

# ASTRONOMY 2020

## Supplementary Information

### BRISBANE

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](http://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](http://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		
	<b>JULY</b>		<b>AUGUST</b>		<b>SEPTEMBER</b>		<b>OCTOBER</b>		<b>NOVEMBER</b>		<b>DECEMBER</b>	
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
	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>	<small>h m s ° ' "</small>
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



# LUNAR OCCULTATIONS for BRISBANE (27° 30' S, 153° 01' 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](http://www.lunar-occultations.com/iota/iotandx.htm)  
[www.occultations.org.nz](http://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.

**EST** the date and time of the occultation, hr and min are in EST  
**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 2<sup>nd</sup> 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.

EST	Object	PD	Mag	Elg°	Alt°	PA°	A	B	EST	Object	PD	Mag	Elg°	Alt°	PA°	A	B	EST	Object	PD	Mag	Elg°	Alt°	PA°	A	B
Jan 01 21:52	3478	DD	6.4	71	14	72	0.3	1.5	Apr 12 02:24	2394	RD	6.3	130	78	254	3.0	0.7	Jul 15 03:43	38 Ara	DB	5.2	70	27	26	0.3	1.6
Jan 08 20:38	105 Tau	DD	5.8	150	38	82	2.4	-0.1	Apr 14 00:36	2706	DB	5.8	105	31	87	0.8	-0.8	Jul 15 04:52	38 Ara	RD	5.2	70	39	266	2.3	-0.6
Jan 09 02:02	108 Tau	DD	6.3	152	12	11	3.6	7.8	Apr 14 01:45	2706	RD	5.8	105	46	296	1.1	-1.8	Jul 31 01:30	2457	DD	6.3	130	21	73	0.2	1.4
Jan 09 20:24	1 Gem	RB	4.3	163	30	229	1.2	0.7	Apr 14 03:51	26 Sgr	RD	6.2	104	74	249	2.7	0.7	Aug 03 01:01	2921	DD	6.0	167	63	35	1.0	3.2
Jan 10 03:02	9 Gem	DD	6.2	165	11	55	1.5	2.2	Apr 15 03:13	2875	DB	6.0	92	53	132	1.2	-3.1	Aug 03 02:22	2928	DD	6.4	167	46	43	0.6	2.5
Jan 20 02:43	Eta Lib	DB	5.4	62	21	112	0.3	-1.4	Apr 15 04:07	53 Sgr	RD	6.4	92	65	228	2.7	1.9	Aug 11 01:03	Xi Ari	DB	5.5	101	22	18	0.0	2.0
Jan 20 03:47	Eta Lib	RD	5.4	61	35	300	0.7	-1.7	Apr 15 04:18	2875	RD	6.0	92	68	227	2.7	2.1	Aug 11 02:02	Xi Ari	RD	5.5	101	33	275	2.2	-1.2
Jan 23 13:29	Jupiter	DB	-1.7	21	50	38	0.8	3.2	May 05 00:11	16 Vir	DD	5.0	139	38	195	-1.5	-6.7	Aug 29 21:44	53 Sgr	DD	6.4	136	78	29	1.6	4.1
Jan 23 14:27	Jupiter	RD	-1.7	21	37	298	1.7	-0.4	May 05 00:32	16 Vir	RB	5.0	139	34	230	3.4	5.8	Aug 29 21:53	2875	DD	6.0	136	77	34	1.7	3.6
Jan 28 19:39	Psi 1 Aqr	DD	4.2	39	17	13	-0.3	3.1	May 09 00:14	2316	RD	6.4	164	78	342	0.9	-3.6	Sep 13 04:59	57 Gem	DB	5.0	61	24	39	0.9	1.2
Jan 28 20:18	Psi 1 Aqr	RB	4.2	39	8	294	0.4	0.2	May 09 21:57	2457	RD	6.3	151	38	247	1.6	0.0	Sep 22 19:30	Psi Oph	DD	4.5	68	43	86	1.3	1.1
Jan 28 20:21	Psi 2 Aqr	DD	4.4	39	8	91	0.1	0.9	May 10 23:25	1 Sgr	DB	5.0	137	45	151	0.1	-3.3	Sep 22 20:38	Psi Oph	RB	4.5	68	28	293	0.9	0.1
Feb 05 23:17	865	DD	6.2	130	26	53	2.2	2.1	May 11 00:17	1 Sgr	RD	5.0	137	56	237	2.6	1.1	Sep 25 21:32	49 Sgr	DD	5.5	107	55	70	1.5	1.6
Feb 08 01:19	82 Gem	DD	6.3	156	25	126	1.0	-0.4	May 19 04:51	26 Cet	DB	6.1	43	23	94	1.1	-1.3	Sep 25 22:47	49 Sgr	RB	5.5	107	38	261	0.9	1.2
Feb 08 20:43	Gam Cnc	DD	4.7	168	28	138	2.0	-2.3	May 29 19:07	Eta Leo	DD	3.5	80	40	141	1.2	-1.2	Oct 01 21:42	49	DD	6.1	174	54	357	-0.2	4.7
Feb 08 21:46	Gam Cnc	RB	4.7	168	36	242	2.3	0.6	May 29 20:19	Eta Leo	RB	3.5	80	29	281	1.5	0.4	Oct 07 01:33	Ome 2 Tau	DB	4.9	128	37	54	1.8	0.7
Feb 18 02:26	Xi Oph	DB	4.4	68	23	64	1.0	0.0	Jun 01 00:02	1739	DD	6.4	108	14	89	0.6	1.0	Oct 07 03:08	Ome 2 Tau	RD	4.9	127	42	252	2.7	0.7
Feb 18 03:11	Xi Oph	RD	4.4	67	33	334	-0.2	-3.0	Jun 05 21:40	2394	DD	6.3	176	63	116	1.6	-1.5	Oct 10 01:28	37 Gem	RD	5.7	94	11	313	2.1	-3.0
Feb 18 04:23	2509	DB	5.8	67	48	71	2.1	0.0	Jun 07 20:17	2706	RD	5.8	158	22	323	-0.4	-2.5	Oct 21 19:02	2602	DD	5.4	62	47	118	1.8	-0.4
Feb 22 05:03	Eta Cap	DB	4.9	20	12	130	-0.4	-2.4	Jun 07 22:07	26 Sgr	RD	6.2	157	45	281	1.2	-1.2	Oct 21 19:46	9 Sgr	DD	5.9	63	38	146	2.3	-2.4
Feb 29 20:03	38 Ara	DD	5.2	62	19	71	1.1	1.6	Jun 08 21:14	53 Sgr	RD	6.4	145	22	254	0.6	-0.4	Oct 21 20:03	2602	RB	5.4	63	34	234	0.3	2.1
Mar 03 19:51	108 Tau	DD	6.3	96	36	105	2.5	0.0	Jun 08 21:22	2875	RD	6.0	145	24	255	0.7	-0.4	Oct 21 20:19	9 Sgr	RB	5.9	63	31	205	-0.7	4.2
Mar 04 22:30	8 Gem	DD	6.1	109	20	69	1.8	1.5	Jun 10 01:14	17 Cap	DB	5.9	131	60	105	2.2	-1.5	Oct 22 18:34	2771	DD	5.6	75	66	159	9.9	9.9
Mar 04 22:54	9 Gem	DD	6.2	110	17	118	0.8	0.0	Jun 10 02:36	17 Cap	RD	5.9	131	78	228	2.3	2.0	Oct 22 18:51	2771	RB	5.6	75	62	182	9.9	9.9
Mar 05 20:23	48 Gem	DD	5.9	121	38	93	2.6	0.0	Jun 12 03:13	56 Aqr	RD	6.4	107	63	218	1.9	2.1	Nov 20 22:33	17 Cap	DD	5.9	70	10	89	0.0	0.9
Mar 09 00:54	42 Leo	DD	6.2	163	40	169	0.1	-2.5	Jun 13 04:11	Psi 3 Aqr	DB	5.0	95	62	359	0.2	5.4	Nov 24 00:14	Psi 3 Aqr	DD	5.0	105	14	119	0.8	-0.1
Mar 11 02:33	16 Vir	DD	5.0	166	51	196	-1.8	-6.5	Jun 13 05:02	Psi 3 Aqr	RD	5.0	95	70	293	4.6	-2.5	Dec 05 03:48	Lam Cnc	RD	5.9	131	38	308	2.1	-1.1
Mar 11 02:57	16 Vir	RD	5.0	166	47	233	4.5	5.0	Jun 28 21:23	1813	DD	5.7	91	33	81	1.6	1.4	Dec 27 21:28	Ome 2 Tau	DD	4.9	150	42	112	3.8	-1.2
Mar 17 01:51	2595	DB	5.7	86	31	99	0.7	-1.2	Jun 28 22:15	1813	RB	5.7	91	22	340	0.3	-1.9	Dec 27 22:37	Ome 2 Tau	RB	4.9	150	40	201	1.7	3.1
Mar 17 03:02	2595	RD	5.7	86	47	292	1.1	-1.6	Jul 11 04:58	3506	DB	6.1	114	67	25	1.2	2.9	Dec 27 23:39	53 Tau	DD	5.5	151	34	28	2.1	3.0
Mar 18 01:46	2754	RD	5.9	74	20	283	0.2	-1.2	Jul 13 00:38	33 Cet	RD	6.0	93	13	322	9.9	9.9	Dec 28 02:06	651	DD	6.0	151	11	119	0.6	0.0
Apr 07 19:20	1813	DD	5.7	169	25	176	0.2	-3.4	Jul 13 06:03	89 Psc	DB	5.1	91	59	15	0.9	3.1	Dec 30 20:01	37 Gem	RD	5.7	175	11	254	0.7	-0.4