SPIN-ORBITAL LIQUID ON A TRIANGULAR LATTICE

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9.7 cm

Strong coupling between spins and orbital degrees of freedom in strongly correlated transition metal oxides may lead to spin-orbital entanglement and to violation of the Goodenough-Kanamori rules [1]. Here we investigate the spin-orbital d^1 model for triply degenerate t_{2g} orbitals on a triangular lattice [2] which unifies intrinsic frustration of orbital interactions with geometrical frustration. Using Lanczos exact diagonalization of finite clusters we establish that the ground state of this model is characterized by pronounced valence-bond correlations which are frustrated and fluctuate strongly. The numerical results suggest that the Goodenough-Kanamori rules are violated in some cases and the spin-orbital liquid state emerges in the thermodynamic limit [3]. Finally, we provide evidence that the resonating spin-orbital liquid involves entangled states on the bonds. We argue that: (i) quantum fluctuations play a crucial role in the ground states and magnetic transitions, and (ii) effective spin exchange constants alone do not determine spin bond correlations and spin excitations in the spin-orbital liquid.

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