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Spin-orbit coupling effects in Fe/GaAs heterostructures: First principles calculations[1] MARTIN GMITRA, ALEX MATOS-ABIAGUE, University of Regensburg, Germany, CLAUDIA AMBROSCH-DRAXL, University of Leoben, Austria, JAROSLAV FABIAN, University of Regensburg, Germany — The tunneling anisotropic magnetoresistance (TAMR) effect in semiconductor heterostructures containing a single ferromagnetic layer is potentially useful for spintronics devices. Important, TAMR has recently been observed in a metallic system, namely, in Fe/GaAs/Au junctions. Surprisingly, while all the bulk components of the system are cubic, the observed anisotropy is twofold, of the C_{2v} class. This suggests that rather than coming from the bulk anisotropy of the density of states, the effect arises from the interface that indeed has a reduced symmetry. A phenomenological model reflecting this symmetry in the form of the Bychkov-Rashba and the Dresselhaus spin-orbit coupling was proposed, giving a quantitative fit to the experiment. Here we report on comprehensive first principle calculations of the spin-orbit effects stemming from the interface anisotropy, providing support to the phenomenological theory. In particular, we have performed FPLAPW density functional calculations of an Fe/GaAs slab to extract quantitative information about the proposed model that are Bychkov-Rashba and Dresselhaus parameters.

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