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REVIEW

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A REVIEW OF THE MONOGRAPH BY J.J. SMULSKY "A NEW ASTRONOMICAL THEORY OF THE ICE AGES" (Riga, Latvia, Lambert Academic Publishing, 2018)

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In a review of the monograph "A New Astronomical Theory of the Ice Ages" by J.J. Smulsky, the main principles of this theory are outlined. The structure of the book and its main conclusions are discussed.

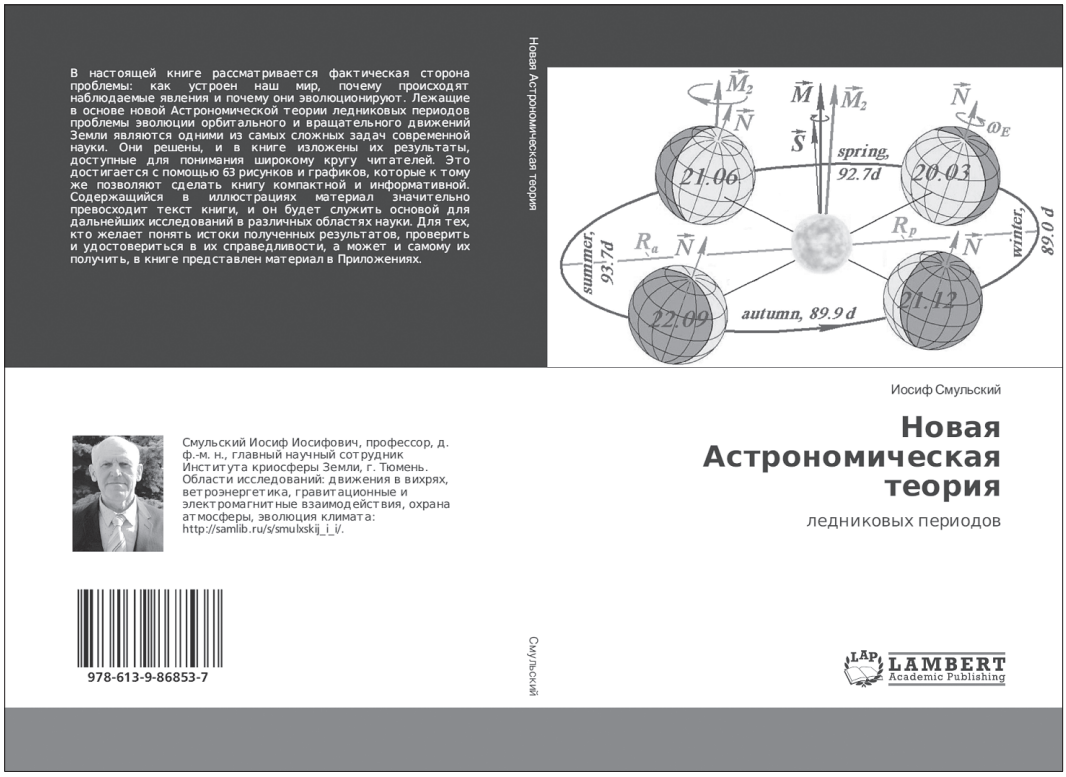
Earth's orbit, axis of rotation, insolation, climate changes, ice ages

In the middle of 2018, a monograph by J.J. Smulsky "A New Astronomical Theory of the Ice Ages", 132 pp., was published in Riga by Lambert Academic Publishing. The cause of the alternation of the ice ages on the Earth is one of the intriguing mysteries of the problem of climate change. It is shown in the monograph that fluctuations in the parameters of the orbital and rotational movements of the Earth are such a cause. It is consistently and more and more convincingly revealed in three monographs by J.J. Smulsky, which were published one after another. In the monograph published jointly with V.P. Melnikov in 2009 "The Astronomical Theory of Ice Ages: New Approaches. The Solved and Unsolved Problems", the problem is posed, and the evolution of the orbital rotation of the Earth is investigated. In the monograph published in 2016 "The Evolution of the Earth's Axis and of the Paleoclimate over 200,000 Years", the results of the evolution of the rotational movement of the Earth, changes of its insolation over 200,000 years are presented and its relation to the paleoclimate is shown.

In the newly published monograph "A New Astronomical Theory of the Ice Ages", the author considers the problem as a whole within the time range of 20 million years. The material of the book is presented in the form that is easy to understand by broad masses of readers. The main results related to solution of differential equations of the orbital and rotational movements of the Earth are presented at the end of the book and in the Appendix.

The book begins with the pictorial presentation of the orbital and rotational movements of the Earth (see the Figure), resulting in daily and annual variations in the illumination of the Earth by the Sun. In the book, the main aspects of their evolution are shown, namely, precession of the orbital axis of the Earth $\vec{S}$ and of its axis $\vec{N}$ relative the vectors $\vec{M}$ and $\vec{M}_2$ in space, respectively. These presentations will help the reader to understand all the aspects of the evolution of the Earth's movements.

Further on, the monograph stepwise describes the evolution of orbital movement in different time ranges. Similarly, the evolution of the rotational movement is described in the range from 0.1 year to 10,000 years. The authors compared his results to the observations and results of S.G. Sharaf and N.A. Budnikova, J. Laskar and other researchers. They match. The difference between the author's results for the inclination of the Earth's rotation axis and the results of other researchers begin after 3,000 years. The cause of this difference consists in different extents of considering the rotational movement of the Earth in the astronomical theory of climate change. In the theory proposed by Milankovitch, a simplified approach to precession of the Earth's axis based on Poisson's equations is used. These equations were obtained from differential equations for rotational movement, in which the second derivatives and the products of the first derivatives were neglected J.J. Smulsky solved the latter equations without their simplification by numerical methods. As a result, it turned out that the oscillations of the Earth's rotational axis had an amplitude which is 7–8 times higher than that described in the previous theories. J.J. Smulsky tested the results of the Earth's rotation problem during three years: the problem was solved by three more methods. The results were confirmed. In the monograph (Figs. 61 and 62), the author explains the physical cause of large oscillations of the Earth's axis. It turns out that precession of perpendicular $\vec{S}$ to the Earth's orbit and its axis $\vec{N}$ takes place in relation to different directions in space (see the Figure). The perpendicular precesses in relation to the total vector



of the momentum of the quantity of movement $\vec{M}$ of the solar system. The Earth's rotation axis $\vec{N}$ precesses in relation to the other direction $\vec{M}_2$, which is declined from the the total angular momentum vector of the solar system $\vec{M}$ by the angle 3.2°.

This difference between precession movements of the Earth's orbit and its equator could be established only as a result of solving differential equations of the rotational movement of the Earth with a high degree of precision and for large time lapses. This is a new and important result in celestial mechanics and astronomy. It will contribute to our better understanding of the structure of the Solar System and of its evolution.

Discussion of the orbital and rotational movements is followed by the diagrams of changes in the inclination angle and of the Earth's insolation over 200,000 years. The insolation extremes are numbered, and the insolation periods of the climate change are introduced. It is shown in the book that over the recent 50,000 years they match the known changes in the paleoclimate. In fact, the insolation fluctuations are the cause of long-period climate fluctuations.

Considering the time ranges of 1, 5 and 20 million years, changes in the inclination and of the Earth's insolation are consistently investigated. For comparison, the diagrams demonstrate the changes in these parameters according to the previous Astronomical Theory. For the period larger than 5 million years, the total diagrams of both insolation and of the parameters of the orbital and rotational movements of the Earth on which insolation depends are provided. For the period larger than 20 million years, statistics of changes in the inclination and in insolation is considered. Also shown are changes in the insolation and the inclination angle in the modern epoch and for 1 million years into the future. The last chapter of the book deals with a number of additional issues; in particular, the insolation periods are matched with the marine isotope stages (MIS). The author comes to a conclusion that MIS do not reflect changes in the insolation and paleoclimate.

The book contains numerous diagrams presented in 63 figures and the text explaining them. The diagrams contain much more information than what can be presented in the text of such a small format. These diagrams will be a subject for analysis to be made by specialists from different areas of science.

The book is an important benchmark for understanding the nature and the processes occurring in it. It can be recommended to college and graduate students in physics and astronomy, as well as in geosciences.