Effects of inelasticity of the Martian interiors

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Because of the inelasticity of the Martian interiors Phobos is decelerating in its orbit and it is drifting towards the planet. The mantle inelasticity (more accurately, the ineleasticity of the lower part of the mantle) determines the tidal lag. So the dissipative factor of the Martian interiors is determined by the data on the tidal delay of Phobos. The value of tidal Love number k_2 is known from the observations of the solar tide on Mars (Yoder et al., 2003) and equal to 0.149. The values of the Love number k_2 impose strong new constraints on the model of the planet. Because of the inelasticity of the interiors k_2 contains both elastic and inelastic components while the models of the Martian interior are elastic Our main task is to estimate the value of the correction introduced to the Love number due to the inelasticity of the interiors. The corresponding discussion has performed in this study demonstrates that k_{2S} = 0.145 increases by several thousandths when the inelasticity of Mars is taken into account. Yoder et al. (2003) adopted an inelastic correction of 0.004. Our discussion of this question shows that this correction can be both somewhat higher (about 0.005) or slightly lower (about 0.003). The practical importance of this question for the construction of the interior structure model of the planet follows from the fact that a decrease in the inelastic correction results in an increase in k_{2S} and, hence, in an increase in the model radius of the planetary core by about 100 km. The converse is also true. Because of many uncertainties in this question, we think that it is reasonable to leave this correction (0.004)without any change. But one should keep in mind that the mean value of k_{2S} equal to about 0.145 can be either 1-2 % greater or smaller.