Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Unitarity of scattering and edge spin accumulation in a ballistic and quasiballistic regimes ALEXANDER KHAETSKII, University at Buffalo, SUNY, EUGENE SUKHORUKOV, University of Geneva, Switzerland — We consider a 2D ballistic structure with spin-orbit-related splitting of the electron spectrum. We calculated the edge spin density which appears in the presence of a charge current through the structure. Combined effect of the boundary scattering and spin precession leads to oscillations of the edge polarization. The problem is solved with the use of the method of scattering states. We clarified the important role of the unitarity of scattering for the problem of edge spin accumulation. For Rashba Hamiltonian, which is linear in momentum, and in the case of a straight boundary it leads to exact cancellation of long-wave oscillations of the spin density with a period order of spin precession length. However, this appears to be rather exceptional case. In general, the smooth spin oscillations recover, as it happens, e.g., for the wiggly boundary. For qubic Hamiltonian (2D holes) the unitarity scattering conditions are different, as a result, even in the case of a straight boundary the cancellation of the smooth oscillations in spin density does not occur. Similar problem is considered for the case when the sample size is large compared to the mean free path which in its turn is much larger than the spin precession length. For example, for the cubic Hamiltonian the "edge" contribution to the spin density can be larger than the "bulk" one which appears as a result of the spin flux from the bulk. This demands the reinterpretation of the experimental results [1]. [1]. J. Wunderlich et al., PRL 94, 047204 (2005).

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Date submitted: 07 Dec 2010 Electronic form version 1.4