Young Star's Companion Has Only Forty Times the Mass of Jupiter

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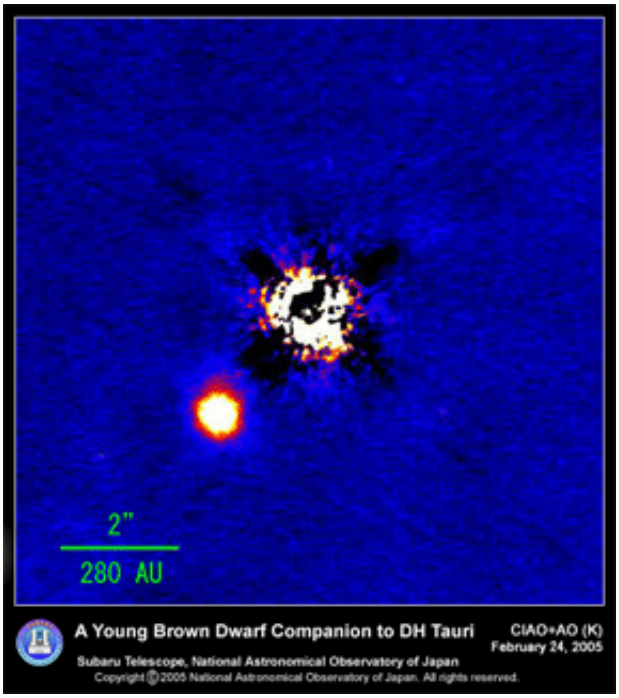

Astronomers have weighed DH Tauri's companion and have found that it is a brown dwarf with only 40 times the mass of Jupiter. DH Tauri is a young star only one million years old in the constellation Taurus. It is so young it will not begin nuclear fusion for another one hundred million years. It is 460 light years away and two thirds as massive as the Sun. Its companion is among the coolest and lightest of known brown dwarfs orbiting young stars. If the companion had been less massive it probably

would have been a planet. A team from the National Astronomical Observatory of Japan, Kobe University, the University of Tokyo, and the Graduate University for Advanced Studies conducted this research.

The search for planets outside our solar system (extrasolar planets) motivates much of modern astronomy. Subaru Telescope is contributing to this search by observing many nearby young stars in the constellation Taurus with its Coronagraphic imager with Adaptive Optics (CIAO). (See our April 2004 press release for more information on this program and an image of a protoplanetary disk.)

CIAO's speciality is observing faint objects near bright objects. CIAO sharpens an image using a technique called adaptive optics, and blocks the light from a bright object using a mask called a coronagraph.

The research team targeted young stars since planets and brown dwarfs are brighter when they are young. Planets weigh less than 13 times the mass of Jupiter. Brown dwarfs are 13 to 80 times more massive than Jupiter. Unlike stars like the Sun, brown dwarfs don't have enough mass to generate energy through nuclear fusion.

So far, extrasolar planets orbiting around normal stars have been detected only by indirect means, such as observing the wobble in the main star caused by the gravitational tug and pull with the orbiting planet. No direct image of an extrasolar planet around a normal star exists to date. If astronomers could get a direct image of an extrasolar planet, they can begin to study physical properties such as temperature and composition.

When the research team took an image of the star DH Tauri (abbreviated as DH Tau), they noticed an object 250 times fainter 2.3 arcseconds away. At the distance of DH Tauri (460 light years), this separation is equivalent to 330 times the distance between Earth and the

Sun. Although the object was in older images of DH Tauri, its location in the new image revealed that it was not an unrelated background object, but a companion that orbits DH Tauri.

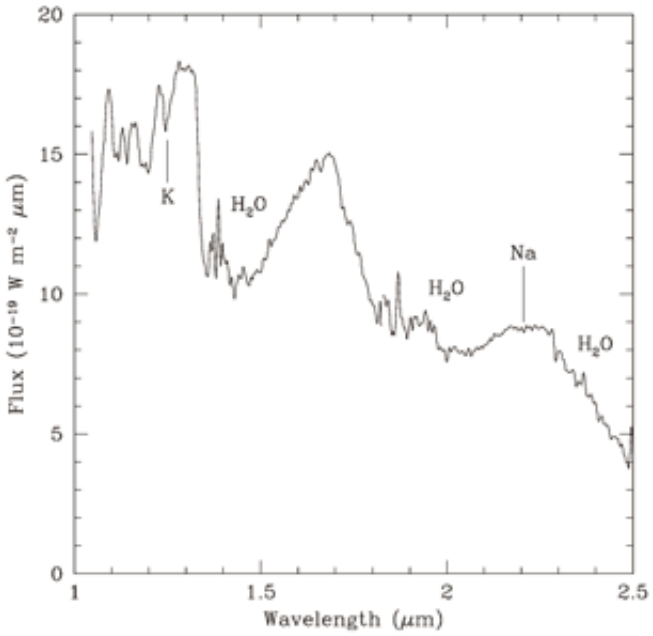

Figure 2: The spectrum of the companion from 1 to 2.5 μm.

To understand the physical nature of this companion, the team made followup observations using a spectrograph on Subaru (the Cooled Infrared Spectrograph and Camera; CISCO), The companion's spectrum in the 1 to 2.5 μm region shows signatures of water and potassium. From these, the research team can infer that the surface temperature of the companion is about 2700 to 2800 degrees Kelvin, its surface gravity is 4 times that of Jupiter and its mass is only 40 times larger than Jupiter. This puts the companion in the brown dwarf category.

Yoichi Itoh from the Kobe University says "this discovery gives substance to our hope that we can find a planet with a mass comparable to Jupiter using our technique and strategy." "We are getting ever closer to our goal of getting an image of an extrasolar planet," he says.

Source: National Astronomical Observatory of Japan