This book is devoted entirely to the work that has been done on the Sherrington–Kirkpatrick model and to developments that have followed from that work; it does not touch on the problems of real random magnetic systems. The authors give a masterly account of the work on the model in the first 85 pages. Such a summary cannot be found elsewhere, and much of our current understanding of the problem is due to the authors of this book and their collaborators. Twenty-four reprints on the subject follow. The predominant theme of this first part of the book is that the model describes a system that has many equilibrium states at the same temperature, and that these states are organized with an ultrametric structure.

The rest of the book is devoted to two applications of the ideas that were developed to deal with the spin glass model. Both original text and relevant reprints are included. The first application considered is work on optimization problems such as the traveling salesman problem. The relevance of the spin glass work to this famous problem is that multiple equilibrium states are analogous to the many local minima of the traveling salesman problem, and in both cases techniques are needed that will find properties of the global minimum or minima.

The section entitled "Biological Applications," apart from a two-page summary of Philip Anderson's work on prebiotic evolution, is devoted entirely to John Hopfield's model of neural nets and various modifications of it. Here there is a correspondence between the multiple equilibrium states of the spin glass and the multiple memories stored in a neural net.

The first part of the book describes clearly and authoritatively the remarkable properties of the infinite-range spin glass, and the reprints are well chosen to show how the theory developed. The theory is so interesting that I feel it ought to describe real physical systems, but many of us doubt that real spin glasses have more than a small proportion of the model's rich and novel properties. The remainder of the book, on the applications of the theory to other fields, is sketchy rather than comprehensive. I feel that the spin glass experts are like settlers encamped in hostile territory. They have interesting observations to make, but have not learned how to communicate with the earlier settlers. In some of the papers on neural nets there is barely a reference to work by scientists outside the spin glass community.

This is an important book, which every physics library should have. It is also good reading for anyone who wants to know about these aspects of the spin glass problem, and why "replica symmetry breaking" and "ultrametricity" may be important.

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Statistical Field Theory

Giorgio Parisi
Addison-Wesley, Redwood City, Calif., 1988. 352 pp. $48.50 hc ISBN 0-201-05985-1

The symbiotic relationship between statistical mechanics and quantum field theory has come into much prominence in recent years, particularly since the introduction in 1971 of Kenneth Wilson's renormalization group approach. Just as field theory proved to be the natural language with which to describe and perform computations for critical phenomena, the renormalization group approach led to a clearer notion of such concepts in field theory as the continuum limit. A major character in this interplay between the two areas of theory has been Giorgio Parisi. He has made seminal contributions to both, ranging from his work on Monte Carlo simulation of gauge theories to his extremely original notion of replica symmetry breaking in the theory of spin glasses.

One is always interested in knowing more about the insights such leading figures have into their subject matter. A textbook, where a more leisurely pace prevails than in research papers, is surely one of the most fertile sources of priceless insights. However, rarely do active researchers find the time or the motivation to write up their unique perspectives. Fortunately for us Parisi has chosen to do just that, and I waded into the material most eagerly. It lived up to its promise.

As one may infer from the title, the book contains detailed treatments of a variety of special topics: spin models, path integrals, Euclidean field theory, renormalization group approach, nonequilibrium processes and computer simulations. I am not aware of any other book that covers all these topics or their interrelationships.

The book is self-contained and accessible to any beginning graduate student who is willing to be guided by it. Every idea that is introduced (the ε expansion is a notable example) is treated in some depth, with all the 2π's in place, so that the student can start working on real problems after going through the material. Several ideas from rigorous statistical mechanics, such as the Osterwalder–Schrader positivity conditions or the theory of symmetry breaking, are explained in the simplest possible terms, but without compromise.

The book does not include any problems, so it probably would not be easy to use as a text, unless the instructor came up with the problems himself. On the other hand, it is ideal for self-study or study by a journal club that wants to master this very fundamental subject and needs just a good introduction, as well as a guide through the literature, or simply for those who work in the field.

I recommend the book without reservation to this audience. It is bound to become a canonical reference in the future. An adviser who is confronted with a student wanting to work in this field and needing an introductory text can now tell the student to get a copy of Parisi's book and call back after finishing it.

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The Physics of Structurally Disordered Matter: An Introduction

N. E. Cusack
Adam Hilger, Bristol, UK (US dist. Taylor and Francis, New York), 1987. 402 pp. $162.00 hc ISBN 0-85274-591-5; $68.00 pb ISBN 0-85274-829-9

The general topic of structurally disordered matter entered into the mainstream of condensed matter physics roughly two decades ago, although most beginning (and even advanced) texts that one is likely to encounter in a typical university solid-state physics course give the subject short shrift. The reasons aren't too difficult to uncover: Our understanding of "disordered" systems lags far behind that of their "ordered" counterparts; most important issues in the various fields are a long way from being settled; and there are few central unifying theories to lend coherence to the subject. (There is even some disagreement on which problems properly belong to the subject.) As a result, there are few texts that extensively treat both ordered and disordered systems, that is, electrons in periodic and random potentials, crystals and glasses, crystalline and amorphous semiconductors, and so on.

Despite the difficulties posed by writing a pedagogical text on disordered systems, the number of such books has been steadily increasing