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Magnon Kerr Effect in a Cavity Quantum Electrodynamics System[1] YI-PU WANG, GUO-QIANG ZHANG, DENGKE ZHANG, XIAO-QING LUO, WEI XIONG, SHUAI-PENG WANG, Beijing Computational Science Research Center, TIE-FU LI, Tsinghua University, CAN-MING HU, Department of Physics and Astronomy, University of Manitoba, J. Q. YOU, Beijing Computational Science Research Center — We experimentally demonstrate magnon Kerr effect in a cavity quantum electrodynamics (QED) system, where magnons in a small yttrium iron garnet (YIG) sphere are strongly but dispersively coupled to the photons in a three-dimensional cavity. The Kerr term comes from the magnetocrystalline anisotropy of the YIG sphere. When the YIG sphere is pumped to generate considerable magnons, the Kerr effect yields a perceptible shift of the cavity central frequency and more appreciable shifts of the magnon modes. We derive an analytical relation between the magnon frequency shift and the drive power for the uniformly magnetized YIG sphere and find that it agrees very well with the experimental results of the Kittel mode. Our study paves the way to explore nonlinear effects in the cavity QED system with magnons. The nonlinear properties may be utilized in the hybrid quantum systems.

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