

Modulation of spin dynamics in a channel of a nonballistic spin field effect transistor

Shafir E., Shen M., Saikin S.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

We have investigated the effect of gate control over the spin polarization drag in an $\text{Al}_{0.3}\text{Ga}_{0.7}\text{As}/\text{GaAs}/\text{Al}_{0.3}\text{Ga}_{0.7}\text{As}$ heterostructure. The study is motivated by a recent proposal for a nonballistic spin field effect transistor that utilizes the interplay between the Rashba and the Dresselhaus spin-orbit interaction in the device channel. A model that utilizes real material parameters, in order to calculate spin dynamics as a function of the gate voltage, has been developed. From the obtained results, we define the efficiency of the spin-polarization modulation and spin-density modulation. The estimated modulation of the spin polarization at room temperature is of the order of 15-20%. The results show that the effect is not sufficient for device applications. However, it can be observed experimentally by spatially resolved optical pulse-probe techniques. © 2004 The American Physical Society.

<http://dx.doi.org/10.1103/PhysRevB.70.241302>
