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Spin and orbital states of frustrated orbital-degenerate Hubbard model

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In order to clarify the combined effects of geometrical frustration and orbital degree of freedom, we have investigated an e_g-orbital degenerate Hubbard model at quarter filling on a zigzag chain and a ladder by using numerical techniques [1]. Note that the lattice is located in the xy plane, as shown in Fig. 1. In the zigzag chain, a $3x^2-r^2$ orbital is selectively occupied to gain the kinetic energy, i.e., the shape of the occupied orbital extends just along the direction of a double chain. Then, the spin frustration is suppressed due to the spatial anisotropy of orbitals, since the zigzag chain is nearly decoupled to a double-chain spin system. On the other hand, in the ladder, the spin correlation shows a simple staggered pattern in a similar way of a spin ladder, since the shape of the occupied orbital extends to the rung direction as well as to the leg direction. However, the orbital fluctuation is found to be significant in contrast to the case of the zigzag chain. We will discuss a key role of the orbital anisotropy in the determination of characteristic spin and orbital configurations.

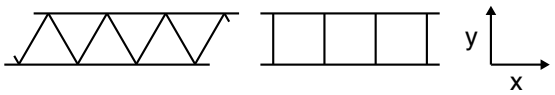

Fig. 1: Lattice structure of the zigzag chain and the ladder.

[1] H. Onishi and T. Hotta, cond-mat/0410023.