Astronomers discover seven new giant exoplanets

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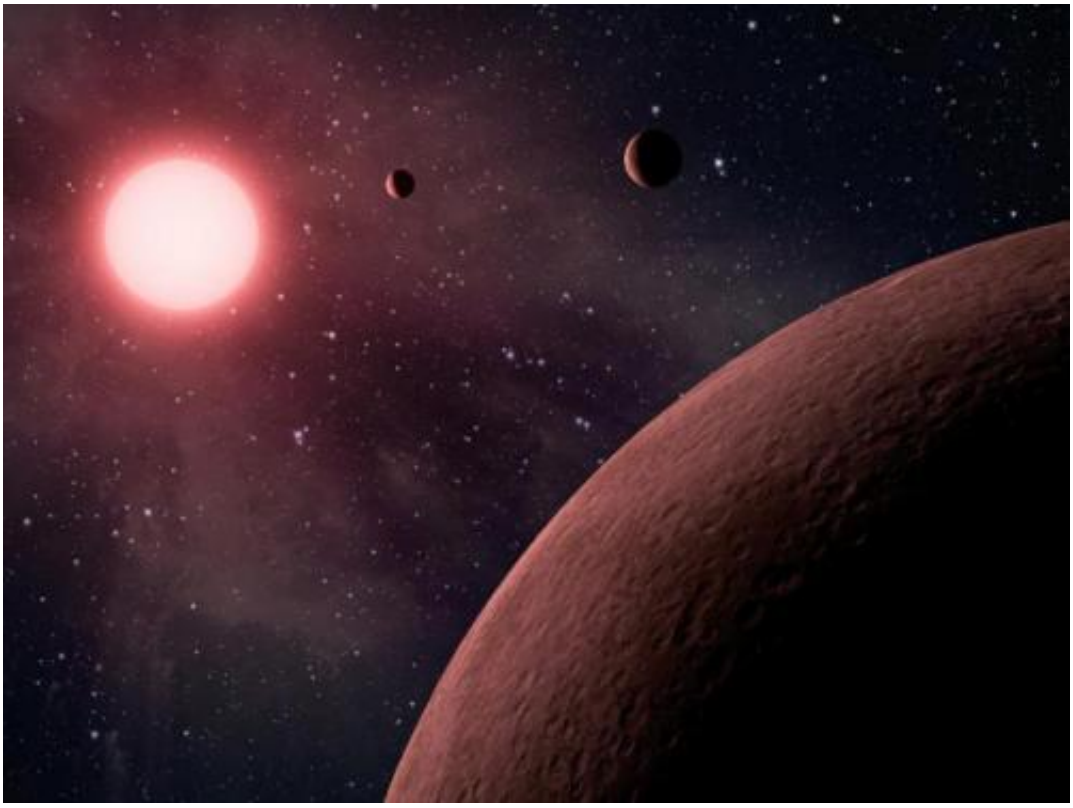

This artist's concept depicts a planetary system. Credit: NASA/JPL-Caltech

(Phys.org)—Using the SuperWASP-South Observatory in South Africa, a team of European astronomers has discovered seven new giant planets orbiting distant stars. According to a new study, the smallest of the newly detected alien worlds is about 38 times more massive than the Earth and has a radius nearly nine times greater than the radius of our planet. The

discovery is reported in a paper published on Apr. 14 on *arXiv.org*.

WASP, short for Wide Angle Search for Planets, is an international consortium conducting an ultra-wide angle search for exoplanets using the transit photometry method. The SuperWASP program employs two robotic observatories: SuperWASP-North at the Roque de los Muchachos Observatory in Canary Island, Spain, and SuperWASP-South, at the South African Astronomical Observatory, located near Sutherland, South Africa. These observatories are equipped with eight wide-angle cameras that simultaneously monitor the sky for planetary transit events, which allows monitoring of millions of stars at the same time.

A team of European astronomers led by Coel Hellier of the Keele University, U.K., used SuperWASP-South to detect some interesting planetary candidates during an observation campaign between 2006 and 2012. Then they carried out follow-up observations of these targets, utilizing the 1.2-m Euler/CORALIE spectrograph and the 0.6-m TRAPPIST photometer, both located at the La Silla Observatory in Chile, to confirm their planetary status.

"The overall task of finding transiting exoplanets is indeed challenging, as shown by the fact that most of the transit surveys have not been nearly as successful as WASP. The only survey to have found more planets is NASA's Kepler space mission, which costs 100 times more than our project. In the Southern Hemisphere, WASP-South has found over 90 percent of the exoplanets transiting bright stars," Hellier told Phys.org.

The team detected a real variety of large planets, from 'super-Neptunes' to 'hot-Jupiters'. According to the research, all of the seven alien worlds orbit distant, bright sun-like stars.

The most massive of the newly-found exoplanets is WASP-141b, a

typical 'hot-Jupiter'—a planet similar in characteristics to Jupiter, with high surface temperatures due to orbiting its parent stars very closely. WASP-141b has a mass of 2.7 Jupiter masses and is slightly larger than our solar system's biggest planet (1.2 Jupiter radii). The planet has an orbital period of 3.3 days.

With only 0.12 Jupiter masses, WASP-139b is the lowest-mass planet yet found by WASP. It has a radius of 0.8 Jupiter radii and a low density that makes this planet a good target for atmospheric characterization. WASP-139b was classified as a 'super-Neptune'—a low-mass gas planet more massive than Neptune, but smaller than Saturn.

According to Hellier, the most interesting exoplanet out of these detected by the team is WASP-140b. It is a 'hot Jupiter' with a mass of 2.4 Jupiter masses and a large radius of about 1.4 Jupiter radii. It has an orbital period of 2.2 days and notably, its orbit is significantly eccentric.

"I think that WASP-140b is the most interesting. Most 'hot Jupiter' planets are in circular orbits, since tidal interactions with their host star circularize the orbits on timescales much shorter than the ages of the systems. WASP-140b, though, has a small but definitely real eccentricity of 0.047," Hellier said.

He noted that few other 'hot Jupiters' also have eccentric orbits, but of these WASP-140b has by far the shortest timescale for circularization, estimated at only five million years. In contrast, the host star is much older and seems to be about eight billion years old.

"Thus, the planet must have moved into its current orbit very recently—so recently that it is still circularizing its orbit," Hellier noted.

Other new exoplanets described in the paper include 'warm Jupiter' WASP-130b, with an orbital period of 11.6 days, the longest yet found

by WASP; a bloated Saturn-mass planet WASP-131b; WASP-132b—one of the least-irradiated and coolest of WASP planets; and a typical bloated 'hot Jupiter' WASP-142b.

"We will likely keep observing these planets. For example, WASP-131b is a very low-density planet with a 'fluffy' atmosphere. It is a Saturn-mass planet but bloated to a larger radius than Jupiter and it also transits a bright star. This makes it an excellent target for atmospheric characterization studies," Hellier said.

More information: WASP-South transiting exoplanets: WASP-130b, WASP-131b, WASP-132b, WASP-139b, WASP-140b, WASP-141b & WASP-142b, arXiv:1604.04195 [astro-ph.EP] arxiv.org/abs/1604.04195

Abstract
We describe seven new exoplanets transiting stars of V = 10.1 to 12.4. WASP-130b is a "warm Jupiter" having an orbital period of 11.6 d, the longest yet found by WASP. It transits a V = 11.1, G6 star with [Fe/H] = +0.26. Warm Jupiters tend to have smaller radii than hot Jupiters, and WASP-130b is in line with this trend (1.23 Mjup; 0.89 Rjup).
WASP-131b is a bloated Saturn-mass planet (0.27 Mjup; 1.22 Rjup). Its large scale height coupled with the V = 10.1 brightness of its host star make the planet a good target for atmospheric characterisation.
WASP-132b is among the least irradiated and coolest of WASP planets, being in a 7.1-d orbit around a K4 star. It has a low mass and a modest radius (0.41 Mjup; 0.87 Rjup). The V = 12.4, [Fe/H] = +0.22 star shows a possible rotational modulation at 33 d.
WASP-139b is the lowest-mass planet yet found by WASP, at 0.12 Mjup and 0.80 Rjup. It is a "super-Neptune" akin to HATS-7b and HATS-8b. It orbits a V = 12.4, [Fe/H] = +0.20, K0 star. The star appears to be anomalously dense, akin to HAT-P-11.
WASP-140b is a 2.4-Mjup planet in a 2.2-d orbit that is both eccentric

(e = 0.047) and with a grazing transit (b = 0.93) The timescale for tidal circularisation is likely to be the lowest of all known eccentric hot Jupiters. The planet's radius is large (1.4 Rjup), but uncertain owing to the grazing transit. The host star is a V = 11.1, [Fe/H] = +0.12, K0 dwarf showing a prominent 10.4-d rotational modulation. The dynamics of this system are worthy of further investigation.

WASP-141b is a typical hot Jupiter, being a 2.7 Mjup, 1.2 Rjup planet in a 3.3-d orbit around a V = 12.4, [Fe/H] = +0.29, F9 star.

WASP-142b is a typical bloated hot Jupiter (0.84 Mjup, 1.53 Rjup) in a 2.1-d orbit around a V = 12.3, [Fe/H] = +0.26, F8 star.