Discovery of Earth-like planets prompts speculation about alien life

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If there's one thing astronomy has proven over and over again throughout history, it's that the Earth is less special than we think. The Earth is not the center of the universe; it's not the center of the solar system. It's not unique in its size or material composition, and it's not the only planet with weather, volcanoes, tectonic activity, or liquid water.

Our planet's only one-of-a-kind attribute is the presence of living things. But even this might not be unique to us.

Many believe that last week's historic announcement of seven Earth-like planets orbiting the star TRAPPIST-1 may put us closer than ever to discovering life outside our solar system.

The TRAPPIST-1 system was spotted by researchers from the University of Liège in Belgium, at Chile's La Silla observatory using the Transiting Planets and Planetesimals Small Telescope, or TRAPPIST, which (per scientific convention) lent the star system its name. The formal announcement of this discovery on February 22 has generated lots of excitement among scientists and amateurs alike.

Three thousand confirmed exoplanets have been discovered since 1992. So what makes the TRAPPIST-1 system stand out?

All seven confirmed TRAPPIST-1 planets are made of rock, not gas, and they're similar to Earth in size. It's relatively rare to find planets the same size as ours, and even rarer to find so many in the same place.

Earth-sized planets are normally very hard to detect because they are relatively small. In one common method of detecting planets, called the transit method, astronomers monitor how much light a star emits and look for times when it's emitting less light than usual. These "dips" in the light output can indicate that a planet's orbit is crossing in front of the star. It's hard to find small planets with this method because when orbiting a large star, small planets proportionally block out very little light, making the "dips" difficult to detect. To make small planets easier to notice, the astronomers behind the TRAPPIST project specifically targeted small stars.

TRAPPIST-1 is a dwarf star, very cool and barely larger than Jupiter. Because dwarf stars live an extremely long time, and would allow the greatest amount of time for life to evolve, dwarf star systems are commonly thought to be the most likely place for advanced alien civilizations to develop. TRAPPIST-1 consumes energy very slowly, so it could live for an estimated 12 trillion years – about a thousand times longer than our Sun.

Is it possible that life has evolved on the planets of TRAPPIST-1?

Three of the seven planets exist in the habitable zone, the region of the stellar system that could hypothetically sustain life. The habitable zone, sometimes called the "Goldilocks zone," is neither too hot nor too cold for water to be liquid. This is important because liquid water is often considered a prerequisite for life.

While many characteristics of the TRAPPIST-1 system are exciting to those who hope to find life on these planets, there are also factors that reduce the likelihood we will find aliens there.

All seven TRAPPIST-1 planets orbit closer to their star than Mercury does to our Sun, leading astronomers to believe that all potentially habitable planets are tidally locked to the star. Tidally locked planets are manipulated by gravity to rotate at the same rate they revolve around their star, so one hemisphere of the planet always faces toward the star, and the other always faces away from it. Both hemispheres suffer from extreme temperatures that are probably unsuitable for life as we know it.

Another probable consequence of TRAPPIST-1's proximity to its planets is high amounts of X-ray and ultraviolet (XUV) radiation reaching the planets. Intense amounts of XUV radiation make it extremely difficult for a planet to retain liquid water.

Research on the TRAPPIST-1 system is still in the early stages; it is impossible to be certain yet whether any of the planets are capable of originating or sustaining life. However, plans are already being made to investigate further.

Examining the planets' atmospheres with large, powerful space telescopes like the Hubble and James Webb will allow astronomers to detect which gases are present. Some gases, like ozone and methane, may indicate the presence of life.

In addition, ground-based telescopes more powerful than TRAPPIST will detect any additional planets that may be in the TRAPPIST-1 system and provide the data needed to construct accurate estimations of their mass. With accurate mass estimations, scientists will

know the composition of the planets – that is, if they are almost all rock, or if they contain a significant amount of water.

Despite the uncertainty surrounding the star system, some are already looking for signs of life there. The Search for Extra-Terrestrial Intelligence (SETI) is keeping its eyes on TRAPPIST-1 with the Allen Telescope Array in California, listening for alien radio transmissions. No signals have been detected yet, but SETI researchers are hopeful that TRAPPIST-1 will turn out to be the right place to look.