Optical control of spin in nonlinear photoemission from metal surfaces

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The interaction of polarized light with electronic states that are influenced by spin-orbit coupling provides mechanisms for selective excitation of spin-polarized electrons in nonmagnetic and magnetic solids. The result of spin-orbit coupling in photoexcitation bears close analogy to the effect of a magnetic field, and it provides the means to control magnetic and other spin-dependent phenomena by optical excitation processes on time scales of the order of the applied laser pulse lengths.

We demonstrate how to optically control the spin polarization of photoelectrons emitted in nonlinear photoemission at Cu(001) surfaces under the influence of spin-orbit coupling in the copper electronic structure [1,2].

At magnetic surfaces, spin-selective excitation of photoelectrons can lead to magnetization dependent photoemission intensity changes (magnetic dichroism). As an implication of this effect in two-photon-photoemission experiments, magnetic dichroism from unoccupied quantum well states in ultrathin cobalt films grown on Cu(001) is discussed [3,4].

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