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EINLADUNG zum IFP-SEMINAR

Thema: **Heusler compounds: From semiconductors to spintronics**

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Host: Silke Bühler-Paschen

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Ort: TU Wien, Institut für Festkörperphysik
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Abstract:

Heusler compounds are a remarkable class of intermetallic materials with 1:1:1 (often called Half-Heusler) or 2:1:1 composition comprising more than 1500 members [1]. New properties and potential fields of applications emerge constantly; the prediction of topological insulators is the most recent example [2]. Surprisingly, the properties of many Heusler compounds can easily be predicted by the valence electron count or within a rigid band approach. The subgroup of more than 250 semiconductors is of high relevance for the development of novel materials for energy technologies. Their band gaps can readily be tuned from zero to 4 eV by changing the chemical composition. Thus, great interest has been attracted in the fields of thermoelectrics and topological insulator research [2,3]. Ternary materials based on multifunctional properties, i.e. the combination of two or more functions such as superconductivity and topological edge states will revolutionize technological applications. The wide range of the multifunctional properties of Heusler compounds is reflected in extraordinary magneto-optical, magneto-electronic, and magneto-caloric properties. Tetragonal Heusler compounds Mn_2YZ as potential materials for STT applications can be easily designed by positioning the Fermi energy at the van Hove singularity in one of the spin channels [4,5]. The Mn^{3+} ions in Mn2YZ cause a Jahn Teller distortion. High calculated magnetic anisotropy energy (MAE) is the sufficient condition for a material with perpendicular magneto-crystalline anisotropy (PMA). Materials with saturation magnetizations (MS) of 0.2 – 4.0 μ_B, high Curie temperatures (TC) of 380 – 800 K, high spin polarizations, PMA, and required lattice constant matching with MgO can be realized with ferri- or ferromagnetic Heusler-related compounds. Such materials are strongly recommended for the spin transfer torque magnetic random access memory (STT-MRAM) data storage and the spin torque oscillators (STO) for telecommunication. Additional properties can be designed in tetragonal Heusler compounds with three magnetic sublattices such as high coercive fields for permanent magnets, spin gapless semiconductivity [6] and a giant exchange bias [7].

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