

Astrobiology News December 2017: Two-, Three-, and Four-Star Families

Without any spoilers for those of you who intend to see *Star Wars: The Last Jedi*, but haven't already seen it, there is a scene that mirrors our first encounter with Luke Skywalker, as he watched the two suns of his home world, Tatooine, setting in the 1977 classic *Star Wars: A New Hope*. Of course, when the first *Star Wars* movie was released forty years ago, we had yet to discover even one exoplanet orbiting a single star, but the landscape has changed dramatically since the end of the 20th century, and in 2011, the first unambiguous detection of an exoplanet that orbits two stars was announced. With the blessings of George Lucas, Kepler-16b was nicknamed "Tatooine" by scientists.

Unlike Luke Skywalker's home world, Kepler-16b is not in a galaxy "far, far away", but rather a "mere" 200 light-years away, and it doesn't share many other similarities with Tatooine – it is thought to be cold and gaseous, not hot and arid. Nevertheless, over 50% of stars has one or more companion star, so it is particularly interesting to explore what types of worlds – particularly potentially habitable worlds - might exist on stable orbits in systems containing more than one star. In binary (two-star) systems, exoplanets can orbit one or both stars¹, depending upon their location in the system and the distance between the stars. It's not always obvious that a given star has a stellar companion – and as you might imagine, the presence of more than one star can complicate measurements of star and exoplanet properties, so searching for stellar companions is an important aspect of characterizing these systems.²

Exoplanets have also been discovered in systems with three and even four stars. In fact, it was citizen scientists working on the *Planet Hunters* project who discovered the first exoplanet in a quadruple star system.³ Just as there are websites that keep tallies of the number of known exoplanets⁴ and potentially habitable exoplanets⁵, there is a website that keeps a tally of known exoplanets in multiple star systems.⁶ There is even a site that lets you compute habitable zones in multiple star systems!⁷

Whether there are any exoplanets in six-star systems like the fictional *Lagash* envisioned in Isaac Asimov's famous 1941 science fiction short

story, *Nightfall*⁸, remains to be seen, but on a clear winter night, cast your gaze up to the bright star, Castor, in the constellation Gemini. Not counting the Sun, Castor is the 24th brightest star in the sky (as seen from Earth), and at a distance of roughly 50 light-years, it ranks as the closest known six-star system. You'll need a small telescope to resolve Castor into two stars, though, and somewhat more sophisticated equipment to tease out all six.

Clear Skies & Joyous Holidays!

Until next month,

Grace

¹ A 3rd possibility is too complex to explain in this brief article, but see endnote 6.

² <https://astrobiology.nasa.gov/news/a-search-for-stellar-companions/>

³ Schwamb et al. 2013, *Astrophysical Journal*, 768, 127 (21 pp)

⁴ <http://exoplanet.eu/>

⁵ <http://phl.upr.edu/projects/habitable-exoplanets-catalog>

⁶ <http://www.univie.ac.at/adg/schwarz/multiple.html>

⁷ <http://astro.twam.info/hz/>

⁸ <https://sites.uni.edu/morgans/astro/course/nightfall.pdf>