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Spin Mott Glass Phase in the Disordered Spin Systems

DAO-XIN YAO, NV-SEN MA, State Key Laboratory of Optoelectronic Materials and Technologies, School of Physics and Engineering, Sun Yat-sen University, ANDERS SANDVIK, Department of Physics, Boston University, MA — We use quantum Monte Carlo simulations to study a glassy ground state of $S=1/2$ quantum spins by using a dimerized $J1$ - $J2$ - $J3$ Heisenberg model on the square lattice. $J1$ corresponds to weak bonds, and $J2$ and $J3$ are stronger bonds which are randomly distributed on columnar rungs forming coupled 2-leg ladders. By tuning the average value of $J2$ and $J3$, the system undergoes Neel-glass-paramagnetic quantum phase transition. The size of the glass region is affected by the value of the disorder strength. In the glass phase, we find that the uniform susceptibility decreases with T according to $\exp(-b/T^a)$ with $a < 1$; thus the state is incompressible at $T=0$ and classified as a Mott glass (MG). At the Neel-MG transition, the susceptibility behaves as $T^{2/z-1}$. The dynamical exponent z is found to be larger than 1.

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