Time-resolved MOKE and GMI effects in Co-rich Amorphous Ribbons

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Recent development of the ultrafast spectroscopy provides a unique tool to access elementary scattering and relaxation processes by optically exciting the electronic and spin subsystems [1]. A particular interest is amorphous microwires and ribbons exhibiting giant magnetoimpedance (GMI) effect. We present the study of magnetization precession in a Co-rich ribbon induced by femto-second laser pulses. We deduce the frequency and amplitude of the magnetization precession as a function of the laser intensity (Fig. 1).
The magnetization precession is triggered by a thermal change in the effective field of the magnetic anisotropy on a single-picosecond timescale. We reveal a correlation between the frequency of magnetization precession obtained by laser induced excitation and the resonance frequency of GMI response. These results enable detection of the GMI effect in the ultrahigh-frequency regime, which appears highly attractive for gigahertz applications.
The improvements in the properties of GMI materials will facilitate the development of multifunctional composites suitable for wireless and nondestructive monitoring of external stimuli [2]. Thermal processing of metallic ribbons provides a fruitful playground for engineering their properties. During annealing at low temperatures, changes in the internal stress in amorphous metallic ribbons result in an improvement of their magnetic softness and modification of the surface magnetic anisotropy. The GMI effect in these ribbons is sensitive to annealing. Local ultrafast heating of such ribbons by femtosecond laser pulses may have an impact on their transient GMI response. Substituting annealing procedures with laser heating may open up additional possibilities for tuning the properties of the ribbons.

References

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Figures

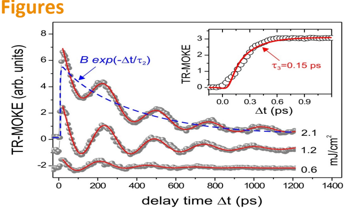

Figure 1: Time-resolved Kerr rotation as a function of the delay time Δ*t* for several fluences of the pump. The inset shows the time-resolved Kerr rotation for pump fluence of 2.1 mJ/cm^2.