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# Electron-phonon coupling in $\text{Mn}_{1-x}\text{Fe}_x\text{Si}$

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The interplay of ferromagnetic exchange, Dzyaloshinsky-Moriya interaction and crystal potential results in the complex phase diagram of the chiral magnet MnSi ( $T_C \approx 30$  K). In  $\text{Mn}_{1-x}\text{Fe}_x\text{Si}$ , long-range magnetic order is suppressed and helimagnetic correlations vanish at  $x \approx 0.2$  along with a redistribution of d states at the Fermi energy.

Here, we present a study of the lattice dynamical properties of  $\text{Mn}_{1-x}\text{Fe}_x\text{Si}$  with  $0 \leq x \leq 0.22$ . Employing time-of-flight neutron spectroscopy and high energy resolution inelastic x-ray scattering, we investigate the doping dependence of phonon energies,  $E_{\text{phon}}$ , and line widths,  $\Gamma_{\text{phon}}$  ( $\Gamma_{\text{phon}} \propto 1/\text{life time}$ ). In contrast to the general trend of slightly increasing energies with doping because of the reduced lattice constant, we find a significant softening and broadening of a phonon mode propagating along the [111] direction, which is also the direction of the magnetic ordering wave vector in MnSi. Ab-initio lattice dynamical calculations based on density-function theory predict an increasingly strong electron-phonon coupling for this particular mode linked to changes of the Fermi surface geometry upon doping.

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