Title:	Geometric Phase and its applications : Topological Phases , Quantum walks and Non-Inertial quantum systems
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Abstract:	Geometric phase plays a fundamental role in quantum theory and accounts for wide phe- nomena ranging from the Aharanov-Bohm effect, the integer and fractional quantum hall ef- fects, and topological phases of matter, including topological insulators, to name a few. In this thesis, we have proposed a fresh perspective of geodesics and null phase curves, which are key ingredients in understanding the geometric phase. We have also looked at a number of appli- cations of geometric phases in topological phases, quantum walks, and non-inertial quantum systems. The shortest curve between any two points on a given surface is a (minimal) geodesic. They are also the curves along which a system does not acquire any geometric phase. In the same context, we can generalize geodesics to define a larger class of curves, known as null phase curves (NPCs), along which also the acquired geometric phase is zero; however, they need not be the shortest curves between the two points. We have proposed a geometrical decomposition of geodesics and null phase curves on the Bloch sphere, which is crucial in improving our understanding of the geometry of the state space and the intrinsic symmetries of geodesics and NPCs. We have also investigated the persistence of topological phases in quantum walks in the presence of an external (lossy) environment. We show that the topological order in one and two-dimensional quantum walks persist against moderate losses. Further, we use the geo- metric phase to detect the non-inertial modifications to the field correlators perceived by a circularly rotating two-level atom placed inside a cavity.
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