

Abstract Submitted
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A non-magnetic liquid with nematicity in the spin-1 $SU(3)$ Heisenberg model on the square lattice WENJUN HU, Rice University, SHOUSHU GONG, National High Magnetic Field Laboratory, HSIN-HUA LAI, ANDRIY H. NEVIDOMSKYY, Rice University — We study the spin-1 $SU(3)$ Heisenberg model with the nearest-neighbor bilinear and biquadratic interactions on the square lattice by using the large-scale density matrix renormalization group. By calculating spin and quadrupolar order parameters on the cylinder geometry up to system width $L_y = 9$, we find many competing peaks of structure factor at different momenta including the three-sublattice magnetic order proposed by previous studies. However, through appropriate extrapolation on large system size, all the spin and quadrupolar orders are scaled to zero. Surprisingly, we also find a finite lattice nematicity that characterizes a spontaneous lattice C_4 symmetry breaking. Our results exclude the three-sublattice magnetic order, and reveal a non-magnetic liquid with nematicity in the vicinity of the highly competing $SU(3)$ point. We further discuss this new quantum phase by analyzing the low-energy excitations and by considering different perturbations on the $SU(3)$ model.

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