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Rabi oscillations of paramagnetic ions in solids: Role of electrostatic interactions

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Abstract

© Springer-Verlag Wien 2014. We study the decay of Rabi oscillations of magnetically coupled impurity ions diluted in the solid. Electrostatic interactions between the ions treated as charged defects shift their g-factors and result in valuable correlations of their Larmor frequencies if the ions are close enough. We find an increase in the decay time of Rabi oscillations in comparison with the case of uncharged defects. The magnitude of the effect depends on the ratio between the impurity and the total defect concentrations, as well as on the type of the electron paramagnetic resonance line broadening mechanism (by random electric fields, electric field gradients, etc.). We present results in the arbitrary order of multipole expansion with respect to valence electron coordinates of the paramagnetic ion. Corresponding corrections to the decay times of Rabi oscillations of Nd3+ ions in CaWO4 crystal are obtained.

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