THE RKKY INTERACTION WITH DIFFUSED CONTACT POTENTIAL

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The Ruderman-Kittel-Kasuya-Yosida (RKKY) interaction is considered when the contact potential is replaced by an arbitrary distribution, instead of the conventional Dirac's δ-function. Such approximation describes better the physical situation where the localized spins are attributed to extended electronic orbitals. The appropriate formulas for the RKKY exchange integrals in the case of 1D, 2D and 3D systems are re-derived. In order to exemplify such modification, the three distributions are used for numerical calculations of the RKKY interaction vs. spin-spin distance, namely: gaussian, uniform (rectangular) and exponential ones. It is shown that diffusion of the contact potential removes an unphysical divergency of the RKKY integral at zero distance, and the finite value obtained depends strongly on the distribution width. Moreover, when this width increases, the first minima of the interaction become shallow and rise up towards the positive values, while the amplitude of further oscillations decreases. The strongest effect corresponds to the exponential distribution, and the weakest to the uniform one. For large distances the amplitude of oscillations is reduced by some distance-independent factor, while the period of oscillations remains unchanged and no phase shift occurs. The above generalization of the RKKY interaction is supposed to have remarkable consequences for the thermodynamic description of relevant magnetic systems.

9.7 cm

13.4 cm

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