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Numerical Investigations of Spontaneous Orbital Currents in the Three-Orbital Hubbard Model[1] CHENG-CHIEN CHEN, ALEXANDER KEMPER, Stanford Institute for Materials and Energy Science, SLAC National Accelerator Laboratory, CHUNJING JIA, Department of Applied Physics, Stanford University, RONNY THOMALE, Department of Physics, Stanford University, THOMAS DEVEREAUX, Stanford Institute for Materials and Energy Science, SLAC National Accelerator Laboratory — Recent experiments show that the pseudogap regime of the cuprate superconductors could be characterized by a phase where the time-reversal symmetry is spontaneously broken but the translational symmetry remains intact. One possible but still highly disputed theory involves a circulating current looping around the Cu and O atoms. To address this issue, we perform large-scale exact diagonalization using a three-orbital Hubbard model on a Cu8O16 cluster. We find that the current-current correlations fall off quickly and show no signs of particular orbital current patterns. We also extend our calculations by adding explicitly a perturbative orbital current term into the Hamiltonian to study its experimental consequences. Using the magnetic moment measured in neutron scattering to constrain the strength of this perturbation, we compute the dichroic signals of various photon-spectroscopies to provide experimental benchmarks to test the existence of such a circulating current phase.

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