Thorngren, Daniel
The Metallicity of Giant Planets

Given their common origins, we expect that the composition of planets and their parent stars are connected. However, observational verification of this has been limited to a handful of exoplanets. We examine a sample of nearly 40 giant transiting exoplanets whose equilibrium temperatures are low enough (<1000 K) that they don’t exhibit the hot Jupiter radius inflation effect, making them amenable to structure modeling. Matching 1-D thermal evolution models to the planets’ mass, radius, age, and stellar insolation, we calculate their bulk metallicity Z_planet, and compare it with the stellar Z (derived from stellar [Fe/H]). We examine several trends in the results. Most significantly, metal enrichment relative to the parent star consistently decreases with mass, and we examine possible explanations for the remaining scatter. We also note other patterns in the metal content, confirming the observation of a roughly 10 Earth-mass minimum for heavy elements. However, we do not observe a previously suggested pattern in heavy-element mass against stellar metallicity. Our results shed light on planetary formation models, and can be used to constrain and verify population synthesis models.