Common Earths

Are we alone? Is there another Earth out there? These questions have haunted stargazers since we discovered the Sun was just another star. Now, astronomers using the Spitzer Space Telescope have discovered that worlds with potential for life might be more common than we thought. Hello, I'm Daniel Brennan.

This Spitzer Space Telescope podcast is part of a series highlighting recent discoveries in infrared astronomy. It's produced by NASA's Spitzer Science Center at the California Institute of Technology in Pasadena. The Spitzer mission is managed by NASA's Jet Propulsion Laboratory.

The recent finding by NASA's Spitzer Space Telescope indicates that terrestrial planets might form around many, if not most, of the nearby sun-like stars in our galaxy. University of Arizona, Tucson, astronomer Michael Meyer and his colleagues used Spitzer to determine whether planetary systems like ours are common or rare in our Milky Way galaxy. They found that at least 20 percent, and possibly as many as 60 percent of stars similar to the sun are candidates for forming rocky planets.

The astronomers used Spitzer to survey six sets of stars, grouped depending on their age, with masses comparable to our sun. The sun is about 4.6 billion years old. They wanted to study the evolution of disks of gas and dust around stars in order to compare the results with current models of the formation of our own Solar System.

Spitzer does not detect planets directly. Instead, it picks up infrared signatures of dust -- the rubble left over from collisions as planets form -- at a range of wavelengths. The hottest dust is detected at the shortest wavelengths, between 3.6 microns and 8 microns. Cool dust is detected at the longest wavelengths, between 70 microns and 160 microns. Warm dust can be traced at 24-micron wavelengths. Because dust closer to the star is hotter than dust farther from the star, the "warm" dust likely traces material orbiting the star at distances comparable to the distance between Earth and Jupiter.

What Meyer found is about 10 to 20 percent of the youngest stars had 24-micron emission due to dust, but around stars older than 300 million years, they didn't often see 24-micron dust. That implies that the older stars have mature terrestrial planetary systems that have cleaned up the dust.

Theoretical models and data from meteorites suggest that Earth formed over 10 to 50 million years as a result of collisions between smaller bodies, a timetable similar to what is being observed around the stars in the study.

In a separate study, Thayne Currie and Scott Kenyon of the Smithsonian Astrophysical Observatory, in Cambridge, Mass., and their colleagues also found evidence of dust from terrestrial planet formation around stars from 10 to 30 million years old. That implies that the processes that created the Earth could be occurring around many stars in our part of the galaxy.

One model that explains the results has been proposed by Kenyon along with Ben Bromley of the University of Utah, Salt Lake City. Their models predict warm dust would be detected at 24-micron wavelengths as small rocky bodies collide and merge. Collisions that kick up dust would be a natural outcome of rocky planet formation, according to their work. The model predicts a higher frequency of dust emission for younger stars, which is what Spitzer observed.

The numbers on how many stars form planets are ambiguous because there's more than one way to interpret the Spitzer data. The warm-dust emission that Spitzer observed around 20 percent of the youngest cohort of stars could persist as the stars age. That is, the warm dust generated by collisions around stars three to 10 million years old could carry over and show up as warm dust emission seen around stars in the 10- to 30-million-year-old range and so on. Interpreting the data this way, about one out of five sun-like stars is potentially planet-forming, Meyer says.

But Meyer says that there's a more optimistic way to interpret the data. He suggests that the biggest, most massive disks would undergo the runaway collision process first, and assemble their planets quickly. That rapid-planet-formation process would be what Spitzer is seeing in the youngest stars. Their disks might live hard and die young, shining brightly early on, then fading; while, smaller, less massive disks begin to emit in 24 microns only later on. In the smaller disks, there are fewer particles to collide with each other, delaying planet formation.

If this second scenario is correct and the most massive disks form their planets first and the wimpiest disks take 10 to 100 times longer, then up to 62 percent of the surveyed stars have formed, or may be forming, planets. But it will take future missions to test the theory, which may begin as early as next year with the launch of NASA's Kepler mission.

For the Spitzer Science Center, I'm Daniel Brennan.

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