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Multimagnon dynamics and thermalization in the S=1 easy-axis ferromagnetic chain[1] PRAKASH SHARMA, KYUNGMIN LEE, HITESH CHANGLANI, Florida State University and National High Magnetic Field Laboratory — While most isolated quantum systems prepared out of equilibrium eventually thermalize under time evolution, this is not guaranteed. Motivated by recent experiments in ultra cold-atomic settings [W.C. Chung et al., Phys. Rev. Lett. 126, 163203 (2021)], we investigate the dynamics and effective interactions of magnon quasiparticles in a ferromagnetic spin-1 Heisenberg chain with easy-axis onsite anisotropy. We show how the binding energy of multiple interacting magnons decreases due to effective mutual attraction, and how this energy scale is relevant for dynamics. Working with a proposed modification of the cold atoms experiment, where the magnon density can be tuned, we simulate these spin chains using the matrix product state based time-evolution block decimation algorithm. We show that the system can exhibit either (rapid) thermalization or many-body coherent oscillations depending on the magnon density and the strength of the easy-axis anisotropy (which controls the effective attraction between the magnons). The dynamical oscillations, akin to those reported for many-body quantum scars, are explained with an analytic approximation that is accurate in the limit of small anisotropy. Finally, we discuss how our predictions can be tested in future experimental settings.

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