

Is the Universe Lively or Lonely? The Quest for World and Life beyond our Solar System

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The question of life on other planets has fascinated humanity for hundreds, if not thousands of years, resulting in volumes of philosophical and theological reflection. Today this interest is being pursued through scientific research studying the formation of planets, the origins of life, and the span and history of the Universe. Modern scientific instruments and an increased interest in the search for extra-terrestrial life have spurred the search for extra solar planets and the effort to determine their ability to host life.

“Almost everything we thought we knew was wrong,” said Dr. Carl Pilcher, senior scientist of NASA’s Astronomy and Physics Division. Dr. Pilcher spoke at an April 15, 2004 lecture sponsored by the AAAS Dialogue on Science, Ethics and Religion as part of an ongoing monthly lecture series. Responding to Dr. Pilcher’s talk was Ernan McMullin, Director Emeritus of the Program of the History and Philosophy of Science at the University of Notre Dame.

The search for extraterrestrial life, Dr. Pilcher explained, begins with the search for planets capable of hosting life. The most common technique for locating planets measures what scientists have termed the Doppler shift. As a planet rotates around a star, it causes a slight shift in the star. As a planet rotates in front of a star, it shortens the wavelength of the light from the star, as the planet rotates away from the star, the wavelength increases. By measuring the

wavelength of a star's light, scientists determine if a planet is present, and its proximity to the star.

This technique, Dr. Pilcher explained, has altered the scientific perception of how and where planets formed. As recently as the early 1990's, scientists believed that a Jupiter-sized planet could only form far away from its rotational star. He even noted that the discovery of a Jupiter-sized planet in close rotation to its star would "most upset [science's] whole notion of how planets are formed."

"We had this really nice explanation of how you make Jupiters and where they appear," Dr. Pilcher said. "Well, they appear someplace else, too."

One conclusion of the Doppler shift technique, Dr. Pilcher asserted, is that some planets that have not yet been discovered are still implied. To date, mostly Jupiter-sized planets have been discovered, but as observational techniques and instruments improve, more and smaller planets will be located

"We're beginning to get to the point where we can begin to see Uranuses and Neptunes," Dr. Pilcher said, "and we're going to get to the point where we can see other Earths."

Another technique for locating planets measures the amount of light blocked from a star as the planet passes in front of it. This "transit technique" will be used when NASA launches the Kepler mission to detect planets around stars. The lens of the Kepler telescope has a field of

view that is 22 times larger than a full moon and will be able to monitor 100,000 stars for signs of planets. The telescope will send data back to earth every 15 minutes for four years.

“That’s one of the first major steps to answering the question, ‘Is the Universe Lively or Lonely,’” Pilcher said. “And if we find other earth-size planets, we’ll start to build the case for there being other critters out there.”

To address the likelihood of finding these “other critters” Dr. Pilcher defined what scientists have termed the Continuously Habitable Zone (CHZ). The CHZ is the area around a star that allows water to remain liquid on the surface of a planet of that star. A bright star would have a CHZ that is far away, while a smaller or fainter star would have a CHZ that is closer. In our solar system, for example, the CHZ includes Earth, Mars and Venus.

This, however, provides us with only initial criteria for planets with the ability to support life. Although Earth has supported life for nearly 4 billion years, it is only within the last 2.5 billion years that oxygen has built up in the atmosphere.

Dr. Pilcher concluded his remarks on the probability of discovering life by discussing the Drake equation. The Drake equation is offered as a way to estimate the number of intelligent civilizations in the galaxy using a combination of astronomical, biological, and cultural factors. The Drake equation takes into account not only the biological probability of the existence of extra-terrestrial life, but also the probability of such life evolving into intelligent beings with the

technology to allow them to communicate with us and a culture that would be conducive to searching for other life.

Dr. Ernan McMullin responded to Dr. Pilcher by reminding the audience that the desire to locate extraterrestrial life has clouded the judgment of scientists in the past. “The case of the search for life has been a dominant theme of people seeing what they want to see,” he cautioned, as for example the “canals” on Mars. “It is only now with strict controls that we are moving on to a different era.”

Dr. McMullin reminded the audience that the search for extraterrestrial life has different philosophical and theological implications than does the search for extraterrestrial intelligence, although both carry with them profound theological implications.

“If you were to find an independent origin of life, it would make it difficult to suppose that the creation of life here required some sort of Creator here, because it would seem sort of peculiar on the Creator’s part to set up a few microbes on a place like Mars.”

Other the other hand, Dr. McMullin continued, there are the implications of the discovery of extra-terrestrial intelligence. Early Christian theologians, he noted, addressed this point. Augustinian philosophers argued the possibility that an omnipotent creator would place the creation the seeds of life that would develop later when the conditions were right. When the question of extra-terrestrial life was first discussed in the 17th century, most Christian theologians

emphasized that it would be evidence of God not restricting life to Earth, but spreading it all around.

“We have to think we are far from understanding how or why the universe came about in the way in which it did, but, especially, we have to believe that the Creator is not someone that is limited by the human imagination,” McMullin concluded. “When we ask what is happening with the presumed inhabitants of other planets, we have to wonder what would be happening with them in terms of their relationship with their Creator.”