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book reviews

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Random fields and spin glasses: a field theory approach. By Cirano De Dominicis and Irene Giardina. Pp. 230. Cambridge: Cambridge University Press, 2006. Price GBP 55.00, USD 95.00. ISBN 9780521847834.

This book describes disordered models, with methods developed in field theory and in particular within the Wilson renormalization group approach. Many ideas in this field are due to Parisi and his school, and De Dominicis has been one of the main contributors to this area. It is therefore very useful to have a coherent and authoritative description of what has been achieved. Technically the methods are quite advanced, but on the whole I found the presentation clear and accessible.

The models discussed include the random-field Ising model, spin-glass models, both the Sherrington–Kirkpatrick and high-dimensional Edwards–Anderson models (in particular, I appreciated the discussion why, for Edwards–Anderson models, both $d = 6$ and $d = 8$ have some properties of an upper critical dimension in perturbation theory), disordered spherical models, and dynamics and ageing. The authors mention, but not in great detail, competing approaches. Let me mention three examples of this. The Parisi solution of the Sherrington–Kirkpatrick model has been mathematically justified by the work of Talagrand, and Guerra and Toninelli and collaborators. This fact is mentioned, but not more than that. The Parisi dimensional reduction argument breaks down for the random-field Ising model in three dimensions, as was proven by Bricmont–Kupiainen. The reason is briefly mentioned but no details are given. Qualitatively, the interpretation of the Parisi solution, as well as the possible occurrence of other scenarios, have been extensively investigated by Newman–Stein. There is a (too) short discussion in the final chapter, which mentions that there is no agreement in the community about the validity of the results. The discussion between the practitioners of different methods has been very fruitful, and in my opinion has informed and benefited both Parisi-type and alternative approaches.

All this, however, has contributed to more doubt on the validity of the various results obtained within perturbation theory than is usual in models without disorder. In view of this, I would have preferred a more extensive qualitative discussion. Despite this, I think the authors have added a valuable contribution to the literature.

Summarising, I think that De Dominicis' and Giardina's book is very useful to have, but for an overview of the physics of disordered models one needs to complement it. A good way of doing this is, for example, to consult Bovier's recent book, *Statistical Mechanics of Disordered Systems* (Cambridge University Press, 2006).

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