“Forests” detectable even in distant solar systems, scientists suggest

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“Tree-like” life forms might be detectable even from across the vast spaces that separate us from planets in other solar systems, two scientists propose.

But any test of the claim will have to wait until humans are able to photograph Earth-like planets outside our solar system, an achievement that NASA scientists say they’re working toward.

Assuming this does become possible, past research has already suggested ways to indirectly detect living things on such planets. For example, hordes of breathing creatures can lead an atmosphere to have distinctive characteristics; these could be detectable in the light that atmosphere sends our way. Liquid oceans, with their ready potential to host life, might give away their presence through a distinctive “glint.”

An aerial view of pine forest in the United States' Yellowstone National Park. (Courtesy Jim Peaco, U.S. Nat'l Park Svc.)

Plant-like organisms would probably sustain themselves by taking in light from the host star, scientists say. Certain colors of light would absorbed more than others, leading the light reflected by the “plants” to have distinctive, and measurable, characteristics.

But this method doesn’t reveal the structure of the plant, and thus can’t tell apart, say, trees and algae.

Now, researchers Christopher E. Doughty and Adam Wolf of the Carnegie Institution in Stanford, California, propose an additional technique that could reveal whether plants are “tree-like” in structure.

For plants on Earth, “competition for light and the need to transport water and nutrients has led to a tree-like body plan characterized by hierarchic branching networks,” the pair wrote, setting forth their proposal in the Dec. 1 issue of the research journal *Astrobiology*.

These tree-like forms cast shadows, they noted. The large-scale pattern of shadows would lead the light reflected off the vegetation to take on specific brightness and color characteristics. For a viewer on a distant planet, Doughty and Wolf wrote, these characteristics would depend on the angles at which the viewer, the planet and its sun lie with respect to each other; but these characteristics would change in a predictable way over time, producing detectable pattern.

“The presence of tree-like structures is clearly distinguishable” from, say, flat ground with the same color, wrote the researchers, who developed a computer simulation to work out this special pattern of reflectance characteristics.

If this vegetation were widespread enough, it would affect the reflectance properties of the whole

planet, they added. Clouds would be a problem, they noted, but could potentially be taken into account.

Most interestingly, they added, the reflectance pattern due to widespread tree-like structures is distinctive enough that it can be observed even if a planet is barely visible, appearing as a single point of light in our telescopes. The changes in this dot's brightness and color at different "sun/view geometries," they explained, should be the giveaway.

To date, only a handful of planets outside our solar system have been detected through actual imaging of their surfaces, and all of these are believed to be gaseous planets at least a few times the size of Jupiter. Detecting smaller, Earth-like planets by photographing their surfaces is beyond the reach of current telescopes. This could change, though. NASA has announced that it is studying a mission dubbed the Terrestrial Planet Finder, a pair of complementary space-based observatory designed to capture the dim light from distant Earth-like planets.