TECHNISCHE UNIVERSITÄT KAISERSLAUTERN

SPIN+X SFB/TRR 173 Kaiserslautern • Mainz

JOHANNES GUTENBERG UNIVERSITÄT MAINZ

DISTINGUISHED LECTURE SERIES

Winter Term 2020/2021

Prof. Dr. Ulrich ECKERN

University of Augsburg

Spin-charge conversion and spectral properties of heterostructures containing half-metals: The role of nonquasiparticle states

In order to repeat the obvious, at least for the participants in this lecture series: Half-metallic systems, in particular, Heusler alloys have been attracting considerable attention as they exhibit a high spin polarization as well as huge magneto-resistance ratios, and hence have an outstanding potential for technological applications. In addition, there are various important open question at a basic science level, for example, how spin is converted to charge at an interface. In this context, in a recent experiment-theory collaboration [1], we have elucidated the role of spin-orbit coupling for the prototypical Heusler alloy NiMnSb deposited on YIG: Both interface and bulk contributions turn out to be essential, and the detailed thickness and temperature behaviors are decisive to develop a semi-microscopic (quasiclassical) understanding. While these studies invoke the infamous nonquasiparticle (NQP) states on a phenomenological level, we have also used a detailed microscopic approach to clarify the origin of the NQP states, employing a model description for layered structures containing half-metallic ferromagnets [2]. In particular, the effects of strong electronic correlations have been analyzed, at zero and at finite temperature, on the basis of Dynamical Mean-Field Theory. The inclusion of long-ranged Coulomb forces allows to describe charge fluctuations at and near interfaces, which tend to degrade half-metallicity.

[1] Z. Wen, Z. Qiu, S. Tölle, C. Gorini, T. Seki, D. Hou, T. Kubota, U. Eckern, E. Saitoh, and K. Takanashi, Sci. Adv. 5, eaaw9337 (2019).

[2] A. Weh, J. Otsuki, H. Schnait, H. G. Evertz, U. Eckern, A. I. Lichtenstein, and L. Chioncel, Phys. Rev. Research 2, 043263 (2020)

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