

Barycenters of Some Solar System Objects

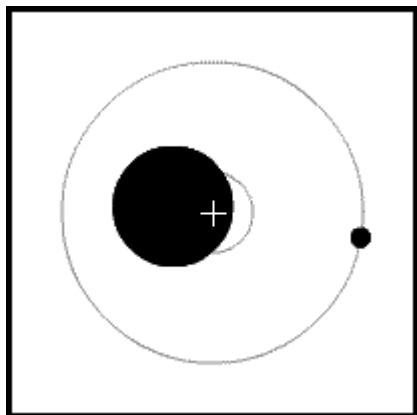
The Barycenter is the point around which two, or more, celestial bodies orbit, where their centers of mass are in balance. With two bodies, the Barycenter always falls on a line between the two centers of mass. The Barycenter for the Earth-Moon system lies about 1710 km (1060 miles) below the Earth's surface.

Larger Body	m_1	Smaller Body	m_2	a (km)	r_1 (km)	R_1 (km)	r_1 / R_1
Earth	1	Moon	0.0123	384,000	4,670	6,380	0.732
Sun	3.33×10^5	Earth	1	1.5×10^8	449	696,000	0.000646
Sun	3.33×10^5	Jupiter	318	7.78×10^8	7.42×10^5	6.96×10^5	1.07
Pluto	2.1×10^{-3}	Charon	2.54×10^{-4}	1.96×10^4	2,110	1,150	1.83

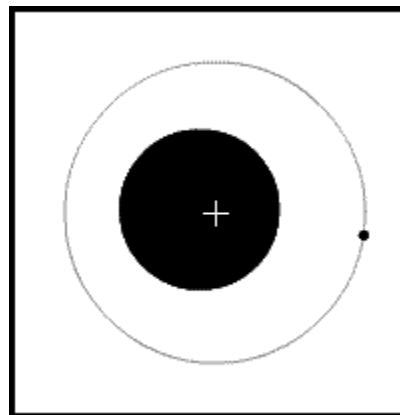
- m_1 and m_2 are the larger and smaller body masses, respectively, and are expressed in Earth masses (i.e. the mass of the Earth = 1)
- a is the distance between the two masses in kilometers.
- r_1 is the semi-major axis of the primary's orbit around the Barycenter in kilometers.
- R_1 is the radius of the larger, more massive body in kilometers.
- r_1 / R_1 is the ratio of the values in the prior two columns.

If the ratio, above, is less than 1, than the Barycenter falls within the larger mass. If it is greater than 1, then it is external to the larger mass.

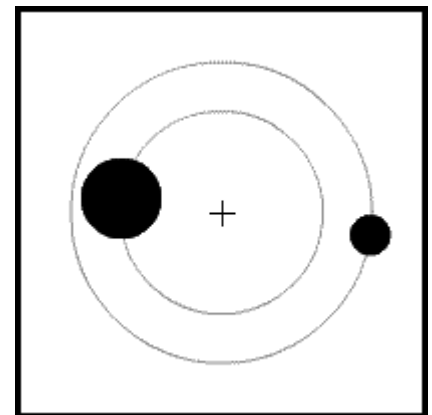
In the Earth-Moon, and Sun-Earth systems, the Barycenters fall within the larger body. For the Sun-Jupiter system, the Sun orbits a Barycenter just above its surface. And with the Pluto-Charon system, both bodies have distinct orbits around the Barycenter (*as such Pluto and Charon were considered a double planet by many before the redefinition of planet in August 2006 by the IAU.*)



Earth – Moon System
Barycenter is within the Earth, but far from the Earth's center of Mass.



Sun – Earth System
The Barycenter just off-center from the center of the Sun's mass.



Pluto – Charon System
The Barycenter is external to both bodies.