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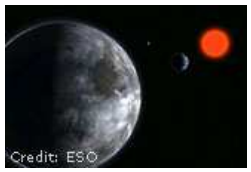

Hopes Dashed for Life on Distant Planet

By Ker Than
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Scientists earlier this year announced they had found a small, rocky planet located just far enough from its star to sustain liquid water on its surface, and thus possibly support life.

Turns out the scientists might have picked the right star for hosting a habitable world, but got the planet wrong. The world known as Gliese 581c is probably too hot to support liquid water or life, new computer models suggest, but conditions on its neighbor, Gliese 581d, might be just right.

The findings are detailed in the May 25 issue of the journal *Astronomy & Astrophysics*.

So much promise

Gliese 581c, discovered in April by a team led by Stephane Udry of the Geneva Observatory in Switzerland, is about 50 percent bigger than Earth and about five times more massive. It is located about 20.5 light-years away, and circles a dim red dwarf star called Gliese 581.

Of the more than 200 extrasolar planets, or "exoplanets," discovered since 1995, Gliese 581c was the first found that resides within the habitable zone of its star, if only barely. The habitable, or "Goldilocks" zone is the region around a star where the temperature is neither too hot nor too cold, so water can exist on a planet's surface in its liquid state. Water is a key ingredient for life as we know it.

But new simulations of the climate on Gliese 581c created by Werner von Bloh of the Institute for Climate Impact Research in Germany and his team suggest the planet is no Earthly paradise, but rather a faraway Venus, where carbon dioxide and methane in the atmosphere create a runaway greenhouse effect that warms the planet well above 212 degrees Fahrenheit (100 Celsius), boiling away liquid water and with it any promise of life.

Another contender

But the same greenhouse effect that squashes prospects for life on Gliese 581c raises the same hope for another planet in the system, a world of eight Earth-masses called Gliese 581*d*, which was also discovered by Udry's team.

"This planet is actually outside the habitable zone," said Manfred Cuntz, an astronomer at the University of Texas at Arlington and a member of von Bloh's team. "It appears at first sight too cold. However, based on the greenhouse effect, physical processes can occur which are heating up the planet to a temperature that allows for fluid water."

And where this is fluid water, there is the chance of life as well. The researchers speculate that "at least some primitive forms of life" might exist on Gliese 581d. There is no evidence to support that speculation, however.

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Artist's impression of the planetary system around the red dwarf Gliese 581. New computer models suggest the planet might be too hot to support liquid water and life. Credit: ESO

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David Charbonneau, an astronomer at the Harvard-Smithsonian Center for Astrophysics (CfA) who was not involved in the study, said the results from von Bloh's team are "probably a sound calculation but we don't actually know if it's correct."

Gliese 581d demonstrates the importance of taking a planet's atmospheric conditions into account when considering its potential for habitability. The concept of a habitable zone "is a very useful thing because it does inform us a great deal, and it explains a lot in the solar system. But it's not the whole story," Charbonneau said.

Jaymie Matthews, an astronomer at the University of British Columbia in Canada, doesn't treat the new findings as conclusive, but finds them "interesting as an illustration of how we can use remote exoplanetary environments as possible test beds for climate models."

The models made by von Bloh's team could be tested if scientists can measure thermal emissions and the reflectivity, or "albedo," of the planets, Matthews said.

Scientists "have done this already for HD 209458b, a hot Jupiter, but we will need to do this for possibly 'Earthy' planets to truly assess their habitability," he added.

A stable star

Matthews own research, recently presented at the annual meeting of the Canadian Astronomical Society, suggests one reason Gliese 581 is such a promising star for finding habitable planets is that it is similar to our own sun in that it is remarkably stable.

Matthews and his team used a Canadian space telescope called MOST to monitor Gliese 581 for six weeks. During that time, they observed very few instances of the powerful solar flares common among red dwarf stars.

"If the star showed significant variations in brightness during the weeks we monitored it, that would at least complicate the thermal equilibrium of the planets around it," Matthews explained.

The stability of the light also suggests Gliese 581 is old and that is has been around for at least a few billion years.

"Young stars, like young people, can have bad cases of acne (large starspots and activity) and spin around," Matthews said in an email interview. "Older stars like the sun have relatively clear complexions and rotate rather sedately."

Gliese 581's advanced age is good news for scientists hoping to find signs of life in the system.

"We know it took about three and a half billion years for life on Earth to reach the level of complexity that we call human," Matthews said, "so it's more encouraging for the prospects of complex life on any planet around Gliese 581 if it's been around for at least as long."

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