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dynamic phonon laser in a cavity magnomechanical system SAEID VASHAHRI GHAMSARI, MIN XIAO, Univ of Arkansas-Fayetteville — We have studied a new type of phonon laser that works based on the mechanical vibrations caused by the magnetostrictive force in a cavity magnomechanical system beyond the steady state. The system includes a small yttrium iron garnet (YIG) sphere that is placed in a microwave cavity. Also, a uniform external bias magnetic field H is applied in the vertical direction and a drive magnetic field is established perpendicular to H. The uniform field produces a uniform magnon mode. Excitation of the magnons in the YIG sphere by the drive field leads to varying magnetization and hence geometric deformation of the surface (magnetostriction), and it results in the magnon-phonon coupling. One can control the frequency of the collectively excited magnons by adjusting H. The cavity has two supermodes corresponding to the ground and excited states, like a two-level atom. Once there is a population inversion between the cavity supermodes, a coherent phonon field is amplified. In contrast to the steady-state case, in the dynamical case, the phonon laser operates under the blue-detuned pump rather than red-detuned. Moreover, the quantum and thermal noise significantly contribute to the supermode population inversion and hence the stimulated emitted phonons.

Saeid Vashahri Ghamsari
Univ of Arkansas-Fayetteville

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