Astrobiology News March 2019: K Dwarfs and the Search for Extraterrestrial Life

In honor of Women's History Month, I'll highlight a recent article by one of the many excellent female astrobiologists. Giada Arney presented a TED talk late last year entitled *Discovering the Story of Life in the Universe*.¹ Earlier this month, Arney published a paper arguing that stars known as K dwarfs may offer the best prospects for detecting signs of life on orbiting worlds.²

What makes K dwarfs so interesting in the search for extraterrestrial life? K dwarfs fall between stars like our Sun (G dwarfs) and dim, red, long-lived M dwarfs³ in terms of brightness, temperature, and lifespan. With lifetimes of ~17-70 billion years, K dwarfs offer plenty of time for life to evolve on worlds in their habitable zones. Although M dwarfs are even longer-lived, these stars undergo very energetic stellar flares and are much brighter when they are young, so any planets that would otherwise be in the habitable zone of these stars might have their water boiled off early on.

Since K dwarfs may offer a "sweet spot," Arney investigated what signs of life might look like on a hypothetical planet orbiting a K dwarf.⁴ The simultaneous presence of methane and oxygen in a planet's atmosphere is considered to be a particularly good biosignature, since these molecules react, and thus destroy each other. To be detected, they must be replenished, very possibly by life, and remain in significant amounts in a planet's atmosphere.

Using a computer model to simulate how the chemistry and temperature of a planet's atmosphere responds to different host stars, Arney showed that the methane-oxygen signal would be easier to detect from planets in the habitable zones of K dwarfs compared to Sun-like stars. Proposed future missions such as LUVOIR⁵ or HabEx⁶ could be designed to detect such signals from planets orbiting "nearby" K dwarfs.

By the way, two of the K dwarfs Arney considers good targets in the search for signs of life, 61 Cyg and Epsilon Indi, may be familiar to my fellow *Star Trek* geeks as the legendary home systems of the Tellarites

and the Andorians.⁷ How cool would it be if either of these two stars actually does host a world harboring life?

Until next month,

Grace (gwolfchase@adlerplanetarium.org)

¹ https://www.voutube.com/watch?v=v9vL0x9LTRU

² https://iopscience.iop.org/article/10.3847/2041-8213/ab0651/meta

³ I've written about prospects for life on worlds orbiting M dwarfs in the past – for e.g., check out the articles on TRAPPIST-1 in the Astrobiology archive: http://theclergyletterproject.org/Resources/Astrobiology.html

⁴ https://www.nasa.gov/feature/goddard/2019/k-star-advantage

⁵ https://asd.gsfc.nasa.gov/luvoir/

⁶ <u>https://www.jpl.nasa.gov/habex/</u>
⁷ <u>https://memory-beta.fandom.com/wiki/The_Worlds_of_the_Federation</u>