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It is often assumed that the exchange interaction between two magnetic ions in a semiconductor host

able for the systems considered here.[14] (ii) The discretization of the interactions between rigid spins centered at atomic sites (rigid spin approximation). (iii) The use of the magnetic susceptibility rather than its inverse. (iv) The classical treatment of spin excitations. Approximations (ii)–(iv) are justified if there are large magnetic moments associated with the magnetic ions,[13] as is the case for Mn impurities in GaAs (

the hole density corresponds to a half-filled Mn $_2$ band. This is so because ferromagnetism in this system is due to the interaction between partially occupied orbitals localized on different Mn sites, not to RKKY-type interactions.[11]

To understand the dependence of T_C on the presence of spectator Mn ions (Fig. 1), we show in Fig. 2(a) the LRT-calculated exchange interactions J_{NN} between two specific nearest-neighbor Mn ions [denoted in the following as $Mn^{(1)}$ and $Mn^{(2)}$]

{ , , ,…} were determined[18] by fitting Eq. (1) to a large number of first-principles total-energy calculations of $\Delta H_{CE}(\sigma)$ of different chemical arrangements σ of Mn and Ga atoms in (Ga, Mn)As. Once established, the cluster expansion can be subjected to a Monte Carlo simulation to produce configurations with arbitrary degree of short-range order (SRO). The Monte Carlo simulation cell includes 8192 atoms (4096 cations). The SRO parameter of shell (, ,) is