Simulations suggest life on planet Proxima b might be possible if it has a thick atmosphere or strong magnetic field

December 13 2016, by Bob Yirka

Artist's impression of the planet orbiting the red dwarf star Proxima Centauri. Credit: ESO

(Phys.org)—Dimitra Atri, an astrobiologist with the Blue Marble

Institute of Space Science, has published a paper in *Monthly Notices of the Royal Astronomical Society* outlining his work running simulations of planet Proxima b, an exoplanet circling the star Proxima Centauri, which could possibly support life.

Last August, a team of scientists identified a planet circling Proxima Centauri—at 4.2 light-years away, the red dwarf is the closet star to our own sun and the discovery of a planet in its Goldilocks zone excited the astronomy community because it represented the possibility extraterrestrial life. Since that time, Atri reports, he has created and run simulations meant to measure the impact of stellar flares on the planet and whether they might be enough to prevent or allow life to exist on the planet.

Proxima b has been considered a good candidate for supporting life—initial reports suggested it has a rocky surface, is close in size to Earth and circles its star closely enough to receive adequate warmth. On the other hand, it also could face extinction-level events on a periodic basis via stellar flares spewing radiation across its surface. Such stellar flares are more worrisome for a planet like Proxima b because it is much closer to its star than Earth is to the sun—it is actually even closer than Mercury is to our sun. It does not burn up, however, because the star is much cooler than the sun.

To discern if Proxima b might be capable of supporting life, Atri had to take into account three main factors—the type and size of stellar flares, various thicknesses of the planet's atmosphere and the strength of its magnetic field. He reports that if Proxima b turns out to have an atmosphere similar to Earth's, life on the surface could very well survive most of the flares occurring on its star. Conversely, if it does not, or if it has a weak magnetic field, then any life on the planet would likely be snuffed out by large stellar flares.

More information: Dimitra Atri. Modelling stellar proton event-induced particle radiation dose on close-in exoplanets, *Monthly Notices of the Royal Astronomical Society: Letters* (2017). DOI: 10.1093/mnrasl/slw199

Abstract

Kepler observations have uncovered the existence of a large number of close-in exoplanets and serendipitously of stellar superflares with emissions several orders of magnitude higher than those observed on the Sun. The interaction between the two and their implications on planetary habitability are of great interest to the community. Stellar proton events (SPEs) interact with planetary atmospheres, generate secondary particles and increase the radiation dose on the surface. This effect is amplified for close-in exoplanets and can be a serious threat to potential planetary life. Monte Carlo simulations are used to model the SPE-induced particle radiation dose on the surface of such exoplanets. The results show a wide range of surface radiation doses on planets in close-in configurations with varying atmospheric column depths, magnetic moments and orbital radii. It can be concluded that for close-in exoplanets with sizable atmospheres and magnetospheres, the radiation dose contributed by stellar superflares may not be high enough to sterilize a planet (for life as we know it) but can result in frequent extinction level events. In light of recent reports, the interaction of hard-spectrum SPEs with the atmosphere of Proxima Centauri b is modelled and their implications on its habitability are discussed.