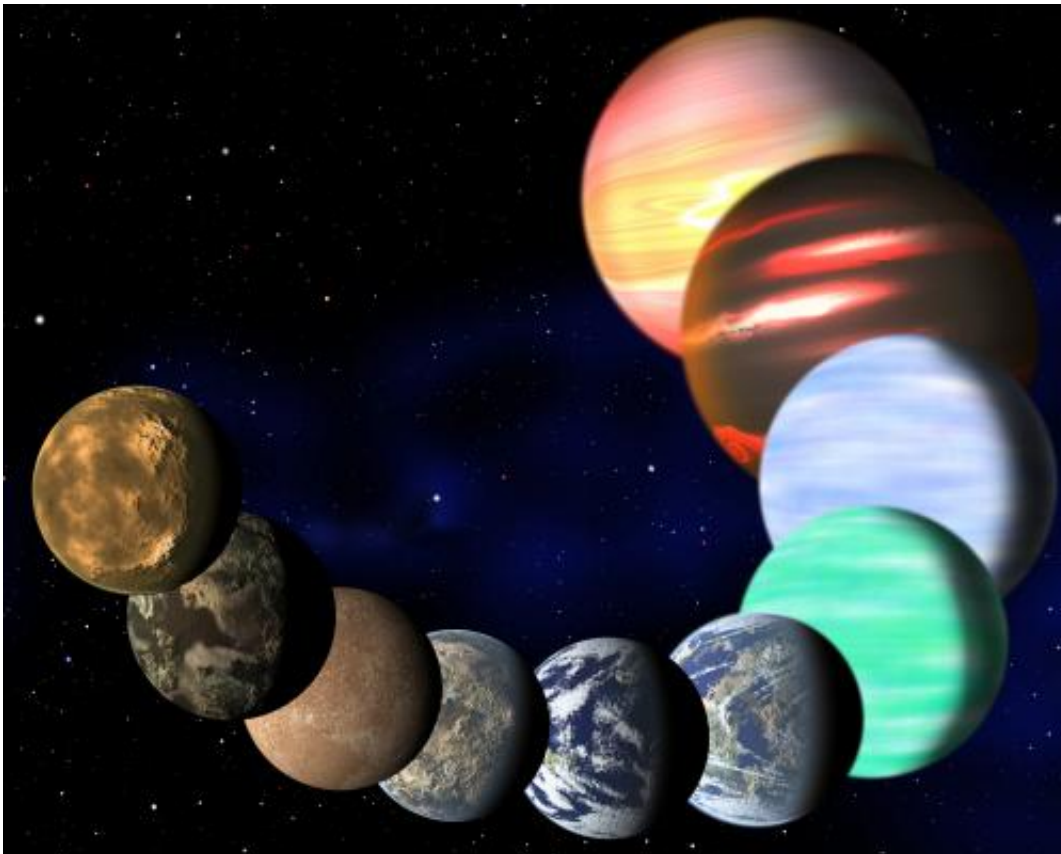


Study: At least one in six stars has an Earth-sized planet

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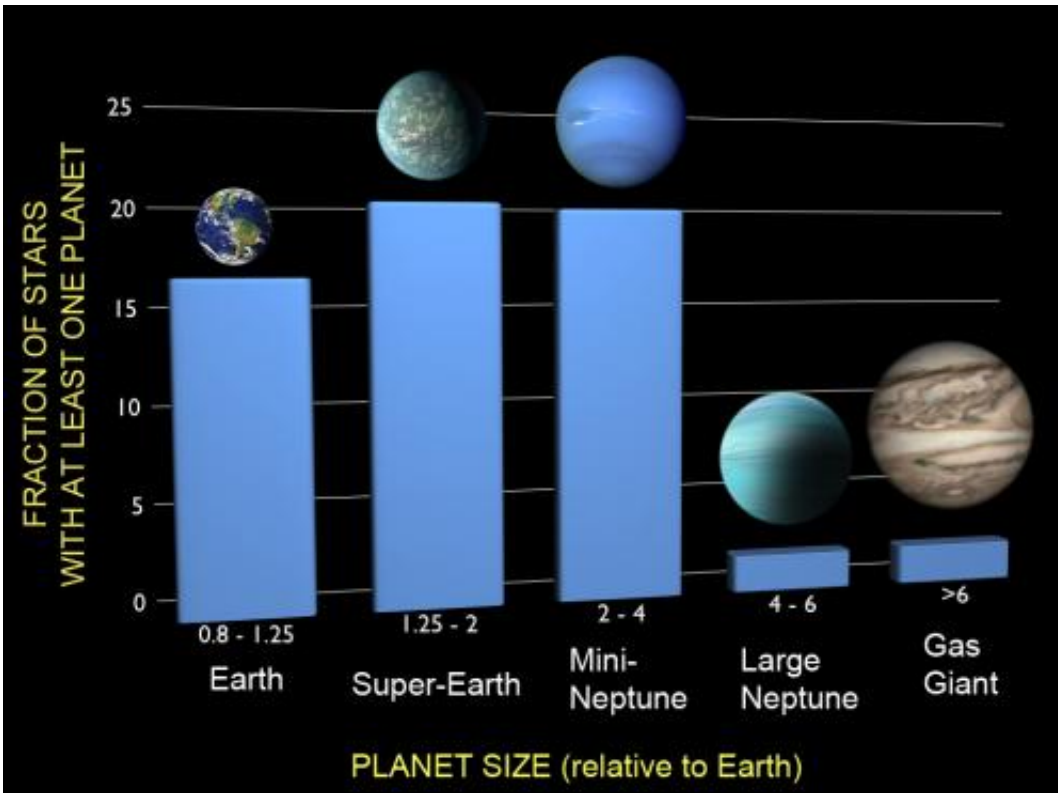
This artist's illustration represents the variety of planets being detected by NASA's Kepler spacecraft. A new analysis has determined the frequencies of planets of all sizes, from Earths up to gas giants. Key findings include the fact that one in six stars hosts an Earth-sized planet in an orbit of 85 days or less, and that almost all sun-like stars have a planetary system of some sort. Credit: C. Pulliam & D. Aguilar (CfA)

(Phys.org)—The quest for a twin Earth is heating up. Using NASA's Kepler spacecraft, astronomers are beginning to find Earth-sized planets orbiting distant stars. A new analysis of Kepler data shows that about 17 percent of stars have an Earth-sized planet in an orbit closer than Mercury. Since the Milky Way has about 100 billion stars, there are at least 17 billion Earth-sized worlds out there.

Francois Fressin, of the Harvard-Smithsonian Center for Astrophysics (CfA), presented the analysis today in a press conference at a meeting of the [American Astronomical Society](#) in Long Beach, Calif. A paper detailing the research has been accepted for publication in The [Astrophysical Journal](#).

[Kepler](#) detects planetary candidates using the transit method, watching for a planet to cross its star and create a mini-eclipse that dims the star slightly. The first 16 months of the survey identified about [2,400 candidates](#). [Astronomers](#) then asked, how many of those signals are real, and how many planets did Kepler miss?

By simulating the Kepler survey, Fressin and his colleagues were able to correct both the impurity and the incompleteness of this list of candidates to recover the true occurrence of planets orbiting other [stars](#), down to the size of Earth.



A new analysis examined the frequencies of planets of different sizes based on findings from NASA's Kepler spacecraft, correcting for both incompleteness and false positives. The results show that one in six stars has an Earth-sized planet in a tight orbit. About a fourth of all stars in the Milky Way have a super-Earth, and the same fraction have a mini-Neptune. Only about 3 percent of stars have a large Neptune, and only 5 percent a gas giant at the orbital distances studied. Credit: F. Fressin (CfA)

"There is a list of astrophysical configurations that can mimic planet signals, but altogether, they can only account for one-tenth of the huge number of Kepler candidates. All the other signals are bona-fide planets," says Fressin.

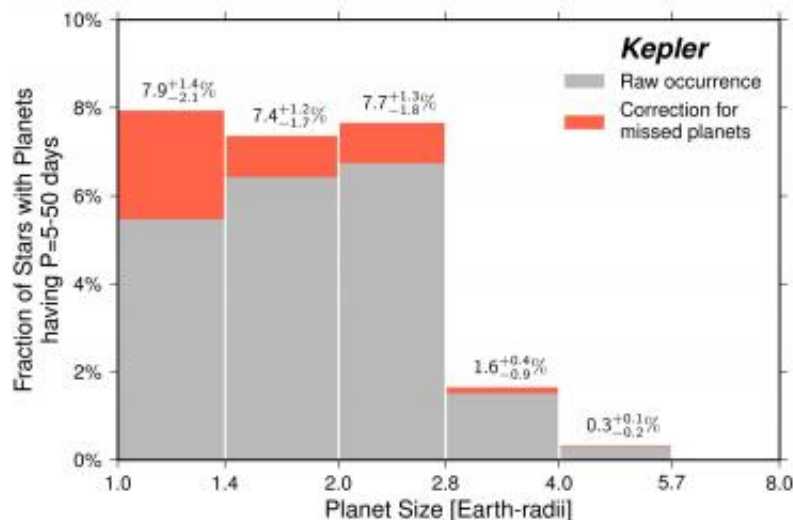
Most sun-like stars have planets

Altogether, the researchers found that 50 percent of stars have a planet of Earth-size or larger in a close orbit. By adding larger planets, which have been detected in wider orbits up to the orbital distance of the Earth, this number reaches 70 percent.

Extrapolating from Kepler's currently ongoing observations and results from other detection techniques, it looks like practically all Sun-like stars have planets.

The team then grouped planets into five different sizes. They found that 17 percent of stars have a planet 0.8 - 1.25 times the size of Earth in an orbit of 85 days or less. About one-fourth of stars have a super-Earth (1.25 - 2 times the size of Earth) in an orbit of 150 days or less. (Larger planets can be detected at greater distances more easily.) The same fraction of stars has a mini-Neptune (2 - 4 times Earth) in orbits up to 250 days long.

Larger planets are much less common. Only about 3 percent of stars have a large Neptune (4 - 6 times Earth), and only 5 percent of stars have a gas giant (6 - 22 times Earth) in an [orbit](#) of 400 days or less.



The fraction of sun-like stars having planets of different sizes, orbiting within 1/4 of the Earth-sun distance (0.25 AU) of the host star. The graph shows that planets as small as Earth (far left) are relatively common compared to planets 8.0x the size of Earth (similar to Jupiter). For example, 7.9 percent of sun-like stars harbor a planet with a size of 1.0-1.4 times the size of Earth, orbiting inward of 1/4 the Earth-sun distance (closer than Mercury's distance from the sun). There are increasing numbers of planets from 8x the size of Earth down to 2.8x Earth. Remarkably, the number of planets smaller than 2.8x Earth is approximately constant with planet size, down to the size of our Earth. The gray indicates the planets discovered in this study, and the orange represents the correction applied to account for planets the TERRA software would miss statistically, typically about 20 percent. Credit: Erik Petigura, Andrew Howard and Geoff Marcy

Smaller planets aren't picky

The researchers also asked whether certain sizes of planets are more or less common around certain types of stars. They found that for every planet size except gas giants, the type of star doesn't matter. Neptunes are found just as frequently around red dwarfs as they are around sun-like stars. The same is true for smaller worlds. This contradicts previous findings.

"Earths and super-Earths aren't picky. We're finding them in all kinds of neighborhoods," says co-author Guillermo Torres of the CfA.

Planets closer to their stars are easier to find because they transit more frequently. As more data are gathered, planets in larger orbits will come to light. In particular, Kepler's extended mission should allow it to spot Earth-sized planets at greater distances, including Earth-like orbits in the habitable zone.

Provided by Harvard-Smithsonian Center for Astrophysics

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