Oscillatory Magnetoresistance in a Spin Field Effect Transistor

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We consider ballistic magnetotransport across the interface of a ferromagnetic metal and a quasi one-dimensional compound semiconductor. A regime of negative magnetoresistance is found for a value of the magnetic field below a critical value. This regime can be controlled with an external transverse electric field that modulates the Rashba spin orbit interaction in the semiconductor. Next, we consider a Spin Field Effect Transistor (SPINFET) consisting of a quasi one-dimensional semiconductor channel flanked by two ferromagnetic contacts. A third gate contact is used to apply a transverse electric field on the channel to modulate the Rashba interaction. We show that positive or negative magnetoresistance can be observed in the SPINFET by tuning the gate voltage.

References

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