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Simulating the star tracks in the field of view of the Lunar polar telescope of the ILOM project in dependence on the Lunar dynamical figure

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The measurement of the rotation of the Moon is one of techniques to get the information of the internal structure of celestial body. The Lunar Laser Ranging (LLR) has given unprecedented data on the lunar rotation, and gives some proposals of the state of the core. In situ Lunar Orientation Measurement (ILOM) is an experiment to measure the lunar physical librations in situ on the Moon with a small telescope which tracks stars. Simulating the trajectory of stars due to the lunar rotation observed by the ILOM-telescope in the polar region was already made by using numerical theory DE405 (Noda et al., 2008).
We have executed calculations of libration tracks of stars on the basis of analytical libration theory (Petrova, 1996; Chapront et al, 1999). It allowed us to do simulating for various models of Lunar gravity field (Lunar dynamical figure). We used dynamical figures constructed on the basis of data received in the current mission Kaguya (SELENE), and then we compared the results with calculations with other dynamic models constructed on the data obtained by the Clementine (GLGM-2) and the Lunar Prospector (LP150Q). The differences between the models GLGM-2, LP150Q and the Kaguya model are larger than 10 milliseconds of arc. This means that proposed accuracy of ILOM observations - 1 millisecond of arc will be enough to improve many parameters of the Lunar interior. In particular, residual estimations will allow to detect small amplitudes of free libration caused by a liquid Lunar core and to estimate its characteristic, first of all - core's ellipticity.
All calculation and comparisons, graphic presentation were executed in the VBA environment for MS Excel.
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