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Coherence of an electron bound to a moving quantum dot
REINALDO DE MELO E SOUZA, ANDRE SARAIVA, Federal University of Rio de Janeiro, XUEDONG HU, University of Buffalo, BELITA KOILLER, Federal University of Rio de Janeiro — Several problems have hindered the development of logic gates based on electrons bound to a quantum dot. Strong exchange interactions implicate short coherence time (as compared to processing time) and this constitutes one of the greatest obstacles. As an alternative, in recent years there has been much study involving flying qubits, in which we have the coherent transport of a particle. In the case of electrons, it has been experimentally shown that they can be successfully transported from a quantum dot to another one (separated by few micrometers) by a surface acoustic wave (SAW). Nevertheless, distinct factors may affect the electron coherence along the motion. In this work we analyze theoretically the transport of an electron from one quantum dot to another one by an applied potential. Although the time dependence for the entire process is usually very complicate, we may describe the problem in several steps so that each one can be modeled as a harmonic oscillation with time-dependent parameters, enabling us to obtain general analytic expressions (spin-orbit coupling neglected) in situations of experimental interest.

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