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Gliese 581 planets may be habitable

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WASHINGTON: Two independent studies confirm that one of the two Earth-like planets, the discovery of which was announced in April, may indeed be located within the habitable zone around the star Gliese 581.

A European team of astronomers had announced in April that they had discovered two new planets — Gliese 581c and Gliese 581d — orbiting the M star Gliese 581 (a red dwarf), with masses of at least 5 and 8 Earth masses. Given their distance to their parent star, the new planets were the first ever-possible candidates for habitable planets.

Now, two international teams — one led by Franck Selsis of CRAL and LAB in France and the other by Werner von Bloh of PIK, Germany — have conducted two theoretical studies of the Gliese 581 planetary system to investigate the possible habitability of the new super-Earths from two different points of view.

The researchers have estimated the boundaries of the habitable zone around Gliese 581 to determine how close and how far from this star liquid water can exist on the surface of a planet.

F Selsis' team computed the properties of a planet's atmosphere at various distances from Gliese 581. It was done with the theory in mind that the water reservoir would vaporise if the planet were too close to the star, and thus Earth-like life forms could not exist.

W von Bloh's team studied a narrower region of the habitable zone where Earth-like photosynthesis could be possible. This photosynthetic biomass production depends on the atmospheric CO2 concentration as much as on the presence of liquid water on the planet.

Using a thermal evolution model for the super-Earths, the researchers have computed the sources of atmospheric CO2 released through ridges and volcanoes, and its sinks (the consumption of gaseous CO2 by weathering processes). The main aspect of their model was the persistent balance between the sink of CO2 in the atmosphere-ocean system and its release through plate-tectonics, as it exists on Earth.

In this model, the ability to sustain a photosynthetic biosphere strongly depends on the age of the planet because a too old planet might not release enough gaseous CO2, and in that case the planet would no longer be habitable.

The findings of the two studies indicate, while Gliese 581 c is too close to the star to be habitable, the planet Gliese 581 d may be habitable.

However, the environmental conditions on planet d might be too harsh to allow complex life to appear. Planet d is tidally locked, like the Moon in our Earth-Moon system, meaning that one side of the planet is permanently dark. The temperature difference between the day and night sides of the planet may cause strong winds.

As the planet is located at the outer edge of the habitable zone, life forms would have to grow with reduced stellar irradiation and a very peculiar climate.

The studies also suggest that the distances of planets c and d to the central star has strong variations due to the eccentricity of their orbits, and that their orbital periods are short as they are close to the star.

The research shows that planet d might temporarily leave and re-enter the habitable zone during its journey. But even under such strange conditions, it might still be habitable if its atmosphere is dense enough.

However, in any case, habitable conditions on planet d should be very different from the conditions on Earth.

The two studies have been reported by Astronomy & Astrophysics.

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