Blind radial velocity searches for planets around M-dwarfs with NIRPS

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M-dwarfs and ultra-cool dwarfs are prime targets for the detection and characterization of Earth-like exoplanets in the habitable zone, owing to their small radii and low masses, which enhance the efficiency of transit and radial-velocity techniques. They are the most abundant stars in the Galaxy, and are expected to host a large population of planets. Yet, many systems in the solar neighborhood remain undiscovered, limiting the target sample for future facilities such as ANDES and PCS on the ELT.

We present NIRPS (Near InfraRed Planet Searcher), a high-resolution near-infrared spectrograph installed at the ESO 3.6m telescope, designed to overcome the limitations of optical radial-velocity surveys of these intrinsically faint stars. We describe the observing strategy and first results of the Guaranteed Time Observations WP1 program, that has now been ongoing for nearly three years, and dedicated to a blind radial-velocity search for exoplanets around nearby M-dwarfs. This program aims to (1) identify Earth-like planets best suited for atmospheric characterization in reflected light, and (2) investigate planet formation processes and their dependence on protoplanetary disk initial conditions.

First results demonstrate the capabilities of NIRPS, including sub-m/s radial-velocity precision and the recovery of the two known planets orbiting Proxima Centauri, before only accessible with ESPRESSO on an 8-m telescope. The simultaneous use of NIRPS and HARPS enables a novel approach to mitigating stellar activity, a major limitation in M-dwarf surveys, by exploiting the chromatic dependence of radial-velocity signals and combining optical and near-infrared diagnostics.

We present a synthesis of the new detections, methodological advances, and observing strategies enabled by NIRPS, and discuss its synergies with forthcoming missions. These results highlight the key role of NIRPS in expanding the census of nearby low-mass planets and preparing optimal targets for future detailed characterization.