Q-C SKYWATCH

M Dwarf stars are our cool neighbors

Astronomers key in to their dim low-temp status

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Since the discovery of the first exoplanet, or planet orbiting another star, more than two decades ago, astronomers have been scouring the sky for Earth 2.0.

While it may seem that the best place to look for potentially habitable exoplanets is other stellar systems similar to ours, we are still a ways off from detecting an Earth-sized exoplanet orbiting a star like the sun. Instead, astronomers have turned to observing M Dwarfs, the coolest and dimmest type of star.

M Dwarfs are the most abundant stars in our region of the Milky Way, making up about 75 percent of the stars surrounding our solar system. These stars also harbor large populations of terrestrial (rocky) planets, an important prerequisite to life. Because of the lower stellar temperature, the habitable zone around M Dwarfs, or the range of orbits in which liquid water could exist on the surface of a planet, is closest to the star. This makes it easier to find planets around M Dwarfs with the two most common methods of detecting exoplanets.

All stars give off electromagnetic radiation through light of different wavelengths, including the visible light that surrounds us during the day and the ultraviolet (UV) rays that can leave us with sunburns. Luckily, our ozone layer protects us from the majority of this harmful UV radiation. But M dwarfs are more active than our sun, meaning they emit radiation more frequently and at higher intensities.

This radiation could affect the atmospheres of the exoplanets in an M Dwarf system, making their habitability uncertain. Therefore, for astronomers to analyze the atmospheres of exoplanets surrounding M Dwarfs, they must also understand the unique UV emission profile of the star in the system.

However, UV observations are challenging to obtain. Because our ozone layer absorbs light in the ultraviolet range, we cannot accurately measure UV emission from ground-based telescopes. While space-based telescopes, such as Hubble, can observe UV light from these M Dwarfs, time on space telescopes is limited and competitive.

A number of instruments that will observe these targets are in the works, including the James Webb Space Telescope, but in the meantime, finding a way to characterize the ultraviolet spectrum of stars through other methods is essential.

This is where the work of the MUSCLES Treasury Survey comes in. MUSCLES stands for "Measuring Ultraviolet Spectral Characteristics of Low-mass Stars with Exoplanetary Systems" and is a collaboration between many universities and research organizations across the world.

MUSCLES seeks to identify a mathematical relationship between a star's emission in visible and ultraviolet wavelengths. To achieve this, the collaboration looks at one M Dwarf target at a time, measuring the flux of different ultraviolet spectral lines, each line corresponding to a different element present in the star.

We then compare this information to measurements of several spectral lines in the visible wavelength range, fitting a model to the data.

As methods of detecting exoplanets improve, astronomers will shift toward studying the planets orbiting stars more similar to our own. But now, in our ongoing search for stellar systems compatible with life as we know it on earth, we cannot forget about our coolest stellar neighbors, the M Dwarfs.