Geometric phase and chiral anomaly in path integral formulation[1]

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Abstract

The geometric phases in quantum mechanics are nicely formulated by path integral if one uses the second quantization technique. The exact hidden local symmetry inherent in the Schrödinger equation becomes transparent in this formulation, and the holonomy associated with the hidden local symmetry controls all the geometric phases, namely, adiabatic, non- adiabatic and mixed state geometric phases. All the geometric phases are dynamical in the sense that they are part of the effective Hamiltonian and thus topologically trivial. In particular, the adiabatic (Berry) phase is recognized as an approximate diagonalization of the effective Hamiltonian. The basic differences between geometric phases and chiral anomalies in field theory, which are also nicely formulated by path integral, are mentioned.

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[1]Related fields: 1. Quantum Mechanics, 2. Quantum Field Theory