Diagrammatic calculation of the Bloch equations in the presence of spin-orbit coupling

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ABSTRACT

We study the current-induced spin polarization in a two-dimensional electron gas. To this end, we derive the Bloch equations in the presence of the extrinsic (due to impurities) and intrinsic (Rashba and Dresselhaus) spin-orbit coupling by using the standard Kubo formulation. We find that the interplay of the mechanisms yields a new electric field dependent term in the Bloch equations. We analyze the consequences of this new term on the dependent of the current-induced spin polarization on derivation of the in-plane applied electric field.