MAGNETISM AND CHARGE RESPONSE IN QUASI-1D WIGNER LATTICE COMPOUNDS

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9.7 cm

Doped edge-sharing Cu-O chain compounds are ideal realizations of 1D Wigner lattices. Such doped edge-sharing chains are found in the recently synthesized $Na_3Cu_2O_4$ and $Na_8Cu_5O_{10}$ systems [1], and they are also structural elements in the widely studied composite compounds $Sr_{14-x}Ca_xCu_{24}O_{41}$. As a result of the geometrical structure (90 degree Cu-O-Cu coordination) the hopping matrix elements and hence the kinetic energy is small compared to the Coulomb energy. At low temperature the charge order resulting from Coulomb interaction $V_l \sim 1/l$ generates Heisenberg chains with varying distance between spins, i.e., dictated by the Coulomb interaction. We analyse the strikingly different magnetic properties of $Na_3Cu_2O_4$ and $Na_8Cu_5O_{10}$ adopting the picture of *modulated Heisenberg chains*. We discuss the role of quantum charge fluctuations on magnetism. Spin-charge coupling is manifested in the fluctuation of spin positions, which results in a doping dependence of exchange interactions.
In the final part, we turn to the charge dynamics of Wigner lattices. Charge excitations are described as fractionally charged domain walls in these systems. We present a detailed discussion of domain-wall excitation spectra, excitonic states, and of the temperature dependence of optical conductivity [2].

[1] P. Horsch, M. Sofin, M. Mayr, and M. Jansen, Phys. Rev. Lett. **94**, xxxxxx (2005).
[2] M. Mayr and P. Horsch, (to be published)

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