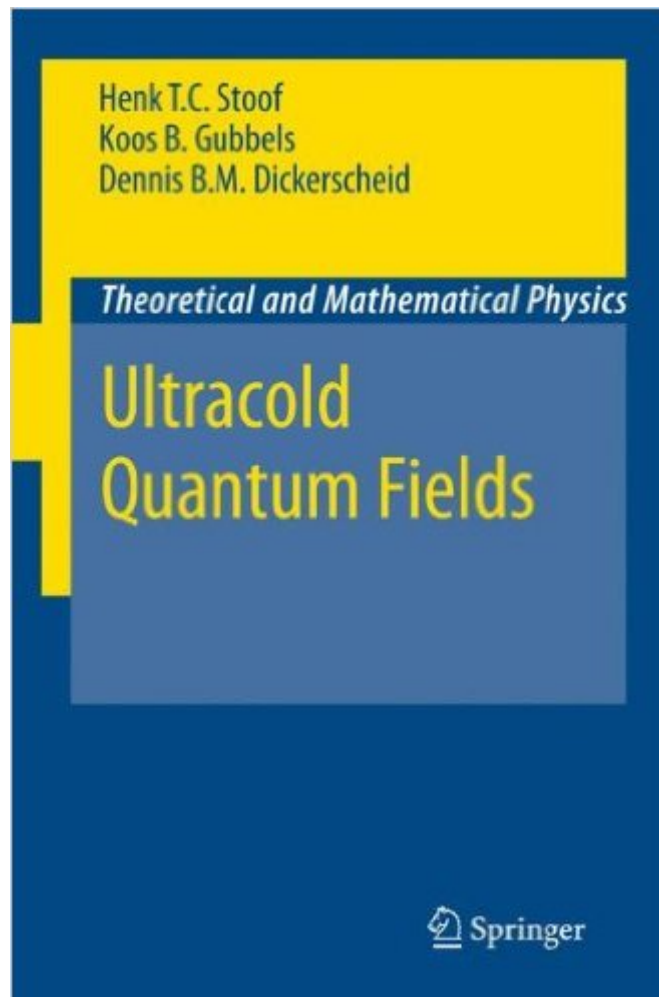


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# Ultracold Quantum Fields (Theoretical And Mathematical Physics)



## Synopsis

On June 19th 1999, the European Ministers of Education signed the Bologna Declaration, with which they agreed that the European university education should be uniformized throughout Europe and based on the two cycle bachelor master<sup>TM</sup>s system. The Institute for Theoretical Physics at Utrecht University quickly responded to this new challenge and created an international master<sup>TM</sup>s programme in Theoretical Physics which started running in the summer of 2000. At present, the master<sup>TM</sup>s programme is a so called prestige master at Utrecht University, and it aims at training motivated students to become sophisticated researchers in theoretical physics. The programme is built on the philosophy that modern theoretical physics is guided by universal principles that can be applied to any subfield of physics. As a result, the basis of the master<sup>TM</sup>s programme consists of the obligatory courses Statistical Field Theory and Quantum Field Theory. These focus in particular on the general concepts of quantum field theory, rather than on the wide variety of possible applications. These applications are left to optional courses that build upon the firm conceptual basis given in the obligatory courses. The subjects of these optional courses include, for instance, Strongly Correlated Electrons, Spintronics, Bose Einstein Condensation, The Standard Model, Cosmology, and String Theory.

## Book Information

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## Customer Reviews

For those who want updating on the status of low-temperature physics, or for students who are

learning the subject for the first time, this book is an excellent choice. It not only has challenging problem sets at the end of every chapter, but it contains insightful commentary and the details of how to approach problems in the physics of ultracold gases. As expected for a book on theoretical physics, there is not much discussion on experimental techniques, but enough however to gain an appreciation for the brilliance behind them. A book like this can be partitioned according to three different areas, namely the strategies discussed for solving problems, the physical insights, and topics that would be of interest to the mathematical community: Strategies for the solution of ultracold many-body problems: 1. The renormalization group, which is a method that allows calculations over and above mean field theory, and which allows higher-order (beyond quadratic) fluctuations to be taken into account. Using the renormalization group one can study critical phenomena by finding the fixed points of the renormalization group transformation. This approach is constructive in that it entails that the fixed points be found explicitly, and not merely a proof of their "existence." The renormalization group can also be used to study quantum phase transitions, and this raises the question as to whether it is always true that near a classical critical point the quantum theory reduces to the classical theory. The renormalization group is applicable at any temperature, and it can be used to determine the homogeneous phase diagram of a strongly-interacting imbalanced Fermi mixture. 2.

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