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Magnon-phonon hybridization and enhanced anharmonicity in noncollinear magnets (Y/Lu)MnO_3

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Anharmonicity in phonons, magnons, and their coupling plays a crucial role in diverse thermodynamic behavior and zero temperature damping of these quasi particles. Although such magnon-phonon coupling and damping can be in principle examined by spectroscopic techniques, actual observations are rare for real magnetic materials with collinear spin structures. In contrast, much stronger effects are expected for noncollinear magnets. We report the observation of such magnon-phonon hybridization and damping in noncollinear magnets (Y/Lu)MnO_3 using an inelastic neutron scattering technique [1]. In addition to the usual spin wave signals seen below 20 meV, weaker extra peaks are observed at higher energies. We could then reproduce these additional peaks using Hamiltonian with a magnon-phonon coupling of an exchange striction type. With this analysis, the additional intensities can be attributed to magneto-elastic excitations: which are caused by a direct magnon-phonon coupling originating from noncollinear spin structure. Such magneto-elastic excitations are also found to show large linewidth broadening near certain reciprocal points, which is qualitatively reproduced by anharmonic spin waves calculations. We will also discuss possible exchange striction terms required and how the magnon-phonon coupling can enhance such damping. [1] J. Oh et al., Nat. Comms. 7, 13146 (2016).