Nonlinear effects in 2DEG with cubic form of Rashba spin-orbit interaction

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Nonlinear transport phenomena are focusing recenty enormous attention due to the unidirectional character of the current response that may be easily applied in spin-logic devices [1] or the current rectification in THz technology [2]. Moreover, the nonlinear Hall effect is sensitive to breaking the crystal symmetries and does not undergo the limits of optical methods. Therefore, it became a prominent tool for material characterisation in spatial-symmetry-related physics and probing the topological phase transitions [3].

Here, we consider theoretically 2DEG with a spin-orbit coupling of k-cubed Rashba type in the presence of an external magnetic field. We derived the intrinsic nonlinear Hall effect induced by the Berry curvature dipole [4]. We discuss, among others, the nonlinear transverse response that can be tuned by an in-plane magnetic field. Furthermore, using Green's function formalism, we provide the analytical results for the bilinear magnetoresistance as well as the planar Hall effect originating in non-equilibrium spin polarisation in the system [5].

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