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The impact of exoplanets' measured parameters on the inferred internal structure.

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Exoplanet characterization is one of the main foci of current exoplanetary science. For super-Earths and sub-Neptunes, we mostly rely on mass and radius measurements, which allow to derive the body's mean density and give a rough estimate of the planet's bulk composition. However, the determination of planetary interiors is a very challenging task. In addition to the uncertainty in the observed fundamental parameters, theoretical models are limited due to the degeneracy in determining the planetary composition. We aim to study several aspects that affect internal characterization of super-Earths and sub-Neptunes: observational uncertainties, location on the M-R diagram, impact of additional constraints as bulk abundances or irradiation, and model assumptions.

We use a full probabilistic Bayesian inference analysis that accounts for observational and model uncertainties. We employ a Nested Sampling scheme to efficiently produce the posterior probability distributions for all the planetary structural parameter of interest. We include a structural model based on self-consistent thermodynamics of core, mantle, high-pressure ice, liquid water, and H-He envelope.

Regarding the effect of mass and radius uncertainties on the determination of the internal structure, we find three different regimes: below the Earth-like composition line and above the pure-water composition line smaller observational uncertainties lead to better determination of the core and atmosphere mass respectively, and between them internal structure characterization only weakly depends on the observational uncertainties. We also find that using the stellar Fe/Si and Mg/Si abundances as a proxy for the bulk planetary abundances does not always provide additional constraints on the internal structure. Finally we show that small variations in the temperature or entropy profiles lead to radius variations that are comparable to the observational uncertainty. This suggests that uncertainties linked to model assumptions can eventually become more relevant to determine the internal structure than observational uncertainties.