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978-1-108-49076-4 — Multi-scale (Time and Mass) Dynamics of Space Objects (IAU S364)

Edited by Alessandra Celletti, Cristian Beaugé, Cătălin Galeş, Anne Lemaître

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MULTI-SCALE (TIME AND MASS) DYNAMICS OF SPACE OBJECTS

IAU SYMPOSIUM 364

COVER ILLUSTRATION:

Multi-scale dynamics of space objects

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MULTI-SCALE (TIME AND MASS) DYNAMICS OF SPACE OBJECTS

PROCEEDINGS OF THE 364th SYMPOSIUM OF
THE INTERNATIONAL ASTRONOMICAL UNION
HYBRID MEETING, IASI, ROMANIA
18–22 OCTOBER, 2021

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Preface

With the advent of powerful telescopes, instruments and computation facilities, as well as the results from space missions ventured towards the edge of the Solar system, we are witnessing a new era of extraordinary discoveries, that is pushing the frontier of science toward new horizons. Different or refined theories, methods and techniques are needed to deal with the enormous amount of highly accurate observational data on the celestial bodies. The emergence of new open problems, such as the formation, habitability and long-term evolution of planetary systems, the complex dynamical behavior of minor bodies in the Solar system, the increased traffic in Earth's orbit, the exploration and exploitation of space objects, stimulates the birth of new lines of investigation, the search for novel scientific methods and techniques, as well as the development of technologies.

The range of phenomena that manifest at all different time and length scales and the wide range of sizes of space objects, from minor bodies in the Solar system to exoplanets, from dust particles to Jupiter-size bodies, require the development of dynamics modelling and analysis tools that can handle these different scales. The understanding of the dynamics of space objects of various sizes, both natural and artificial, is a key to the advancement of various branches of science, such as celestial mechanics, astrodynamics, planetary sciences, applied mathematics and dynamical systems, with considerable benefits to society and economy.

These topics motivated the organization of the **IAU Symposium 364, Multi-scale (time and mass) dynamics of space objects**, held online from Iasi (Romania) during the period October 18–22, 2021. Although the pandemic situation did not allow to gather together in Iasi, the Symposium represented a unique opportunity to share ideas and projects. This book is a collection of contributions given by distinguished scientists at **the IAU Symposium 364**. The methods in dynamics modeling of space objects have already reached a state of maturity, and their implementation provided a large number of results of particular importance both in theory and in applications. The contributions in this volume deal with a variety of important topics covering the recent advances in the multi-scale dynamics of natural and artificial space objects from various perspectives, among which:

- a) dynamics modelling of space objects at different time and length scales (multi-scale): dust particles, asteroids and comets, planets and exoplanets, satellites and space debris;
- b) theories and tools to analyze the long-term evolution of space objects: perturbation methods, numerical, semi-analytical and analytical techniques, computer-algebraic techniques, planetary ephemerides, special manipulators and computational environments, dynamical systems methods;
- c) multi-scale stability analysis of celestial bodies: resonances, mechanisms of onset of chaos, chaos indicators, equilibrium points, invariant manifolds, local and global analysis;

The Symposium was attended by an overall number of 199 participants from different institutions all over the world. The Symposium was made possible thanks to the support of the International Astronomical Union, with the endorsement of Division A Fundamental Astronomy, A4-Inter-Division A-F Commission Celestial Mechanics and Dynamical Astronomy. The Symposium was organized thanks to the collaboration of the University of Rome Tor Vergata (Italy), the University Alexandru Ioan Cuza of Iași (Romania) and the Romanian National Committee for Astronomy.

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We take the opportunity to thank all members of the Scientific Organizing Committee (SOC) of the Symposium and all members of the Local Organizing Committee. We acknowledge the Department of Mathematics of the University of Al. I. Cuza, Iasi, Romania, for hosting the Symposium and, in particular, we warmly thank the dean of the Faculty, Prof. Răzvan Liţcanu, and the vice-dean, Prof. Marius Apetrii.

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