



DEPARTMENT OF UNIVERSITY RELATIONS  
P.O. BOX 3983  
ATLANTA, GA 30302-3983  
PHONE: 404/651-3025 FAX: 404/651-3567

## NEWS RELEASE

**FOR RELEASE: 9:20 am PST, Tuesday January 9, 2007**

**Contacts:**

Ms. Ellyn Baines or Dr. Hal McAlister  
Center for High Angular Resolution Astronomy  
Phone: 404/651-4248 or 404/651-1390  
baines@chara.gsu.edu  
hal@chara.gsu.edu

Mr. Aaron Baca  
University Relations  
Phone: 404/651-1444  
abaca@gsu.edu

### **FIRST DIRECTLY-DETERMINED EXTRASOLAR PLANET DIAMETER**

SEATTLE — Astronomers from Georgia State University's Center for High Angular Resolution Astronomy (CHARA) and the Michelson Science Center at the California Institute of Technology have directly measured the diameter of the star HD 189733. This has enabled the determination of the diameter of the planet orbiting the star, a significant result in that it represents the first extrasolar planet diameter that has been determined through purely direct means. This announcement is being presented today on behalf of the group by Ellyn Baines, a doctoral student at Georgia State, to the American Astronomical Society meeting in Seattle Washington.

In 2005, an international team of astronomers found a planet orbiting HD 189733, located in the constellation Vulpecula, with the very short period of 2.2 days. Remarkably, the plane of the planet's orbit lies very nearly within the line of sight from the Earth so that the planet was discovered to pass in front of the star once every orbit causing the light from the star to dim by about 3 percent. By accurately measuring the shape of the dimming during this so-called "transit" event, the planet's diameter was found to be about 17% that of its parent star. An estimate of the diameter of HD 189733 indicated that the planet was slightly larger than Jupiter.

The CHARA Array, a six-telescope facility located on Mount Wilson in southern California, was used to measure the angular size of HD 189733. This instrument uses the principles of optical interferometry to measure minute angular sizes equivalent to the capability of a single telescope nearly a quarter mile in

diameter. Operating at wavelengths in the near-infrared part of the spectrum, the CHARA Array possesses the highest resolving power of any optical interferometer in the world. This unique capability permitted the Georgia State/Caltech team to measure the angular diameter of HD 189733 in the so-called H-band spectral region, centered at a wavelength of 1.65 microns. The star was found to subtend an angle of 0.38 milliarcsecond. There are 3.6 million milliarcseconds in one degree of angle, and the angular size of HD 189733 is equivalent to that of a nickel seen from a distance of 11,500 kilometers.

The star's distance from the sun was accurately determined by the HIPPARCOS spacecraft more than a decade ago to be 62.8 light years. By combining the angular diameter of the star with this distance, the true diameter of HD 189733 is directly found to be about 1.1 million kilometers, or about 78% the size of our sun. When joined with the relative size of the planet found from the earlier transit observations, the diameter of the planet, conventionally referred to as HD 189733b, comes out to be 185,000 kilometers, which is about 30% larger than Jupiter. The overall uncertainty in this result is about 10%.

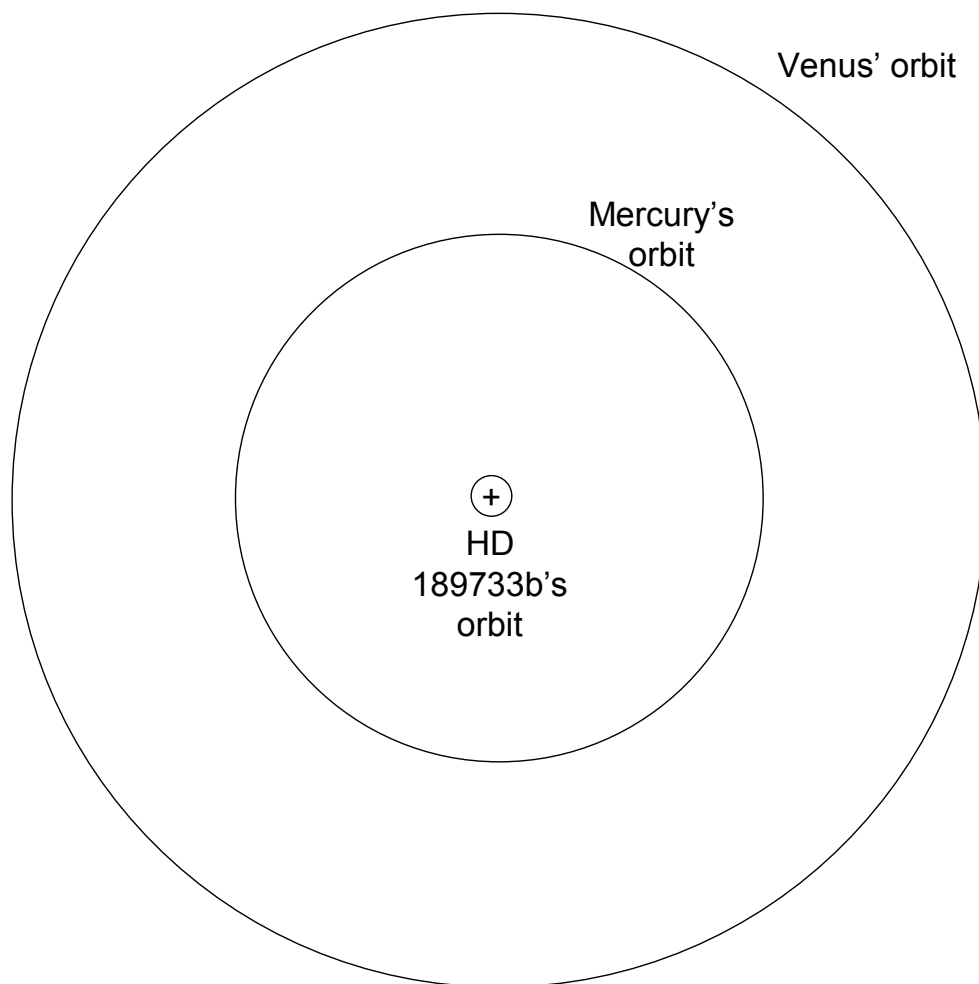
This new result is somewhat larger than the value previously inferred for the planet's diameter. That value was, of necessity, based upon indirect determinations of the central star's diameter using a temperature derived from a relation involving measurements of the star's brightness at several infrared wavelengths. That approach may be reliable for a large sample of stars but is subject to possible systematic errors when applied to an individual object. The new interferometric measurement is a direct, geometric determination independent of any intermediate calibration process or assumptions about the temperature of the central star's surface. The newly determined diameter leads to a density for the planet of about 0.75 gm/cm<sup>3</sup>, which is similar to that of Saturn, the least dense of all planets in our solar system.

"This sort of measurement is perfectly suited to the CHARA Array's capabilities," said Ms. Baines, "and we look forward to measuring the diameters of several other stars with transiting planets. These direct measurements of planet diameters and densities tell us a lot about how these gas giants might differ from Jupiter because of their very close proximity to their parent star."

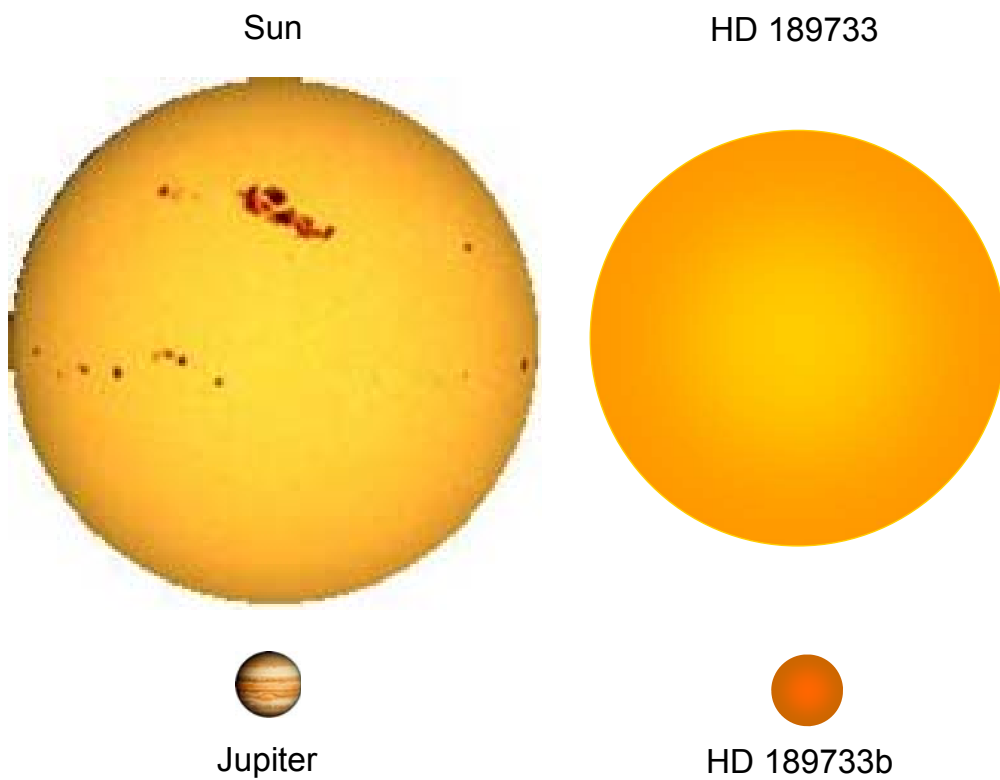
The CHARA Array, owned and operated by Georgia State University, was constructed with funding from the National Science Foundation, Georgia State, the W. M. Keck Foundation, and the David and Lucile Packard Foundation. The NSF Division of Astronomical Sciences has awarded funds for ongoing CHARA research.

###

This release and the figures below can be found at [www.chara.gsu.edu/CHARA/Press.html](http://www.chara.gsu.edu/CHARA/Press.html) after the embargo has ended.



**Figure 1** – The close proximity of the planet HD 189733b to its central star is indicated in comparison with the orbits of Mercury and Venus drawn on the same scale.



**Figure 2** – The star HD 189733 and its planet are shown above on the same scale as Jupiter and the sun. *Images of sun and Jupiter courtesy of NASA.*