The Era of Non-Transiting Habitable Zone Terrestrial Planets Around M-dwarfs

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Over the last decade, terrestrial planets in the habitable zones (HZs) of M dwarfs have received increasing scrutiny due to their favorable signal sizes of atmospheric molecular features, as compared to planets around G dwarfs. Together, ground-based surveys, space-based missions such as CoroT, the Kepler/K2 missions, CHEOPs and TESS have found over 3, 000 terrestrial exoplanets, but only those worlds transiting M dwarfs are suitable for atmospheric characterization with near-term facilities such as the James Webb Space Telescope (JWST). In particular, new generation radial-velocity (RV) instruments, such as HPF, NEID, ESPRESSO and CARMENES will discover several nearby, non-transiting HZ planets around M-dwarfs in the next few years. The next generation of extremely large ground-based telescopes may have the capability to directly image the nearest, non-transiting HZ M-dwarf planets using high-resolution spectroscopy to characterize their atmospheres. We will present results from our effort to model and characterize the atmospheres of non-transiting HZ planets around M-dwarfs, estimate the strength of different chemical signatures, and assess the potential detectability of those features with near-term large ground-based facilities and potential space-based near-IR mission concepts.