Spin-transport Mediated Single-shot All-optical Magnetization Switching of Metallic Films

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During the last decade all-optical ultrafast magnetization switching in magnetic material thin film without the assistance of an applied external magnetic field has been explored [1,2]. It has been shown that femto-second light pulses can induce magnetization reversal in a large variety of magnetic materials [3,4]. However, so far, only certain particular ferrimagnetic thin films exhibit magnetization switching via a *single* femto-second optical pulse. All optical helicity dependent switching of a ferromagnetic layer could be demonstrated for a low number of pulses [5]. We will present the single-pulse switching of various magnetic material (ferrimagnetic, ferromagnetic) within a magnetic spin-valve structure and further show that the four possible magnetic configurations of the spin valve can be accessed using a sequence of *single* femto-second light pulses. Our experimental study reveals that the magnetization states are determined by spin-polarized currents generated by the light pulse interactions with the GdFeCo layer [6]. A detail study showing how spin-polarized currents are generated and how they interact with magnetic layers (Ferromagnetic or Ferrimagnetic) to lead to magnetization switching will be presented [7,8].

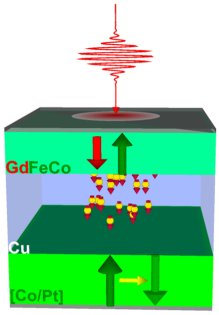

Figure 1: Sketch of a spin-valve structure used to demonstrate femto-second single pulse switching of each magnetic layer independently. The generation of femto-second spin current is shown to play a major role.

References:

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