

# FUTURE SPACE PROBLEMS AND THEIR SOLUTIONS

**AUTHOR:** Joseph J. Smulsky (Chief Scientist, Institute of Earth's Cryosphere, Tyumen Scientific Centre, SB RAS, Doctor of Physical-Mathematical Sciences, Professor of Theoretical and Applied Mechanics, <http://wgalactica.ru/smull/>)

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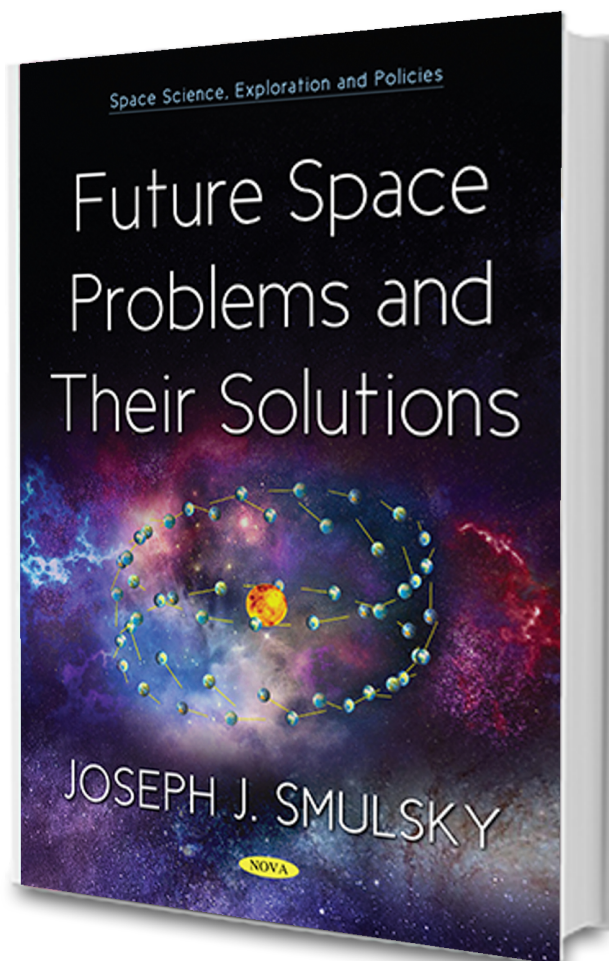
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**BOOK DESCRIPTION:** This book is devoted to the calculation of bodies' movements in various cases of interaction that are relevant now and in the future. The developed system "Galactica" has free access and is designed for numerically solving the problems of gravitational interaction of N-bodies. It tackles a whole range of problems: The optimal motion of the spacecraft, the evolution of the solar system for 100 million years, the influence of the Sun on Mercury's perihelion, the motion of near-Earth asteroids, the evolution of Earth's rotation axis, etc. As a result of solving a number of problems, new knowledge about our world was obtained.

The Galactica system is used for computing movements of two asteroids: Apophis and 1950DA. The evolution of their movement over a span of 1,000 years is investigated. The moments of their closest passages near the Earth are defined. The different ways of asteroid trajectory transformations into orbits of the Earth's satellites are considered.

The issues connected with the Astronomical Theory of Ice Ages from the perspective of celestial mechanics are examined. Differential equations of rotational motion are solved with the help of the numerical method without simplification. The evolution of the Earth's axis was examined, and the periods of its oscillations that coincide with the observed ones were obtained. The calculations for a hundred thousand years demonstrate significant oscillation of the Earth's axis. The oscillations of the Earth's axis result in such oscillations of insolation that explain the paleoclimate changes.

The book describes all the theoretical, practical issues and the Galactica system manual so that even a novice researcher could use it in his/her works.



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## REVIEWS

"Today it is customary to speak of the Universe as a product of the Big Bang, which gave rise to the mystery of dark matter, expanding Universe and other tempting but badly comprehend realities. Joseph J. Smulsky gives the chance to feel harmony of the world, to see it in the image of reasonable classical simplicity peculiar to Isaak Newton's mechanics. The elegance of simplicity and the complexity of the system appear in their mathematically comprehended unity." - **Vladislav V. Cheshev, Professor of the National Research Tomsk State University, Russia**

"The problems of gravitational interaction of bodies are extremely diverse. The author considers the situations most significant for the space exploration and to the preservation of life conditions on the Earth-planet. The developed program Galactica can be of interest for professionals and students of the relevant specialties, as for as it allows to apply the received data for the analysis of various problems of celestial mechanics." - **Boris F. Boyarshinov, Doctor of technical sciences, Insitute of Thermophysics, SB RAS, Novosibirsk, Russia**

"The book is very impressive. Joseph J. Smulsky considers grandiose projects: the optimal approach of the spacecraft to the Sun, the transformation of asteroids into satellites of the Earth, the creation of new planets like the Earth etc. Without doubt that the space agencies will use the solutions and soft, which are discussed and presented in the book. That will raise the computation culture in the area under consideration." - **Michael P. Anisimov, Dr.Sc. in Physics and Mathematics, Leading Research Scientist, Head of the Nanoaerosol Laboratory, Siberian Division of the Russian Academy of Sciences, Novosibirsk, Russia; Research Professor, Clarkson University, NY USA**

"Environment and human well-being are due to many factors, including the influence of movements of cosmic bodies both in the Solar system and beyond. The proposed monograph provides an excellent opportunity to predict the motion and rotation of planets, to optimize the flights of spaceships by means of a sufficiently simple to assimilate the program Galactica. A lot of worries are caused by possible collisions of comets and asteroids with the Earth. The examples of the most dangerous two asteroids show the capabilities of the Galactica program to calculate their evolution. These opportunities are wider than they are presented in the book. But even what is given impresses with its multifaceted tasks and their scale." - **Nicolay E. Shishkin, Doctor of technical sciences, Insitute of Thermophysics, SB RAS, Novosibirsk, Russia**

"The system "Galactica" is well described and allows the user with higher education to work with it. All calculation results are displayed for convenience on the display screen. Using this system, the trajectories of asteroids "Apophis" and "1950 DA," their possible approaches to the Earth are studied and various ways of transforming these trajectories are indicated. Thus, the reader will find a lot of interest and will be able to explain some of the phenomena that occur in the long-term climate change on Earth, the formation of the future habitat of mankind. Maybe some insights will not coincide with existing conceptions at this time; however, they will serve as a basis for further research in this interesting field of knowledge." - **Vasily M. Fomin, Academician of RAS, Scientific Head of the Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia**