

Instructions: 3 questions. (Limit your responses with the qualifier "according to the paper". There might be other answers, etc, but we want to constrain ourselves to the text at hand: *Discovery of a candidate inner Oort cloud planetoid*)

1. Surprise

What specific characteristic of the orbit was surprising to the authors of the paper?

The heliocentric distance of 90 AU, consistent with the simple estimate from the night of discovery, is more distant than anything previously observed in the solar system. Many known Kuiper Belt objects and comets travel on high-eccentricity orbits out to that distance and beyond, so detection of a distant object is not inconsistent with our present understanding of the solar system. The distant perihelion is, however, unanticipated.

2. But why?

What were the 3 possibilities the authors discussed to explain why this object is where it is?

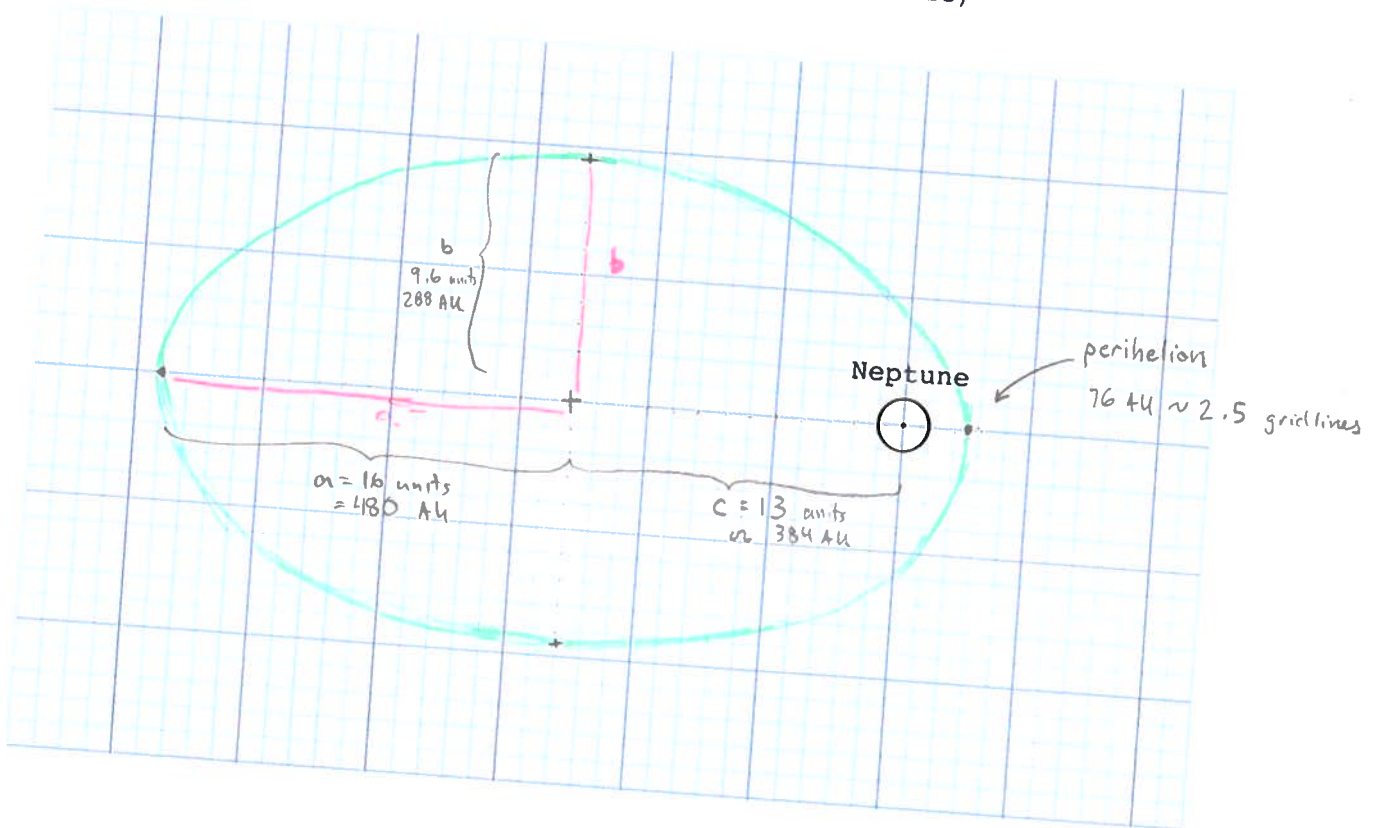
Such an orbit is unexpected in our current understanding of the solar system but could be the result of scattering by a yet-to-be-discovered planet, perturbation by an anomalously close stellar encounter, or formation of the solar system within a cluster of stars.

3. Art Class

The orbit reported in the paper had a perihelion of 76 AU and a semi-major axis of 480 +/- AU. The eccentricity quoted was roughly 0.8. On the grid below, showing Neptune's orbit location towards the ecliptic plane (30 AU semi-major axis = 1 grid line) around the sun (little black dot), sketch the orbit of Sedna. Use the basic relations of an ellipse helpful, as we the calculator provided, to get a reasonable shape (i.e. try to also get a value for b).

$$e = \frac{c}{a} = \sqrt{1 - \frac{b^2}{a^2}}$$

(You can ignore the inclination of the orbit for this exercise)



first, find b

$$e = \left(1 - \frac{b^2}{a^2}\right)^{1/2}$$

$$e^2 = 1 - \frac{b^2}{a^2}$$

$$b^2 = a^2(1 - e^2)$$

$$= 480^2(1 - 0.8^2)$$

$$b^2 = 288 \text{ AU}$$

with 1 grid = 30 AU

$$\therefore b = 9.6 \text{ grid lines}$$

find c

$$.8 = \frac{c}{480}$$

$$\therefore c = 384$$

$$\text{or } 12.8 \text{ grid lines} \\ \sim 13$$