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Enhancement and suppression of spin density polarization due to inhomogeneous electric fields[1] DAN CSONTOS, SERGIO ULLOA, Dept. of Physics and Astronomy, Ohio University, Athens, OH 45701 — We report on a theoretical and computational study of the spin polarization propagation in charge and spin inhomogeneous semiconductor structures. We use a self-consistent, semi-classical approach based on the Boltzmann transport equation to calculate the spin density imbalance, δn_s, defined as $\delta n_s = n_\uparrow - n_\downarrow$, and the spin density polarization, P_s, defined as the ratio $P_s = \delta n_s / n$, where n is the total charge density, in the presence of inhomogeneous electric fields. We find that the spin-polarized transport can be drastically enhanced or suppressed by inhomogeneous electric fields, such as those arising at semiconductor interfaces. Furthermore, we find that the spin density imbalance, δn_s, and spin density polarization, P_s, have diametrically opposite dependence on doping concentrations and charge inhomogeneous distributions. This is in contrast to the common assumption in the literature that these two quantities essentially have the same spin relaxation lengths.

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Dan Csontos
Dept. of Physics and Astronomy, Ohio University

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