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Angular Momentum of Phonons and Einstein-de Haas Effect[1]
LIFA ZHANG, QIAN NIU, University of Texas at Austin — We study angular momentum of phonons in a magnetic crystal. In the presence of a spin-phonon interaction, we obtain a nonzero angular momentum of phonons, which is an odd function of magnetization. At zero temperature, phonon has a zero-point angular momentum besides a zero-point energy. With increasing temperature, the total phonon angular momentum diminishes and approaches to zero in the classical limit. The nonzero phonon angular momentum can have a significant impact on the Einstein-de Haas effect. To obtain the change of angular momentum of electrons, the change of phonon angular momentum needs to be subtracted from the opposite change of lattice angular momentum. Furthermore, the finding of phonon angular momentum gives a potential method to study the spin-phonon interaction. Possible experiments on phonon angular momentum are also discussed.

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