# PERCOLATION EFFECTS IN DILUTE MAGNETIC SEMICONDUCTORS

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We discuss the origine of ferromagnetism in dilute magnetic semiconductors with wide band-gaps such as (Ga,Mn)N or (Zn,Cr)Te as compared to the ferromagnetism in systems like (Ga,Mn)As or (In,Mn)As. While in the later case, the ferromagnetism is caused by Zener's p-d exchange, in systems like (Ga,Mn)N and (Zn,Cr)Te the main interaction is Zener's double exchange. The electronic structure calculations are performed by using the KKR-Green function method in connection with the CPA to describe the substitutional disorder of the transition metal atoms. We use both the local density approximation (LDA) and the LDA+U method to describe correlation effects. The exchange interaction constants Jij between two magnetic ions are calculated by embedding the two ions i and j into an effective CPA-medium. The Curie temperatures are calculated from the Heisenberg model by Monte Carlo simulations using Binder's cumulant method. The general trend for impurity band systems is, that the exchange interactions Jij are very strong, but short ranged. Therefore the interaction is dominated by a strong nearest neighbour interaction. This has important consequences. For instance, in dilute systems percolation of the strong nn interactions cannot be achieved, since the concentrations are far below the percolation threshold. Therefore the ferromagnetism is dominated by the weak longer-ranged interactions and the Curie temperatures are very low.

9.7 cm

13.4 cm

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