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Ultracold Quantum Fields by H. T. C. Stoof, K. B. Gubbels and D. B. M. Dickerscheid, Springer, 2009, pp. xiv + 485. Scope: monograph. ISBN 13978 1 4020 8762 2 (hardcover), 13978 1 4020 8763 9 (e-book). Level: researchers, postgraduate physicists and senior undergraduates.

The first experimental observations of macroscopic quantum phenomena – superconductivity in metals and superfluidity in liquid helium – were made long before any theoretical framework existed within which they could be understood. Gavroglu and Goudaroulis described them a few years ago as being "concepts out of context", which they certainly were. Decades were to pass before the development of quantum statistical mechanics could provide the necessary illumination and bring an appreciation that the superconducting transition could be perceived as the Bose-Einstein condensation (BEC) of pairs of fermions. Even now, the theory of superfluid helium remains incomplete and unsatisfying because of the inherent difficulty of describing a many-body system with strong interactions. Although the liquid phases of ^{3}He and ^{4}He are held together by weaker interatomic forces than exist between any other atoms, and although quantum mechanical zero-point energy keeps the atoms relatively far apart, these systems are of relatively very high density and are decidedly nonideal if viewed as gases.

The situation with laser-cooled atomic gases could hardly be more different. When BEC was first observed in trapped bosonic alkali atoms in 1995, there was already a huge body of theory waiting to be applied and developed. Furthermore, the low densities of these systems mean that the effects of the interatomic forces are negligible compared to those in the liquid heliums, allowing for the precise calculation of physical properties. The authors of *Ultracold Quantum Fields* have provided a self-contained, introductory, but quite detailed, account of how this can be done.

The book has developed as an expansion of lectures given at Les Houches and in a master's programme in theoretical physics at the University of Utrecht. It is divided into three parts of ascending difficulty. The first of these provides the mathematical methods needed for what follows and covers e.g. Gaussian integration with complex variables, the basics of quantum mechanics including the exact solution of the harmonic oscillator, quantum statistical mechanics, Feynman's path integral approach, and second quantization. Part II is the most substantial part of the book. It develops an extensive range of functional tools in quantum field theory, and discusses the effect of interactions and the Landau theory of phase transitions. It includes chapters on the theory of atomic physics, Bose-Einstein condensation, superfluidity, and BCS theory. It also goes beyond the Landau theory to consider critical phenomena, renormalisation group theory and universality, and much else. In the three chapters of Part III the authors apply the functional formalism to several questions and results of topical interest including low-dimensional atomic gases, analogues of condensed matter phenomena in optical lattices, the Néel state, Feshbach resonances, and Josephson oscillations.

The book has evidently been put together with great care and is very well-written. It provides detailed textual explanations to guide the reader through the equations, and includes the intermediate steps in derivations. It should therefore be found friendly and understandable by students including, in many cases, senior undergraduates. There are problems at the ends of chapters and a select bibliography. It is pleasure to commend it warmly to those entering, teaching or working in the burgeoning field of ultracold atomic gases as well as in many-particle physics more generally.

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