

Fluorescent glow may reveal hidden life in the cosmos

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Illustration by Wendy Kenigsberg/Matt Fondeur/Cornell University

Astronomers have uncovered a new way of searching for life in the cosmos. Harsh ultraviolet radiation flares from red suns, once thought to destroy surface life on planets, might help uncover hidden biospheres. Their radiation could trigger a protective glow from life on exoplanets called biofluorescence, according to new Cornell University research.

"Biofluorescent Worlds II: Biological Fluorescence Induced by Stellar UV Flares, a New Temporal Biosignature," was published in *Monthly Notices of the Royal Astronomical Society*.

"This is a completely novel way to search for life in the universe. Just imagine an alien world glowing softly in a powerful [telescope](#)," said lead author Jack O'Malley-James, a researcher at Cornell's Carl Sagan Institute.

"On Earth, there are some undersea coral that use biofluorescence to render the sun's harmful ultraviolet radiation into harmless visible wavelengths, creating a beautiful radiance. Maybe such life forms can exist on other worlds too, leaving us a telltale sign to spot them," said co-author Lisa Kaltenegger, associate professor of astronomy and director of the Carl Sagan Institute

Astronomers generally agree that a large fraction of exoplanets—planets beyond our solar system—reside in the habitable zone of M-type [stars](#), the most plentiful kinds of stars in the universe. M-type stars frequently flare, and when those ultraviolet flares strike their planets, biofluorescence could paint these worlds in beautiful colors. The next generation of Earth- or space-based telescopes can detect the glowing exoplanets, if they exist in the cosmos.

Ultraviolet rays can get absorbed into longer, safer wavelengths through a process called "photoprotective biofluorescence," and that mechanism leaves a specific sign for which astronomers can search.

"Such biofluorescence could expose hidden biospheres on new worlds through their temporary glow, when a [flare](#) from a star hits the planet," said Kaltenegger.

The astronomers used emission characteristics of common coral

fluorescent pigments from Earth to create model spectra and colors for planets orbiting active M stars to mimic the strength of the signal and whether it could be detected for life.

In 2016, astronomers found a rocky [exoplanet](#) named Proxima b—a potentially habitable world orbiting the active M star Proxima Centauri, Earth's closest star beyond the sun—that might qualify as a target. Proxima b is also one of the most optimal far-future travel destinations.

"These biotic kinds of exoplanets are very good targets in our search for exoplanets, and these luminescent wonders are among our best bets for finding life on exoplanets," O'Malley-James said.

Large, land-based telescopes that are being developed now for 10 to 20 years into the future may be able to spot this glow.

"It is a great target for the next generation of big telescopes, which can catch enough light from small planets to analyze it for signs of [life](#), like the Extremely Large Telescope in Chile," Kaltenegger said.

More information: Jack T O'Malley-James et al, Biofluorescent Worlds – II. Biological fluorescence induced by stellar UV flares, a new temporal biosignature, *Monthly Notices of the Royal Astronomical Society* (2019). [DOI: 10.1093/mnras/stz1842](https://doi.org/10.1093/mnras/stz1842)

Provided by Cornell University

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