Constrainst on Mercury's core size and composition. Attilio Rivoldini[1,2], Tim Van Hoolst[1]. [1]Royal Observatory of Belgium, Avenue Circulaire 3, B-1180 Brussels, Belgium (Attilio.Rivoldini@oma.be), [2]Université Catholique de Louvain, Earth and Live Institute, Georges Lemaître Centre for Earth and Climate Research, Louvain-la-Neuve, Belgium

Introduction: The recently determined global gravity field of Mercury by the MESSENGER mission [1] and the accumulated radar measurements about the spin state of Mercury [2, 3] provide important constraints on its interior structure. By combining both data sets the moment of inertia of Mercury and of its silicate shell have been determined reliably for the first time. Both are expected to provide constraints on Mercury's core radius and on the core's light elements concentration. In this study our aim is to determine to what precision those two parameters can be obtained by using Mercury's mass, its global moment of inertia, and the moment of inertia of its outer silicate shell.

Method: The aim of this study is to constrain with the mass and both moments of inertia (global and of the silicate shell) the density and thickness of Mercury's crust, the density of its mantle, and the radius, and sulfur concentration in its core. The temperature inside the core is assumed adiabatic and is calculated from the temperature at the core-mantle boundary which is a parameter of our model. We assume that sulfur is the only light element in the core and calculate the core's pressure- and temperature-dependent thermoelastic properties following [4]. Moreover, we only seek for models that allow for an inner core. To model the size of the inner core we use recent data on the melting temperature of iron-sulfur.

In order to infer knowledge about the model parameters from the data we use a Bayesian inversion method [5]. The result of this method is a probability density functions on the parameters of the model. From the probability density function we calculate marginal densities and estimate parameter values and regions of occurrence.

Results: Fig.[1] represents the relation between the core sulfur concentration and the core radius. At 1σ the models have a core radius that is in a range of $[1890, 2035]\mathrm{km}$ and have an associated sulfur concentration that is smaller than about $6.5\mathrm{wt}\%$. However, models with larger cores that have more sulfur are also possible. The largest sulfur concentration in the retained models correspond to the largest value yielding an inner core and depends on the core-mantle boundary temperature and pressure and on the iron-sulfur melting temperature.

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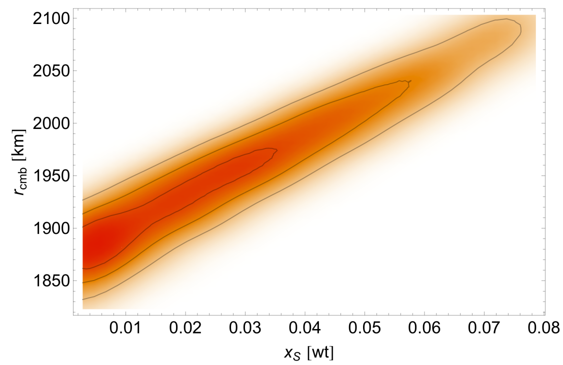

Figure 1: Inferred probability density function on core radius r_{cmb} and core sulfur concentration.

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