



Contribution ID: 364

Type: **Poster**

## Lattice Dynamics of Epitaxial Strain-Free Interfaces

*Tuesday, 18 September 2018 17:15 (15 minutes)*

We studied the phonon properties of ultrathin Fe<sub>3</sub>Si layers in Ge/Fe<sub>3</sub>Si/GaAs heterostructures as a model system for epitaxial, strain-free interfaces. Epitaxial Fe<sub>3</sub>Si layers with thicknesses from 3ML to 36ML were grown on GaAs(001) substrates and capped by a 4 nm thick amorphous Ge layer. Sample characterization with various methods showed the formation of epitaxial Fe<sub>3</sub>Si nanostructures with perfect stoichiometry and high interface quality. Nuclear Inelastic Scattering was used to determine the iron-partial phonon density of states at room temperature as a function of layer thickness. The results exhibit up to a two-fold enhancement of the low-energy phonon states compared to the bulk material for layer thicknesses of 8 monolayers and below. First-principles calculations explain the observed effect by novel, interface-specific phonon modes originating from the significantly reduced atomic force constants and allow for achieving a comprehensive understanding of the lattice dynamics of epitaxial, strain-free interfaces.

The work was financially supported by the Helmholtz Association (VHNG-625) and the BMBF (05K16VK4).

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**Session Classification:** Poster session 2

**Track Classification:** P5 Thin films, 2D materials and surfaces