DOI: http://dx.doi.org/10.18524/1810-4215.2016.29.85236

IS THERE 9-TH PLANET IN OUR SOLAR SYSTEM?

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ABSTRACT. Brown and Batygin informed on indirect evidence of existence of the ninth planet in Solar System (SS). Some evidence pointing on its possible mass in 10 Earth's mass; its distance from Sun at perihelion can be ~200AU, at aphelion 600-1200AU, and orbital period about 15000 years. Authors suggest that in early SS about 4.5 billion years ago, planet has been pushed out of the field of planets formation near the Sun. But all these conclusions are based on computer calculations of orbits of several known trans-Neptunian objects (TNOs), including Sedna, 2004VN112, 2012VP113, 2010GB174, 2007TG422, 2013RF98. We draw attention to the fact that these 6 TNOs found at perihelion, when their brilliance for terrestrial observers be maximal, and orbital speed was greatest.

But just only after 50-100 years, they depart from this convenient location in space to open them. And then for thousands years, these objects will move in remote parts of their orbits. Our estimates show that the actual number of TNO with the same orbits as 6 taken into account in calculations objects should be several orders of magnitude greater. But for the moment they are invisible for terrestrial observer, because they are very far from perihelion point. Therefore, on the basis of purely probabilistic assumptions, it should be very large number of TNOs with very eccentric orbits. Then real results of calculation for the entire ensemble of existing remote objects is strikingly different from the primary. And therefore problem of ninth planet is still on the agenda. Most likely, it is necessary to raise the question of finding the many thousands of TNOs on highly elongated orbits, and very far from terrestrial observer.

Keywords: Trans-Neptunian objects: Kuiper belt: 9-th planet

The distinctive orbital alignment observed within the scattered disk population of the Kuiper belt, remains largely unexplained (Vidmachenko, 2005, 2015, 2016c, d, e, g). In January 2016 M. Brown and K. Batygin informed (Batygin et al, 2016) on the indirect evidence of existence of the ninth planet in the Solar System. They are talking about circumstantial evidence pointing to its possible mass

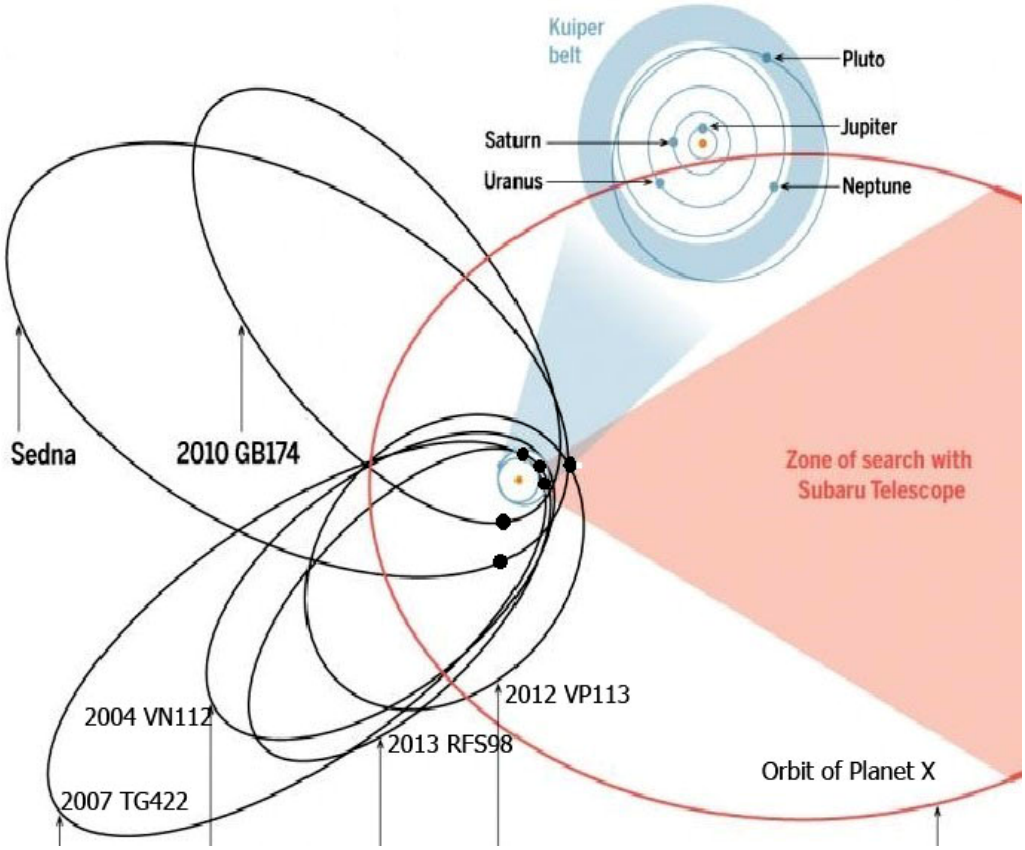

Figure 1: Orbits of TNOs and of possible planet.

in 10 times the mass of the Earth; its distance from the Sun at perihelion can be ~200 AU at aphelion – 600-1200 AU and orbital period – about 15 thousand years.

The authors suggest that in the early solar system about 4.5 billion years ago, the planet has been pushed out of the field of formation of planets near the Sun (Vidmachenko, 2009, 2016a, b, f, Vidmachenko et al., 2013b, 2014); and then it slowed down by the gas and "settled" on a remote elliptical orbit. But all these conclusions about the planet are based on computer calculations of the orbits of several known trans-Neptunian objects (TNOs), including Sedna, 2004VN112, 2007 TG422, 2010GB174, 2012VP113, 2013 RF98 (Table 1). M. Brown and K. Batygin assumed that the orientations of orbits of these objects are arranged so that they have to be influenced by of existence of a large unknown body. This may be a new planet, acting on these objects by a powerful gravitational field.

Table 1: Tans-Neptunian objects with large aphelion.

Objects	Perihe-lion, AU	Aphelion, AU	The size, km	Distance from the Sun at time of discovery, AU
Sedna	76,315	1006,54	995 ± 80	89,6 2003
2010 GB174	48,7	654	130 – 300	70,8 2016
2012 VP113	80,6	446	300–1000	83 2014
2007 TG422	35,6	967	343	37 2007
2004 VN112	47,3	607		47,3 2009
2013 RF98	36,28	600	50-110	36,5 2016

We draw attention to Fig. 1, which shows the orbit of TNO and possible unknown planet X. And, above all, we point out their place in orbit in moments close to their discovery.

When they were discovered, all of them were located quite close to the perihelion. In this case, whereas their brightness is maximized for the terrestrial observer - and the orbital speed was the largest (Vidmachenko et al., 2012, 2013b, 2014). But after only some 50-100 years, they depart from this convenient location in space for their possible discoveries. And then for many thousands of years, these objects will move in remote areas of their orbits.

In this regard, our estimates show that the actual number of TNOs and comet's nucleus on the same, or similar orbits, as well as for the 6 objects, which have been taken into account in the calculations in (Batygin et al., 2016), must be several orders of magnitude larger (Churyumov et al., 2013, 2014, 2015, 2016a, b, c, Vidmachenko 2005, 2016a, d, Vidmachenko et al., 2013a). But at the moment they are invisible to the terrestrial observer, because they are at a very great distance from the perihelion. Due to the enormous eccentricity of the orbit on the rate at places away from perihelion - significantly less than the current speed near perihelion for the several newly discovered TNOs (Table 1.)

Thus, on the basis of purely probabilistic assumptions, the number of TNOs on very elongated orbits, should not amount to tens and units, and they should be a lot of tens of thousands (Vidmachenko et al., 2012, 2013a, 2014). Thus, the real picture of the results of the calculation for the entire ensemble of existing remote objects is very different from the number of TNOs, which were included in the calculation in Batygin et al. (2016). The calculations of Batygin and Braun indicate the possible location of a planet to within a quadrant. Therefore, the review of such a large area of the sky may last a very long time. For the initial evaluation, we used observational data from the Space Telescope «WISE», which was launched in 2009 to study the sky at infrared wavelengths. From the results of observations at distances of up to 30000 AU, an analog of the giant planet Saturn was not registered. Our estimates indicate that up to 1000 AU would have been seen super-Earth with a radius of 11000 km (that is, it is about 10 Earth masses). Thus, either the 9-th unknown planet right now there is an even greater distance, or it is possible that these results cannot be directly scaled to the super-Earth with disproportionately smaller number of internal heat.

And so the question of the presence of the ninth planet in the solar system is still on the agenda. Most likely, it is necessary to raise the question of finding the many thousands of trans-Neptunian objects, which must be on highly elongated orbits and very far from the terrestrial observer..

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