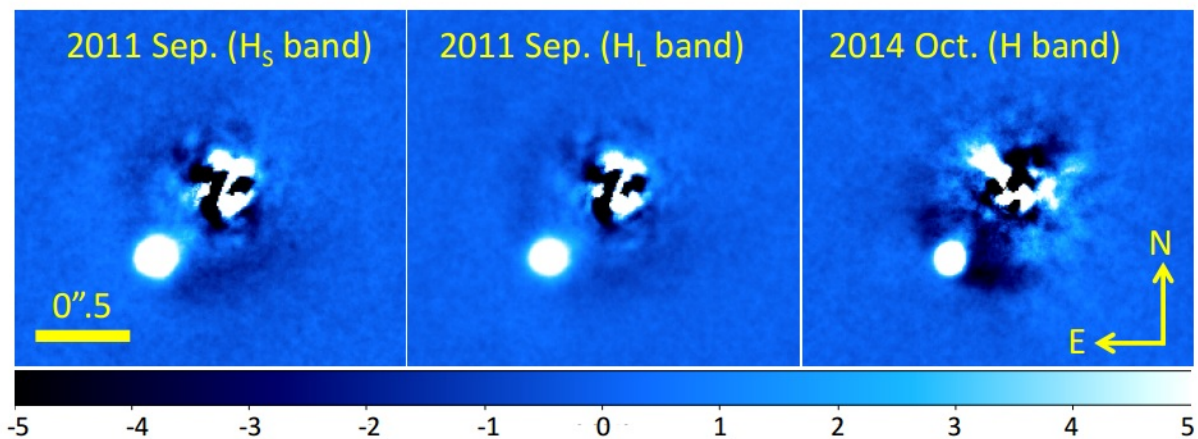


Astronomers discover new substellar companion to the Pleiades member star

August 10 2016, by Tomasz Nowakowski



Final Pleiades HII 3441 images. (Left) reduced HS -band image taken in the 2011 observation. (Middle) reduced HL-band image taken in the 2011 observation. (Right) reduced H-band image taken in the 2014 observation. All images were analyzed using standard ADI. Pleiades HII 3441B can be seen southeast of the primary star. There is no methane absorption in Pleiades HII 3441B when left and middle panels are compared. Credit: Konishi et al., 2016.

An international team of astronomers has found a new substellar mass companion to one of the stars in the Pleiades open cluster. The discovery could contribute to our understanding of stellar and substellar multiplicity as well as formation mechanisms in this cluster. A study detailing the new findings was published Aug. 5 on the arXiv pre-print server.

Due to its proximity, the well-known Pleiades cluster is frequently observed and studied by amateur and professional astronomers. The cluster, located some 440 light years away, is about 120 million years old, which makes it one of the nearest young open clusters. It is also a great target for searching new low-mass substellar objects such as brown dwarfs.

From 2011 to 2015, an international team of researchers led by Mihoko Konishi of the National Astronomical Observatory of Japan conducted a series of observations of the cluster's member star, designated Pleiades HII 3441, looking for planetary-mass and substellar companions. These observations were part of the Strategic Explorations of Exoplanets and Disks with Subaru (SEEDS) survey, which uses adaptive optics assisted high contrast imaging for studying planets and disks, including primordial systems, transitional systems and mature systems. The survey utilizes the 8.2 Subaru Telescope located on Mauna Kea, Hawaii.

The newly detected object was named Pleiades HII 3441B. According to the study, it was found southeast of the primary star with a projected separation of about 66 AU.

"A companion candidate was detected southeast of the primary star, and subsequently confirmed as a companion object to the primary star. (...) The projected separation and position angle are $0.''49 \pm 0.''02$ (66 ± 2 AU) and $136.4^\circ \pm 3.2^\circ$, respectively. These values were derived by averaging all observations," the researchers wrote in the paper.

The mass of Pleiades HII 3441B was calculated to be approximately 68 Jupiter masses and its temperature was estimated to be 2,700 K. Moreover, the team found that there is no methane absorption in the atmosphere of this substellar companion. They emphasized that methane is considered to condense below 1,300 K.

The object was classified an M7-type brown dwarf, due to the fact that its mass is below the hydrogen-burning limit (72 Jupiter masses). Its spectral type was deducted from the photometry-derived temperature. However, as the researchers noted, Pleiades HII 3441B is "close to the boundary between the stellar and substellar regime."

The scientists have also taken into account the possibility that the object is another faint Pleiades member along the same line of sight; it cannot be ruled out completely as the observations could not detect the orbital motion.

According to the researchers, their study provides an important input for the determination of the initial mass function in Pleiades, and might help us understand the formation mechanisms in the cluster. Substellar multiplicity in Pleiades is also discussed in the paper, with the aim to estimate the general fraction of substellar companions in star clusters. However, as the team noted, further studies are needed in order to get comprehensive answers.

"A much larger survey of the Pleiades would be needed to draw general conclusion on the multiplicity differences between open clusters and field star populations," the astronomers concluded.

More information: arxiv.org/pdf/1608.01780.pdf

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