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On the ellipticity of the Martian core-mantle boundary

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The core-mantle boundary flattening of efficient equilibrium Martian interior structure models e^{-1} is in the range of 230-260. The figure of Mars significantly deviates from hydrostatically equilibrium state. To calculate corrections to the value of core-mantle boundary flattening for two types of models: an elastic model and a model with some liquid or weakened layers (relaxed values of shear moduli), the joint analysis of second-degree harmonics of the topography and the nonequilibrium part of the gravitational potential of the planet has been made. Considering Mars as an elastic sphere, the anomalous density field is represented in the form of two weightable thin layers positioned on the surface and on the interior level - the crust-mantle interface (i.e., the "Moho") and expanded in terms of spherical harmonics, the amplitudes being selected so that the anomalous gravitational field can be produced. The problem is reduced to the determination of Green's response function for the case of a single anomalous density wave (ADW) located at two depth level. The gravitational response functions, the so-called loading coefficients (load factors) , generated by surface density anomalies and produced by deeply buried density anomalies have been numerically calculated for a set of interior structure models. The models used for the calculations differ by both the thickness and the density of the crust and as a consequence, the radius of the core. We tested values of 2.7-3.2 g/cm^3 for crustal density (or different crust mantle density contrasts) and the crustal thickness were taken to be 50 and 100 km, to determine the effect on estimated parameters. To calculate the amplitudes of ADW, the data on martian topography (Smith et. al., 2001) and gravity (Lemoine et al., 2001; Konopliv et al., 2006) have been used. Only unequilibrium components of gravity and topography fields have been considered: surface relief (or topography) was referenced to the standard equilibrium spheroid in the first approximation, and the hydrostatically equilibrium field of Martian spheroid was subtracted from the full potential. Using

the amplitudes of ADW as boundary conditions the displacements at the mantle-core boundary and the ellipticity of this level have been estimated. The displacements along the polar axis are in the range of 420-480 m, and about 690-710 m, being negative in the equatorial plane. The ellipticity (dynamical flattening) e^{-1} is estimated to be about 260-270.