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Berry Curvature and Phonon Hall Effect TAO QIN, Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China, JUNREN SHI, International Center for Quantum Materials, Peking University, Beijing 100871, China — Abstract We establish the general phonon dynamics of magnetic solids by incorporating the Mead-Truhlar correction in the Born-Oppenheimer approximation. The effective magnetic-field acting on the phonons naturally emerges, giving rise to the phonon Hall effect. A general formula of the intrinsic phonon Hall conductivity is obtained by using the corrected Kubo formula with the energy magnetization contribution properly incorporated. The resulting phonon Hall conductivity is fully determined by the phonon Berry curvature and the dispersions. Based on the formula, the topological phonon system could be rigorously defined. In the low temperature regime, we predict that the phonon Hall conductivity is proportional to T^3 for the ordinary phonon systems, while that for the topological phonon systems has the linear T dependence with the quantized temperature coefficient.

[1] Tao Qin and Junren Shi, arXiv:1111.1322 (2011)
[2] Tao Qin, Qian Niu and Junren Shi, Phys. Rev. Lett., Accepted, (2011).

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