

Exoplanets 101: Looking for life beyond our Solar System

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An artist's impression of a view of the surface of the planet Proxima b orbiting the red dwarf star Proxima Centauri

An Earth-like planet orbiting the star closest to our Sun, [revealed Wednesday](#), is the most recent—and among the most stunning—in a string exoplanet discoveries going back 20 years.

Herewith, a backgrounder on the search for life beyond the horizon of

our Solar System.

WHAT IS AN EXOPLANET?

Simple: any planet outside our Solar System.

The first exoplanet was detected in 1995, but the number has exploded in the last few years. A recent statistical study estimated that there a trillion in our galaxy alone.

Today, according to a tally by NASA, there are 3,374 known [exoplanets](#). Of those, 1,248 are so-called ice giants, 990 are gas giants, and 775 are "super Earths" with masses many times higher than the rock we call home.

There are only 347 smaller terrestrial planets with Earth-like mass, and of those only a handful in a "temperate" zone that would allow for the presence of liquid water—a key ingredient for life (as we know it).

None of these were within reach until today, with the discovery of Proxima b, revealed Wednesday.

HOW ARE EXOPLANETS DETECTED?

There are several ways to find planets that cannot be directly observed, according to NASA.

WOBBLE WATCHING - This involves looking for changes in the colour spectrum emitted by a star due to the gravitational pull of one or more invisible planets.



A view of the southern skies over the ESO 3.6-metre telescope at the La Silla Observatory in Chile with images of the stars Proxima Centauri (lower-right) and the double star Alpha Centauri AB (lower-left) from the NASA/ESA Hubble Space Telescope

If these patterns are regular and cyclical, corresponding to a tiny wobble in the star, chances are they are caused by a planet. Also called radial velocity, this is how Proxima b was discovered. Exoplanets found this way: 17.6 percent.

SHADOW SEARCHING - When a planet passes directly between its star and an observer—an astronomer peering through a telescope, or a satellite in space—it dims the star's light by a tiny but measurable amount. This transit method has been the most successful so far—NASA's Kepler spacecraft used it to find thousands of candidate planets from 2009 to 2013. Obviously, if a planet doesn't happen to be on the same plane as the star AND the observer, it doesn't work. Exoplanets found this way: 79 percent.

PICTURE PRODUCING - Snapping a picture of an exoplanet in front of its star is something like trying to photograph a microscopic speck of dust on a glowing lightbulb. But by removing the blinding glare of the star, astronomers can capture an image, a method called direct imaging. Only a tiny fraction of distant [planets](#) have been detected this way: 1.2 percent.

BEAM BENDING - In another technique, light from a [distant star](#) is bent and focused by gravity as an orbiting planet passes between the star and Earth.

Called gravitational micro-lensing, the gravity of the planet and star focus light rays of the distant planet on an observer in the same way that a magnifying glass focuses the Sun's light onto a tiny, bright spot. Only a handful of exoplanets have been found using this method.

WHAT CONDITIONS SUPPORT LIFE?

That depends on what the meaning of "life" is!

For life as we know it, liquid water is an essential ingredient. Of the exoplanets found to date, however, only a handful are in a "temperate" zone in relation to their star: not so hot that water evaporate, not so cold that it freezes rock solid.

Life on Earth is also unimaginable without an atmosphere, containing in our case the oxygen we need to survive. An atmosphere also protects animal species in particular from damaging high-energy radiation from the Sun—ultraviolet and X-rays.

But as we do not even know yet how life emerged on Earth, it is also possible that living creatures elsewhere in the Universe could survive and thrive in conditions that would be lethal for our tender-footed species.

source: NASA, ESA

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