

"Long before it's in the papers"

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## Astronomers: planet is blacker than coal, but glows faintly

Aug. 11, 2011  
Courtesy of the Royal Astronomical Society  
and World Science staff

**Astronomers say they have discovered the darkest known planet – a distant, Jupiter-sized gas giant known as TrES-2b.**

Their measurements indicate the planet reflects less than one percent of the starlight falling on it. That would make it blacker than coal or any planet or moon in our solar system, which it is not part of.

"It's truly an alien world," said astronomer David Kipping of the Harvard-Smithsonian Center for Astrophysics, lead author of a report on the object appearing in the research journal *Monthly Notices of the Royal Astronomical Society*.

In our solar system, Jupiter is swathed in bright clouds of ammonia that reflect more than a third of the sunlight reaching it, according to astronomers. In contrast, the newfound planet lacks reflective clouds due to its high temperature.

TrES-2b orbits its star at a relatively small estimated distance of five million kilometres (three million miles). The star's intense light heats the planet to an estimated 1000 more degrees Celsius – much too hot for ammonia clouds. Instead, its exotic atmosphere contains light-absorbing chemicals like vaporized sodium and potassium, or gaseous titanium oxide, the astronomers say. Yet none of these chemicals fully explain the extreme blackness.

"It's not clear what is responsible," said study co-author David Spiegel of Princeton University. "However, it's not completely pitch black. It's so hot that it emits a faint red glow, much like a burning ember or the coils on an electric stove."

Kipping and Spiegel determined the reflectivity of the planet using data from NASA's Kepler spacecraft. Kepler is designed to measure the brightnesses of distant stars with extreme precision. The team monitored the brightness of the TrES-2 system as the planet orbited its star. They detected a subtle dimming and brightening due to the planet's changing phase.

TrES-2b is thought to be tidally locked like our moon, meaning one side of the planet always faces the star. And like our moon, the planet shows changing phases as it orbits its star. This causes the total brightness of the star plus planet to vary slightly.

"By combining the impressive precision from Kepler with observations of over 50 orbits, we detected the smallest-ever change in brightness from an exoplanet: just six parts per million," said Kipping. "In other words, Kepler was able to directly detect visible light coming from the planet itself."

The extremely small fluctuations proved that TrES-2b is incredibly dark, Kipping added; a more reflective world would have shown larger brightness variations as its phase changed. TrES-2b, discovered in 2006 by the Trans-Atlantic Exoplanet Survey, orbits the star GSC 03549-02811, which lies an estimated 750 light-years away in the direction of the constellation Draco. One light-year is about 10 trillion kilometres, or 6 trillion miles.

