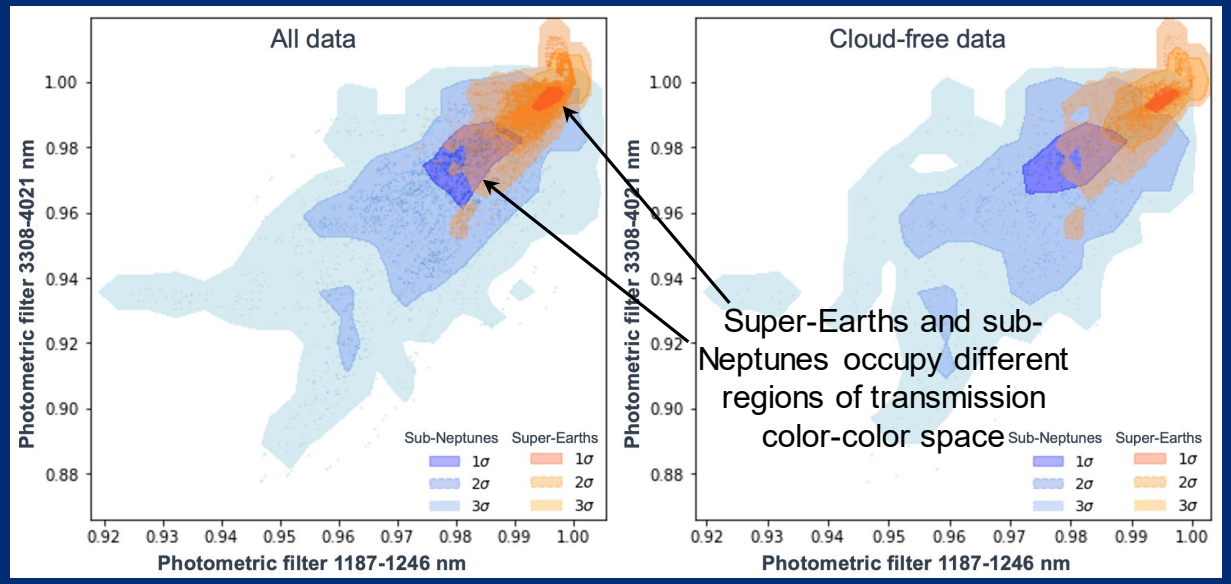
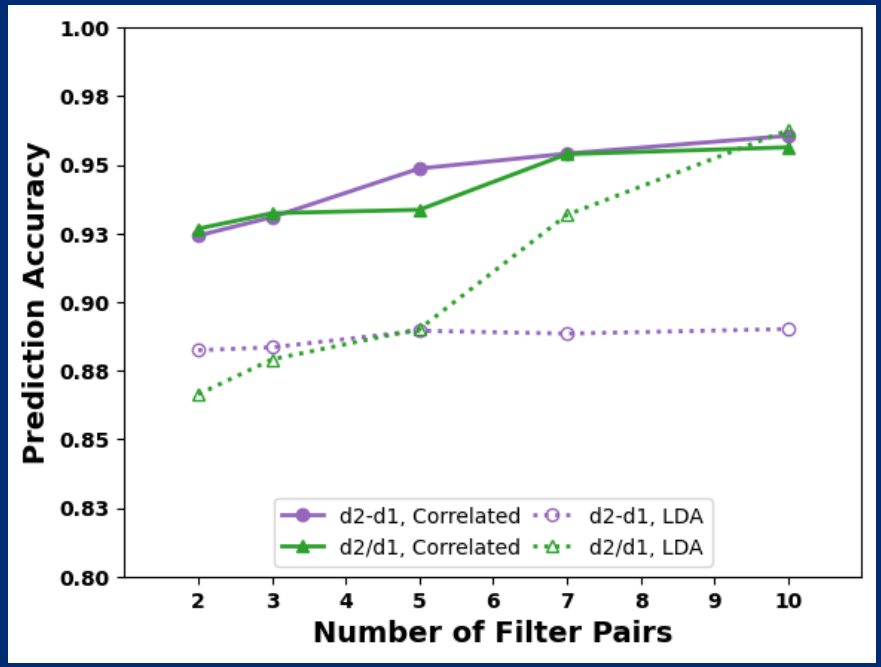
On the Utility of Transmission Color Analysis

Using color analysis of low-resolution transmission spectra to differentiate super-Earths from sub-Neptunes



Super-Earths and sub-Neptunes comprise a substantial fraction of the observed exoplanet population, and there is a bulk composition degeneracy at ~1.8 R_{Earth}, with implications for planet and system evolution. BUT collection of detailed exoplanet spectra currently requires significant time on resource-constrained telescopes like HST and JWST.



Being able to classify these planets using low-resolution transmission spectra will enable rapid characterization and system-level studies

- Atmospheric metallicity is expected to be a key differentiator between super-Earths and sub-Neptunes
- We performed a correlation analysis and linear discriminant analysis of the spectra for an array of simulated atmospheres, ranging from low metallicity (sub-Neptune) to high metallicity (super-Earths), against a transit depth (d_2-d_1) difference and a transit depth ratio (d_2/d_1)

Just a few specific near-infrared filters can be used to differentiate between super-Earths and sub-Neptunes, with ~93% accuracy for noise-free spectra

K.S. Sotzen, K.B. Stevenson, E.M. May, et al. (2021), The Astronomical Journal, Vol. 162, No. 4. https://doi.org/10.3847/1538-3881/ac0e2c