To curious aliens, Earth would stand out as living planet

December 20 2007

With powerful instruments scouring the heavens, astronomers have found more than 240 planets in the past two decades, none likely to support Earth-like life.

But what if aliens were hunting life outside their own planet" Armed with telescopes only a bit bigger and more powerful than our own, could they peer through the vastness of space and lock in onto Earth as a likely home to life"

That's the question at the heart of paper co-authored by a University of Florida astronomer that appeared this week in the online edition of Astrophysical Journal. The answer, the authors say, is a qualified "yes." With a space telescope larger than the Hubble Space Telescope pointed directly at our sun, they say, "hypothetical observers" could measure Earth's 24-hour rotation period, leading to observations of oceans and the chance of life.

"They would only be able to see Earth as a single pixel, rather than resolving it to take a picture," said Eric Ford, a UF assistant professor of astronomy and one of five authors of the paper. "But that could be enough for them to identify our planet as one that likely contains clouds and oceans of liquid water."

This research may sound whimsical, but it has a serious goal: to provide a road map for Earth-bound astronomers trying to study Earth-like planets — a task expected to become possible in coming decades as

more powerful telescopes come on line, said Enric Palle, the lead author of the paper and an astronomer with the Instituto de Astrofisica de Canarias.

For humans or curious aliens, observing planets is challenging for a number of reasons – habitable planets all the more so. The planet can't be too close or too far away from its star, or its surface would scald or freeze. And, it must have a protective atmosphere like Earth's.

Most planets found so far are much larger than Earth, which means they are likely hot gas planets similar to Jupiter, a profoundly uninhabitable place with no solid surface and atmosphere composed largely of hydrogen and helium.

But astronomers are beginning to plan how future space telescopes could directly detect planets much closer to Earth's size and proximity to the sun. One challenge: To figure out how to use a planet's light to recognize if its surface and atmosphere are Earth-like.

For Ford and his colleagues, the answer lies in probing how the Earth would appear to outside or alien observers.

Astronomers have long recognized that even a large telescope would need to observe Earth for several weeks to collect enough light to identify chemicals in the planet's atmosphere. During these observations, the brightness of the Earth would change, primarily because of clouds rotating into and out of view. If astronomers could measure Earth's rotation period, then they would know when a given part of the planet was in view. The hitch was that astronomers were unsure whether Earth's seemingly chaotically changing cloud patterns would make it impossible for alien observers to determine this rotation rate.

Based on data retrieved from satellite observations of Earth, Ford and

his colleagues created a computer model for the brightness of the Earth, revealing that on the global scale Earth's cloud cover is remarkably consistent — with rain forests usually turning up cloudy, arid regions clear, and so on. As a result, extraterrestrial astronomers who watched Earth for a period of several months would notice repeating patterns – a bit like watching the spots on a spinning ball come into view and then disappear. From those repeating patterns, they could then deduce Earth's 24-hour rotation period, Ford said.

That done, the "E.T." astronomers could infer that anomalies in the pattern were caused by changing weather patterns, most prominently, clouds, he said. Although some uninhabitable planets are extremely cloudy, the repeated presence and absence of clouds indicates active weather. On Earth, this variability results in water turning from gas to a vapor and back again, so finding similar variability on another planet would be a reasonable indication of liquid water.

"Venus is always covered in clouds. The brightness never changes," Ford said. "Mars has virtually no clouds. Earth, on the other hand, has a lot of variation."

Not only that, but observers could likely also infer the presence of continents and oceans from Earth's changing light pattern.

The research will be useful to astronomers designing the next generation of space telescopes because it provides an outline of the capabilities required for studying the surfaces of Earth-like planets, Ford said. He said it appears that zeroing in on Earth-like planets orbiting the nearest stars would require a telescope at least twice the size of the Hubble Space Telescope. Ford said he hopes that his research will help to motivate an ever larger space telescope that could search for Earth-like planets around many stars.

Source: University of Florida