Earth's strongest winds wouldn't even be a breeze on these planets

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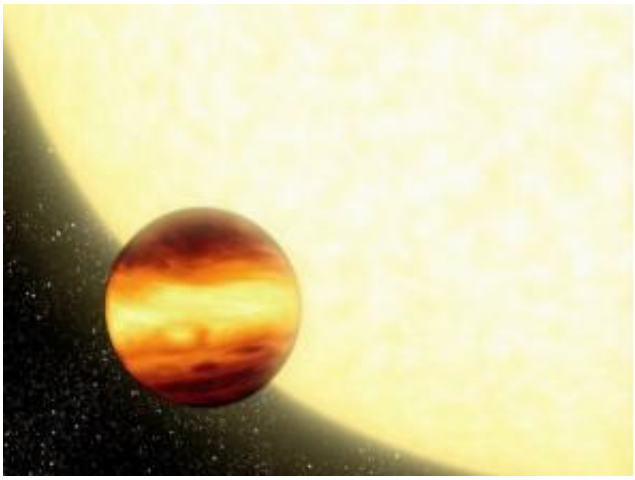

An artist's conception shows a gas-giant planet orbiting very close to its parent star, creating searingly hot conditions on the planet's surface. New research suggests that for three such planets lying from 50 to 150 light-years from Earth, strong winds thousands of miles per hour mix the atmosphere so that the temperature is relatively uniform from the permanently light side to the permanently dark side. This illustration represents an infrared view of a planetary system, in which brightness indicates warmer temperatures. For example, the bright band around the equator of the planet denotes warmer temperatures on both the dark and sunlit sides. The planet's poles, shown in darker colors, would be cooler. Credit: NASA/JPL-Caltech/R. Hurt

Earth's inhabitants are used to temperatures that vary, sometimes greatly, between day and night. New measurements for three planets outside our solar system indicate their temperatures remain fairly constant – and

blazing hot – from day to night, even though it is likely one side of each planet always faces its sun and the other is in permanent darkness.

The reason apparently is supersonic winds, perhaps as strong as 9,000 miles an hour, that constantly churn the planets' atmospheres and keep temperatures on the dark side from plunging.

The planets, gas giants similar in size to Jupiter, were discovered in the last decade orbiting stars about the same size as our sun and less than 150 light years from Earth. All of them orbit within about 5 million miles of their stars, far less than Mercury's distance from our sun.

Astronomers have wondered whether planets orbiting so close to their stars but with one side in constant daylight and the other permanently dark would exhibit sharp temperature differences between the day side and the night side. For the three planets in this study, the temperatures appear to be constant, likely because of the strong winds that mix the atmosphere planetwide, said Eric Agol, a University of Washington assistant professor of astronomy and co-author of a poster presenting the findings today at the American Astronomical Society national meeting in Seattle.

"We can't say for sure that we've ruled out significant day-night temperature differences, but it seems unlikely there is a very big contrast based on our measurements and what we know about these systems," said Agol, who is lead scientist for a project using the Spitzer Space Telescope to measure the temperature properties of extrasolar planets.

Agol and colleagues Nicolas Cowan, a UW astronomy doctoral student and lead author of the poster, and David Charbonneau of the Harvard-Smithsonian Center for Astrophysics measured infrared light from each of the planetary systems at eight different positions in their orbits in late 2005. They measured the thermal brightness of the systems when the

planets' day sides faced the Earth, when the night sides faced the Earth and at various phases in between. They detected no infrared brightness variations in any of the systems, suggesting there are not big differences in temperatures on the day and night sides.

Instead the planets appear to have a fairly uniform temperature of about 925 degrees Celsius, or about 1700 degrees Fahrenheit.

"If heat from the parent star is carried to the dark side, then the overall temperature would be lowered somewhat because the heat is being distributed across the planet," Agol said. "Some theorists believe that supersonic winds are responsible for recirculating the heat."

Measuring the planets' temperatures is a painstaking process because a planet's radiation is drowned out by the light from its host star. Even when a planet goes behind the parent star and disappears completely from view, the decline in light from the entire system is almost imperceptible, on the order of 0.25 percent, Agol said. Making the observations requires precise calibration and light measurements.

The three planets are 51 Pegasi, about 50 light years from our sun, HD179949b about 100 light years distant, and HD209458b about 147 light years away. A light year is about 5.88 trillion miles. In 1995, 51 Pegasi became the first planet orbiting another star to be discovered. Since then numerous planets – gas giants the mass of Jupiter or larger – have been observed from Earth. Most orbit very close to their stars. A common theory is that they formed far away from their stars, perhaps in about the same position as Jupiter is to our sun, and then migrated close to their stars. Their distance makes it difficult to gather much direct data about the planets.

To date no Earth-sized planets have been reported orbiting other stars like our sun.

Agol noted that the planets probably have the same side always facing the star because they are so close to their parent stars. The effect is the same as the Earth has on the moon, which has had its rotation slowed so much by Earth's gravity that the same side always faces Earth.

"These planets are so close to their host stars that the tidal forces are enormous, a few thousand times as strong as on Earth," he said. "The tides are so strong and form a bulge that distorts the planet so much that the orbit is slowed by the star's tug on the tidal bulge."

Source: University of Washington