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Statistical Mechanics of Superconductivity

By Takafumi Kita

Springer Verlag, Japan. Hardback. Book Condition: new. BRAND NEW, Statistical Mechanics of Superconductivity, Takafumi Kita, This book provides a theoretical, step-by-step comprehensive explanation of superconductivity for undergraduate and graduate students who have completed elementary courses on thermodynamics and quantum mechanics. To this end, it adopts the unique approach of starting with the statistical mechanics of quantum ideal gases and successively adding and clarifying elements and techniques indispensable for understanding it. They include the spin-statistics theorem, second quantization, density matrices, the Bloch-De Dominicis theorem, the variational principle in statistical mechanics, attractive interaction and bound states. Ample examples of their usage are also provided in terms of topics from advanced statistical mechanics such as two-particle correlations of quantum ideal gases, derivation of the Hartree-Fock equations, and Landau's Fermi-liquid theory, among others. With these preliminaries, the fundamental mean-field equations of superconductivity are derived with maximum mathematical clarity based on a coherent state in terms of the Cooper-pair creation operator, a quasiparticle field for describing the excitation and the variational principle in statistical mechanics. They have the advantage that the phase coherence due to the Cooper-pair condensation can be clearly seen making the superfluidity comprehensible naturally. Subsequently, they are applied to homogeneous cases to...

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