

Seven New Planets Discovered - ARE WE STILL ALONE?

By Henry Holden (Images: Courtesy: NASA/JPL-Caltech)

SCIENTISTS HAVE recently discovered seven new planets, about 40 light-years (235-trillion miles) from Earth. The system of planets is relatively close to us, in the constellation Aquarius. Because they are found outside of our solar system, these planets are scientifically known as exoplanets.

This exoplanet system is called TRAPPIST-1, named for The Transiting Planets and Planetesimals Small Telescope (TRAPPIST) in Chile. In May 2016, researchers using TRAPPIST announced they had discovered three planets in the system. Assisted by several ground-based telescopes, including the European Southern Observatory's Very Large Telescope, they confirmed the existence of two of these planets and discovered five additional ones, increasing the number of known planets in the system to seven.

In the autumn of 2016, the Spitzer Space Telescope observed TRAPPIST-1 nearly continuously for 500 hours.

Spitzer is uniquely positioned in its orbit to observe enough crossings, or transits of the planets in front of the host star to reveal the complex architecture of the system. Engineers optimised Spitzer's ability to observe transiting planets during Spitzer's "warm mission," which began after the spacecraft's coolant ran out as planned after the first five years of operations.

This newly discovered solar system mimics a smaller version of our own. The star at its centre, called TRAPPIST-1, is less than a tenth the size of our sun, and about 75 percent cooler. Its planets circle tightly around it; the closest takes just a day and a half to complete an orbit, and the most distant takes about 20 days.

In contrast to our sun, the TRAPPIST-1 star – classified as an ultra-cool dwarf – is cool enough that liquid water could survive on planets orbiting very close to it. All seven of the TRAPPIST-1 planetary orbits are closer to their host star than Mercury is to

our sun. The planets also are very close to each other. If a person was standing on one of the planet's surface, they could gaze up and possibly see geological features or clouds of neighbouring worlds. These would probably appear larger than the moon in Earth's sky.

HEAVY DUTY STAR WATCHING

The Spitzer, Hubble, and Kepler space telescopes will help astronomers plan for follow-up studies using NASA's upcoming James Webb Space Telescope, launching in 2018.

The James Webb Space Telescope will have much greater sensitivity and will be positioned one million miles from Earth. It will present an unprecedented view of the universe.

It can observe large exoplanets and detect starlight filtered through their atmosphere.

Webb will be able to detect the chemical fingerprints of water, methane, oxygen, ozone, and other components of a planet's atmosphere. Webb also will analyze the planets' temperatures and surface pressures – key factors in assessing their habitability.

The researchers believe that TRAPPIST-1f, in particular, is the best candidate for supporting

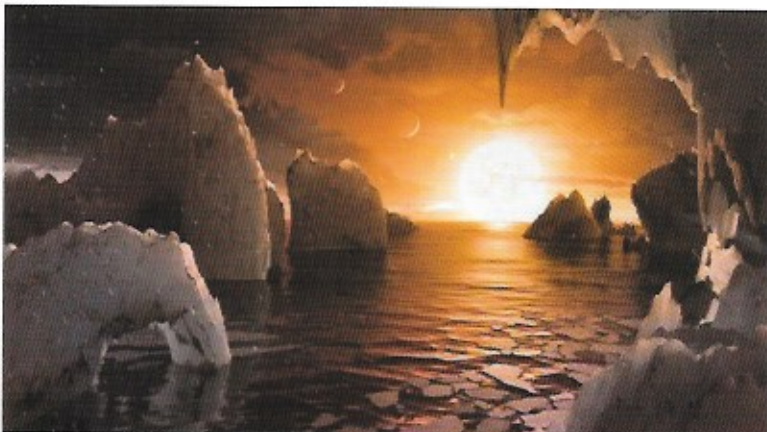
life. It is slightly cooler than Earth, but could be suitable with the right atmosphere and enough greenhouse gases.

"I think we've made a crucial step towards finding if there is life out there," said Amaury Triaud, an astronomer at the University of Cambridge. "I don't think any time before we had the right planets to discover and find out if there was life. Here, if life managed to thrive and release gases similar to what we have on Earth, we will know. Life may begin and evolve differently on other planets, so finding the gases that indicate life is key," he added.

"This discovery could be a significant piece in the puzzle of finding habitable environments, places that are conducive to life," said Thomas Zurbuchen, associate administrator of NASA's Science Mission Directorate. "Answering the question 'Are we alone?' is a top science priority, and finding so many planets like these for the first time in the habitable zone is a remarkable step forward toward that goal."

"We've learned from studying and discovering exoplanets before, that where there is one, there are more," said Sara Seager, professor of planetary science and physics at Massachusetts Institute of Technology. Seager and other researchers are encouraged by

This illustration shows the possible surface of TRAPPIST-1f, one of the newly discovered planets in the TRAPPIST 1 system. Scientists using the Spitzer Space Telescope and ground-based telescopes have discovered that there are seven Earth-size planets in the system.





This illustration shows the seven planets orbiting TRAPPIST-1, and ultra-cool dwarf star, as they might look as viewed from Earth using a fictional, incredibly powerful telescope.

this discovery. "It improves our chances of finding another habitable planet, like Earth, in the future, by knowing where to look."

WHAT WE KNOW

The planets are very close to each other. There are seven of them within a space five times smaller than the distance from Mercury to our sun. This proximity allows the researchers to study the planets in depth as well, gaining insight about planetary systems other than our own.

Starting closest to the star and moving out, the planets have respective orbits from one-and-a-half, to nearly 13 Earth days. The orbit of the farthest planet is still unknown.

The surface of one of the planets, receives 200 times less light than from our sun. But the star is so close you would still receive just as much energy to keep you warm. It would also afford some stunning views, as the other planets would appear in the sky as big as the moon (or

even twice as big).
On TRAPPIST-1f, the star would appear three times as big as the sun in our sky. And because of the red nature of the star, the light would be a salmon hue, the researchers speculate.

The researchers believe the planets formed together further from the star. Then, they moved into their current line-up. This is similar Jupiter and its Galilean moons.

Like our moon, the researchers believe the planets closest to the star are tidally locked, meaning that the planets always face one way to the star. One side of the planet is perpetually night, while the other is always day.

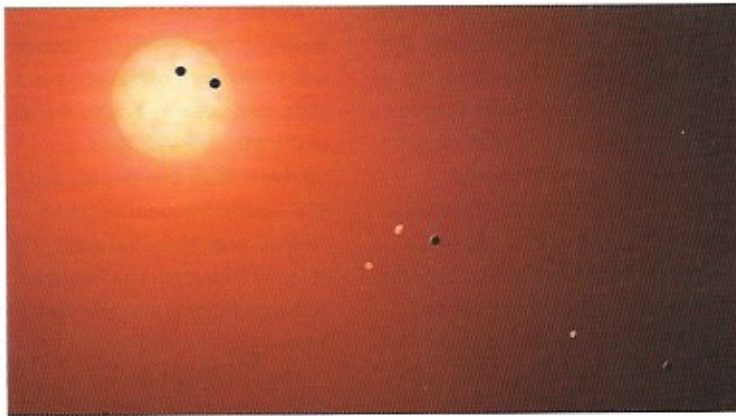
Over the next decade, the researchers hope to define the atmosphere of each planet, as well as to determine whether they truly do have liquid water on the surface and possible signs of life.

Although 40 light-years away does not sound too far, it would take millions of years to reach this star system. But from a research perspective, it is a close

opportunity and the best target to search for life beyond our solar system.

This star system will probably outlive us because this type of star evolves so slowly. When our sun dies, TRAPPIST-1 will still be a young star, and will live for another trillion years. After we are gone, if there is another part of the universe for life to carry on, it may be in the TRAPPIST-1 system.

"This is the most exciting result I have seen in the 14 years of Spitzer operations," said Sean Carey, manager of NASA's Spitzer Science Centre at Caltech/IPAC in Pasadena, California. "Spitzer will follow up in the fall to further refine our understanding of these planets so that the James Webb Space Telescope can follow up. More observations of the system are sure to reveal more secrets." →



This artist's concept shows what the TRAPPIST-1 planetary system may look like, based on available data about the planets' diameters, masses and distances from the host star.