Astrobiology News November 2017:
Earth-like Planets Orbiting the Nearest Stars?

Most of the stars you can see in the night sky aren't the closest stars, but rather the most luminous – faraway beacons of light intrinsically thousands of times brighter than our Sun. The brightest of these are also quite rare, comprising less than 1% of the stars in our Galaxy. On the other hand, the dimmest stars (known as red dwarfs or M dwarfs) make up about 70% of all the stars in our Galaxy. Of the 60 known *main sequence*[1] stars within a distance of about 5 parsecs[2] from the Sun, 50 are red dwarfs, although the vast majority of these are invisible to the unaided eye. What makes red dwarfs particularly compelling targets to search for Earth-like planets is their proximity. Five parsecs is close enough for the next generation of "Extremely Large Telescopes" (ELTs) to detect signs of certain molecules, such as oxygen, in the atmospheres of planets orbiting these stars. The detection of such molecules would go a long way toward establishing habitable conditions on these worlds.

Several factors may negatively impact the prospects for life on planets orbiting red dwarfs. For one thing, to have temperatures conducive to life as we know it, planets have to orbit very close to these stars – so close that they should be *tidally locked,* meaning the same side of the planet would continually face its star (like the Moon toward the Earth.) Although huge temperature differences might be expected between the day and night sides of such planets, this isn't necessarily a showstopper, as life might inhabit various temperate niches. Another potential challenge to life is the fact that most red dwarfs are prone to especially violent outbursts of radiation; however, a recently discovered planet orbiting a nearby red dwarf might not face this particular problem.

Ross 128 b is the 2nd closest "exo-Earth"[3] to our Solar System[4]. Its star, Ross 128, is a "mere" 3.4 parsecs distant, and appears to lack the intense outbursts of most red dwarfs[5]. At present, the term "exo-Earth" may be a bit misleading. Unlike the TRAPPIST-1 planets[6], Ross 128 b doesn't *transit*[7] its star, and the method by which it was discovered gives us only a lower limit to the planet's mass. Still, it's a particularly promising target for future observations that could determine just what type of world Ross 128 b is!

It bears remembering that if signs of life were discovered on a world orbiting one of the nearest stars, it would suggest that life is ubiquitous in our Universe. I don't think it would be an overstatement to suggest that this would be the most significant discovery in the history of human civilization, and it is exciting to think that this question might be answered within the next decade!

Until next month,

Grace

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[1] A main sequence star shines by fusing hydrogen to helium deep within its core. A star's mass determines how long it can do this – the most massive stars "only" a few million years; a star like the Sun, about 10 billion years; a red dwarf, about 10 trillion years.

[2] Five parsecs is about 16.3 light-years. Astronomers use parsecs more often than light-years as a measure of distance to objects outside of our Solar System.

[3] "Exo-Earth" refers to an Earth-sized world orbiting in the habitable zone of a star other than our Sun; however, Earth-sized doesn't imply that the world is anything like the Earth. Further observations are required to determine just how "Earth-like" such a world may be!

[4] The closest exo-Earth orbits the star Proxima Centauri, 1.3 parsecs from the Sun. See http://www.theclergyletterproject.org/pdf/abnews92016.pdf

[5] https://www.eso.org/public/news/eso1736/?lang

[6] See http://www.theclergyletterproject.org/pdf/abnews32017.pdf and http://www.theclergyletterproject.org/pdf/abnews52017.pdf

[7] A transiting planet passes in front of its star (as seen from Earth) as it orbits.