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METHOD OF ANALYSIS OF EXISTANCE OF THE ZONES OF LOWER SEISMIC VELOCITIES OF PLANETS AND SATELLITES

Yury Barkin[1*], Hideo Hanada[2], Mikhail Barkin[3]

[1]Sternberg Astronomical Institute, Moscow, Russia, [2]Astronomical Observatory of Japan, Mizusawa, Japan, [3]Moscow Aviation Institute, Moscow, Russia

In connection with the planned space missions to the Moon and Mars to study the internal structure of these celestial bodies by seismic methods seem to be very relevant theoretical studies of possible features or internal structures of these celestial bodies. The mechanism of forced oscillations of the core and mantle of the celestial bodies and study of their geodynamic and geophysical consequences gives us opportunity to study some inner structures of the Earth, the Moon and Mars and some others celestial bodies (in particular the zones of lower seismic velocity).

The mechanism of forced relative oscillations, displacements and rotations of shells of given celestial body under the action of the gravitational attraction of external celestial bodies [1] in the last decade has attracted wide attention of specialists in various geosciences and planetary science. On the base of this geodynamical mechanism and model some fundamental problems of geodynamics and celestial mechanics, geology, geodesy and geophysics have been solved in last 10-15 years. Here we study the possible role of forced relative oscillations of the core and mantle of the Earth and Mars, some satellites of Jupiter and Saturn in the formation of the shell structures (layers) of these celestial bodies. First and foremost, the existence and nature of the zones of low seismic velocities (LVZ), as well as the zones of the extreme radial deformation of the spherical layer of the mantle. For the Earth and Mars the zones of low seismic velocity correspond to the spherical zones of the mantle for which the displacements of the particles due to gravitational action of displaced core are either small or absent and the change in directions of radial displacements is observed.

Our results suggest that for the Earth, the origin of the low-velocity zone and its position (with mean depth about 144 km) is determined by the mechanism of forced displacements of the Earth's core. A similar low-velocity zone at about 300 km depth we have been predicted for Mars. The style of deformations of the mantle layers of the Mars and the Earth (and probably for Venus) have much in common. Therefore the existence of the low-velocity zone of the planet Mars, at a depth of 300 km, seems quite real. Similar studies we fulfill now for some synchronous satellites of Jupiter and Saturn (Io, Ganymede, Europa, Titan, Enceladus, etc.) to identify zones of extreme radial deformations that occur during forced relative radial oscillations of the shells. In the report the preliminary findings on the positions situation of the zones with extreme largest deformation and the zone in which the deformations are small or absent are discussed.

References:

[1] Barkin Yu.V. (2002) Proc. of the Section of Earth Sciences, Russian Academy of Natural Sciences. Moscow, VINITI. No. 9, C. 45-97. In Russian.

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