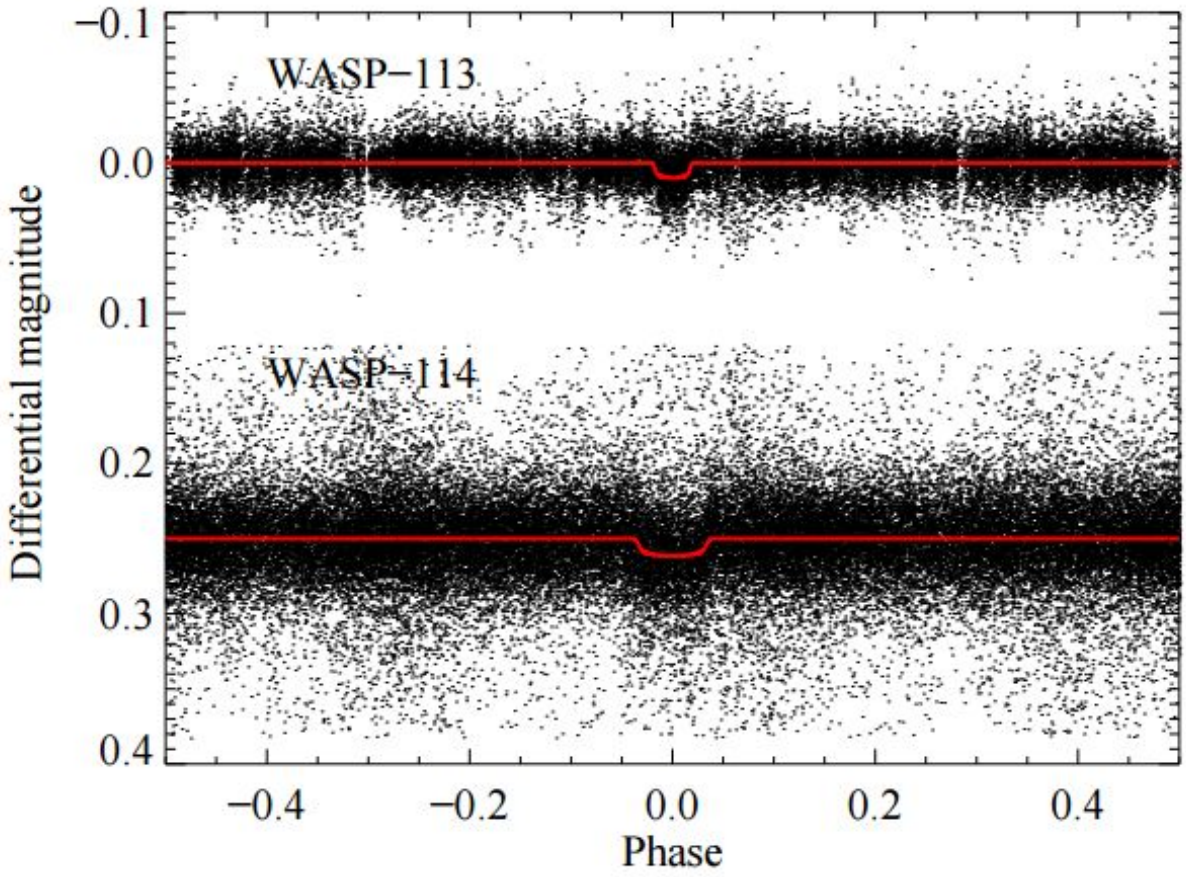
Two inflated 'hot-Jupiter' planets discovered around distant stars

July 12 2016, by Tomasz Nowakowski



SuperWASP phase folded light curve for WASP-113 (top) and WASP-114 (bottom). The best transit model described in detail in section 4 is overplotted. The data of WASP-114 was displaced vertically for clarity. Credit: arXiv:1607.02341 [astro-ph.EP]

(Phys.org)—Astronomers have detected two new "hot Jupiters" with a radius larger than they should have. Designated WASP-113b and WASP-114b, these exoplanets orbit their host stars located some 1,170 and 1,500 light years away respectively. A July 8 paper detailing the finding appeared on the arXiv pre-print server.

An international team of researchers, led by Susana Barros of the University of Porto in Portugal, found the alien worlds by utilizing an array of eight robotic cameras at the Roque de los Muchachos Observatory in La Palma, Canary Islands. The observations were conducted under the Super Wide Angle Search for Planets (SuperWASP) program, which is the leading ground-based transit survey, having discovered more than 150 exoplanets to date.

The scientists also used the SOPHIE spectrograph on the 1.93m telescope of the Haute-Provence Observatory in France and the CORALIE spectrograph mounted on the 1.2m Swiss Euler telescope in La Silla, Chile, to carry out follow-up spectrographic observations of the two stars named WASP-113 and WASP-114. These follow-up studies allowed the team to obtain physical characteristics of the newly detected planetary systems.

According to the paper, WASP-113b and WASP-114b are larger in size than Jupiter, with an inflated radius of about 1.4 and 1.3 Jupiter radii respectively. However, although they are both similar in size, WASP-113b is less than half Jupiter's mass while WASP-114b has almost twice the mass of Jupiter. Therefore, WASP-114b is 4.2 times more dense than WASP-113b.

The researchers emphasized that their computations indicated that the radii of these planets should be smaller. They estimated a radius of 1.05 Jupiter radii for WASP-113b and a radius of approximately 1.15 Jupiter radii for WASP-114b. Thus, the confirmed larger radius and a density

lower than that of our solar system's biggest planet, suggest that the newly found worlds are inflated gas giants.

"Assuming the coreless models we estimated a radius of 1.05 R_{jup} for WASP-113b and 1.15 R_{jup} for WASP-114b. Both these predicted radii are more than 2 σ smaller than the radii measured for the planets in our analysis. Hence, we conclude that the planets are inflated," the researchers wrote in the paper.

Researchers widely debate the cause of the inflation process in gas giant planets. It could be due to tidal heating, kinetic heating, enhanced atmospheric opacities and ohmic dissipation.

The study also reveals that both exoworlds belong to the "hot Jupiter" family of planets. The so-called "hot Jupiters" are gas giant planets, similar in characteristics to the solar system's biggest planet, with orbital periods of less than 10 days. They have high surface temperatures as they orbit their parent stars very closely. According to the research, WASP-113b has an orbital period of 4.54 days and a surface temperature of about 1,500 K, while WASP-114b orbits its parent star every 1.55 days and has a temperature of approximately 2,040 K.

The team hopes that future observations of these planets could shed light on the radius anomaly and on the atmospheric composition of these planets.

"The large scale-height of WASP-113b, and its relatively bright host star, makes it a good target for transmission spectroscopy observations to probe its atmospheric composition. The scale height of WASP-114b is smaller and combined with its fainter host star would make atmospheric studies more challenging," the researchers concluded.

More information: Discovery of WASP-113b and WASP-114b, two

inflated hot-Jupiters with contrasting densities, arXiv:1607.02341 [astro-ph.EP] arxiv.org/abs/1607.02341

Abstract

We present the discovery and characterisation of the exoplanets WASP-113b and WASP-114b by the WASP survey, {it SOPHIE} and {it CORALIE}.

The planetary nature of the systems was established by performing follow-up photometric and spectroscopic observations. The follow-up data were combined with the WASP-photometry and analysed with an MCMC code to obtain system parameters. The host stars WASP-113 and WASP-114 are very similar. They are both early G-type stars with an effective temperature of ~5900K, [Fe/H]~0.12 and Teff ~4.1dex. However, WASP-113 is older than WASP-114. Although the planetary companions have similar radii, WASP-114b is almost 4 times heavier than WASP-113b. WASP-113b has a mass of 0.48 MJup and an orbital period of ~4.5days; WASP-114b has a mass of 1.77 MJup and an orbital period of ~1.5days. Both planets have inflated radii, in particular WASP-113 with a radius anomaly of R=0.35. The high scale height of WASP-113b (~950 km) makes it a good target for follow-up atmospheric observations.