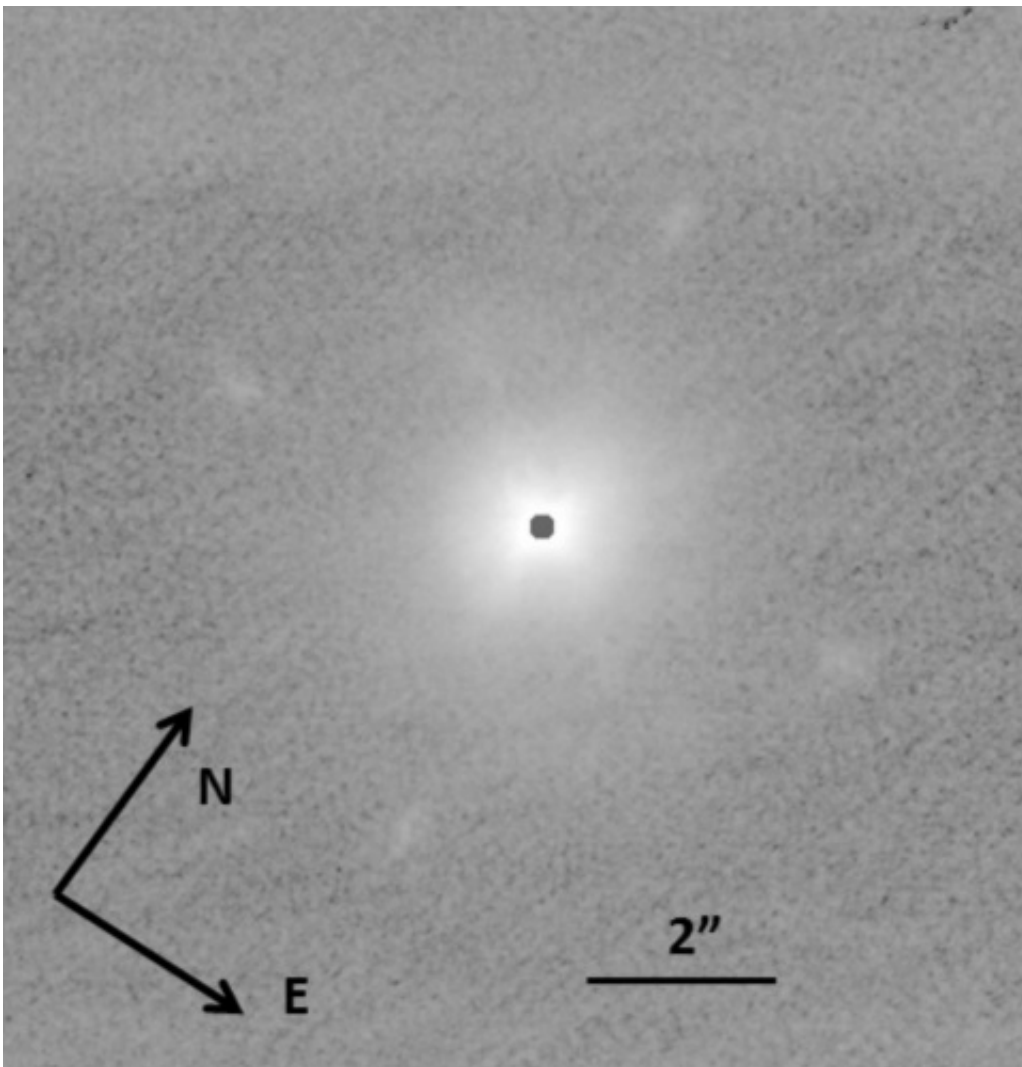


Astronomers discover a highly inflated sub-Saturn extrasolar planet

July 13 2016, by Tomasz Nowakowski



Palomar AO image of KELT-11. The four spots oriented cardinally with the target are a result of the alignment procedure and are not astrophysical. Credit: Pepper et al., 2016.

(Phys.org)—An international team of astronomers led by Joshua Pepper of the Lehigh University in Bethlehem, Pennsylvania, has detected an extremely inflated sub-Saturn exoplanet orbiting a bright subgiant star. The newly discovered alien world is one of the most inflated, least dense planets known to date. The findings were presented in a paper published July 6 on *arXiv.org*.

The team used the Kilodegree Extremely Little Telescope (KELT) to observe a bright subgiant star named HD 93396 (KELT-11), which is located some 320 light years away. They were looking for transit signals indicating the presence of a planet circling this distant star. KELT was chosen for this job as it can observe stars generally brighter than those observed by other ground-based surveys.

"KELT is important specifically for the discovery of transiting [giant planets](#) orbiting bright stars. These are the best targets for developing the tools for measuring the atmospheric properties of planets. While KELT is not discovering large numbers of planets compared to other surveys, our discoveries are individually very valuable," Pepper told Phys.org.

KELT consists of two robotic telescopes, KELT-North and KELT-South, that are conducting a survey for transiting exoplanets. KELT-North is located in Arizona, while KELT-South is situated in South Africa.

The transit signal detected by KELT was very weak and very long, lasting almost seven hours, due to the fact that HD 93396 is a subgiant. For these reasons, it was difficult for the researchers to get the whole transit in one night.

"This discovery was very challenging. The original KELT observations of the star - its light curve - showed only a hint of the transit, just slightly above the threshold that led us to selected for follow-up. Because the

transit is both shallow (a little under 0.3 percent change in brightness) and long, it was very difficult to obtain reliable, complete confirmation observations," Pepper revealed.

To confirm the planetary status of the detected object and obtain its characteristics, the team carried out follow-up observations employing a set of other telescopes worldwide.

The planet, designated KELT-11b is a low-mass gas giant, larger in size than Jupiter with a radius of about 1.37 Jupiter radii, but having only approximately 20 percent of Jupiter's mass. This makes KELT-11b the third-lowest density planet ever discovered with a precisely measured mass and radius.

The newly discovered planet is also described by the researchers as extraordinarily inflated, due to the fact that its radius is much larger than expected. According to the study, its radius is about twice as large as predicted by the mass-radius-incident flux relation. However, as the cause of the inflation process is still being debated, KELT-11b could provide some answers on the nature of this mechanism.

"We think that KELT-11b will be a great test case to help us understand the mechanism that causes inflated planets. It will also be a valuable target for developing the techniques for probing exoplanet atmospheres as we prepare for the capabilities of the James Webb Space Telescope. Furthermore, since the host star has evolved onto the subgiant branch and is reaching the end of its life, we hope that we can study the behavior of planetary systems at the end-stage of their star's lifetime," Pepper concluded.

Pepper and his team plan further studies of this planet. They have already obtained some observations from the Spitzer Space Telescope to better measure the planet properties, and they are currently discussing

observations with the Hubble Space Telescope and other observatories to star probing the planet's atmosphere.

More information: KELT-11b: A Highly Inflated Sub-Saturn Exoplanet Transiting the V=8 Subgiant HD 93396, arXiv:1607.01755 [astro-ph.EP] arxiv.org/abs/1607.01755

Abstract

We report the discovery of a transiting exoplanet, KELT-11b, orbiting the bright (V=8.0) subgiant HD 93396. A global analysis of the system shows that the host star is an evolved subgiant star with $T_{\text{eff}}=5370\pm 51$ K, $M_*=1.438+0.061-0.052M_{\odot}$, $R_*=2.72+0.21-0.17R_{\odot}$, $\log g_*=3.727+0.040-0.046$, and $[\text{Fe}/\text{H}]=0.180\pm 0.075$. The planet is a low-mass gas giant in a $P=4.736529\pm 0.00006$ day orbit, with $M_P=0.195\pm 0.018M_J$, $R_P=1.37+0.15-0.12R_J$, $\rho_P=0.093+0.028-0.024$ g cm^{-3} , surface gravity $\log g_P=2.407+0.080-0.086$, and equilibrium temperature $T_{\text{eq}}=1712+51-46$ K. KELT-11 is the brightest known transiting exoplanet host in the southern hemisphere by more than a magnitude, and is the 6th brightest transit host to date. The planet is one of the most inflated planets known, with an exceptionally large atmospheric scale height (2763 km), and an associated size of the expected atmospheric transmission signal of 5.6%. These attributes make the KELT-11 system a valuable target for follow-up and atmospheric characterization, and it promises to become one of the benchmark systems for the study of inflated exoplanets.

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