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Open quantum system in external magnetic field within non-Markovian quantum Langevin approach

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Abstract

The non-Markovian dynamics of a charged particle linearly coupled to a neutral bosonic heat bath is investigated in an external uniform magnetic field. The analytical expressions for the time-dependent and asymptotic friction and diffusion coefficients, cyclotron frequencies, variances of the coordinate and momentum, and orbital magnetic moments are derived. The role of magnetic field in the dissipation and diffusion processes is illustrated by several examples in the low- and high-temperature regimes. The localization phenomenon for a charged particle is observed. The orbital diamagnetism of quantum system in a dissipative environment is studied. The quantization conditions are found for the angular momentum.

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Keywords: Open quantum systems; Friction and diffusion coefficients; Non-Markovian dynamics; fluctuations; magnetic field; cyclotron frequency; friction coefficients; Langevin formalism

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