



EINLADUNG zum IFP-SEMINAR

Intrinsically weak magnetic anisotropy of cerium in potential hard-magnetic intermetallics

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Host: Karsten Held
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Abstract:

Identifying and designing new materials for permanent magnet applications is currently a very active field of research. While, at present, the best permanent magnets are based on expensive rare-earth elements Nd, Tb or Dy (e.g. $\text{Nd}_2\text{Fe}_{14}\text{B}$), efforts are made to replace them with more available elements like Ce, with the hope to discover compounds with even better performance and lower material and production costs. However, the intrinsic magnetic properties of Ce in these systems are poorly understood due to the difficulty of a quantitative description of the Kondo effect, a many-body phenomenon where conduction electrons screen out the Ce-4f moment. I will present an ab-initio dynamical mean-field theory study which shows that the Ce-4f shell in Ce-Fe intermetallics is indeed partially Kondo screened. The Kondo scale is dramatically enhanced by nitrogen interstitials completely suppressing the Ce-4f contribution to the magnetic anisotropy, in striking contrast to the effect of nitrogenation in isostructural intermetallics containing other rare-earth elements. I will present the full temperature dependence of the Ce-4f single-ion anisotropy and show that even unscreened Ce-4f moments contribute little to the room-temperature intrinsic magnetic hardness. These findings establish fundamental constraints on the potential of cerium-based permanent magnet intermetallics.