# Optically induced demagnetization in $Gd_{23}Fe_{77-x}Co_x$

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The manipulation of the magnetic order in a ferrimagnet by the use of an ultrafast laser radiation has seen growing interest since the work published by Beaurepaire et al. [1]. In GdFeCo rare earth (RE)-transition metal (TM) amorphous alloys, it has been demonstrated that all optical switching (AOS) can occur in these materials and the magnetization reversal can be triggered in a sub-picosecond timescale [2]. The magnetization reversal within this material is found to be achieved via a transient FM-like state where the RE and TM moments are parallely aligned [3]. Such reversal can be triggered every time when the two sub-lattices are brought out of their equilibrium state by a heat pulse alone [4]. In terms of applications, this mechanism could revolutionize the industry of magnetic recording and information technologies. Therefore, in sight of the large interest that has been paid to the study of this reversal mechanism, an important aspect is to determine the parameters that could boost this reversal process.

In order to achieve such a goal, we have investigated the optically induced demagnetization dynamics in GdFeCo RE-TM amorphous alloy when changing the Fe/Co constituent ratio. For that purpose, $Gd_{23}Fe_{77-x}Co_x$ thin films were fabricated with magnetron sputtering technique, where the Co composition x was varied from 0 to 15 atomic percent while keeping the Gd composition fixed. The obtained samples exhibit strong out-of-plane anisotropy and equivalent coercive fields.

The ultrafast demagnetization dynamics of the thin films is measured with the Faraday effect in a stroboscopic pump-probe experiment. Fig.1 displays the normalized Faraday signal obtained in $Gd_{23}Fe_{77}$ and $Gd_{23}Fe_{67}Co_{10}$ as a function of the elapsed time after exposing the sample to an ultrashort laser radiation. As it can be deduced from the graph, the difference in demagnetization dynamics for $Gd_{23}Fe_{77}$ and $Gd_{23}Fe_{67}Co_{10}$ is of significant importance when considering the AOS phenomena. Our primary findings, which will be presented during this talk, could lead to important indications for the engineering of new magnetic media.

Reference

1) E. Beaurepaire et al., Phys. Rev. Lett.76, 4250 (1996)
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3) I. Radu et al., Nature 472, 205 (2011)
4) T.A. Ostler et al., Nature comm. 3, 666 (2012)

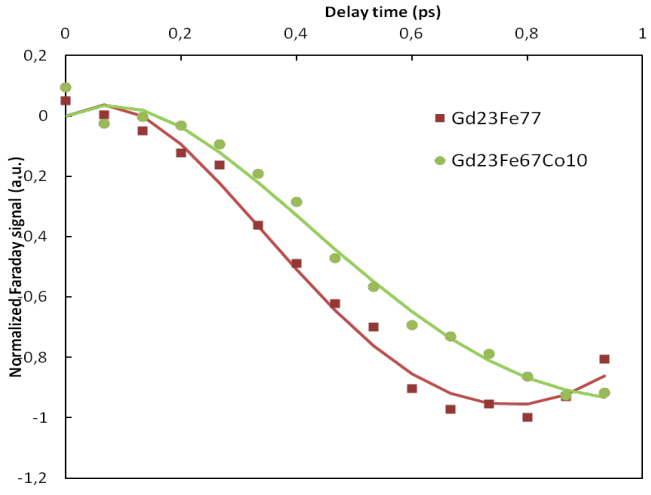


Fig.1 Demagnetization dynamics of Gd23Fe77 and Gd23Fe67Co10 amorphous alloys measured with Faraday pump-probe set-up in the time range [0, 1ps]. The solid lines are fits obtained from double exponential function.