Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Inverse Edelstein Effect[1] KA SHEN, GIOVANNI VIGNALE, Department of Physics, University of Missouri, Columbia MO 65211, ROBERTO RAIMONDI, CNISM and Dipartimento di Matematica e Fisica, Università Roma Tre, Via della Vasca Navale 84, 00146 Rome, Italy — In this work, we provide a precise microscopic definition of the recently observed "Inverse Edelstein Effect", in which a non-equilibrium spin accumulation in the plane of a two-dimensional (interfacial) electron gas drives an electric current perpendicular to its own direction. The drift-diffusion equations that govern the effect are presented and applied to the interpretation of the experiments. By taking into account the Rashba spin-orbit interaction, we show how the inverse Edelstein effect arises as a combination of the z-spin current flowing along the y-direction due to an non-equilibrium S^y polarization and of the inverse spin Hall effect mechanism which yields, in turn, a x-flowing charge current. Explicit results have been shown in the diffusive regime where we have used the theoretical framework of the $SU(2)$ formulation for linear-in-momentum spin-orbit coupling.

[1]NSF Grant No. DMR-1104788 and EU Grant. No. PITN-GA-2009-234970

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Date submitted: 14 Nov 2013 Electronic form version 1.4