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Spin currents in the presence of non-uniform fields. ADNAN REBEI, Seagate Technology — A two dimensional electron gas with spin-orbit coupling and in the presence of an in-plane electric field give rise to a spin Hall current independent of the Rashba coupling. We show that this universality of the strength of the spin current survives even in the presence of non-uniform electric and magnetic fields. Gradients in magnetic fields are shown to couple charge and spin transport and hence provide a better way to detect spin currents. Our calculation parallels that of the derivation of the Chern-Simons effective action in a relativistic electron gas and hence avoids the use of the Kubo formula. The spin conductivity is also discussed in terms of spin accumulation in a non-uniformly magnetized square loop.

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