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Inelastic Neutron Scattering on FeNiCo High-Entropy Alloys

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High-entropy alloys, equiatomic alloys of five or more principal elements, have recently been the focus of much attention due to their superior structural properties. The stability of these materials is a matter of great concern for application, where it is still not settled whether the prototypical examples are thermodynamically stable phases or just metastable on accessible timescales. In this respect, a profound knowledge of lattice vibrations (phonons) is necessary as they are responsible for phase stabilities and thermodynamic properties, but also for other properties such as thermal conductivity. However, these issues have so far scarcely been studied directly.

Equiatomic FeNiCo is of specific interest as a medium-entropy analogue of the prototypical Cantor alloy CoCrFeMnNi. In this class of materials, clearly also the role of magnetic effects has to be considered, with the richness of phenomena expected due to the interactions between the different atomic moments arranged on the face-centred cubic lattice with potential short-range order, and the interplay between magnonic and phononic excitations at elevated temperatures.

Here we present the results obtained by inelastic neutron scattering, displaying the evolution of the vibrational spectra with temperature. We also comment on the possibility to observe short-range order via the elastically diffracted intensity. The experiments were performed at the time-of-flight spectrometer (TOFTOF) at the MLZ Garching.

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