

Nonextensive Statistical Mechanics and Its Applications

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1. Auflage 2001. Buch. IX, 278 S. Hardcover
ISBN 978 3 540 41208 3
Format (B x L): 0 x 0 cm
Gewicht: 1290 g

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Preface

It is known that in spite of its great success Boltzmann–Gibbs statistical mechanics is actually not completely universal. A class of physical ensembles involving long-range interactions, long-time memories, or (multi-)fractal structures can hardly be treated within the traditional statistical-mechanical framework. A recent nonextensive generalization of Boltzmann–Gibbs theory, which is referred to as nonextensive statistical mechanics, enables one to analyze such systems. This new stream in the foundation of statistical mechanics was initiated by Tsallis’ proposal of a nonextensive entropy in 1988. Subsequently it turned out that consistent generalized thermodynamics can be constructed on the basis of the Tsallis entropy, and since then we have witnessed an explosion in research works on this subject.

Nonextensive statistical mechanics is still a rapidly growing field, even at a fundamental level. However, some remarkable structures and a variety of interesting applications have already appeared. Therefore, it seems quite timely now to summarize these developments.

This volume is primarily based on The IMS Winter School on Statistical Mechanics: Nonextensive Generalization of Boltzmann–Gibbs Statistical Mechanics and Its Applications (February 15–18, 1999, Institute for Molecular Science, Okazaki, Japan), which was supported, in part, by IMS and the Japanese Society for the Promotion of Science. The volume consists of a set of four self-contained lectures, together with additional short contributions. The topics covered are quite broad, ranging from astrophysics to biophysics. Some of the latest developments since the School are also included herein.

We would like to thank Professors W. Beiglböck and H.A. Weidenmüller for their advice and encouragement.

Funabashi,
Okazaki,
November 2000

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