Ferromagnetic semiconductors at the boundary of holes' localization

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The presence of localized spins exerts a strong influence on quantum Anderson-Mott localization in doped semiconductors. At the same time carrier-mediated interactions between the localized spins are modified or even halted by carriersô localization and the associated disorder-driven spatial fluctuations in the local density of carrier states [1,2].

The interplay of these effects is discussed for IIï VI [3-5] and IIIï V [6-10] diluted magnetic semiconductors. This insight is exploited to interpret the complex dependence of resistance [6-9], anomalous Hall effect [10], and magnetization [11] on temperature, magnetic field, and concentration of valence-band holes in (Ga,Mn)As. In particular, high field negative magnetoresistance results from the orbital weak localization effect [6]. The resistance maximum and the associated negative magnetoresistance near the Curie temperature are assigned to the destructive influence of preformed ferromagnetic bubbles [11] on the óóantilocalizationôô effect driven by disorder-modified carrierï carrier interactions [5,6]. These interactions account also for the low temperature increase of resistance [6-9]. Furthermore, the sensitivity of conductance to spin splitting and to scattering by spin disorder may explain resistance anomalies at coercive fields, where relative directions of external and molecular fields change.

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