ELECTRONIC AND TRANSPORT PROPERTIES OF A FERROMAGNET WITH A DOMAIN WALL

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9.7 cm

We present a theoretical description of conduction electrons in a ferromagnetic metal, which interact with a domain wall. The description takes into account Coulomb repulsion between electrons and the exchange interaction. Within the semiclassical approximation we calculate the equilibrium spin and charge distributions and show that the wall gives rise to a nonuniform accumulation of both charge and spin. The calculations are self-consistent and account for the effects of spin and charge redistribution at the wall on the electronic spectrum of conduction electrons propagating in an effective self-consistent elecrostatic potential and in the exchange field created by a nonuniform magnetization. We also calculate the local charge and spin conductivities, and analyse possible effects associated with the charge and spin accumulation at the wall. The nonuniformity of charge conductivity can give rise to the heating effect (Peltier effect) at the domain wall. It also leads to a nonuniform internal electric field, when an external bias voltage is applied. This, together with an inhomogeneous distribution of charge, can result in a drift of the wall due to electric current.

13.4 cm

Subject category :

2. Magnetic Films, Surfaces and Multilayers

Presentation mode :
Poster

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