Universidad Carlos III de Madrid

Seminario del Instituto Gregorio Millán

Spin dynamics in one dimension: any surprises?

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Abstract

We analyze spin dynamics in one dimensional systems and find that despite simplicity they show interesting surprises.

We concentrate on two effects: spin-dependent tunneling and spin relaxation and noise.

First, we analyze spin dynamics in the tunneling decay of a localized particle in the presence of spin-orbit coupling. The spin polarization at a short time scale is affected by initial state while at long times both the probability and the spin density exhibit diffraction-in-time phenomenon. We find that tunneling in general can be characterized by a new parameter, the tunneling length, which can be seen in the spin precession.

Next, we consider the effects of random potentials in one-dimensional nanosystems and develop a theory of spin relaxation there. A theory of spin noise in semiconductor nanowires considered as prospective elements for spintronics will be presented. In these structures spin-orbit coupling can be realized as a random function of coordinate. We demonstrate that the spin relaxation can be very slow and the resulting noise power spectrum diverges as frequency goes to zero.

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