

Proximity of new planets stuns even astronomers

Yale UniversityYale University

One is a rocky planet 1.5 times the size of Earth. The other is a gaseous world nearly four times Earth's size. Together they form a spectacular system in which two planets orbit closer to each other than any yet discovered.

"We've never known of planets like this," said Yale University astronomer Sarbani Basu, a member of the research team that analyzed the system. "If you were on the smaller planet looking up, the larger planet would seem more than twice the size of Earth's full moon. It would be jaw-dropping."

Basu's research focused on determining the properties of the planets' host star — work that was essential for discerning the characteristics of the orbiting planets.

The 46-member, international team, led by astronomers at Harvard and the University of Washington, report their discovery June 21 in Science Express, the early release version of the journal Science.

"These two worlds are having close encounters," said Josh Carter, lead author of the paper and a Hubble Fellow at the Harvard-Smithsonian Center for Astrophysics.

Located about 1200 light years away, the two-planet system — now called Kepler-36 — orbits a star similar to Earth's sun, but bigger and older.

The larger outer planet, Kepler-36c, is a hot, gaseous, Neptune-like planet. The smaller inner planet, Kepler-36b, is rocky and subject to quakes and volcanic eruptions caused by the interplay of the planets' gravitational forces on each other.

Like our sun, Kepler-36 pulsates constantly. Data on its quakes enabled the team to determine its size, weight, and age (all greater than those of our sun). Knowing the star's radius and mass enabled the calculation of the sizes and masses of the planets. From this information, astronomers could determine the planets' densities and characteristics: the smaller planet is denser than the Earth and hence must be rocky; the larger planet is much less dense, in fact less dense than water, suggesting it is gaseous.

"The precise determination of the planets' properties was possible because the star around which they revolve could be characterized precisely," said Basu.

The planets' proximity to each other is astonishing, according to the researchers. The rocky inner planet orbits its star every 14 days, at an average distance of 11 million miles. The outer gaseous planet orbits every 16 days, at an average distance of 12 million miles.

Every 97 days they move into perfect alignment, a position known as conjunction.

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At that point they are separated by a mere 1.2 million miles — less than five times the distance between Earth and its moon. By contrast, Venus, Earth's nearest neighbor, never comes closer than 26 million miles.

The research team identified the planets by analyzing data from NASA's *Kepler* satellite. *Kepler* detects planets by measuring variations in the brightness of stars; dips in brightness may indicate a planet passing in front the star.

This discovery poses new challenges to the theories of planet formation. Astronomers are now trying to understand how planets with markedly different compositions and densities fell into remarkably close orbit.

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Eric Agol of the University of Washington is a co-lead author of the paper.

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