

Abstract Submitted
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Beyond the spin-Hall effect DIMITRIE CULCER, ROLAND WINKLER, Argonne National Laboratory and Northern Illinois University — Considerable progress has been made in recent years in the electrical manipulation of spins in semiconductors. An extraordinary amount of experimental and theoretical work have culminated in the prediction and discovery of the spin-Hall effect and of spin generation by an electric field. In the past year alone the spin-Hall effect was observed at room temperature and several groups successfully measured spin currents directly. However, we will demonstrate that the symmetry of crystal lattices allows spin currents other than the spin-Hall current and the spin current response to an electric field can be very complex. We will discuss samples in which such currents are expected to arise. The presence of non- spin-Hall currents has important and interesting consequences with regard to the manipulation of spins by electric fields. We will moreover show that spin currents and bulk spin densities in an electric field arise from linearly independent contributions to the density matrix, and that the presence of a nonequilibrium spin density has a profound effect on the spin current [1, 2]. [1] D. Culcer and R. Winkler, arxiv:0708.4009, to appear in Phys. Rev. Lett. [2] D. Culcer and R. Winkler, arxiv:0710.5260, submitted to Phys. Rev. B.

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