Recent new progress on variational approach for strongly correlated t-J model

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For strongly correlated systems, there are many competing low energy states. It is particularly challenging for numerical approaches. Recently we have modified the numerical methods to treat the spatially inhomogeneous states like stripes in the $t - J$ model. The introduction of a weak electron- phonon interaction to renormalize the effective hopping constant has stabilized the stripe ground states with the right periods. The results are shown to agree very well with experiments. Since the renormalization will depend on local charge density, thus the variational calculation has to use an iterative approach with multivariable minimization. We will discuss the method and results in this talk. In addition, a generalization of the Gutzwiller projected variational wave function to treat varying number of particles will be discussed also.