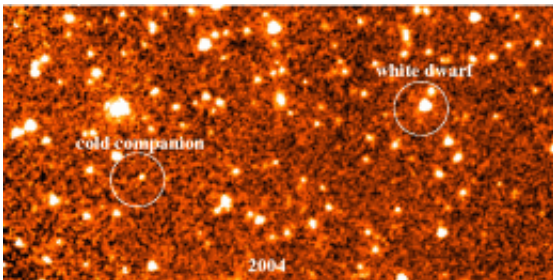


Record-breaking photo reveals a planet-sized object as cool as the Earth

October 19 2011



These two infrared images were taken by the Spitzer Space Telescope in 2004 and 2009. They show a faint object moving through space together with a white dwarf. The brown dwarf, named WD 0806-661 B, is the coldest companion object to be directly imaged outside our solar system. Credit: Kevin Luhman, Penn State University, October 2011

(PhysOrg.com) -- The photo of a nearby star and its orbiting companion -- whose temperature is like a hot summer day in Arizona -- will be presented by Penn State Associate Professor of Astronomy and Astrophysics Kevin Luhman during the Signposts of Planets conference at NASA's Goddard Space Flight Center on 20 October 2011. A paper describing the discovery will be published in the *Astrophysical Journal*.

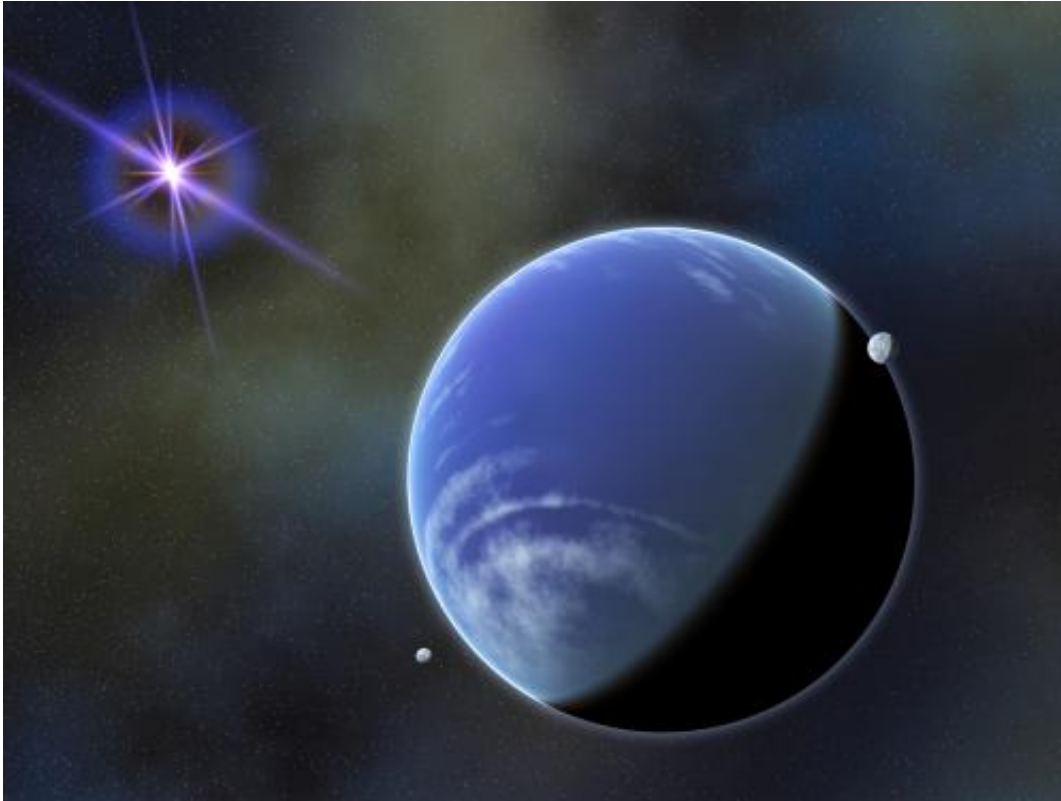
"This planet-like companion is the coldest object ever directly photographed outside our solar system," said Luhman, who led the discovery team. "Its mass is about the same as many of the known extra-solar planets -- about six to nine times the mass of Jupiter -- but in other

ways it is more like a star. Essentially, what we have found is a very small star with an [atmospheric temperature](#) about cool as the Earth's."

Luhman classifies this object as a "brown dwarf," an object that formed just like a star out of a massive cloud of dust and gas. But the mass that a brown dwarf accumulates is not enough to ignite thermonuclear reactions in its core, resulting in a failed star that is very cool. In the case of the new brown dwarf, the scientists have gauged the temperature of its surface to be between 80 and 160 [degrees Fahrenheit](#) -- possibly as cool as a human.

Ever since brown dwarfs first were discovered in 1995, astronomers have been trying to find new record holders for the coldest brown dwarfs because these objects are valuable as laboratories for studying the atmospheres of planets with Earth-like temperatures outside our solar system.

Astronomers have named the brown dwarf "WD 0806-661 B" because it is the orbiting companion of an object named "WD 0806-661" -- the "white dwarf" core of a star that was like the Sun until its outer layers were expelled into space during the final phase of its evolution. "The distance of this white dwarf from the Sun is 63 light years, which is very near our solar system compared with most stars in our galaxy," Luhman said.



An artist's impression of the coldest imaged companion, named WD 0806-661 B, (right foreground) orbiting at a large distance from a white dwarf --the collapsed-core remnant of a dying star. Credit: NASA Goddard Space Flight Center/Francis Reddy

"The distance of this white dwarf from its brown-dwarf companion is 2500 astronomical units (AU) -- about 2500 times the distance between the Earth and the Sun, so its orbit is very large as compared with the orbits of planets, which form within a disk of dust swirling close around a newborn star," said Adam Burgasser at the University of California, San Diego, a member of the discovery team. Because it has such a large orbit, the astronomers say this companion most probably was born in the same manner as binary stars, which are known to be separated as far apart as this pair, while remaining gravitationally bound to each other.

Luhman and his colleagues presented this new candidate for the coldest known brown dwarf in a paper published in spring 2011, and they now have confirmed its record-setting cool temperature in a new paper that will be published in the [Astrophysical Journal](#).

To make their discovery, Luhman and his colleagues searched through infrared images of over six hundred stars near our solar system. They compared images of nearby stars taken a few years apart, searching for any faint points of light that showed the same motion across the sky as the targeted star. "Objects with cool temperatures like the Earth are brightest at infrared wavelengths," Luhman said. "We used NASA's Spitzer Space Telescope because it is the most sensitive infrared telescope available."

Luhman and his team discovered the brown dwarf WD 0806-661 B moving in tandem with the white dwarf WD 0806-661 in two Spitzer images taken in 2004 and 2009. The images, which together show the movement of the objects, are available here. "This animation is a fun illustration of our technique because it resembles the method used to discovery Pluto in our own solar system," Luhman said.

In a related new discovery involving a different cool brown dwarf, Penn State Postdoctoral Scholar John Bochanski and his colleagues have made the most detailed measurement yet of ammonia in the atmosphere of an object outside our solar system. "These new data are much higher quality than previously achieved, making it possible to study, in much more detail than ever before, the atmospheres of the coldest brown dwarfs, which most closely resemble the atmospheres that are possible around planets," Bochanski said.

"Brown dwarfs that are far from their companion stars are much easier to study than are planets, which typically are difficult to observe because they get lost in the glare of the stars they orbit," Burgasser said. "[Brown](#)

[dwarfs](#) with Earth-like temperatures allow us to refine theories about the atmospheres of objects outside our [solar system](#) that have comparatively cool atmospheres like that of our own planet."

Provided by Pennsylvania State University

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