

Elliptical orbit of 2003 VB12 (Sedna) suggests possible orbit around dark matter center with the solar system as counter mass

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Abstract

Classical laws of physics constraints the movement of objects into a circular orbit around a center of mass without interference from external bodies, much like the way a planet is supposed to orbit around its star. Presence of other objects (such as other planets), however, exert a gravitational pull on the planet and may tilt its orbit into an elliptical one. Casting a glance at our solar system would reveal that all eight planets orbit around the Sun in approximately circular orbits with all planets' motion in the same plane. Nevertheless, discoveries of about a dozen extreme outer solar system objects (ESO) with highly elliptical and out of plane orbits around the Sun, where their closest approach to the Sun coincides with their transit across the plane of the planets in the solar system. Various theories have been put forward to account, in aggregate, for the strange orbital motion of the ESO around the Sun, with the presence of a super Earth planet X affecting the orbits of the ESO being a more plausible hypothesis. But, closer examination of the orbits of the various ESO highlighted the possibility that they are all orbiting a centre of mass where their orbits are perturbed by gravitational pulls from nearby astronomical objects; thereby, negating one possibility where planet X could account for all observed orbits of ESO. In particular, 2003 VB12 (Sedna), an inner Oort Cloud object, seemed to be orbiting a centre of mass with our solar system as a counter mass rather than the alternative notion of 2003 VB12 (Sedna) being an as yet undefined outer member of our solar system with the Sun as the centre of mass of rotation, but whose orbit was perturbed into a highly elliptical one due to a super Earth planet X. Considering the orbits of other ESOs revealed that this alternative hypothesis may also hold true for 2010 GB174, 2007 TG422, 2004 VN112, 2007 VJ305, 2005 RH52, 2003 HB57, 2002 GB32, 2001 FP185, 2010 GB174, 2000 CR105, and 2010 VZ98. The postulated model did not fit the orbit of 2012 VP113 as the ESOs did not make a close pass of our Sun. But, what could be the material that account for the gravitational pull and mass in the centre of mass of the new hypothesis? One candidate is dark matter since hitherto no planet or other celestial bodies have been observed in the region where the postulated centre of mass of 2003 VB12 (Sedna) should be. Consider the thought experiment that each of the ESOs have at its centre of rotation a body of dark matter with significant mass and gravitational pull, the overlapping and relatively close-by orbits (in astronomical terms) of the various ESOs suggests possible new properties of dark matter given that our current postulations would not accommodate multiple dark matter centres present in the neighbourhood of one ESO (e.g., 2012 VP113 and 2004 VN112). One possibility would require dark matter to be periodically concentrated and diluted around a centre in space, where over a specific observation period, it would exert its gravitational pull on a particular ESO that led to the observed orbit around the Sun. Or, could dark matter be diffusive in nature but concentrate around the centre of rotation of an ESO? In this scenario, depending on the concentration gradient of dark

matter around a centre of rotation, possibility exists that the observed orbits of 2012 VP113 and 2004 VN112 could be accommodated by a diffusive dark matter centre in the centre of rotation of the respective ESO. Taken together, the possibility that extreme outer solar system objects (ESO) orbit around a hitherto unknown body in the centre of rotation rather than in an elliptical orbit around the Sun may provide new clues to our search for super Earths in the immediate neighbourhood of our solar system. In addition, the hypothesis also suggests new properties of dark matter such as its diffusive nature and, most importantly, not being concentrated in a particular location, but rather present as a concentration gradient in space.

Keywords: extreme outer solar system object, elliptical orbit, dark matter, circular orbits, centre of rotation, centre of mass, gravitational perturbation, planet X, super Earths,

Subject areas: planetary science, astronomy,

Conflicts of interest

The author declares no conflicts of interest.

Author's contribution

The author was reading the feature story of the February 2016 issue of *Scientific American*, “The Search for Planet X”, when he realized that extreme outer solar system object 2003 VB12 (Sedna) and others could be orbiting around a dark matter centre rather than the alternative hypothesis of their orbits being significantly affected by a posited planet X. He wrote this abstract preprint to share his idea with the astronomy community for discussion.

Funding

No funding was used in this work.