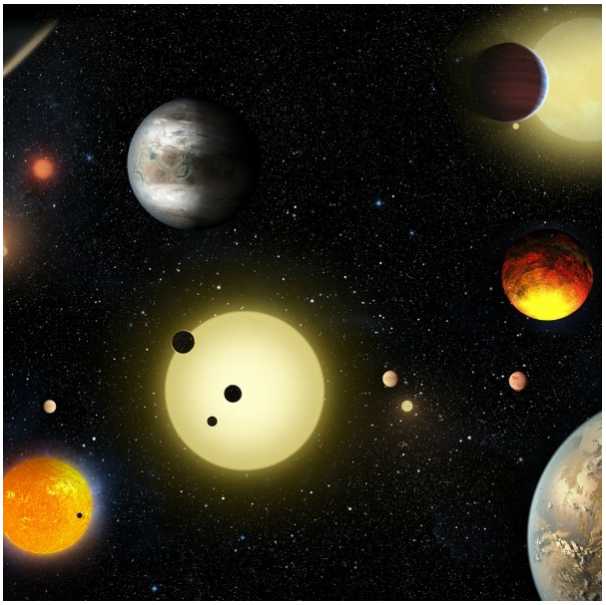
KEPLER CONFIRMS 1,284 NEW PLANETS



This artist's concept depicts select planetary discoveries made to date by NASA's Kepler space telescope.

Scientists say that they've now confirmed that 1,284 objects observed outside Earth's solar system by NASA's Kepler spacecraft are indeed planets. Announced on May 10, 2016 in the Astrophysical Journal, it's the largest single announcement of new planets to date and more than doubles the number of confirmed planets discovered by Kepler so far to more than 2,325. And it means that – of the nearly 5,000 total exoplanet candidates found to date – **more than 3,200 have been verified, 2,325 by Kepler, and the rest by other means. Go Kepler!**

This gives us hope that somewhere out there, around a star much like ours, we can eventually discover another Earth.

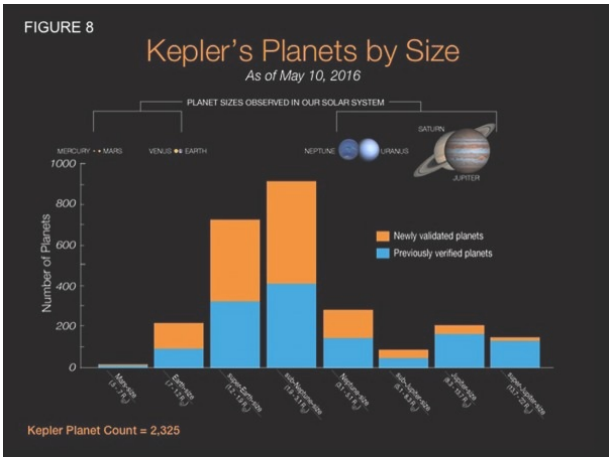
The Kepler mission finds planets by the transit method; that is, it looks for a brief dip in a star's light as planets previously hidden in their stars' glare pass in front of the stars (much like the May 9 Mercury transit across the face of our sun). False positives are common. They can result from – for example – smaller, dimmer stars orbiting larger, brighter companion stars.

That's why validation is needed.

During the May 10 announcement, the scientists explained a new technique developed by Princeton astrophysicist **Timothy Morton**, who is lead author of the Astrophysical Journal paper. It's a statistical analysis method that can be applied to many planet candidates simultaneously. Morton's method essential compares values from previous exoplanet observations to current measurements. His method uses paired simulations, comparing values from previous exoplanet observations to current measurements. The first compares the flicker in question to other confirmed signatures of both exoplanets and imposters. The second simulation determines whether—given what scientists know about the total distribution of exoplanets in the Milky Way—the flicker in question makes sense as an exoplanet. Combined, the two simulations assign each flicker a statistical probability of being an exoplanet:

Planet candidates can be thought of like bread crumbs. If you drop a few large crumbs on the floor, you can pick them up one by one. But, if you spill a whole bag of tiny crumbs, you're going to need a broom. This statistical analysis is our broom.

The researchers used an automated software developed at Princeton known as Vespa that allows scientists to efficiently determine if a Kepler signal is caused by a planet. Vespa computes the chances that a Kepler signal actually came from a certain type of planet. Automated software such as Vespa is necessary because of the sheer amount of Kepler data and the similarity that some planetary signals — especially those of larger planets — have to other objects such as stars that orbit each other.



The graph above shows the type of planets newly verified by Vespa (orange) compared to the number of those planets previously confirmed (blue). Vespa more likely verified smaller planets because of their prevalence and unambiguous signal; signals thought to come from less common Jupiter-sized planets were more likely to actually emanate from stars.

Scientists from Princeton University and NASA analysed the Kepler space telescope's July 2015 planet candidate catalogue, which identified 4,302 potential planets. For 1,284 of the candidates, the probability of being a planet is now greater than 99 percent – the minimum required to earn the status of "planet." An additional 1,327 candidates are more likely than not to be actual planets, but they do not meet the 99 percent threshold and will require additional study. The remaining 707 are more likely to be other astrophysical phenomena. This analysis also validated 984 candidates previously verified by other techniques.

In the newly-validated batch of planets, nearly 550 could be rocky planets like Earth, based on their size. **Nine of these orbit in their sun's habitable zone, which is the distance from a star where orbiting planets can have surface temperatures that allow liquid water to pool. With the addition of these nine, 21 exoplanets are now known to be members of this exclusive group.** Launched in March 2009, Kepler is NASA's first mission to find potentially habitable Earth-size planets. For four years now, it monitored 150,000 stars in a single patch of sky for telltale dips in brightness.

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