

Offered Title: Asteroids Again: Trojans in the Solar System

First, a correction. In my article about Near Earth Asteroids I stated they share Earth's orbit. I should have qualified that statement by saying "for part of their orbit", as these asteroids have their own orbits that simply coincide with Earth's orbit for a very brief time.

I have described the asteroid belt and Earth orbit crossing asteroids, but not asteroids in planetary orbits, including Earth's. They are called Trojans.

Trojan asteroids are in the same orbit as the planet they are associated with. Why are they called trojans? The first to be discovered were named after opponents in the mythical/historical Trojan (Greek-Troy) war as described in Homer's *Iliad*, and this continues, though I wonder when they will run out of names.

The search for Trojans started as the result of a prediction. In 1772 Joseph-Louis Lagrange's solutions to the three-body orbital mechanics problem predicted 5 zones along Jupiter's orbit around the Sun where gravitational forces between it and the Sun are counteracted. Any smaller co-orbiting object within these zones should have a stable orbit around the Sun. Lagrange predicted that objects existed in these zones, but it wasn't until 1906 that German astronomer Max Wolf observed them. Astronomers then discovered that only two of the zones had objects, the zone leading in Jupiter's orbit and the zone following.

Since that time astronomers have identified zones, now named Lagrangian points (or Lagrange points, libration points, L-points) for all the planet-Sun, and planet-larger moon combinations. They are designated as L1 – L5 and are used as needed for placing spacecraft in their own stable orbit around the Sun. The Solar and Heliospheric Observatory (SOHO) is in a Sun-Earth L1 point. When it's finally launched, the James Web Space Telescope will be placed in a Sun-Earth L2 point. These zones allow the spacecraft to remain in a specific orbit without using much fuel.

Interestingly, the trojans in Jupiter's orbit and in all other planet's orbits occur at L4 (60 degrees leading) and L5 (60 degrees following) the planet, so L4 and L5 appear to be the "natural" collective zones. Per naming convention, leading path asteroids (L4) are named after Greek warriors and those following (L5) after warriors from Troy. As with all things human the naming convention, as adopted from Austrian astronomer Johann Palisa's suggestion, put the first two asteroid names in the wrong camps. Maybe this was purposeful as the first two were spies embedded in the others camp!

More recently the term *trojan* has been ascribed to small Solar System bodies in the same orbit as larger bodies, such as planets. The term *trojan asteroid* has been ascribed to those asteroids in Jupiter's orbit.

So, who has trojans? Discovered up to this point: Earth has one, Mars has seven, Jupiter has thousands, Neptune has seventeen.

Unlike in the *Iliad*, these trojans are not a threat.

What's in the Sky?

June 27; night; southeast: Saturn and a nearly full Moon are so close!