Characterizing Terrestrial Atmospheres with the Extremely Large Telescopes

Miles Currie, Victoria Meadows, and the VPL Team
University of Washington

Goals:

We aim to demonstrate how we can use the upcoming extremely large telescopes to search for signs of habitability and life in terrestrial exoplanet atmospheres.

Methods:

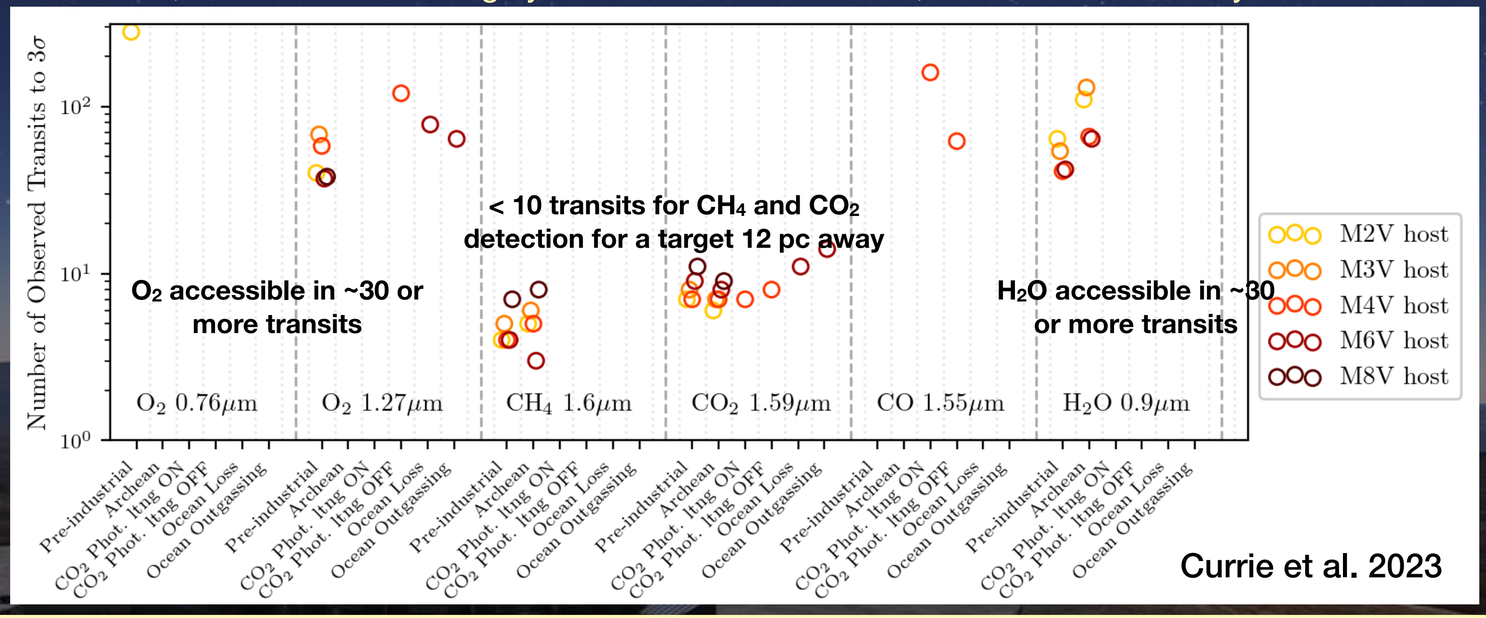
We simulate ELT observations of biosignature and environmental context molecules in terrestrial exoplanet atmospheres in the HZ of M dwarf stars, and calculate detectability using high-resolution cross-correlation spectroscopy.

Main Takeaway:

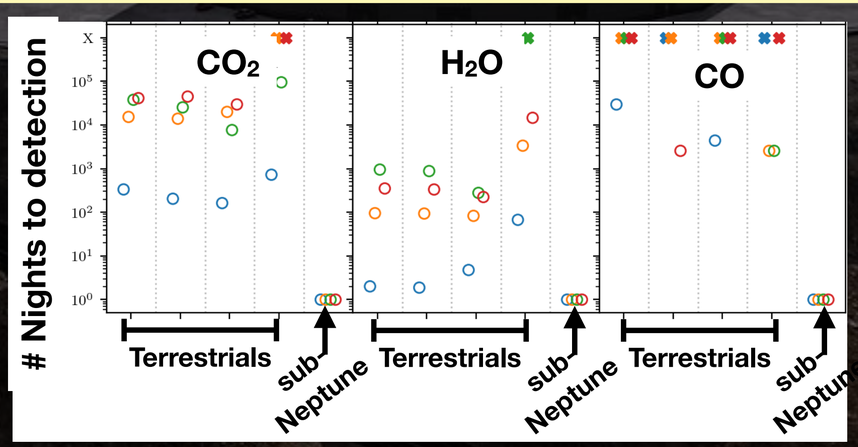
The ELTs may be used to search for biosignature pairs for both transiting and non-transiting nearby targets, and potentially rule out some biosignature false positive scenarios.

Image Credit: ESO/L.Calçadal

In transmission, CH_4 and CO_2 are highly detectable with the ELTs, and H_2O and O_2 may also be accessible.



Currie et al. 2023



Currie et al. 2024 in prep

Using reflected light observations (non-transiting targets), a few nights of ELT time could help constrain the Msin(i) degeneracy for Proxima Centauri b (the best ELT reflected light target) by either identifying or ruling out a sub-Neptune atmosphere.

Miles Currie — mcurr@uw.edu — milescurrie.com