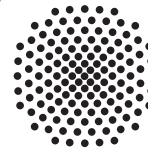


# Stuttgarter Physikalisches Kolloquium

Max-Planck-Institut für Festkörperforschung  
Fachbereich Physik, Universität Stuttgart

Ansprechpartner: Dirk Manske  
E-Mail: D.Manske@fkf.mpg.de  
Telefon: 0711 689-1552



Hybrid

Login data will be announced by e-mail and on the colloquium webpage.

Dienstag, 9. Juli 2024

16.15 Uhr

Lecture Hall 2D5

Max-Planck-Institut für Festkörperforschung, Heisenbergstraße 1, 70569 Stuttgart-Büsnau

## Double-perovskite oxide heterostructures

**Marta Gibert**

Institute of Solid State Physics, TU Wien

### Abstract

Atomically-engineered heterostructures constitute excellent model systems for investigating fundamental structure-property relations in transition metal oxides and their evolution as the thickness of the constituent layers is reduced to only a few unit cells. The double-perovskite  $RE_2NiMnO_6$  ( $RE$ = rare earth) family is characterized as being insulating ferromagnets, an unusual combination of properties. Ferromagnetism arises through oxygen-mediated superexchange in the rock salt-ordered Ni/Mn sublattice. The Curie Temperature of  $La_2NiMnO_6$  is  $T_C=280K$ , and for the other members of the family,  $T_C$  decreases linearly with the size of the ionic radius of the  $RE$ .

Here, we will show that epitaxial  $RE_2NiMnO_6$  films ( $RE=La, Nd, Sm$ ), grown by RHEED-enabled off-axis magnetron sputtering, display long-range  $Ni^{2+}$  and  $Mn^{4+}$  order and strain-independent bulk-like  $T_C$  at a thickness of 30 unit cells [1,2]. We find that the ferromagnetic behavior occurs down to ultra-low thicknesses of (at least) 3 unit cells ( $\sim 1.2$  nm). However, below 10 unit cells, the magnetic properties deteriorate due to an interfacial charge transfer caused by the polar discontinuity at the  $RE_2NiMnO_6/SrTiO_3$  interface [2,3]. For the case of  $Nd_2NiMnO_6$ , a detailed x-ray magnetic circular dichroism (XMCD) study allows us to separate the magnetic components into a robust ferromagnetic Ni/Mn sublattice and a paramagnetic Nd sublattice. We will also present our latest efforts in combining different  $RE_2NiMnO_6$  double perovskites into potential multiferroic artificially-layered superlattices [4].

[1] G. De Luca et al., *APL Materials* 9, 081111 (2021).

[2] J. Spring et al., *Physical Review Materials* 7, 104407 (2023).

[3] G. De Luca et al., *Advanced Materials* 34, 2203071 (2022).

[4] H. J. Zhao et al., *Nature Communications* 5, 4021 (2014).