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Book Review: *Statistical Physics for Cosmic Structures*

Statistical Physics for Cosmic Structures. A. Gabrielli, F. Sylos Labini, M. Joyce and L. Pietronero, Springer Verlag, Berlin, 2005.

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In the last few years, we have witnessed an increase in the applications of Statistical Physics to different disciplines thanks to its methodology which is able to analyze fluctuation phenomena in systems composed of a great number of entities. Up to now, many of these applications have focused on small-scale systems such as nano-conductors or DNA molecules whereas only a few have dealt with large-scale systems such as the cosmological structures that this book aims to describe. This publication is therefore very timely and may contribute to set the basis for subsequent studies in the field.

Any book on an interdisciplinary subject must build up a self-consistent theory able to explain a great number of observations. The concepts introduced must be pertinent for the phenomena in question and sufficiently elaborated in order to extract solid conclusions in an clear and concise way. These requirements have been perfectly fulfilled in the material presented in this book. Throughout its chapters the reader can find a comprehensive exposition of phenomena taking place in cosmological structures and their explanation by using statistical mechanical methods.

The book starts with an introductory chapter showing that cosmological matter exhibits the common behavior found in other complex systems and can thus be treated by using statistical methods. The first part presents concepts useful in the study of a distribution of mass in space, a primordial problem one has to face in the study of cosmic structures. Basic notions of probability theory, correlation functions, spectral analysis, stochastic processes and of fractals and multifractals are given. The second part deals with concrete applications of statistics to cosmology, in particular the role played by fluctuations in cosmological models, in the observations of spatial distributions of matter, such as in the case of galaxy clusters, as well as in the gravity field due to stochastic particle distributions. The last part includes diverse appendixes containing details about methods and calculations which help to establish a close connection between statistics and cosmology.

The procedure followed, which is somewhat similar to the one used in liquid theory to characterize the distribution of the molecules in a liquid, and the simple and agile notation the authors use help facilitate comprehension of cosmic structure concepts. Researchers familiar with statistical physics methods and their application to the study of complex systems of different nature, after a rapid reading of the first part and identifying the known concepts, can go directly to the second part to delve deeper into the subject. In the first part, those who are not experts in Statistical Physics will find a self-contained framework to better interpret the many interesting phenomena included in the second part. For this reason, this book is highly recommendable due to the insight it gives into the field of cosmic structures, providing sound basis for further research.

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