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Photostriction-Magnetostriction Coupled Epitaxial Nanostructures YING-HAO CHU, National Chiao Tung University — Extensive research on complex oxide thin films and heterostructures suggest new possibilities to create and design devices with tantalizing functionalities by taking the advantages of the interplay between lattice, charge, orbital, and spin degrees of freedom. Recently, the self-assemble vertical nanostructures have drawn considerable attentions due to the strong coupling mediated by high interface-to-volume ratio to tailor the properties of oxide nanostructures. However, most studies have been stressing on the controllability of heterostructues through external electric or magnetic fields. In this study, we have synthesized SrRuO3 (SRO)-CoFe2O4 (CFO) nanostructures to introduce light as other external control parameter, where the light-controlled properties are enabled by ultrafast photostriction of SRO and the magnetostriction of CFO. Through a combination of ultrafast-optics, magnetic force microscopy, and soft Xray absorption spectroscopy, the coupling between SRO and CFO is clearly revealed. When illuminating CFO-SRO nanostructures, SRO matrix inflates its volume via expanding its c-axis; the elongated SRO matrix relaxes the out-of-plane compressive strain in CFO pillars effectively reduces the magnetic anisotropy thereof; the reduce magnetic anisotropy resets the preferred magnetization direction of CFO pillars; after removing the illumination, the magnetic anisotropy is re-installed and CFO pillars choose to reverse their magnetization. Our study paves a way to ultrafast optical-coupled functionalities.

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