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Quantum Oscillation of Conductance and Negative Tunneling Magnetoresistance in Velocity-Modulated Graphene Spin-Valve Device

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Mismatch effect of renormalized Fermi velocity of massive Dirac fermions on the spin transport properties and tunneling magnetoresistance in a gapped graphene-based ferromagnetic/velocity barrier/ferromagnetic (FG/VB/FG) junction is investigated. The electrostatic potential created by the applied voltage on the VB region can generate spin-dependent collimation of Dirac fermions. The quantum beating pattern in the spin conductance oscillation are shown as a function of the Fermi energy at low velocity ratio (the Fermi velocity inside the barrier to that outside the barrier). The Fermi-velocity mismatch effect between graphene junction give rises to the oscillating behavior of negative tunneling magnetoresistance at the velocity ratio less than one.

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