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Interfacial spin-coupling in magnetic bilayers and their role for ultrafast magnetization dynamics

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Rare-earth metals exhibit the highest magnetic moments among all atomic elements and show delicate magnetic ordering and concomitant complex photo-induced dynamics. We studied the fluence-dependent magnetization dynamics in Gadolinium (Gd), Terbium (Tb), and in bilayer systems combining both metals, grown on a W(110) substrate. For our investigations the FemtoSpex slicing facility at the synchrotron source BESSY II is ideal since we can probe the magnetization dynamics with X-ray magnetic circular dichroism element-specifically and with a time resolution of 130 fs. All samples show a two-step demagnetization as observed in previous experiments on Gd and Tb [1-4]. Interestingly the static magnetic properties as well as the laser-induced ultrafast spin dynamics of a Gd thin film can be dramatically altered by depositing a few monolayers of Tb on top. Our results further indicate that the interfacial coupling in the bilayer system and the sub-picosecond spin dynamics of the composite system depend on the sample temperature and varies with distance from the interface. Our future studies will profit from the new BMBF-financed DynaMax endstations at the slicing beamline.

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