

Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

The t - J model for Cu_2O_5 coupled ladders in $\text{Sr}_{14-x}\text{Ca}_x\text{Cu}_{24}\text{O}_{41}$ ¹
KRZYSZTOF WOHLFELD, IFW Dresden, Germany, ANDRZEJ M. OLES, Jagellonian University, Poland, GEORGE A. SAWATZKY, University of British Columbia, Canada — Starting from the proper charge transfer model for Cu_2O_5 coupled ladders in $\text{Sr}_{14-x}\text{Ca}_x\text{Cu}_{24}\text{O}_{41}$ in the strongly correlated regime, we derive the low energy Hamiltonian for this system with superexchange J and the effective d - d hopping t . It occurs that the widely used ladder t - J model is not sufficient and has to be supplemented by the Coulomb repulsion between doped holes in the neighboring ladders. Next, we show how a simple mean-field solution of this extended t - J model may explain the onset of the experimentally observed charge density wave with the odd (three or five) period in $\text{Sr}_{14-x}\text{Ca}_x\text{Cu}_{24}\text{O}_{41}$. This suggests that it is not the bare ladder t - J model but the extended t - J model which should be used as the starting point for the explanation of the superconductivity observed under pressure in the Cu_2O_5 coupled ladders in $\text{Sr}_{0.4}\text{Ca}_{13.6}\text{Cu}_{24}\text{O}_{41}$.

¹We acknowledge financial support by the Foundation for Polish Science (FNP) and by the Polish Ministry of Science and Higher Education under Project No. N202 068 32/1481.

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Date submitted: 19 Nov 2009

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