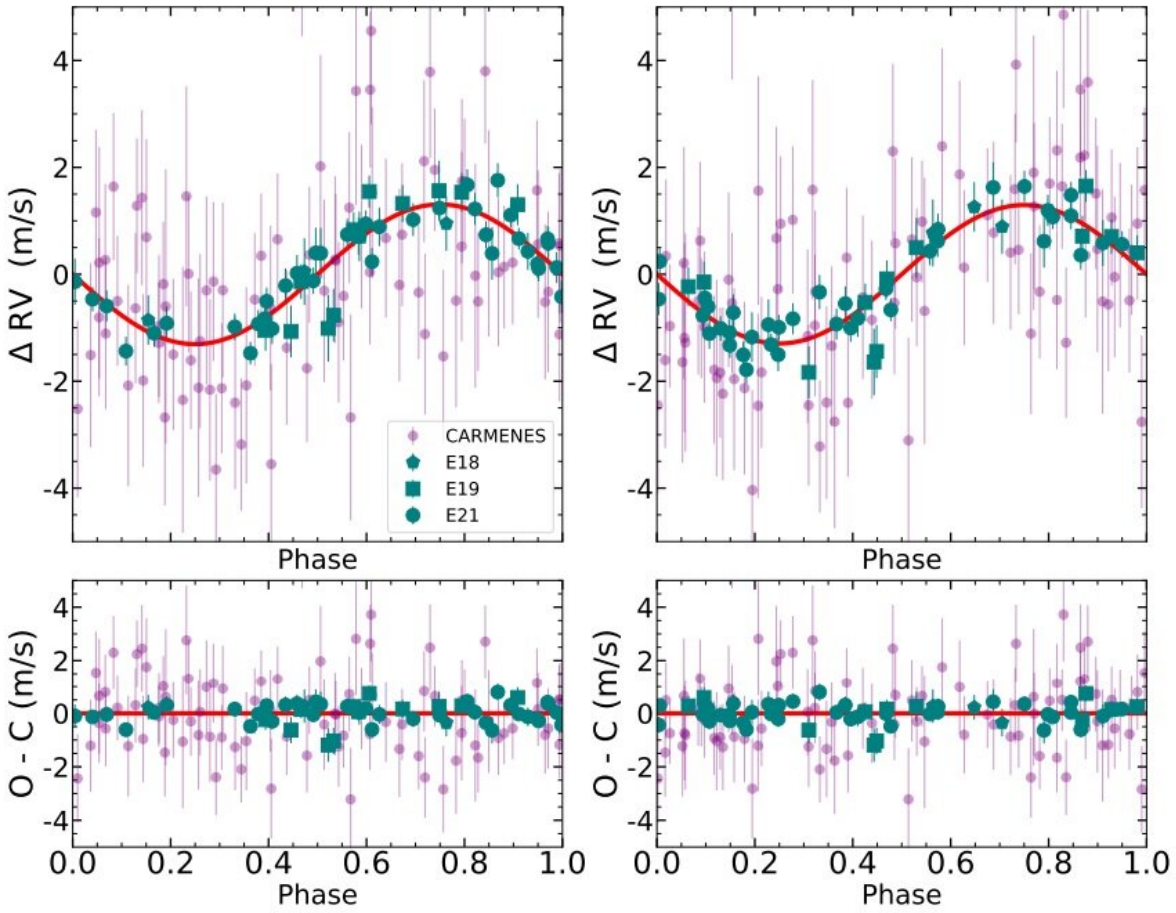
Two Earth-mass exoplanets orbiting nearby star discovered

December 21 2022, by Tomasz Nowakowski



Planetary signals. Top left panel: RVs of GJ 1002 b phase folded with a period of 10.35 days, after subtracting the activity model and the signal at 20.2 days. Top right panel: RVs of GJ 1002 b phase folded with a period of 20.2 days, after subtracting the activity model and the signal at 10.335 days. Bottom panels: Corresponding phase folded residuals. Credit: Mascareño et al, 2022

Using the radial velocity (RV) method, an international team of astronomers has discovered two new exoplanets transiting a nearby M-dwarf star known as GJ 1002. The newfound alien worlds have masses similar to that of our planet and orbit the host star in its habitable zone. The finding is reported in a paper published in *Astronomy & Astrophysics*.

The radial velocity (RV) method to detect an exoplanet is based on the detection of variations in the velocity of the central star, due to the changing direction of the gravitational pull from an unseen exoplanet as it orbits the star. Thanks to this technique, more than 600 exoplanets have been detected so far.

Now, a group of astronomers led by Alejandro Suárez Mascareño of the University of La Laguna, Spain, reports the finding of two new extrasolar planets as a result of RV measurements of the M-dwarf GJ 1002. The observations that led to the discovery were conducted with the Echelle SPectrograph for Rocky Exoplanets and Stable Spectroscopic Observations (ESPRESSO) and the Calar Alto high-Resolution search for M-dwarfs with Exoearths with Near-infrared and optical Échelle Spectrographs (CARMENES).

"We studied the nearby M-dwarf GJ 1002 using RVs and activity indicators from ESPRESSO and CARMENES. Using a joint model that combined information from the FWHM [full-width half maximum] of the CCF [cross-correlation function] and RVs into a multi-series Gaussian process, we detected the presence of two planetary signals," the researchers explained.

The newfound exoplanets received designations GJ 1002 b and GJ 1002 c. They both orbit GJ 1002 within its habitable zone and given that the star is only 15.78 light years away, the planets are among the closest to Earth that could potentially host habitable environments.

According to the paper, GJ 1002 b has a minimum mass of about 1.08 Earth masses. It orbits its parent star every 10.35 days, at a distance of some 0.0457 AU from it. The planet's equilibrium temperature was estimated to be 230.9 K.

GJ 1002 c appears to be slightly more massive than GJ 1002 b as its minimum mass was calculated to be 1.36 Earth masses. The exoplanet is separated from the host by about 0.074 AU and its orbital period was measured to be 21.2 days. The equilibrium temperature of GJ 1002 c is at a level of 181.7 K. The astronomers added that this alien world may be a good candidate for further atmospheric characterization.

The parent star GJ 1002 is a faint M-dwarf of spectral type M5.5V. It has a radius of about 0.137 solar radii and its mass is approximately 0.12 solar masses. The star's effective temperature is 3,024 K and its metallicity was measured to be around -0.25.

The researchers noted that it is possible that there are additional Earth-mass planets in the outer half of GJ 1002's habitable zone.

"The Gaia DR3 [Data Release 3] data show an excess of astrometric noise that could point to a massive companion at large orbital separation," the authors of the paper concluded.

More information: A. Suárez Mascareño et al, Two temperate Earth-mass planets orbiting the nearby star GJ 1002, *Astronomy & Astrophysics* (2022). DOI: 10.1051/0004-6361/202244991

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