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Phonon confinement and spin-phonon coupling in tensile-strained thin EuO films

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Europium monoxide (EuO) is the first rare-earth semiconducting oxide known for its giant magneto-optic Kerr [1] and Faraday [2] effects, metal-to-insulator transition and anomalous Hall effect [4]. Presently, it is one of the favored candidates for applications as a spin filter in future spintronic devices due to the large exchange splitting of its conduction band [5]. Employing inelastic X-ray scattering, nuclear inelastic scattering and first-principles theory we determined the lattice dynamics of this material and discovered a giant and anisotropic spin-phonon coupling [6]. This discovery imposed an intriguing question about the manifestation of this phenomenon in thin and ultrathin films related to the proposed applications. Using *in situ* nuclear inelastic scattering on ^{151}Eu we investigated the phonon density of states of EuO films with thickness between 8 nm and of 1 atomic layer. The experimental results unveiled drastic lattice dynamics modifications in the ultrathin EuO films that can be comprehensively understood by the help of first-principles theory [7].

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