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Multi-parametric analysis of the lunar internal structure based on space data

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Abstract

© SGEM2017 All Rights Reserved. Numerous space agencies and powers have announced their plans on lunar exploration for the next years. The main purposes are preparation and creation of long-term scientific, technological, experimental, and industrial bases on the near side of the Moon and in the areas of the lunar poles for conducting scientific experiments and investigating lunar bowels. The American space agency (NASA) has published the most detailed for today map of the lunar South Pole. The new data has been collected by the “Lunar Reconnaissance Orbiter” (LRO) spacecraft which is currently travelling around the Earth’s artificial satellite’s polar orbit (i.e. orbit with 900 inclination). The spacecraft is moving 45 km above the lunar surface which is lower than in any of previous missions. This fact alongside with the high-quality equipment has allowed “LRO” to obtain the most detailed map of the polar area. Particularly, the spacecraft has managed to find traces of hydrogen in the South Pole craters. In the present work we are discussing geophysical parameters, geometric and dynamic compression of the liquid core and elastic mantle of the multi-layer Moon. The lunar internal structure, including the lunar liquid core, is considered; an analytical solution of Clairaut’s equation for determining geometrical compression of the two-layer Moon model is obtained; mathematical and bifurcation analyses of the solution for the problem’s physical parameters are conducted; the software for computer simulating of different radiuses, densities, and values of geometrical compression is developed. These estimates are necessary for free librations of the lunar layers investigations and for the development of lunar laser ranging and radio interferometry in the international cooperation of space powers in the fields of both observations and processing and interpretation of observational data. Such investigations require development of adequate theoretical provision for modern technologies. In the present work relativistic effects of the Earth-Moon system rotation and the latest achievements in geophysics and selenophysics are taken into account.

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Keywords

Lunar internal structure, Lunar laser ranging, Selenodesy, Space astronomy, Space missions

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