Post-formation H-He envelopes in super-Earths

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Out of the more than 5000 detected exoplanets a considerable amount belongs to a group that is not found in the solar-system. Improving our understanding of planets that fall within the mini-Neptune or super-Earth category has thus become more relevant. One hypothesis is that these planets, when they have the right amount hydrogen, can have a layer of liquid water underneath a primordial atmosphere. In order to have liquid water at the core-envelope boundary, a planet must have a hydrogen envelope within a certain range of pressures (Mol Lous et al. 2022). We aim at better understanding the likelihood that planets with such an ideal amount of primordial envelope forms. In addition to that we want to improve the general understanding of primordial gas accretion for planets that do not reach the runaway gas accretion phase. To this end we apply formation models that include different solid accretion rate prescriptions. We consider that the envelope can be enriched by the accreted solids (following Valletta & Helled, 2020). We study how different assumptions and parameters influence the final envelope to core ratio. We find that the amount of accreted hydrogen and helium notably depends on the assumed solid accretion model. When envelope enrichment is accounted for in the formation models this can either promote the accretion of primordial gas (through a decrease in mean molecular weight) or hinder it (through increased opacities).