**New type of telescope may detect extraterrestrial life within the next 25 years**

A team of Dutch astronomers has shown that with a new type of telescope it may be possible to detect signs of extraterrestrial life on planets orbiting other stars than the Sun. Although even the most nearby stars are at enormous distances, biological activity can reveal itself through gases released in the planet atmospheres, which would otherwise not be present – so called biomarker gases. This idea, which has been around since the 1960s, has now been coupled to a new observing strategy, which uses relatively low-cost ground-based flux collector telescopes for high-precision measurements of oxygen in exoplanet atmospheres.

The study will be published this week in the Astrophysical Journal.

As has been argued now for several decades, observations of planets orbiting distant stars, so called exoplanets, may one day reveal signs of extraterrestrial life. About one-fifth of the Earth atmosphere consists of molecular oxygen, which is only present because it is generated by biological activity – e.g. photosynthesis in plants, and would otherwise be absent because it is so easily spent by oxidation through a range of chemical processes. Finding oxygen in the atmosphere of an Earth-like planet orbiting a distant star could therefore point to extraterrestrial life.

Until now it was thought that such observations, which are extremely challenging, would need to be performed using a telescope in space. The oxygen (or ozone) in our own atmosphere would simply hamper such measurements too much. However, plans from both U.S. and European scientists to build dedicated space missions, such as the Terrestrial Planet Finder and Darwin, have been canceled, making it unlikely that such a space-mission would be launched within the next 25 years. A group of scientists from Leiden University and the Space Research Organization (SRON) in the Netherlands have now shown that one need not to go to space to measure biomarker gases. This can be done from the ground using a technique, which has recently given very promising results.

“The way to separate out possible molecular oxygen from a distant exoplanet from the oxygen in our own atmosphere is to measure very precisely the wavelengths of its absorption lines”, explains Ignas Snellen, lead author of the study. “Due to the relative velocity of the exoplanet with respect to the Earth, the lines in the exoplanet spectrum will be slightly Doppler shifted, which can be measured when precise enough instruments are used. In this way, the telescope does not have to be in space, saving at least an order of magnitude in costs”. Recently, this method has been applied very successfully to Jupiter-size exoplanets that orbit their star very closely, revealing carbon monoxide in their atmospheres using the Very Large Telescope (VLT) in Chile.

The team shows that the oxygen signal from a hypothetical Earth-twin planet seen against the light of a red dwarf, a star significantly cooler and five times smaller than our Sun, is only three time weaker than the carbon monoxide signal recently detected in the hot Jupiter tau Bootis. Such red dwarf stars will be hundreds of times fainter than tau Bootis, therefore requiring telescopes significantly larger than currently available. “The next generation European Extremely Large Telescope or E-ELT, will be 25 times more powerful than the VLT for this type of measurements”, says Remco de Kok, member of the team. “If Earth-like planets are very common and can be found relatively nearby, it may be possible to detect molecular oxygen with the E-ELT – but we would need to be very lucky. Even the E-ELT may not be powerful enough”.

What the team therefore suggests is to invest in the development of flux collector telescopes. “For spectroscopy of bright stars and their planets it is not necessary to build a telescope that produces the very sharp images foreseen for the ELT. What is important is to collect as much light as possible, which can be done with a telescope mirror which is less accurately formed – and therefore can be constructed for only a small fraction of the cost”, says Snellen. “With an array of such flux collectors covering a few football fields one could perform a statistical study of extraterrestrial life in the solar neighborhood. Although there is still a long way to go, this should be possible within the next 25 years.”

Article:

I. Snellen, R.J. de Kok, R. le Poole, M. Brogi, J. Birkby: Finding extraterrestrial life using ground-based high-dispersion spectroscopy

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Image: http://www.strw.leidenuniv.nl/~snellen/Snellen_FluxCollectors.jpg

Contact:

Ignas Snellen
Leiden Observatory, Leiden University, The Netherlands
snellen@strw.leidenuniv.nl
+31-71-5275838

Remco de Kok,
SRON, Utrecht, The Netherlands
R.J.de.kok@sron.nl
+31-88-7775725

Rudolf Le Poole
Leiden Observatory, Leiden University, The Netherlands
lepoole@strw.leidenuniv.nl
+31-71-5275871