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Spin accumulation in a Rashba-type two-dimensional electron gas due to a nonuniform driving electric field[1] LU-YAO WANG, CHON-SAAR CHU, Department of Electrophysics, National Chiao Tung University, MAL'SHUKOV ANATOLY, Institute of Spectroscopy, Russian Academy of Science
— It is well understood that a Rashba-type two-dimensional electron gas (2DEG) does not support spin accumulation, or spin Hall effect, in the diffusive regime when the driving electric field is uniform. In this work we address the issue about a possible restoration of the spin Hall effect when the driving field is nonuniform. Toward this end, we consider the spin accumulation in the vicinity of a circular hole, with radius $R \sim l_{so}$, where the driving field becomes nonuniform. Here l_{so} is the spin relaxation length, and $l_{so} >> l_e$, the electron mean free path. Our result shows that the nonuniform driving field gives rise to nonuniform in-plane spin densities S_x and S_y, which in turn contribute to a finite spin current via the combined processes of spin diffusion and spin-precession. The spin accumulation thus obtained is proportional to the Rashba coupling constant α, and its spatial pattern is one of spin-dipole form, aligned perpendicular to the driving field.

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