



## **Mercury's inner core size and core crystallization regime**

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Earth-based radar observation of Mercury's rotation vector combined with gravity observation by the MESSENGER spacecraft yield a measure of Mercury's moment of inertia and the amplitude of the 88-day libration of its silicate shell. These two geodetic constraints provide information on Mercury's interior structure, including the presence of a fluid core, the radius of the core-mantle boundary and the bulk densities of the core and mantle. In this work, we show how they further provide information on the size of the solid inner core and on the crystallization regime of the fluid core. If Mercury's fluid core is a Fe-FeS alloy, the largest inner core compatible with geodetic observations is  $1325 \pm 250$  km. The crystallization scenario that best fits the observations involves the formation of Fe-snow within the fluid core. Snow formation can be restricted to a thin layer or can occupy the whole of the fluid core depending on inner core size and initial sulfur concentration. Our results offer important constraints for dynamo models of Mercury, but also advocate for the further development of models that incorporate the various features of snow formation.