中国科学院透明光功能无机材料重点实验室
人工晶体研究中心

Ultrafast nonthermal all-optical switching of magnetization in dielectrics

主讲人：Prof. Andrzej Stupakiewicz

时间：2024年5月11日 14:00-16:00

地点：嘉定园区F7第二会议室

联系人：　武安华

报告摘要：The discovery of the all-optical switching of magnetization only by a femtosecond laser pulse triggered intense discussions about mechanisms responsible for laser-induced changes. One of the most intriguing examples is the least-dissipative mechanisms of coherent photo-magnetic switching with orthogonal linear polarizations laser pulses in iron-cobalt garnet dielectrics [1]. The switching properties are vastly different, related to the crystal site hosting the excited Co-ions. As these ions are the source of the strong magnetic anisotropy in a garnet, their excitation between the crystal filed split states results in a coherent and ultrafast manipulation of spin-orbital interaction [2]. Moreover, we demonstrate that the ultrafast laser excitation of iron-garnet causes toggle-switching with a train of identical laser pulses between two stable magnetic bit states [3]. This new regime of nonthermal toggle switching can be observed in an exceptionally broad temperature range. Additionally, we demonstrated that with femtosecond pulses it is possible to write and rewrite magnetic bits with a frequency of up to 50 GHz. Moreover, another non-thermal mechanism of ultrafast magnetization switching was found in these garnets by resonant pumping of optical phonon modes [4]. Our results reveal the principles to be employed in achieving cold and ultrafast magnetic recording in dielectrics far beyond today’ s state of the art.

[1] A. Stupakiewicz, et al. Nature 542, 71 (2017).

[2] A. Stupakiewicz, et al. Nature Comm. 10, 612 (2019).

[3] T. Zalewski, et al. Nature Comm. 15 (2024) accepted.

[4] A. Stupakiewicz, et al. Nature Phys. 17, 489 (2021).

报告人简历：Prof. Andrzej Stupakiewicz (education: Ph.D.’ 2000, DSc’ 2010, Prof’ 2021). He is interested in ultrafast magnetism, nanomagnetism and advanced magneto-optics, with a particular focus on ultrafast magnetic recording. The most important scientific achievement is the discovery of a new method of nonthermal ultrafast photo-magnetic recording in a dielectric, which was selected for "Achievements of Polish Science 2016".

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