Astrophysicists identify a 'super-Jupiter' around a massive star

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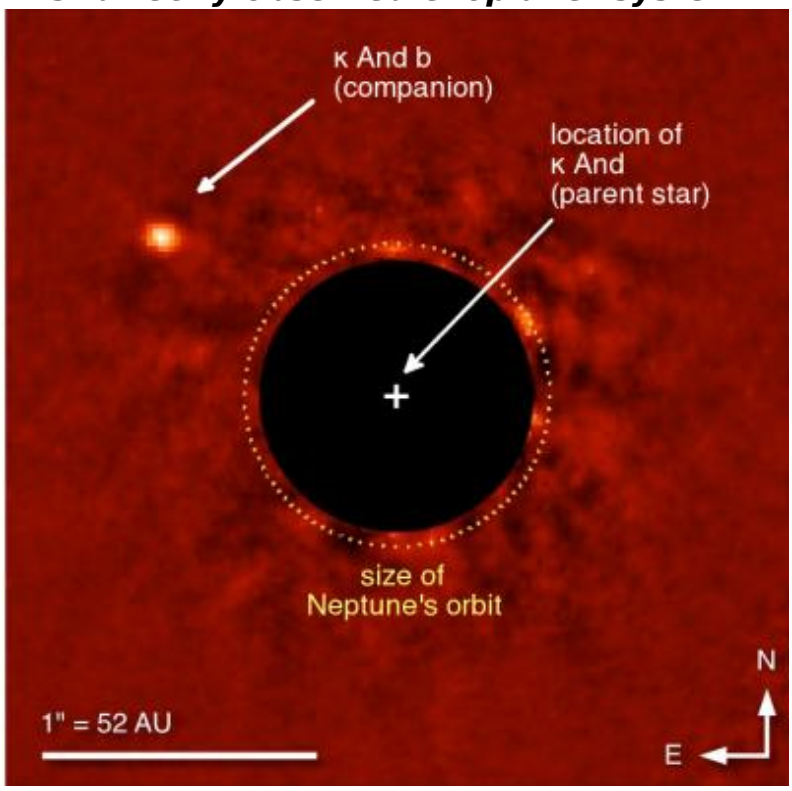
First directly observed exoplanet system in 4 years



TORONTO, ON – Astrophysicists at the University of Toronto and other institutions across the United States, Europe and Asia have discovered a 'super-Jupiter' around the massive star Kappa Andromedae. The object, which could represent the first new observed exoplanet system in almost four years, has a mass at least 13 times that of Jupiter and an orbit somewhat larger than Neptune's.

The host star around which the planet orbits has a mass 2.5 times that of the Sun, making it the highest mass star to ever host a directly observed planet. The star can be seen with the naked eye in the constellation Andromeda at a distance of about 170 light years.

"Our teamidentified a faint object located very close to Kappa Andromedae in January that looks much like other young, massive directly imaged planets but does not look like a star," said Thayne Currie, a post-doctoral fellow in the Department of Astronomy & Astrophysics at the University of Toronto and coauthor of a paper titled "Direct imaging of a `super-Jupiter' around a massive star" to be published in the Astrophysical Journal Letters. "It's likely a directly imaged planet." The report on the study can be viewed on arXiv.org at http://arxiv.org/abs/1211.3744 [1].

The researchers made the discovery based on an infrared imaging search carried out as part of the Strategic Explorations of Exoplanets and Disks with Subaru

(SEEDS) program using the Subaru telescope located in Hawaii.

"Kappa Andromedae moves fast across the sky so it will appear to change position relative to more distant, background objects," Currie says. "When we reobserved it in July at multiple wavelengths, we saw the faint object again, located at about the same position as it was in January. This indicates that it is bound to the star and not an unrelated background object." Labelled by the researchers Kappa And b, it could be the first direct rendering of an exoplanet in two years and of a new exoplanet system in almost four years, ending a significant drought in the field.

In a single infrared snapshot, the tiny point of light that is Kappa And b is completely lost amid the overwhelming glare of the host star. The SEEDS observing team was able to distinguish the object's faint light using a technique known as angular differential imaging, which combines a time-series of individual images in a manner that allows for the otherwise overwhelming glare of the host star to be removed from the final, combined image.

Young planets retain significant heat from their formation, enhancing the brightness at infrared wavelengths. This makes young star systems attractive targets for direct imaging planet searches. However, despite this fact, the successful direct imaging of extrasolar planets is exceptionally rare, especially for orbital separations akin to our own solar system planets. The extraordinary differences in brightness between a star and a planet are a primary reason why only a handful of planets have ever been directly imaged around stars.

"Although astronomers have found over 750 planets around other stars, we actually directly detect light from the atmosphere of only a few of them," said Currie. "There are approximately six now. Kappa And b is one of them if our estimates for its age and mass are correct, which we think they are. The rest are only inferred directly."

The large mass of both the host star and gas giant provide a sharp contrast with our own solar system. Observers and theorists have argued recently that large stars like Kappa Andromedae are likely to have large planets, perhaps following a simple scaled-up model of our own solar system. But experts predict that there is a limit to such extrapolations; if a star is too massive, its powerful radiation may disrupt the normal planet formation process that would otherwise occur. The discovery of the super-Jupiter around Kappa Andromedae demonstrates that stars as large as 2.5 solar masses are still fully capable of producing planets within their primordial circumstellar disks.

"This planetary system is very different from our own," Currie says. "The star is much more massive than our Sun and Kappa And b is at least 10 times more massive than any planet in the solar system. And, Kappa And b is located further from the star than any of the solar system planets are from the Sun. Because it is generally much harder to form massive planets at large distances from the parent star, Kappa And b could really be a challenge for our theories about how planets form."

The SEEDS research team continues to study the Kappa And b emitted light across

a broad wavelength range, in order to better understand the atmospheric chemistry of the gas giant, and constrain the orbital characteristics. The researchers also continue to explore the system for possible secondary planets, which may have influenced the Kappa And b formation and orbital evolution. These follow-up studies will yield further clues to the formation of the super-Jupiter, and planet formation in general around massive stars.

Source: http://www.eurekalert.org/pub_releases/2012-11/uot-aia111912.php [2]

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