

# Seminar über die Physik der kondensierten Materie (SFB/TRR173 Spin+X und SFB/TR288 Kolloquium, TopDyn-Seminar)

Sept. 18, 2024 at 1 p.m.  
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## **New Ferromagnetic Materials for Spintronic Devices Predicted by Machine Learning**

In spintronics, magnetic tunnel and giant magnetoresistive junctions have been commonly used for magnetic recording, memories and sensors [1,2]. These junctions typically consists of a CoFeB/MgO/CoFeB trilayer. They satisfy the endurance required for fabrication and operation. For further improvement in their performance, namely their magnetoresistance ratios, Heusler alloys can be an ideal candidate due to their half-metallicity.

In this study, machine learning was used for the search of new Heusler alloys to satisfy the above requirements with maintaining the 100% spin polarisation at their Fermi level. As an example, a CoIrMnAl alloy was predicted to be ferromagnetic in experimental and theoretical studies [3,4]. The films were sputtered using ultrahigh vacuum magnetron sputtering on MgO(001) and Si substrates. The structural and magnetic characterisation was done by X-ray diffraction and transmission electron microscopy, and vibrating sample magnetometry, respectively. The optimised films were implemented in a magnetic tunnel junction for transport measurements,

showing over 100% tunnelling magnetoresistance ratioThe material search is found to be useful by combining with ab initio calculations on alloys suggested by machine learning.

This work was partially supported by JST-CREST (No. JPMJCR17J5) and EPSRC (EP/V007211/1).

#### References

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- [4]R. Monma et al., J. Alloys Comp. 868, 159175 (2021).

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