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Interplay of confinement and spin-orbit interaction in ferromagnetic semiconductors

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We review experimental and theoretical works which show a surprising influence of confinement on properties of III-V ferromagnetic semiconductors related to the spin-orbit interaction. In particular, according to SQUID studies, magnetization of (Ga,Mn)As thin films show two distinct components of orthogonal in-plane easy axes, whose relative strength can be controlled by the gate voltage [M. Sawicki et al. Nature Phys. 6**,** 22 (2010)]. Furthermore, in high T_C structures a confinement leads to an unanticipated collapse of the anomalous Hall effect [D. Chiba et al. Phys. Rev. Lett. 104**,** 106601 (2010)]. A possibility of a non-trivial interplay of confinement and spin orbit interaction is further highlighted by the theoretical prediction of a non-collinear spin arrangement in thin films of (Ga,Mn)As [A. Werpachowska and T. Dietl, Phys. Rev. B 82**,** 085204 (2010)]. Finally, we show how a large energy separation between the heavy and light hole subbands in compressively strained gated InAs:Mn quantum wells leads to hysteretic behavior even in the single Mn impurity limit [U. Wurstbauer et al. Nature Phys. (2010) doi:10.1038/nphys1782].