

ASTRONOMY 2020

Supplementary Information

DARWIN

Quasar Publishing
Version 1.0

This year for our thirtieth edition we have made some changes. As part of this we have removed some data from the yearbook.

To decide what could be taken out we reviewed how the people, who value our book, participate in the hobby and how has this evolved over the years. For the true beginners with little more than a sense of wonder and a thirst to know, we believe they are well catered for in Astronomy 2020.

Telescope users have become polarised into two camps. There are those we call the pure observers who, with some knowledge, spend their money on the optics, taking a more low cost approach to their mounts. Then there are the people who ride the back of the technology revolution turning to computer controlled scopes, now much more affordable instruments, that can automatically slew to an object selected from its database.

Keeping this in mind, we had a hard look at the sea of numbers in Part II. Printed rise and set times for all the planets are not used by the beginner or pure observer and not needed by the techies. Besides, no one observes the planets (or anything) close to the horizon unless they have to. For this reason we

believe the approximate times given in the Rise–Set charts in Part I should suffice. Often the transit times for the outer planets are more valuable, when the planet is high in the northern sky with minimal atmospheric turbulence. Using the same reasoning, the position tables of the Sun, Moon and planets are either not used or not necessary.

When we started these books in 1990 there was no internet (believe it or not!), so some of the information we supplied wasn't easily obtainable elsewhere. Today a lot is available either online, from computer programmes or through cheap (or free) astronomy/planetarium apps on mobile devices. The lunar occultation tables are no longer included as the Occult software (written by Australian David Herald) is readily available for download and it can tailor event times for your location. Nevertheless, if you still need this information it is now available here.

The data on the following pages (available for download from our web site) is supplementary to the yearbook ASTRONOMY 2020 that we published in October 2019. Note there is a separate PDF for each capital city in Australia.

www.quasarastronomy.com.au/downloads---2020.html

In the event you are reading this and don't know what the yearbook we are referring to is, have a look here.

www.quasarastronomy.com.au/order.html

GEOCENTRIC POSITION of the SUN

(0 hr UT, Epoch 2000.0)

	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
	RA hh mm.m	Dec. ° ' "	RA hh mm.m	Dec ° ' "	RA hh mm.m	Dec ° ' "	RA hh mm.m	Dec ° ' "	RA hh mm.m	Dec ° ' "	RA hh mm.m	Dec ° ' "
1	18 42.4	-23 04.8	20 55.0	-17 23.1	22 48.4	-07 35.6	00 42.1	+04 31.9	02 33.6	+15 04.1	04 36.4	+22 02.9
2	18 46.8	-23 00.1	20 59.1	-17 06.2	22 52.1	-07 12.8	00 45.8	+04 55.0	02 37.4	+15 22.1	04 40.5	+22 10.8
3	18 51.2	-22 54.9	21 03.2	-16 49.0	22 55.8	-06 49.8	00 49.4	+05 18.0	02 41.2	+15 39.9	04 44.6	+22 18.4
4	18 55.6	-22 49.3	21 07.2	-16 31.5	22 59.6	-06 26.8	00 53.1	+05 40.9	02 45.1	+15 57.4	04 48.7	+22 25.6
5	19 00.0	-22 43.2	21 11.3	-16 13.7	23 03.3	-06 03.7	00 56.7	+06 03.8	02 48.9	+16 14.6	04 52.8	+22 32.4
6	19 04.4	-22 36.7	21 15.3	-15 55.6	23 07.0	-05 40.4	01 00.4	+06 26.5	02 52.8	+16 31.6	04 57.0	+22 38.8
7	19 08.8	-22 29.7	21 19.3	-15 37.3	23 10.7	-05 17.2	01 04.0	+06 49.1	02 56.6	+16 48.3	05 01.1	+22 44.8
8	19 13.2	-22 22.3	21 23.3	-15 18.7	23 14.4	-04 53.8	01 07.7	+07 11.6	03 00.5	+17 04.7	05 05.2	+22 50.4
9	19 17.5	-22 14.4	21 27.3	-14 59.8	23 18.1	-04 30.4	01 11.4	+07 33.9	03 04.4	+17 20.9	05 09.4	+22 55.6
10	19 21.9	-22 06.1	21 31.3	-14 40.7	23 21.8	-04 06.9	01 15.0	+07 56.2	03 08.3	+17 36.7	05 13.5	+23 00.4
11	19 26.3	-21 57.4	21 35.3	-14 21.3	23 25.5	-03 43.4	01 18.7	+08 18.3	03 12.2	+17 52.3	05 17.6	+23 04.8
12	19 30.6	-21 48.3	21 39.2	-14 01.7	23 29.1	-03 19.8	01 22.4	+08 40.3	03 16.1	+18 07.5	05 21.8	+23 08.7
13	19 34.9	-21 38.7	21 43.2	-13 41.9	23 32.8	-02 56.2	01 26.1	+09 02.1	03 20.1	+18 22.5	05 25.9	+23 12.3
14	19 39.3	-21 28.7	21 47.1	-13 21.8	23 36.5	-02 32.5	01 29.8	+09 23.8	03 24.0	+18 37.1	05 30.1	+23 15.5
15	19 43.6	-21 18.3	21 51.0	-13 01.5	23 40.2	-02 08.9	01 33.5	+09 45.3	03 28.0	+18 51.4	05 34.2	+23 18.3
16	19 47.9	-21 07.5	21 54.9	-12 41.0	23 43.8	-01 45.2	01 37.2	+10 06.7	03 31.9	+19 05.4	05 38.4	+23 20.6
17	19 52.2	-20 56.3	21 58.8	-12 20.3	23 47.5	-01 21.5	01 40.9	+10 27.9	03 35.9	+19 19.1	05 42.5	+23 22.6
18	19 56.4	-20 44.6	22 02.7	-11 59.4	23 51.1	-00 57.7	01 44.6	+10 48.9	03 39.9	+19 32.5	05 46.7	+23 24.1
19	20 00.7	-20 32.6	22 06.5	-11 38.3	23 54.8	-00 34.0	01 48.3	+11 09.7	03 43.8	+19 45.5	05 50.9	+23 25.2
20	20 05.0	-20 20.2	22 10.4	-11 17.1	23 58.4	-00 10.3	01 52.0	+11 30.4	03 47.8	+19 58.2	05 55.0	+23 25.9
21	20 09.2	-20 07.4	22 14.2	-10 55.6	00 02.1	+00 13.4	01 55.8	+11 50.9	03 51.8	+20 10.6	05 59.2	+23 26.2
22	20 13.4	-19 54.2	22 18.1	-10 34.0	00 05.7	+00 37.1	01 59.5	+12 11.2	03 55.8	+20 22.6	06 03.4	+23 26.1
23	20 17.7	-19 40.7	22 21.9	-10 12.2	00 09.4	+01 00.8	02 03.3	+12 31.3	03 59.9	+20 34.3	06 07.5	+23 25.5
24	20 21.9	-19 26.8	22 25.7	-09 50.2	00 13.0	+01 24.4	02 07.0	+12 51.1	04 03.9	+20 45.6	06 11.7	+23 24.6
25	20 26.1	-19 12.5	22 29.5	-09 28.1	00 16.6	+01 48.1	02 10.8	+13 10.8	04 07.9	+20 56.5	06 15.8	+23 23.2
26	20 30.2	-18 57.9	22 33.3	-09 05.9	00 20.3	+02 11.6	02 14.6	+13 30.3	04 12.0	+21 07.1	06 20.0	+23 21.4
27	20 34.4	-18 42.9	22 37.1	-08 43.5	00 23.9	+02 35.2	02 18.4	+13 49.5	04 16.0	+21 17.3	06 24.1	+23 19.3
28	20 38.6	-18 27.6	22 40.8	-08 21.0	00 27.6	+02 58.6	02 22.1	+14 08.5	04 20.1	+21 27.2	06 28.3	+23 16.7
29	20 42.7	-18 12.0	22 44.6	-07 58.4	00 31.2	+03 22.0	02 25.9	+14 27.3	04 24.2	+21 36.7	06 32.4	+23 13.6
30	20 46.8	-17 56.0			00 34.8	+03 45.4	02 29.8	+14 45.8	04 28.3	+21 45.8	06 36.6	+23 10.2
31	20 50.9	-17 39.7			00 38.5	+04 08.7			04 32.3	+21 54.5		
	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
1	06 40.7	+23 06.4	08 45.5	+18 01.3	10 41.4	+08 17.5	12 29.4	-03 10.3	14 25.4	-14 24.8	16 29.0	-21 47.5
2	06 44.8	+23 02.2	08 49.3	+17 46.1	10 45.0	+07 55.7	12 33.0	-03 33.5	14 29.4	-14 43.9	16 33.4	-21 56.6
3	06 49.0	+22 57.6	08 53.2	+17 30.6	10 48.7	+07 33.7	12 36.6	-03 56.7	14 33.3	-15 02.7	16 37.7	-22 05.3
4	06 53.1	+22 52.5	08 57.1	+17 14.8	10 52.3	+07 11.7	12 40.2	-04 19.9	14 37.2	-15 21.3	16 42.0	-22 13.6
5	06 57.2	+22 47.1	09 00.9	+16 58.7	10 55.9	+06 49.5	12 43.9	-04 43.0	14 41.2	-15 39.7	16 46.4	-22 21.5
6	07 01.3	+22 41.3	09 04.7	+16 42.3	10 59.5	+06 27.2	12 47.5	-05 06.0	14 45.2	-15 57.8	16 50.7	-22 28.9
7	07 05.4	+22 35.1	09 08.6	+16 25.7	11 03.1	+06 04.8	12 51.2	-05 29.0	14 49.2	-16 15.7	16 55.1	-22 35.9
8	07 09.5	+22 28.5	09 12.4	+16 08.8	11 06.7	+05 42.3	12 54.8	-05 51.9	14 53.2	-16 33.2	16 59.5	-22 42.4
9	07 13.6	+22 21.5	09 16.2	+15 51.7	11 10.3	+05 19.8	12 58.5	-06 14.8	14 57.2	-16 50.5	17 03.9	-22 48.6
10	07 17.7	+22 14.1	09 20.0	+15 34.3	11 13.9	+04 57.1	13 02.2	-06 37.5	15 01.2	-17 07.6	17 08.2	-22 54.2
11	07 21.8	+22 06.4	09 23.8	+15 16.6	11 17.5	+04 34.3	13 05.8	-07 00.2	15 05.3	-17 24.3	17 12.6	-22 59.4
12	07 25.9	+21 58.2	09 27.6	+14 58.7	11 21.1	+04 11.5	13 09.5	-07 22.8	15 09.3	-17 40.7	17 17.1	-23 04.2
13	07 29.9	+21 49.7	09 31.3	+14 40.6	11 24.7	+03 48.5	13 13.2	-07 45.3	15 13.4	-17 56.8	17 21.5	-23 08.5
14	07 34.0	+21 40.8	09 35.1	+14 22.2	11 28.3	+03 25.6	13 16.9	-08 07.6	15 17.5	-18 12.6	17 25.9	-23 12.3
15	07 38.0	+21 31.6	09 38.8	+14 03.6	11 31.8	+03 02.5	13 20.7	-08 29.9	15 21.6	-18 28.1	17 30.3	-23 15.7
16	07 42.1	+21 22.0	09 42.6	+13 44.8	11 35.4	+02 39.4	13 24.4	-08 52.1	15 25.7	-18 43.3	17 34.7	-23 18.6
17	07 46.1	+21 12.0	09 46.3	+13 25.7	11 39.0	+02 16.2	13 28.1	-09 14.1	15 29.8	-18 58.1	17 39.2	-23 21.0
18	07 50.1	+21 01.6	09 50.0	+13 06.5	11 42.6	+01 53.0	13 31.9	-09 36.0	15 34.0	-19 12.6	17 43.6	-23 23.0
19	07 54.1	+20 50.9	09 53.8	+12 47.0	11 46.2	+01 29.8	13 35.6	-09 57.7	15 38.1	-19 26.8	17 48.0	-23 24.5
20	07 58.2	+20 39.9	09 57.5	+12 27.3	11 49.8	+01 06.5	13 39.4	-10 19.3	15 42.3	-19 40.6	17 52.5	-23 25.5
21	08 02.2	+20 28.5	10 01.2	+12 07.4	11 53.4	+00 43.2	13 43.2	-10 40.8	15 46.5	-19 54.0	17 56.9	-23 26.1
22	08 06.1	+20 16.7	10 04.9	+11 47.4	11 57.0	+00 19.8	13 46.9	-11 02.1	15 50.7	-20 07.1	18 01.4	-23 26.2
23	08 10.1	+20 04.6	10 08.6	+11 27.1	12 00.5	-00 03.5	13 50.7	-11 23.2	15 54.9	-20 19.8	18 05.8	-23 25.8
24	08 14.1	+19 52.2	10 12.2	+11 06.7	12 04.1	-00 26.9	13 54.5	-11 44.2	15 59.1	-20 32.1	18 10.2	-23 25.0
25	08 18.0	+19 39.4	10 15.9	+10 46.1	12 07.7	-00 50.3	13 58.4	-12 04.9	16 03.4	-20 44.1	18 14.7	-23 23.6
26	08 22.0	+19 26.4	10 19.6	+10 25.3	12 11.3	-01 13.6	14 02.2	-12 25.5	16 07.6	-20 55.7	18 19.1	-23 21.8
27	08 25.9	+19 13.0	10 23.2	+10 04.4	12 14.9	-01 37.0	14 06.0	-12 45.9	16 11.9	-21 06.8	18 23.5	-23 19.6
28	08 29.9	+18 59.2	10 26.9	+09 43.3	12 18.5	-02 00.3	14 09.9	-13 06.1	16 16.1	-21 17.6	18 28.0	-23 16.9
29	08 33.8	+18 45.2	10 30.5	+09 22.1	12 22.1	-02 23.7	14 13.8	-13 26.1	16 20.4	-21 28.0	18 32.4	-23 13.7
30	08 37.7	+18 30.9	10 34.2	+09 00.7	12 25.8	-02 47.0	14 17.6	-13 45.9	16 24.7	-21 37.9	18 36.8	-23 10.0
31	08 41.6	+18 16.2	10 37.8	+08 39.1			14 21.5	-14 05.4			18 41.3	-23 05.9

GEOCENTRIC POSITION of the MOON

(0 hr UT, Epoch 2000.0)

	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
	RA hh mm.m	Dec. ° ' "	RA hh mm.m	Dec ° ' "	RA hh mm.m	Dec ° ' "	RA hh mm.m	Dec ° ' "	RA hh mm.m	Dec ° ' "	RA hh mm.m	Dec ° ' "
1	23 15.7	-10 04.9	01 56.6	+06 46.5	03 13.9	+14 13.4	06 27.4	+23 37.5	09 04.4	+20 22.1	12 27.9	+02 40.0
2	00 00.0	-05 39.9	02 41.8	+11 10.9	04 02.4	+17 50.3	07 24.8	+23 29.6	10 00.8	+16 43.7	13 20.9	-03 14.0
3	00 43.6	-01 03.0	03 29.3	+15 13.3	04 53.8	+20 44.1	08 23.3	+22 00.0	10 56.2	+12 02.6	14 14.9	-09 00.5
4	01 27.4	+03 37.9	04 19.7	+18 41.7	05 48.4	+22 41.2	09 21.9	+19 08.2	11 50.9	+06 33.8	15 10.8	-14 17.5
5	02 12.2	+08 14.3	05 13.5	+21 21.6	06 45.9	+23 27.7	10 19.9	+15 01.0	12 45.4	+00 36.4	16 08.8	-18 42.6
6	02 58.9	+12 36.6	06 10.9	+22 57.1	07 45.6	+22 52.3	11 17.0	+09 52.2	13 40.4	-05 27.3	17 08.8	-21 55.9
7	03 48.4	+16 32.8	07 11.0	+23 13.3	08 46.2	+20 49.4	12 13.3	+04 01.5	14 36.7	-11 12.9	18 09.6	-23 43.8
8	04 41.2	+19 48.4	08 12.5	+22 00.9	09 46.5	+17 21.9	13 09.3	-02 06.9	15 34.6	-16 15.6	19 09.8	-24 02.0
9	05 37.5	+22 06.7	09 14.0	+19 19.3	10 45.6	+12 42.2	14 05.6	-08 07.1	16 34.0	-20 13.3	20 07.9	-22 55.6
10	06 36.8	+23 11.7	10 14.1	+15 18.9	11 43.2	+07 10.3	15 02.7	-13 33.5	17 34.5	-22 50.0	21 02.9	-20 37.3
11	07 37.9	+22 51.3	11 12.0	+10 18.5	12 39.5	+01 11.1	16 00.8	-18 03.9	18 34.7	-23 58.3	21 54.4	-17 22.6
12	08 39.2	+21 02.1	12 08.0	+04 41.5	13 35.1	-04 49.5	16 59.7	-21 21.6	19 33.2	-23 40.2	22 42.8	-13 26.7
13	09 39.1	+17 50.8	13 02.3	-01 07.9	14 30.6	-10 27.0	17 58.6	-23 17.3	20 29.0	-22 05.5	23 28.6	-09 02.9
14	10 36.8	+13 32.8	13 55.9	-06 47.5	15 26.5	-15 20.4	18 56.5	-23 49.5	21 21.6	-19 27.6	00 12.8	-04 22.1
15	11 32.1	+08 28.0	14 49.5	-11 57.8	16 23.0	-19 13.5	19 52.5	-23 03.5	22 11.1	-16 00.8	00 56.1	+00 26.6
16	12 25.5	+02 57.6	15 43.6	-16 22.9	17 19.9	-21 55.2	20 45.9	-21 09.2	22 57.8	-11 58.2	01 39.4	+05 14.5
17	13 17.8	-02 38.4	16 38.5	-19 49.7	18 16.7	-23 20.0	21 36.5	-18 18.6	23 42.5	-07 31.0	02 23.8	+09 53.1
18	14 09.8	-08 01.8	17 34.1	-22 08.9	19 12.5	-23 28.1	22 24.4	-14 43.9	00 26.1	-02 48.7	03 10.0	+14 12.4
19	15 02.4	-12 56.1	18 29.9	-23 14.9	20 06.7	-22 24.3	23 10.1	-10 36.4	01 09.3	+01 59.7	03 58.7	+18 00.8
20	15 56.0	-17 06.2	19 25.1	-23 07.2	20 58.7	-20 17.3	23 54.3	-06 06.4	01 52.9	+06 45.4	04 50.2	+21 04.8
21	16 51.0	-20 18.9	20 18.9	-21 49.9	21 48.3	-17 17.4	00 37.7	-01 23.3	02 37.9	+11 18.8	05 44.7	+23 10.3
22	17 47.1	-22 23.5	21 10.6	-19 31.1	22 35.6	-13 35.9	01 21.1	+03 23.6	03 24.8	+15 29.0	06 41.5	+24 04.3
23	18 43.4	-23 14.0	22 00.0	-16 21.4	23 21.1	-09 23.8	02 05.0	+08 04.8	04 14.1	+19 03.7	07 39.6	+23 38.2
24	19 39.1	-22 49.7	22 47.2	-12 32.6	00 05.2	-04 51.5	02 50.3	+12 30.2	05 06.2	+21 49.4	08 37.6	+21 49.9
25	20 33.1	-21 16.0	23 32.5	-08 16.0	00 48.6	-00 08.9	03 37.6	+16 28.6	06 00.8	+23 33.3	09 34.6	+18 45.0
26	21 24.7	-18 42.6	00 16.5	-03 42.4	01 32.0	+04 34.4	04 27.2	+19 48.1	06 57.2	+24 04.5	10 29.7	+14 35.2
27	22 13.8	-15 21.4	00 59.9	+00 58.4	02 16.2	+09 09.0	05 19.3	+22 16.3	07 54.4	+23 17.1	11 23.2	+09 35.8
28	23 00.6	-11 24.8	01 43.4	+05 37.4	03 01.7	+13 24.9	06 13.9	+23 41.2	08 51.4	+21 10.8	12 15.4	+04 04.1
29	23 45.5	-07 04.2	02 27.8	+10 05.5	03 49.2	+17 11.4	07 10.1	+23 53.3	09 47.3	+17 51.6	13 07.3	-01 42.1
30	00 29.3	-02 29.6			04 39.3	+20 17.2	08 07.3	+22 47.1	10 41.8	+13 30.3	13 59.6	-07 24.5
31	01 12.7	+02 10.1			05 32.1	+22 29.9			11 35.2	+08 20.9		
	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
1	14 53.4	-12 43.9	18 28.3	-24 00.6	21 54.1	-17 18.8	00 01.8	-05 14.6	02 45.6	+12 43.1	04 57.9	+22 18.2
2	15 49.2	-17 20.6	19 26.7	-23 51.1	22 42.7	-13 17.1	00 45.3	-00 19.1	03 31.8	+16 48.1	05 50.7	+24 11.0
3	16 47.1	-20 55.7	20 23.5	-22 22.0	23 29.0	-08 45.8	01 28.6	+04 35.7	04 20.2	+20 14.3	06 45.4	+24 54.3
4	17 46.7	-23 13.6	21 17.7	-19 44.1	00 13.6	-03 57.6	02 12.3	+09 19.8	05 10.9	+22 50.0	07 40.9	+24 21.8
5	18 46.8	-24 05.1	22 08.8	-16 12.1	00 57.2	+00 56.7	02 57.2	+13 43.6	06 03.8	+24 24.7	08 36.2	+22 32.7
6	19 45.7	-23 30.1	22 57.0	-12 01.1	01 40.5	+05 47.0	03 43.7	+17 36.9	06 58.3	+24 49.3	09 30.6	+19 31.4
7	20 42.3	-21 36.9	23 42.9	-07 25.1	02 24.5	+10 24.0	04 32.5	+20 49.1	07 53.7	+23 58.5	10 23.8	+15 26.4
8	21 35.7	-18 39.5	00 27.1	-02 36.1	03 09.8	+14 38.6	05 23.8	+23 09.2	08 49.1	+21 51.0	11 15.8	+10 29.3
9	22 25.8	-14 54.0	01 10.5	+02 15.7	03 57.1	+18 20.9	06 17.4	+24 26.3	09 43.9	+18 30.6	12 07.2	+04 54.1
10	23 12.9	-10 35.3	01 54.0	+07 01.3	04 47.0	+21 19.9	07 12.9	+23 31.1	10 37.9	+14 05.1	12 58.9	-01 03.6
11	23 58.0	-05 56.3	02 38.5	+11 32.0	05 39.7	+23 23.8	08 09.4	+23 17.4	11 31.3	+08 46.5	13 51.9	-07 05.0
12	00 41.7	-01 07.5	03 24.7	+15 38.6	06 35.1	+24 20.4	09 06.2	+20 43.7	12 24.6	+02 50.2	14 47.1	-12 48.5
13	01 25.0	+03 42.0	04 13.3	+19 10.4	07 32.4	+23 59.5	10 02.6	+16 54.1	13 18.7	-03 24.0	15 45.1	-17 49.6
14	02 08.8	+08 24.0	05 05.0	+21 55.3	08 30.8	+22 14.9	10 58.3	+11 58.7	14 14.3	-09 32.7	16 46.1	-21 43.2
15	02 54.0	+12 49.4	05 59.7	+23 39.4	09 29.2	+19 07.3	11 53.5	+06 13.3	15 12.3	-15 09.2	17 49.3	-24 08.5
16	03 41.5	+16 48.1	06 57.1	+24 10.0	10 26.7	+14 44.7	12 48.6	-00 01.2	16 12.7	-19 46.6	18 52.8	-24 54.2
17	04 31.8	+20 07.9	07 56.1	+23 17.3	11 23.1	+09 22.8	13 44.3	-06 20.0	17 15.2	-23 01.8	19 54.6	-24 01.7
18	05 25.3	+22 34.9	08 55.4	+20 58.5	12 18.6	+03 22.6	14 41.3	-12 16.3	18 18.2	-24 40.7	20 53.1	-21 44.1
19	06 21.6	+23 54.7	09 53.9	+17 19.4	13 13.6	-02 51.4	15 40.0	-17 23.6	19 20.1	-24 41.1	21 47.5	-18 20.5
20	07 20.1	+23 55.6	10 50.8	+12 33.7	14 09.0	-08 53.9	16 40.4	-21 19.2	20 19.2	-23 12.2	22 37.9	-14 10.3
21	08 19.2	+22 31.6	11 46.1	+07 01.1	15 05.2	-14 20.6	17 41.6	-23 47.8	21 14.6	-20 30.1	23 25.1	-09 30.6
22	09 17.8	+19 44.9	12 40.1	+01 03.9	16 02.8	-18 50.4	18 42.4	-24 43.4	22 06.0	-16 52.9	00 09.9	-04 35.0
23	10 14.7	+15 45.9	13 33.7	-04 55.0	17 01.4	-22 07.1	19 41.4	-24 09.4	22 54.1	-12 37.0	00 53.4	+00 25.9
24	11 09.7	+10 50.9	14 27.5	-10 34.0	18 00.6	-24 00.4	20 37.5	-22 17.0	23 39.6	-07 56.2	01 36.5	+05 23.0
25	12 03.1	+05 19.3	15 22.3	-15 33.4	18 59.1	-24 27.6	21 30.2	-19 20.6	00 23.3	-03 01.7	02 20.2	+10 07.9
26	12 55.4	-00 29.0	16 18.5	-19 35.8	19 56.1	-23 32.8	22 19.6	-15 35.4	01 06.4	+01 56.9	03 05.3	+14 31.4
27	13 47.7	-06 14.5	17 16.0	-22 27.6	20 50.5	-21 25.7	23 06.4	-11 15.3	01 49.5	+06 50.7	03 52.6	+18 23.3
28	14 40.7	-11 38.3	18 14.3	-23 59.6	21 42.0	-18 18.9	23 51.1	-06 32.3	02 33.6	+11 30.4	04 42.5	+21 31.8
29	15 35.1	-16 22.3	19 12.2	-24 08.5	22 30.8	-14 26.1	00 34.6	-01 37.2	03 19.4	+15 45.9	05 35.0	+23 44.2
30	16 31.4	-20 09.7	20 08.6	-22 58.0	23 17.2	-10 00.6	01 17.6	+03 20.2	04 07.4	+19 25.8	06 29.8	+24 48.7
31	17 29.4	-22 45.8	21 02.7	-20 37.1	00 01.8	-05 14.6	02 01.1	+08 10.3	04 57.9	+22 18.2	07 26.0	+24 36.8

GEOCENTRIC POSITION OF PLANETS (& Pluto) (0hr UT, Epoch 2000.0)

	MERCURY		VENUS		MARS		JUPITER		SATURN		URANUS		NEPTUNE		PLUTO	
	RA	Dec	RA	Dec	RA	Dec	RA	Dec	RA	Dec	RA	Dec	RA	Dec	RA	Dec
	h m s	° ' "	h m s	° ' "	h m s	° ' "	h m s	° ' "	h m s	° ' "	h m s	° ' "	h m s	° ' "	h m s	° ' "
Jan 4	18 39.0	-24 39.3	21 23.3	-17 12.7	15 52.1	-19 51.1	18 30.9	-23 09.8	19 32.8	-21 40.5	02 01.5	+11 50.5	23 10.3	-06 26.8	19 36.4	-22 15.2
11	19 28.5	-23 50.7	21 56.7	-14 18.8	16 11.8	-20 50.9	18 37.8	-23 04.7	19 36.3	-21 33.1	02 01.4	+11 50.2	23 10.8	-06 23.0	19 37.4	-22 13.5
18	20 18.2	-21 48.3	22 29.0	-11 06.9	16 31.8	-21 42.5	18 44.7	-22 58.5	19 39.9	-21 25.4	02 01.5	+11 50.9	23 11.5	-06 18.7	19 38.5	-22 11.8
25	21 07.3	-18 30.3	23 00.2	-07 41.5	16 52.1	-22 25.3	18 51.5	-22 51.4	19 43.3	-21 17.4	02 01.7	+11 52.4	23 12.2	-06 13.9	19 39.5	-22 10.2
Feb 1	21 53.6	-14 04.8	23 30.7	-04 07.1	17 12.7	-22 58.9	18 58.2	-22 43.3	19 46.8	-21 09.3	02 02.1	+11 54.8	23 13.0	-06 08.7	19 40.4	-22 08.5
8	22 31.9	-09 07.6	00 00.5	-00 28.0	17 33.4	-23 22.8	19 04.7	-22 34.5	19 50.2	-21 01.2	02 02.7	+11 58.0	23 13.9	-06 03.2	19 41.4	-22 06.9
15	22 51.6	-05 11.8	00 29.8	+03 11.7	17 54.4	-23 36.7	19 10.9	-22 25.0	19 53.4	-20 53.0	02 03.4	+12 02.0	23 14.8	-05 57.4	19 42.3	-22 05.5
22	22 43.1	-04 24.4	00 58.7	+06 48.0	18 15.4	-23 40.5	19 16.9	-22 15.1	19 56.6	-20 45.0	02 04.3	+12 06.8	23 15.7	-05 51.5	19 43.1	-22 04.1
29	22 16.6	-06 54.7	01 27.5	+10 17.1	18 36.5	-23 34.0	19 22.7	-22 05.0	19 59.5	-20 37.2	02 05.2	+12 12.2	23 16.7	-05 45.4	19 43.9	-22 02.9
Mar 7	21 59.4	-09 54.2	01 56.2	+13 35.3	18 57.5	-23 17.4	19 28.0	-21 54.7	20 02.3	-20 29.7	02 06.4	+12 18.2	23 17.7	-05 39.2	19 44.7	-22 01.9
14	22 02.4	-11 22.4	02 24.6	+16 38.8	19 18.5	-22 50.8	19 33.1	-21 44.7	20 04.9	-20 22.7	02 07.6	+12 24.7	23 18.7	-05 33.0	19 45.3	-22 01.1
21	22 21.0	-11 07.3	02 52.9	+19 24.4	19 39.4	-22 14.5	19 37.7	-21 34.9	20 07.3	-20 16.2	02 08.9	+12 31.7	23 19.7	-05 26.9	19 45.9	-22 00.4
28	22 49.2	-09 24.9	03 20.7	+21 49.4	20 00.1	-21 28.9	19 41.9	-21 25.8	20 09.4	-20 10.4	02 10.3	+12 39.1	23 20.6	-05 21.0	19 46.3	-22 00.1
Apr 4	23 23.4	-06 29.9	03 47.7	+23 51.3	20 20.6	-20 34.5	19 45.6	-21 17.5	20 11.2	-20 05.3	02 11.7	+12 46.8	23 21.5	-05 15.2	19 46.7	-22 00.0
11	00 01.8	-02 32.7	04 13.2	+25 28.4	20 40.9	-19 32.0	19 48.8	-21 10.2	20 12.7	-20 01.1	02 13.2	+12 54.6	23 22.4	-05 09.8	19 47.0	-22 00.1
18	00 44.4	+02 17.6	04 36.4	+26 40.0	21 00.8	-18 22.0	19 51.5	-21 04.1	20 14.0	-19 57.8	02 14.7	+13 02.6	23 23.3	-05 04.6	19 47.1	-22 00.5
25	01 31.7	+07 50.0	04 56.3	+27 26.0	21 20.5	-17 05.3	19 53.6	-20 59.5	20 14.9	-19 55.4	02 16.3	+13 10.6	23 24.0	-04 59.9	19 47.2	-22 01.2
May 2	02 24.8	+13 43.4	05 11.5	+27 46.6	21 39.9	-15 42.9	19 55.1	-20 56.6	20 15.5	-19 54.2	02 17.9	+13 18.6	23 24.8	-04 55.5	19 47.2	-22 02.1
9	03 23.7	+19 13.9	05 20.4	+27 41.1	21 58.9	-14 15.5	19 55.9	-20 55.3	20 15.8	-19 54.0	02 19.4	+13 26.4	23 25.4	-04 51.7	19 47.0	-22 03.2
16	04 24.4	+23 18.6	05 21.5	+27 07.1	22 17.5	-12 44.2	19 56.1	-20 55.8	20 15.7	-19 54.8	02 20.9	+13 34.1	23 26.0	-04 48.4	19 46.8	-22 04.6
23	05 20.1	+25 20.9	05 14.1	+26 00.1	22 35.8	-11 09.8	19 55.7	-20 58.2	20 15.3	-19 56.7	02 22.4	+13 41.5	23 26.4	-04 45.7	19 46.5	-22 06.3
30	06 06.1	+25 33.0	04 59.5	+24 17.8	22 53.8	-09 33.5	19 54.6	-21 02.3	20 14.6	-19 59.7	02 23.8	+13 48.6	23 26.8	-04 43.5	19 46.1	-22 08.1
Jun 6	06 39.5	+24 28.5	04 41.6	+22 09.9	23 11.3	-07 56.2	19 52.9	-21 08.1	20 13.6	-20 03.6	02 25.2	+13 55.3	23 27.1	-04 42.0	19 45.6	-22 10.1
13	06 58.5	+22 42.5	04 26.1	+20 02.4	23 28.5	-06 19.0	19 50.6	-21 15.3	20 12.4	-20 08.3	02 26.5	+14 01.6	23 27.3	-04 41.1	19 45.1	-22 12.2
20	07 01.5	+20 47.2	04 16.9	+18 23.5	23 45.2	-04 43.0	19 47.8	-21 23.7	20 10.8	-20 13.8	02 27.7	+14 07.3	23 27.4	-04 40.8	19 44.5	-22 14.5
27	06 50.2	+19 13.3	04 15.6	+17 26.6	00 01.4	-03 09.3	19 44.6	-21 33.0	20 09.1	-20 19.8	02 28.8	+14 12.5	23 27.4	-04 41.1	19 43.8	-22 16.8
Jul 4	06 32.8	+18 28.6	04 21.4	+17 09.8	00 17.0	-01 38.9	19 41.1	-21 42.8	20 07.1	-20 26.4	02 29.7	+14 17.1	23 27.3	-04 42.1	19 43.1	-22 19.2
11	06 22.3	+18 46.7	04 33.2	+17 23.4	00 32.1	-00 12.8	19 37.3	-21 52.7	20 05.1	-20 33.2	02 30.6	+14 21.0	23 27.1	-04 43.6	19 42.4	-22 21.6
18	06 28.2	+19 53.3	04 49.9	+17 55.9	00 46.3	+01 07.9	19 33.5	-22 02.3	20 03.0	-20 40.1	02 31.3	+14 24.3	23 26.8	-04 45.8	19 41.7	-22 24.0
25	06 53.3	+21 07.1	05 10.5	+18 36.6	00 59.7	+02 22.0	19 29.7	-22 11.5	20 00.8	-20 46.9	02 31.8	+14 26.9	23 26.5	-04 48.4	19 41.0	-22 26.4
Aug 1	07 36.3	+21 29.3	05 34.1	+19 16.3	01 12.0	+03 28.7	19 26.2	-22 19.8	19 58.7	-20 53.6	02 32.2	+14 28.7	23 26.0	-04 51.5	19 40.3	-22 28.6
8	08 31.7	+20 02.7	06 00.2	+19 48.0	01 23.0	+04 27.1	19 22.9	-22 27.1	19 56.6	-20 59.9	02 32.5	+14 29.7	23 25.5	-04 55.1	19 39.7	-22 30.8
15	09 30.1	+16 34.8	06 28.3	+20 05.7	01 32.6	+05 16.2	19 20.1	-22 33.2	19 54.7	-21 05.7	02 32.6	+14 30.1	23 24.9	-04 59.0	19 39.0	-22 32.8
22	10 24.1	+11 47.0	06 58.0	+20 04.8	01 40.2	+05 55.1	19 17.7	-22 38.2	19 53.0	-21 10.9	02 32.5	+14 29.6	23 24.3	-05 03.2	19 38.5	-22 34.7
29	11 12.1	+06 26.7	07 28.8	+19 42.1	01 45.8	+06 23.2	19 16.0	-22 41.9	19 51.4	-21 15.4	02 32.3	+14 28.4	23 23.6	-05 07.6	19 38.0	-22 36.4
Sep 5	11 54.8	+01 03.9	08 00.3	+18 55.7	01 48.9	+06 40.0	19 14.9	-22 44.2	19 50.2	-21 19.2	02 31.9	+14 26.5	23 22.9	-05 12.2	19 37.5	-22 37.9
12	12 33.6	-04 04.4	08 32.3	+17 44.7	01 49.4	+06 45.4	19 14.5	-22 45.4	19 49.2	-21 22.1	02 31.4	+14 23.9	23 22.2	-05 16.8	19 37.2	-22 39.1
19	13 09.2	-08 47.4	09 04.4	+16 09.4	01 47.1	+06 39.4	19 14.7	-22 45.3	19 48.6	-21 24.2	02 30.7	+14 20.7	23 21.5	-05 21.4	19 36.9	-22 40.2
26	13 41.5	-12 54.4	09 36.5	+14 11.3	01 42.1	+06 23.7	19 15.6	-22 43.9	19 48.3	-21 25.4	02 29.9	+14 16.9	23 20.8	-05 25.8	19 36.8	-22 41.0
Oct 3	14 09.0	-16 10.7	10 08.4	+11 52.4	01 35.0	+06 00.9	19 17.2	-22 41.3	19 48.3	-21 25.7	02 29.0	+14 12.5	23 20.2	-05 30.0	19 36.7	-22 41.6
10	14 27.7	-18 09.8	10 40.2	+09 15.3	01 26.4	+05 34.8	19 19.4	-22 37.4	19 48.6	-21 25.1	02 28.1	+14 07.7	23 19.5	-05 34.0	19 36.7	-22 41.9
17	14 29.5	-17 59.0	11 11.7	+06 23.3	01 17.5	+05 09.9	19 22.2	-22 32.2	19 49.3	-21 23.6	02 27.0	+14 02.6	23 18.9	-05 37.6	19 36.9	-22 42.0
24	14 07.8	-14 31.1	11 43.1	+03 19.9	01 09.3	+04 51.3	19 25.6	-22 25.7	19 50.4	-21 21.2	02 25.9	+13 57.2	23 18.4	-05 40.7	19 37.1	-22 41.8
31	13 41.2	-09 38.2	12 14.5	+00 09.1	01 02.7	+04 42.8	19 29.5	-22 17.8	19 51.7	-21 18.0	02 24.8	+13 51.8	23 18.0	-05 43.4	19 37.5	-22 41.5
Nov 7	13 41.6	-08 15.6	12 46.1	-03 05.4	00 58.3	+04 46.6	19 33.8	-22 08.5	19 53.4	-21 13.8	02 23.7	+13 46.3	23 17.6	-05 45.5	19 37.9	-22 40.8
14	14 07.3	-10 30.8	13 18.0	-06 19.4	00 56.4	+05 03.1	19 38.6	-21 57.8	19 55.4	-21 08.8	02 22.6	+13 40.9	23 17.4	-05 47.0	19 38.4	-22 40.0
21	14 44.5	-14 09.0	13 50.5	-09 28.5	00 57.0	+05 32.0	19 43.8	-21 45.6	19 57.6	-21 03.0	02 21.5	+13 35.7	23 17.2	-05 47.9	19 39.1	-22 39.0
28	15 26.5	-17 49.8	14 23.6	-12 28.3	01 00.0	+06 12.3	19 49.3	-21 32.0	20 00.1	-20 56.4	02 20.5	+13 30.9	23 17.1	-05 48.1	19 39.8	-22 37.8
Dec 5	16 10.9	-20 59.1	14 57.6	-15 14.3	01 05.0	+07 02.1	19 55.1	-21 16.8	20 02.8	-20 49.0	02 19.6	+13 26.6	23 17.1	-05 47.7	19 40.5	-22 36.4
12	16 57.2	-23 20.8	15 32.5	-17 42.0	01 11.8	+07 59.7	20 01.2	-21 00.1	20 05.6	-20 40.9	02 18.8	+13 22.8	23 17.3	-05 46.6	19 41.4	-22 34.9
19	17 45.1	-24 45.0	16 08.4	-19 46.9	01 20.2	+09 03.7	20 07.5	-20 42.0	20 08.7	-20 32.1	02 18.2	+13 19.6	23 17.5	-05 44.9	19 42.3	-22 33.3
26	18 34.2	-25 03.9	16 45.1	-21 24.9	01 29.9	+10 12.6	20 13.9	-20 22.5	20 11.9	-20 22.7	02 17.7	+13 17.2	23 17.9	-05 42.5	19 43.2	-22 31.5

RISE and SET times for DARWIN (CST)

	SUN				MERCURY		VENUS		MARS		JUPITER		SATURN		URANUS		NEPTUNE		PLUTO		
	Twi Beg	Rise	Set	Twi End	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	
Jan	4	05:08	06:27	19:17	20:35	06:09	19:02	09:01	21:37	03:28	16:08	06:03	18:50	07:07	19:50	14:05	01:50	10:58	23:12	07:10	19:54
	11	05:13	06:31	19:19	20:36	06:32	19:23	09:10	21:40	03:19	16:02	05:43	18:29	06:43	19:26	13:37	01:23	10:31	22:45	06:43	19:27
	18	05:17	06:34	19:20	20:37	06:56	19:43	09:17	21:42	03:10	15:55	05:22	18:08	06:19	19:01	13:10	00:55	10:04	22:18	06:17	19:01
	25	05:22	06:38	19:20	20:36	07:21	20:01	09:24	21:42	03:02	15:48	05:01	17:47	05:55	18:37	12:43	00:28	09:37	21:51	05:50	18:34
Feb	1	05:26	06:41	19:20	20:35	07:44	20:15	09:30	21:42	02:55	15:42	04:41	17:26	05:31	18:13	12:15	23:57	09:11	21:24	05:24	18:08
	8	05:30	06:44	19:18	20:32	07:59	20:20	09:36	21:41	02:47	15:36	04:20	17:05	05:07	17:49	11:49	23:30	08:44	20:57	04:57	17:41
	15	05:33	06:46	19:16	20:29	07:55	20:07	09:41	21:39	02:40	15:29	03:59	16:44	04:43	17:24	11:22	23:03	08:18	20:31	04:31	17:14
	22	05:36	06:48	19:13	20:25	07:20	19:29	09:45	21:37	02:34	15:23	03:37	16:22	04:19	17:00	10:55	22:36	07:51	20:04	04:04	16:48
	29	05:38	06:49	19:10	20:21	06:24	18:37	09:49	21:36	02:27	15:16	03:16	16:00	03:54	16:35	10:29	22:10	07:25	19:37	03:37	16:21
Mar	7	05:39	06:50	19:06	20:17	05:37	17:56	09:53	21:34	02:21	15:09	02:54	15:38	03:29	16:10	10:02	21:43	06:58	19:11	03:10	15:54
	14	05:40	06:51	19:02	20:12	05:10	17:34	09:57	21:32	02:15	15:02	02:31	15:15	03:05	15:45	09:36	21:17	06:32	18:44	02:44	15:27
	21	05:41	06:51	18:57	20:07	05:01	17:25	10:01	21:30	02:09	14:55	02:09	14:52	02:40	15:20	09:10	20:50	06:05	18:17	02:17	15:00
	28	05:41	06:51	18:53	20:03	05:03	17:25	10:03	21:28	02:03	14:47	01:46	14:28	02:14	14:54	08:44	20:24	05:39	17:51	01:50	14:33
Apr	4	05:41	06:52	18:48	19:59	05:12	17:29	10:05	21:25	01:57	14:39	01:22	14:04	01:49	14:28	08:18	19:58	05:12	17:24	01:22	14:06
	11	05:41	06:52	18:44	19:55	05:26	17:36	10:04	21:21	01:50	14:30	00:58	13:40	01:23	14:02	07:52	19:32	04:46	16:57	00:55	13:39
	18	05:41	06:53	18:40	19:51	05:46	17:47	10:01	21:15	01:44	14:22	00:33	13:15	00:57	13:36	07:26	19:06	04:19	16:31	00:28	13:11
	25	05:42	06:53	18:37	19:48	06:10	18:02	09:54	21:06	01:37	14:12	00:08	12:49	00:30	13:09	07:00	18:40	03:53	16:04	23:56	12:44
May	2	05:42	06:54	18:34	19:46	06:41	18:23	09:42	20:53	01:30	14:03	23:38	12:23	23:59	12:42	06:35	18:14	03:26	15:37	23:29	12:16
	9	05:43	06:56	18:31	19:44	07:18	18:49	09:24	20:34	01:23	13:53	23:11	11:56	23:32	12:15	06:09	17:47	02:59	15:10	23:01	11:49
	16	05:43	06:57	18:29	19:43	07:55	19:18	08:56	20:08	01:16	13:42	22:44	11:29	23:04	11:48	05:43	17:21	02:32	14:43	22:33	11:21
	23	05:45	06:59	18:28	19:43	08:25	19:44	08:20	19:34	01:08	13:32	22:16	11:01	22:36	11:20	05:17	16:55	02:05	14:16	22:05	10:53
	30	05:46	07:01	18:28	19:43	08:44	20:02	07:37	18:53	01:00	13:21	21:47	10:33	22:08	10:52	04:51	16:29	01:38	13:49	21:38	10:25
Jun	6	05:48	07:03	18:28	19:44	08:49	20:08	06:49	18:10	00:51	13:09	21:18	10:04	21:40	10:23	04:25	16:03	01:11	13:22	21:10	09:57
	13	05:49	07:05	18:29	19:45	08:38	20:00	06:04	17:29	00:42	12:57	20:48	09:34	21:11	09:54	03:59	15:36	00:43	12:54	20:41	09:29
	20	05:51	07:07	18:31	19:47	08:12	19:37	05:26	16:55	00:33	12:45	20:17	09:04	20:41	09:25	03:32	15:10	00:16	12:27	20:13	09:01
	27	05:52	07:08	18:32	19:48	07:32	18:59	04:56	16:27	00:23	12:32	19:46	08:33	20:12	08:56	03:06	14:43	23:45	11:59	19:45	08:33
Jul	4	05:53	07:09	18:34	19:50	06:46	18:15	04:33	16:06	00:12	12:19	19:15	08:02	19:43	08:27	02:40	14:17	23:17	11:32	19:17	08:05
	11	05:54	07:09	18:36	19:51	06:08	17:37	04:18	15:50	23:59	12:05	18:44	07:31	19:13	07:58	02:13	13:50	22:49	11:04	18:49	07:37
	18	05:54	07:09	18:38	19:52	05:47	17:15	04:07	15:39	23:47	11:50	18:12	07:00	18:43	07:28	01:46	13:23	22:21	10:36	18:20	07:09
	25	05:54	07:08	18:39	19:53	05:46	17:12	04:01	15:31	23:34	11:35	17:41	06:29	18:13	06:58	01:19	12:56	21:53	10:08	17:52	06:40
Aug	1	05:53	07:06	18:41	19:54	06:01	17:28	03:57	15:27	23:19	11:19	17:10	05:58	17:44	06:29	00:52	12:29	21:25	09:40	17:24	06:12
	8	05:51	07:04	18:42	19:54	06:27	17:58	03:56	15:25	23:04	11:01	16:39	05:27	17:14	05:59	00:25	12:02	20:57	09:12	16:56	05:44
	15	05:49	07:01	18:43	19:55	06:55	18:32	03:57	15:25	22:46	10:43	16:08	04:57	16:44	05:30	23:54	11:34	20:29	08:44	16:27	05:16
	22	05:46	06:57	18:43	19:54	07:17	19:03	03:59	15:27	22:27	10:22	15:38	04:27	16:15	05:01	23:26	11:07	20:01	08:16	15:59	04:48
	29	05:42	06:53	18:43	19:54	07:33	19:28	04:02	15:31	22:05	10:00	15:09	03:58	15:46	04:32	22:58	10:39	19:33	07:48	15:31	04:20
Sep	5	05:38	06:48	18:43	19:54	07:43	19:47	04:05	15:36	21:41	09:35	14:40	03:30	15:17	04:03	22:30	10:11	19:04	07:20	15:03	03:52
	12	05:33	06:44	18:43	19:54	07:50	20:03	04:08	15:41	21:13	09:08	14:13	03:02	14:49	03:35	22:02	09:43	18:36	06:52	14:35	03:24
	19	05:28	06:39	18:43	19:53	07:54	20:15	04:11	15:47	20:43	08:38	13:45	02:34	14:20	03:07	21:34	09:15	18:08	06:24	14:08	02:56
	26	05:23	06:34	18:43	19:53	07:55	20:23	04:14	15:54	20:10	08:06	13:19	02:08	13:53	02:39	21:06	08:47	17:40	05:56	13:40	02:29
Oct	3	05:18	06:29	18:43	19:54	07:52	20:26	04:16	16:00	19:35	07:32	12:53	01:42	13:25	02:11	20:37	08:18	17:11	05:27	13:12	02:01
	10	05:14	06:25	18:43	19:55	07:41	20:18	04:18	16:07	18:59	06:56	12:28	01:16	12:58	01:44	20:09	07:50	16:43	04:59	12:45	01:34
	17	05:09	06:21	18:44	19:56	07:16	19:50	04:19	16:13	18:22	06:20	12:03	00:51	12:31	01:17	19:40	07:21	16:15	04:31	12:17	01:06
	24	05:05	06:17	18:45	19:58	06:30	18:57	04:20	16:20	17:46	05:45	11:39	00:27	12:05	00:51	19:11	06:53	15:47	04:03	11:50	00:39
	31	05:01	06:14	18:47	20:01	05:40	17:59	04:21	16:26	17:12	05:11	11:15	00:00	11:39	00:25	18:43	06:24	15:19	03:35	11:23	00:12
Nov	7	04:58	06:12	18:49	20:04	05:14	17:32	04:22	16:33	16:41	04:39	10:52	23:37	11:13	23:55	18:14	05:56	14:51	03:08	10:56	23:41
	14	04:56	06:11	18:52	20:07	05:09	17:33	04:24	16:40	16:11	04:09	10:30	23:14	10:47	23:29	17:45	05:27	14:23	02:40	10:29	23:14
	21	04:55	06:11	18:55	20:12	05:15	17:47	04:26	16:48	15:45	03:42	10:08	22:51	10:22	23:04	17:16	04:59	13:55	02:12	10:02	22:47
	28	04:54	06:12	18:59	20:16	05:26	18:05	04:29	16:56	15:21	03:16	09:46	22:29	09:57	22:39	16:48	04:30	13:28	01:44	09:35	22:20
Dec	5	04:55	06:13	19:02	20:20	05:40	18:25	04:32	17:05	14:59	02:53	09:24	22:07	09:32	22:14	16:19	04:02	13:00	01:17	09:08	21:53
	12	04:57	06:15	19:06	20:25	05:56	18:46	04:37	17:15	14:40	02:31	09:03	21:45	09:08	21:49	15:51	03:34	12:33	00:50	08:42	21:27
	19	05:00	06:19	19:10	20:29	06:15	19:08	04:44	17:26	14:21	02:11	08:42	21:23	08:44	21:24	15:23	03:06	12:06	00:22	08:15	21:00
	26	05:03	06:22	19:13	20:32	06:36	19:30	04:51	17:36	14:05	01:52	08:21	21:02	08:19	21:00	14:55	02:38	11:39	23:51	07:49	20:33

LUNAR OCCULTATIONS for DARWIN (12° 23' S, 130° 44' E)

INTRODUCTION From month to month the Moon does not occult the same stars. In fact over a number of years it drifts in declination between plus and minus 28°. The brighter stars that the Moon occults are listed in the Zodiacal Catalogue (ZC). There are about 3500 stars in the ZC.

The Moon moves from west to east, so it rises and sets later each day. From just after New Moon to just before Full Moon, stars being occulted disappear behind part of the dark limb and reappear from the bright limb. The limb is another term for the edge of the Moon. After Full Moon a star disappears on the bright limb and reappears on the dark limb. There is no dark limb at Full Moon.

Dark limb events, in particular disappearances, are the easiest to observe. Following a star until it *winks out* is much easier than scanning the lunar limb, waiting for it to suddenly reappear. The brighter the star, the more spectacular the event. The table here present the easier to observe occultations for this year as predicted. Both events, the disappearance and reappearance, are not necessarily included. An event may not be present because:

1. The Moon is in daylight.
2. The Moon is too close to or below the horizon.
3. For faint stars, events on a bright limb (in particular reappearances) are difficult to observe and have been omitted.

TELESCOPE REQUIREMENTS. These vary greatly with the brightness of the star being observed, the brightness of the Moon (how close to Full Moon) and whether the event is on a bright or dark limb. Disappearances of first magnitude stars on the dark limb can be observed with the naked eye.

www.lunar-occultations.com/iota/iotandx.htm
www.occultations.org.nz

The faintest stars, which have occultation predictions, are about 6.5 magnitude. The criteria for selection are complex involving the Sun and Moon altitude, star magnitude and whether it is a bright or dark limb event.

CST the date and time of the occultation, hr and min are in CST
OBJECT n, nn, nnn, nnnn ZC catalogue number
 ggg ccc Greek letter and constellation abbreviation
 n ccc Flamsteed number and constellation
 name of planet, satellite or deep sky object.

PD event, consisting of two letters.
 The first letter is the Event type: D = Disappearance and R = Reappearance. The 2nd letter represents: D = Dark limb, B = a bright limb event. G indicates a graze at or near the location. M means a miss with a graze nearby.

Mag magnitude of the star.
Elg elongation or separation of the Moon from the Sun as measured in degrees.

Alt altitude of the Moon during the occultation.
PA position angle is the position the event occurs on the limb of the Moon (measured as degrees east of north).

A coefficient of longitude (see below)
B coefficient of latitude (see below)
 NB. For some stars, close to grazing, A and B values would be useless, and no values are shown.

CALCULATING EVENT TIME FOR OTHER LOCATIONS

Unless the event is close to a graze (PA is close to 0° or 180°) this method will give a good approximation for any location within about 500 km of this city. The predicted time at your location is given by:

$$\text{Predicted Time} = \text{Time from Table} + (A \times n) + (B \times p)$$

where *A* and *B* are taken from the table below and *n* and *p* are given by (convert to decimal degrees)

$$n = \text{your longitude} - \text{reference longitude}$$

$$p = \text{reference latitude} - \text{your latitude}$$

you need to preserve the signs of *n* and *p*, that is, whether they are positive or negative and it is best to use your closest city.

CST	Object	PD	Mag	Elg°	Alt°	PA°	A	B	CST	Object	PD	Mag	Elg°	Alt°	PA°	A	B	CST	Object	PD	Mag	Elg°	Alt°	PA°	A	B
Jan 01 21:50	3478	DD	6.4	71	29	5	-0.3	3.9	Mar 19 05:06	2921	DB	6.0	61	33	102	1.1	-0.9	Sep 03 05:27	Psi 2 Aqr	DD	4.4	172	28	347	-1.6	6.2
Jan 03 21:04	26 Cet	DD	6.1	93	57	102	3.7	-0.5	Apr 12 00:58	2394	RD	6.3	130	44	262	1.9	-0.1	Sep 03 05:49	Psi 2 Aqr	RD	4.4	172	23	310	2.4	-3.1
Jan 03 22:04	26 Cet	RB	6.1	93	43	188	0.5	4.1	Apr 14 00:40	2706	RD	5.8	105	15	310	-0.2	-1.6	Sep 21 20:32	32 Lib	DD	5.6	55	28	158	1.4	-3.0
Jan 04 00:16	29 Cet	DD	6.4	94	12	99	0.5	0.1	Apr 14 02:29	26 Sgr	RD	6.2	104	39	274	1.4	-0.6	Sep 21 21:10	32 Lib	RB	5.6	55	18	230	0.1	2.6
Jan 09 02:57	109 Tau	DD	5.0	153	22	58	1.6	1.7	Apr 15 02:58	53 Sgr	RD	6.4	92	33	262	1.3	-0.1	Sep 21 21:22	34 Lib	DD	5.8	56	16	100	0.5	0.1
Jan 09 21:25	3 Gem	DD	5.8	164	41	140	4.3	-4.5	Apr 15 03:08	2875	RD	6.0	92	35	263	1.4	-0.2	Sep 25 20:00	Chi Sgr	DD	5.0	107	78	110	3.4	-1.2
Jan 10 02:24	9 Gem	DD	6.2	165	38	27	3.9	5.6	May 03 00:06	46 Leo	DD	5.4	112	32	137	0.6	-1.1	Sep 25 21:26	Chi Sgr	RB	5.0	107	65	229	2.0	2.4
Jan 19 03:57	13 Lib	DB	5.8	73	33	121	0.7	-1.4	May 04 22:44	16 Vir	DD	5.0	139	73	187	-0.6	-4.8	Sep 27 01:21	2991	DD	6.1	120	26	131	2.5	-2.2
Jan 19 05:09	13 Lib	RD	5.8	73	50	302	1.4	-1.6	May 04 23:27	16 Vir	RB	5.0	139	67	251	4.3	1.8	Oct 01 03:14	3506	DD	6.1	166	41	90	2.0	0.5
Jan 20 02:49	Eta Lib	RD	5.4	61	6	312	-0.3	-1.5	May 08 06:00	Omi Lib	RD	6.1	174	19	250	0.4	1.3	Oct 02 20:37	29 Cet	RD	6.4	171	21	222	0.5	1.4
Jan 28 20:08	Psi 2 Aqr	DD	4.4	39	24	32	0.2	2.3	May 08 22:43	2316	RD	6.4	164	44	347	-0.2	-3.4	Oct 02 22:41	33 Cet	RD	6.0	171	50	226	1.5	1.6
Jan 28 21:04	Psi 2 Aqr	RB	4.4	39	10	271	0.3	0.4	May 10 23:13	1 Sgr	RD	5.0	137	25	252	1.1	0.2	Oct 21 19:49	9 Sgr	RB	5.9	63	46	296	2.2	-0.8
Feb 03 21:22	577	DD	6.0	106	52	123	3.8	-2.2	May 12 01:03	2811	RD	6.3	124	36	215	3.1	3.5	Oct 22 20:32	2790	DD	6.3	76	50	69	1.6	1.3
Feb 03 22:21	577	RB	6.0	106	42	197	2.1	4.5	May 12 06:31	49 Sgr	DB	5.5	122	64	95	2.8	0.0	Oct 28 02:52	3478	DD	6.4	137	17	6	-0.3	3.6
Feb 05 21:02	861	DD	6.4	130	54	129	4.1	-2.8	May 14 02:19	27 Cap	RD	6.3	99	30	187	3.6	9.4	Nov 05 01:28	132 Tau	DB	5.0	135	41	74	2.1	0.3
Feb 07 03:05	1050	DD	5.7	145	15	96	0.7	0.2	May 19 05:08	26 Cet	RD	6.1	43	15	281	0.8	-1.1	Nov 05 03:07	132 Tau	RD	5.0	135	52	252	3.1	0.8
Feb 07 23:59	82 Gem	DD	6.3	156	54	113	2.6	-0.9	May 29 18:59	Eta Leo	RB	3.5	80	60	279	3.0	-0.4	Nov 06 01:41	Eps Gem	DB	3.1	124	34	129	3.2	-2.7
Feb 08 20:30	Gam Cnc	RB	4.7	169	24	296	1.5	-1.3	Jun 05 20:24	2394	DD	6.3	176	30	112	0.6	-1.1	Nov 06 02:40	Eps Gem	RD	3.1	123	44	210	1.3	3.2
Feb 18 04:03	2509	RD	5.8	66	27	340	-0.5	-3.1	Jun 07 21:06	26 Sgr	RD	6.2	157	14	294	0.0	-1.1	Nov 11 04:19	Iot Leo	MD	3.9	61	19	23	9.9	9.9
Feb 27 21:00	89 Psc	DD	5.1	41	9	36	0.4	2.2	Jun 10 01:15	17 Cap	RD	5.9	130	45	285	1.7	-1.2	Nov 20 22:33	17 Cap	DD	5.9	70	19	10	-1.0	3.4
Feb 29 20:34	38 Ara	RB	5.2	63	31	292	1.7	-0.7	Jun 28 20:16	1813	DD	5.7	91	66	62	5.5	3.5	Nov 23 20:42	3413	RB	6.1	104	77	187	0.3	4.2
Mar 03 19:59	108 Tau	RB	6.3	97	54	279	3.4	-0.3	Jun 28 20:49	1813	RB	5.7	91	59	14	-1.5	-6.3	Nov 23 23:41	Psi 3 Aqr	DD	5.0	105	34	48	0.7	1.9
Mar 03 21:38	109 Tau	DD	5.0	97	42	154	1.4	-5.8	Jul 03 00:42	Psi Oph	DD	4.5	146	57	141	2.2	-2.4	Nov 24 00:49	Psi 3 Aqr	RB	5.0	105	18	247	0.4	1.2
Mar 03 22:12	109 Tau	RB	5.0	98	36	198	3.6	6.6	Jul 03 01:46	Psi Oph	RB	4.5	147	42	244	1.4	1.8	Dec 02 23:43	977	RD	6.4	155	36	225	1.1	1.6
Mar 04 21:32	8 Gem	DD	6.1	109	49	43	3.3	3.0	Jul 05 05:30	24 Sgr	DD	5.5	174	18	107	0.8	-0.2	Dec 04 00:22	57 Gem	DB	5.0	143	33	121	2.5	-1.9
Mar 04 21:44	9 Gem	DD	6.2	110	48	98	2.7	-0.1	Jul 06 01:53	49 Sgr	RD	5.5	174	76	284	3.2	-0.7	Dec 04 01:38	57 Gem	RD	5.0	143	45	231	2.3	1.7
Mar 05 20:11	48 Gem	RB	5.9	122	51	315	3.3	-2.7	Jul 31 20:57	4 Sgr	DD	4.7	141	69	114	2.4	-1.4	Dec 21 23:20	3506	DD	6.1	85	19	53	0.4	1.6
Mar 08 23:26	42 Leo	DD	6.2	163	61	169	0.9	-3.8	Jul 31 22:31	4 Sgr	RB	4.7	142	77	267	3.1	0.2	Dec 24 00:27	89 Psc	DD	5.1	107	21	122	1.3	-1.6
Mar 11 01:10	16 Vir	DD	5.0	166	71	208	9.9	9.9	Aug 01 03:57	1 Sgr	DD	5.0	144	10	91	0.2	0.4	Dec 27 20:18	Ome 2 Tau	DD	4.9	150	42	20	0.3	2.7
Mar 11 01:24	16 Vir	RD	5.0	166	73	227	9.9	9.9	Aug 10 00:10	Nu Psc	DB	4.5	112	12	70	0.4	0.3	Dec 27 21:29	Ome 2 Tau	RB	4.9	150	53	279	3.7	-0.8
Mar 15 03:37	2316	RD	6.4	110	63	294	2.0	-1.3	Aug 10 01:18	Nu Psc	RD	4.5	111	28	228	0.8	1.2	Dec 28 00:09	646	DD	6.1	151	51	104	3.4	-0.5
Mar 17 01:58	2595	RD	5.7	86	15	302	-0.1	-1.4	Aug 24 20:08	2110	RB	6.3	72	50	269	2.1	0.5	Dec 28 01:04	651	DD	6.0	151	42	86	2.6	0.5