Strange New Worlds: R. K. Kopparapu1,2,3, 1NASA Goddard, 2Sellers Exoplanet Environment Collaboration, 3Virtual Planetary Laboratory

Introduction: In the search for exo-Earth candidates, we have, and continue to, detect a multitude of exoplanets that are not found in our Solar system. The most common type of planets in our Galaxy are objects between the size of our Earth and Neptune, which are not found around the Sun. Furthermore, these planets are found around a variety of stellar spectral types, at varying distances, indicating different formation mechanisms, and distinct atmospheric physics.

I will discuss a classification scheme for exoplanets in planetary radius and stellar flux bins, based on chemical species’ condensation sequences in planetary atmospheres. The order of condensation of these species represents the order in which the boundaries of classification scheme are defined.

Fig. 1: The boundaries of the boxes represent the regions where different chemical species are condensing in the atmosphere of that particular sized planet at that stellar flux, according to equilibrium chemistry calculations. The radius division is from Fulton et al. (2017) for super-Earths and sub-Neptunes, and from Chen & Kipping (2016) for the upper limit on Jovians.

In the near-term, transit spectroscopy characterization of terrestrial planet atmospheres is within reach with JWST. The transit method has a dramatic bias toward the detection of planets that are closer to the host star than farther away. Consequently, “Venus zone” was proposed, where inner boundary uses the atmospheric erosion limit, and the outer boundary in terms of the runaway greenhouse limit (Kane et al. 2014).

I will provide updates to Venus zone limits for planets around M-dwarf stars, considering recent results from 3-D climate models and different planetary masses.

References: