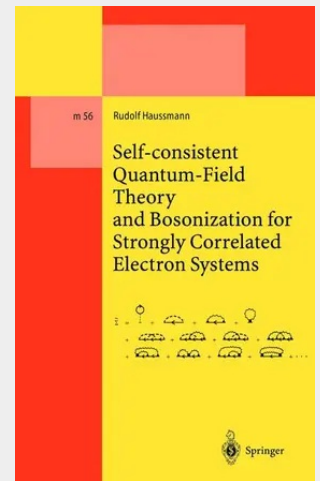


Self-consistent Quantum-Field Theory and Bosonization for Strongly Correlated Electron Systems

In interaction the between the leads to a quantum liquids particles variety of and unusual states of condensed matter interesting systems, super e.g. and the fractional in electron Hall effect conductivity quantum (FQHE) sys tems. In this book for we investigate quantum field theoretical approaches fermion the is interacting systems. Originally, quantum fieldtheory designed describe as a to perturbation theory weakly interacting many particle sys tems. For treatment of interaction and correlation effects a proper beyond the the series of must beresummed perturbation theory, Feynmandiagrams severalresummationschemeswhich the We on partially. present depend par ticular effect considered. We start with ofthe a physical compactdescription self consistent and the quantum fieldtheory approximations. conserving the of in fermion is caused two Superconductivity systems by interplay formation ofbound attractive interaction between the phenomena: pairsby fermions condensation ofthe low to and at temperatures leading long pairs order and We consider three dimensional of a range superfluidity. system fermionswith attractiveinteractionwhichshowsacrossoverfrom short range BCS to Bose Einstein condensation ofbound ifthe superconductivity pairs interaction is tuned fromweak to While the self coupling. strength strong consistent version ofthe is well suited to describe con quantum field theory densation of and a second resummation to the pairs superfluidity, leading the ofbound Bethe Salpeter equation describes formation pairs.

This research monograph offers an introduction to advanced quantum field theoretical techniques for many-particle systems beyond perturbation theory. Several schemes for resummation of the Feynman diagrams are described. The resulting approximations are especially well suited for strongly correlated fermion and boson systems. Also considered is the crossover from BCS superconductivity to Bose--Einstein condensation in fermion systems with strong attractive interaction. In particular, a field theoretic formulation of "bosonization" is presented; it is published here for the first time. This method is applied to the fractional quantum Hall effect, to the Coulomb plasma, and to several exactly solvable models.



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