

# INVESTIGATION OF THE PARAMETERS OF THE LUNAR MANTLE WITH THE PURPOSE OF CREATING A HIGH-SPEED SEISMIC MODEL OF THE LOWER MANTLE

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**Introduction:** One of the means of investigating the internal structure of the Moon is the study of seismic observations. Such observations were taken during the Apollo space missions. This work is focused on determining the structure of the silicate mantle (M\_E) according to the high-speed seismic model of the lower mantle [1]. A comparative analysis of the obtained data with the seismic model [2] was carried out.

**Methods:** The basis of the method used in this work is the assumption that the Moon has a five-layer internal structure: an iron core, lower M\_E, middle M\_E, upper M\_E mantles, and crust [3]. The core size is determined in the process of building the model [4]. It is believed that material composition (MC) is homogeneous in content [5]. Это касается и плотности вещества и насыщенности оксидов (SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, FeO, Si = MgO, CaO) для каждой j-й области мантии. This also applies to the density of matter and the saturation of oxides (SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, FeO, Si = MgO, CaO) for each j-th region of the mantle. MC does not correlate with depth and density inversion at the region boundaries either.

**Results:** In this work, a model of the internal structure of a previously homogeneous Moon, which is heterogeneous due to melting processes, is studied. This uses data on internal seismic velocities determined by other researchers when creating seismic models and takes into account the fact that the zonal structure of the lunar mantle is a lunar model built using modern approaches and algorithms to reduce high seismic velocities in the lower M\_E. The reconstruction of the material composition and planetophysical properties of the lunar mantle is based on the inversion of seismic and gravitational constraints of the Monte Carlo method.

**Conclusions:** As a result of this study, based on regression modeling, the internal structure of the Moon was studied for a high-speed seismic system [6]. The main specific results are as follows: 1) the Moon's mantle is differentiated into layers according to the material composition, but with different zonal concentrations of CaO, FeO and Al<sub>2</sub>O<sub>3</sub>; 2) physically and chemically substantiated densities and seismic velocity gradients for three M\_E were determined; 3) the physical properties of M\_E and the phase composition were studied using the Gibbs free energy minimization method and state expressions in the 5-element system SiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub>-FeO-MgO-CaO; 4) the values of seismic velocities and the saturation of the presence of basic oxides in 3 zones of the mantle were calculated; 5) the final stage of the work was the assessment of the size of the inner core of the Moon. The results of the work can be used in research in the field of selenography [7–10], in the development of stochastic methods of analysis [11–12] and in the study of the dynamic properties of the lunar body [13–15].

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