

Penn State expert determined to find life on Earth-like planets

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Thanks to popular Hollywood films like "E.T.," "Avatar" and "Super 8," life on other planets seems highly conceivable to people who have considered the idea that we are not alone in the universe. Jim Kasting, distinguished professor of geosciences in Penn State's College of Earth and Mineral Sciences and an expert in atmospheric evolution, is one person who considers it a lot.

As a kid growing up near the space program in Huntsville, Ala., reading as much science fiction as he could get his hands on, Kasting had space exploration on his mind all the time. It influenced who he is today as well as the research he's most interested in conducting. By studying early Earth's atmosphere and the origins of oxygen in it, Kasting has become one of the foremost experts on planetary habitable zones. In his book, "How to Find a [Habitable Planet](#)," Kasting explains how his research with NASA may be able to detect worlds outside of our solar system that are suitable for sustaining life.

As a doctoral student studying [atmospheric science](#) in the late 1970s, Kasting read several papers written by American astrophysicist Michael Hart concerning atmospheric evolution. His work piqued Kasting's interest toward proving that, despite Hart's beliefs, there are [habitable planets](#) in the universe besides Earth. After completing his doctoral degree at the University of Michigan, Kasting served as a research scientist at NASA's Ames Research Center before joining Penn State. After conducting extensive research on the subject, he feels confident saying there are other planets in the universe able to host [living](#)

[organisms](#) -- and he hopes to live to see the day when this is a proven fact.

"I'm very much an optimist," Kasting said. "I think there is somewhere else that has a rocky surface with an atmosphere similar to ours and with [liquid water](#) on the surface. There are almost certainly other Earth-like planets on which life may arise."

In early 2010, NASA announced that the Kepler spacecraft, designed to discover Earth-like planets within the Milky Way galaxy, found several rocky planets within their star's habitable zone. All of these planets are too far away -- hundreds to thousands of light years -- to determine whether they are actually habitable.

So, how do Kasting and other researchers hope to prove that planets around other stars are capable of hosting life? There are several ways, according to Kasting. The first task is to identify rocky planets within the habitable zones of nearby stars. One option called the Space Interferometry Mission, or SIM Lite, could have done this. SIM Lite was a space telescope designed to hunt for Earth-sized planets, but NASA canceled the project in late 2010 after more than \$500 million of work because the 2010 Astronomy and Astrophysics Decadal Survey didn't consider it a high priority. Kasting said the telescope would have been able to measure side-to-side wiggle in a planet's parent star, like our Sun, to determine the motion of a planet orbiting it.

Another option, but one that Kasting said is even more ambitious and expensive, is the Terrestrial Planet Finder (TPF). Several "flavors" of this telescope use different techniques to look for planets. One uses an internal coronagraph to block the light of a solar system's parent star, to see smaller, dimmer planets. Alternatively, one could fly an occulting disk, or "starshade," in front of the telescope to block the star's light while retaining light from its planets. Another technique uses an infrared

astronomical interferometer to measure the heat energy emitted from the planets in a solar system, while blocking out the star's heat energy.

Right now, NASA has canceled the TPF mission indefinitely. However, the 2010 Decadal Survey recommended this mission for further study, so it may reappear in the future. Furthermore, since Japan and some of Europe are interested in similar technology and research, Kasting hopes the U.S. can collaborate with both to conduct international space missions.

"What hurt our funding is the previous administration's interest in putting men back on the moon and trying to send them to Mars," Kasting said. "Also, right now a lot of astronomers are more interested in researching the Big Bang and dark energy as well as gravitational waves. We need to convince more of them to be interested in planets and the search for extraterrestrial life."

Since astronomers' interests are varied, it's hard to secure the several billion dollars needed to build one of these big space telescopes. Kasting hopes to collaborate with other countries to acquire the funding needed to launch any of the telescopes. He also hopes other researchers can share the same equipment to conduct their own studies, saving money and ensuring many different astronomical investigations can be pursued using these instruments. If any of these efforts succeed, Kasting may finally help humankind learn whether extraterrestrial life exists.

Provided by Pennsylvania State University

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