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## Нестандартные оптические проявления квантовой геометрической фазы = Nonstandard optical manifestations of the quantum geometric phase : Nonstandard optical manifestations of the quantum geometric phase : диссертация ... кандидата физико-математических наук : 01.04.05 / Ростом Айхам; [Место защиты: ФГАОУ ВО «Новосибирский национальный исследовательский государственный университет»]. - Новосибирск, 2022. - 126 с. разд. паг. : ил.

## Введение диссертации (часть автореферата)на тему «Нестандартные оптические проявления квантовой геометрической фазы»

Abstract

Anholonomy is a purely geometric feature of the physical evolution. During this process, the physical system fails to return to its original state after a cyclic evolution, leading to a rotation by a non-integrable (path-dependent) phase angle called the geometric phase. The quantum theory deals with indistinguishable processes and describes their physical effects through the expectation values and probabilities, which can be derived from the interference between probability amplitudes. In such a quantum structure of interference between complex quantities, the geometric phase factor must be a key element. It carries non-trivial information about the geometry or topology of the quantum evolution and shifts the dynamical oscillations of the quantum interference pattern.

The geometric phase is a kinematic notion that accompanies any kind of evolution of the physical system (classical, quantum, discrete, continuous, adiabatic, non-adiabatic, cyclic, and open). However, it has been studied only for the most general types of quantum states, i.e., for noncompound isolated pure or mixed quantum states.

The present work investigates the role that the geometric phase plays in open and composite quantum systems. This includes an atomic Bose-Einstein condensate localized in the minima of a double-well optical potential with irreversible photon loss, the evolution of subspaces of quantum states, and optical interferometry under system-environment nondestructive interaction.

It has been found that the optical geometric phase can cause a remarkable modification of the state of Bose-Einstein condensate. The amount of modification can be revealed by studying the tunneling between the atomic localizations. Moreover, the geometric phase can be defined not only for the evolution of vectors in the Hilbert space, but also for the evolution of subspaces. It is also shown that the operation on the geometric phase in interferometry is the optimal strategy for postselected quantum metrology.

The results of the dissertation are of particular importance for our fundamental understanding of quantum correlations and for practical applications in quantum metrology and control.