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Revealing nearby Earth-mass planets with ESPRESSO

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During last decade there have been a tremendous increase in detection and characterization of low-mass exoplanets, reaching the Earth size and mass domain. ESPRESSO is an ultra-stable high-resolution spectrograph, developed by institutions from Switzerland, Italy, Portugal, Spain, and ESO, located in the combined Coud'e Lab of the VLT at ESO, and is able to operate either using one 8.2m-VLT UT or simultaneously with the four VLT UTs. ESPRESSO started routine operations in October 2018 at ESO, and is designed to achieve a radial velocity precision of 10 cm/s, thus opening the possibility to explore new frontiers in science such as the search for rocky planets and the measurement of the variation of physical constants (Pepe et al. 2021). ESPRESSO has been very successful so far in detecting and characterizing low-mass planets demonstrating the sub-m/s capabilities of the instrument, providing a unique ground-based facility with great synergy with exoplanet dedicated satellites such as Kepler (Toledo Padr'ón et al. 2020), TESS (Demangeon et al. 2021, Barros et al. 2022) and CHEOPS (Leleu et al. 2021). One of the most relevant recent achievement of ESPRESSO is the confirmation of the 11.2d Earth mass planet Proxima b in the habitable zone of Proxima Centauri, previously reported in Anglada-Escudé et al. (2016), and the discovery of the sub-Earth mass planet Proxima d in a 5.1 days orbit with a semiamplitude velocity of 40 cm/s together with a simultaneous, precise characterization of the activity of the star (Suárez Mascaréno et al. 2020; Faria et al. 2022). This discovery together with the 5yr period super-Earth planet candidate Proxima c reported in Damasso et al. (2020), composes the currently known planetary system in the nearest stellar neighbour to our Sun. Recently, we have reported the discovery of two Earth-mass planets in the habitable zone for the nearby star GJ1002 (Suárez Mascareño et al. 2023). With ESPRESSO we are opening the possibility to characterize the Earth-mass and sub-Earth-mass population of exoplanets in the solar neighbourhood. This is encouraging new detailed studies of nearby stars with current and future facilities such as ANDES@ELT (Marconi et al. 2022). In this talk I will briefly summarize the main features of ESPRESSO performance focusing on revealing the Earth-mass and sub-Earth mass planets orbiting nearby stars and future prospects.

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