



ScienceWatch – Habitable Exoplanets

"You've got two solid planets in the habitable zone of their star. We don't know if life evolves everywhere, but if it does, these two planets provide great candidates for life." - L. Kaltenegger

The search for exoplanets, those outside our solar system, began 20 years ago. The Doppler technique detects the wobble of a distant star caused by an orbiting planet's gravitational pull (<http://hras.org/sw/swnovdec10.htm>). Using this method, astronomers have discovered ~700 exoplanets orbiting ~400 stars. But the nature of the technique, which depends upon large gravitational forces, means that most of these exoplanets turn out to be gas giants, incompatible with life as we know it.

For the past four years an intensive search has been underway to find smaller, rocky exoplanets using a different detection method with the hope that one or more of these could sustain life. The space telescope, Kepler, launched by NASA in 2009, has been examining 170,000 stars looking for planets as they transit across their sun and cause a slight dimming of the light that hits the telescope's extremely sensitive light meter. The Kepler team has already found 130 confirmed new exoplanets, and another 2,700 possible new ones. But its primary goal is to find a "Goldilocks planet", a rocky one like ours, with an atmosphere, and in the habitable zone (HZ) —not too hot, not too cold— where liquid water can exist.

Writing in the May 3, 2013 issue of *Science*, the NASA team of 69 scientists led by William J. Borucki, NASA Ames Research Center, Moffett Field, CA, and including Lisa Kaltenegger, Harvard University, Cambridge, MA, reports finding a star, Kepler-62 in the constellation Lyra, 1,200 light years away, with not one, but two of its planets in the HZ.



The astronomers say Kepler-62, which is smaller and cooler than our sun, has five planets orbiting it. The planets range in diameter from half to twice earth-size. The two planets that have generated excitement, 62e and 62f, are the smallest so far detected in the HZ, with radii 1.6 and 1.4 that of earth, respectively. Kepler-62e has a "year" of only 122 earth days, while Kepler-62f is more promising with a "year" of nine earth months and it sits more squarely in the HZ.

Although they do not yet know the atmospheric makeup of these two exoplanets, the Kepler team says that the characteristics they have determined so far, especially for 62f—

its size, distance from its sun and its age of about 7 billion years, all fit in with a rocky planet that could have an earthlike atmosphere (CO₂, H₂O, N₂).

Unfortunately, Kepler's ability to locate exoplanets is over. This summer NASA reported that two of the four wheels that point the telescope at distant targets have stopped working, making it impossible to accurately find a target star. The good news is that in 2017 NASA plans to launch another exoplanet mission. The Transiting Exoplanet Survey Satellite (TESS) will use wide-field cameras to look at brighter stars, those nearer the earth, because it will be easier to characterize the atmospheres of potentially habitable exoplanets that are closer to us. After TESS locates the exoplanets, the atmospheric studies will be done by yet another NASA mission, the James Webb Space Telescope, due to launch in 2017.

These days it's very exciting to be an astronomer.

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