræ (Vega)	0.2	18	33	47.4	+38	41	48.2
α	Sagittarii	2.3	18	49	29.9	−26	24	46.1
α	Aquilæ (Altair)	0.9	19	46	14.8	+ 8	37	20.0
γ	Cygni	2.3	20	18	53.4	+39	57	31.1
α	Cygni	1.4	20	38	15.7	+44	56	51.6
ϵ	Pegasi	2.4	21	39	37.1	+ 9	26	53.8
α	Pis. Austr. (Fomalhaut)	1.3	22	52	30.8	−30	6	55.2
α	Pegasi (Markab)	2.5	23	0	7.6	+14	42	17.1

DISTANCES OF THE STARS

The *annual parallax* of a star is the angle subtended at the star by a radius of the earth's orbit. It is from this quantity that the distances of the stars are calculated. For a small number of stars their distances from us have been determined with considerable accuracy, and some of these are given in the following table.

In the fifth column the distance is given in terms of the Sun's distance, and in the sixth column the distance is expressed in Light-years, i.e., the number of years required for the light from the star to travel to us. Light travels at the rate of 186,000 miles per second.

Name	Magnitude	Annual Parallax	Proper Motion	Distance	
				Times Sun's Distance	Light Years
		″	″		
α Centauri....	0.7	0.75	3.67	275,000	4
21 185 Lalande.	6.9	0.50	4.75	447,000	6.5
61 Cygni.....	5.1	0.40	5.16	550,000	8
Sirius.....	−1.4	0.39	1.31	570,000	8.3
Procyon....	0.5	0.27	1.25	825,000	12
σ Draconis....	4.7	0.25	.....	907,000	13.2
Altair.....	1.0	0.20	0.65	1,120,000	16.3
ϵ Indi.....	5.2	0.20	4.60	1,120,000	16.3
o^2 Eridani.....	4.5	0.19	4.05	1,169,000	17
β Cassiopeiæ..	2.4	0.16	0.55	1,375,000	20
Vega.....	0.2	0.16	0.36	1,375,000	20
70 Ophiuchi....	4.1	0.15	1.13	1,444,000	21
e Eridani.....	4.4	0.14	3.03	1,581,000	23
Aldebaran..	1.0	0.12	0.19	1,856,000	27
Capella.....	0.2	0.11	0.43	1,994,000	29
Regulus....	1.4	0.10	0.27	2,200,000	32
Polaris.....	2.1	0.07	0.05	3,231,000	47
85 Pegasi.....	5.8	0.054	1.29	4,125,000	60

RADIANTS OF THE CHIEF METEORIC SHOWERS, 1907

By *W. F. Denning.*

B, Bright ; R, Rapid ; S, Slow ; K, Streaks ; T, Trains.

Date	Radiant R. A.	Radiant Dec.	Meteors	Date	Radiant R. A.	Radiant Dec.	Meteors
	°	°			°	°	
Jan. 2—4	**230**	**+53**	R	July—Aug.	339	−27	ST
Jan.—Mar.	147	−12	SB	Aug. 10—12	45	+57	RK
Jan. 11	220	+13	RK	Aug. 10—Sept. 16	353	−11	ST
Jan. 17—25	143	+48	R	Aug. 5—16	290	+53	RB
Jan. 22—Feb. 1	159	+26	R	Aug. 21—25	291	+60	SB
Jan. 25	131	+32	R	Aug. 25	5	+11	S
Feb. 5—23	75	+41	SB	Aug.—Sept.	346	+ 1	ST
Feb. 15	236	+11	RK	Aug.—Oct. 2	74	+42	RK
Feb. 20	263	+36	RK	Sept. 3—8	353	+39	vR
Mar. 1—4	166	+ 4	SB	Sept. 5—15	62	+37	RK
Mar. 14	250	+54	R	September	64	+22	RK
Mar. 18	316	+76	SB	Sept. 7—27	75	+15	RK
Mar. 13—24	161	+58	R	Sept. 3—22	60	+49	RK
Mar.—May	263	+62	R	Sept. 15—Oct. 11	14	+ 7	S
April 12—24	210	−10	SB	Sept. 21	31	+19	ST
April 17—22	218	−31	ST	Sept. 29—Oct. 5	189	+73	R
April 18—23	189	−31	ST	Oct. 2	230	+52	SB
April 20—22	**271**	**+33**	RK	Oct. 4	133	+79	RK
April 30	290	+59	R	Oct. 8	77	+31	RK
April—May	193	+58	SB	Oct. 8—14	45	+58	ST
May 1—6	**338**	**− 2**	RK	Oct. 16—23	89	+ 8	RK
May 11—18	231	+27	S	Oct. 18—24	**92**	**+15**	RK
May 26—31	310	+80	ST	Oct.	100	+13	RK
May 25—June 4	280	+31	R	Oct.	133	+68	RK
May 30—Aug.	333	+27	RK	Oct. 11—Nov. 1	43	+22	SB
May—June	235	+ 9	ST	Nov. 2—3	58	+ 9	SB
May—July	252	−21	SB	Nov. 7—28	154	+41	RK
June 4—13	312	+61	RK	Nov. 14—16	**151**	**+23**	RK
June—Sept.	335	+57	R	Nov. 17—23	**25**	**+43**	ST
June—Sept.	303	+24	R	Nov. 20—28	63	+23	SB
July 6—Aug. 22	284	−13	ST	Nov. 23—Dec. 1	189	+73	R
July 15—31	23	+43	RK	Nov. 25—Dec. 12	316	+60	ST
July 6—Aug. 16	315	+48	R	Nov. 30	190	+58	RK
July—Aug.	269	+48	ST	Nov. 30—Dec. 9	162	+58	RK
July 15—28	304	−10	ST	Dec. 6	80	+23	SB
July	22	+22	RK	Dec. 8	208	+71	R
July 25—Sept. 15	48	+43	RK	Dec. 10—12	**108**	**+33**	R
July 27—31	**339**	**−11**	ST	Dec. 7—12	**119**	**+29**	R
July—Sept.	335	+73	R	Dec. 22	194	+67	RK
July—Oct. 8	30	+36	RK	Dec. 22—29	194	+33	RK
July—Oct.	310	+79	S				

EPHEMERIS OF THE PERSEID RADIANT POINT

Maximum, August 11.

Date	Radiant Point		Date	Radiant Point	
	R.A.	Dec.		R.A.	Dec.
	°	°		°	°
July 25....	24.9	+52.5	Aug. 6 ...	38.9	+56.0
26....	26.0	52.8	7....	40.2	56.2
27....	27.1	53.2	8...	41.5	56.5
28....	28.2	53.5	9....	42.9	56.7
29....	29.3	53.8	10....	44.3	56.9
30....	30.5	54.1	11....	45.7	57.1
31....	31.6	54.4	12....	47.1	57.3
Aug. 1....	32.7	54.7	13....	48.5	57.5
2....	33.9	55.0	14....	50.0	57.7
3 ...	35.1	55.3	15...	51.4	57.8
4....	36.4	55.5	16....	52.9	58.0
5....	37.6	55.7	17....	54.4	58.2

EPHEMERIS OF THE LYRID RADIANT POINT

Maximum, April 20-21.

Date	Radiant Point		Date	Radiant Point	
	R.A.	Dec.		R.A.	Dec.
	°	°		°	°
April 16....	264.8	+33	April 21....	271.0	+33
17....	266.0	33	22....	272.3	33
18 ...	267.3	33	23....	273.5	33
19....	268.5	33	24 ...	274.8	33
20....	269.8	33	25....	276.0	33

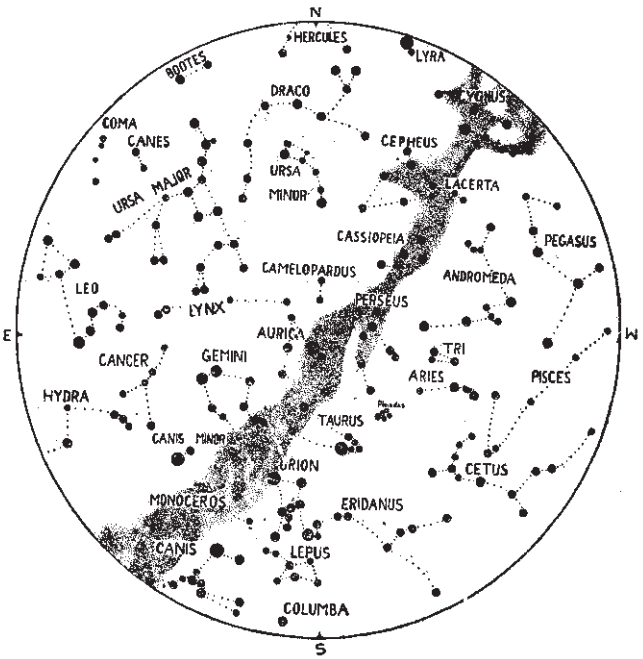
MONTHLY PREDICTIONS FOR 1907

Of the pages which follow two are devoted to each month.

On the first of these is a star map for the month, and also the times of the rising or the setting of the Planets according as they are morning or evening Stars on the 15th day of the month. These times are only approximate, being calculated for north latitude 45° with no allowance for refraction. They are given in local mean time, hours counting from midnight, and for any place the proper correction for standard time must be applied.

On the second page will be found the phases of the Moon, the planetary configurations, and the minima of Algol and eclipses of Jupiter's satellites visible in Canada. On this page 75th Meridian time is used.

THE NIGHT SKY FOR JANUARY



The heavens as they appear on

December 6, midnight; January 6, 22^h; February 5, 20^h

THE PLANETS ON JANUARY 15, 1907

	h	m	
Mercury, Morning Star, rises	7	02	Local Mean Time
Venus, Morning Star, rises	4	17	
Mars, Morning Star, rises	4	53	
Jupiter, Evening Star, sets	6	22	
Saturn, Evening Star, sets	20	44	

JANUARY

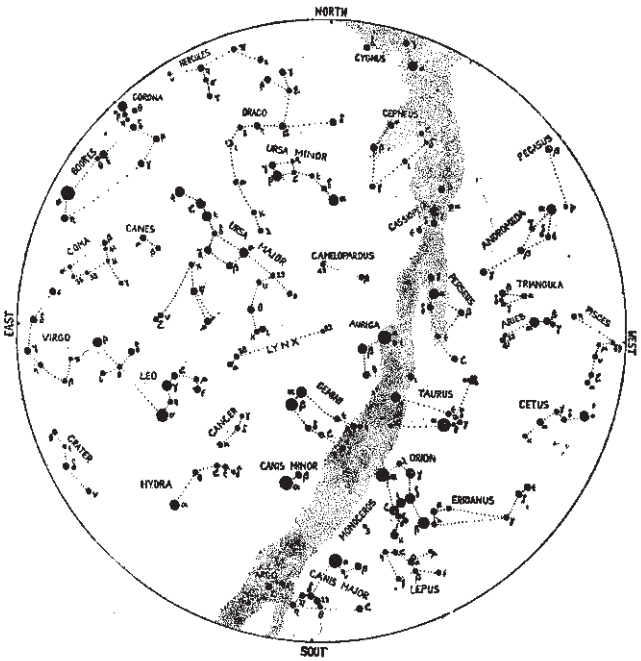
ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

Day.

1.
2. 2^h ⊕ in Perihelion; 14^h ♂ Ψ ☉.
3.
4. 4^h ☿ in ♑; 14^h ♀ greatest brilliancy; eclipse I Sat., re-ap. 1^h 49^m.
5. Eclipse I Sat., re-ap. 20^h 18^m.
6. 7^h 15^m minimum of Algol.
☾ 7. 14^h 55^m Moon's last quarter; 22^h ♀ in Perihelion.
8. Eclipse IV Sat., disap. 0^h 11^m, re-ap. 1^h 50^m.
9. 4^h 4^m minimum of Algol; 7^h 32^m ☌ ♂ ☾, ♂ 4° 22′ S.
10.
11. 0^h 12^m ☌ ♀ ☾, ♀ 0° 17′ N.; Eclipse I Sat., re-ap. 3^h 44^m; II Sat., re-ap. 20^h 38^m.
12. Eclipse I Sat., re-ap. 22^h 13^m; 0^h 52^m minimum of Algol.
13. 0^h ☌ ☿ ♁, ☿ 0° 41′ S.; 3^h 35^m ☌ ♁ ☾, ♁ 2° 23′ S.; 3^h 56^m ☌ ☿ ☾, ☿ 3° 4′ S. Total eclipse of ☉, (see page 37).
● 14. 6^h 5^m New Moon; 9^h ☿ in Aphelion; 21^h 41^m minimum of Algol.
15, 16.
17. 9^h 14^m ☌ ♭ ☾, ♭ 1° 35′ N.; 18^h 30^m minimum of Algol.
18. Eclipse II Sat., re-ap. 23^h 13^m.
19.
20. Eclipse I Sat., re-ap. 0^h 8^m.
◗ 21. 8^h 50^m Moon's first quarter; eclipse I Sat., re-ap. 18^h 37^m.
22, 23.
24. Eclipse IV Sat., disap. 18^h 10^m, re-ap. 20^h 7^m.
25. Eclipse III Sat., re-ap. 18^h 48^m.
26. 9^h 4^m ☌ ♃ ☾, ♃ 2° 37′ N.; eclipse II Sat., re-ap. 1^h 48^m; 8^h 57^m minimum of Algol.
27. 1^h 28^m ☌ Ψ ☾, Ψ 1° 5′ N.; eclipse I Sat. re-ap. 2^h 3^m.
28. Eclipse of ☾, partial (see page 37); eclipse I Sat., 20^h 32^m.
☉ 29. 13^h 53^m full Moon; 22^h ♀ greatest heliocentric lat. N.; 5^h 46^m minimum of Algol.
30, 31.

THE NIGHT SKY FOR FEBRUARY



The heavens as they appear on

January 6, midnight; February 5, 22^h; March 7, 20^h

THE PLANETS ON FEBRUARY 15, 1907

	h	m	
Mercury, Evening Star, sets	18	12	Local Mean Time
Venus, Morning Star, rises	4	27	
Mars, Morning Star, rises	2.	06	
Jupiter, Evening Star, sets	4	02	
Saturn, Evening Star, sets	19	00	

FEBRUARY

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

Day

1. Eclipse III Sat., disap. $19^h\ 51^m$; III Sat., re-ap. $22^h\ 48^m$; $2^h\ 34^m$ minimum of Algol.
2. 12^h ☌ ☿ ☉ superior; eclipse II Sat., re-ap. $4^h\ 23^m$.
3. 18^h ☿ greatest hel. lat. S.; eclipse I Sat., re-ap. $3^h\ 59^m$; $23^h\ 24^m$ minimum of Algol.
4. Eclipse I Sat., re-ap. $22^h\ 28^m$.
5.
☾ 6. $1^h\ 0^m$ Moon's last quarter; $19^h\ 48^m$ ☌ ♂ ☾, ♂ 3° 57′ S.; $20^h\ 12^m$ minimum of Algol.
7. 20^h ♃ in ♌.
8. Eclipse III Sat., disap. $23^h\ 51^m$.
9. 0^h, ♀ greatest elong. W. 46° 53′; $1^h\ 50^m$ ☌ ♀ ☾, ♀ 0° 51′ N.; $15^h\ 49^m$ ☌ ♁ ☾, ♁ 2° 15′ S.; eclipse III Sat., re-ap. $2^h\ 49^m$.

10, 11.

● 12. $17^d\ 51^m$ new Moon; eclipse I Sat., re-ap. $0^h\ 23^m$; II Sat., re-ap. $20^h\ 7^m$.

13. $3^h\ 1^m$ ☌ ☿ ☾, ☿ 1° 6′ N.; eclipse I Sat., re-ap. $18^h\ 52^m$.
14. $0^h\ 50^m$ ☌ ♭ ☾ ♭, 1° 48′ N.

15, 16.

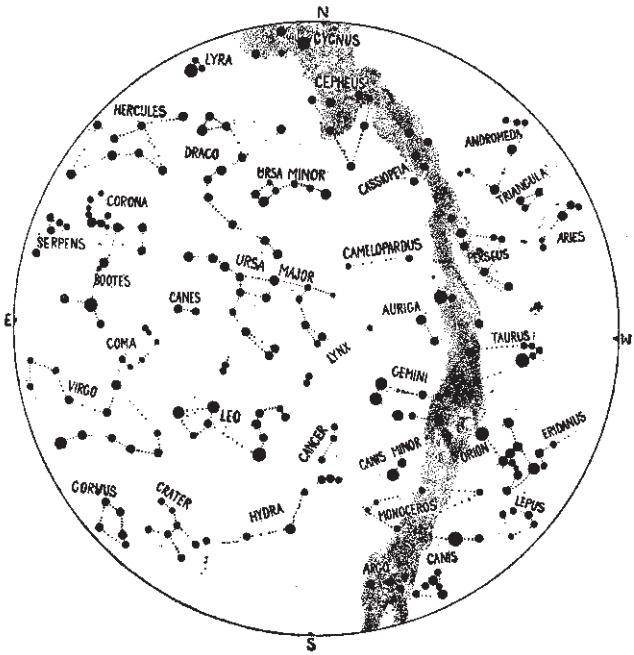
17. 18^h ☌ ♀ ♁, ♀ 3° 11^m N.
18. $7^h\ 28^m$ minimum of Algol.
19. Eclipse I Sat., re-ap. $2^h\ 19^m$; II Sat. re-ap. $22^h\ 51^m$.

◗ 20. $4^h\ 43^m$ Moon's first quarter; eclipse I Sat., re-ap. $20^h\ 47^m$.

21. 6^h ☌ ☿ ♭, ☿ 1° 40′ N.; $4^h\ 16^m$ minimum of Algol.
22. $13^h\ 36^m$ ☌ ♃ ☾, ♃ 2° 45′ N.; 19′ ☿ in ♌.
23. $7^h\ 59^m$ ☌ ♆ ☾, ♆ 1° 5′ N.
24. $1^h\ 5^m$ minimum of Algol.
25. 15^h ♃ stationary.
26. $21^h\ 54^m$ minimum of Algol.
27. $9^h\ 8^m$ ☿ in Perihelion; eclipse II Sat., re-ap. $1^h\ 26^m$; I Sat., re-ap. $22^h\ 43^m$.

☉ 28. $6^h\ 31^m$ full Moon.

THE NIGHT SKY FOR MARCH



The heavens as they appear on

February 5, midnight; March 7, 22^h; April 7, 20^h

THE PLANETS ON MARCH 15, 1907

	h	m	
Mercury, Evening Star, sets	18	34	Local Mean Time
Venus, Morning Star, rises	4	32	
Mars, Morning Star, rises	1	35	
Jupiter, Evening Star, sets	3	13	

Saturn will be in conjunction with the Sun March 9; after this a Morning Star.

MARCH

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

Day

1, 21^h, ☿ greatest elong. E., 18° 10′; 18^h 43^m minimum of Algol.

2, 3, 4, 5, 6.

☾ 7. 8^h 50^m Moon's last quarter; 5^h 26^m ☌ ♂, ☾, ♂ 3° 13′ S.; eclipse I Sat., re-ap. 0^h 39^m.

8. 5^h ☿ stationary; eclipse I Sat., re-ap. 19^h 0^m.

9. 0^h 46^m ☌ ♁, ☾, ♁ 2° 3′ S.; 8^h ☌ ♭ ☉; 16^h ☿ greatest hel. lat. N.; eclipse III Sat., re-ap. 18^h 56^m.

10. 0^h □ ♂ ☉; 13^h 41^m ☌ ♀ ☾, ♀ 1° 28′ N.

11, 12.

13. 16^h 8^m ☌ ♭ ☾, ♭ 2° N; 5^h 58^m minimum of Algol.

● 14. 6^h 13^m, new Moon; 7^h 54^m ☌ ☿ ☾, ☿ 8° 30′ N.

15. Eclipse I Sat., re-ap. 21^h 4^m.

16. Eclipse IV Sat., disap. 0^h 15^m; 2^h 47^m minimum of Algol.

17. Eclipse III Sat. disap. 19^h 53^m; II Sat., re-ap. 19^h 54^m; III Sat., re-ap. 22^h 57^m.

18. 3^h ☌ ☿ ☉ superior; 23^h 36^m minimum of Algol.

19, 20.

21. 13^h ☉ enters ♈, spring commences; 20^h Ψ stationary; 23^h 38^m ☌ ♃ ☾, ♃ 2° 32′ N.; 20^h 25^m minimum of Algol.

☽ 22. 1^h 18^m Moon's first quarter; 15^h 43^m ☌ Ψ ☾, Ψ 0° 56′ N.; eclipse I Sat., re-ap. 22^h 59^m.

23. 16^h □ ♃ ☉; eclipse II Sat., re-ap. 22^h 29^m; III Sat., disap. 23^h 53^m.

24, 25, 26.

27. 0^h ♀ in ♉.

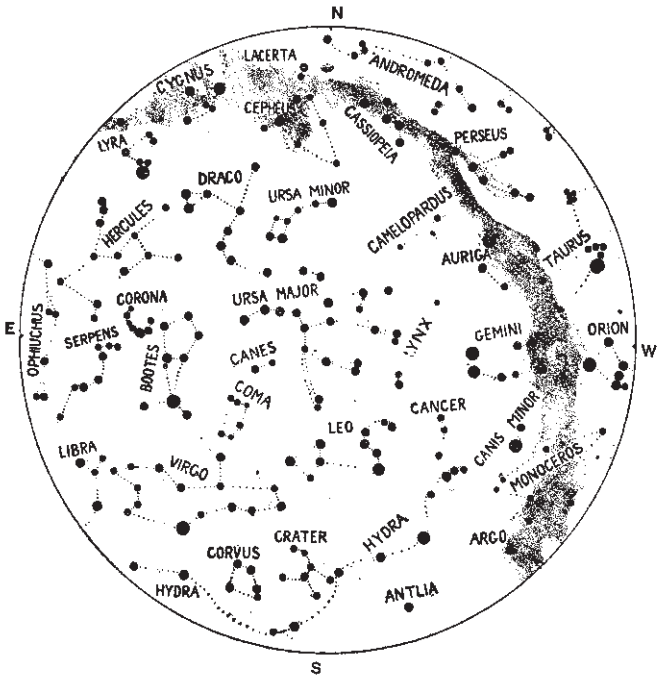
28.

○ 29. 19^h 52^m full Moon; 4^h ♂ in ♉.

30. 13^h ☿ stationary; eclipse I Sat., re-ap. 0^h 55^m.

31. 13^h □ Ψ ☉; eclipse I Sat., re-ap. 19^h 24^m.

THE NIGHT SKY FOR APRIL



The heavens as they appear on

March 7, midnight; April 7, 22^h; May 7, 20^h

THE PLANETS ON APRIL 15, 1907

	h	m	
Mercury, Morning Star, rises	4	35	Local Mean Time
Venus, Morning Star, rises	4	05	
Mars, Morning Star, rises	0	43	
Jupiter, Evening Star, sets	0	27	
Saturn, Morning Star, rises	4	23	

APRIL

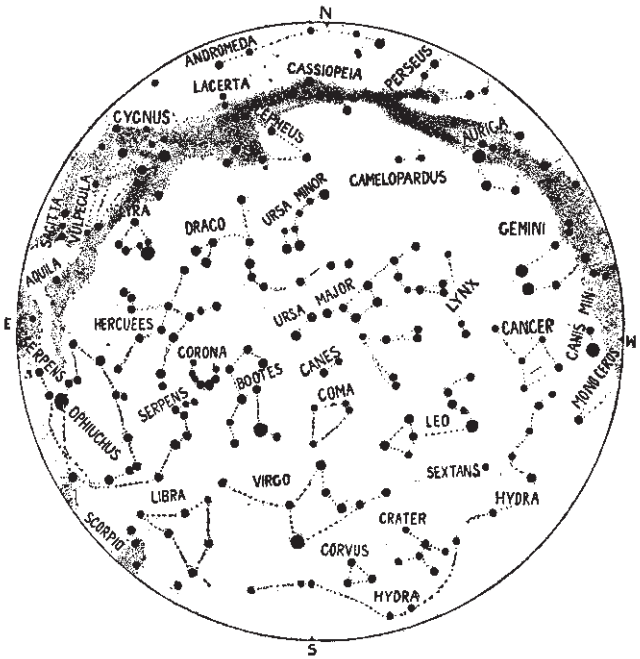
ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

Day

1. Eclipse of IV. Sat., re-ap. $21^h\ 10^m$.
2. 3^h ☿ in ♈; $7^h\ 40^m$ minimum of Algol.
3. 8^h □ ♁ ☉.
4. $11^h\ 48^m$ ☌ ♂ ☾, ♂ 2° 32′ S.
5. $15^h\ 28^m$ Moon's last quarter; $7^h\ 8^m$ ☌ ♁ ☾, ♁ 1° 47′ S.; $4^h\ 29^m$ minimum of Algol.
6.
7. Eclipse I Sat., re-ap. $21^h\ 19^m$.
8. $1^h\ 18^m$ minimum of Algol.
9. 0^h ☌ ☿ ♃, ☿ 0° 32′ N.; $6^h\ 26^m$, ☌ ♀ ☾, ♀ 2° 31′ N.
10. $5^h\ 34^m$ ☌ ♭ ☾, ♭ 2° 14′ N.; $6^h\ 53^m$ ☌ ☿ ☾, ☿ 2° 35′ N.; $22^h\ 7^m$ minimum of Algol.
11.
12. $19^h\ 14^m$ new Moon; 9^h, ☿ in Aphelion.
13. $18^h\ 56_m$ minimum of Algol.
14. 23^h, ☿ greatest elong. W. 27° 36′; eclipse I Sat., re-ap. $23^h\ 15^m$.
15, 16.
17. 18^h, ♁ stationary; eclipse II Sat., re-ap. $19^h\ 34^m$.
18. $13^h\ 57^m$ ☌ ♃ ☾, ♃ 2° 4′ N.
19. $0^h\ 8^m$ ☌ ♆ ☾, ♆ 0° 41′ N.
20. $20^h\ 46^m$ Moon's first quarter.
21. 10^h ☌ ♀ ♭, ♀ 0° 38m N.
22.
23. Eclipse I Sat., re-ap. $19^h\ 40^m$.
24. Eclipse II Sat., re-ap. $22^h\ 9^m$.
25. $6^h\ 11^m$ minimum of Algol.
26, 27.
28. $6^h\ 13^m$ full Moon; eclipse III Sat., disap. $19^h\ 54^m$, re-ap. $23^h\ 4^m$; $3^h\ 0^m$ minimum of Algol.
29.
30. 7^h ♀ in Aphelion; eclipse I Sat., re-ap. $21^h\ 35^m$; $23^h\ 48^m$ minimum of Algol.

THE NIGHT SKY FOR MAY



The heavens as they appear on

April 7, midnight; May 7, 22^h; June 1, 20^h 30^m

THE PLANETS ON MAY 15, 1907

	h	m	
Mercury, Morning Star, rises	4	16	Local Mean Time
Venus, Morning Star, rises	3	27	
Mars, Morning Star, rises	23	31	
Jupiter, Evening Star, sets	22	55	
Saturn, Morning Star, rises	3	32	

MAY

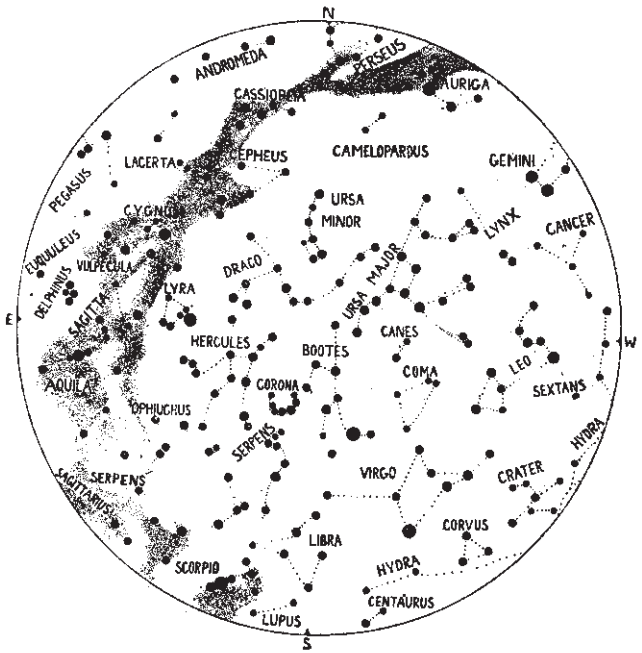
ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

Day

1. 18^h ☌ ♂, ♂ 0° 46′ S.
2. $13^h\ 7^m$ ☌ ♂ ☾, ♃ 1° 33′ S.; $13^h\ 35^m$ ☌ ♂ ☾, ♂ 2° 20′ S.; 18^h ☿ greatest heliocentric lat. S.
3. $20^h\ 38^m$ minimum of Algol.
4. ☾ $22^h\ 2^m$ Moon's last quarter.
5, 6.
7. $16^h\ 12^m$ ☌ ♄ ☾, ♄ 2° 29′ N.
8.
9. $4^h\ 2^m$ ☌ ♀ ☾, ♀ 3° 26′ N.
10. $18^h\ 31^m$ ☌ ☿ ☾, ☿ 3° 26′ N.
11.
12. ● $9^h\ 7^m$ new Moon.
13, 14.
15. $7^h\ 53^m$ minimum of Algol.
16. $6^h\ 43^m$ ☌ ♃ ☾, ♃ 1° 31′ N.; $8^h\ 35^m$ ☌ ♆ ☾, ♆ 0° 25′ N.; eclipse I Sat., re-ap. $19^h\ 54^m$.
17.
18. $4^h\ 42^m$ minimum of Algol.
19.
20. ☽ $13^h\ 36^m$ Moon's first quarter.
21. 18^h ☿ in ♌; 19^h ☌ ♃ ♆, ♃ 1° 0′ N.; $1^h\ 31^m$ minimum of Algol.
22. 20^h ♀ greatest heliocentric lat. S.
23. $22^h\ 34^m$ minimum of Algol.
24. 3^h ☌ ☿ ☉ superior.
25.
26. 8^h ☿ in Perihelion; $19^h\ 8^m$ minimum of Algol.
27. ○ $14^h\ 26^m$ full Moon.
28.
29. $20^h\ 22^m$ ☌ ♃ ☾, ♃ 1° 27′ S.; $15^h\ 57^m$ minimum of Algol.
30. $7^h\ 42^m$ ☌ ♂ ☾, ♂ 3° 13′ S.
31.

THE NIGHT SKY FOR JUNE



The heavens as they appear on

May 7, midnight; June 7, 22^h; June 22, 21^h

THE PLANETS ON JUNE 15, 1907

	h	m	
Mercury, Evening Star, sets	21	25	Local Mean Time
Venus, Morning Star, rises	2	58	
Mars, rises 21 49, sets	5	55	
Jupiter, Evening Star, sets	21	17	
Saturn, Morning Star, rises	0	36	

JUNE

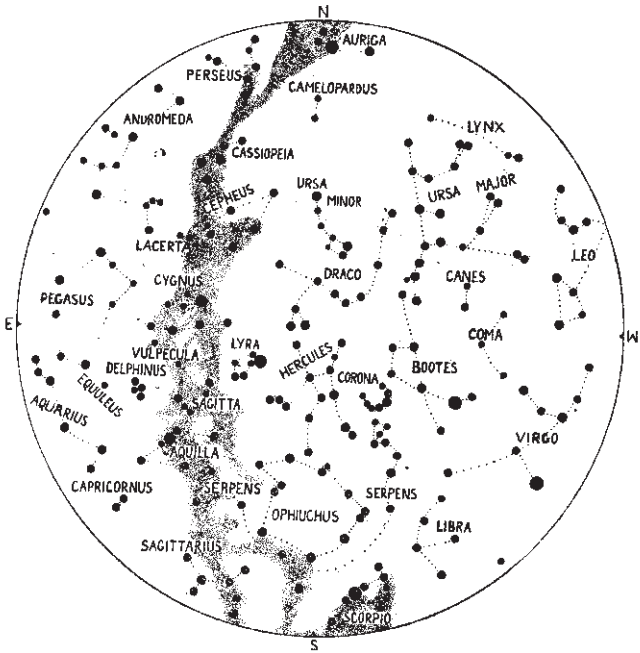
ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

Day

1. $12^h\ 46^m$ minimum of Algol.
2.
☾ 3. $5^h\ 28^m$ Moon's last quarter.
4. $1^h\ 8^m$ ☌ ♭ ☾, ♭ 2° 42′ N.
5. 15^h ☿ greatest heliocentric lat. N.; 21^h ♂ stationary.
6.
7. $6^h\ 24^m$ minimum of Algol.
8. $8^h\ 2^m$ ☌ ♀ ☾, ♀ 3° 18′ N.; eclipse I Sat., re-ap. $20^h\ 8^m$.
9.
● 10. $23^h\ 58^m$, new Moon; $3^h\ 12^m$ minimum of Algol.
11.
12. $16^h\ 8^m$ ☌ ☿ ☾, ☿ 3° 9^m N; $16^h\ 39^m$ ☌ ♆ ☾, ♆ 0° 16′ N.; 21^h, ☌ ☿ ♆, ☿ 2° 52′ N.
13. $0^h\ 38^m$ ☌ ♃ ☾, ♃ 0° 57^m N.; $0^h\ 2^m$ minimum of Algol.
14.
15. 15^h ☌ ☿ ♃, ☿ 1° 41′ N.; $20^h\ 22^m$ minimum of Algol.
16, 17, 18.
☽ 19. $3^h\ 3^m$ Moon's first quarter; 8^h □ ♭ ☉.
20, 21.
22. 9^h ☉ enters ♋; summer commences.
23, 24.
○ 25. $21^h\ 35^m$ full Moon.
26. $5^h\ 4^m$ ☌ ♁ ☾, ♁ 1° 30′ S.; $13^h\ 56^m$ ☌ ♂ ☾, ♂ 5° 19′ S.
27. 6^h ☿ greatest elong. E. 25° 29′; $8^h\ 6^m$ minimum of Algol.
28.
29. 2^h ☿ in ♉.
30.

THE NIGHT SKY FOR JULY



The heavens as they appear on

June 7, midnight; July 7, 22^h; July 30, 20^h 30^m

THE PLANETS ON JULY 15, 1907

	h	m	
Mercury, Evening Star, sets	20	04	Local Mean Time
Venus, Morning Star, rises	2	58	
Mars rises 21.29, sets	3	05	
Mars will be in opposition July 6.			
Jupiter, in conjunction July 16; after this a morning star.			
Saturn, Morning Star, rises	22	38	

JULY

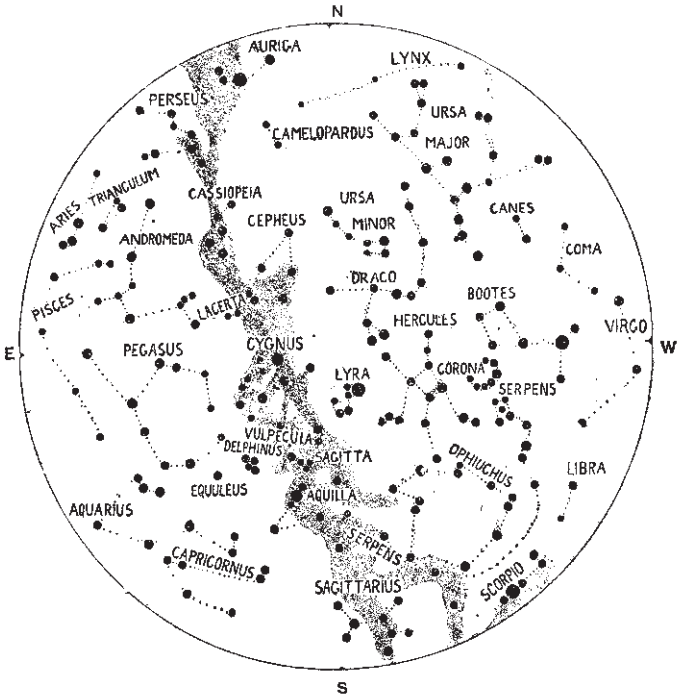
ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

Day

1. $9^h\ 37^m$ ☌ ♄ ☾, ♄ 2° 45′ N.
☾ 2. $14^h\ 42^m$ Moon's last quarter.
3. 15^h ☍ ♉ ☉; $1^h\ 44^m$ minimum of Algol.
4.
5. 8^h ☌ ♆ ☉; 10^h ⊕ in Aphelion; $22^h\ 32^m$ minimum of Algol.
6. 10^h ☍ ♂ ☉.
7.
8. $17^h\ 22^m$ ☌ ♀ ☾, ♀ 1° 57′ N.; $19^h\ 21^m$ minimum of Algol.
9. 8^h ☿ in Aphelion.
● 10. $15^h\ 25^m$ new Moon; annular eclipse of Sun (see page 37); $0^h\ 49^m$ ☌ ♆ ☾, ♆ 0° 11′ N.; 11^h ☿ stationary; $18^d\ 59^m$ ☌ ♃ ☾, ♃ 0° 25^m N.; 20^h, ♄ stationary.
11.
12. $0^h\ 43^m$ ☌ ☿ ☾, ☿ 4° 22′ S.
13. 0^h ♂ nearest earth.
14, 15.
16. 2^h ☌ ♃ ☉.
17.
☽ 18. $13^h\ 20^m$ Moon's first quarter; 3^h ♀ in ♌.
19. 14^h ☌ ☾ ♉, ♂ 5° 18′ S.
20. $6^h\ 37^m$ minimum of Algol.
21. 14^h ☌ ♀ ♆, ♀ 0° 58′ N.
22.
23. $12^h\ 53^m$ ☌ ♂ ☾, ♂ 7° 0′ S.; $14^h\ 9^m$ ☌ ♉ ☾, ♉ 1° 36′ S.; $3^h\ 25^m$ minimum of Algol.
24. 22^h ☌ ☿ ☉ inferior; partial eclipse of Moon (see page 37).
☉ 25. $4^h\ 38^m$ full Moon.
26. $0^h\ 14^m$ minimum of Algol.
27.
28. $17^h\ 51^m$ ☌ ♄ ☾, ♄ 2° 37′ N.; $21^h\ 3^m$ minimum of Algol.
29. 17^h ☿ greatest heliocentric lat. S.
30.
31. 23^h ☌ ☿ ♃, ☿ 4° 37′ S.

THE NIGHT SKY FOR AUGUST



The heavens as they appear on

July 7, midnight; August 7, 22^h; September 6, 20^h

THE PLANETS ON AUGUST 15, 1907

	h	m	
Mercury, Morning Star, rises	3	29	Local Mean Time
Venus, Morning Star, rises	4	18	
Mars, Evening Star, sets	0	48	
Jupiter, Morning Star, rises	1	37	
Saturn Morning Star, rises	20	34	

AUGUST

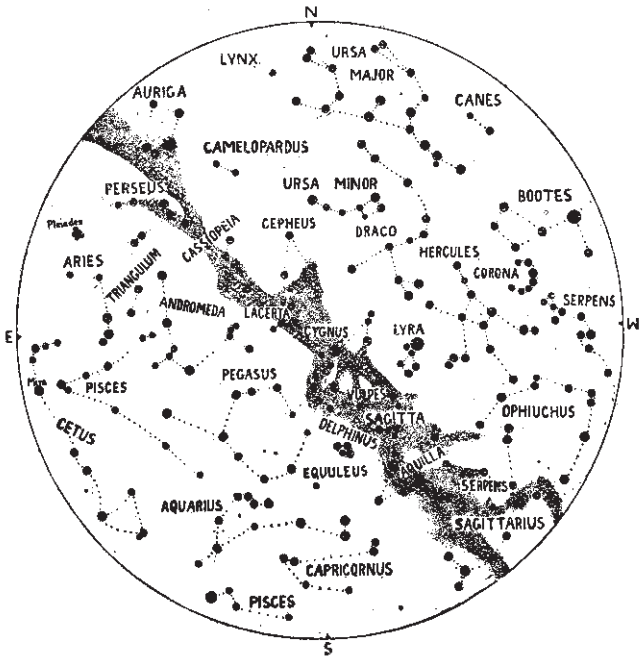
ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

Day

1. $2^h\ 34^m$ Moon's last quarter; 8^h ☌ ☿ ♀, ☿ 4° 51′ S.; 12^h ☌ ♀ ♌, ♀ 0° 18′ N.
2, 3.
4. 0^h ☿ stationary.
5.
6. $8^h\ 59^m$ ☌ ♆ ☾, ♆ 0° 5′ N.
7. $11^h\ 1^m$ ☌ ☿ ☾, ☿ 3° 2′ S.; $13^h\ 30^m$ ☌ ♌ ☾, ♌ 0° 6′ S.
8. $3^h\ 8^m$ ☌ ♀ ☾, ♀ 0° 12′ S.
9. $6^h\ 44^m$ new Moon; 1^h ♂ stationary; $8^h\ 18^m$ minimum of Algol.
10. 22^h ☌ ♀ ♌, ☿ 2° 5′ S.
11.
12. 22^h ☿ greatest elong. W. 18° 51′; $5^h\ 7^m$ minimum of Algol.
13, 14.
15. $1^h\ 56^m$ minimum of Algol.
16. $21^h\ 14^m$ Moon's first quarter.
17. 17^h ☿ in ♌; $22^h\ 45^m$ minimum of Algol.
18.
19. $20^h\ 36^m$ ☌ ♂ ☾, ♂ 6° 31′ S.; $22^h\ 13^m$ ☌ ♓ ☾, ♓ 1° 38′ S
20. 14^h ♀ in Perihelion; $19^h\ 34^m$ minimum of Algol.
21.
22. 8^h ☿ in Perihelion.
23. $12^h\ 23^m$ full Moon.
24. 16^h ☌ ♂ ♓, ♂ 4° 37′ S.
25. $1^h\ 42^m$ ☌ ♭ ☾, ♭ 2° 23′ N.
26.
27. Eclipse II Sat., disap. $4^h\ 52^m$.
28.
29. Eclipse I Sat., disap. $3^h\ 47^m$.
30. $17^h\ 34^m$ Moon's last quarter.
31.

THE NIGHT SKY FOR SEPTEMBER



The heavens as they appear on

August 7, midnight; September 6, 22^h; October 6, 20^h

THE PLANETS ON SEPTEMBER 15, 1907

	h	m	
Mercury, Evening Star, sets	18	30	Local Mean Time
Venus, in conjunction with the Sun September 14			
Mars, Evening Star, sets	23	36	
Jupiter, Morning Star, rises	2	18	
Saturn rises 18. 29, sets	5	53	

Saturn in opposition September 17.

SEPTEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

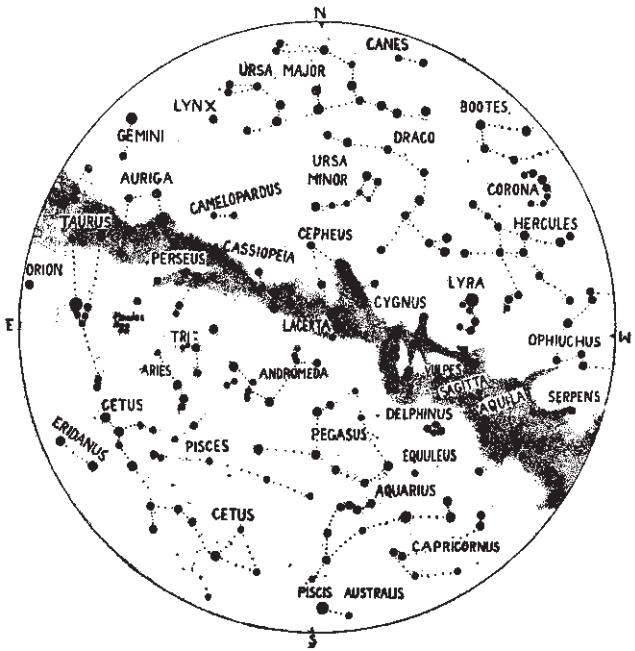
Day

1. 14^h ☿ greatest heliocentric lat. N.; 23^h ♂ greatest heliocentric lat. S.; 6^h 49^m minimum of Algol.
2. 17^h 28^m ♂ Ψ ☾, Ψ 0° 4′ S.
3. 15^h ♂ ☿ ♀, ☿ 0° 26′ N.
4. 7^h 54^m ♂ 2 ☾, 2 0° 38′ S.; 3^h 38^m minimum of Algol.
5.
6. 23^h ♂ ☿ ☉ superior.
7. 21^h 12^m new Moon; 9^h 48^m ♂ ♀ ☾, ♀ 2° 28′ S.; 15^h 18^m ♂ ☿ ☾, ☿ 2° 33′ S.; 0^h 27^m minimum of Algol.
8.
9. 21^h 16^m minimum of Algol.
10.
11. 15^h ♀ greatest heliocentric lat. N.
12. Eclipse III Sat., re-ap. 23^h 1^m; 18^h 5^m minimum of Algol.
13.
14. 20^h ♂ ♀ ☉ superior.
15. 3^h 48^m Moon's first quarter.
16. 4^h 43^m ♂ ♁ ☾, ♁ 1° 30′ S.; 18^h 12^m ♂ ♂ ☾, ♂ 4° 27′ S.
17. 21^h ☍ ♄ ☉.
18. 17^h ♁ stationary.
19. Eclipse III Sat., disap. 3^h 34^m.
20.
21. 21^h 40^m full Moon; 8^h 21^m ♂ ♄ ☾, ♄ 2° 12′ N.; eclipse I Sat., disap. 3^h 55^m; 8^h 31^m minimum of Algol.

22, 23.

24. 0^h ☉ enters ♎, autumn commences; 5^h 20^m minimum of Algol.
25. 2^h ☿ in ♍.
26. 8^h ♂ in Perihelion.
27. 2^h 9^m minimum of Algol.
28. Eclipse II Sat., disap. 4^h 35^m.
29. 11^h 45^m Moon's last quarter; 22^h 58^m minimum of Algol.
30. 2^h 5^m ♂ Ψ ☾, Ψ 0° 20′ S

THE NIGHT SKY FOR OCTOBER



The heavens as they appear on

September 6, midnight; October 6, 22^h; November 6, 20^h

THE PLANETS ON OCTOBER 15, 1907

	h	m	
Mercury, Evening Star, sets	17	55	Local Mean Time
Venus, Evening Star, sets	17	36	
Mars, Evening Star, sets	23	07	
Jupiter, Morning Star, rises	0	05	
Saturn, Evening Star, sets	3	40	

OCTOBER

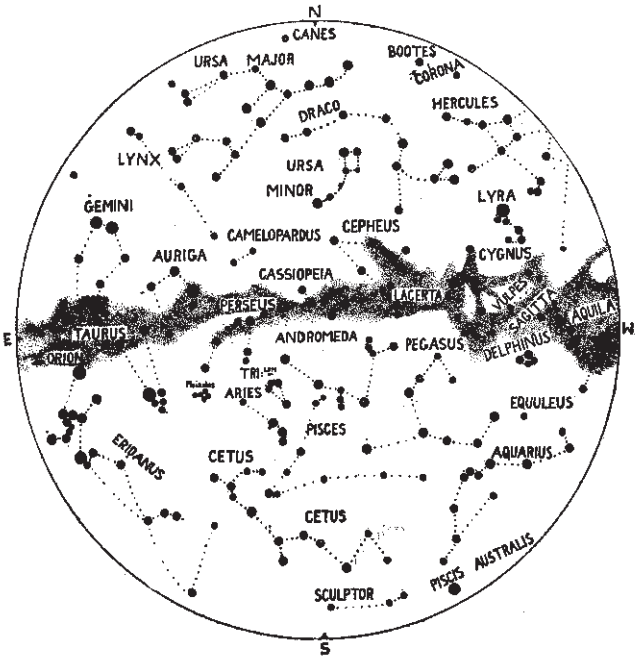
ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

Day

1.
2. $1^h\ 24^m$ ☌ ♃ ☾, ♃ 1° 11′ S.; $19^h\ 47^m$ minimum of Algol.
3. 0^h □ ♅ ☉; eclipse IV Sat., re-ap. $4^h\ 52^m$.
4.
5. 7^h ☿ in Aphelion.
6.
● 7. $10^h\ 29^m$ new Moon; $13^h\ 56^m$ ☌ ♀ ☾, ♀ 4^h 15′ S.; eclipse I Sat., disap. $2^h\ 10^m$.
8. $16^h\ 48^m$ ☌ ☿ ☾, ☿ 6° 54′ S.
9. 2^h □ ♆ ☉.
10, 11, 12.
13. $10^h\ 35^m$ ☌ ♅ ☾, ♅ 1° 13′ S.
☽ 14. $10^h\ 10^m$ Moon's first quarter; eclipse I Sat., disap. $4^h\ 3^m$; $7^h\ 24^m$ minimum of Algol.
15. $0^h\ 30^m$ ☌ ♂ ☾, ♂ 1° 47′ S.
16.
17. $3^h\ 51^m$ minimum of Algol.
18. $13^h\ 19^m$ ☌ ♄ ☾, ♄ 2° 13′ N.
19. 23^h ♆ stationary.
20. 0° 40^m minimum of Algol.
○ 21. $9^h\ 25^m$ full Moon; eclipse I Sat., disap. $5^h\ 56^m$.
22. $21^h\ 21^m$ minimum of Algol.
23. 6^h ☿ greatest elong. E. 24° 20′; eclipse II Sat., disap. $1^h\ 43^m$.
24.
25. 16^h ☿ greatest heliocentric lat. S.; eclipse III Sat., re-ap. $2^h\ 51^m$; $18^h\ 17^m$ minimum of Algol.
26.
27. $10^h\ 17^m$ ☌ ♆ ☾, ♆ 0° 37′ S.
28.
☾ 29. $8^h\ 0^m$ Moon's last quarter; $16^h\ 34^m$ ☌ ♃ ☾, ♃ 1° 41′ S.
30. Eclipse I Sat., disap. $2^h\ 18^m$; II Sat., disap. $4^h\ 19^m$.
31.

THE NIGHT SKY FOR NOVEMBER



The heavens as they appear on

October 6, midnight; Nov. 6, 22^h; December 6, 20^h

THE PLANETS ON NOVEMBER 15, 1907

	h	m	
Mercury, Morning Star, rises	6	02	Local Mean Time
Venus, Evening Star, sets	17	14	
Mars, Evening Star, sets	22	53	
Jupiter, Morning Star, rises	22	17	
Saturn, Evening Star, sets	1	31	

NOVEMBER

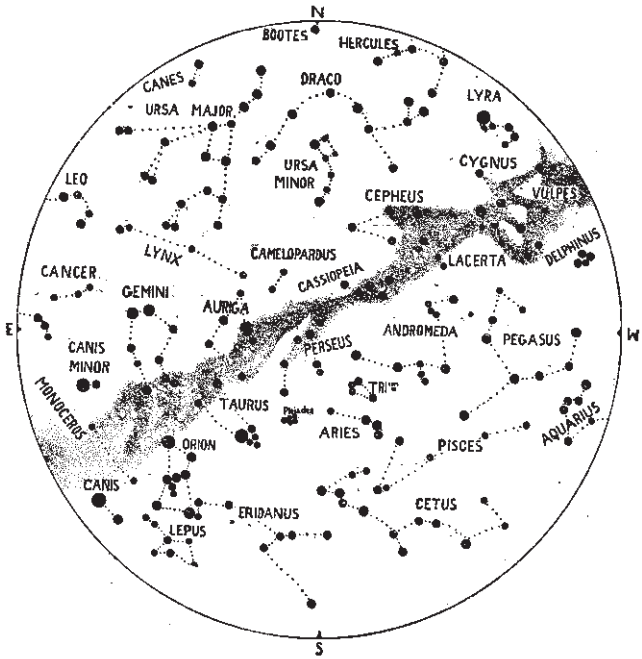
ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

Day

1. 16^h ☿ stationary; eclipse III Sat., disap. $3^h\ 21^m$.
2.
3. $8^h\ 44^m$ minimum of Algol.
4.
● 5. $22^h\ 47^m$ new Moon.
6. 0^h □ ♃ ☉; 16^h ♀ in ♉; $16^h\ 52^m$ ☌ ♀ ☾, ♀ 4° S.; $19^h\ 10^m$ ☌ ☿ ☾, ☿ 6° S.; eclipse I Sat., disap. $4^h\ 11^m$; $5^h\ 33^m$ minimum of Algol.
7. 11^h ☌ ☿ ♀, ☿ 1° 54′ S.
8.
9. $17^h\ 55^m$ ☌ ♁ ☾, ♁ 0° 55^m S.; $2^h\ 22^m$ minimum of Algol.
10.
11. 16^h □ ♂ ☉; $23^h\ 11^m$ minimum of Algol.
◗ 12. $17^h\ 22^m$ Moon's first quarter; $11^h\ 11^m$ ☌ ♂ ☾, ♂ 0^d 58′ N.
13. 16^h ☿ in ♌; eclipse I Sat., disap. $6^h\ 4^m$.
14. 7^h ☌ ☿ ☉ inferior; ☿ transits Sun (see page 37); $17^h\ 23^m$ ☌ ♄ ☾, ♄ 2° 27′ N.; $20^h\ 0^m$ minimum of Algol.
15. Eclipse I Sat., disap. $0^h\ 32^m$.
16, 17.
18. 7^h ☿ in Perihelion.
19.
☺ 20. $0^h\ 12^m$ full Moon.
21. Eclipse I Sat., disap. $2^h\ 25^m$.
22.
23. 9^h ☿ stationary; $17^h\ 28^m$ ☌ ♆ ☾, ♆ 0° 48′ S.
24. Eclipse II Sat., disap. $1^h\ 24^m$.
25. 19^h ♄ stationary.
26. $3^h\ 33^m$ ☌ ♃ ☾, ♃ 1° 57′ S.; $7^h\ 15^m$ minimum of Algol.
27.
☾ 28. $4^h\ 29^m$ Moon's last quarter; 13^h ☿ greatest heliocentric lat. N.
29. Eclipse I Sat., disap. $4^h\ 18^m$; III Sat., re-ap. $22^h\ 42^m$; $4^h\ 4^m$ minimum of Algol.
30. Eclipse I Sat., disap. $22^h\ 46^m$.

THE NIGHT SKY FOR DECEMBER



The heavens as they appear on

November 6, midnight; December 6, 22^h; January 6, 20^h

THE PLANETS ON DECEMBER 15, 1907

	h	m	
Mercury, Morning Star, rises	6	14	Local Mean Time
Venus, Evening Star, sets	17	49	
Mars, Evening Star, sets	22	47	
Jupiter, Morning Star, rises	20	18	
Saturn, Evening Star, sets	23	35	

DECEMBER

ASTRONOMICAL PHENOMENA

(75th Meridian Time, Hours Numbering from Midnight)

Day

1. 5^h ♃ stationary; 9^h ☿ greatest elong. W. 20° 20′; eclipse II Sat., disap. 4^h 0^m.
2. 0^h 53^m minimum of Algol.
3. 16^h 49^m ☌ ☿ ☾, ☿ 2° 9′ S.
4. 21^h 41^m minimum of Algol.
5. ● 10^h 30^m new Moon.
6. 17^h 44^m ☌ ☿ ☾, ☿ 2° 5′ S.; eclipse I Sat., disap. 6^h 11^m; III disap. 23^h 10^m.
7. 4^h 26^m ☌ ♁ ☾, ♁ 0° 39′ S.; eclipse III Sat., re-ap. 2^h 40^m; 18^h 31^m minimum of Algol.
8. Eclipse I Sat., disap. 0^h 40^m; II Sat., disap. 6^h 36^m.
9. Eclipse IV Sat., disap. 0^h 37^m; IV Sat., re-ap. 5^h 7^m.
10. 22^h ♀ in Aphelion.
11. 0^h 44^m ☌ ♂ ☾, ♂ 3° 24′ N.; 22^h 55^m ☌ ♄ ☾, ♄ 2^h 44^m N.
12. ◗ 2^h 24^m Moon's first quarter; 5^h ☌ ♀ ♁, ♀ 0^h 59^m S.
13. 23^h □ ♄ ☉.
14. Eclipse III Sat., disap. 3^h 8^m, re-ap. 6^h 38^m.
15. Eclipse I Sat., disap. 2^h 33^m.
16. 8^h 37^m minimum of Algol.
17.
18. Eclipse II Sat., disap. 22^h 30^m.
19. ☉ 18^h 3^m full Moon; 5^h 46^m minimum of Algol.
20. 23^h 19^m ☌ Ψ ☾, Ψ 0° 49′ S.
21.
22. 1^h ☿ in ♈; 19^h ☉ enters ♋, winter commences; eclipse I Sat. disap. 4^h 26^m; 2^h 35^m minimum of Algol.
23. 9^h 6^m ☌ ♃ ☾, ♃ 1° 54^m S.; eclipse I Sat., disap. 22^h 55^m.
24.
25. Eclipse IV Sat., re-ap. 23^h 10^m; 23^h 24^m minimum of Algol.
26. Eclipse II Sat., disap. 1^h 6^m.
27. ☾ 23^h 19^m Moon's last quarter.
28. 20^h 12^m minimum of Algol.
29. Eclipse I Sat., disap. 6^h 20^m.
30.
31. 10^h ☌ ♂ ♄, ♂ 1° 50′ N.; eclipse I Sat., disap. 0^h 48^m.

EXTRACTS FROM THE BY-LAWS OF THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

NOTE:—In order to encourage the formation of *Sections* of the Society at the chief centres of Canada, and to provide for a proper co-ordination of all *Sections*, a revision of the By-Laws will be made in the near future.

NAME

The Astronomical and Physical Society of Toronto was incorporated in 1890; in 1900 the name was changed to The Toronto Astronomical Society; and in 1903, with the gracious permission of His Majesty the King, the name, The Royal Astronomical Society of Canada, was assumed.

OBJECTS

I. The objects of THE ROYAL ASTRONOMICAL SOCIETY OF CANADA shall be :

(*a*) To study astronomical and astro-physical subjects, and such cognate subjects as the Society shall approve of and shall, in its opinion, tend to the better consideration and elucidation of astronomical and astro-physical problems, and to diffuse theoretical and practical information with respect to such subjects;

(*b*) To publish from time to time the results of the work of the Society; and

(*c*) To acquire and maintain a library, and such apparatus and real and personal property as may be necessary and convenient for the carrying into effect of the objects of the Society.

MEMBERSHIP

II. The members of the Society shall be enrolled in two divisions, to be known as "Active Members" and as "Honorary Members," respectively.

III. The Active Members shall consist of persons duly elected to be Associates, Life Associates, Fellows, and Life Fellows, respectively.

(*a*) The Associates shall form the ordinary membership of the Society.

(*b*) The Fellows shall be chosen from among the Associates in virtue of scientific attainments or services.

(*c*) Life Associates and Life Fellows shall be persons elected as such and as hereinafter provided.

IV. The Honorary Membership shall consist of Corresponding Fellows, of whom there shall at no time be more than twenty-five; of Honorary Fellows, of whom there shall at no time be more than fifteen; of Patrons, and of an Honorary President.

(*a*) Corresponding Fellowship may be conferred as a recognition of eminent scientific attainments or services;

(*b*) Honorary Fellowship may be conferred as a recognition of scientific attainments or services of the highest order.

(*c*) Any person may be named and enrolled as a Patron of the Society if he shall have rendered illustrious services to the Society, or shall have presented to it substantial gifts of instruments, books, or apparatus, or shall have paid at any one time the sum of one hundred dollars for its benefit or towards its purposes.

V. Honorary Members shall pay no fees and shall have no votes.

ELECTION AND ADMISSION OF ASSOCIATES

VII. Any person desirous of being admitted into the Society as an Associate must be proposed and recommended agreeably to Form No. 1 in the Appendix hereto. The nomination paper must set forth the name in full, the calling, and the usual place of residence of the candidate, and must be subscribed by at least two active members of the Society, one of whom must, of his personal knowledge, certify that the candidate is a proper person to become an Associate.

VIII. Every proposal and recommendation for the election of an Associate shall be read aloud at one of the regular meetings of the Society, and handed to the Recorder, by whom it shall be posted up in the Library of the Society until the opening of the meeting at which the candidate is to be balloted for.

IX. A candidate may be balloted for at any regular meeting of the Society, provided at least seven Fellows and Associates are present, and that the requirements of By-law VIII. have been complied with.

X. No candidate shall be held to have been duly elected unless he have in his favor at least two-thirds of the Fellows and Associates present when the balloting takes place.

ELECTION AND ADMISSION OF FELLOWS

XIV. An Associate, not in arrears and being otherwise eligible, may be nominated as a candidate for Fellowship. The nomination shall be according to Form No. 5, and shall be read aloud at a regular meeting of the Society, whereupon it shall be posted by the Recorder in the Library until the next regular meeting, when the President shall take the pleasure of the Society on the question whether it shall be referred to the Council for a report. If the decision of the Society be in favor of such reference, the Council shall take the matter into consideration, and shall have due regard to the qualifications of the candidate, including, if they exist, his application as a student, his fitness as a teacher, his success as an observer, his original work, the value of the papers he has contributed, the regularity of his attendance on the meetings of the Society, and the interest he has manifested in its welfare and usefulness. When prepared to do so, the Council shall make a special report as to the fitness of the candidate, and such report may be accepted, modified, tabled or rejected by the Society at a regular meeting. Voting at any stage in a candidature for Fellowship shall be by ballot, and unless a two-thirds vote, whether in Council or in general meeting, favors election, the nomination shall be held to have failed.

FEES

XVI. Unless otherwise provided, the annual fee of a Fellow or of an Associate shall become due and shall be payable on the first day of January in each year. The fee shall be Two Dollars per annum.

Provided, that an Associate elected on or after the first day of September shall, as his or her first fee, pay in full for the ensuing calendar year and, in addition, for each remaining month of the current year a sum in due proportion to the annual fee.

XVII. Any Fellow or Associate at any time, all sums then due being first paid, may compound for his annual contributions by the payment of Twenty Dollars, and become a Life Fellow or a Life Associate. A Life Fellow or a Life Associate subject to expulsion shall have his payment returned less the annual fees he would have had to pay had he been an ordinary member until the date of his expulsion.

OFFICERS

XXI. The officers of the Society shall be chosen annually and shall consist of a President, a First Vice-President, a Second Vice-President, with the addition of other Vice-Presidents living outside of the Province of Ontario, when deemed desirable by the Society, a Treasurer, a Secretary, a Recorder, a Librarian, and a Curator. If a vacancy occurs in any of the above-mentioned offices, other than that of President, it may be filled for the remainder of the year by the Council, at a meeting, of which notice has been given; the action of the Council in this behalf shall, however, be subject to ratification or revision by the Society, to which the said action shall be reported at the first meeting of the Society held after the vacancy has been so filled. If a vacancy occur in the office of President, the First Vice-President shall thereupon become President, and the Second Vice-President shall become First Vice-President; the office of Second Vice-President shall be filled as above provided.

THE COUNCIL

XXIV. The Council shall consist of the officers of the Society mentioned in By-law XXI., and of five Associates to be chosen at the Annual General Meeting. Past-Presidents of the Society shall be Members of the Council *honoris causa*.

GENERAL PROVISIONS

L. This Society shall continue to be an independent body, and shall not become merged in any other Society, body, or organization. The Society shall have a Common Seal of such device as shall be approved of by the Society.

LI. Subject to such terms and conditions, general and special, as the Society shall impose, other Societies having, in whole or in part, like purposes and objects, may become affiliated with it.

LII. Subject to the Statutes in that behalf, the Society may receive and hold gifts, grants, and bequests of real property, and donations of personal property, including money, stocks, manuscripts, books, instruments, etc.

LIII. Every ordinary contributor to the property of the Society shall be recorded as a Benefactor, and as such his or her name shall be read at the Annual General Meeting.

ROYAL ASTRONOMICAL SOCIETY
OF CANADA

OFFICERS FOR 1907

Honorary President—W. F. KING, B.A., LL.D., Chief Astronomer, Ottawa.
President—C. A. CHANT, M.A., PH.D.
1st Vice-President—W. BALFOUR MUSSON.
2nd Vice-President—LOUIS B. STEWART, D.T. S.
Secretary—J. R. COLLINS, 198 College St., Toronto.
Treasurer—GEORGE RIDOUT, 77 York St., Toronto.
Recorder—MISS ELSIE A. DENT.
Librarian—A. SINCLAIR, M.A.
Curator—ROBERT S. DUNCAN.
Council—The above Officers and the following members:
JOSEPH POPE, C.M.G., F.R.S.C., Ottawa.
A. F. MILLER, Toronto.
REV. D. B. MARSH, F.R.A.S., Springville.
ALFRED T. DELURY, M.A.
L. H. GRAHAM, M.A.
AND
Past Presidents ANDREW ELVINS, JOHN A. PATERSON, K.C., M.A., and R. F. STUPART, F.R.S.C.
The Toronto Section meets fortnightly at 198 College St.

OTTAWA SECTION, OFFICERS FOR 1907

President—DR. W. F. KING, Chief Astronomer.
Vice-President—OTTO KLOTZ, LL.D., F.R.A.S.
Secretary—J. S. PLASKETT, B.A., Dominion Observatory.
Treasurer—R. M. STEWART, M.A.
Council—JOSEPH POPE, C.M.G., A. H. MCDOUGALL, M.A., and F. A. MCDIARMID, B.A.
The Section meets monthly at the Dominion Astronomical Observatory.

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