



Statistical Physics of Fields

By Mehran Kardar

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Statistical Physics of Fields By Mehran Kardar

While many scientists are familiar with fractals, fewer are familiar with scale-invariance and universality which underlie the ubiquity of their shapes. These properties may emerge from the collective behaviour of simple fundamental constituents, and are studied using statistical field theories. Initial chapters connect the particulate perspective developed in the companion volume, to the coarse grained statistical fields studied here. Based on lectures taught by Professor Kardar at MIT, this textbook demonstrates how such theories are formulated and studied. Perturbation theory, exact solutions, renormalization groups, and other tools are employed to demonstrate the emergence of scale invariance and universality, and the non-equilibrium dynamics of interfaces and directed paths in random media are discussed. Ideal for advanced graduate courses in statistical physics, it contains an integrated set of problems, with solutions to selected problems at the end of the book and a complete set available to lecturers at www.cambridge.org/9780521873413.

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Editorial Review

Review

In this much-needed modern text, Kardar presents a remarkably clear view of statistical mechanics as a whole, revealing the relationships between different parts of this diverse subject. In two volumes, the classical beginnings of thermodynamics are connected smoothly to a thoroughly modern view of fluctuation effects, stochastic dynamics, and renormalization and scaling theory. Students will appreciate the precision and clarity in which difficult concepts are presented in generality and by example. I particularly like the wealth of interesting and instructive problems inspired by diverse phenomena throughout physics (and beyond!), which illustrate the power and broad applicability of statistical mechanics.

Leon Balents, Department of Physics, University of California, Santa Barbara

"... Statistical Physics of Fields is the welcome result of an innovative and popular graduate course Kardar has been teaching at MIT for almost twenty years. It is a masterful account of the essentials of a subject which played a vital role in the development of twentieth century physics ... Statistical Physics of Fields builds on the foundation laid by the Statistical Physics of Particles, with an account of the revolutionary developments of the past 35 years, many of which were facilitated by renormalization group ideas. Much of the subject matter is inspired by problems in condensed matter physics, with a number of pioneering contributions originally due to Kardar himself."

David R Nelson, Arthur K Solomon Professor of Biophysics, Harvard University

"If Landau and Lifshitz were to prepare a new edition of their classic Statistical Physics text they might produce a book not unlike this gem by Mehran Kardar. Indeed, Kardar is an extremely rare scientist, being both brilliant in formalism and an astoundingly careful and thorough teacher. He demonstrates both aspects of his range of talents in this pair of books, which belong on the bookshelf of every serious student of theoretical statistical physics."

H Eugene Stanley, Director, Center for Polymer Studies, Boston University

"This is one of the most valuable textbook I have seen in a long time. Written by a leader in the field, it provides a crystal clear, elegant and comprehensive coverage of the field of statistical physics. I am sure this book will become the reference for the next generation of researchers, students and practitioners in statistical physics. I wish I had this book when I was a student but I will have the privilege to rely on it for my teaching."

Alessandro Vespignani, Center for Biocomplexity, Indiana University

"Kardar, who has taught a statistical physics of fields course at MIT for the last 20 years, has finally put the content of his lectures into a single textbook. Designed for advanced students of physics, this book expands upon the notion of fractals, and concentrates on the shape, symmetry and locality of these entities. The author uses his work in particle physics as a foundation to explore statistical fields, fluctuations, the scaling hypothesis, lattice systems, and directed paths in random media."

Book News

"Over the past two decades, I have admired Kardar's contributions to theoretical physics, and now I admire his contribution to teaching physics. The first volume, Statistical Physics of Particles, is distinguished by its useful feature of teaching physics by example... the first eight chapters of Statistical Physics of Fields are stunning. With that volume Kardar has produced an excellent and unique textbook that will serve our community well for many years."

David Chandler, Physics Today

About the Author

Mehran Kardar is Professor of Physics at MIT, where he has taught and researched in the field of Statistical Physics for the past twenty years. He received his BA in Cambridge, and gained his Ph.D. at MIT. Professor Kardar has held research and visiting positions as a junior fellow at Harvard, a Guggenheim fellow at Oxford, UCSB, and at Berkeley as a Miller Fellow.

Users Review

From reader reviews:

Dan Maes:

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Dorothy Payne:

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Theresa Diaz:

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