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On the sinergy between HWO and ground-based high-resolutions spectrographs

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The atmospheric characterisation of nearby rocky exoplanets will soon become achievable thanks to the next generation of telescopes, such as the ground-based Extremely Large Telescope (ELT) and the proposed space mission Habitable Worlds Observatory (HWO).

This powerful synergy between ground- and space-based facilities will open new frontiers in the study of exoplanet atmospheres by combining reflected light measurements at low resolution from HWO with those at high resolution from spectrographs like ANDES@ELT. Together, these complementary observations will make it possible to constrain bulk compositions, temperature–pressure profiles, and key chemical tracers for nearby Earth-sized planets in the habitable zone.
Over the past 13 years, the Global Architecture of Planetary Systems (GAPS) program at the TNG has built an unparalleled legacy dataset: multiple transits (3–11 per target) for a selected sample of ~40 exoplanets, simultaneously observed in the visible and near-infrared with GIARPS (HARPS-N + GIANO-B). This unique resource serves as an essential benchmark to investigate atmospheric variability and refine retrieval techniques in preparation for the ELT era. Drawing on this expertise, our team has pushed forward the detection of atomic and molecular species in (ultra-)hot and warm gas giants. By combining our high-resolution data with archival low-resolution space spectra (e.g., HST, JWST), we demonstrate how a multi-resolution approach improves constraints on atmospheric structures and compositions.
This groundwork sets the stage for the next leap: merging the capabilities of ANDES and HWO to characterise terrestrial exoplanets in unprecedented detail, paving the way to robust constraints on potential biosignatures and for the detection of life beyond our Solar System.

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