

Field-assisted optical switching of magnetization in ferromagnetic Weyl semimetal SrRuO_3

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The itinerant ferromagnet SrRuO_3 exhibits Weyl-fermionic behaviors at low temperatures, including the unsaturated linear magnetoresistance, and the negative magnetoresistance under magnetic fields parallel to electric fields [1]. The behavior of anomalous Hall conductivity has also suggested the presence of divergent Berry curvature near the band-crossing points [2, 3], presumably attributed to the Weyl nodes. Given that the magnetic order is intimately connected to

the anomalous transport properties in magnetic Weyl semimetals, it is imperative to establish the scheme to create and manipulate the magnetic domains. As a crucial first step along this direction, we investigated the scheme of optical recording of magnetic domain textures in a thin film of SrRuO_3 . Due to the strong coercive field of SrRuO_3 , its magnetization cannot be reversed by weak external magnetic fields. However, laser irradiation under a weak bias magnetic field either diminishes the magnetic anisotropy or heats the lattice above the Curie temperature, both of which facilitate magnetization switching with relatively low magnetic fields. In this presentation, we report on this field-assisted optical switching scheme. As shown in Fig.1, the magnetic domain structures are recorded on the thin film sample by sweeping the laser beam spot. This methodology allows generating arbitrary, complex magnetic textures in the sample.

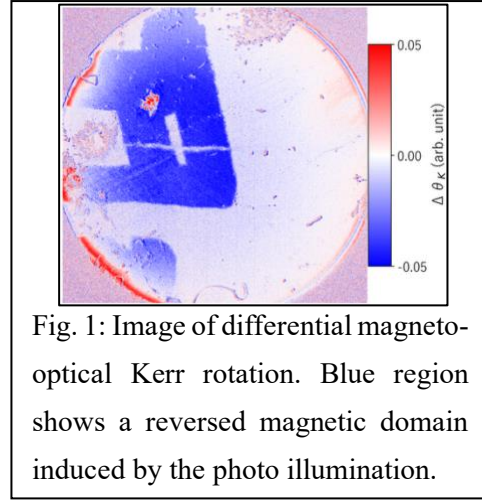


Fig. 1: Image of differential magneto-optical Kerr rotation. Blue region shows a reversed magnetic domain induced by the photo illumination.

[1] K. Takiguchi et al., *Quantum transport evidence of Weyl fermions in an epitaxial ferromagnetic oxide*, Nat Comm **11**, 4969 (2020).

[2] Z. Fang et al., *The anomalous Hall effect and magnetic monopoles in momentum space*, Science, **302**, 92 (2003).

[3] R. Shimano et al., *Terahertz Faraday rotation induced by an anomalous Hall effect in the itinerant ferromagnet SrRuO_3* , EPL **95**, 17002 (2011).