Astronomers discover four new 'hot Jupiters'

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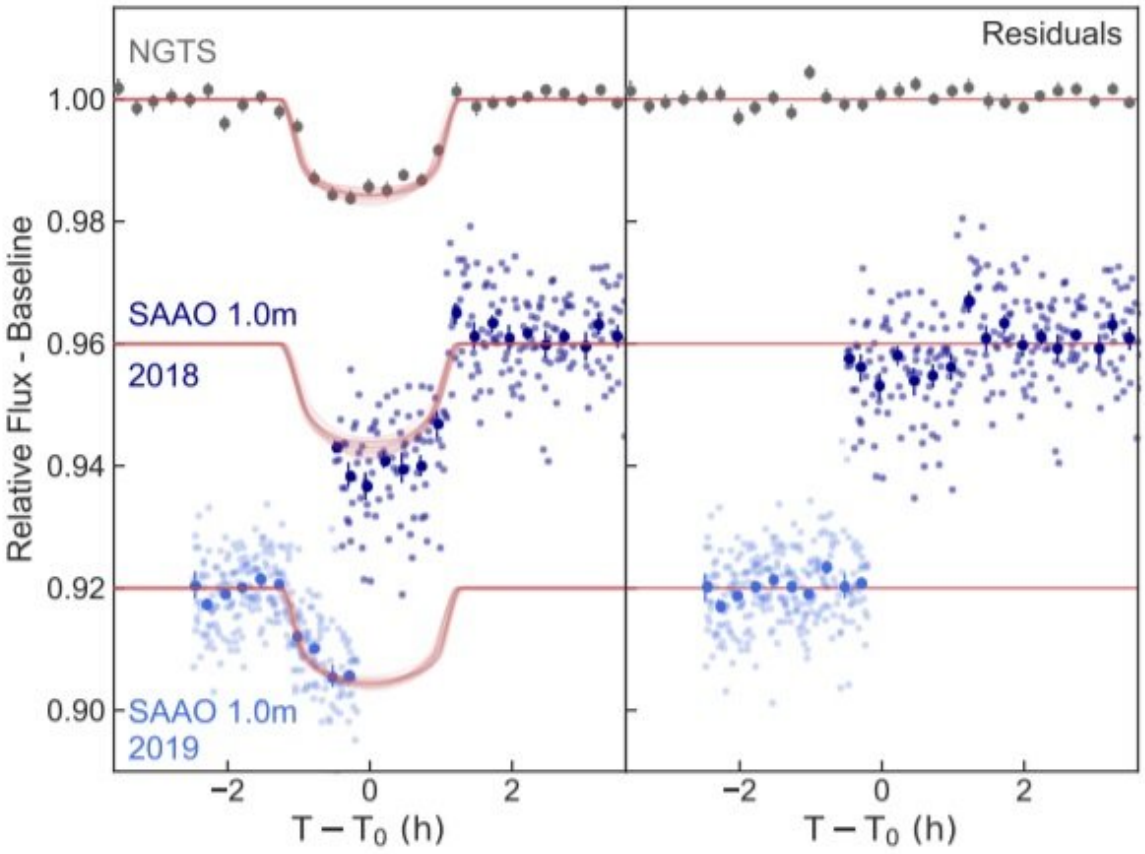

Photometry for NGTS-15b. The NGTS discovery lightcurve is phase-folded at the best-fitting period of 3.27623 ± 0.00001 d. Credit: Tilbrook et al., 2021.

An international team of astronomers has detected four new "hot Jupiter" exoplanets as part of the Next Generation Transit Survey

(NGTS). The newly found alien worlds are at least 10% larger than Jupiter but less massive than the solar system's biggest planet. The finding is reported in a paper published March 18 on arXiv.org.

The so-called "hot Jupiters" are similar in characteristics to the solar system's biggest planet, with orbital periods of less than 10 days. Such exoplanets have high surface temperatures, as they orbit their parent stars very closely.

Now, a team of astronomers led by Rosanna H. Tilbrook of the University of Leicester, U.K., reports the finding of four new objects of this type. The detection was made using NGTS' array of 12 independently mounted 20-cm Newtonian telescopes at the Paranal Observatory
in Chile.

The researchers identified transit signals in the light curves of four stars during an observational campaign taking place between August 2017 and August 2018. The planetary nature of these signals was later confirmed by follow-up observations conducted at the South African Astronomical Observatory (SAAO) and by analyzing data from NASA's Transiting Exoplanet Survey Satellite (TESS).

The newly found exoworlds received designations NGTS-15b, 16b, 17b and 18b. All the four objects are short-period planets (with orbital periods shorter than five days) orbiting different G-type main sequence stars.

With a radius of about 1.1 Jupiter radii, NGTS-15b is the smallest planet out of the newfound quartet. It is some 25 percent less massive than Jupiter, and orbits its host every 3.27 days, at a distance of 0.044 AU from it. The planet has an equilibrium temperature of 1,146 K. The parent star, NGTS-15, is of spectral type G6V, has a mass similar to that

of the sun, but is approximately 5% smaller than it. Observations indicate that NGTS-15 is about 3.28 billion years old, has an effective temperature of around 5,600 K and is located nearly 2,600 light years away.

Although NGTS-16b is the largest exoplanet (with a radius of 1.3 Jupiter radii) reported in the paper, its mass is only 0.67 Jupiter masses. The planet has an orbital period of 4.84 days, is separated from its host by approximately 0.05 AU, and its equilibrium temperature is at a level of 1,177 K. NGTS-16 is a solar-mass star of spectral type G7V with a radius of about 1.21 solar radii. The star's age is estimated to be 10.29 billion years and its effective temperature is calculated to be 5,550 K. The planetary system is located some 2,900 light years away from the Earth.

NGTS-17b is the most massive exoplanet out of the newly discovered four, as its mass was calculated to be about 0.764 Jupiter masses. The planet is around 24% larger than Jupiter and its equilibrium temperature is at a level of 1,457 K. The results show that NGTS-17b is circling its 9.2 billion-year-old host every 3.24 days, at a distance of approximately 0.04 AU from it. The parent star NGTS-17, located some 3,400 light years away, is slightly more massive than the sun and has a radius of almost 1.34 solar radii. The star's effective temperature is 5,650 K.

The extrasolar planet NGTS-18b is the least massive one described in the paper. It has a mass of only 0.41 Jupiter masses; however, it is about 21% larger than Jupiter. The exoworld is separated from NGTS-18 by 0.045 AU and it takes it just 3.05 days to fully orbit its host. The equilibrium temperature of this planet is estimated to be around 1,381 K. When it comes to the parent star of spectral type G5V, it has a radius of about 1.4 solar radii and its mass is similar to that of our sun. The star is 10.8 billion years old, has an effective temperature of about 5,610 K and is located some 3,600 light years away from the Earth.

Taking into account all the results, the authors of the paper concluded that three of the four newly detected objects, namely NGTS-16b, NGTS-17b, and NGTS-18b, are likely inflated exoplanets.

"By considering the host star luminosities and the planets' small orbital separations (0.039 – 0.052 AU), we find that all four hot Jupiters are highly irradiated and therefore occupy a region of parameter space in which planetary inflation mechanisms become effective. Comparison with statistical studies and a consideration of the planets' high incident fluxes reveals that NGTS-16b, NGTS-17b, and NGTS-18b are indeed likely inflated, although some disparities arise upon analysis with current Bayesian inflationary models," the astronomers wrote.

More information: NGTS 15b, 16b, 17b and 18b: four hot Jupiters from the Next Generation Transit Survey, arXiv:2103.10302 [astro-ph.EP] arxiv.org/abs/2103.10302

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