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Book Review: *Quantum Theory of Collective Phenomena*

Quantum Theory of Collective Phenomena; G. L. Sewell. Oxford University Press, New York, 1986

There are few books on the subject of the statistical mechanics of large quantum systems; some of them present rather the mathematical structure of the theory (e.g., Bratelli–Robinson, Emch). Therefore a book that is easily accessible to physicists and chemists is welcome, especially one that (like Thirring's) makes valuable reading for matematicians interested in the physical application of operator algebras.

The book is self-contained and, as the title suggests, it stresses the statistical mechanics of phase transitions, critical phenomena, and metastability in equilibrium as well as in steady states far from equilibrium.

The book is divided into three parts, the first one giving a nice and gentle introduction into the mathematical formalism of infinite quantum systems based on operator algebras. Part II develops on this background the thermodynamic theory, and we found the presentation of the role of the KMS condition especially appealing. Part III introduces the reader to the physics of collective phenomena, which has been widely studied in recent years. Chief among the topics are phase transitions, critical phenomena, and metastable states.

Remarkably nice is the introductory presentation of the renormalization group approach to critical phenomena: It is based on simple probabilistic concepts and on a detailed analysis of the hierarchical model.

The book ends with a discussion (based on an explicit treatment of the laser and pumped phonon models) of ordering and phase transitions arising from irreversible processes in systems far from equilibrium.

To summarize, this book provides a nice overview starting from standard quantum theory and statistical mechanics. The mathematics is kept as

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simple as possible without sacrificing rigor. The book may be recommended for students as a well-balanced introduction to this rich subject and it can serve as a useful handbook for the expert.

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