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Mass-Radius relationships of small, highly irradiated exoplanets with small water mass fractions

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This work aims to determine the mass-radius rela-tionships of highly irradiated (500< Tirr<2000K)small planets ($0.2<M<2.3M$□) with water con-tents up to 5%. To do so, we coupled an internalmodel of small terrestrial planets (Brugger et al.,2017) to the atmosphere model elaborated by Marcqet al. (2017, 2019), following the approach depictedin Aguichine et al. (2021) and Mousis et al. (2020).

We show that these planets, even with smallwater contents, can become strongly inflated andproduce large radii for small masses.We alsoshow that strongly irradiated small planets cannotsustain their atmospheres due to the lack of hy-drostatic stability, implying they cannot preserveany hydrosphere. The temperature and the watermass fraction are the key parameters controllingthe extent of inflation and the thickness of thesupercritical layer. An important amount of wateralso leads to the contraction of the rocky interior.However, the composition of the rocky interioronly has a limited impact on the final mass-radiusrelationship, and barely impacts the behavior of thehydrosphere.