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Cavity magnomechanics XUFENG ZHANG, CHANGLING ZOU, LIANG JIANG, HONG X. TANG, Yale University — Mechanical oscillators have been recently widely utilized to couple with optical and microwave photons in a variety of hybrid quantum systems, but they all lack the tunability. The magnetostrictive force provides an alternative mechanism to allow phonon to couple with a different type of information carriermagnon, the collective excitation of magnetization whose frequency can be tuned by a bias magnetic field. Here, we demonstrate an intriguing hybrid system that consists of a magnonic, a mechanical, and a microwave resonator. The magnon-phonon interaction results in hallmark coherent phenomena such as magnomechanically induced transparency/absorption and magnomechanical parametric amplification. The magnetic field dependence of magnon provides our system with unprecedented tunability. Moreover, the great flexibility of our system allows us to achieve triple resonance among magnon, phonon and photon, which drastically enhances the magnomechanical interaction. Our work demonstrates the fundamental principle of cavity magnetomechanics, opening up great opportunities in various applications, such as tunable microwave filter and amplifier, long-lifetime quantum memories, microwave-to-optics conversion.

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