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Phonon dynamics of the Heisenberg chain with finite-frequency phonons. FRANZ MICHEL, TU Graz, Austria, HANS GERD EVERTZ, TU Graz, Austria — Since the discovery of the inorganic Spin-Peierls compound $CuGeO_3$, one dimensional spin systems coupled to phonons have been studied intensively. While static properties are well understood, the dynamic phonon behavior is still unclear. We have studied the phonon dynamics of the spin $\frac{1}{2}$ Heisenberg chain with bond phonons, around the structural phase transition which occurs as a function of spin-phonon coupling. We have employed Quantum Monte Carlo simulations based on stochastic series expansion (SSE), at almost zero and at finite temperature. The dynamic properties have been obtained by mapping the SSE to a continuous time path integral. At zero temperature we find that the quantum phase transition is of the central peak type as inferred before by Sandvik et al[1]. The renormalisation of the main phonon branch, however, depends strongly on the phonon frequency. As a function of temperature at fixed coupling, we find both a central peak for lower and phonon softening for higher spin-phonon coupling. This behavior is similar to the 3 dimensional case. [1] A. W. Sandvik et al., Phys. Rev. Lett. 83, 195 (1999)

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