New class of planetary systems: Astronomers find two new planets orbiting double suns

11 January 2012

This is an artist's rendition of the Kepler-35 planet system, in which a Saturn-size planet orbits a pair of stars. The larger star is similar to the size of the Sun, while the smaller star is 79 percent of the Sun's radius. The stars orbit and eclipse each other every 21 days, but the eclipses do not occur exactly periodically. This variation in the times of the eclipses motivated the search for the planet, which was discovered to transit the stars as it orbits the pair every 131 days. Analogous events led to the discovery of the planet Kepler-34. The discovery of these two new systems establishes a new class of 'circumbinary' planets, and suggests there are many millions of such giant planets in our Galaxy. Credit: Illustration by Lynette Cook

Using data from NASA's Kepler Mission, astronomers announced the discovery of two new transiting "circumbinary" planet systems -- planets that orbit two stars. This work establishes that such "two sun" planets are not rare exceptions, but are in fact common with many millions existing in our Galaxy. The work is published today in the journal *Nature* and presented at the American Astronomical Society meeting in Austin, TX.

Using data from NASA's Kepler mission, a team that includes a University of Florida astronomer has discovered two new planets orbiting double star systems, something that had never been seen until last September.

The newly confirmed planets, called Kepler-34b and Kepler-35b, will be announced in Wednesday's online edition of the journal *Nature*, said Eric B. Ford, UF associate professor of astronomy. William F. Welsh, associate professor at San Diego State University, is the lead author on the paper.

Kepler-34b and Kepler-35b both orbit a "binary star." They are actually a pair of gravitationally bound stars that orbit each other. While the existence of such bodies, called "circumbinary planets," had long been predicted, they remained just a theory until the team discovered Kepler-16b in September 2011. They dubbed Kepler-16b "Tatooine" because of its resemblance to the two-sun world depicted in the "Star Wars" film series.

This is an artist's rendition of the Kepler-35 planet system, in which a Saturn-size planet orbits a pair of stars. The larger star is similar to the size of the Sun, while the smaller star is 79 percent of the Sun's radius. The stars orbit and eclipse each other every 21 days, but the eclipses do not occur exactly periodically. This variation in the times of the eclipses motivated the search for the planet, which was discovered to transit the stars as it orbits the pair every 131 days. Analogous events led to the discovery of the planet Kepler-34. The discovery of these two new systems establishes a new class of 'circumbinary' planets, and suggests there are many millions of such giant planets in our Galaxy. Credit: Mark A. Garlick

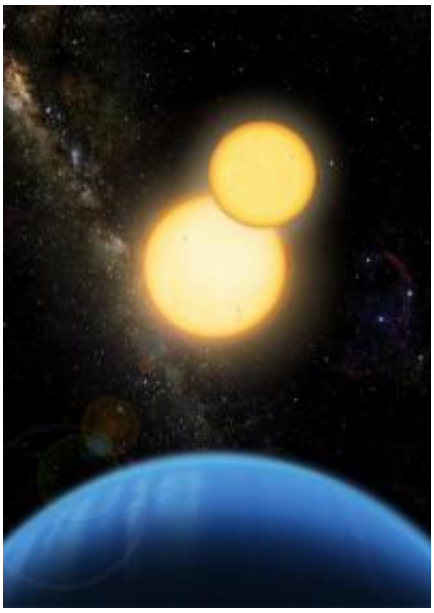
"We have long believed these kinds of planets to be possible, but they have been very difficult to detect for various technical reasons," Ford said. "With the discoveries of Kepler-16b, 34b and 35b, the Kepler mission has shown that the galaxy abounds with millions of planets orbiting two stars."

The planets were discovered by measuring the star light decrease as the planets pass in front of, or transit, either of the two stars. Kepler also measures the star light decrease when one of the stars passes in front of the other. The mutual gravitational tugs of the stars and planets cause the times of the transits to deviate from a regular schedule, allowing astronomers to confirm the planet and measure its mass.

Both planets are low-density gas giants, comparable in size to Jupiter, but much less massive. Compared to Jupiter, Kepler-34 is about 24 percent smaller in size, but has 78 percent less mass. It can complete a full orbit in 288 terrestrial days. Kepler-35 is about 26 percent smaller, has 88 percent less mass, and completes its orbit around the stars much faster - just 131 days.

The astronomers believe the planets are made primarily of hydrogen and too hot to sustain life.

"Circumbinary planets can have much more complex climates, since the distance between the planet and each star change significantly during each orbital period, the length of an alien planet's year," Ford said. "For Kepler-35b, the amount of incoming star light changes by over 50 percent within a single Earth year. For Kepler-34b, each Earth-year brings 'summers' with 2.3 times as much star light as winters. Over the course of a year, the change in the amount of sunlight heating the Earth varies by only 6 percent."



This is an artist's rendition of the Kepler-35 planet system, in which a Saturn-size planet orbits a pair of stars. The larger star is similar to the size of the Sun, while the smaller star is 79 percent of the Sun's radius. The stars orbit and eclipse each other every 21 days, but the eclipses do not occur exactly periodically. This variation in the times of the eclipses motivated the search for the planet, which was discovered to transit the stars

as it orbits the pair every 131 days. Analogous events led to the discovery of the planet Kepler-34. The discovery of these two new systems establishes a new class of `circumbinary' planets, and suggests there are many millions of such giant planets in our Galaxy. Credit: Illustration by Lior Taylor

NASA's Kepler mission, which began in March 2009, uses a 1-meter space telescope trained on one small portion of the Milky Way for several years. Astronomers analyze data from the telescope for periodic dimming that indicates a planet crossing in front of its host star. The mission's goal is to find the frequency of Earth-size planets in the habitable zone of their host stars - where a planet might have liquid water on its surface.

Most Sun-like stars in the galaxy are not alone, like the Earth's sun, but have a "dance partner," forming a binary system or binary star. Kepler has already identified about 2,165 eclipsing binaries, of the more than 160,000 stars being observed.

NASA originally planned to stop receiving data from the Kepler spacecraft in November 2012.

"Astronomers are practically begging NASA to extend the Kepler mission until 2016, so it can characterize the masses and orbits of Earth-size planets in the habitable zone. Kepler is revolutionizing so many fields, not just planetary science," Ford said. "It would be a shame not to maximize the scientific return of this great observatory. Hopefully common sense will prevail and the mission will continue."

More information: "Transiting circumbinary planets Kepler-34 b and Kepler-35 b" by Welsh, et al., *Nature*: dx.doi.org/10.1038/nature10768

Provided by University of Florida