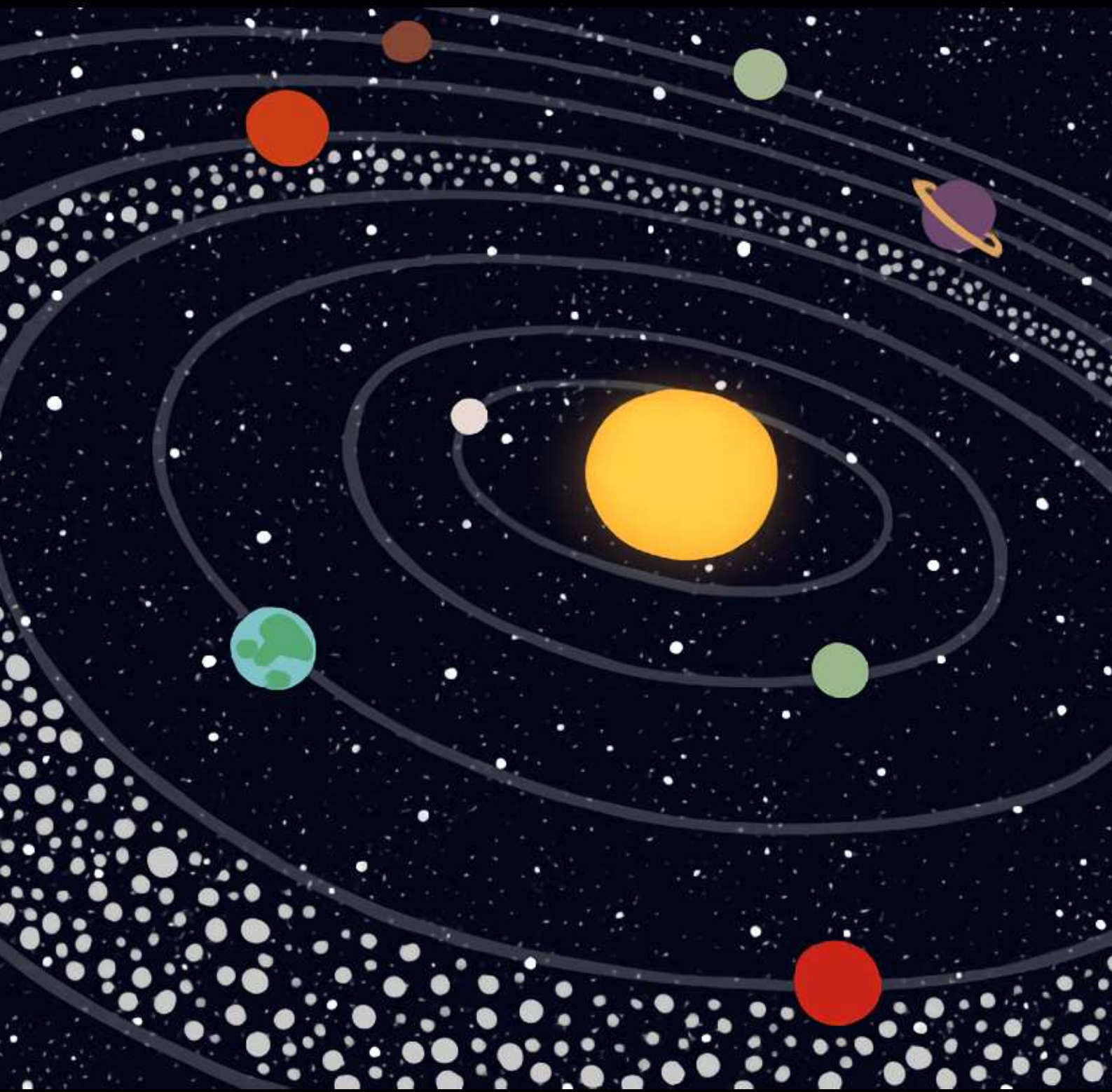


MODERN PROBLEMS in Solar System Physics and Their Solutions

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In Solar System Physics
and Their Solutions**

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In this educational manual the basic modern concepts and five fundamental problems of Solar System physics are considered. For some of the problems the possible solutions are presented. The authors consider all the problems in details and give an extensive review of the corresponding literature. Besides, a number of important auxiliary tasks are presented. The authors pay special attention to the numerical results of the theoretical research and analysis. Each chapter of manual is accompanied by control questions to a theme for self-checking of the student.

The manual is intended primarily for students (masters) enrolled in the master's program "Quantum Field Research in the Microcosm and Astrophysics". The program is realized on the basis of the Samara National Research University Named After Academician S.P. Korolev. It can be useful to students of natural-scientific orientation with the study of certain subjects in English. Benefit can be claimed by lecturers of universities involved in the organization of various astronomical and physical activities (olimpiads, conferences) for pupils and students.

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Foreword

The astronomy is one of the most ancient sciences, created by mankind thousands of years ago for the purpose of studying the movements and the nature of celestial bodies. Because of this astronomy has rich history, extremely wide range of research objects, large number of branches, fields and specific subfields. Nowadays it is one of the most quickly developing natural sciences of the XXI century.

One of the most important and priority fields of astronomy is *the Solar System Physics* within which both the nature of the Solar System bodies and physical processes and related phenomena are studied. According to modern representations, *the Solar System* is a physical system of the gravitationally bound celestial bodies (such as the Sun, the planets and their satellites, the small bodies), the fields and corpuscular radiations generated by them. Besides, the Solar System is a planetary system which possesses our planet – Earth. Today Earth remains the unique planet not only in the Solar system or our Galaxy, but even in all visible part of the Universe because *there is life on its surface*.

A man, being the only reasonable creature on Earth, must protect and care about the future of our planet. The desire of mankind not only to preserve life on Earth and increase their wealth, but to expand their knowledge and form a picture of the world, adequate to reality, lead to the objective necessity of regular studies of the System.

As in any developing science within the Solar System Physics there are a number of fundamental problems. Some of these problems, such as the Problem of precession of the Mercury perihelion, have already received an adequate explanation; the other remain unsolved at the time and require further research of possible solutions.

In this educational manual the basic modern concepts and the five fundamental problems of the Solar System physics are considered. For some of the problems the possible solutions are presented. The authors consider all the problems in details and give an extensive review of the correspond-

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