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Imprinting the momentum distribution anisotropy of photoexcited electrons in semiconductors into their spins by a ferromagnetic proximity effect LAN QING, Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627, HANAN DERY, Department of Electrical and Computer Engineering, University of Rochester, Rochester, New York 14627 —

We calculate the spin polarization after the reflection off a ferromagnet while considering the anisotropic crystal momentum distribution of photoexcited electrons in semiconductors. The imprinted spin information persists much longer than the momentum relaxation time in subpicoseconds, and hence provides an enormous expansion of the time scale to observe the anisotropy. In steady state conditions, the scale may extend even longer to the spin-lattice relaxation time. In the case of cubic crystal symmetry, the initial momentum distribution of photoexcited electrons, and thus the imprinted spin vector, depends on the directions of the light polarization, the normal of the semiconductor/ferromagnet interface, and the magnetization. We show detailed results of various configurations for both linearly and circularly polarized light, and discuss the effects of the direct and mixing conductance of the interface. While mainly focusing on direct gap semiconductors, we also briefly mention the anisotropy signal due to indirect optical transitions in silicon.

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