viewing background probability or statistics. For such a preparation, it is not necessary that the reader be familiar with theory and techniques at the level of Billingsley(1968) and Serfling(1980), but be aware that the author liberally sprinkles measure-theoretic concepts and non-elementary limiting techniques throughout the essay! An understanding of the ideas in Ripley(1981) is also highly desirable for appreciating the many elegant ideas in this outstanding essay.

References

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[3] Ripley, B.D.(1981). *Spatial Statistics.* New York: John Wiley.

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STATISTICAL MECHANICS: RIGOROUS RESULTS
by David Ruelle, Addison-Wesley (1969,1989)

Addison-Wesley have reissued Ruelle's famous book as part of a new series *Advanced Book Classics*. This book is a landmark in modern statistical mechanics. The basic concept of the book is the use of functional analysis as a foundation for statistical mechanics, and this idea is behind much study in the past three decades. Not only have the techniques of functional analysis provided insight upon physical problems, but standard methods of statistical

mechanics form the underlying basis for the *theory of large deviations*, which is of considerable current interest to researchers in probability theory.

During the twenty years since this book was first issued, the problems it approaches have become clarified, and some have been solved, but most remain as an open challenge. Mathematicians with an interest in functional analysis may wish to have a go. This book is a good place to start, but they will not find the going easy: Ruelle packs a lot into 200 pages.

The most interesting aspects of statistical physics involve phase transitions. For the standard models, phase transition does not occur with finite systems, so one must start with infinite systems which are the limits of finite approximations. One such is a Newtonian system of infinitely many point particles, but the simpler model of an infinite lattice where each lattice point must be in one of a finite number (usually 2) of states is also studied. The continuous and lattice systems can be considered as classical or quantum. Thus there are several stages of increasing difficulty, from the classical lattice to the quantum continuous systems.

The first step is to deal with the limit of finite systems in such a way that for energy considerations the *boundary* of the finite approximation can be ignored. The assumptions on the strength of the interactions are those needed to make the limiting process work. It has since been discovered the a slightly more restricted family of interactions has much nicer properties concerning phase transitions. For continuous systems a rather special class of interactions is considered. The important case of the Coulomb interaction is not treated in this book.

One area in which reasonably satisfactory results obtain is that in which the interactions of the system are sufficiently weak. In this case one can prove that the behavior is quite close to that of non-interacting systems. For slightly stronger interactions, even in the classical lattice model, one has the presence of several phases in the sense that the infinite limit with different boundary conditions yields different states.

The case of stronger interactions is more interesting and more difficult. Limited progress has been made in this case. The book also deals with various probabilistic, group theoretic, algebraic and functional algebraic methods of treating statistical mechanical systems.

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