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# Exoplanets: A Home Away from Earth, Three Potential Destinations for The Human Race Once Life on Earth Is No Longer An Option

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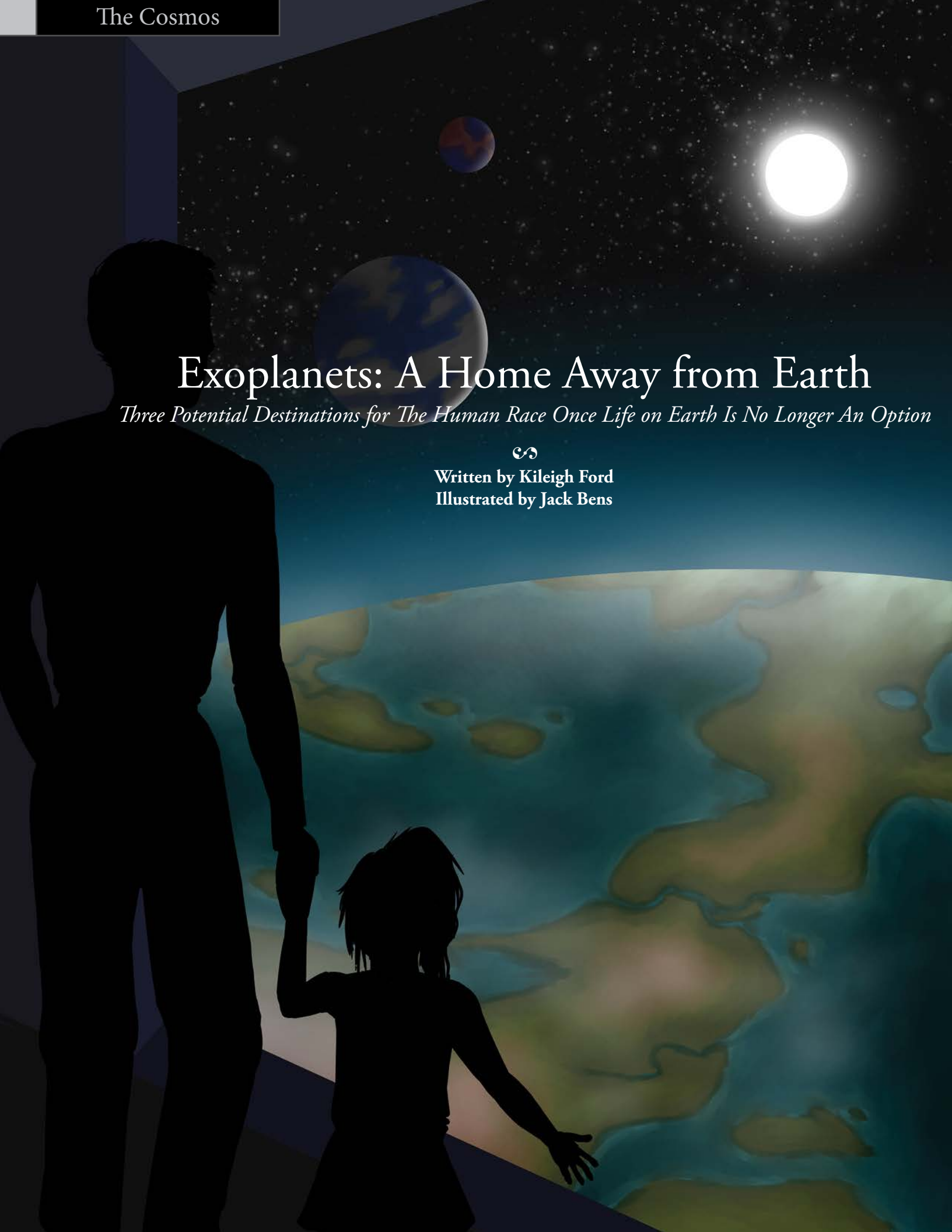

# Exoplanets: A Home Away from Earth

*Three Potential Destinations for The Human Race Once Life on Earth Is No Longer An Option*

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If we were to pick up and move Earth's population today, where would we go? With the eventual death of our Sun in 5 billion years, there are a few options in our solar system for relocation—but the most viable choices are just outside. Exoplanets are planets beyond our solar system that resemble the Earth in size and lie in the habitable zone of the star they orbit. Exoplanets increase in number every year, each varying in size, resources, and makeup. Despite 3,708 confirmed exoplanets and another 4,496 candidates, astronomers are still on the hunt to find Earth's perfect twin.

In order to be habitable, an exoplanet must lie close enough to its star that liquid water can exist on the surface, which also depends on the temperature of the planet. Exoplanets may have a greenhouse effect, like we do on Earth, where greenhouse gases present in the atmosphere trap the heat radiating from planet within the atmosphere, heating it up. This can create a different temperature from what scientists calculate the expected temperature of a planet to be just based on the distance from the exoplanet to its star. Meanwhile, clouds reflect light, so cloud coverage contributes to cooling the planet from a high average temperature or

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can cool an environment too much to support human life. The proper environment for fostering human life is delicate, and while not all of these exoplanets may be able to meet these requirements, there are so many planets confirmed exoplanets that the probability of finding at least one that fits humanity's habitat needs as exactly as possible is very high.

Not all planets orbit a star like our Sun; the type of star a planet orbits is a big contributor to its habitability. A dim, cooler star—like red dwarf stars—will have a habitable zone in closer proximity than a huge, very hot star, which will host a habitable zone much further away. However, red dwarf stars shoot stellar blasts, bursts of magnetic energy, and x-rays—or electromagnetic waves of radiation—into space, potentially harming life on a planet orbiting too close to the star. These smaller stars tend to have longer lifetimes (from around 1 trillion to 100 billion years), whereas supermassive, hot stars burn up more quickly and, therefore, have a much shorter lifetime (around 100 million years). A habitability scale created by the authors of the paper "Comparative Habitability of Transiting Exoplanets" ranks confirmed exoplanets based on the planet's distance from its star, how rocky the surface is (rockier is better because it is easier to harvest metals and other resources, as well as electricity), the balance of light and heat the planet receives from its star, and its albedo (solar energy reflected off of its atmosphere). Earth itself is not a perfect 1, meaning most habitable, on this scale, but a 0.829. This may indicate that a perfect 1 is out there—we just have to look.

To get to these exoplanets, it will take some time and advancement in technology. Scientists chart the changing position of a planet over the course of six months against background stars to determine the angle at which Earth faces it, and use trigonometry to determine how far away the planet is. Measured in light years, the closest exoplanet viable for human life is about 4 light years away. A light year is a distance that refers to how far light travels in 365.25 days. Unfortunately, we cannot currently travel at the speed of light. If we could, it would take us 4 years to get to the closest exoplanet. To put things in perspective, 1 lightyear is approximately 5.9 trillion miles, or 1.2 billion hours! This means it would take a spaceship 137,000 years with current technology to make it to the exoplanet.

Let's take the first step outside of our solar system to the third-closest star to our Sun, Proxima Centauri. An almost Earth-sized planet exists in the habitable zone of this red dwarf star, which is located 4.22 light years away from Earth. This same planet is the closest exoplanet to Earth and the planet, named Proxima Centauri b, is a viable option for a new human domain. However, with a radius 1.3 times greater than Earth's, Proxima Centauri b is much closer to its star than we are to the Sun, which creates a set of circumstances very different from Earth. Proxima Centauri b receives x-rays that are 400 times stronger from Proxima Centauri than the x-rays we receive on Earth from the Sun. Proxima Centauri also often shoots out nuclear blasts.

Proxima Centauri b has a period of 11.2 days, which means it takes 11.2 days to orbit around its star. If the planet is tidally locked to its star, the orbital periods of the planet and star will be the same. If not tidally locked, they could have different periods (similar to Mercury and our Sun) in which Proxima Centauri b would orbit its star twice every three days. The differing periods would be ideal, as it would create a more even climate on the planet for humanity to dwell.

One major issue with Proxima Centauri b is that we don't know what it is composed of. Because we do not know the diameter of the planet, we cannot calculate its density and therefore, though it is likely that the planet has a rocky composition, it could also be a gas ball like Uranus. Evidently, Proxima Centauri b has several mysteries about its habitability that scientists have yet to figure out. While this could pan out extraordinarily well for humankind's sake, it could also turn out to be the opposite of what humans would need; this uncertainty is a problem we encounter with many exoplanets.

Moving on to the second area of space in the search for a new home, we find ourselves 1,200 light years away from Earth on the potentially Earth-like planet of Kepler-62f. Just 1.4 times bigger than Earth, this planet orbits a star that is smaller and dimmer than our Sun. Through a modeling study, astronomers discovered that Kepler-62f could be an entirely water-covered land mass. The conditions of a planet like this means that life may already exist there. According to the author of the model, Lisa Kaltenegger, "There may be life there, but could it be technology-based like ours? Life on these worlds would be under water with no easy access to metals, to electricity, or fire for metallurgy." This option would mean relearning how to live as a society and adapting to life in or on water, potentially with new species with which to coexist.

Perhaps Kepler-62f is not the best option, but its neighbor, Kepler-442b, is 5 light years closer to Earth, and Wired's K.G. Orphanides has dubbed it "more habitable than Earth." As previously mentioned, in a habitability ranking Earth earns a habitability rating of 0.829—but Kepler-442b receives a 0.836. Kepler-442b is 1.35 times the size of the Earth, has a period of 112.3 days, and lies well within the assumed habitable zone of the star it orbits, so it is more like Earth in these characteristics than other exoplanets. Would an expedited and expensive attempt to advance our space travel technology be worth it to live on a planet more habitable than Earth? That is the question we need to examine in finding our way to Kepler-442b.

If we were to pick up and move Earth's population today, where would we go? Three choices—each a new, unique world for humans to explore. These worlds vary from one another in immense ways, but demonstrate the variety of environments that potentially await human life. With many unknowns and a need for advancement in technology, there is still a ways to go in figuring out which planets could best suit human needs. For now, Earth suits us well, but in a few centuries humanity may find itself migrating to Proxima Centauri b, Kepler-62f, or Kepler-442b—bringing with it new ways of life and society. ●