# Research group proposes first system for assessing the odds of life on other worlds

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(PhysOrg.com) -- Within the next few years, the number of planets discovered in orbits around distant stars will likely reach several thousand or more. But even as our list of these newly discovered "exoplanets" grows ever-longer, the search for life beyond our solar system will likely focus much more narrowly on the relatively few of these new worlds which exhibit the most Earth-like of conditions.

For much of the scientific community, the search for alien life has long been dominated by the notion that our own planet serves as the best model of conditions best suited to the emergence of life on other worlds. And while there's an undeniable logic to seeking life in the same sort of conditions in which you already know it to be successful, there are scientists like Dirk Schulze-Makuch, an astrobiologist with the Washington State University School of Earth and Environmental

Sciences and Abel Mendez, a modeling expert from the University of Puerto Rico, who also see such a model as the product of a potentially limiting form of earthling-biased thinking.

To Schulze-Makuch and his nine fellow authors – an international working group representing, NASA, SETI, the German Aerospace Center, and four universities – the search for life on other worlds is really driven by two questions.

"The first question is whether Earth-like conditions can be found on other worlds, since we know empirically that those conditions could harbor life," Schulze-Makuch said. "The second question is whether conditions exist on exoplanets that suggest the possibility of other forms of life, whether known to us or not."

In a paper to be published in the December issue of the journal *Astrobiology*, Schulze-Makuch and his co-authors propose a new system for classifying exoplanets using two different indices – an Earth Similarity Index (ESI) for categorizing a planet's more earth-like features and a Planetary Habitability Index (PHI) for describing a variety of chemical and physical parameters that are theoretically conducive to life in more extreme, less-earthlike conditions.

Similarity indices provide a powerful tool for categorizing and extracting patterns from large and complex data sets. They are relatively quick and easy to calculate and provide a simple quantitative measure of departure from a reference state, usually on a scale from zero to one. They are used in mathematics, computer imaging, chemistry and many other fields.

The two indices proposed by the group mark the first attempt by scientists to categorize the many exoplanets and exomoons that are expected to be discovered in the near future in accordance with their

potential to harbor some form of life.

"As a practical matter, interest in exoplanets is going to focus initially on the search for terrestrial, Earth-like planets," said Schulze-Makuch. "With that in mind, we propose an Earth Similarity Index which provides a quick screening tool with which to detect exoplanets most similar to Earth."

But the authors believe that focusing exclusively on earth-based assumptions about habitability may well be too restrictive an approach for capturing the potential variety of life forms that, at least in principle, may also exist on other worlds.

"Habitability in a wider sense is not necessarily restricted to water as a solvent or to a planet circling a star," the paper's authors write. "For example, the hydrocarbon lakes on Titan could host a different form of life. Analog studies in hydrocarbon environments on Earth, in fact, clearly indicate that these environments are habitable in principle. Orphan planets wandering free of any central star could likewise conceivably feature conditions suitable for some form of life."

The paper's authors concede that attempting to rate the probability that life of some unknown form could exist on any given world is an intrinsically more speculative endeavor. But the alternative, they argue, is to risk overlooking potentially habitable worlds by using overly restrictive assumptions.

"Our proposed PHI is informed by chemical and physical parameters that are conducive to life in general," they write. "It relies on factors that, in principle, could be detected at the distance of exoplanets from Earth, given currently planned future (space) instrumentation."

**More information:** A Two-Tiered Approach to Assessing the

Habitability of Exoplanets, *Astrobiology*.

Provided by Washington State University