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DISSIPATIVE TWO-LEVEL SPIN SYSTEM AND GEOMETRICAL PHASE

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Abstract. We propose to extend the concept of geometric phase to quantum dissipative systems, in the case of meta-stable spin states in magnetic resonance. We use the generalized version of Lewis–Riensenfeld invariant theory to study the dissipative systems described by non-hermitian time-dependent Hamiltonian.

1. Introduction

Two decades ago, Berry [2] has discovered the geometrical phase associated to adiabatic cyclic evolution of non-degenerates eigenstates of quantum Hermitian Hamiltonian. Later, the growing investigations were devoted to the generalization of Berry's result to several contexts. Indeed, Wilzek and Zee [13] extend this result to adiabatic evolution of degenerates eigenstates. Removing the adiabatic hypothesis, Aharonov and Anandan [1] have generalized Berry's result to the non-adiabatic case. Samuel and Bhandari [12] and Pati [11] established the Berry's phase analogue in the case of non-cyclic evolutions. All this works deal with quantum Hermitian Hamiltonians.

In the last decade, there has been substantial interest in the complex geometric phase acquired by the eigenstates of the dissipative quantum systems described by non-hermitian Hamiltonians.

Garrison and Wright [5] have shown that the geometrical phase associated with cyclic unitary time evolutions are replaced by the geometrical multipliers in the case of dissipative evolution equations, phenomenologically described by non-hermitian Hamiltonian. Latter Dattoli *et al* [4] studied the geometric phase for the optical supermode propagation in a free electron laser, which is a classical system described by a Schrödinger-like equation with non-hermitian Hamiltonian. The complex geometric phase is also studied by Nenciu and Rasche [10] and by