# MODEL OF THE LIBRATION ZONE OF THE MOON IN THE SYSTEM OF THE FUNDAMENTAL STAR CATALOG

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**Introduction:** The libration zone of the Moon has not yet been studied accurately enough due to its inaccessibility to direct observations. Nevertheless, while studies on the movement in space of the center of mass of the Moon are being performed and selenodetic reference networks are being created, the construction of accurate models of the lunar relief will not lose its relevance [1–8]. Positional observations make it possible to determine the coordinates of the center of the Moon's figure, which, as it is well known, does not coincide with the center of mass. A difference of up to 0.5" (selenocentric coordinates) can result from the influence of the above factors. In addition, this value is a variable depending on the optical libration. When taking positional observations, the location of the center of the Moon's disk, i.e. approximating circle, can be calculated from the coordinates of a large number of points on its edge, and if we assume that the influence of the microrelief is considered as a random variable obeying the law of normal distribution, the coordinates of the center of mass can be determined by the method proposed in [9].

**Methods:** The method for creating a digital model of the libration zone of the Moon (DMLZM) is based on the reduction of positional observations [10], when it is impossible to obtain simultaneously a large number of coordinates of points in the libration zone. Therefore, when building DMLZM, adaptive regression modeling is used. The final version of DMLZM should allow accounting for: 1) mutual position of the center of mass and the center of the figure at the moment of observation; 2) errors arising due to the unaccounted influence of the microrelief of the libration zone at the point of observation, which can be as great as several seconds. Therefore, to take into account the irregularities of the edge of the Moon's disk with simultaneous reduction to the center of its mass, models of the relief of the libration zone are used.

**Results:** On the basis of large-scale images of the Moon with stars, a model of the libration zone of the Moon was built in the system of the fundamental catalogue of stars. The studies have shown that the model data center is close to the lunar ephemeris center of mass given by the DE423 theory (created in 2010, includes nutations and librations). It should be noted that, despite a significant number of images of the Moon (over 80 nights of observations), the coordinate plane in some parts turned out to be insufficiently provided with observations, especially in areas near the poles of the Moon.

**Conclusions:** The model of the libration zone of the Moon was studied based on photoelectric observations of the occultations of stars by the Moon using the method described in [11]. The results of this study showed that the weighted average value of $\Delta R = (R_{*\leftarrow} - 932.58")$, where $R_{*\leftarrow} = -0.004" \pm 0.593"$ is topocentric distance between the Moon's center of mass and a star at an average distance from the Earth, and the offset of the center of map data from the center of mass of the Moon, given by the theory of motion DE423, is about 0.1". The constructed model can be used to successfully solve problems related to the orbital motion of the Moon [12], since it is necessary to know the exact position of its center of mass, whose determination from observations is difficult due to the influence of the relief of the libration zone, the nature of mass distribution in the Moon [13], and its rotational parameters [14, 15].

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