SPECTROSCOPY

Will planets reveal the light of their life?

Optical signatures from organic chemicals may help scientists detect traces of life on other planets.

Until somebody finally gets around to inventing warp drive, the search for life outside our solar system will probably depend on surveillance methods that can spot organic 'fingerprints' over a considerable distance.

One potentially useful signature for life (as we know it) is homochirality. This refers to a scenario in which a pool of organic molecules is biased to exhibit a particular geometric 'handedness'; for example, organisms on Earth make exclusive use of L-form amino acids and are incapable of synthesizing proteins from their mirror-image D-form counterparts. This property can be observed via circular polarization spectroscopy, and William Sparks, an astronomer at the Space Telescope Science Institute, hypothesized that this might offer a practical method for remote detection of traces of life.

Sparks recently collaborated with a team of microbiologists and other astronomers to test this method on cultures of photosynthetic bacteria, the type of organism that may most closely resemble our eventual 'first contact'. "If you just pick a random extrasolar planet, chances are—all other things being equal—the dominant life form would be photosynthetic microbes," he says.

Their approach proved effective with both marine cyanobacteria and bacteriochlorophyll-using, anaerobic purple bacteria; in each case, the circular polarization spectra they obtained consistently revealed signatures indicative of the appropriate photosynthetic pigment molecule. By comparison, iron oxide powder—a potential source of false-positives in other chlorophyll-detection techniques—generated no such signature. These data reveal the practicality of using circular polarized light to detect organic molecules in live organisms or possibly even lingering traces of extinct life.

Mars and Europa may represent the closest promising targets for astrobiologists, but finds there would likely lie well below the surface, out of reach of the stellar illumination needed for spectroscopic analysis, and Sparks' ideal target would be a planet with exposed, microbe-rich niches, like Earth's seas. "We might find an exposed-surface ocean on an extrasolar planet," he suggests.

Until a suitable world is discovered, the team will be refining their approach a bit closer to home. "It's a pretty obvious thing to go from the laboratory, where you're looking at little Petri dishes full of bugs, and to take the equipment outside and look at some forests or pools with algae," says Sparks. "That's on the immediate horizon."

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RESEARCH PAPERS

Sparks, W.B. *et al.* Detection of circular polarization in light scattered from photosynthetic microbes. *Proc. Natl. Acad. Sci. USA* **106**, 7816–7821 (2009).