Analytical three layer models, figures and gravitational moments of the Jupiter's Satellites Io and Europe.

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Two types of the trial three-layer models of the satellites Io and Europe are constructed. In the first-type models Io l and El the cores are assumed to consist of the Fe-FeS eutectic melt of the densities ρ_1=5.15 g/cm^3 (Io l) and ρ_2=5.2 g/cm^3 (El) characteristic of the conditions at the satellites cores. In the second-type models Io3 and E3 the cores consist of FeS with the admixture of nickel and are of the density ρ_1=4.6 g/cm^3. Our approach used here differs from that used previously both in the model chemical composition of the satellites and in the boundary conditions applied in the models. An important question to be answered in the Galilean satellites internal structure modeling is that of the condensate composition in the epoch of the Jupiter system formation. Jupiter's core and Galilean satellites formed of the condensate substance. The formation of Ganymede and Callisto took place sufficiently far from Jupiter in the zones with the temperatures below water condensation temperature thus water having been fully incorporated into these bodies, whose modeling showed the mass ratio of the icy component to the heavy component I/TK is about 1. The question of the TK-component composition must be clarified by the Io and Europe modeling. The second-type models Io3 and E3, in which the satellites cores consist of FeS, yield the cores to be as great as 25.2 % (Io3) and 22.8 % (E3) by mass. In discussing the TK-component composition here we note that the theoretical TK-component mass in the core amounts to about 25.4 % of the mass of the satellite with the possible FeS+Ni core. In this case such an important parameter as the mantle silicates iron saturation is Fe # =0.265. The Io3 and E3 models fit in well with this theoretical prediction. The first- and the second-type models are notably different in core radius, thus allowing the geophysical exploration of Io and Europe to clarify, in principle, the TK-component composition in the zone of formation of the Jupiter system. Another problem investigated here is that of the error made in constructing the Io and Europe models in the case the Radau-Darwin formula is used in the transition from the Love number k_2 to the non-dimensional polar moment of inertia C. The Radau-Darwin formula underestimates C by one and a half unit in the third digit in the third sign for Io. For Europe this effect is three times smaller in approximate correspondence with the ratio of $\alpha_{Io}/\alpha_{Europe}$ about 0.4 of the parameters of smallness for the satellites under consideration. The modeling of the satellites internal structure reveals strong dependence of the core radius on both the mean moment of inertia I^* and k_2. For this reason the above mentioned discrepancy in C for Io must be regarded rather noticeable.