

# Life in these star-systems could have spotted Earth

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A view of Earth and Sun from thousands of miles above our planet. Stars that enter and exit a position where they can see Earth as a transiting planet around our Sun are brightened. Credit: OpenSpace/American Museum of Natural History

Scientists at Cornell University and the American Museum of Natural History have identified 2,034 nearby star-systems—within the small cosmic distance of 326 light-years—that could find Earth merely by

watching our pale blue dot cross our sun.

That's 1,715 star-systems that could have spotted Earth since human civilization blossomed about 5,000 years ago, and 319 more star-systems that will be added over the next 5,000 years.

Exoplanets around these [nearby stars](#) have a cosmic front-row seat to see if Earth holds life, the scientists said in research published June 23 in *Nature*.

"From the exoplanets' point-of-view, we are the aliens," said Lisa Kaltenegger, professor of astronomy and director of Cornell's Carl Sagan Institute, in the College of Arts and Sciences.

"We wanted to know which stars have the right vantage point to see Earth, as it blocks the Sun's light," she said. "And because stars move in our dynamic cosmos, this vantage point is gained and lost."

Kaltenegger and astrophysicist Jackie Faherty, a senior scientist at the American Museum of Natural History and co-author of "Past, Present and Future Stars That Can See Earth As A Transiting Exoplanet," used positions and motions from the European Space Agency's Gaia eDR3 catalog to determine which stars enter and exit the Earth Transit Zone—and for how long.

"Gaia has provided us with a precise map of the Milky Way galaxy," Faherty said, "allowing us to look backward and forward in time, and to see where stars had been located and where they are going."

Of the 2,034 star-systems passing through the Earth Transit Zone over the 10,000-year period examined, 117 objects lie within about 100 light-years of the sun and 75 of these objects have been in the Earth Transit Zone since commercial radio stations on Earth began broadcasting into

space about a century ago.

"Our solar neighborhood is a dynamic place where stars enter and exit that perfect vantage point to see Earth transit the Sun at a rapid pace," Faherty said.

Included in the catalog of 2,034 star-systems are seven known to host exoplanets. Each one of these worlds has had or will have an opportunity to detect Earth, just as Earth's scientists have found thousands of worlds orbiting other stars through the transit technique.

By watching distant exoplanets transit—or cross—their own sun, Earth's astronomers can interpret the atmospheres backlit by that sun. If exoplanets hold intelligent life, they can observe Earth backlit by the sun and see our atmosphere's chemical signatures of life.

The Ross 128 system, with a red dwarf host star located in the Virgo constellation, is about 11 light-years away and is the second-closest system with an Earth-size exoplanet (about 1.8 times the size of our planet). Any inhabitants of this exoworld could have seen Earth transit our own sun for 2,158 years, starting about 3,057 years ago; they lost their vantage point about 900 years ago.

The Trappist-1 system, at 45 light-years from Earth, hosts seven transiting Earth-size planets—four of them in the temperate, habitable zone of that star. While we have discovered the exoplanets around Trappist-1, they won't be able to spot us until their motion takes them into the Earth Transit Zone in 1,642 years. Potential Trappist-1 system observers will remain in the cosmic Earth transit stadium seats for 2,371 years.

"Our analysis shows that even the closest [stars](#) generally spend more than 1,000 years at a vantage point where they can see Earth transit,"

Kaltenegger said. "If we assume the reverse to be true, that provides a healthy timeline for nominal civilizations to identify Earth as an interesting planet."

The James Webb Space telescope—expected to launch later this year—is set to take a detailed look at several transiting worlds to characterize their atmospheres and ultimately search for signs of life.

The Breakthrough Starshot initiative is an ambitious project underway that is looking to launch a nano-sized spacecraft toward the closest [exoplanet](#) detected around Proxima Centauri—4.2 light-years from us—and fully characterize that world.

"One might imagine that worlds beyond Earth that have already detected us, are making the same plans for our planet and solar system," said Faherty. "This catalog is an intriguing thought experiment for which one of our neighbors might be able to find us."

**More information:** Past, present and future stars that can see Earth as a transiting exoplanet, *Nature* (2021). [DOI: 10.1038/s41586-021-03596-y](#) , [www.nature.com/articles/s41586-021-03596-y](http://www.nature.com/articles/s41586-021-03596-y)

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