

MERCURY AND VENUS

Mercury in 2017 will make three and a half "apparitions" in the pre-dawn sky, alternating with three into the sunset sky. That is, in January it swings out on the westward side of the Sun (the right-hand side, as seen from Earth's northern hemisphere); then disappears behind the Sun, to reappear on the eastward ("left," or evening) side in March-April; and so on.

Venus at the beginning of 2017 is out just about as far as it can go on the eastern side, so it is the conspicuous "evening star"—but not for long: rapidly whirling in to overtake us on the inside, it disappears in front of the Sun's glare in late March. Then it reappears in the pre-dawn sky, and is the high "morning star" that will be noticed from May to October.

VENUS	r.a.(2000)	dec.	hedis	gedis	elo	mag	dia"
Jan 12 13 max.elong.east	22 44 49	-8 30	0.721	0.684	47	-4.4	24.5
Jan 13 2 0.4°N of Neptune	22 46 44	-8 15	0.721	0.680	47	-4.4	24.6
Jan 17 18 ascending node	23 3 23	-6 2	0.721	0.646	47	-4.5	25.9
Feb 17 7 max.illum.area	0 25 21	7 28	0.718	0.427	40	-4.6	39.2
Feb 20 17 perihelion	0 30 14	8 38	0.718	0.405	39	-4.6	41.3
Mar 2 14 stat.in r.a.>retr	0 36 44	11 12	0.719	0.347	32	-4.6	48.2
Mar 14 6 max.lat.north	0 26 57	11 52	0.719	0.298	19	-4.3	56.2
Mar 25 10 inf.conj.with sun	0 4 3	9 29	0.720	0.281	-8	-4.0	59.6
Apr 12 24 stat.in r.a.>dir.	23 40 20	3 18	0.723	0.330	-27	-4.4	50.7
Apr 30 4 max.illum.area	23 59 38	1 30	0.725	0.435	-39	-4.5	38.5
May 9 7 descending node	0 21 30	2 20	0.726	0.502	-43	-4.5	33.4
Jun 2 15 1.8°S of Uranus	1 40 27	8 3	0.728	0.693	-46	-4.3	24.1
Jun 3 12 max.elong.west	1 43 45	8 19	0.728	0.700	-46	-4.3	23.9
Jun 12 21 aphelion	2 19 31	11 10	0.728	0.776	-46	-4.2	21.6
Jul 5 4 max.lat.south	3 53 17	17 36	0.727	0.951	-43	-4.1	17.6
Aug 5 20 max.declin.north	6 25 7	21 59	0.724	1.180	-38	-4.0	14.2
Aug 30 11 ascending node	8 28 47	19 3	0.720	1.334	-32	-4.0	12.5
Oct 3 5 perihelion	11 10 17	6 46	0.718	1.505	-24	-3.9	11.1
Oct 5 13 0.2°N of Mars	11 20 60	5 42	0.718	1.515	-23	-3.9	11.1
Oct 24 23 max.lat.north	12 49 42	-3 39	0.719	1.587	-19	-3.9	10.5
Nov 13 6 0.3°N of Jupiter	14 20 22	-12 38	0.721	1.642	-14	-3.9	10.2
Dec 15 16 2.2°S of Mercury	17 6 46	-22 41	0.726	1.698	-6	-3.9	9.9
Dec 19 24 descending node	17 30 20	-23 15	0.726	1.702	-5	-3.9	9.8
Dec 25 18 1.1°S of Saturn	18 1 50	-23 39	0.727	1.706	-3	-3.9	9.8
Dec 28 11 max.declin.south	18 16 45	-23 42	0.727	1.708	-3	-3.9	9.8

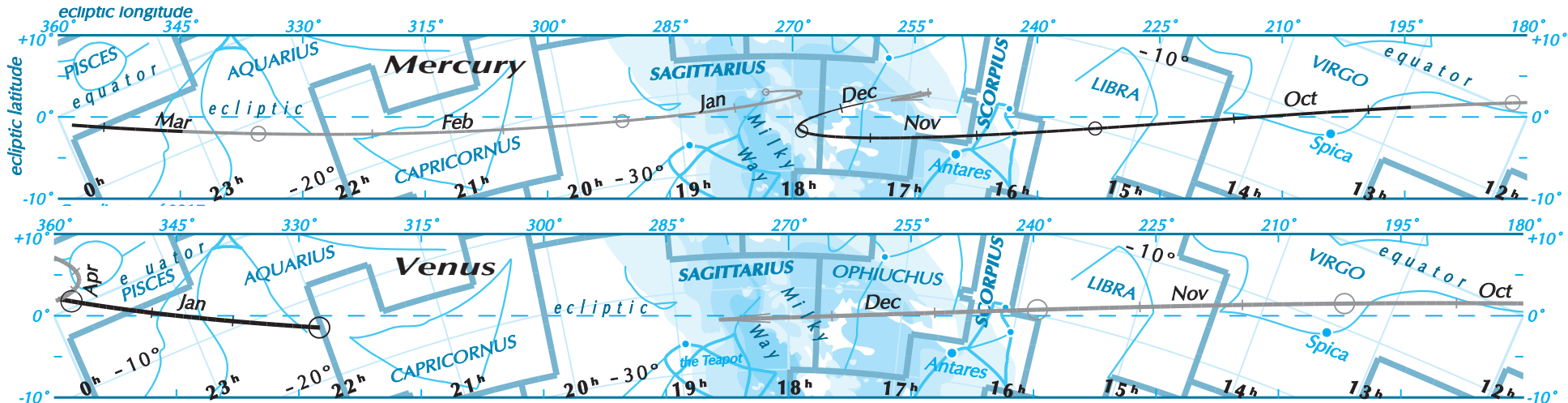
MERCURY	r.a.(2000)	dec.	hedis	gedis	elo	mag	dia"
Jan 4 20 max.lat.north	17 58 25	-20 12	0.337	0.731	-15	1.3	9.1
Jan 8 10 stat.in r.a.>dir.	17 54 6	-20 26	0.356	0.794	-20	0.5	8.4
Jan 17 9 max.illum.area	18 13 53	-21 42	0.407	0.971	-24	-0.1	6.9
Jan 19 10 max.elong.west	18 22 19	-21 58	0.417	1.009	-24	-0.2	6.6
Jan 28 6 descending node	19 7 30	-22 31	0.452	1.153	-23	-0.2	5.8
Jan 29 18 1.2°S of Pluto	19 16 7	-22 29	0.456	1.174	-22	-0.2	5.7
Feb 7 14 aphelion	20 10 8	-21 20	0.467	1.277	-19	-0.3	5.2
Feb 27 21 max.lat.south	22 23 23	-12 17	0.412	1.381	-6	-1.1	4.8
Mar 4 5 1.1°S of Neptune	22 53 16	-9 8	0.388	1.375	-3	-1.5	4.9
Mar 7 0 sup.conj.with sun	23 12 32	-6 55	0.372	1.363	2	-1.7	4.9
Mar 18 22 ascending node	0 35 25	3 49	0.314	1.221	11	-1.3	5.5
Mar 22 17 max.illum.area	1 0 15	7 15	0.308	1.140	15	-1.1	5.9
Mar 23 14 perihelion	1 5 45	8 0	0.308	1.119	15	-1.0	6.0
Mar 27 6 2.4°N of Uranus	1 26 45	10 55	0.312	1.026	18	-0.7	6.5
Apr 1 10 max.elong.east	1 49 43	14 3	0.330	0.888	19	-0.0	7.5
Apr 2 19 max.lat.north	1 54 10	14 39	0.337	0.852	19	0.2	7.8
Apr 10 1 stat.in r.a.>retr	2 4 58	16 2	0.378	0.691	15	1.9	9.7
Apr 20 6 inf.conj.with sun	1 49 42	13 3	0.431	0.575	-2	5.7	11.6
Apr 26 5 descending node	1 37 9	10 7	0.452	0.573	-10	3.7	11.7
Apr 28 17 0.1°S of Uranus	1 33 42	9 2	0.458	0.585	-13	3.0	11.4
May 2 14 stat.in r.a.>dir.	1 31 37	7 48	0.464	0.615	-18	2.1	10.9
May 6 14 aphelion	1 33 49	7 11	0.467	0.658	-22	1.5	10.2
May 7 24 2.2°S of Uranus	1 35 38	7 8	0.466	0.675	-23	1.3	9.9
May 17 23 max.elong.west	2 1 46	8 49	0.449	0.822	-26	0.5	8.1
May 20 11 max.illum.area	2 11 27	9 42	0.440	0.864	-26	0.4	7.7
May 26 20 max.lat.south	2 41 25	12 35	0.412	0.975	-24	0.0	6.9
Jun 14 21 ascending node	4 57 27	22 40	0.314	1.285	-8	-1.5	5.2
Jun 16 16 max.illum.area	5 13 46	23 20	0.310	1.301	-6	-1.7	5.1
Jun 19 13 perihelion	5 41 6	24 10	0.308	1.319	-3	-2.1	5.1
Jun 21 14 sup.conj.with sun	6 0 41	24 32	0.309	1.324	1	-2.2	5.0
Jun 24 8 max.declin.north	6 27 14	24 43	0.315	1.322	4	-1.9	5.1
Jun 28 18 0.8°N of Mars	7 8 24	24 18	0.332	1.299	9	-1.4	5.1
Jun 29 18 max.lat.north	7 17 25	24 5	0.337	1.290	10	-1.3	5.2
Jul 23 4 descending node	9 54 33	12 43	0.452	0.976	26	0.2	6.9
Jul 30 5 max.elong.east	10 22 19	8 48	0.465	0.871	27	0.4	7.7
Jul 30 9 max.illum.area	10 22 52	8 42	0.465	0.869	27	0.4	7.7
Aug 2 13 aphelion	10 32 10	7 8	0.467	0.823	27	0.6	8.1
Aug 12 6 stat.in r.a.>retr	10 45 29	3 46	0.454	0.695	22	1.3	9.6
Aug 22 19 max.lat.south	10 28 30	4 33	0.412	0.618	9	3.7	10.8
Aug 26 21 inf.conj.with sun	10 15 46	6 16	0.390	0.625	-4	4.8	10.7
Sep 1 24 4.1°S of Mars	10 0 52	9 18	0.355	0.691	-11	2.6	9.7
Sep 4 16 stat.in r.a.>dir.	9 59 1	10 21	0.340	0.741	-14	1.6	9.0
Sep 10 20 ascending node	10 9 30	11 22	0.314	0.893	-18	-0.0	7.5
Sep 12 10 max.elong.west	10 15 20	11 14	0.311	0.937	-18	-0.3	7.1
Sep 15 12 perihelion	10 29 50	10 32	0.307	1.024	-17	-0.7	6.5
Sep 16 18 0.1°N of Mars	10 36 37	10 5	0.308	1.058	-17	-0.8	6.3
Sep 19 14 max.illum.area	10 53 16	8 48	0.313	1.132	-15	-1.0	5.9
Sep 25 18 max.lat.north	11 33 24	4 54	0.337	1.264	-11	-1.2	5.3
Oct 8 21 sup.conj.with sun	12 58 54	-5 4	0.410	1.408	1	-1.5	4.7
Oct 18 15 1.0°S of Jupiter	13 58 54	-12 3	0.450	1.425	7	-0.9	4.7
Oct 19 3 descending node	14 2 2	-12 24	0.452	1.424	7	-0.8	4.7
Oct 29 12 aphelion	15 4 32	-18 32	0.467	1.378	13	-0.5	4.9
Nov 18 18 max.lat.south	17 4 47	-25 23	0.412	1.123	21	-0.3	6.0
Nov 24 0 max.elong.east	17 31 18	-25 44	0.383	1.017	22	-0.3	6.6
Nov 24 1 max.declin.south	17 31 20	-25 44	0.383	1.017	22	-0.3	6.6
Nov 24 12 max.illum.area	17 33 27	-25 44	0.381	1.007	22	-0.3	6.6
Nov 28 10 3.1°S of Saturn	17 48 2	-25 30	0.358	0.919	21	-0.2	7.3
Dec 3 8 stat.in r.a.>retr	17 55 54	-24 41	0.332	0.806	18	0.4	8.3
Dec 6 11 1.3°S of Saturn	17 52 2	-23 50	0.319	0.743	14	1.3	9.0
Dec 7 20 ascending node	17 47 55	-23 23	0.314	0.721	12	1.9	9.3
Dec 12 12 perihelion	17 24 44	-21 38	0.307	0.678	2	5.0	9.9
Dec 13 2 inf.conj.with sun	17 21 19	-21 24	0.308	0.678	2	5.1	9.9
Dec 15 16 2.2°N of Venus	17 6 47	-20 27	0.311	0.688	-7	3.4	9.7
Dec 22 17 max.lat.north	16 46 55	-19 23	0.337	0.798	-18	0.5	8.4
Dec 23 3 stat.in r.a.>dir.	16 46 52	-19 24	0.339	0.806	-19	0.4	8.3

TABLES OF PHENOMENA. Columns are: right ascension (in hours, minutes, seconds) and declination (in degrees and minutes), for epoch 2000; distance from Sun and Earth, in astronomical units; elongation from Sun (in degrees; negative means "westward"); magnitude; diameter in arc seconds. "Stat.in r.a.>dir." means "stationary in right ascension, starts to move direct (eastward)"; "retr" means retrograde (westward). "Inf." and "sup. conj." mean inferior and superior conjunction with the Sun; these divide the planet's morning and evening apparitions. Dates of greatest illuminated extent do not coincide with greatest elongation, and may be of more interest to telescopic observers. Dates of conjunctions with other planets are in right ascension.

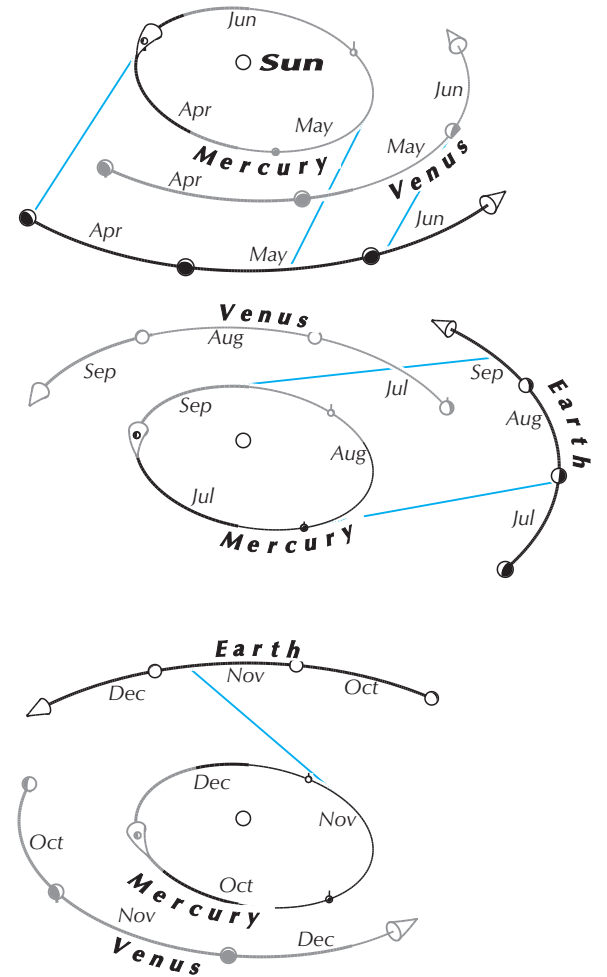
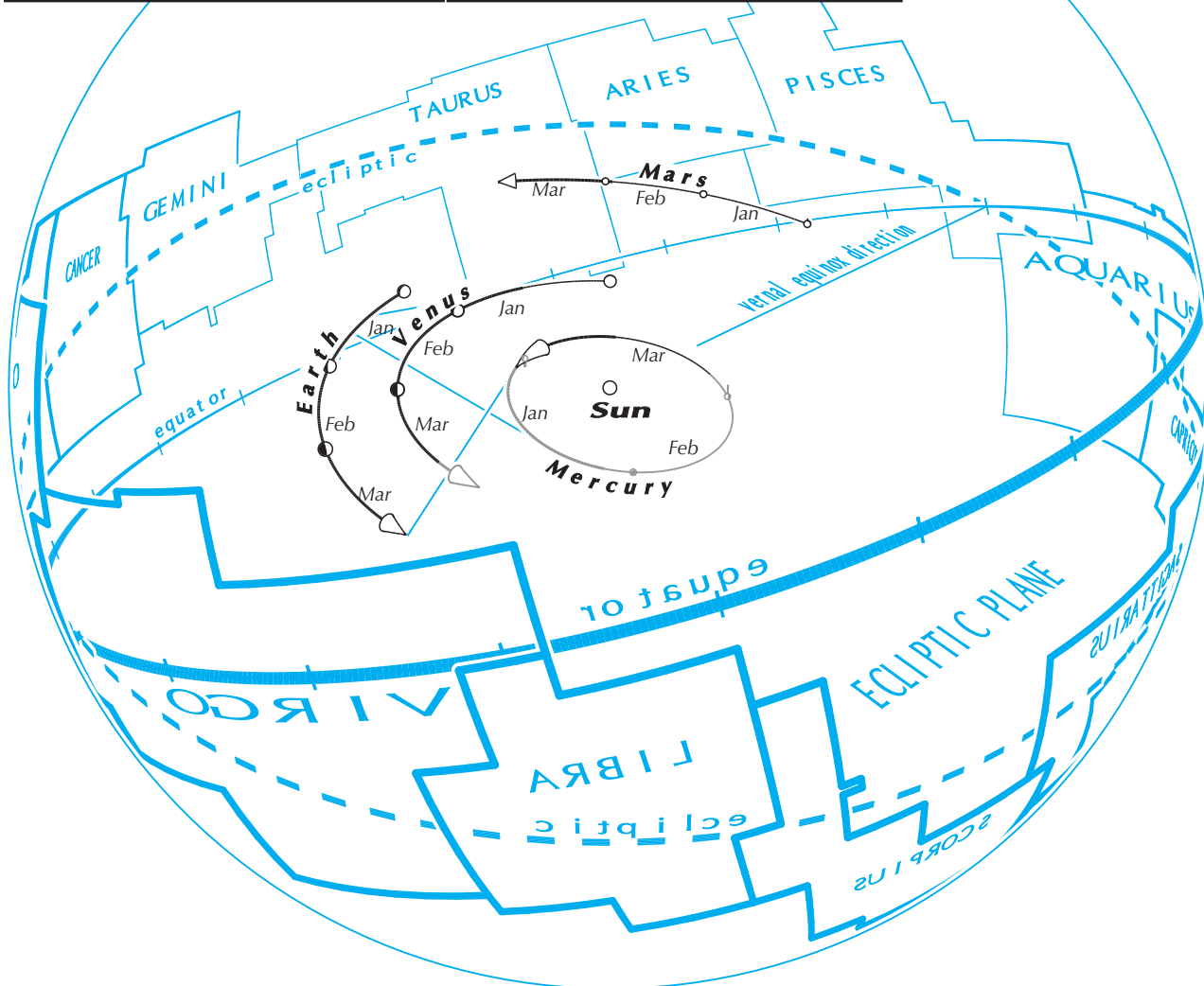
CHARTS of the paths of Mercury and Venus, plotted in ecliptic latitude and longitude. (Plotted equatorially they would take up much more vertical space.) The more familiar grid of equatorial coordinates (right ascension and declination) is also shown, curving in relation to the ecliptic system. The ecliptic itself is marked by dashes 2° long. Ticks mark the planets' positions at days 11 and 21 of each

month. At day 1 is an open circle, sized for magnitude (brightness), so that the planet can be compared with the stars. On the scale of the maps (2 cm to 15°) the planets' disks would be only a few hundredths of a millimeter wide. Mercury and Venus stay near the Sun; so they start and end each year near its winter position in Sagittarius. Their paths are black when in the evening sky (east of the Sun,

left as seen from the northern hemisphere), gray in the morning sky (west or right of the Sun). Transition from black to gray is at inferior conjunction, when the planet passes in front of the Sun; gray to black at superior conjunction, beyond the Sun.



Mercury		Venus	
mean dist. from sun	0.39 a.u.	mean dist. from sun	0.72 a.u.
sidereal period	0.24 year = 88 days	sidereal period	0.62 year = 225 days
synodic period	116 days	synodic period	584 days
eccentricity	0.206	eccentricity	0.007
inclination	7°	inclination	3.4°
diameter	4,880 km	diameter	12,100 km



CONTINUATIONS of the motions of Mercury, Venus, and Earth in the other quarters of the year. The Earth goes around the Sun once in the year, but Venus 1.625 times and Mercury 4.15 times.

SPATIAL VIEW of the orbits of the inner planets during the first quarter of the year. This picture is heliocentric: the Sun is the fixed point and origin for measurements. The viewpoint in this and other spatial views in the book is from ecliptic longitude 230°, latitude +35°, in the head of the constellation Serpens, so that the 23½° tilt of the ecliptic plane to the equatorial plane can be seen. This view is from a distance of 6 astronomical units (a.u.) from the Sun. On an imaginary sphere, 2 a.u. out, are shown the planes of the equator and ecliptic, and the boundaries of the zodi-

acal constellations. The planets move nearly in the ecliptic plane, so as seen from the Earth they appear against the background of these constellations (except that part of the ecliptic, in the foreground, lies in Ophiuchus rather than Scorpius). Along the orbital paths, globes represent the planets at the start of each month. Their size is exaggerated 500 times, the Sun's only 5 times. When a planet is in or north of the ecliptic plane, its path is drawn with a thicker line. When it is in the morning sky (west of the Sun) as seen from the Earth, its course is shown in gray.

MERCURY AND VENUS APPARITIONS compared. Blue areas represent morning apparitions (westward elongation); gray, evening apparitions (eastward). The top figures are the maximum elongations (angular distances the planet attains from the Sun), reached at the top dates shown beneath. Curves show the altitude of the planet above the horizon at sunrise or sunset, for latitude 40° north (thick line) and 35° south (thin), with maxima reached at the parenthesized dates below (40° north bold).

