FINDING EARTH LIKE PLANETS AND THE POSSIBILITY OF LIFE BEYOND EARTH

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The discovery of thousands of exoplanets in recent years has provided strong evidence that planets are common in our galaxy. Many of these exoplanets are located in the "habitable zone," where conditions may be suitable for liquid water and potentially life as we know it.

Beyond Earth, there are several celestial bodies that scientists believe could harbour conditions suitable for life, such as Jupiter's moon Europa and Saturn's moon Enceladus, both of which have subsurface oceans. Mars, despite its harsh surface conditions, also holds potential for microbial life or the possibility of past life.

While the existence of extra-terrestrial life is still a matter of speculation, ongoing scientific research and technological advancements continue to shed light on this intriguing question. The discovery of even microbial life beyond Earth would have profound implications for our understanding of the universe. Overall, while we do not yet have definitive evidence of life beyond Earth, the growing body of evidence suggests that the possibility of finding extra-terrestrial life is becoming increasingly likely. The range of planets listed as habitable is huge but an important one is listed here, what do you think, will we ever find any intelligent life beyond Earth and what shall be the geopolitical scenario of Earth if we ever come across one?

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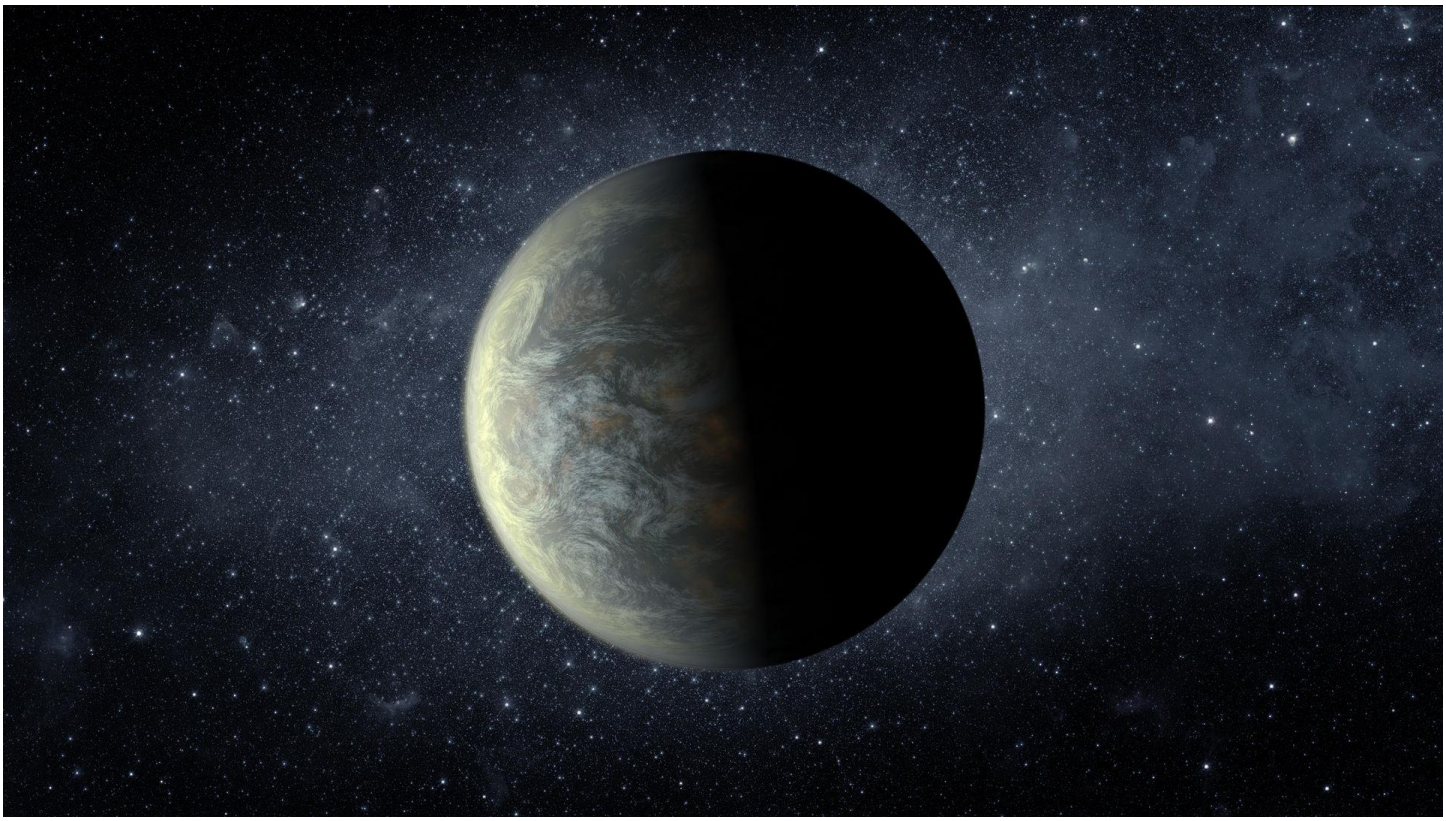
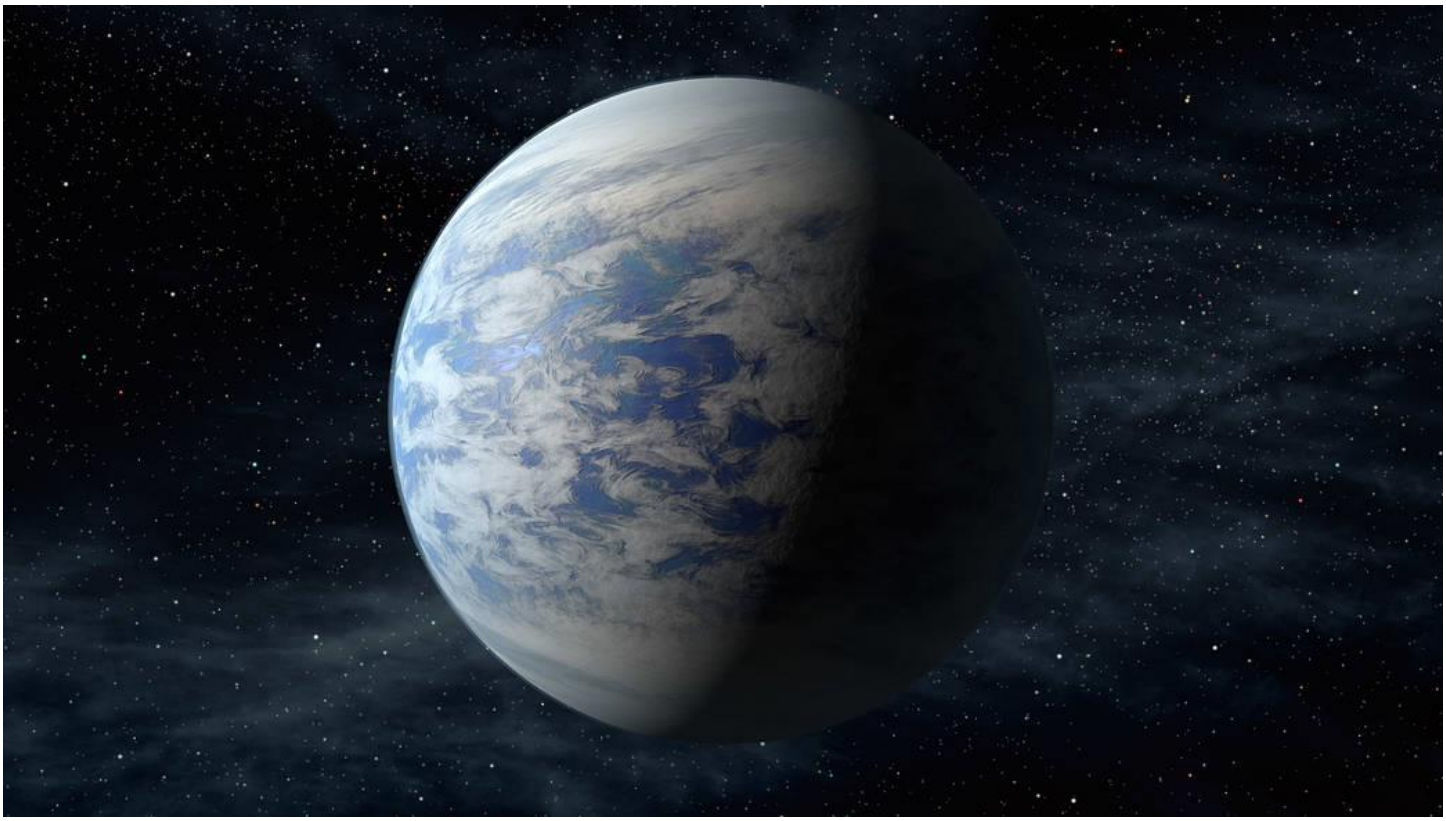


KEPLER-20F

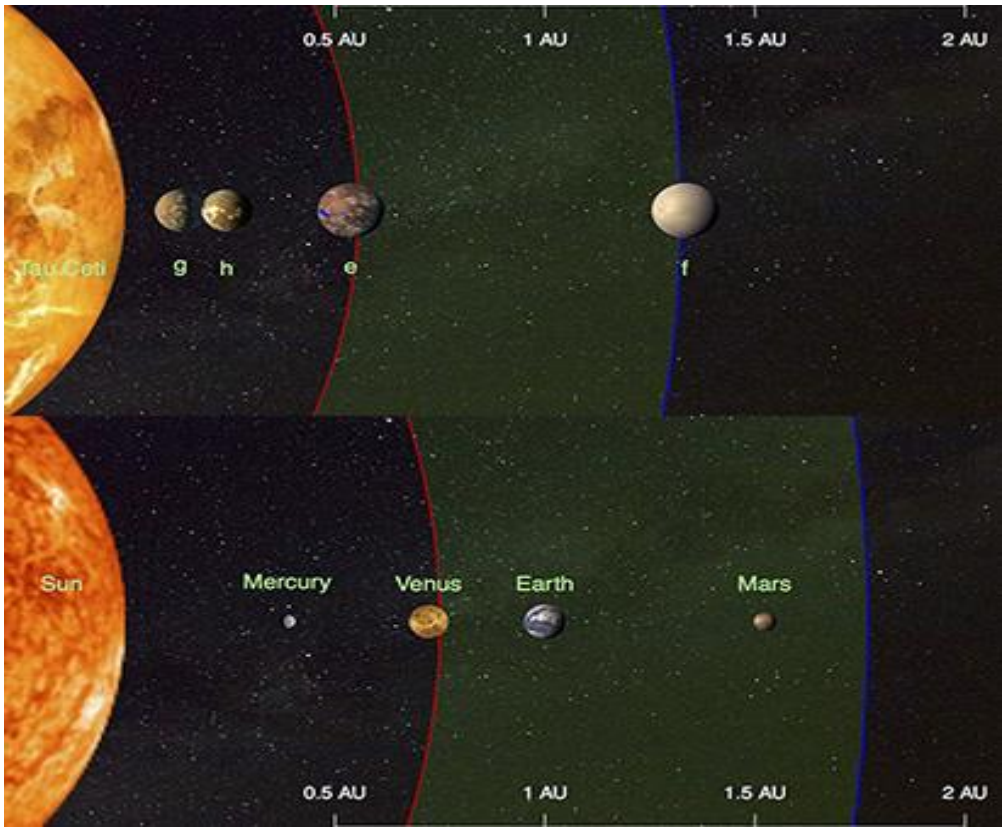
NASA's Kepler mission has discovered the first Earth-size planets orbiting a sun-like star outside our solar system. The planets, called Kepler-20e and Kepler-20f, are too close to their star to be in the so-called habitable zone where liquid water could exist on a planet's surface, but they are the smallest exoplanets ever confirmed around a star like our sun. Kepler-20f is the closest object to the Earth in terms of size ever discovered. With an orbital period of 20 days and a surface temperature of 800 degrees Fahrenheit, it is too hot to host life. It is an exoplanet which orbits its host star Kepler-20 which is about 921.4 light-years (285.4 pc) from the solar system. Kepler-20 is 0.9 times more massive compared with our sun. The surface temperature of this star is 5502 degrees which has a few spectral types of G8 stars. Kepler-20f orbits its star every 19.6 days with as distance of 0.14 AU (20,883,862.7km).



KEPLER-69C

Kepler-69c can be also considered as Super-Earth /Super-Venus. This is a debatable planet among scientists as they still are researching whether it's an Earth-like planet or a Venus-like planet. It revolves around its host star namely Kepler-69 at a distance which is 0.64 times that of Earth every 242 days (close to Venus's orbital period). Kepler-69 is a G-type star which is orbited by two planets.

The surface temperature of this star is around 5368 K with an estimated age of around 400 million years. Kepler-69c is a confirmed super-earth extra-solar planet, which is a rocky planet. It is located 2,430 light-years (746 parsecs) from Earth. This planet is present in a habitable zone, and by considering its distance from its host star, there is a chance that Kepler-69c might have water in it or even a global ocean on its surface.



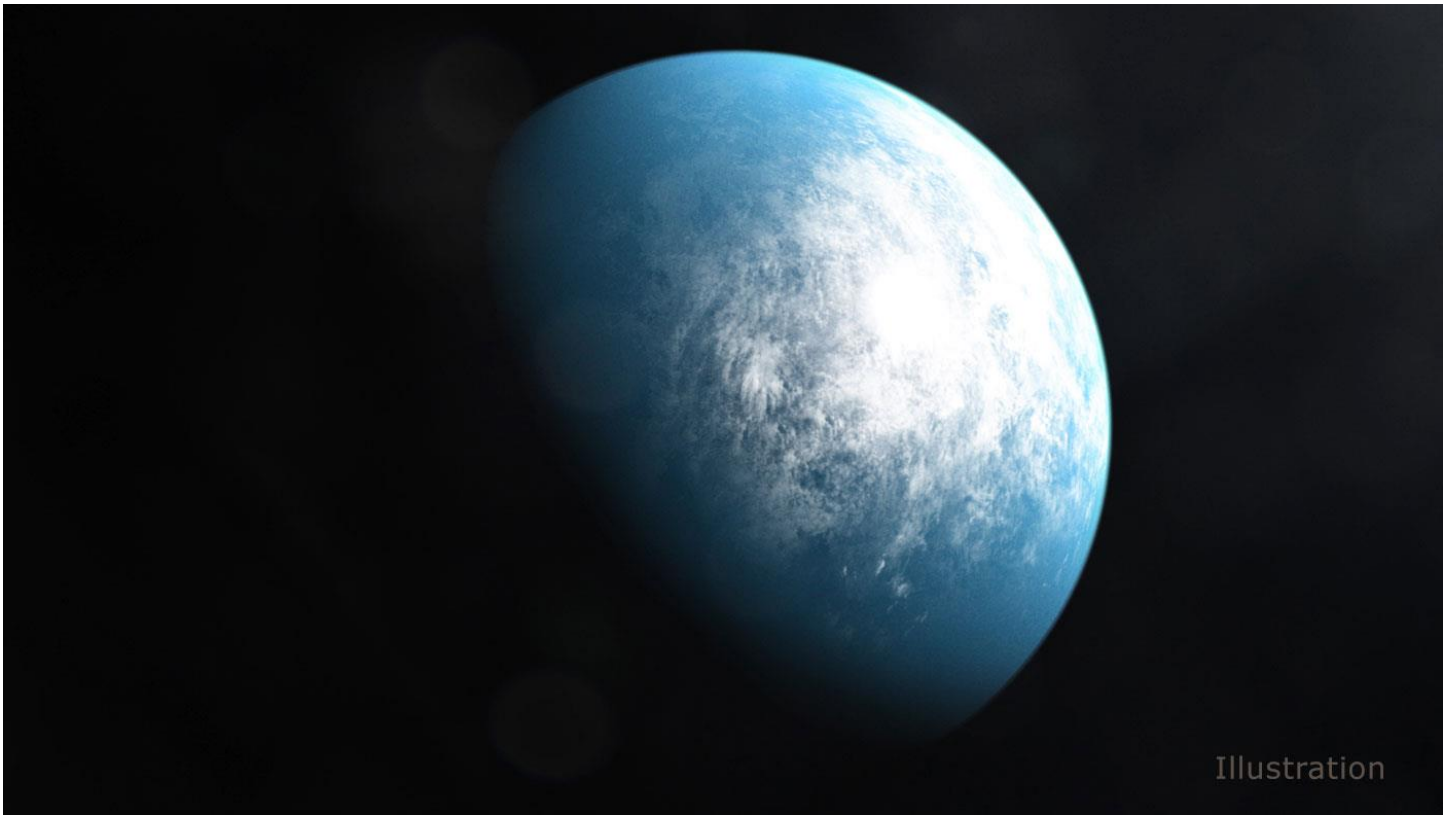
TAU CETI STAR

This is not a planet but a star very similar to our sun which is at a distance of 12 light-years (3.7 parsecs) from Earth. It has five possible planets orbiting this star, two of which are potentially in the habitable zone, because of the debris dust around this start, any planet in this system would face far more impact events than Earth did. Tau Ceti is consistently listed as a target for the Search for Extra-Terrestrial Intelligence (SETI) and appears in some science fiction literature.

The principal factor which puts Tau Ceti in a potential search for intelligent life beyond Earth is that the star's proximity to planets. After a few observations, the results on what kind of planet might exist in that system were declared. This result excludes the presence of Hot Jupiters and probably excludes any planet with minimal mass greater than or equal to Jupiter's mass and with orbital periods less than 15 years. However, as of 2019, analysis of the star has detected the signature of a possible planet of a few Jovian masses, with a tangential velocity of around 11.3 m/s.

Taue Ceti is in the habitable zone only if we make generous assumptions. Tau Ceti f has likely resided in the habitable zone for much less than 1 billion years as per some researchers. The other three Tau Ceti planet candidates (b, c and d) all orbit considerably closer to the star than do e and f, making them likely too hot to harbour life-like conditions.

All five Tau Ceti worlds are likely larger than planet Earth. Planets e and f are estimated to be 4.3 and 6.6 times bigger than Earth, respectively; the other three planets appear to harbour the size of 2 and 4 Earth masses.



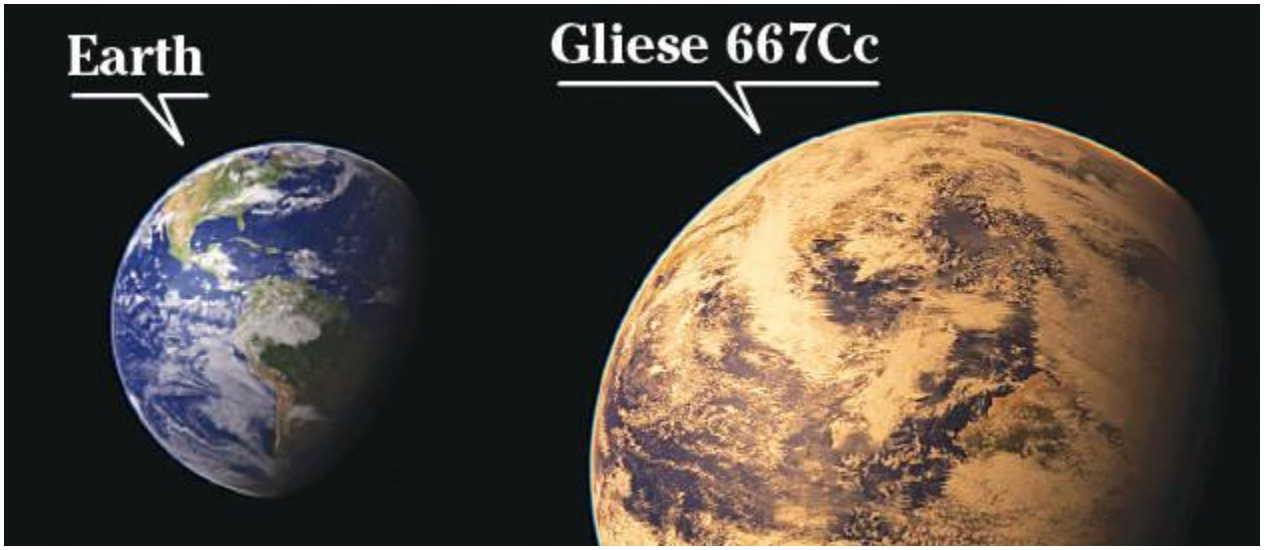
TOI 700 D

TOI 700d orbits its M-type dwarf star 16% the distance of the earth orbits the sun. It is considered the first Earth-Sized planet to be discovered. TOI 700d is one of the only few Earth-size planets discovered in a star's habitable zone as of now, the others might also include several planets in the TRAPPIST-1 system. The TOI 700 is a cool M dwarf star located just over 100 light years from the southern constellation Dorado.

It is roughly 40% of our sun's mass and size and about half its surface temperature. The innermost planet, called TOI 700b, is almost exactly Earth-size, is probably rocky and completes an orbit every 10 days. The middle planet, TOI 700c, is 2.6 times larger than Earth- between the sizes of Earth and Neptune-orbits every 16 days and is likely a a-dominated world. TOI 700d, the outermost known planet in the system and the only one in the habitable zone, measures 20% larger than Earth, orbits every 37 days and receives from its star 86% of the energy that the Sun provides to Earth.

The climate models examined a variety of surface types and atmospheric compositions typically associated with what scientists regard to be potentially habitable worlds. Because TOI 700d is tidally locked to its star, the planer's cloud formations and wind patterns may be strikingly different from Earth's.

One simulation included an ocean-covered TOI 700 d with a dense, carbon-dioxide-dominated atmosphere similar to what scientists suspect surrounded Mars when it was young. The model atmosphere contains a deep layer of clouds on the star-facing side. Another model depicts TOI 700 d as a cloudless, all-land version of modern Earth, where winds flow away from the night side of the planet and converge on the point directly facing the star.

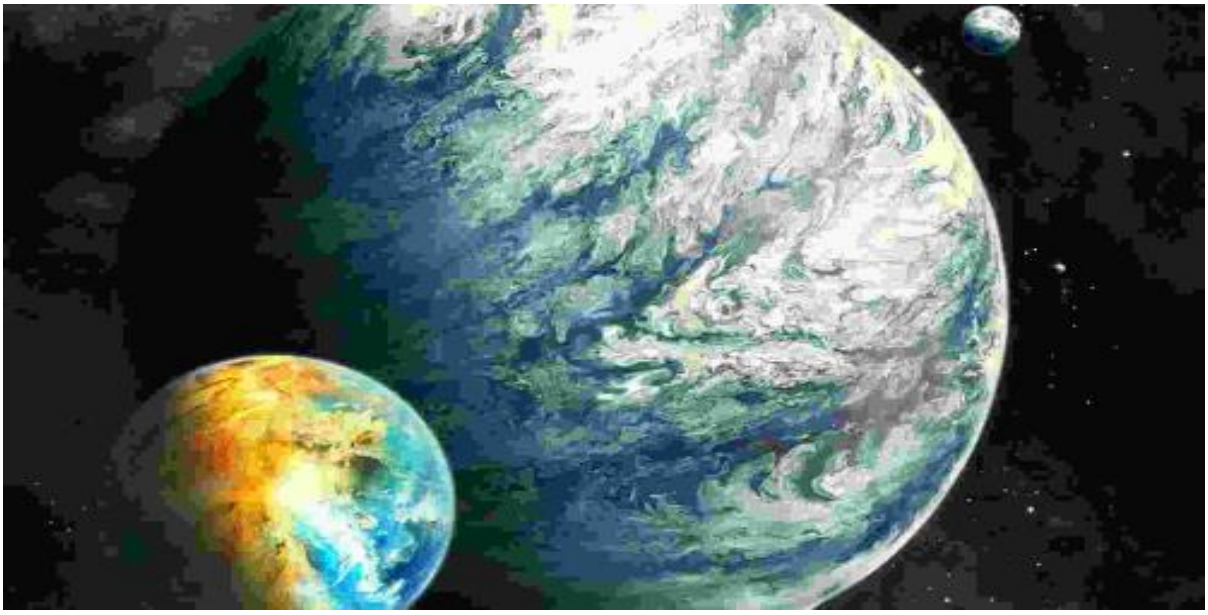


GLIESE 667CC

Gliese 667C, also known as GJ 667C, is a red dwarf star located in the Gliese 667 triple star system. It is the smallest and dimmest star in the system, with about one-third the mass of our Sun. Gliese 667C gained significant attention because it was found to host several exoplanets, including potentially habitable ones. In 2013, a team of astronomers discovered three super-Earth planets orbiting Gliese 667C within the star's habitable zone—the region where conditions might be suitable for liquid water to exist on the surface.

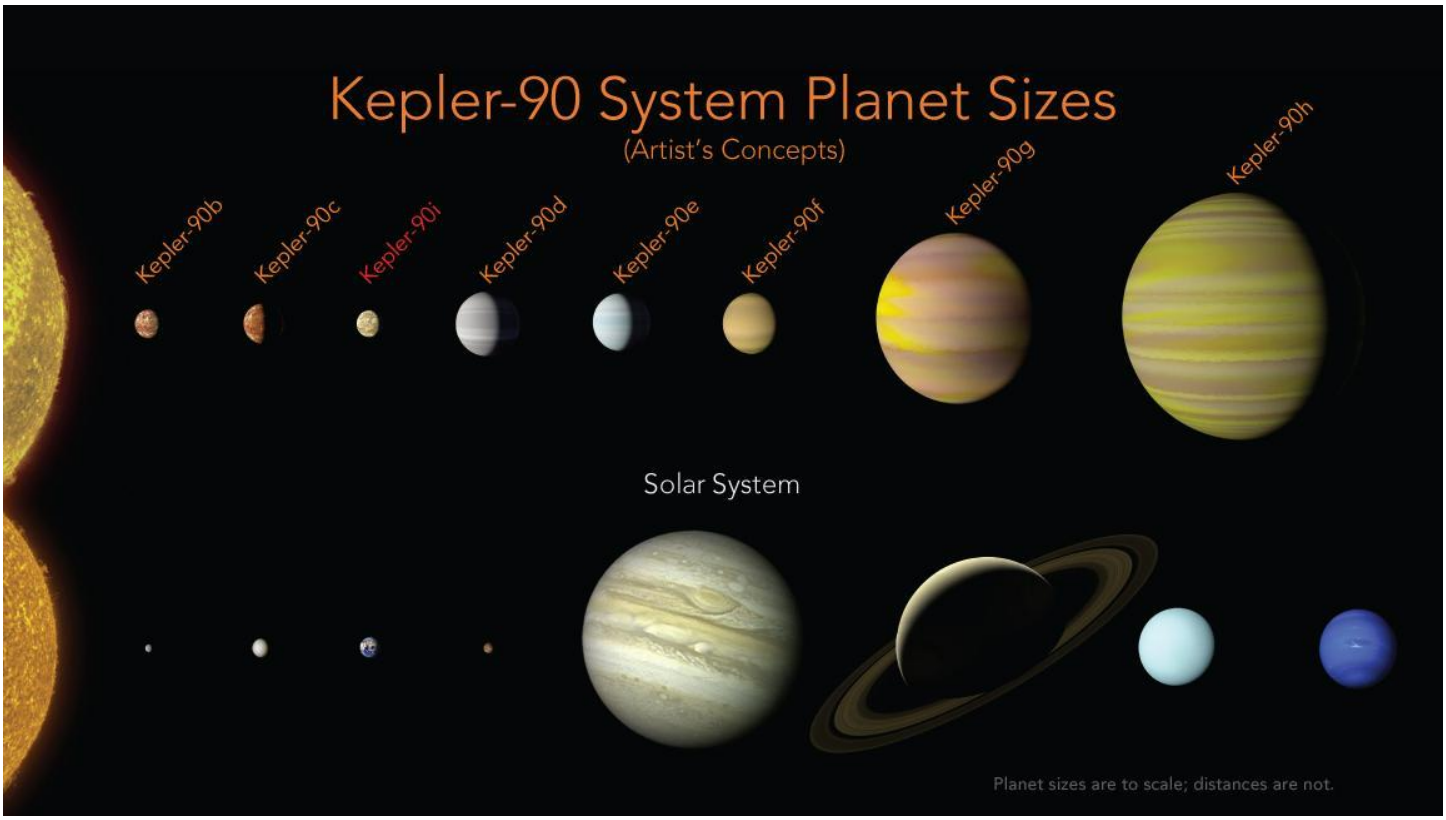
The three planets are named Gliese 667Cc, Gliese 667Ce, and Gliese 667Cf. Gliese 667Cc, the second planet in the system, has received the most attention due to its potential for habitability. It is estimated to be about 4.5 times the mass of Earth and orbits its star at a distance of about 0.12 AU, completing an orbit in roughly 28 Earth days.

The GJ667Cc receives a radiation flux which is about 90% of what we receive from our Sun on Earth. Although most of this radiation is emitted in the Infrared (IR), it is most likely enough to allow for liquid water on the planetary surface. The temperature could be a pleasant 30 degree C if we assume a planetary atmosphere that is similar to the Earth's. Further observations are needed to answer if GJ 667Cc truly supports liquid water and if the conditions on this planet are appropriate for the hosting life.



KIC-7340288 B

Officially named KIC-7340288 b, the planet discovered by young researcher Michelle Kunimoto is among 17 planets discovered by her while doing her PhD at University of British Colombia (UBC), Canada. The KIC-7340288 b is just 1 ½ times the size of Earth – small enough to be considered rocky, instead of gaseous like the giant planets of the Solar System – and in the habitable zone of its star. The planet has a year that is 142 ½ days long, orbiting its star at 0.444 Astronomical Units (AU) – just bigger than Mercury's orbit in our Solar System, and gets about a third of the light Earth gets from the Sun.

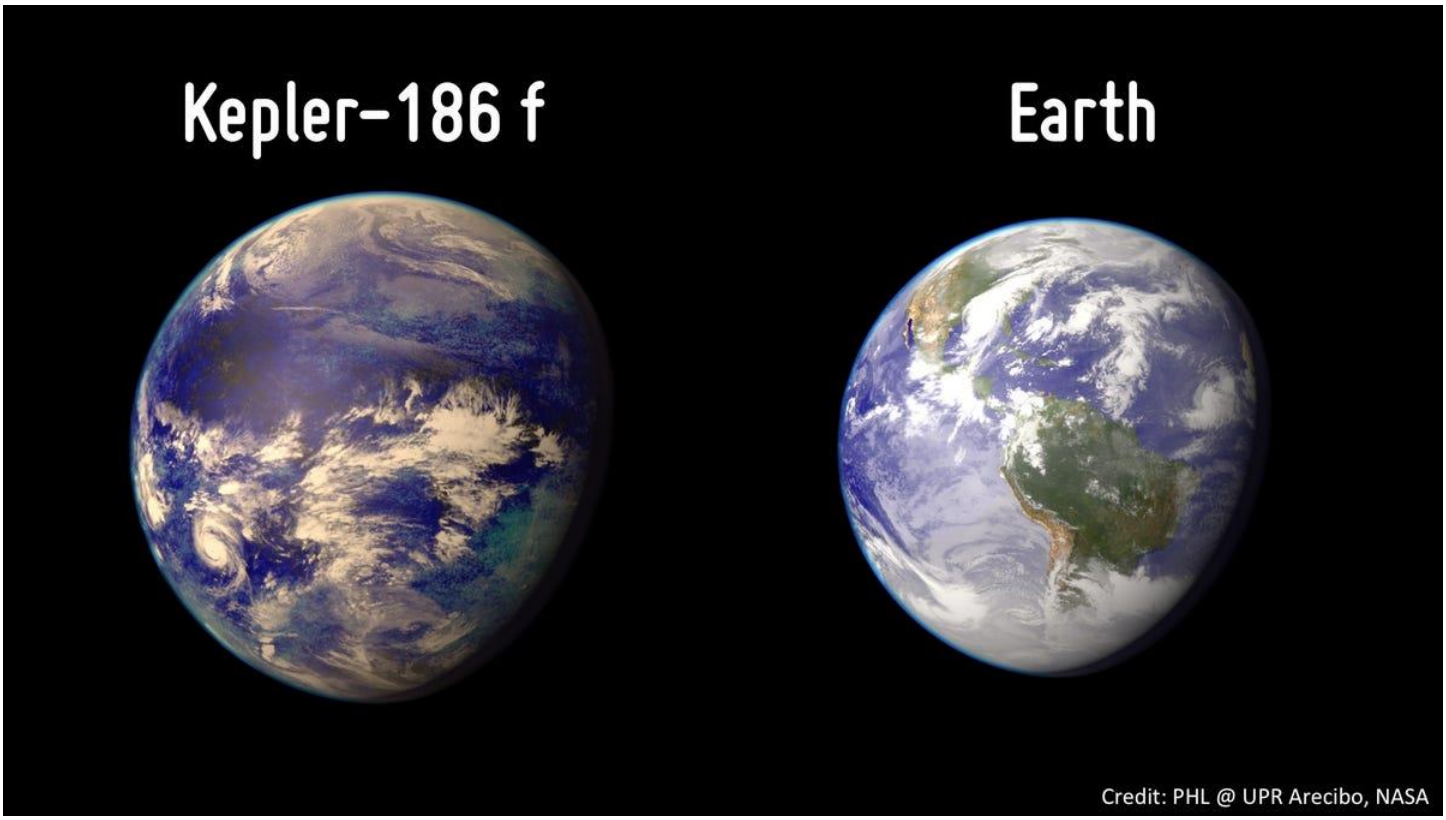


KEPLER-9D

Kepler-9d, formerly known as KOI-377.03, is a planet in orbit around the sun-like star Kepler-9. Initially discovered by Kepler spacecraft, a terrestrial planet-searching satellite built and operated by NASA, Kepler-9d is most likely a Super-Earth, with an estimated radius approximately 60% larger

than that of Earth's, although its exact mass cannot be determined.

The Kepler-9d orbits Kepler-9 every 1.56 days at a distance of .0273 AU from its star, an extremely close distance. Although Kepler-9d is the closest planet to its star in its system, it is named Kepler-9d instead of Kepler-9b because two gas giants, Kepler-9b and Kepler-9c, were confirmed first.



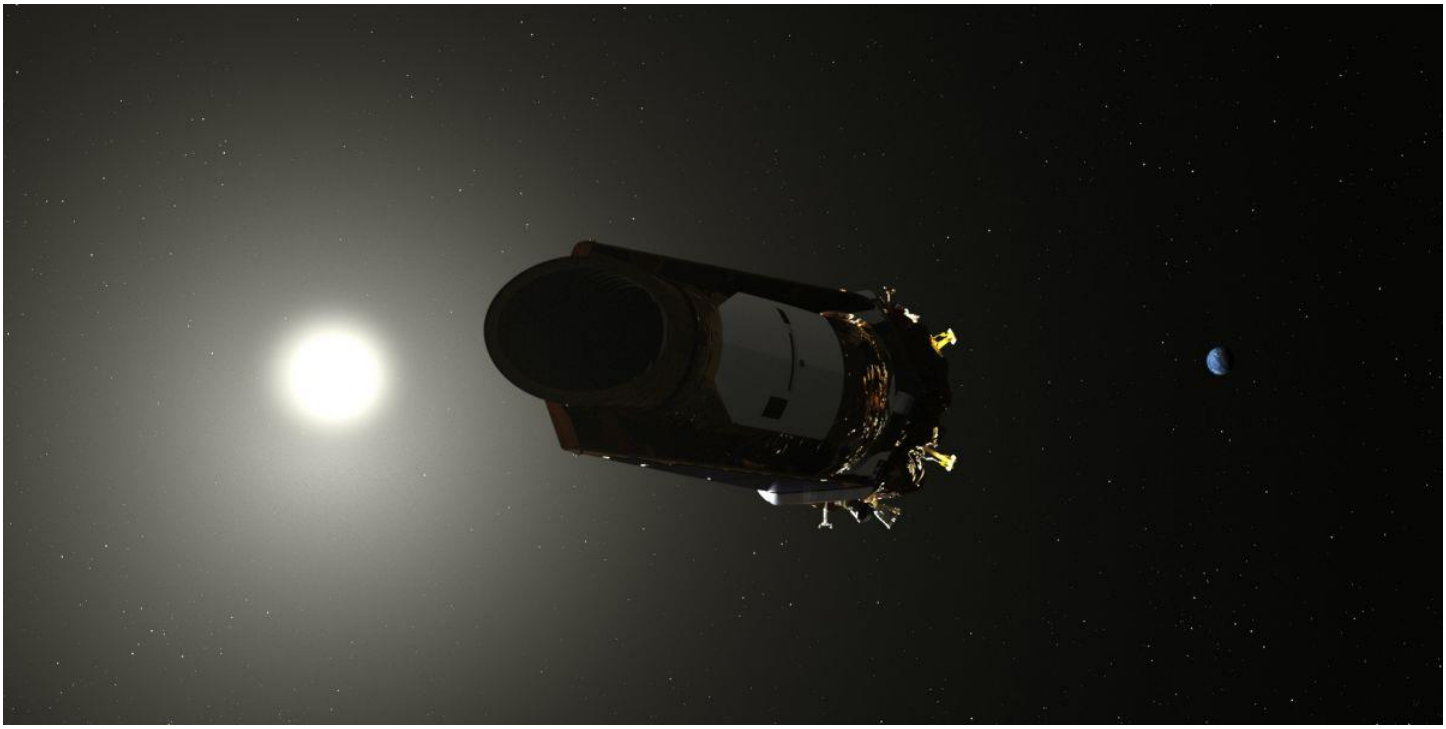
KEPLER-186F

NASA's **Kepler Space Telescope**, astronomers have discovered the first Earth-size planet orbiting a star in the "habitable zone" – the range of distance from a star where liquid water might pool on the surface of an orbiting planet. The discovery of Kepler-186f confirms that planets the size of Earth exists in the habitable zone of stars other than our sun.

While planets have previously been found in the habitable zone, they are all at least 40% larger in size than Earth and understanding their makeup is challenging. Kepler-186f is more reminiscent of Earth.

Kepler-186f resides in the Kepler-186 system, about 500 light-years from Earth in the constellation Cygnus. The system is also home to four companion planets, which orbit a star half the size and mass of our sun. The star is classified as an M dwarf, or red dwarf, a class of stars that makes up 70% of the stars in the Milky Way galaxy. "M dwarfs are the most numerous stars," said Quintana. "The first signs of other life in the galaxy may well come from planets orbiting an M dwarf."

Kepler-186f orbits its star once every 130-days and receives one-third the energy from its star that Earth gets from the sun, placing it nearer the outer edge of the habitable zone. On the surface of Kepler-186f, the brightness of its star at high noon is only as bright as our sun appears to us about an hour before sunset.



KEPLER SPACE TELESCOPE

Being in the habitable zone does not mean we know this planet is habitable. The temperature on the planet is strongly dependent on what kind of atmosphere the planet has. Kepler-186f can be thought of as an Earth cousin rather than an Earth twin. Experts believe that the planet has many properties that resemble Earth.

The four companion planets, Kepler-186b, Kepler-186c, Kepler-186d, and Kepler-186e, whiz around their sun every four, seven, 13, and 22 days, respectively, making them too hot for life as we know it. These four inner planets all measure less than 1.5 times the size of Earth.

The next steps in the search for distant life include looking for true Earth-twins – Earth-size planets orbiting within the habitable zone of a sun-like star – and measuring their chemical compositions. The Kepler Space Telescope, which simultaneously and continuously measured the brightness of more than 150,000 stars, is NASA's first mission capable of detecting Earth-size planets around stars like our sun.

TRAPPIST-1E

Some 40 light-years from Earth, a planet called TRAPPIST-1e offers a heart-stopping view: brilliant objects in a red sky, looming like larger and smaller versions of our own moon but these are no moons. They are other Earth-sized planets in a spectacular planetary system outside our own. These

seven rocky worlds huddle around their small, dim, red star, like a family around a campfire.

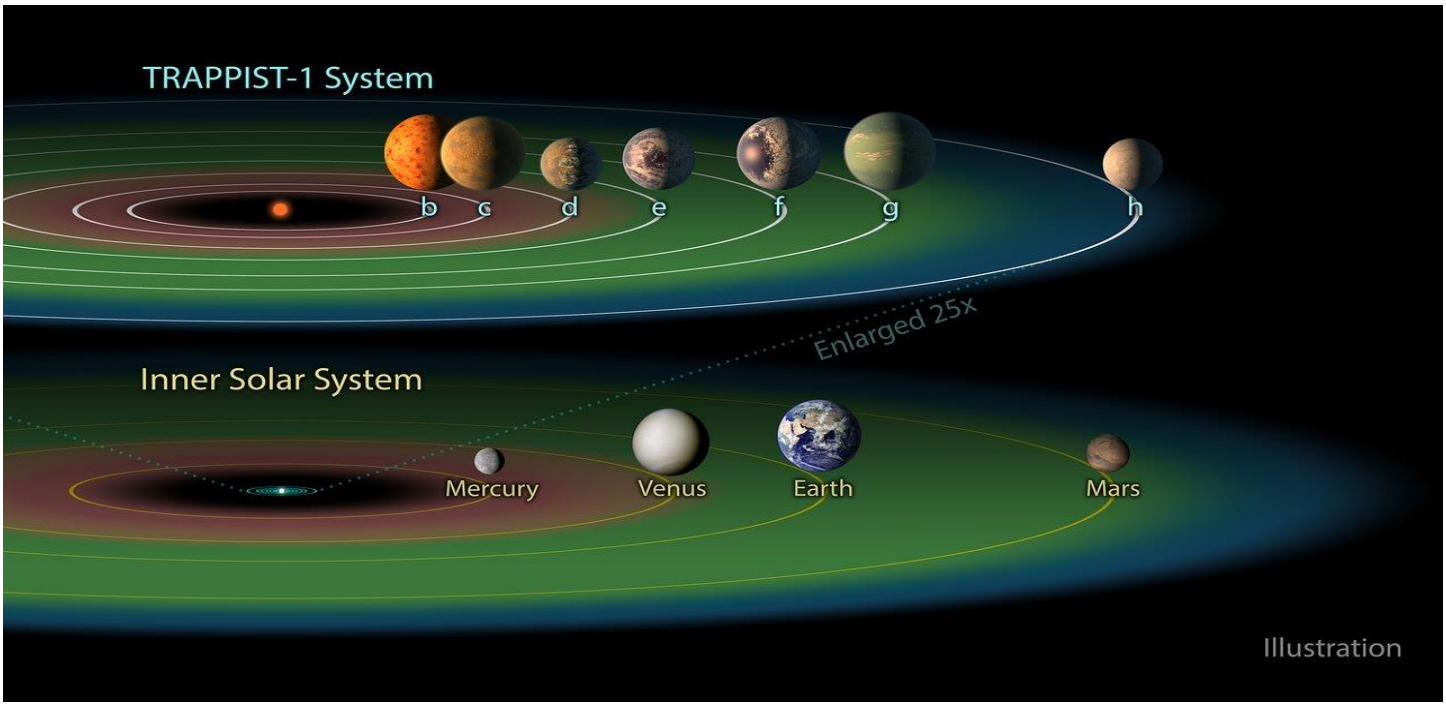
Any of them could harbour liquid water, but the planet shown here, fourth from the TRAPPIST-1 star, is in the habitable zone, the area around the star where liquid water is most likely to be detected. This system was revealed by the TRAnsiting Planets and PlanetIsmals Small Telescope (TRAPPIST) and NASA's Spitzer Space Telescope. The planets are also excellent targets for NASA's **James Webb Space Telescope**.

One of seven planets orbiting a small star, TRAPPIST-1, may be capable of supporting life as we know it on Earth, new climate models suggest. Located 39 light-years away from Earth, TRAPPIST-1 is a relatively cool M-dwarf star with about 9 % the mass of Earth's sun and about 12 % its radius. This ultra-cool star is believed to host at least seven rocky planets that are about the size of Earth or smaller.

Using terrestrial climate and photochemistry models, researchers from the University of Washington (UW) simulated environmental states for each planet of the TRAPPIST-1 system. The models show that all seven exoplanets likely evolved like Venus, meaning that any water or oceans would have evaporated early on in the system's formation, the research team said in a statement.

According to these models, the seven planets of TRAPPIST-1 would have dense, uninhabitable atmospheres. However, one of the worlds, called TRAPPIST-1e, may host liquid water on its surface and, as a result, be able to support Earth-like life, according to the statement.

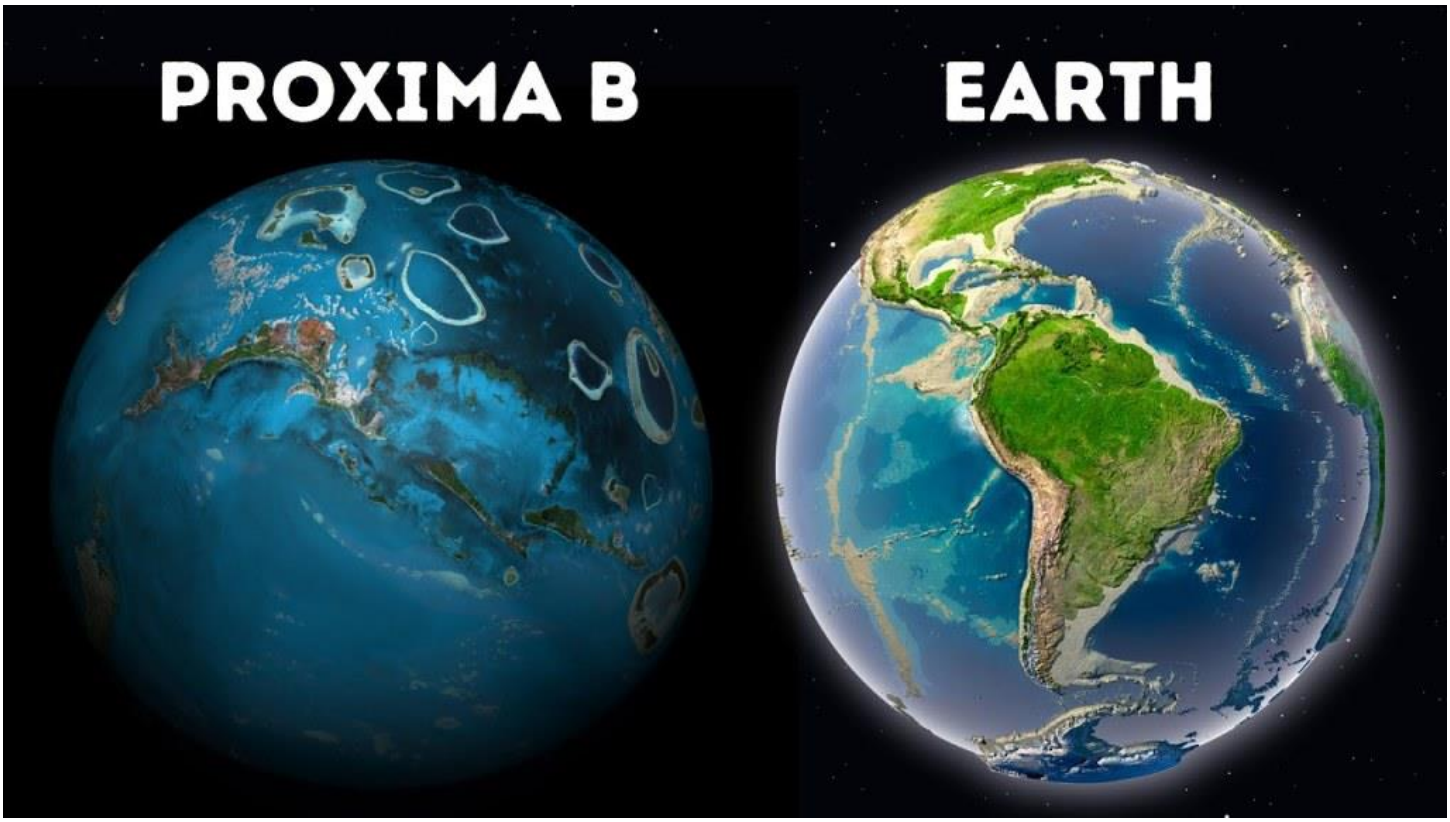
It was one of seven new exoplanets to be discovered orbiting the star using observations from the **Spitzer Space Telescope**. The exoplanet is within the star's habitable zone. Since its initial announcement, the physical characteristics have become better defined, allowing scientists to better understand its nature. TRAPPIST-1e is very similar to Earth, with just about the same mass, radius, density, gravity, temperature, and stellar flux. It is also confirmed to have a compact atmosphere like the terrestrial planets in our solar system.



More detailed studies of TRAPPIST-1e and the other TRAPPIST-1 planets released in 2018 determined that the planet is one of the most Earth-sized worlds found, with 91% the radius, 77% the mass, 102.4% the density (5.65 g/cm3), and 93% the surface gravity. TRAPPIST-1e is confirmed to be a terrestrial planet with a solid, rocky surface. It is cool enough for liquid water to pool on the surface, but not too cold for it to freeze like on TRAPPIST-1f, g, and h.

The planet receives a stellar flux 0.604 times that of Earth, about a third lower than that of Earth but significantly more than that of Mars. Its equilibrium temperature ranges from 225 K (−48 °C; −55 °F)to 246.1 K (−27.1 °C; −16.7 °F), depending on how much light the planet reflects into space. Both of these are between those of Earth and Mars as well.

TRAPPIST-1e is confirmed to have a compact, hydrogen-free atmosphere like those of our Solar System's rocky planets, further raising the chances of habitability. Hydrogen is a powerful greenhouse gas, so if there was enough to be easily detected, it would mean that the surface of TRAPPIST-1e would be inhospitable. Since such an atmosphere is not present, it raises the chances for the planet to have a more Earth-like atmosphere instead. The TRAPPIST-1e could be an early target of the James Webb Space Telescope.



PROXIMA B

Proxima Centauri b is a super Earth exoplanet that orbits an M-type star called Proxima Centauri. Its mass is 1.27 of Earths', it takes 11.2 days to complete one orbit of its star, and is 0.0485 AU from its star. Its discovery was announced in 2016. The discovery of a roughly Earth-size planet around Proxima Centauri, the nearest star to Earth, has generated a lot of buzz, and even speculation that a robotic probe may visit the world in the coming decades.

But "Earth-size" is a very different thing than "Earth-like." Even though the newfound planet, known as Proxima b, appears to orbit in its star's habitable zone – the range of distances where water could exist in liquid form – nobody knows if it's actually capable of supporting life.

Rory Barnes, a professor of astronomy at the University of Washington, stressed this point in an essay posted on palereddot.org, the website dedicated to the discovery team's search for a planet around Proxima Centauri. If Proxima b formed relatively far away from the star (and later migrated inward to its present position), then it has a better chance of being

ice-rich, ensuring a plentiful supply of water. But if the world formed closer in, much or all of its water may have been heated to vapor and lost. Or the planet could have formed with lots of water, lost it, and then had more delivered to it by comets and/or asteroids, as the Earth did.

Proxima b may be the closest of the thousands of exoplanets – which are planets orbiting stars outside our solar system – discovered to date, but at 4.2 light years away the prospect of a quick visit to find any Proximese aliens is still remote. Based on spacecraft today, a probe launched now would take around 70,000 years to reach the new planet. The James Webb Space Telescope, may provide more insights into the planet's atmosphere and composition, which would be crucial in assessing its habitability. **[End]**