Selected transport phenomena induced by cubic forms of spin-orbit interaction in 2D structures

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In two-dimensional systems, the lack of inversion symmetry leads, in principle, to the two well-known types of spin-orbit coupling: the Dresselhaus SOC and the Rashba one. In most cases, the k-linear forms of these two couplings are considered. In the case of Rashba systems, the k-cubed component may exist regardless of the k-linear one and has been found, e.g., in strained-Ge/SiGe heterostructure [1]. Moreover, it has been shown experimentally that 2DEG at interfaces of perovskite oxides, such as $LaAlO_3/SrTiO_3$, reveals strong SOC of the Rashba type, and the k-cubed form may play an important role [2]. The cubic Dresselhaus SOC is also often neglected, whereas this component may be important at higher carrier concentrations.

We will discuss and summarize our recent studies of selected transport phenomena, such as anomalous Hall and Nernst effect and current-induced spin polarization in effective models describing magnetic and nonmagnetic 2DEG with the k-cubed form of Rashba and Dresselhaus SOC. Using Matsubara Green's function formalism in the linear response regime, we obtained detailed analytical and numerical results. We focused, e.g., on the interplay between SOC and exchange interaction, the role of temperature and distinct properties of k-cubed SOC concerning k-linear one [4].

References:

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