Slow (relativistic) and fast (exchange) switching in Gd/FeCo multilayers

Aleksandr Buzdakov[1], Thomas Blank[2], Konstantin Zvezdin[3], Alexey Kimel[2]
[1]Istituto Italiano di Tecnologia, Italy
[2]Radboud University, Netherlads
[3]Istituto PM, Italy

alex.buzdakov@gmail.com

Ferrimagnets are highly appealing in ultrafast magnetism. The discovery of all-optical magnetic switching in GdFeCo alloys nearly two decades ago spurred interest in this field, revealing phenomena like toggle switching and current-induced switching in rare-earth transition metal alloys. Rare-earth/transition-metal multilayers further enhance this field by allowing control over interlayer exchange interaction, magnetization, and magnetic anisotropy. By tuning multilayer thicknesses, one can manipulate compensation and Curie temperatures, leading to diverse laser-induced spin dynamics. This work draws inspiration from recent findings on tunable laser-induced spin dynamics in Gd/FeCo multilayers [1]. We theoretically explored laser-induced magnetization dynamics in Gd/FeCo multilayers, focusing on the effects of applied magnetic field and temperature. Unlike GdFeCo alloys, these multilayers exhibit unique magnetic parameters, which we defined through an H-T phase diagram model fitted to experimental data. Using these parameters and modified Landau-Lifshitz-Bloch equations, we simulated transverse and longitudinal magnetization dynamics, successfully reproducing a wide range of experimental observations. This work advances our understanding of ultrafast magnetization dynamics in multisublattice materials with canted spins.

References

[1] T.G.H. Blank, B.D. Muis, T. Lichtenberg, B. Koopmans, A.V. Kimel, arXiv:2401.10671.

Figures

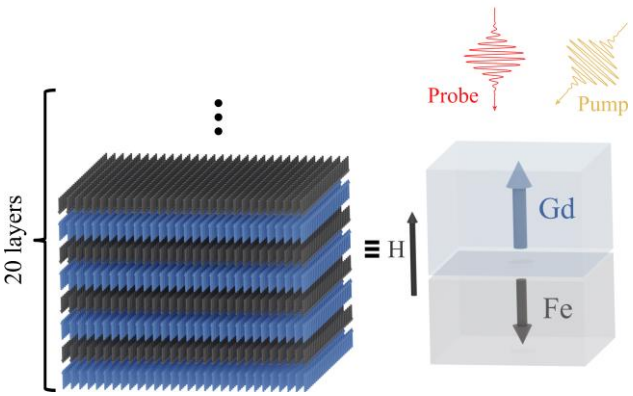

Figure 1. Schematic picture of studied Gd/FeCo multilayered structure.