

Book Review: *Chance and Matter*

Chance and Matter. Proceedings of the Les Houches Summer School, Session XLVI, J. Souletie, J. Vannimenus, and R. Stora, eds., North-Holland, Amsterdam, 1986.

These proceedings are based on lectures given at the Les Houches summer school in 1986. These lecture notes contain a wealth of information on diverse topics, such as classical percolation, localization, growth processes and pattern formation, spin glasses and related complex systems, and macroscopic quantum phenomena. Each of these subjects could easily fill an entire volume, but the summer school was relatively wide-ranging in the topics that were covered. The lecturers on each topic were quite well chosen, their notes uniformly informative, and the generous references in most of the articles can lead the dedicated reader deeper into a single field. This volume should therefore serve as a valuable reference for both the uninitiated and the expert alike.

The first two courses deal primarily with classical percolation theory and its applications. The lectures by Deutscher review percolation theory and contain healthy doses of experimental facts about conductance measurements, superconductivity, and quantum effects, for both the novice and the theoretician. The lectures of Guyon are particularly noteworthy for the range of phenomenology that is covered. In addition to the well-studied areas of structure and classical transport in random media, very nice discussions of rheological properties of suspensions, mechanical properties of disordered media, and hydrodynamic dispersion processes are given. Many useful suggestions and questions are posed; some of them may serve as stimuli for further theoretical developments.

Courses 4 and 5 are devoted to the discussion of electronic transport and wave propagation in inhomogeneous media. Both lectures contain excellent pedagogical introductions for nonexperts as well as comprehensive accounts of the current state of the art. In particular, Course 4 by Ramakrishnan gives a historical and experimental account of basic facts that sets the stage for a nice overview of electronic transport phenomena

in disordered media. Course 5 by Soulliard is more mathematical in style and precise in its statement of basic results. This chapter contains a particularly clear discussion of the nature of localization in one-dimensional systems.

Kinetic growth processes are covered in Course 3 by Witten, and pattern formation is covered in Course 10 by Langer. Witten is physical in his approach to the subject, and he nicely reviews the basic features of diffusion-limited aggregation processes. In his very beautiful lectures on pattern formation, Langer stresses the crucial role that classical mathematical analysis plays in addressing the “hard” problems of nonlocality, moving boundaries, and singular perturbations that arise in pattern formation phenomena. He elucidates, with painstaking care, the technical tools needed to attack these problems.

There is a brief, but very elegant Course on spin glasses by G. Parisi. He stresses the ultrametric structure of the equilibrium state and uses this general description to derive a solution to the Sherrington–Kirkpatrick model without replicas. This course is nicely complemented by a Seminar by Stein on the statics and dynamics of complex systems, and one by Derrida on phase transitions in random automata networks. The Course by Leggett on macroscopic quantum phenomena is rather unique in its deep, almost philosophical grappling with fundamental aspects of quantum mechanics at the macroscopic level. There are three more Seminars which nicely complement the Courses of Leggett, Souillard, and Parisi.

Overall, this volume provides an overview of some of the outstanding issues in condensed-matter physics and should become a standard reference. However, one minor shortcoming is that the lecture notes of G. Toulouse and A. Libchaber are not present. I am sure that I am not alone in missing the lecture notes of these two masters in the field. I also believe that these proceedings would be more vibrant if the questions and comments during or after the talks were included. Nevertheless, I heartily recommend this book and I look forward to many more months of enjoyable study of the study of the lecture notes.

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