



EXO WORLDS

Life On Frosted Earths

By Lee Pullen
for [Astrobiology Magazine](#)
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The search for life beyond the Earth is closely linked with hunting for habitable worlds. Astronomers have always hoped to find planets in the so-called "Goldilocks zone" around their parent stars, where the temperature is just right. Liquid water is a key ingredient for life as we know it, and this is one reason why the Earth is in an ideal location. Any closer to the Sun and water would boil away into space; any further out and it would freeze.

This restricts our search as it limits the places we think life could exist, but new research hints that habitable zones could extend much farther than previously thought. Siegfried Franck and a team at the Potsdam Institute for Climate Impact Research and from Warsaw University have been studying frozen extrasolar planets.

"This is a special extension of the theory of habitable zones," says Franck. "We have worked for nearly ten years in the field of extrasolar planetary systems and the search for second homes."

Some international teams have detected extrasolar worlds using a technique known as microlensing. When a planet passes in front of its star as seen from the Earth, the light can become slightly bent. This creates a magnification effect that can be useful for finding large planets that are far from their stars.

"The most interesting aspect is that with microlensing investigations of frozen super-Earths, we find a lot of Earth-like or at least super-Earth planets that are between one and ten Earth masses," says Franck. "Because of the detection mechanism, it can be expected that most are at the outer boundary of the habitable zone." This means they are too far from their parent star for water to remain liquid on the surface of the planet. They could still be habitable, however.

In old models of planetary conditions, average global temperatures provided approximate figures. For example, the Earth is said to have a mean global temperature of 15C. This simplification is useful for mathematical modelling but doesn't reflect reality. We know that some places on the Earth are much hotter and others colder.

There's also great variability in temperatures during different seasons. The latitude of continents dramatically influences temperature as well. Consider that Africa is hotter than Antarctica, even though they're on the same planet. Franck realised that such variations on a planet could change our views on habitable zones.

Franck and his team devised equations to take into account temperature variations caused by the latitude of continents. They found that areas of frozen worlds could be habitable even though they are far from their parent stars. "Our result was that if we investigate this latitudinal dependence, the outer edge of the habitable zone can be extended a remarkable amount," says Franck. The exact number is somewhere between 150 million and 300 million kilometers.

If we were to use our own solar system as an example, a planet could be nearly twice as far from the Sun as the Earth is and still have the potential for a regular supply of liquid water. Life, therefore, could be possible on worlds where the overall temperature is far below the freezing point. Combine this with the chance of additional energy sources from hydrothermal vents, volcanic activity and tidal forces, and the prospect for life on frozen worlds seems less bleak.

This research into habitability has also been used on data gained from the Gliese system, where there are potentially Earth-like planets orbiting that star. The large worlds at the outer edge of that system's habitable zone appear more likely to support life. Conditions on worlds such as these still would be difficult by our standards. Micro-organisms would probably enter a hibernation state through the winter, only becoming active when temperatures creep up during the summer.

The effect of temperature changes in a large ocean would complicate matters further, adding more variables for life to cope with. Still, Earth-bound extremophiles have proved exceptionally resilient to adverse conditions, and this strengthens the case for life on frozen planets.

Franck hopes that in the near future we will have concrete evidence of Earth-like planets, including information about their atmospheres. When we can detect biomarkers which show favourable conditions for life, we will be able to test our ideas of habitable zones. Until then, Franck's theories remain unproven but suggest that frozen planets may indeed be suitable for life.

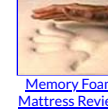
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Weird Object May Be Result Of Colliding Protoplanets

Austin TX (SPO) Jan 11, 2008

Something bizarre orbiting a young, failed star 170 light-years from Earth may be the progeny of two protoplanets that collided and merged, astronomers announced at the American Astronomical Society meeting in Austin, Texas, today. Given its hotter-than-expected temperature, dim luminosity, young age and location, the orbiting object, known as 2M1207B, should be a physical impossibility, scientists say.

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