CENTRIPETAL FORCE/KEPLER'S 3RD. LAW Unit 14

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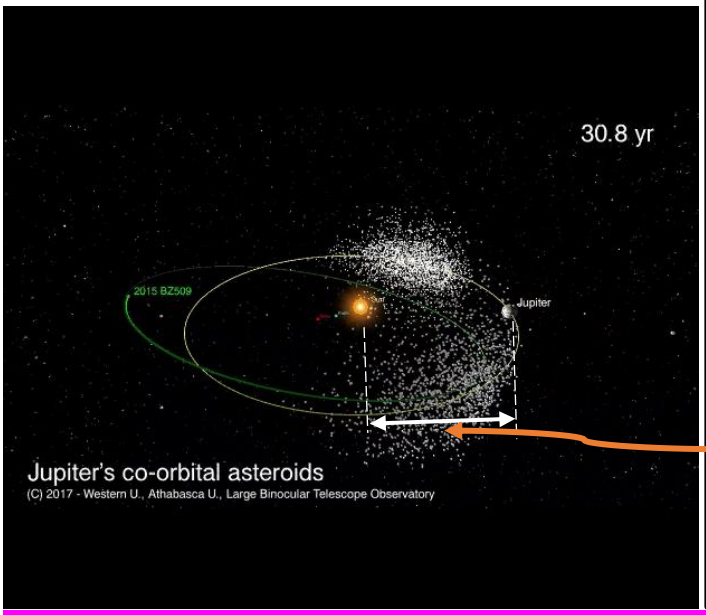
Alien Asteroids Are Here, Scientists Say. Get Used to Them.

An asteroid that cohabits an orbit with Jupiter came from outside the solar system.



INTRODUCTION: **Thanks to ideas of Newton's gravitation law and Kepler the centripetal force needed to keep asteroids in orbit of sun is $GmM/R^2 = mV^2/R$, and since $V = R\omega$ where $\omega = 2\pi f = 2\pi/T$, $M = [4\pi 2/G](R^3/T^2\}$**

QUESTIONS: (a) Asteroid 2015 BZ509 period is listed in the article as 11.6 years around the sun. Find the period T in seconds?, (b) Find mass of sun using Kepler's 3rd. law listed above?, (c) How does computed sun mass in (b) compare with HASA value of 2×10^{30} kg.?

HINTS: 365 days/yr., 24 hrs./day, 3600 s./hr., G = gravitational constant = 6.67×10^{-11} N m.^{2}/kg.^{2}, $R_{2015BZ509} = 7.79 \times 10^{11}$ m.

ANSWERES: (a) 3.658×10^8 s., (b) $M_{SUN} = 2.09 \times 10^{30}$ kg., (c) NASA's value for sun mass is close to our computed.

Astronomers said on Monday that they had identified another invasive asteroid. Unlike Oumuamua, the cigar-shaped rock that caused a sensation when it cruised through the inner solar system and right back out toward interstellar space last winter, however,**(((this asteroid has taken up permanent residence))) among us,))) according to a new study published Monday in Monthly Notices of the Royal Astronomical Society:** Letters. The asteroid, known as 2015 BZ509 — "BZ" for short — was **(((discovered in 2014 sharing orbital space with Jupiter, making a circuit of the sun about every 11.6 years. But it goes around the sun in the opposite direction of Jupiter and the other planets — in a so-called retrograde orbit.)))** The **only reason it can avoid banging into Jupiter is that its orbit is egg-shaped and so the rock slips inside and then outside of the giant planet's orbit** as it goes around. Fathi Namouni, of the Observatoire de la Côte d'Azur in France, and his colleague Helena Morais, of the Universidade Estadual Paulista in Brazil, were trying to figure out how the asteroid got that way, when they discovered that it couldn't have gotten to where it is, at least according to the history of the solar system as we understand it. ***BZ had to have been an outsider from the start.*** Their curiosity was piqued, Dr. Namouni said in an email, by the further discovery last year that the planet and asteroid are locked together in an orbital and gravitational resonance: ***The asteroid completes an orbit in the same time it takes Jupiter***, and so the pair would regularly tug on each other. That meant the asteroid's orbit should be stable. "But at the beginning of this investigation, we did not suspect BZ to be of interstellar origin," he explained. "We developed a new method that allows us to follow the asteroid back in time to see which part of the solar system it came from."