Equation of state of the [Fe,Ni]$_3$Si system at conditions relevant to small terrestrial planets

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The detailed composition of terrestrial planetary cores is still unknown. The nature of the `light element' alloying with Fe-Ni in planetary cores can affect a large range of properties, such as its melting temperature and the stable crystal structures it exhibits. While geophysical and geodetic parameters of a planet can provide first order information, mineral physics can also be used to investigate the compositional space.

We present ab initio simulations on the [Fe,Ni]$_3$Si system (at ~7wt% and 14wt% Ni) to determine stable crystal structures and thermoelastic properties at PT conditions relevant to smaller terrestrial planets (central pressure <45 GPa). This will allow for comparisons to be made to any future seismic profile of Mars (from InSight or otherwise), and other research on the [Fe,Ni]$_3$[Si,S] system. The overall aim to produce a compositional model for the core of Mars and place it in the context of the evolution of planetary cores, including the state and structure of Mars’ core.