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<<凝聚态物理学中的量子场论>>

图书基本信息

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前言

Why is quantum field theory of condensed matter physics necessary?Condensed matter physics deals with a wide variety of topics, ranging from gas to liquids and solids, as well as plasma, where owing to the interplay between the motions of a tremendous number of electrons and nuclei, rich varieties of physical phenomena occur. Quantum field theory is the mostappropriate "language", to describe systems with such a large number of degrees of freedom, and therefore its importance for condensed matter physics is obvious. Indeed, up to now, quantum field theory has been succesfully applied to many different topics in condensed matter physics. Recently, quantum field theory has become more and more important in research on the electronic properties of condensed systems, which is the main topic of the present volume.Up to now, the motion of electrons in solids has been successfully described by focusing on one electron and replacing the Coulomb interaction of all the other electrons by a mean field potential. This method is called mean field theory, which made important contributions to the explanantion of the electronic structure in solids, and led to the classification of insulators, semiconductors and metals in terms of the band theory. It might be said that also the present achievements in the field of semiconductor technology rely on these foundations.In the mean field approximation, effects that arise due to the correlation of the motions of many particles, cannot be described. It has been treated in a perturbative way under the assumption that its effect is small. However, recently, many systems that cannot be described in this standard wayhave been discovered, and it became clear that a new world opened its doors. Connected to these new aspects of condensed matter physics, the most fundamental problem of quantum theory - the duality between the particle picture and the wave picture - appeared in a very striking way. This particle-wave duality appears in the framework of many-particle quantum field theory as a canonical conjugate relation between the particle number and the quantum mechanical phase.

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内容概要

Condensed matter physics deals with a wide variety of topics, ranging from gas to liquids and solids, as well as plasma, where owing to the interplay between the motions of a tremendous number of electrons and nuclei, rich varieties of physical phenomena occur. Quantum field theory is the most.

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