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Disorder Problem In Diluted Magnetic Semiconductors RYKY NELSON, CHINEDU EKUMA, HANNA TERLETSKA, Louisiana State University, VIDHYADHIRAJA SUDHINDRA, Theoretical Sciences Unit, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, 560064, India, JUANA MORENO, MARK JARRELL, Louisiana State University — Motivated by experimental studies [1-4] addressing the role of impurity disorder in diluted magnetic semiconductors (DMS), we investigate the effects of disorder using a simple tight-binding Hamiltonian with random impurity potential and spin-fermion exchange which is self-consistently solved using the typical medium theory. Adopting the typical density of states (TDoS) as the order parameter, we find that the TDoS vanishes below a critical concentration of the impurity, which indicates an Anderson localization transition in the system. Our results qualitatively explain why at concentrations lower than a critical value DMS are insulating and paramagnetic, while at larger concentrations are ferromagnetic. We also compare several simple models to explore the interplay between ferromagnetic order and disorder induced insulating behavior, and the role of the spin-orbit interaction on this competition. We apply our findings to (Ga,Mn)As and (Ga,Mn)N to compare and contrast their phase diagrams.

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[2] M. Dobrowolska et al., Nature Mater. 11, 444-449 (2012).
[3] N. Samarth, Nature Mater. 11, 360-361 (2012).
[4] M. E. Flatté, Nature Phys. 7, 285-286 (2011).

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