Two temperate Earth-mass planets orbiting the nearby star GJ 1002
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We studied the nearby M-dwarf GJ 1002 (< 5 pc away from the Sun) using RVs and activity indicators from ESPRESSO and CARMENES. Using a joint model that combined information from the FWHM of the CCF and RVs into a multi-series Gaussian process, we detected the presence of two Earth-mass planets orbiting within the habitable zone of the star. With both planets orbiting within the HZ of their star, GJ 1002 becomes one of the closest systems with planets that could potentially host habitable environments.

Atmospheric characterisation of exoplanets is typically performed via transmission spectroscopy, which requires the planets to transit. However, there some concepts in place that aim at circumventing these limitations and at studying low-mass exoplanets even at short orbital distances, such as High Dispersion Coronography (HDC) or Nulling interferometry. Given its angular orbital distance, we estimate that GJ 1002 c is a good candidate for atmospheric characterisation via HDC spectroscopy with the future ANDES spectrograph for the ELT. The atmospheres of that planet should be observable around the oxygen absorption at 1300 nm. Both planets also fall within the range of parameters that the future space mission LIFE expects to study.

Additionally, we found long period variations in the temperature of the optical elements of ESPRESSO and CARMENES that affect the measurements of the FWHM of the CCF, most likely by changing the instrumental profile, and could be mistaken by stellar activity variations. The effect is measurable even with temperature changes smaller than 10 mK. We do not find evidence that these temperature variations affect the RV measurements in our dataset. However, it is not guaranteed that this would be the case for all RV datasets. Finding an effect like this highlights the importance of using all available information (including instrumental telemetry data) when analysing RV time-series.