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Magnetoresistance in antiferromagnet-based spin tunnel junctions

TOMAS JUNGWIRTH, Institute of Physics ASCR, Prague and University of Nottingham

To date spintronics research and applications of magnetically ordered systems have focused on ferromagnets (FMs). There are, however, fundamental physical limitations for FM materials which may make them impractical to realize the full potential of spintronics. Metal FMs offer high temperature operation but the large magnetic stray fields make them unfavorable for high-density integration and metals are unsuitable for transistor and information processing applications. FM semiconductors on the other hand do not allow for high-temperature operation. We present a concept in which these limitations are circumvented in spintronics based on antiferromagnets. The concept is based on relativistic magnetic and magneto-transport anisotropy effects in nanodevices whose common characteristics is that they are an even function of the microscopic magnetic moment vector, i.e., can be equally strong in AFMs as in FMs. As a demonstration we present our experimental observation of >100% tunneling anisotropic magnetoresistance in a device with an IrMn AFM tunnel electrode [1]. We will also discuss candidate materials for high-temperature AFM semiconductor spintronics [2].

[1] B. G. Park, J.Wunderlich, X.Marti, V.Holy, Y.Kurosaki, M.Yamada, H.Yamamoto, A.Nishide, J.Hayakawa, H.Takahashi, A.B.Shick, T.Jungwirth, Nature Mat. **10**, 347 (2011).

[2] T.Jungwirth, V.Novák, X.Marti, M.Cukr, F.Máca, A.B. Shick, J.Mašek, P.Horodyská, P.Němec, V.Holý, et al., Phys. Rev. **B 83**, 035321 (2011).