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Sinopsis

This monograph presents recent developments in quantum field theory at finite temperature. By using Lie groups, ideas from thermal theory are considered with concepts of symmetry, allowing for applications not only to quantum field theory but also to transport theory, quantum optics and statistical mechanics. This includes an analysis of geometrical and topological aspects of spatially confined systems with applications to the Casimir effect, superconductivity and phase transitions. Finally, some developments in open systems are also considered. The book provides a unified picture of the fundamental aspects in thermal quantum field theory and their applications, and is important to the field as a result, since it combines several diverse ideas that lead to a better understanding of different areas of physics.

Contents: General Principles: Elements of Thermodynamics; Elements of Statistical Mechanics; Partition Function and Path Integral; Zero Temperature Interacting Fields; Thermal Fields: Thermofield Dynamics: Kinematical Symmetry Algebraic Basis; Thermal Oscillators: Bosons and Fermions; Thermal PoincarÃ© and Galilei Groups; Thermal Propagator; Scattering Process at Finite Temperature; Topics on Renormalization Theory; Ward-Takahashi Relations and Gauge Symmetry; Applications to Quantum Optics: Thermalized States of a Field Mode; Nonclassical Properties of Thermal Quantum States; SU(2) and SU(1,1) Systems: Entanglement; Compactified Fields: Compactified Fields; Casimir Effect for the Electromagnetic Field; Casimir Effect for Fermions; Compactified 4 Theory; Phase Transitions in Confined Systems: Application to Superconducting Films; Second-Order Phase Transition in Wires and Grains; First-Order Phase Transitions in Confined Systems; Applications to Open Systems: Thermo-Algebras in Phase Space: Quantum and Classical Systems; Real-Time Method for Nonequilibrium Quantum Mechanics; Dressed and Bare State Approaches to the Thermalization Process.