Proxima Centauri B, the nearest Earth-like planet

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Abstract

With the finding of an Earth-like planet circling Proxima Centauri, the star closest to Earth and part of a three-star system, our small, lonely piece of space became a tiny bit less lonely in 2016. Proxima Centauri B is an earth-like planet with 1.5 times the mass of Earth. Alpha Centauri is orbiting its star in its habitable zone, where the ideal conditions for liquid water exist. One of the most fundamental ingredients in kicking off life is liquid water. When scientists examine exoplanets, they look for specific characteristics that indicate whether or not they might inhibit life.

I. Introduction

Scientists began actively searching for exoplanets in 1917, but it wasn't until 1992 that the finding of numerous mass planets around pulsar PSR B1257+12 led to the first real detection of an exoplanet. This was only the beginning; since 1992, there has been a significant rise in the discovery of exoplanets, with over 4700 exoplanets discovered in 3490 star systems as of 2016. Proxima Centauri B is one of the most recent discoveries.[1] Proxima Centauri B is a super-earth orbiting in the habitable zone of the Alpha Centauri star system, which is a three-star system. The Alpha Centauri star system positioned 4,2 light-years away from the sun in the southern constellation of Centaurus, is the nearest star system to the sun. In 1915, Scottish astronomer Robert Innes, director of the Union Observatory in Johannesburg, South Africa, found Proxima Centauri, which was too faint to be viewed by the naked eye. Proxima Centauri B was discovered in 2016 using the radial velocity approach and the parent star's periodic Doppler effect.[2] Proxima Centauri B, a super earth with a mass estimated to be 1.17 times that of Earth, orbits the M-type red dwarf in an eleven-day year in its habitable zone, which provides ideal conditions for liquid water to exist, as well as the possibility of an atmosphere and life, even if only microorganisms.

II. Discovery and Observation

The Pale Red Dot campaign, coordinated by Guillem Anglada-Escudé of Queen Mary University of London, was searching for a small back and forth wobble in the star induced by the gravitational force of a possible orbiting planet. A minor gravitational influence of then labeled Proxima Centauri B on its host star, called Proxima Centauri; a red dwarf star in its star system that is overshadowed by its neighboring stars Alpha Centauri AB. Previous research has suggested the presence of a planet orbiting Proxima. Every 11.2 days, something appeared to be occurring to the star, according to data. However, scientists couldn't say if the signal was created by an orbiting planet or by another form of activity like stellar flares. The pale dot campaign was able to confirm the existence of Proxima Centauri B. in 2016 by using Doppler spectroscopy, also known as the radial-velocity method, which involves making a series of studies of the spectrum of light radiated by a star; [6]The wavelength of distinct spectral lines in the spectrum increases and decreases periodically throughout time, indicating periodic fluctuations in the star's spectrum.

(As shown on figure 1) The measurements were done using two spectrographs, HARPS on the ESO 3.6 m Telescope at La Silla Observatory and UVES on the 8-meter Very Large Telescope.[2] The peak radial velocity of the host star combined with the orbital period allowed for the minimum mass of the exoplanet to be calculated.

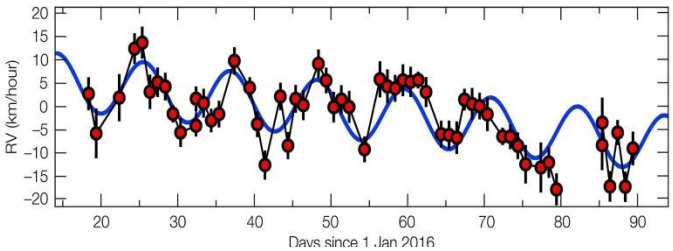

Figure 5: Velocity of Proxima Centauri towards and away from the Earth as measured with the HARPS spectrograph

III. **Physical Characteristics.**

i. Physical Attributes.

Due to the astronomical distance between Earth and Proxima Centauri B, it is difficult to get accurate measurements of the super-earth but approximate measurements can be achieved.[1] The apparent inclination of the planet's orbit has not been measured. An estimated guess of the exoplanet's mass is between 1.17 and 2.77 earth's mass. The planet's orbit has been calculated to 0.05 AU, for comparison Mercury's orbit is 0.40 AU from the sun. The exoplanet might be tidily locked, which means that one side of the planet always faces the star.[7] Proxima Centauri B (as shown in figure 2) orbits its red dwarf once every 11.2 days at a semi-major axis. With a thick enveloping hydrogen and helium atmosphere; this likelihood has been calculated to be greater than 10%. The planet has an equilibrium temperature of 234 K.

Figure 6: an artistic conception of the surface of Proxima Centauri B

ii. Host Star.

[1] Proxima Centauri is a small, low-mass star located 4.2465 light-years away from the Sun in the southern constellation of Centaurus. Proxima Centauri is a red dwarf star with a mass of about an eighth (12.5%) of the Sun's mass and an average density of about 33 times that of the Sun. Red dwarfs are known to be the longest living stars compared to the other types of stars in the main sequence. The estimated life expectancy of a typical red dwarf is in the tens of trillions of years.

IV. Habitability.

A great number of elements from various sources are proposed to affect the habitability of red dwarf systems. The low stellar flux, high possibility of tidal locking, limited habitable zones, and significant stellar variation that planets of red dwarf stars face are all obstacles to their habitability. [4]Proxima Centauri B is no different than any other exoplanet orbiting a red dwarf; the planet is subjected to stellar wind pressures more than 2,000 times that of Earth. It is most likely orbiting its host star in its habitable zone, making liquid water more likely to exist, however, this has yet to be confirmed. The stellar wind and the high radiation will likely weather away any atmosphere making the only hospitable area is the subspace of the planet[5]. In the most fortunate situation where water and an atmosphere are present, a hospitable environment will occur were oceans and temperatures close enough to that of earth. Microorganisms might have evolved to endure the extreme of their planet, but as far as carbon lives then it will be close to impossible to occur.

V. Conclusion

We might not ever get our first interstellar greeting, but the fact that there is a habitable planet right in our cosmic neighborhood. Proxima Centauri B is a sign that our efforts are not meaningless. All the questions

have not been answered; scientists think they can scan the planet's atmosphere for oxygen, methane, and water vapor utilizing ESPRESSO and SPHERE on the VLT.[52] The James Webb Space Telescope may be able to characterize the atmosphere of Proxima Centauri b. Proxima Centauri B was a scientific breakthrough and the starting of the discussion for send interstellar probes looking for neighboring planets and habitable planets. The company Breakthrough initiative and (ESO) are planning on sending a fleet of probes to the Alpha Centauri system; the probes will be able to reach 20% of the speed of light reaching Alpha Centauri in 20 years.

VI. References

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