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

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### 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.

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