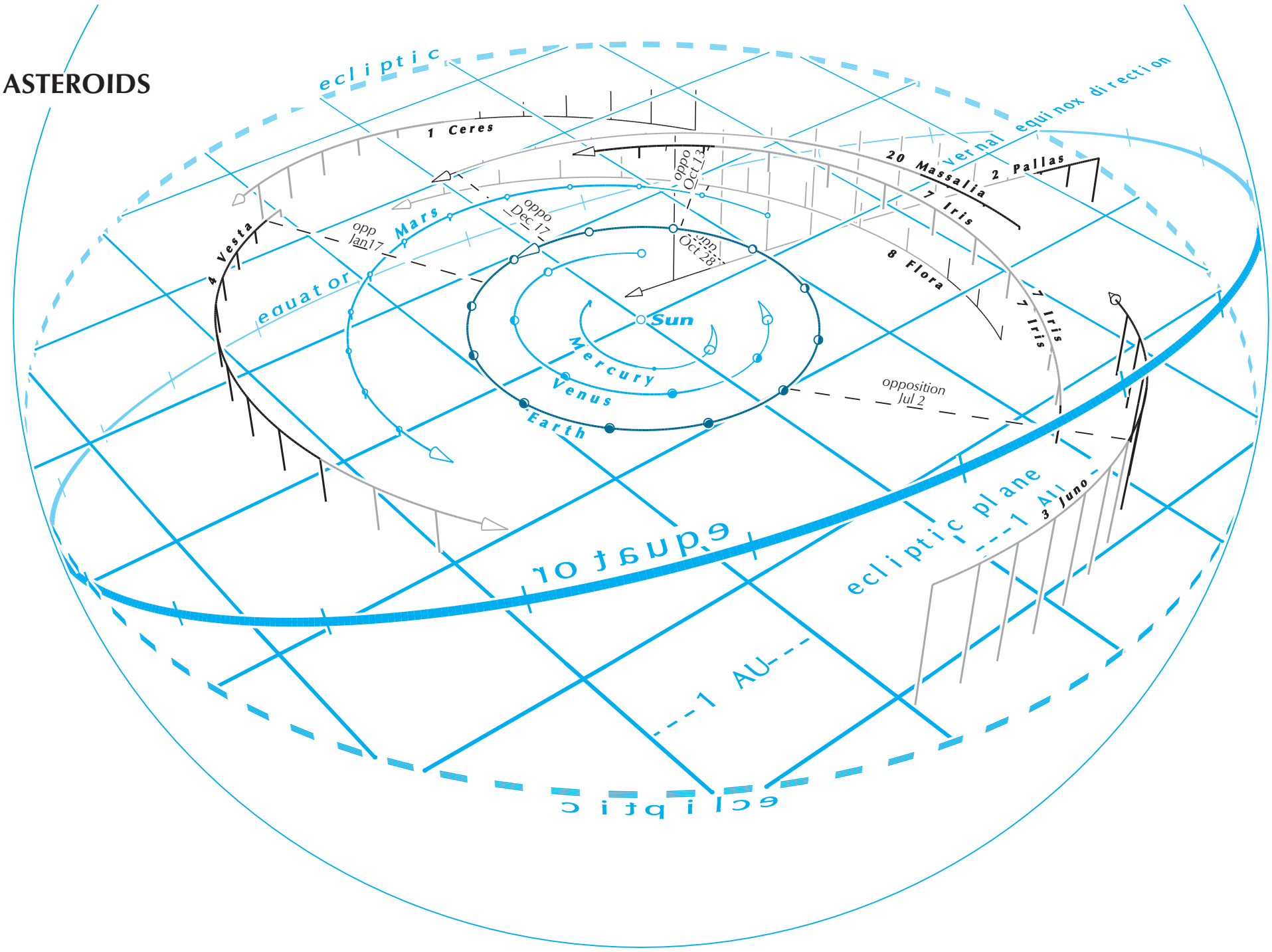
ASTEROIDS



SPATIAL VIEW of a sphere 3.5 a.u. in radius, from a viewpoint 10.5 a.u. from the Sun. Grid-lines on the ecliptic plane are 1 a.u. apart. The path of each body is drawn for the whole year (Venus, 6 months; Mercury, 2 months). Stalks to the ecliptic plane show the body's position at the start of each month. A tick pointing toward (or away from) the Sun shows where an asteroid reaches perihelion or aphelion). Where an asteroid is at opposition, a dashed line connects its position to that of the Earth at the date; each dash or gap is 0.1 AU long. Oppositions shown are in longitude (date of opposition in right ascension can be a day or more different). When an asteroid is in the morning sky (west of the Sun) as seen from Earth, its course is drawn in gray.

Orbital and other facts.
***q*: perihelion distance.**
***a*: mean distance.**
***Q*: aphelion distance.**
e: eccentricity.
***P*: period.**
***i*: inclination.**

name	*discov.*	*diam.*	*q*	*a*	*Q*	*e*	*P*	*i*
		km	*AU*	*AU*	*AU*		*years*	°
1 Ceres	1801	952	2.56	2.77	2.980.08		4.60	11
2 Pallas	1802	524	2.13	2.77	3.410.23		4.62	35
3 Juno	1804	274	1.98	2.67	3.350.26		4.36	13
4 Vesta	1807	525	2.15	2.36	2.570.09		3.63	7
7 Iris	1847	211	1.83	2.39	2.940.23		3.68	6
8 Flora	1847	151	1.86	2.20	2.550.16		3.27	6
20 Massalia	1852	145	2.07	2.41	2.750.14		3.74	1

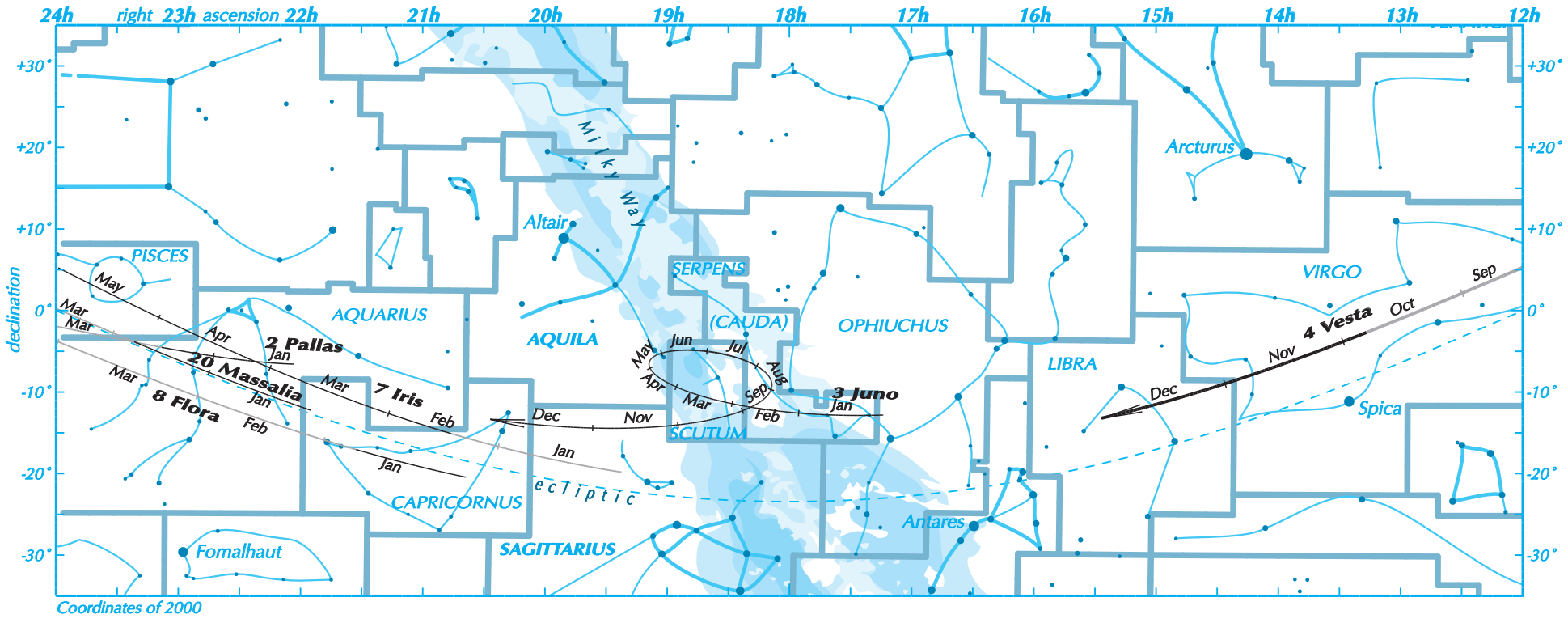
The age of the asteroids began on 1801 Jan. 1, when Giuseppe Piazzi, at Palermo in Sicily, discovered what he and the astronomers of Europe hoped was the "missing planet" in the wide gap between Mars and Jupiter. He named it Ceres, for the Roman goddess of the harvest and patroness of Sicily. Three more were discovered in the next few years, and also named for classical goddesses. There was a gap till 1845 when the 5th was found; then as these small bodies became numerous they were no longer called planets but *asteroids*, "star-like," because they did not seem to show perceptible disks like the planets; later more officially *minor planets*. Now thousands are discovered each years, and there must be millions that are over a few meters in size. Most circulate in the Main Belt between Mars and Jupiter, but there are special classes that go nearer in, some across Earth's orbit, or farther out. All are below naked-eue brightness except sometimes Vesta. Those most observable each year are the First Four (of which 3 Juno is usually the dimmest) and various others from lower down the list that happen to be at favorable oppositions. These Main Belt asteroids have periods of betweem 3 and 5 years; in each of their circuits of the sky they miss opposition in the year when they pass the direction outward from Earth's December-January position.

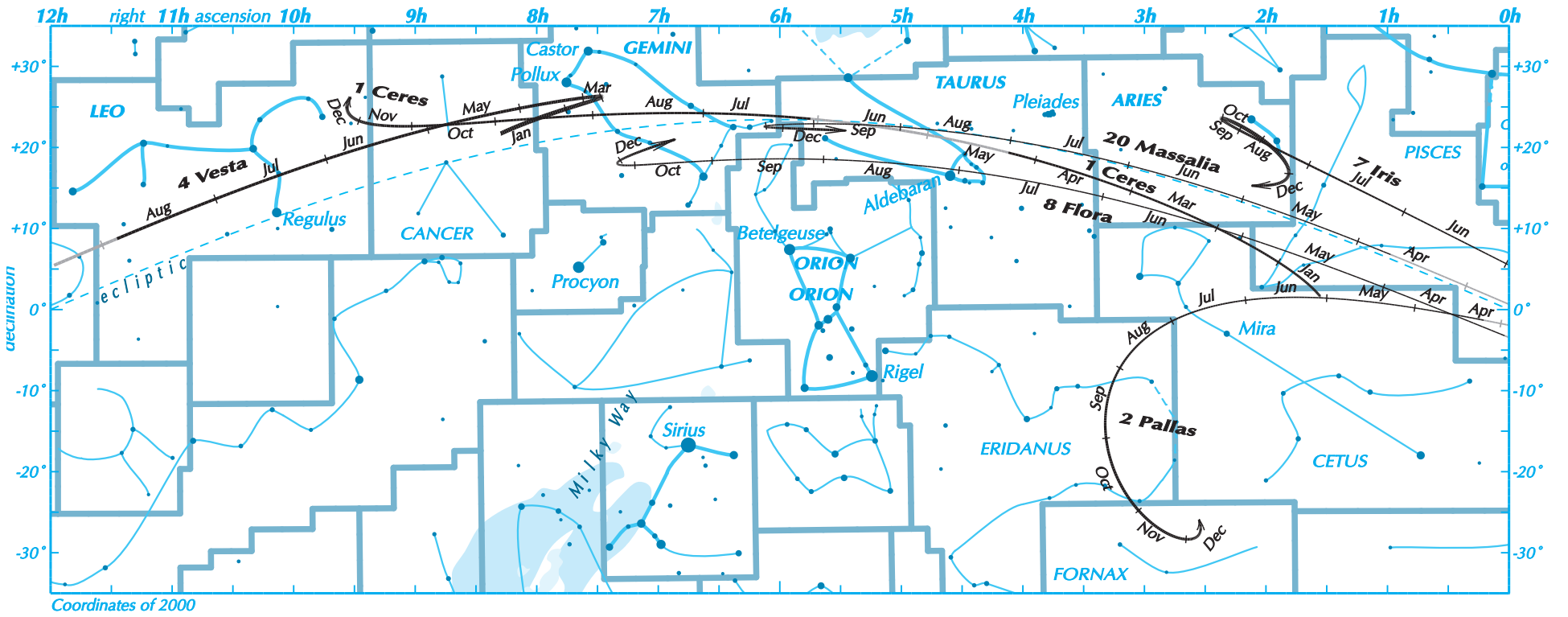
Opposition is the center of the couple of months when an asteroid is nearest and brightest (and appears to be retrograding in the sky as we overtake it), so its exact date does not greatly matter. I calculate it in longitude, as for the planets; in other sources it may be given slightly differently because calculated in right ascension.

PHENOMENA. Columns: right ascension (hours, minutes, seconds) and declination (degrees, minutes), for epoch 2000; distance from Sun and Earth, in astronomical units; elongation from Sun (degrees; negative = westward); magnitude.

	r.a.(2000)	dec.	hedis	gedis elo	mag
1 Ceres					
Dec 31 0	9 31 59	26 5	2.581	1.742-141	7.5
2 Pallas					
Oct 28 16 opposition	3 5 25	-24 0	2.544	1.697-140	8.3
3 Juno					
Jul 2 6 opposition	18 39 24	-5 1	3.080	2.098 162	9.9
4 Vesta					
Jan 17 17 opposition	8 1 1	23 26	2.506	1.523-177	6.3
7 Iris					
Oct 29 14 opposition	2 3 31	21 18	1.837	0.849 172	6.9
Nov 18 9 perihelion	1 50 55	18 21	1.833	0.888 155	7.5
8 Flora					
Jul 20 10 perihelion	4 6 52	16 7	1.856	2.242 -55	11.0
Dec 31 0	6 53 9	20 54	2.013	1.030-176	8.3
#					
20 Massalia					
Dec 17 8 opposition	5 39 55	22 12	2.077	1.093-179	8.4

MAP for selected asteroids through the year. Ticks are at 1st of each month. Paths are thicker where asteroids are brighter; gray where they are less than 15° from the Sun.





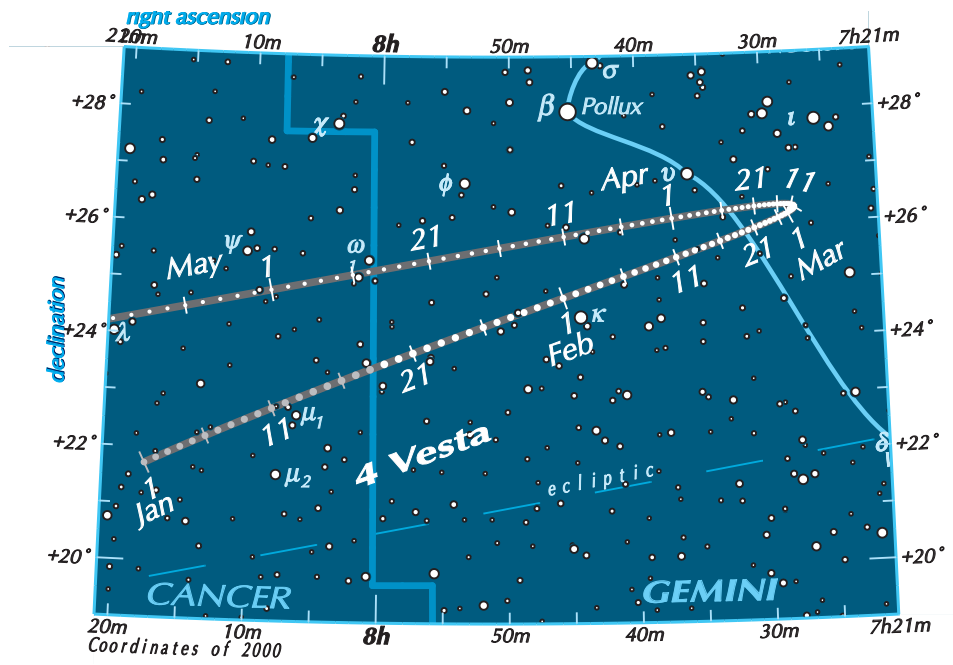
4 Vesta. This year the first of the major asteroids that we pass at opposition is the brightest, the only one you can possibly find with the naked eye.

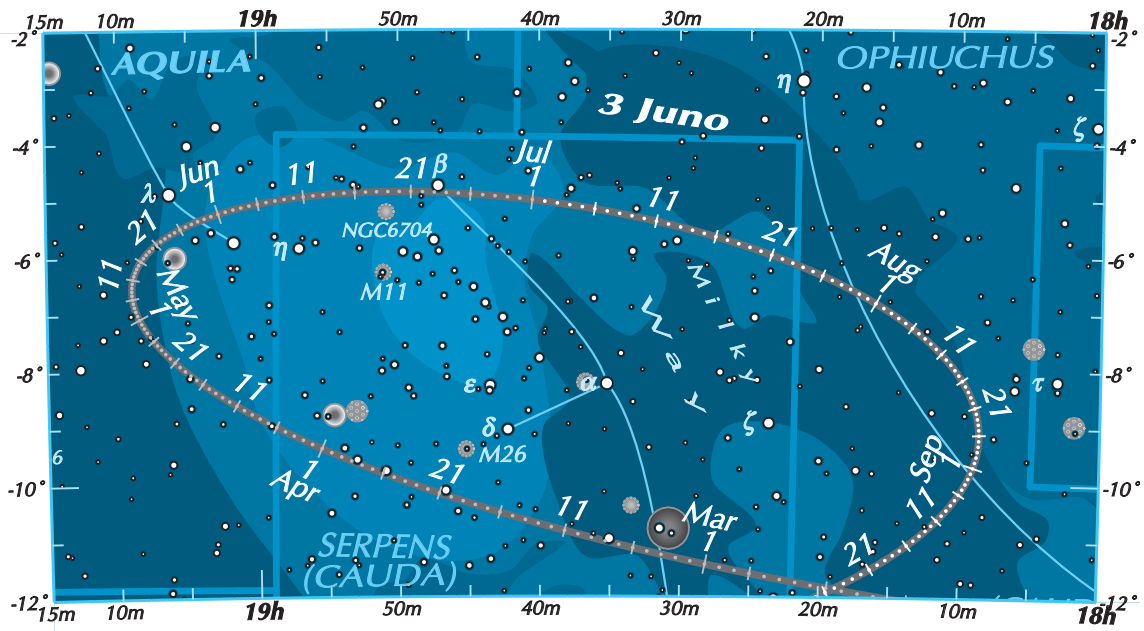
This is a favorable opposition in that Vesta is at its northernmost declination in a long span of years. It is not at its very brightest, reaching magnitude 6.3—just at or above the limit for the naked eye with a dark clear sky. It can at opposition be as dim as 6.6, or as bright as 5.4, as will happen in 2018 when perihelion and opposition are close together (May 10 and June 19).

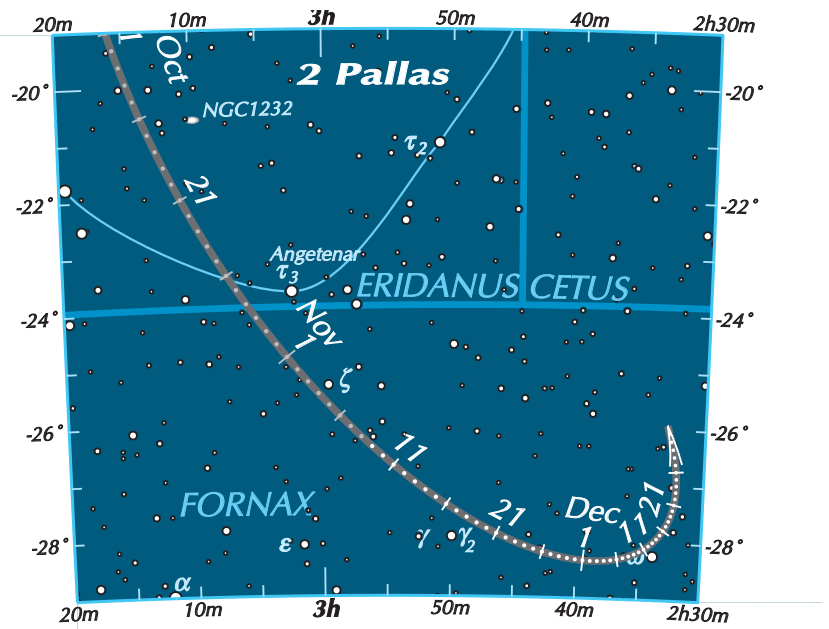
The Moon is Full on Jan. 12, so now rises at about 10 PM, and later on following nights. So the good time for Vesta is really the two weeks starting now. It will fade by a magnitude, but be findable with binoculars in moonless evenings.

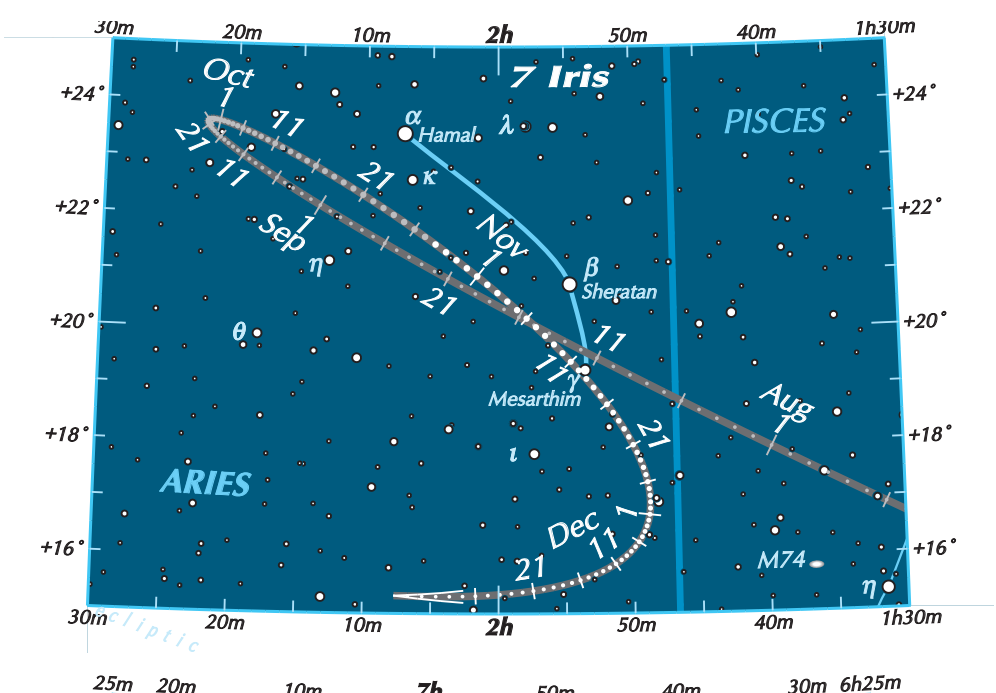
Though Vesta was only the 4th asteroid discovered, it is the second largest: diameter 525 kilometers, slightly wider than Pallas, but considerably more massive. It is the brightest asteroid almost though not quite always (Ceres when brightest is 0.1 magnitude brighter than Vesta when faintest). This results from a combination of size; distance (Vesta's aphelion is slightly farther out than Ceres's perihelion); and high "albedo" or reflectivity—that is, Vesta has a light-colored surface

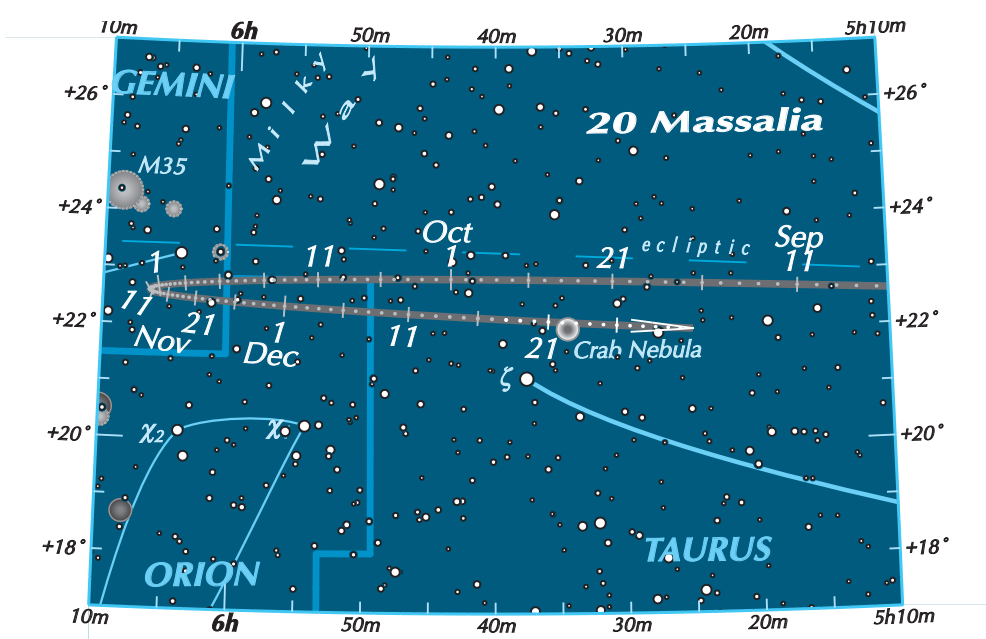
NASA's Dawn spacecraft was in orbit around Vesta from 2011 July to 2012 September, before traveling on to Ceres.g

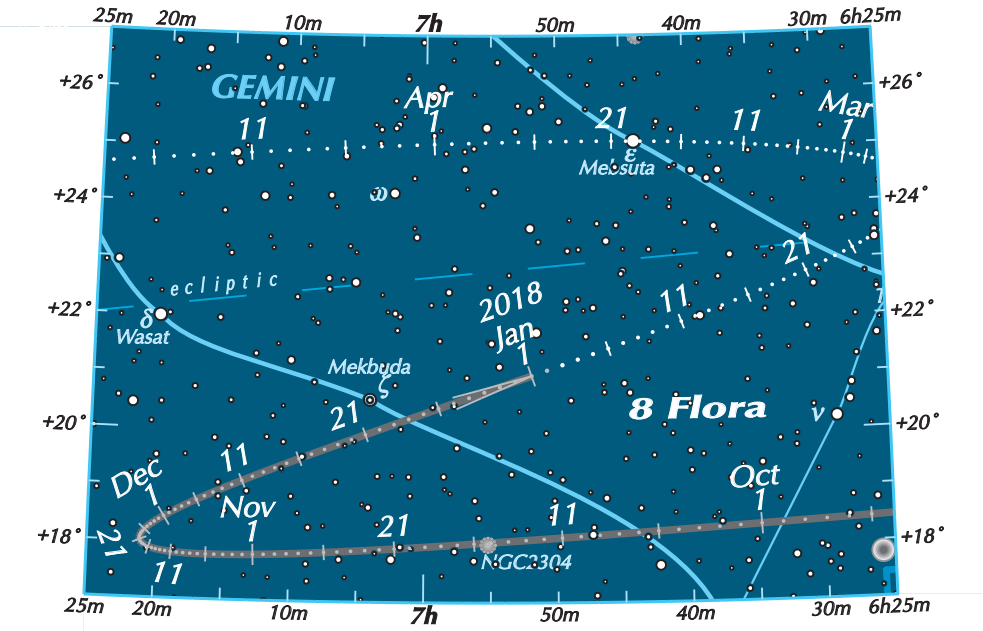


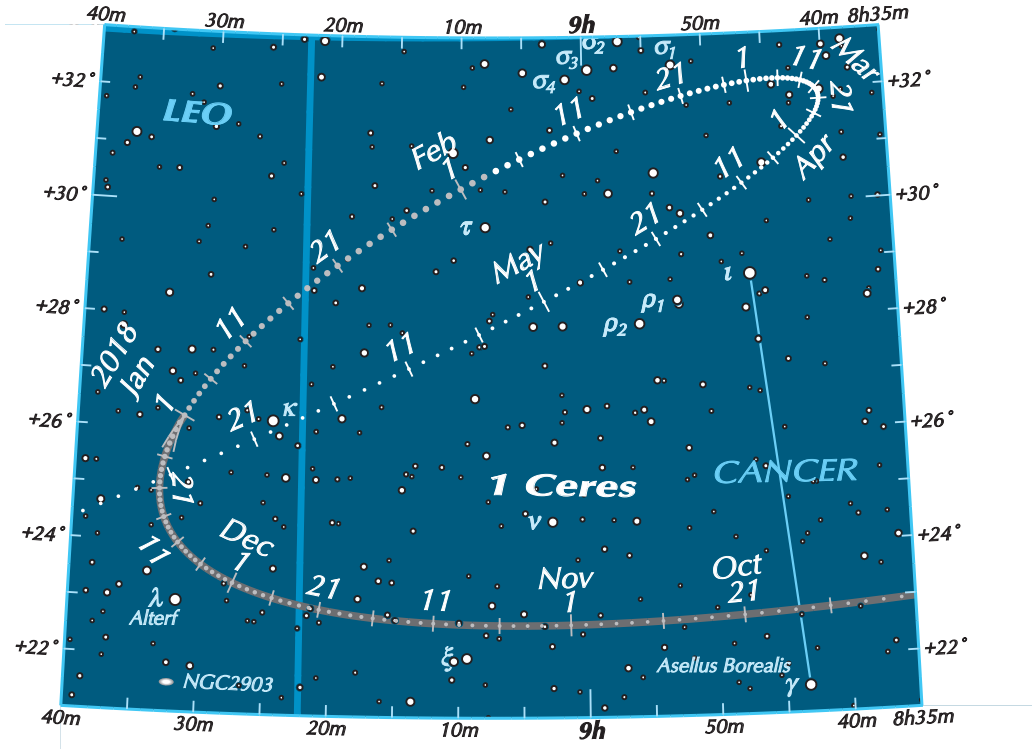

AQUILA
OPHIUCHUS
3 Juno
NGC6704
M11
M26
Milky Way
SERPENS (CAUDA)
Jun
Jul
Aug
Sep
Mar
Apr
May


2 Pallas
NGC1232
Angetenar
ERIDANUS CETUS
FORNAX
Oct
Nov
Dec


7 Iris
Hamal
Sheratan
Mesarthim
PISCES
ARIES
M74
Oct
Nov
Dec
Aug
Sep


20 Massalia
GEMINI
Milky Way
M35
Crab Nebula
ecliptic
ORION
TAURUS
Oct
Nov
Dec
Sep


GEMINI
8 Flora
Wasat
Mekbuda
Mebsuta
NGC2304
ecliptic
2018
Jan
Apr
Mar
Dec
Nov
Oct


LEO
1 Ceres
CANCER
Alterf
Asellus Borealis
NGC2903
2018
Jan
Feb
Mar
Apr
May
Dec
Nov
Oct