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Spin diffusion and precession at the multiferroic interface and InAs quantum wells PENG ZHANG, MING-WEI WU, Hefei National Laboratory for Physical Sciences at Microscale and Department of Physics, University of Science and Technology of China — We study spin diffusion and precession in a two-dimensional electron gas at the multiferroic interface and InAs quantum wells respectively by means of the kinetic spin Bloch equation approach [Wu *et al.*, Physics reports **493**, 61 (2010)]. At the $AlO_3/SrTiO_3/TbMnO_3$ heterostructure with a temperature being as low as 15 K, the two-dimensional electron gas at the $LaAlO_3/SrTiO_3$ interface interacts with the spiral magnetic moments of Mn^{3+} in $TbMnO_3$ via the Heisenberg exchange interaction. It is demonstrated that the spin diffusion length at the interface is always finite, despite the polarization direction of the injected spins. It is also revealed that the Coulomb scattering plays an important role and effectively suppresses the spin diffusion. The spin precession in InAs quantum wells is investigated with the Rashba spin-orbit coupling being modulated by a gate voltage. The gate-voltage dependence of spin diffusion under different temperatures is studied with all the scattering explicitly included. Our result partially supports the claim of the realization of the Datta-Das spin-injected field effect-transistor by Koo *et al.* [Science **325**, 1515 (2009)]. We also show that the scattering plays an important role in spin diffusion in such a system.

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