Astronomers discover cool stars in nearby space

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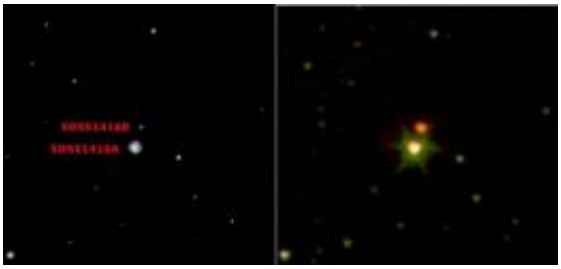

The images show the cool brown dwarf SDSS1416B and its warmer companion brown dwarf SDSS1416A (the left image is from the UKIRT telescope and the right image from the Subaru telescope).

(PhysOrg.com) -- An international team, led by astronomers at the University of Hertfordshire have discovered what may be the coolest sub-stellar body ever found outside our own solar system. Using the United Kingdom Infrared Telescope (UKIRT) in Hawaii, a discovery has been made of an object which is technically known as a brown dwarf. The team's findings have been accepted for publication in the journal *Monthly Notices of the Royal Astronomical Society.*

What has excited astronomers are its very peculiar colours, which actually make it appear either very blue or very red, depending on which part of the spectrum is used to look at it.

The object is known as SDSS1416+13B and it is in a wide orbit around a

somewhat brighter and warmer brown dwarf, SDSS1416+13A. The brighter member of the pair was detected in visible light by the Sloan Digital Sky Survey. By contrast, SDSS1416+13B is only seen in infrared light. The pair is located between 15 and 50 light years from the solar system, which is quite close in astronomical terms.

"This looks like being the fourth time in three years that the UKIRT has discovered made a record breaking discovery of the coolest known brown dwarf, with an estimated temperature not far above 200 degrees Celsius," said Dr Philip Lucas at the University of Hertfordshire's School of Physics, Astronomy and Mathematics.

"We have to be a bit careful about this one because its colours are so different than anything seen before that we don't really understand it yet. Even if it turns out that the low temperature is not quite record breaking, the colours are so extreme that this object will keep a lot of physicists busy trying to explain it."

SDSS1416+13B was first noticed by Dr Ben Burningham of the University of Hertfordshire as part of a dedicated search for cool brown dwarfs in the UKIRT Infrared Deep Sky Survey (UKIDSS). The object appeared far bluer at near infrared wavelengths than any brown dwarf seen before. A near infrared spectrum taken with the Japanese Subaru Telescope in Hawaii showed that it is a type of brown dwarf called a T dwarf, which has a lot of methane in its atmosphere, but with peculiar features including a big gap at certain wavelengths.

Dr Burningham soon noticed that a previously observed brighter star (SDSS1416+13A) which appears close by in the UKIDSS discovery image was also a brown dwarf. Team member Dr Sandy Leggett, of the Gemini Observatory, then used the orbiting Spitzer Space Telescope to investigate SDSS1416+13B at longer wavelengths. She measured its colour at mid-infrared wavelengths, which are thought to be the most

reliable indicator of temperature, and found that it is the reddest known brown dwarf at these wavelengths by some margin. Comparison with theoretical models of the brown dwarf atmospheres then provided a temperature estimate of about 500 Kelvin (227 degrees Celsius).

This artist's concept shows a pair of cool brown dwarfs. Image credit: NASA/JPL-Caltech

"The fact that it is a binary companion to a warmer brown dwarf that also has an unusual spectrum is helping us to fill in some gaps in our understanding", says Dr Burningham. "It seems likely that both brown dwarfs are somewhat poor in heavy elements. This can be explained if they are very old, which also fits with the very low temperature of the faint companion."

Too small to be stars, brown dwarfs have masses smaller than stars but larger than gas giant planets like Jupiter. Due to their low temperature these objects are very faint in visible light, and are detected by their glow at infrared wavelengths. They were originally dubbed "brown dwarfs" long before any were actually discovered, to describe the idea of bodies that were cooler, fainter and redder than red dwarf stars, with the colour brown representing the mix of red and black.

More information: A preprint of the paper can be found at xxx.soton.ac.uk/abs/1001.4393

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