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Cavity magnomechanics CHANG-LING ZOU, XUFENG ZHANG, LIANG JIANG, HONG TANG, Yale University — Recently, cavity magnonics has attracted much attention for potential applications of coherent information transduction and hybrid quantum devices. The magnon is a collective spin wave excitation in ferromagnetic material. It is magnetically tunability, with long coherence time and non-reciprocical interaction with electro-magnetic fields. We report the coherent coupling between magnon, microwave photon and phonon. First, we demonstrate strong coupling and ultrastrong coupling between the magnon in YIG sphere and microwave photon in three-dimensional cavity. Then, based on the hybridized magnon-photon modes, we observe the triply resonant magnon-mcirowave photon-phonon coupling, where the ultrahigh-Q mechanical vibration of YIG sphere is dispersively coupled with the magnon via magnetostrictive interaction. We observe interesting phenomena, including electromagnetically induced transparency/absorption and parametric amplification. In particular, benefit from the large tunability of the magnon, we demonstrate a tunable microwave amplifier with gain as high as 30 dB. The single crystal YIG also has excellent optical properties, and thus provide a unique platform bridging MHz, GHz and THz information carriers. Finally, we present the latest progress towards coherent magnon to optical photon conversion.

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