Fundamental Astronomy

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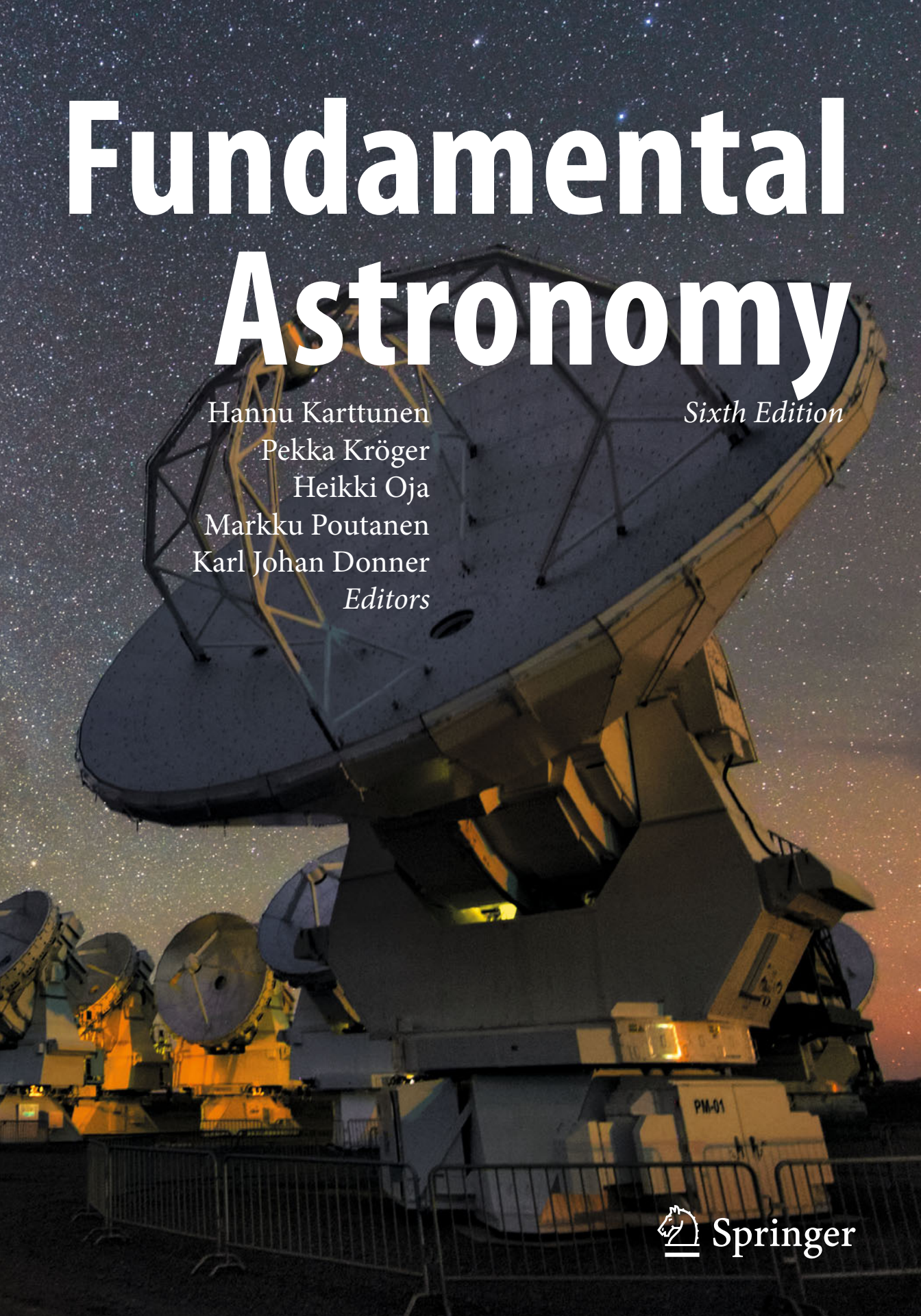
Markku Poutanen
Karl Johan Donner
Editors

Sixth Edition



Springer

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Sixth Edition
With 419 Illustrations
Including 34 Colour Plates
and 83 Exercises with Solutions

Springer

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Cover illustration: Atacama Large Millimeter/submillimeter Array (ALMA) is an interferometer telescope composed of 66 antennas. ALMA observes molecular gas and dust of the cool Universe—building blocks of stars, planetary systems, galaxies and life itself. Credit: ESO/ Y. Beletsky

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Preface to the Sixth Edition

As the title suggests, this book is about fundamental things that one might expect to remain fairly the same. Yet astronomy has evolved enormously over the last few years, and only a few chapters of this book have been left unmodified.

Since the book is used also by many amateurs, the introductory chapter has been extended to give a brief summary of different celestial objects to "soften" the jump to rather technical topics.

The chapter on the solar system was very long. It has now been split into two separate chapters. Chapter 7 deals with general properties of the solar system. Individual objects are discussed in Chap. 8, which is more prone to change when new data will accumulate. Also, new data on exoplanets is obtained at an increasing rate. Therefore exoplanets are given a chapter of their own; it is at the end of the book, since it is closely related to astrobiology, already included in the previous edition. These last chapters may change more than the rest of the book in the future.

These changes mean that the numbering of formulas and figures has changed quite extensively after the previous version of the book.

Cosmology and galactic astronomy have still been evolving rapidly. Therefore there are many revisions to the chapters on the Milky Way, galaxies, and cosmology.

In addition, several other chapters contain smaller revisions and many of the previous images have been replaced with newer ones.

Helsinki, Finland
April 2016

Hannu Karttunen
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Preface to the First Edition

The main purpose of this book is to serve as a university textbook for a first course in astronomy. However, we believe that the audience will also include many serious amateurs, who often find the popular texts too trivial. The lack of a good handbook for amateurs has become a problem lately, as more and more people are buying personal computers and need exact, but comprehensible, mathematical formalism for their programs. The reader of this book is assumed to have only a standard high-school knowledge of mathematics and physics (as they are taught in Finland); everything more advanced is usually derived step by step from simple basic principles. The mathematical background needed includes plane trigonometry, basic differential and integral calculus, and (only in the chapter dealing with celestial mechanics) some vector calculus. Some mathematical concepts the reader may not be familiar with are briefly explained in the appendices or can be understood by studying the numerous exercises and examples. However, most of the book can be read with very little knowledge of mathematics, and even if the reader skips the mathematically more involved sections, (s)he should get a good overview of the field of astronomy.

This book has evolved in the course of many years and through the work of several authors and editors. The first version consisted of lecture notes by one of the editors (Oja). These were later modified and augmented by the other editors and authors. Hannu Karttunen wrote the chapters on spherical astronomy and celestial mechanics; Vilppu Piirola added parts to the chapter on observational instruments, and Göran Sandell wrote the part about radio astronomy; chapters on magnitudes, radiation mechanisms and temperature were rewritten by the editors; Markku Poutanen wrote the chapter on the solar system; Juhani Kyröläinen expanded the chapter on stellar spectra; Timo Rahunen rewrote most of the chapters on stellar structure and evolution; Ilkka Tuominen revised the chapter on the Sun; Kalevi Mattila wrote the chapter on interstellar matter; Tapio Markkanen wrote the chapters on star clusters and the Milky Way; Karl Johan Donner wrote the major part of the chapter on galaxies; Mauri Valtonen wrote parts of the galaxy chapter, and, in collaboration with Pekka Teerikorpi, the chapter on cosmology. Finally, the resulting, somewhat inhomogeneous, material was made consistent by the editors.

The English text was written by the editors, who translated parts of the original Finnish text, and rewrote other parts, updating the text and correcting

errors found in the original edition. The parts of text set in smaller print are less important material that may still be of interest to the reader.

For the illustrations, we received help from Veikko Sinkkonen, Mirva Vuori and several observatories and individuals mentioned in the figure captions. In the practical work, we were assisted by Arja Kyröläinen and Merja Karsma. A part of the translation was read and corrected by Brian Skiff. We want to express our warmest thanks to all of them.

Financial support was given by the Finnish Ministry of Education and Suomalaisen kirjallisuuden edistämisvarojen valtuuskunta (a foundation promoting Finnish literature), to whom we express our gratitude.

Helsinki, Finland
June 1987

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Heikki Oja
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Contents