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Gliese 581d

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Back in April, I posted about the star Gliese 581, and in particular about one of its planets, Gliese 581c. In that post, I reported on Udry et al's announcement of a potentially habitable planet, Gliese 581c. In my previous post, I presented my doubts as to the habitability of this planet. Now, I find that Manfred Cuntz, an astronomer at the University of Texas at Arlington, along with colleagues from the Potzdam Institute for Climate Impact Research, has submitted a paper to Astronomy and Astrophysics with mathematical analysis supporting my impression of this planet. The problem, you see, is that planetary atmospheres tend to have a greenhouse effect. Our own Earth does, in fact. Without the Earth's atmospheric greenhouse effect, Earth would have an average temperature well below the freezing point of water. According to Cuntz and his colleagues' paper, Gliese 581c turns out to be far too hot once you include the effect of a greenhouse effect in its atmosphere.

In fact, this is a most likely scenario. Gliese 581c has a mass of about 5 times the mass of Earth. This would imply that the planet would have a higher gravity than Earth. That would suggest a thicker atmosphere. And, that thicker atmosphere would have a greenhouse effect on the planet, and that greenhouse effect would likely be bigger than Earth's. That would mean that the planet would be far too hot to sustain life.

But, Cuntz and his colleagues did not stop there. They also looked at another recently discovered planet orbiting Gliese 581. This planet, Gliese 581d is larger, nearly 8 times the mass of Earth. It also orbits quite a bit farther from the star, at nearly 0.25 Astronomical Units. In earlier things written about Gliese 581 and its planets, this outer planet was generally discounted as being a possible haven for life. But, interestingly, Cuntz et al have found that may have been a premature dismissal of the planet. With 8 times the mass of the Earth, Gliese 581d would most certainly have a thicker atmosphere, and that would surely contribute to a significant greenhouse effect. Their analysis shows that for certain concentrations of CO_2 in the atmosphere, and sufficient water coverage, the planet Gliese 581d may be habitable. Now, by habitable, I mean that *some* life may exist. They also show that this planet, even much farther from the star than Gliese 581c, will still likely be tidally locked to its parent star. This will make the lit side of the planet likely unbearably hot. And, the night side would be punishingly cold. But, again, with water and enough carbon dioxide, calculations suggest that the temperature extremes, while quite extreme, would not necessarily render the planet uninhabitable. That would be particularly true along the terminator. But, let's be clear: the climate would be *extremely severe*. This new study makes the statement that while the planet may be habitable, complex life is unlikely due to the severity of the climate.

But, this study does seem to make the case that Gliese 581d may, in fact, be the first habitable exoplanet discovered to date. And, that is exciting, even if it is only barely habitable. This is still not a certainty, of course, but it is intriguing.

-Astroprof

Image, courtesy ESA.

1 Comment to 'Gliese 581d':

1. *A Ler…-- Rastos de Luz* on 18 Jun 2007 at 7:49 am: 1

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