Atmospheric characterization of two TESS mini-Neptunes formed in the same protoplanetary nebula using Hubble

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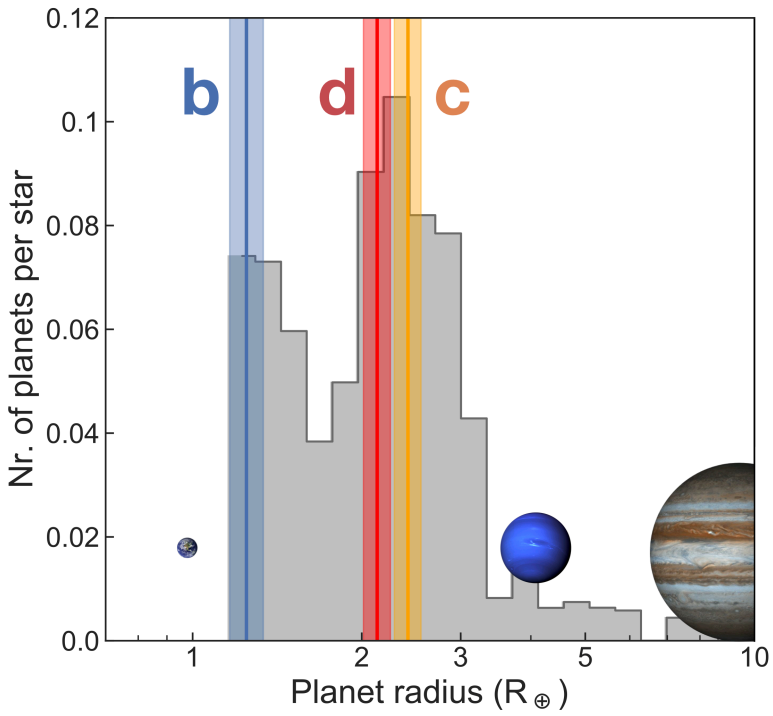
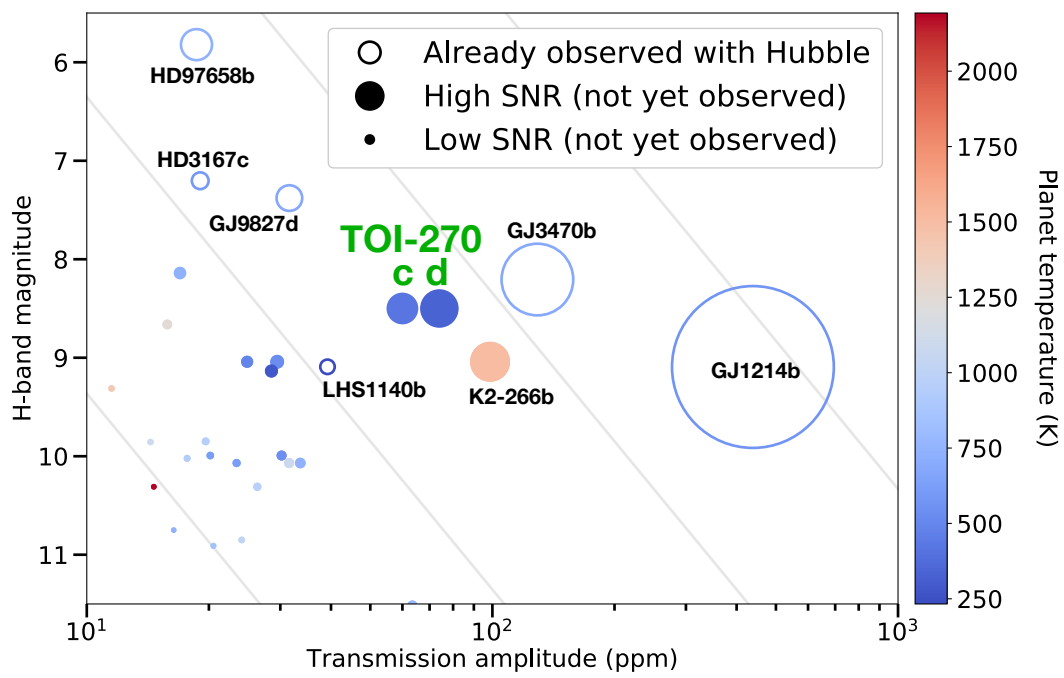
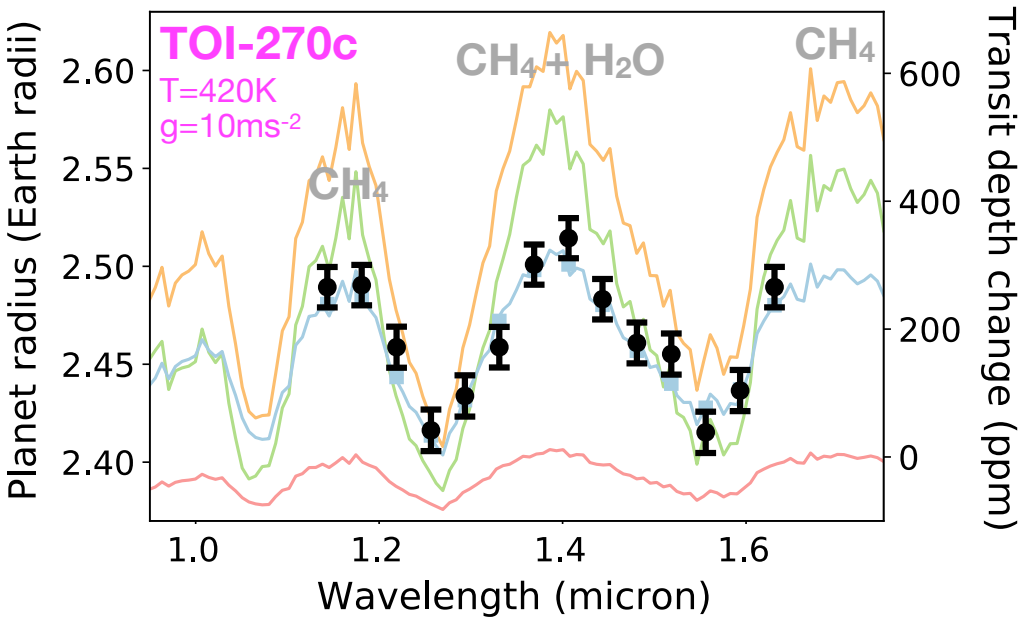
The TESS mission recently uncovered a remarkable multi-planet system consisting of a super-Earth and two temperate mini-Neptunes around the bright M3 dwarf star TOI-270 (Günther *et al.*, 2019). We will acquire near-infrared transmission spectra for the two mini-Neptunes (TOI-270 c&d) using HST WFC3 as part of GO-15814 (PI: T. Mikal-Evans).

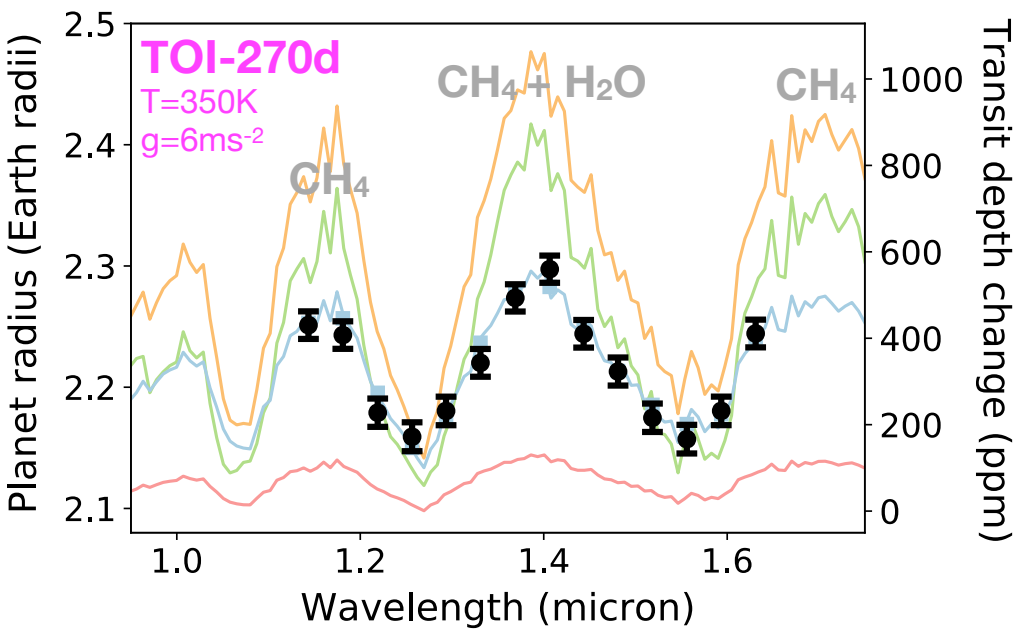


Radius distribution for planets with orbital periods <100 days, adapted from Günther *et al.* (2019). Colored vertical bars show radii of the three TOI-270 planets. TOI-270b is a super-Earth that likely has a predominantly rocky composition with a thin atmosphere, while **TOI-270 c&d are exemplary mini-Neptunes**, likely having thick H_2-dominated atmospheres suitable for transmission spectroscopy with HST.



Known transiting planets with radii $<4R_\oplus$ as a function of host star brightness and 1 pressure scale height transmission signal. Circle size gives relative SN between targets, with unfilled circles indicating planets already observed with HST. Slanting gray lines show constant SN contours to guide the eye. **TOI-270 c&d are the best unobserved mini-Neptunes with temperatures below 1000K.**





Transmission spectrum models assuming chemical equilibrium and different metallicities. Synthetic WFC3 data points with anticipated measurement uncertainties of 30ppm are also plotted. **Prominent spectral features due to CH_4 and H_2O may be detectable at high SN for metallicities <1000x solar.**

Photochemical haze could be present in one or both atmospheres. If so, our observations will provide **a unique test of how photochemical haze production correlates with incident UV flux and planet temperature**, given that both planets orbit the same star.

1*x* solar
10*x* solar
100*x* solar
1000*x* solar

To learn more about the TOI-270 system:

Günther et al., 2019, *Nature Astronomy*, DOI: 10.1038/s41550-019-0845-5