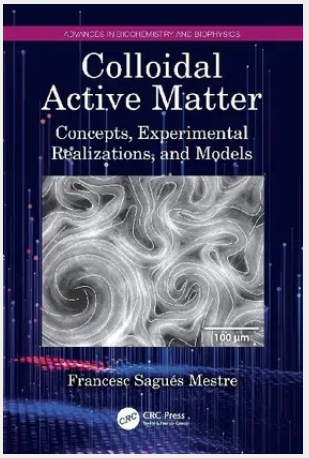
Sagués Mestre

Colloidal Active Matter

Concepts, Experimental Realizations, and Models



What do bird flocks, bacterial swarms, cell tissues, and cytoskeletal fluids have in common? They are all examples of active matter. This book explores how scientists in various disciplines, from physics to biology, have collated a solid corpus of experimental designs and theories during the last two decades to decipher active systems. The book addresses, from a multidisciplinary viewpoint, the field of active matter at a colloidal scale. Concepts, experiments, and theoretical models are put side by side to fully illuminate the subtilities of active systems. A large variety of subjects, from microswimmers or driven colloids to self-organized active fluids, are analysed within a unified perspective. Generic collective effects of self-propelled or driven colloids, such as motility-induced flocking, and new paradigms, such as the celebrated concept of active nematics in reconstituted protein-based fluids, are discussed using well-known experimental scenarios and recognized theories. Topics are covered with rigor and in a self-consistent way, reaching both practitioners and newcomers to the field. The diversity of topics and conceptual challenges in active matter have long hampered the chance to explore the field with a general perspective. This monograph, the first single-authored title on active matter, is intended to fill this gap by bridging disparate experimental and theoretical interests from colloidal soft matter to cell biophysics.

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71,80 €
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Lieferfrist: bis zu 10 Tage

Artikelnummer: 9781032298405
Medium: Buch
ISBN: 978-1-032-29840-5
Verlag: CRC Press
Erscheinungstermin: 08.10.2024
Sprache(n): Englisch
Auflage: 1. Auflage 2024
Serie: Advances in Biochemistry and Biophysics
Produktform: Kartoniert
Gewicht: 471 g
Seiten: 308
Format (B x H): 156 x 234 mm