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Phonon-mediated spin Seebeck effect in magnetic insulator heterostructures

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Abstract

The spin Seebeck effect is investigated in a symmetric multilayer structure consisting of two ferromagnetic insulator layers separated by a nonmagnetic insulating spacer under an applied temperature gradient. Nonlocal spin transport between the two magnetic layers is mediated by phonons excited through magnetoelastic interaction and magnetization dynamics. The results show that the generated spin current is dependent on the geometric dimensions of the structure, exhibiting an oscillatory behavior with gradual attenuation as the thickness of the non-magnetic layer increases, and a resonant behavior with respect to the thickness of the magnetic layers. Furthermore, the spin transport mediated by phonons can persist over distances ranging from several hundred micrometers to millimeters in this structure.

Keywords: Spin Seebeck effect, Magnon-phonon coupling, Ferromagnetic, Magnetoelastic interaction

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