Solar System's Young Twin Has Two Asteroid Belts

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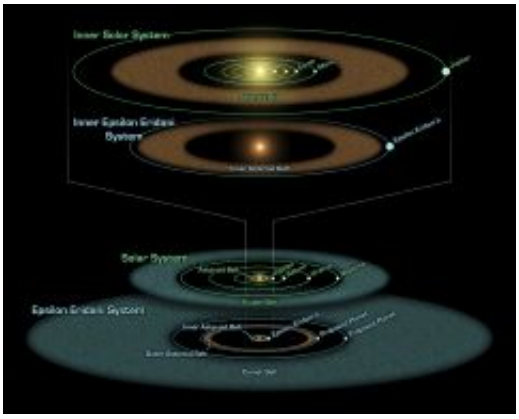

This artist&acutes diagram compares the Epsilon Eridani system to our own solar system. The two systems are structured similarly, and both host asteroids (brown), comets (blue) and planets (white dots). Epsilon Eridani&acutes inner asteroid belt is located at about the same position as ours, approximately three astronomical units from its star (an astronomical unit is the distance between Earth and the sun.). The system&acutes second, denser belt lies at about the same place where Uranus orbits in our solar system, or 20 astronomical units from the star. Epsilon Eridani is thought to have planets orbiting near the rims of its two belts. The first of these planets was identified in 2000 via the radial velocity technique. The second planet orbiting near the rim of the outer asteroid belt at 20 astronomical units was inferred when Spitzer discovered the belt. A third planet might orbit in Epsilon Eridani at the inner edge of its outermost comet ring, which lies between 35 and 90 astronomical units. This planet was first hinted at in 1998 due to observed lumpiness in the comet ring. Credit: NASA/JPL-Caltech

(PhysOrg.com) -- Astronomers have discovered that the nearby star Epsilon Eridani has two rocky asteroid belts and an outer icy ring, making it a triple-ring system. The inner asteroid belt is a virtual twin of the belt in our solar system, while the outer asteroid belt holds 20 times more material. Moreover, the presence of these three rings of material implies that unseen planets confine and shape them.

The star Epsilon Eridani is slightly smaller and cooler than the Sun. It is located about 10.5 light-years from Earth in the constellation Eridanus. (A light-year is the distance light travels in one year, or about 6 trillion miles.) Epsilon Eridani is the ninth closest star to the Sun and is visible to the unaided eye. It is also younger than the Sun, with an approximate age of 850 million years.

Epsilon Eridani and its planetary system show remarkable similarities to our solar system at a comparable age.

"Studying Epsilon Eridani is like having a time machine to look at our solar system when it was young," said Smithsonian astronomer Massimo Marengo (Harvard-Smithsonian Center for Astrophysics). Marengo is a co-author of the discovery paper, which will appear in the Jan. 10 issue of *The Astrophysical Journal*.

Lead author Dana Backman (SETI Institute) agreed, saying, "This system probably looks a lot like ours did when life first took root on Earth."

Our solar system has a rocky asteroid belt between Mars and Jupiter, about 3 astronomical units from the Sun. (An astronomical unit equals the average Earth-Sun distance of 93 million miles.) In total, it contains about 1/20 the mass of Earth's Moon. Using NASA's Spitzer Space Telescope, the team of astronomers found an identical asteroid belt orbiting Epsilon Eridani at a similar distance of 3 astronomical units.

They also discovered a second asteroid belt 20 astronomical units from Epsilon Eridani (about where Uranus is located in our solar system). The second asteroid belt contains about as much mass as Earth's Moon.

A third, icy ring of material seen previously extends about 35 to 100 astronomical units from Epsilon Eridani. A similar icy reservoir in our solar system is called the Kuiper Belt. However, Epsilon Eridani's outer ring holds about 100 times more material than ours.

When the Sun was 850 million years old, theorists calculate that our Kuiper Belt looked about the same as that of Epsilon Eridani. Since then, much of the Kuiper Belt material was swept away, some hurled out of the solar system and some sent plunging into the inner planets in an event called the Late Heavy Bombardment. (The Moon shows evidence of the Late Heavy Bombardment - giant craters that formed the lunar seas of lava called mare.) It is possible that Epsilon Eridani will undergo a similar dramatic clearing in the future.

"Epsilon Eridani looks a lot like the young solar system, so it's conceivable that it will evolve similarly," said Marengo.

The Spitzer data show gaps between each of the three rings surrounding Epsilon Eridani. Such gaps are best explained by the presence of planets that gravitationally mold the rings, just as the moons of Saturn constrain its rings.

"Planets are the easiest way to explain what we're seeing," stated Marengo.

Specifically, three planets with masses between those of Neptune and Jupiter would fit the observations nicely. A candidate planet near the innermost ring already has been detected by radial velocity studies. Those studies suggested that it orbited Epsilon Eridani on a highly

elliptical path, characterized by an eccentricity of 0.7. The new finding rules out such an orbit, because the planet would have cleared out the inner asteroid belt long ago through gravitational disruption.

A second planet must lurk near the second asteroid belt, and a third at about 35 astronomical units near the inner edge of Epsilon Eridani's Kuiper Belt. Future studies may detect these currently unseen worlds, as well as any terrestrial planets that may orbit inside the innermost asteroid belt.

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