Data for Best Viewing of the Planets 2018-2050

July 15, 2018
Edited Nov. 8, 2021

Traditionally, the best time to view a planet was reckoned to be when it was at opposition – the time when the line from the Sun to the Earth extended closest to the planet. This works for the outer planets (Mars and beyond).

But, for the inner planets, Mercury and Venus, the traditional event was the time of the greatest elongation or separation (there is a slight difference here). The separation is the angle from Sun-center to Earth-center to planet-center, while separation relates to ecliptic longitude.

However, for an observer on Earth, an inner planet is visible only from the time the sky is dark enough before sunrise after the planet has risen, or dark enough after sunset before the planet sets. The geometry for this is highly dependent on the observer's location. Listed below are the times when the Sun is six degrees below the horizon for an observer at the Hidden Valley Observatory in Rapid City, South Dakota, and when the elevation of Mercury or Venus above the horizon is greater than the preceding and following days. This information is specific to the location, but illustrative of the sad fact that maximum separation does not always equate to a good view. The date and time are in Mountain Standard Time (add one hour when daylight savings time is needed).

The dates and times for the greatest separation, or opposition, are listed in UTC (subtract 7 hours for MST, or 6 hours for MDT), but typically the view a day or two earlier or later isn't much different. Next, the visual magnitude is listed with 1 equivalent to a bright star, 2 equivalent to a less bright star, and so on. A magnitude of zero, or negative, indicates a greater brightness. A magnitude of 5 or 6 indicates an object that will require a very dark and clear sky, or a telescope. The apparent distance (Earth center to planet center) is listed in Astronomical Units, along with the visual diameter of the planet in seconds of arc (3600" = 1 degree).

The declination is listed in degrees as a guide to how favorably the planet will be located in the sky. As a general rule for observers in the Northern Hemisphere, the view of a celestial object is better when the declination is greater, and not so good when it is negative; in the Southern Hemisphere this is reversed.

For the inferior planets Mercury and Venus, the separation angle between the Sun and the planet is listed in degrees, and whether the planet can be viewed in the morning before sunrise, or in the evening after sunset is indicated.

The superior planets (Mars and beyond) are best viewed when at opposition (i.e. when the planet is 180 degrees away from the Sun (as measured in latitude in the ecliptic plane.). At that time the planet is at its highest in the sky at midnight, and should be above the horizon most of the night (or all of the night).

The brightness of a particular superior planet at opposition is not a constant because planetary orbits (including Earth's) are not perfect circles, so the distance from Sun to planet, and planet to Earth are not usually the same from one opposition to another. Therefore, the best view of a planet in one year may be better or worse than in another year.

Mercury highest above horizon at HVO at 6-degree twilight

Date	MST	Elev.	mag.	Decl.	Seprtn
12/28/2017	06:55:01	10.48	-0.28	-20.161	22.1
03/15/2018	18:28:00	11.99	-0.28	7.436	18.4
04/26/2018	04:21:02	2.45	0.50	1.479	26.7
07/02/2018	20:15:39	8.06	-0.02	19.923	24.5
08/28/2018	04:42:00	10.56	-0.47	15.695	18.2
11/10/2018	17:02:18	3.18	-0.20	-24.778	22.7
12/12/2018	06:46:22	11.38	-0.40	-17.617	20.9
02/27/2019	18:07:28	11.50	-0.36	0.456	18.1
04/03/2019	05:02:13	3.35	0.63	-5.583	25.8
06/16/2019	20:14:40	10.17	0.01	23.576	23.9
08/12/2019	04:21:48	9.89	-0.38	19.252	18.7
10/20/2019	17:30:18	2.23	-0.13	-21.050	24.6
11/27/2019	06:31:31	11.86	-0.54	-14.046	20.0
02/11/2020	17:46:20	10.96	-0.43	-6.492	18.1
03/14/2020	05:37:45	4.57	0.52	-11.317	25.3
05/30/2020	20:03:26	11.97	0.05	25.441	23.0
07/26/2020	04:01:55	8.78	-0.32	21.274	19.5
09/24/2020	18:14:14	2.08	-0.04	-12.494	25.0
11/10/2020	06:12:05	11.90	-0.62	-9.201	19.1
01/25/2021	17:25:09	10.19	-0.47	-12.939	18.3
02/25/2021	06:07:27	5.86	0.32	-16.003	25.1
05/14/2021	19:45:25	13.01	0.10	25.142	21.9
07/10/2021	03:44:54	7.18	-0.27	21.500	20.4
09/02/2021	18:56:04	2.64	-0.03	-3.074	24.5
10/25/2021	05:51:45	11.68	-0.66	-3.685	18.4
01/09/2022	17:05:55	9.02	-0.46	-18.432	18.9
02/08/2022	06:32:14	7.17	0.15	-19.251	24.4
04/28/2022	19:24:29	13.20	0.14	22.619	20.6
06/24/2022	03:34:45	5.32	-0.24	19.881	21.3
08/14/2022	19:30:06	3.67	-0.05	5.053	24.4
10/09/2022	05:32:00	11.39	-0.65	2.124	18.0
12/24/2022	16:52:09	7.45	-0.40	-22.543	19.6
01/23/2023	06:48:28	8.50	-0.04	-20.957	23.7

04/11/2023	19:01:54	12.84	0.00	17.794	19.5
06/07/2023	03:35:00	3.57	-0.17	16.122	22.6
07/28/2023	19:55:14	5.08	-0.05	11.683	24.5
09/23/2023	05:12:48	11.11	-0.61	7.836	17.8
12/08/2023	16:47:10	5.69	-0.31	-24.934	20.5
01/07/2024	06:55:36	9.80	-0.20	-20.955	22.7
03/24/2024	18:39:59	12.29	-0.21	11.372	18.7
05/14/2024	03:54:09	2.46	0.16	7.957	25.8
07/10/2024	20:11:44	6.88	-0.07	17.662	24.2
09/06/2024	04:53:36	10.80	-0.53	13.047	17.9
11/20/2024	16:53:11	4.00	-0.24	-25.481	21.8
12/21/2024	06:52:31	10.90	-0.33	-19.301	21.6
03/08/2025	18:19:34	11.77	-0.29	4.597	18.2
04/15/2025	04:39:19	2.75	0.61	-1.772	26.3
06/25/2025	20:16:38	8.95	-0.01	21.598	24.4
08/21/2025	04:33:46	10.32	-0.45	17.339	18.4
11/01/2025	17:12:23	2.70	-0.18	-23.654	23.6
12/05/2025	06:40:28	11.63	-0.45	-16.175	20.5
02/20/2026	17:58:48	11.28	-0.38	-2.429	18.0
03/25/2026	05:18:21	3.85	0.62	-8.094	25.3
06/09/2026	20:11:07	10.99	0.03	24.581	23.6
08/05/2026	04:13:28	9.49	-0.37	20.307	19.0
10/09/2026	17:47:58	2.06	-0.09	-17.899	25.0
11/20/2026	06:23:48	11.91	-0.58	-12.164	19.6
02/04/2027	17:37:30	10.67	-0.44	-9.225	18.1
03/07/2027	05:51:24	5.11	0.46	-13.401	25.0
05/24/2027	19:56:36	12.51	0.08	25.590	22.6
07/20/2027	03:54:22	8.17	-0.31	21.611	19.9
09/15/2027	18:32:28	2.25	-0.03	-8.491	24.8
11/04/2027	06:03:43	11.82	-0.65	-6.995	18.8
01/19/2028	17:16:47	9.75	-0.46	-15.331	18.5
02/18/2028	06:19:15	6.41	0.27	-17.510	24.6
05/07/2028	19:36:57	13.18	0.14	24.363	21.3
07/03/2028	03:39:41	6.42	-0.27	21.070	20.8
08/24/2028	19:11:56	3.03	-0.04	0.735	24.3
10/18/2028	05:43:32	11.55	-0.67	-1.308	18.2
01/02/2029	16:59:24	8.41	-0.43	-20.300	19.1
02/01/2029	06:39:54	7.73	0.06	-20.180	24.2
04/20/2029	19:14:22	13.09	0.03	20.684	20.1
06/17/2029	03:33:23	4.55	-0.24	18.733	21.7
08/06/2029	19:42:06	4.21	-0.06	8.187	24.3
10/02/2029	05:24:01	11.26	-0.65	4.516	17.8
12/17/2029	16:48:54	6.73	-0.36	-23.737	19.9
01/16/2030	06:52:37	9.05	-0.12	-21.176	23.3
04/03/2030	18:52:04	12.60	-0.16	15.041	19.1
05/29/2030	03:39:51	2.99	-0.06	13.352	23.8
07/20/2030	20:03:51	5.79	-0.08	14.578	24.3
09/16/2030	05:04:56	10.98	-0.59	10.075	17.8
12/01/2030	16:48:09	4.95	-0.25	-25.355	20.8
12/31/2030	06:55:32	10.29	-0.26	-20.473	22.3
03/18/2031	18:31:35	12.06	-0.23	8.653	18.4
05/01/2031	04:13:18	2.41	0.42	3.023	26.8
07/04/2031	20:15:05	7.73	-0.06	19.572	24.2
08/31/2031	04:45:31	10.63	-0.51	14.961	18.1
11/13/2031	16:59:27	3.40	-0.21	-25.054	22.5
12/15/2031	06:48:27	11.26	-0.39	-18.179	21.2

03/01/2032	18:11:07	11.56	-0.31	1.716	18.1
04/05/2032	04:56:56	3.18	0.66	-4.576	25.7
06/18/2032	20:15:39	9.83	0.02	23.020	24.1
08/14/2032	04:25:25	10.03	-0.42	18.756	18.6
10/23/2032	17:24:25	2.34	-0.14	-21.977	24.4
11/28/2032	06:33:31	11.80	-0.49	-14.518	20.1
02/12/2033	17:48:45	11.05	-0.53	-5.841	18.1
03/17/2033	05:32:32	4.38	0.55	-10.449	25.3
06/02/2033	20:06:01	11.71	0.06	25.246	23.2
07/29/2033	04:05:21	9.00	-0.35	21.073	19.3
09/28/2033	18:07:07	2.05	-0.05	-14.011	25.0
11/13/2033	06:15:36	11.90	-0.62	-10.120	19.2
01/28/2034	17:28:45	10.33	-0.43	-11.840	18.2
02/28/2034	06:02:45	5.65	0.34	-15.336	25.2
05/17/2034	19:48:53	12.89	0.12	25.352	22.1
07/13/2034	03:47:36	7.48	-0.30	21.629	20.2
09/05/2034	18:50:45	2.53	-0.03	-4.203	24.4
10/27/2034	05:54:03	11.71	-0.60	-4.368	18.5
01/12/2035	17:09:00	9.24	-0.44	-17.529	18.7
02/11/2035	06:28:34	6.96	0.17	-18.834	24.5
05/01/2035	19:28:15	13.20	0.17	23.211	20.8
06/27/2035	03:35:57	5.63	-0.27	20.331	21.1
08/17/2035	19:25:20	3.48	-0.05	3.906	24.4
10/11/2035	05:34:11	11.42	-0.58	1.398	18.0
12/27/2035	16:54:00	7.73	-0.39	-21.912	19.4
01/26/2036	06:46:11	8.28	-0.03	-20.817	23.9
04/13/2036	19:05:36	12.90	0.04	18.716	19.6
06/09/2036	03:34:09	3.83	-0.18	16.864	22.4
07/30/2036	19:51:34	4.83	-0.05	10.597	24.6
09/24/2036	05:15:00	11.15	-0.53	7.110	17.9
12/10/2036	16:47:19	5.98	-0.31	-24.625	20.3
01/09/2037	06:55:01	9.59	-0.19	-21.101	23.0
03/27/2037	18:43:33	12.37	-0.16	12.513	18.8
05/18/2037	03:49:42	2.57	0.12	9.380	25.4
07/13/2037	20:09:44	6.57	-0.07	16.727	24.4
09/08/2037	04:55:49	10.85	-0.45	12.374	18.0
11/23/2037	16:51:25	4.26	-0.25	-25.537	21.6
12/24/2037	06:53:43	10.74	-0.32	-19.718	21.8
03/11/2038	18:23:10	11.84	-0.24	5.835	18.2
04/19/2038	04:32:36	2.63	0.58	-0.608	26.5
06/27/2038	20:16:35	8.61	-0.05	21.289	24.1
08/24/2038	04:37:19	10.41	-0.49	16.695	18.2
11/04/2038	17:08:50	2.88	-0.20	-24.096	23.4
12/08/2038	06:43:03	11.54	-0.44	-16.825	20.7
02/22/2039	18:01:10	11.36	-0.48	-1.755	18.1
03/28/2039	05:13:04	3.67	0.66	-7.141	25.3
06/12/2039	20:12:50	10.68	0.04	24.165	23.8
08/08/2039	04:17:03	9.66	-0.41	19.928	18.8
10/14/2039	17:39:45	2.11	-0.10	-19.480	25.0
11/22/2039	06:25:57	11.89	-0.53	-12.685	19.7
02/06/2040	17:39:54	10.78	-0.53	-8.600	18.2
03/09/2040	05:46:24	4.91	0.49	-12.616	25.1
05/26/2040	19:59:38	12.31	0.10	25.562	22.8
07/22/2040	03:57:32	8.42	-0.34	21.547	19.6
09/18/2040	18:25:12	2.18	-0.03	-10.145	25.0
11/05/2040	06:06:00	11.84	-0.59	-7.624	18.9

01/21/2041	17:20:15	9.92	-0.43	-14.309	18.4
02/20/2041	06:14:59	6.20	0.29	-16.950	24.7
05/10/2041	19:40:36	13.12	0.15	24.739	21.5
07/06/2041	03:41:48	6.73	-0.29	21.339	20.5
08/27/2041	19:06:50	2.88	-0.04	-0.410	24.2
10/20/2041	05:45:47	11.59	-0.61	-2.005	18.3
01/05/2042	17:02:00	8.65	-0.41	-19.509	19.0
02/04/2042	06:36:46	7.51	0.07	-19.882	24.4
04/23/2042	19:18:06	13.13	0.06	21.444	20.3
06/20/2042	03:33:46	4.84	-0.26	19.310	21.4
08/09/2042	19:37:49	4.00	-0.06	7.060	24.3
10/04/2042	05:26:13	11.31	-0.58	3.792	17.9
12/20/2042	16:50:04	7.01	-0.35	-23.242	19.7
01/19/2043	06:51:03	8.83	-0.10	-21.162	23.6
04/06/2043	18:55:43	12.68	-0.11	16.082	19.2
06/01/2043	03:37:57	3.20	-0.07	14.211	23.6
07/23/2043	20:00:54	5.52	-0.07	13.553	24.3
09/18/2043	05:07:07	11.03	-0.51	9.372	17.9
12/04/2043	16:47:28	5.23	-0.25	-25.193	20.6
01/03/2044	06:55:44	10.09	-0.25	-20.742	22.5
03/20/2044	18:35:10	12.14	-0.18	9.846	18.5
05/05/2044	04:06:02	2.40	0.34	4.674	26.7
07/06/2044	20:13:54	7.40	-0.05	18.725	24.4
09/01/2044	04:47:47	10.70	-0.42	14.331	18.1
11/15/2044	16:56:52	3.62	-0.22	-25.277	22.3
12/17/2044	06:50:19	11.12	-0.38	-18.706	21.4
03/03/2045	18:13:26	11.64	-0.42	2.403	18.2
04/09/2045	04:49:52	3.02	0.63	-3.526	26.1
06/20/2045	20:16:09	9.50	-0.03	22.767	23.9
08/16/2045	04:27:46	10.15	-0.34	18.258	18.7
10/26/2045	17:20:17	2.47	-0.16	-22.581	24.2
12/01/2045	06:36:33	11.74	-0.49	-15.258	20.3
02/15/2046	17:52:26	11.15	-0.49	-4.607	18.1
03/20/2046	05:27:18	4.18	0.58	-9.558	25.3
06/05/2046	20:08:26	11.44	0.07	24.988	23.5
08/01/2046	04:08:50	9.20	-0.39	20.821	19.1
10/03/2046	17:58:18	2.04	-0.06	-15.942	25.2
11/15/2046	06:17:52	11.90	-0.57	-10.693	19.3
01/30/2047	17:31:07	10.47	-0.53	-11.244	18.3
03/02/2047	05:59:39	5.45	0.43	-14.554	24.7
05/20/2047	19:52:18	12.75	0.13	25.497	22.3
07/16/2047	03:50:25	7.76	-0.33	21.704	20.0
09/09/2047	18:43:31	2.42	-0.03	-5.964	24.7
10/30/2047	05:57:36	11.75	-0.61	-5.354	18.6
01/15/2048	17:12:13	9.44	-0.41	-16.592	18.6
02/14/2048	06:24:42	6.75	0.19	-18.378	24.7
05/02/2048	19:30:41	13.19	0.06	23.550	20.9
06/29/2048	03:37:23	5.94	-0.29	20.733	20.9
08/19/2048	19:20:28	3.31	-0.05	2.754	24.3
10/13/2048	05:37:37	11.47	-0.61	0.388	18.1
12/29/2048	16:56:05	8.00	-0.38	-21.235	19.2
01/27/2049	06:44:34	8.07	0.04	-20.515	23.7
04/16/2049	19:09:19	12.96	0.08	19.595	19.8
06/12/2049	03:33:37	4.11	-0.20	17.569	22.2
08/01/2049	19:49:04	4.59	-0.07	10.145	24.2
09/27/2049	05:18:22	11.19	-0.57	6.145	17.9

12/13/2049	16:47:45	6.27	-0.30	-24.261	20.0
01/11/2050	06:54:29	9.37	-0.13	-21.049	22.8
03/30/2050	18:47:10	12.45	-0.12	13.630	18.9
05/22/2050	03:45:44	2.72	0.07	10.796	25.0
07/16/2050	20:07:26	6.27	-0.06	15.757	24.5
09/11/2050	04:59:15	10.91	-0.49	11.524	17.9
11/26/2050	16:49:56	4.52	-0.25	-25.535	21.3
12/27/2050	06:54:40	10.55	-0.31	-20.095	22.1

Venus highest above horizon at HVO at 6-degree twilight

Date	MST	Elev.	mag.	Decl.	Seprtn
05/27/2018	19:59:56	19.78	-3.93	24.850	33.5
12/13/2018	06:47:08	28.22	-4.80	-11.342	44.4
03/24/2020	18:39:58	37.82	-4.49	20.930	46.1
09/06/2020	04:53:32	33.60	-4.24	18.651	44.2
07/15/2021	20:08:15	9.26	-3.87	15.422	29.1
12/05/2021	16:47:19	15.64	-4.88	-23.843	39.1
02/15/2022	06:22:56	17.10	-4.85	-16.816	40.9
07/15/2022	03:49:24	12.68	-3.84	22.615	26.1
05/01/2023	19:28:06	31.42	-4.17	25.752	42.5
10/21/2023	05:46:14	36.14	-4.53	6.895	46.4
02/01/2025	17:34:12	34.32	-4.77	1.223	44.9
08/09/2025	04:18:46	24.17	-3.96	21.926	36.3
05/26/2026	19:59:00	20.16	-3.94	24.908	33.8
12/11/2026	06:45:36	28.61	-4.79	-10.803	44.5
03/22/2028	18:37:30	37.89	-4.49	20.382	46.1
09/05/2028	04:52:25	33.38	-4.23	18.814	44.0
07/11/2029	20:11:10	9.51	-3.87	16.795	28.7
12/03/2029	16:47:37	14.93	-4.88	-24.396	38.9
02/12/2030	06:26:58	17.37	-4.85	-17.043	40.6
07/14/2030	03:48:31	12.32	-3.84	22.597	25.8
04/30/2031	19:26:53	31.74	-4.18	25.737	42.7
10/19/2031	05:43:50	36.19	-4.52	7.514	46.4
01/30/2033	17:31:41	33.96	-4.78	0.307	44.8
08/08/2033	04:17:38	23.81	-3.96	21.972	36.0
05/25/2034	19:58:01	20.54	-3.94	24.956	34.1
12/10/2034	06:44:46	29.00	-4.78	-10.427	44.8
03/21/2036	18:36:18	37.95	-4.51	20.166	46.1
09/04/2036	04:51:20	33.16	-4.22	18.971	43.8
07/08/2037	20:12:59	9.78	-3.87	17.726	28.5
11/30/2037	16:48:20	14.22	-4.88	-25.093	39.1
02/10/2038	06:29:31	17.65	-4.85	-17.282	40.9
07/13/2038	03:47:38	11.95	-3.84	22.579	25.5
04/29/2039	19:25:39	32.05	-4.19	25.724	42.9
10/18/2039	05:42:42	36.24	-4.51	7.860	46.4
01/29/2041	17:30:25	33.57	-4.79	-0.179	44.5
08/07/2041	04:16:28	23.45	-3.95	22.024	35.8
05/24/2042	19:57:01	20.92	-3.95	25.012	34.4
12/08/2042	06:43:05	29.39	-4.77	-9.861	44.9
03/19/2044	18:33:54	38.00	-4.51	19.590	46.2
09/03/2044	04:50:12	32.94	-4.21	19.127	43.6
07/05/2045	20:14:28	10.05	-3.86	18.610	28.3
11/27/2045	16:49:22	13.53	-4.88	-25.723	39.4
02/08/2046	06:31:57	17.94	-4.85	-17.493	41.1
07/12/2046	03:46:48	11.59	-3.83	22.560	25.2

04/28/2047	19:24:26	32.35	-4.20	25.707	43.1
10/16/2047	05:40:20	36.27	-4.50	8.466	46.3
01/27/2049	17:27:54	33.18	-4.80	-1.103	44.4
08/06/2049	04:15:21	23.09	-3.94	22.066	35.5
05/23/2050	19:56:00	21.31	-3.95	25.055	34.7
12/06/2050	06:41:17	29.77	-4.77	-9.279	45.0

Mercury at greatest separation:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.	Seprtn	Type
01/01/2018	19:58:27	-0.35	1.0157096	6.62	-21.080	22.7	Morn.
03/15/2018	15:09:34	-0.34	0.9093770	7.40	7.196	18.4	Evng.
04/29/2018	18:23:45	0.34	0.8398669	8.01	2.361	27.0	Morn.
07/12/2018	05:29:20	0.39	0.8423601	7.99	15.563	26.4	Evng.
08/26/2018	20:34:23	-0.23	0.9158213	7.35	15.809	18.3	Morn.
11/06/2018	15:31:42	-0.26	1.0182788	6.61	-24.278	23.3	Evng.
12/15/2018	11:29:58	-0.47	1.0132915	6.64	-18.415	21.3	Morn.
02/27/2019	01:25:09	-0.51	0.9298750	7.24	-0.128	18.1	Evng.
04/11/2019	19:41:56	0.25	0.8695467	7.74	-4.278	27.7	Morn.
06/23/2019	23:15:40	0.44	0.8250850	8.15	21.253	25.2	Evng.
08/09/2019	23:07:59	-0.03	0.8918176	7.54	19.164	19.0	Morn.
10/20/2019	04:01:45	-0.13	1.0096317	6.66	-20.789	24.6	Evng.
11/28/2019	10:29:14	-0.57	1.0049803	6.69	-14.333	20.1	Morn.
02/10/2020	13:55:56	-0.61	0.9493491	7.09	-7.340	18.2	Evng.
03/24/2020	02:06:21	0.15	0.9059019	7.43	-10.431	27.8	Morn.
06/04/2020	13:07:02	0.43	0.8226089	8.18	24.758	23.6	Evng.
07/22/2020	15:12:09	0.18	0.8660799	7.77	20.725	20.1	Morn.
10/01/2020	16:05:36	-0.02	0.9905179	6.79	-15.733	25.8	Evng.
11/10/2020	17:03:14	-0.62	0.9934060	6.77	-9.256	19.1	Morn.
01/24/2021	01:56:51	-0.66	0.9680114	6.95	-13.974	18.6	Evng.
03/06/2021	11:22:11	0.06	0.9432242	7.13	-15.625	27.3	Morn.
05/17/2021	05:53:38	0.34	0.8335937	8.07	25.247	22.0	Evng.
07/04/2021	19:45:05	0.34	0.8418036	7.99	20.104	21.6	Morn.
09/14/2021	04:24:30	0.08	0.9623061	6.99	-9.567	26.8	Evng.
10/25/2021	05:29:41	-0.64	0.9799881	6.87	-3.584	18.4	Morn.
01/07/2022	11:03:41	-0.64	0.9856182	6.83	-19.552	19.2	Evng.
02/16/2022	21:06:48	-0.04	0.9761771	6.89	-19.462	26.3	Morn.
04/29/2022	08:08:58	0.18	0.8527180	7.89	22.674	20.6	Evng.
06/16/2022	14:55:32	0.43	0.8242026	8.16	17.210	23.2	Morn.
08/27/2022	16:14:19	0.18	0.9279844	7.25	-2.692	27.3	Evng.
10/08/2022	21:13:29	-0.59	0.9650214	6.97	2.306	18.0	Morn.
12/21/2022	15:31:22	-0.57	1.0012365	6.72	-23.576	20.1	Evng.
01/30/2023	05:53:41	-0.16	1.0003808	6.73	-21.604	25.0	Morn.
04/11/2023	22:10:22	-0.02	0.8748156	7.69	17.730	19.5	Evng.
05/29/2023	05:33:52	0.44	0.8186650	8.22	12.362	24.9	Morn.
08/10/2023	01:46:37	0.26	0.8914909	7.55	4.529	27.4	Evng.
09/22/2023	13:15:58	-0.49	0.9480671	7.10	8.045	17.9	Morn.
12/04/2023	14:28:28	-0.46	1.0130064	6.64	-25.609	21.3	Evng.
01/12/2024	14:37:28	-0.28	1.0133209	6.64	-21.832	23.5	Morn.
03/24/2024	22:34:02	-0.23	0.8969768	7.50	11.305	18.7	Evng.
05/09/2024	21:29:19	0.39	0.8280129	8.13	6.215	26.4	Morn.
07/22/2024	06:38:43	0.35	0.8579290	7.84	11.677	26.9	Evng.
09/05/2024	02:30:13	-0.34	0.9284842	7.25	13.229	18.1	Morn.
11/16/2024	08:09:18	-0.34	1.0186454	6.60	-25.411	22.6	Evng.
12/25/2024	02:30:10	-0.40	1.0155953	6.62	-20.160	22.0	Morn.
03/08/2025	06:09:14	-0.42	0.9181850	7.33	4.139	18.2	Evng.
04/21/2025	18:49:03	0.30	0.8512630	7.90	-0.455	27.4	Morn.

07/04/2025	04:38:41	0.41	0.8331304	8.08	18.151	25.9	Evng.
08/19/2025	09:48:01	-0.15	0.9058714	7.43	17.400	18.6	Morn.
10/29/2025	22:02:09	-0.20	1.0157953	6.62	-23.044	23.9	Evng.
12/07/2025	21:02:50	-0.51	1.0102345	6.66	-16.852	20.7	Morn.
02/19/2026	17:41:04	-0.56	0.9383328	7.17	-3.199	18.1	Evng.
04/03/2026	22:33:30	0.21	0.8844749	7.61	-6.953	27.8	Morn.
06/15/2026	19:59:47	0.44	0.8220891	8.18	23.057	24.5	Evng.
08/02/2026	08:07:23	0.06	0.8807692	7.64	20.061	19.5	Morn.
10/12/2026	10:03:14	-0.08	1.0027952	6.71	-18.838	25.2	Evng.
11/20/2026	23:31:13	-0.60	1.0003650	6.73	-12.307	19.6	Morn.
02/03/2027	06:14:42	-0.64	0.9575081	7.03	-10.225	18.3	Evng.
03/17/2027	06:49:55	0.11	0.9220530	7.30	-12.746	27.6	Morn.
05/28/2027	09:57:28	0.40	0.8259783	8.15	25.359	22.9	Evng.
07/15/2027	19:24:28	0.25	0.8552733	7.87	20.741	20.7	Morn.
09/24/2027	21:58:59	0.03	0.9796203	6.87	-13.256	26.3	Evng.
11/04/2027	08:54:42	-0.64	0.9879669	6.81	-6.936	18.8	Morn.
01/17/2028	17:16:25	-0.66	0.9757464	6.89	-16.475	18.8	Evng.
02/27/2028	16:35:31	0.02	0.9582115	7.02	-17.414	26.9	Morn.
05/09/2028	06:13:20	0.28	0.8410977	8.00	24.511	21.4	Evng.
06/26/2028	19:34:08	0.39	0.8332719	8.07	19.154	22.2	Morn.
09/06/2028	10:20:21	0.12	0.9481980	7.10	-6.748	27.1	Evng.
10/17/2028	23:03:25	-0.62	0.9738410	6.91	-1.127	18.2	Morn.
12/31/2028	00:43:11	-0.62	0.9925289	6.78	-21.454	19.6	Evng.
02/09/2029	01:46:23	-0.09	0.9877776	6.81	-20.576	25.7	Morn.
04/21/2029	13:35:15	0.10	0.8619806	7.80	20.834	20.1	Evng.
06/08/2029	11:50:20	0.44	0.8201521	8.20	15.374	23.9	Morn.
08/19/2029	21:41:53	0.21	0.9122363	7.37	0.313	27.4	Evng.
10/01/2029	15:11:44	-0.56	0.9579849	7.02	4.749	17.9	Morn.
12/14/2029	02:57:56	-0.53	1.0067136	6.68	-24.688	20.6	Evng.
01/22/2030	10:10:31	-0.21	1.0071717	6.68	-21.931	24.4	Morn.
04/04/2030	08:19:51	-0.11	0.8843743	7.61	15.166	19.1	Evng.
05/21/2030	02:20:04	0.42	0.8206925	8.20	9.889	25.6	Morn.
08/02/2030	05:34:42	0.30	0.8764585	7.68	7.562	27.3	Evng.
09/15/2030	06:25:48	-0.43	0.9399925	7.16	10.306	17.9	Morn.
11/26/2030	23:28:29	-0.41	1.0163188	6.62	-25.799	21.8	Evng.
01/04/2031	19:55:58	-0.33	1.0154122	6.63	-21.346	22.9	Morn.
03/18/2031	12:06:28	-0.32	0.9062060	7.42	8.349	18.5	Evng.
05/02/2031	20:31:48	0.35	0.8364018	8.04	3.438	26.9	Morn.
07/15/2031	07:24:39	0.38	0.8461175	7.95	14.526	26.6	Evng.
08/29/2031	17:35:10	-0.26	0.9192403	7.32	15.122	18.2	Morn.
11/09/2031	15:06:31	-0.28	1.0186880	6.60	-24.664	23.1	Evng.
12/18/2031	10:25:13	-0.45	1.0141156	6.63	-18.947	21.5	Morn.
02/29/2032	21:48:12	-0.49	0.9268513	7.26	1.052	18.2	Evng.
04/13/2032	20:46:19	0.26	0.8645880	7.78	-3.226	27.6	Morn.
06/26/2032	02:13:57	0.43	0.8267112	8.14	20.469	25.4	Evng.
08/11/2032	21:26:17	-0.06	0.8955555	7.51	18.721	18.9	Morn.
10/22/2032	03:56:14	-0.15	1.0115348	6.65	-21.471	24.4	Evng.
11/30/2032	08:11:02	-0.55	1.0064429	6.68	-15.067	20.2	Morn.
02/12/2033	10:10:16	-0.60	0.9464881	7.11	-6.210	18.2	Evng.
03/27/2033	02:28:03	0.17	0.9002409	7.47	-9.491	27.8	Morn.
06/07/2033	16:24:32	0.43	0.8219655	8.18	24.389	23.8	Evng.
07/25/2033	15:11:40	0.15	0.8698609	7.73	20.601	19.9	Morn.
10/04/2033	16:04:06	-0.03	0.9939857	6.77	-16.637	25.7	Evng.
11/13/2033	13:45:18	-0.62	0.9952774	6.76	-10.127	19.2	Morn.
01/26/2034	22:23:57	-0.66	0.9653330	6.97	-12.969	18.5	Evng.
03/09/2034	11:35:52	0.07	0.9378071	7.17	-14.864	27.4	Morn.

05/20/2034	08:12:33	0.36	0.8312644	8.09	25.384	22.2	Evng.
07/07/2034	21:29:21	0.32	0.8450741	7.96	20.347	21.3	Morn.
09/17/2034	04:15:53	0.07	0.9670670	6.96	-10.617	26.6	Evng.
10/28/2034	01:31:58	-0.64	0.9821169	6.85	-4.530	18.5	Morn.
01/10/2035	08:03:50	-0.65	0.9831494	6.84	-18.748	19.1	Evng.
02/19/2035	21:31:30	-0.03	0.9717896	6.92	-18.940	26.4	Morn.
05/02/2035	08:44:20	0.20	0.8495899	7.92	23.264	20.8	Evng.
06/19/2035	17:52:18	0.42	0.8262030	8.14	17.809	22.9	Morn.
08/30/2035	16:10:40	0.16	0.9333932	7.21	-3.827	27.3	Evng.
10/11/2035	16:56:35	-0.60	0.9673997	6.95	1.349	18.0	Morn.
12/24/2035	13:18:00	-0.58	0.9990970	6.73	-23.053	20.0	Evng.
02/02/2036	06:22:08	-0.14	0.9975121	6.74	-21.373	25.2	Morn.
04/13/2036	21:03:15	0.01	0.8714820	7.72	18.638	19.6	Evng.
05/31/2036	08:41:31	0.44	0.8186087	8.22	13.236	24.6	Morn.
08/12/2036	02:18:22	0.25	0.8967893	7.50	3.363	27.4	Evng.
09/24/2036	09:06:18	-0.51	0.9507382	7.08	7.137	17.9	Morn.
12/06/2036	13:07:49	-0.48	1.0115451	6.65	-25.429	21.1	Evng.
01/14/2037	14:49:03	-0.26	1.0120973	6.65	-21.916	23.7	Morn.
03/27/2037	20:04:47	-0.20	0.8937465	7.53	12.396	18.8	Evng.
05/12/2037	23:56:42	0.40	0.8256470	8.15	7.245	26.2	Morn.
07/25/2037	08:06:04	0.33	0.8624104	7.80	10.560	27.0	Evng.
09/07/2037	22:55:22	-0.37	0.9315257	7.22	12.440	18.0	Morn.
11/19/2037	07:32:57	-0.35	1.0182918	6.61	-25.594	22.4	Evng.
12/28/2037	02:00:44	-0.38	1.0158056	6.62	-20.540	22.3	Morn.
03/11/2038	02:47:04	-0.39	0.9151064	7.35	5.307	18.3	Evng.
04/24/2038	20:27:02	0.32	0.8470041	7.94	0.618	27.3	Morn.
07/07/2038	07:07:40	0.41	0.8360812	8.05	17.200	26.1	Evng.
08/22/2038	07:19:32	-0.18	0.9094012	7.40	16.807	18.5	Morn.
11/01/2038	21:47:47	-0.22	1.0168849	6.62	-23.557	23.7	Evng.
12/10/2038	19:31:11	-0.50	1.0114169	6.65	-17.475	20.9	Morn.
02/22/2039	13:55:30	-0.54	0.9353882	7.19	-2.037	18.1	Evng.
04/06/2039	23:27:27	0.22	0.8791189	7.65	-5.940	27.8	Morn.
06/18/2039	23:10:06	0.44	0.8228542	8.18	22.431	24.7	Evng.
08/05/2039	07:12:22	0.03	0.8846597	7.60	19.746	19.3	Morn.
10/15/2039	09:55:01	-0.10	1.0054190	6.69	-19.616	25.0	Evng.
11/23/2039	20:50:56	-0.59	1.0020430	6.71	-13.105	19.8	Morn.
02/06/2040	02:33:03	-0.63	0.9547063	7.05	-9.142	18.3	Evng.
03/19/2040	07:10:36	0.13	0.9164517	7.34	-11.876	27.7	Morn.
05/30/2040	12:55:03	0.41	0.8245540	8.16	25.203	23.2	Evng.
07/17/2040	20:11:30	0.23	0.8590238	7.83	20.771	20.5	Morn.
09/26/2040	21:54:20	0.01	0.9836035	6.84	-14.226	26.1	Evng.
11/06/2040	05:16:57	-0.63	0.9899162	6.80	-7.842	18.9	Morn.
01/19/2041	14:00:05	-0.66	0.9730809	6.91	-15.547	18.7	Evng.
03/01/2041	16:46:06	0.03	0.9531318	7.06	-16.752	27.0	Morn.
05/12/2041	07:53:57	0.30	0.8382670	8.03	24.855	21.6	Evng.
06/29/2041	21:48:35	0.37	0.8360533	8.05	19.554	22.0	Morn.
09/09/2041	10:19:52	0.11	0.9532412	7.06	-7.843	27.0	Evng.
10/20/2041	18:51:26	-0.63	0.9760392	6.89	-2.081	18.3	Morn.
01/02/2042	22:04:17	-0.63	0.9901604	6.79	-20.766	19.5	Evng.
02/12/2042	02:06:47	-0.07	0.9839174	6.84	-20.179	25.9	Morn.
04/24/2042	13:25:04	0.12	0.8586732	7.83	21.578	20.3	Evng.
06/11/2042	14:54:33	0.44	0.8212148	8.19	16.103	23.7	Morn.
08/22/2042	21:52:13	0.20	0.9177699	7.33	-0.842	27.4	Evng.
10/04/2042	10:53:08	-0.57	0.9604942	7.00	3.808	17.9	Morn.
12/17/2042	01:04:44	-0.54	1.0048660	6.70	-24.311	20.4	Evng.
01/25/2043	10:39:52	-0.19	1.0049959	6.69	-21.839	24.6	Morn.

04/07/2043	06:33:12	-0.08	0.8810807	7.64	16.168	19.2	Evng.
05/24/2043	05:24:34	0.43	0.8196829	8.21	10.850	25.3	Morn.
08/05/2043	06:18:46	0.29	0.8816416	7.63	6.413	27.3	Evng.
09/18/2043	02:27:51	-0.46	0.9428730	7.14	9.442	17.9	Morn.
11/29/2043	22:21:26	-0.43	1.0153152	6.63	-25.780	21.6	Evng.
01/07/2044	19:59:45	-0.31	1.0149011	6.63	-21.567	23.1	Morn.
03/20/2044	09:13:13	-0.29	0.9030134	7.45	9.487	18.5	Evng.
05/04/2044	22:46:24	0.37	0.8332473	8.07	4.506	26.7	Morn.
07/17/2044	09:14:05	0.37	0.8500391	7.91	13.467	26.7	Evng.
08/31/2044	14:27:03	-0.29	0.9225220	7.29	14.408	18.2	Morn.
11/11/2044	14:41:55	-0.30	1.0188977	6.60	-24.999	22.9	Evng.
12/20/2044	09:29:18	-0.44	1.0148152	6.63	-19.443	21.7	Morn.
03/03/2045	18:15:30	-0.46	0.9238283	7.28	2.229	18.2	Evng.
04/16/2045	21:55:58	0.28	0.8597581	7.83	-2.171	27.6	Morn.
06/29/2045	05:12:44	0.43	0.8286375	8.12	19.635	25.6	Evng.
08/14/2045	19:34:26	-0.09	0.8992126	7.48	18.239	18.8	Morn.
10/25/2045	03:55:45	-0.17	1.0132197	6.64	-22.115	24.2	Evng.
12/03/2045	06:06:32	-0.54	1.0078619	6.68	-15.778	20.4	Morn.
02/15/2046	06:24:26	-0.59	0.9436187	7.13	-5.071	18.1	Evng.
03/30/2046	02:59:24	0.18	0.8946000	7.52	-8.532	27.8	Morn.
06/10/2046	19:45:40	0.44	0.8216817	8.19	23.950	24.1	Evng.
07/28/2046	14:59:04	0.12	0.8736966	7.70	20.428	19.8	Morn.
10/07/2046	16:00:02	-0.05	0.9972608	6.75	-17.511	25.5	Evng.
11/16/2046	10:37:14	-0.61	0.9970794	6.75	-10.983	19.4	Morn.
01/29/2047	18:46:37	-0.65	0.9626309	6.99	-11.943	18.4	Evng.
03/12/2047	11:52:59	0.09	0.9323296	7.22	-14.072	27.5	Morn.
05/23/2047	10:39:19	0.37	0.8291984	8.11	25.448	22.5	Evng.
07/10/2047	23:00:18	0.30	0.8485373	7.93	20.536	21.1	Morn.
09/20/2047	04:02:58	0.05	0.9716430	6.92	-11.648	26.5	Evng.
10/30/2047	21:37:18	-0.64	0.9841854	6.84	-5.469	18.6	Morn.
01/13/2048	04:56:55	-0.65	0.9806304	6.86	-17.911	19.0	Evng.
02/22/2048	21:49:46	-0.01	0.9672549	6.96	-18.379	26.6	Morn.
05/04/2048	09:31:14	0.23	0.8465513	7.95	23.795	21.0	Evng.
06/21/2048	20:34:35	0.41	0.8284571	8.12	18.358	22.7	Morn.
09/01/2048	16:05:05	0.15	0.9386719	7.17	-4.954	27.2	Evng.
10/13/2048	12:38:31	-0.61	0.9697196	6.94	0.388	18.1	Morn.
12/26/2048	10:57:28	-0.60	0.9968661	6.75	-22.486	19.8	Evng.
02/04/2049	06:45:08	-0.12	0.9943668	6.77	-21.097	25.4	Morn.
04/16/2049	20:08:58	0.04	0.8681257	7.75	19.509	19.8	Evng.
06/03/2049	11:43:51	0.44	0.8188216	8.22	14.077	24.4	Morn.
08/15/2049	02:45:11	0.24	0.9021631	7.46	2.194	27.4	Evng.
09/27/2049	04:52:19	-0.53	0.9533566	7.06	6.214	17.9	Morn.
12/09/2049	11:40:00	-0.50	1.0099677	6.66	-25.195	20.9	Evng.
01/17/2050	15:04:27	-0.24	1.0105921	6.66	-21.954	23.9	Morn.
03/30/2050	17:46:45	-0.17	0.8904580	7.56	13.470	18.9	Evng.
05/16/2050	02:35:40	0.41	0.8235625	8.17	8.266	26.0	Morn.
07/28/2050	09:24:19	0.32	0.8671483	7.76	9.425	27.1	Evng.
09/10/2050	19:15:10	-0.39	0.9345459	7.20	11.624	18.0	Morn.
11/22/2050	06:50:38	-0.37	1.0177552	6.61	-25.722	22.2	Evng.

Venus at greatest separation:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.	Seprtn	Type
08/17/2018	17:31:12	-4.46	0.6848118	24.37	-5.647	45.9	Evng.
01/06/2019	04:53:39	-4.57	0.6741256	24.76	-16.509	47.0	Morn.
03/24/2020	22:13:34	-4.48	0.7087474	23.55	20.881	46.1	Evng.

08/13/2020	00:14:08	-4.43	0.7075050	23.59	20.030	45.8	Morn.
10/29/2021	20:52:00	-4.54	0.6674576	25.00	-26.943	47.0	Evng.
03/20/2022	09:24:58	-4.52	0.6778399	24.62	-14.899	46.6	Morn.
06/04/2023	11:00:41	-4.43	0.7095703	23.52	22.870	45.4	Evng.
10/23/2023	23:14:28	-4.51	0.6941614	24.04	6.209	46.4	Morn.
01/10/2025	05:01:26	-4.55	0.6827552	24.44	-9.422	47.2	Evng.
06/01/2025	03:28:35	-4.44	0.6998547	23.85	7.693	45.9	Morn.
08/15/2026	06:31:31	-4.46	0.6860210	24.33	-4.602	45.9	Evng.
01/03/2027	17:57:55	-4.57	0.6742462	24.75	-16.021	47.0	Morn.
03/22/2028	12:26:53	-4.49	0.7085127	23.55	20.189	46.1	Evng.
08/10/2028	16:03:07	-4.43	0.7076405	23.58	20.053	45.8	Morn.
10/27/2029	10:52:03	-4.54	0.6674092	25.00	-26.820	47.0	Evng.
03/17/2030	23:55:15	-4.52	0.6776927	24.63	-15.422	46.6	Morn.
06/02/2031	03:33:37	-4.43	0.7096676	23.52	23.386	45.4	Evng.
10/21/2031	14:12:12	-4.50	0.6949490	24.01	6.944	46.4	Morn.
01/07/2033	20:05:19	-4.55	0.6816390	24.48	-10.418	47.2	Evng.
05/29/2033	17:31:43	-4.44	0.6989297	23.88	6.968	45.9	Morn.
08/12/2034	19:00:15	-4.46	0.6873926	24.28	-3.535	45.9	Evng.
01/01/2035	07:27:11	-4.57	0.6744949	24.74	-15.499	46.9	Morn.
03/20/2036	03:24:31	-4.49	0.7080033	23.57	19.470	46.2	Evng.
08/08/2036	08:37:05	-4.43	0.7079196	23.57	20.043	45.8	Morn.
10/25/2037	01:24:04	-4.54	0.6672996	25.01	-26.648	47.0	Evng.
03/15/2038	13:49:33	-4.53	0.6773888	24.64	-15.931	46.6	Morn.
05/30/2039	19:32:56	-4.43	0.7099290	23.51	23.880	45.4	Evng.
10/19/2039	04:21:22	-4.50	0.6953794	24.00	7.681	46.4	Morn.
01/05/2041	09:57:26	-4.55	0.6809630	24.51	-11.429	47.2	Evng.
05/27/2041	07:02:59	-4.44	0.6978646	23.91	6.222	45.9	Morn.
08/10/2042	07:50:43	-4.45	0.6886214	24.23	-2.473	45.8	Evng.
12/29/2042	22:02:05	-4.56	0.6750227	24.72	-14.972	46.9	Morn.
03/17/2044	19:05:55	-4.49	0.7073195	23.59	18.742	46.2	Evng.
08/06/2044	01:26:10	-4.43	0.7083317	23.56	20.013	45.8	Morn.
10/22/2045	15:55:16	-4.53	0.6671803	25.01	-26.433	47.0	Evng.
03/13/2046	02:52:20	-4.53	0.6768413	24.66	-16.417	46.7	Morn.
05/28/2047	10:37:03	-4.44	0.7105082	23.49	24.341	45.4	Evng.
10/16/2047	18:07:04	-4.50	0.6957615	23.99	8.405	46.3	Morn.
01/02/2049	23:06:43	-4.55	0.6804032	24.53	-12.431	47.2	Evng.
05/24/2049	21:10:28	-4.45	0.6969695	23.94	5.479	45.9	Morn.
08/07/2050	21:41:23	-4.45	0.6895886	24.20	-1.433	45.8	Evng.
12/27/2050	13:23:05	-4.56	0.6758989	24.69	-14.424	46.9	Morn.

Mars at opposition:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.
07/27/2018	05:13:20	-2.78	0.3861567	24.25	-25.498
10/13/2020	23:25:54	-2.62	0.4192373	22.34	5.445
12/08/2022	05:41:33	-1.87	0.5495627	17.04	24.995
01/16/2025	02:38:31	-1.38	0.6436723	14.55	25.117
02/19/2027	15:50:50	-1.21	0.6779323	13.81	15.370
03/25/2029	07:48:55	-1.34	0.6491295	14.43	1.070
05/04/2031	12:03:27	-1.80	0.5588894	16.76	-15.478
06/28/2033	01:29:36	-2.52	0.4272262	21.92	-27.822
09/15/2035	19:38:47	-2.84	0.3816962	24.54	-8.037
11/19/2037	09:09:33	-2.16	0.4996062	18.75	20.270
01/02/2040	15:27:17	-1.53	0.6136383	15.26	26.685
02/06/2042	12:04:49	-1.24	0.6718951	13.94	19.826
03/11/2044	12:50:17	-1.26	0.6678999	14.02	6.928
04/17/2046	18:06:27	-1.58	0.6011982	15.58	-8.997

06/03/2048	14:50:47	-2.22	0.4796911	19.52	-24.743
08/14/2050	07:51:31	-2.87	0.3741558	25.03	-20.730

Jupiter at opposition:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.
05/09/2018	00:39:09	-2.52	4.4001548	44.80	-16.071
06/10/2019	15:27:48	-2.62	4.2842328	46.02	-22.438
07/14/2020	07:58:32	-2.75	4.1395031	47.63	-21.909
08/20/2021	00:28:33	-2.88	4.0132089	49.12	-13.545
09/26/2022	19:33:10	-2.94	3.9526443	49.88	-0.019
11/03/2023	05:02:26	-2.91	3.9826438	49.50	13.632
12/07/2024	20:58:01	-2.81	4.0896972	48.21	22.063
01/10/2026	08:42:10	-2.68	4.2318513	46.59	22.191
02/11/2027	00:28:49	-2.56	4.3611422	45.21	15.159
03/12/2028	15:36:50	-2.49	4.4403449	44.40	4.332
04/12/2029	04:04:56	-2.47	4.4490926	44.31	-7.319
05/13/2030	11:33:11	-2.53	4.3853849	44.96	-17.308
06/15/2031	09:19:40	-2.64	4.2647584	46.23	-22.840
07/19/2032	08:33:37	-2.77	4.1213130	47.84	-21.157
08/25/2033	05:39:56	-2.89	4.0022460	49.26	-11.825
10/02/2034	00:58:19	-2.94	3.9531490	49.87	2.035
11/08/2035	05:42:28	-2.90	3.9941152	49.36	15.241
12/12/2036	14:42:16	-2.80	4.1074735	48.00	22.595
01/14/2038	19:57:35	-2.66	4.2495086	46.39	21.551
02/15/2039	08:02:06	-2.55	4.3732883	45.08	13.760
03/16/2040	21:58:20	-2.48	4.4440323	44.36	2.643
04/16/2041	12:20:49	-2.48	4.4444603	44.36	-8.928
05/17/2042	23:54:28	-2.54	4.3741846	45.07	-18.453
06/20/2043	02:36:05	-2.65	4.2504786	46.38	-23.088
07/24/2044	06:54:43	-2.78	4.1080937	47.99	-20.272
08/30/2045	07:02:20	-2.89	3.9948017	49.35	-10.077
10/07/2046	01:29:03	-2.94	3.9542530	49.86	4.006
11/13/2047	02:11:19	-2.89	4.0035143	49.24	16.694
12/17/2048	05:32:27	-2.78	4.1217367	47.83	22.951
01/19/2050	05:56:49	-2.65	4.2639159	46.24	20.775

Saturn at opposition:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.
06/27/2018	13:28:05	0.02	9.0488217	18.37	-22.454
07/09/2019	17:07:16	0.05	9.0327984	18.40	-22.012
07/20/2020	22:27:48	0.10	8.9947106	18.48	-20.658
08/02/2021	06:14:26	0.19	8.9352982	18.60	-18.440
08/14/2022	17:10:37	0.30	8.8568489	18.76	-15.440
08/27/2023	08:28:05	0.44	8.7630148	18.97	-11.761
09/08/2024	04:35:12	0.61	8.6580736	19.20	-7.530
09/21/2025	05:45:37	0.65	8.5467735	19.45	-2.895
10/04/2026	12:29:11	0.36	8.4342565	19.70	1.973
10/18/2027	00:35:31	0.10	8.3259973	19.96	6.871
10/30/2028	17:33:31	-0.12	8.2275744	20.20	11.558
11/13/2029	15:00:22	-0.29	8.1444133	20.41	15.753
11/27/2030	15:55:25	-0.42	8.0815345	20.56	19.149
12/11/2031	18:59:45	-0.49	8.0430706	20.66	21.447
12/24/2032	22:55:20	-0.48	8.0315983	20.69	22.414
01/08/2034	02:11:48	-0.43	8.0480675	20.65	21.947
01/22/2035	03:24:51	-0.31	8.0916184	20.54	20.103

02/05/2036	01:31:47	-0.13	8.1593974	20.37	17.082
02/17/2037	19:27:19	0.11	8.2471541	20.15	13.167
03/03/2038	08:33:01	0.40	8.3495934	19.90	8.667
03/16/2039	16:12:50	0.66	8.4605247	19.64	3.868
03/28/2040	18:15:18	0.48	8.5733335	19.39	-0.980
04/10/2041	15:12:16	0.33	8.6815953	19.14	-5.673
04/23/2042	07:28:20	0.21	8.7802132	18.93	-10.038
05/05/2043	19:38:07	0.12	8.8657727	18.75	-13.928
05/17/2044	04:37:22	0.05	8.9355551	18.60	-17.210
05/29/2045	10:58:10	0.01	8.9872060	18.49	-19.768
06/10/2046	15:22:02	-0.01	9.0189997	18.43	-21.507
06/22/2047	19:08:37	0.00	9.0299581	18.40	-22.358
07/03/2048	23:04:26	0.03	9.0198714	18.43	-22.284
07/16/2049	03:51:17	0.06	8.9891040	18.49	-21.287
07/28/2050	10:42:40	0.14	8.9385337	18.59	-19.403

Uranus at opposition:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.
10/24/2018	00:46:26	5.68	18.8752992	3.73	11.140
10/28/2019	08:14:51	5.67	18.8328951	3.74	12.569
10/31/2020	15:52:43	5.66	18.7876670	3.75	13.948
11/04/2021	23:57:14	5.65	18.7391261	3.76	15.271
11/09/2022	08:25:47	5.64	18.6872229	3.77	16.529
11/13/2023	17:20:05	5.62	18.6315285	3.78	17.715
11/17/2024	02:44:11	5.61	18.5722175	3.79	18.818
11/21/2025	12:24:51	5.60	18.5094264	3.81	19.829
11/25/2026	22:40:43	5.58	18.4441315	3.82	20.740
11/30/2027	09:21:18	5.57	18.3768199	3.84	21.542
12/03/2028	20:28:02	5.55	18.3084479	3.85	22.227
12/08/2029	08:10:39	5.53	18.2394725	3.86	22.786
12/12/2030	20:35:06	5.52	18.1707446	3.88	23.214
12/17/2031	09:26:35	5.50	18.1026347	3.89	23.503
12/20/2032	23:10:21	5.49	18.0356862	3.91	23.649
12/25/2033	13:27:41	5.47	17.9699669	3.92	23.647
12/30/2034	04:37:37	5.46	17.9057455	3.94	23.493
01/03/2036	20:29:41	5.44	17.8426766	3.95	23.185
01/07/2037	13:13:16	5.43	17.7807830	3.96	22.723
01/12/2038	06:41:30	5.41	17.7201070	3.98	22.109
01/17/2039	01:02:27	5.40	17.6610891	3.99	21.344
01/21/2040	19:45:41	5.38	17.6042701	4.00	20.434
01/25/2041	15:26:48	5.37	17.5503221	4.02	19.385
01/30/2042	11:35:03	5.36	17.5000031	4.03	18.204
02/04/2043	08:25:45	5.35	17.4540051	4.04	16.900
02/09/2044	05:49:44	5.34	17.4130276	4.05	15.484
02/13/2045	03:56:14	5.33	17.3775482	4.06	13.964
02/18/2046	02:34:38	5.32	17.3482660	4.06	12.353
02/23/2047	01:49:38	5.32	17.3251045	4.07	10.661
02/28/2048	01:26:09	5.31	17.3081297	4.07	8.899
03/04/2049	01:44:53	5.31	17.2967835	4.07	7.080
03/09/2050	02:29:22	5.31	17.2909055	4.08	5.215

Neptune at opposition:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.
09/07/2018	18:27:11	7.82	28.9329242	2.36	-6.799
09/10/2019	07:24:17	7.82	28.9276827	2.36	-5.986
09/11/2020	20:26:15	7.82	28.9224183	2.36	-5.164

09/14/2021	09:21:29	7.82	28.9166208	2.36	-4.333
09/16/2022	22:21:24	7.81	28.9097832	2.36	-3.496
09/19/2023	11:18:00	7.81	28.9018396	2.36	-2.653
09/21/2024	00:17:17	7.81	28.8931656	2.36	-1.807
09/23/2025	12:54:05	7.81	28.8841731	2.36	-0.959
09/26/2026	01:36:51	7.81	28.8757005	2.36	-0.110
09/28/2027	14:19:21	7.81	28.8680218	2.37	0.738
09/30/2028	02:48:34	7.81	28.8616950	2.37	1.585
10/02/2029	15:24:54	7.81	28.8565498	2.37	2.430
10/05/2030	03:46:25	7.81	28.8526393	2.37	3.272
10/07/2031	16:21:58	7.81	28.8497226	2.37	4.111
10/09/2032	04:45:04	7.80	28.8472944	2.37	4.944
10/11/2033	17:07:13	7.80	28.8448696	2.37	5.773
10/14/2034	05:30:14	7.80	28.8417548	2.37	6.594
10/16/2035	17:58:08	7.80	28.8378400	2.37	7.407
10/18/2036	06:13:27	7.80	28.8329960	2.37	8.210
10/20/2037	18:22:29	7.80	28.8278656	2.37	9.001
10/23/2038	06:30:06	7.80	28.8228478	2.37	9.780
10/25/2039	18:24:06	7.80	28.8187364	2.37	10.545
10/27/2040	06:24:20	7.80	28.8157865	2.37	11.295
10/29/2041	18:02:50	7.80	28.8142450	2.37	12.029
11/01/2042	05:56:02	7.80	28.8143119	2.37	12.747
11/03/2043	17:41:59	7.80	28.8157069	2.37	13.447
11/05/2044	05:20:49	7.80	28.8182818	2.37	14.128
11/07/2045	17:04:12	7.80	28.8212254	2.37	14.790
11/10/2046	04:44:11	7.80	28.8241241	2.37	15.430
11/12/2047	16:28:08	7.80	28.8262962	2.37	16.048
11/14/2048	04:02:50	7.80	28.8276244	2.37	16.642
11/16/2049	15:33:27	7.80	28.8282462	2.37	17.210
11/19/2050	02:55:01	7.80	28.8286954	2.37	17.752

Pluto at opposition:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.
07/12/2018	10:04:08	14.25	32.5830420	0.10	-21.776
07/14/2019	14:51:08	14.28	32.8221633	0.10	-22.073
07/15/2020	19:12:28	14.31	33.0635414	0.10	-22.338
07/17/2021	22:46:17	14.34	33.3067531	0.10	-22.573
07/20/2022	01:38:28	14.37	33.5514770	0.10	-22.780
07/22/2023	03:52:29	14.41	33.7979043	0.10	-22.958
07/23/2024	05:37:44	14.44	34.0465923	0.10	-23.109
07/25/2025	06:32:46	14.47	34.2977483	0.10	-23.234
07/27/2026	06:55:08	14.50	34.5516708	0.09	-23.334
07/29/2027	06:47:45	14.53	34.8079641	0.09	-23.408
07/30/2028	06:03:35	14.56	35.0664595	0.09	-23.459
08/01/2029	04:56:21	14.59	35.3264178	0.09	-23.486
08/03/2030	02:58:49	14.63	35.5871212	0.09	-23.491
08/05/2031	00:51:13	14.66	35.8479959	0.09	-23.475
08/05/2032	22:12:29	14.69	36.1081717	0.09	-23.439
08/07/2033	18:55:20	14.72	36.3672983	0.09	-23.384
08/09/2034	15:18:17	14.75	36.6248829	0.09	-23.311
08/11/2035	11:03:39	14.78	36.8812552	0.09	-23.222
08/12/2036	06:30:48	14.81	37.1369341	0.09	-23.117
08/14/2037	01:19:20	14.84	37.3923101	0.09	-22.997
08/15/2038	19:38:43	14.87	37.6478522	0.09	-22.861
08/17/2039	13:41:50	14.90	37.9034329	0.09	-22.711
08/18/2040	07:18:02	14.92	38.1590448	0.09	-22.547

08/20/2041	00:28:50	14.95	38.4140718	0.09	-22.370
08/21/2042	17:14:27	14.98	38.6679890	0.08	-22.179
08/23/2043	09:51:01	15.01	38.9201821	0.08	-21.976
08/24/2044	01:59:59	15.04	39.1698750	0.08	-21.761
08/25/2045	17:51:00	15.06	39.4165983	0.08	-21.536
08/27/2046	09:17:48	15.09	39.6597915	0.08	-21.302
08/29/2047	00:23:13	15.11	39.8998019	0.08	-21.060
08/29/2048	15:15:59	15.14	40.1370229	0.08	-20.810
08/31/2049	05:26:01	15.17	40.3719994	0.08	-20.553
09/01/2050	19:29:07	15.19	40.6053090	0.08	-20.289