Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Orbitally-driven Peierls state in correlated oxides DANIEL KHOMSKII, II.Physikalisches Institut, Universitaet zu Koeln, Zuelpicher Str.77, 50937 Koeln, Germany, TAKASHI MIZOKAWA, Department of Physics, University of Tokyo, 5-1-5 Kashiwanoha, Chiba 277-8581, Japan — In studying superstructures in transition metal oxides such as charge or orbital ordering, one usually considers site-centered superstructures. Hovewer there exist another possibility: bond-centered superstructures, such as e.g. the Peierls state in low-dimensional systems. In this talk we will consider the possibility of existence of site-centered and bond-centered structures on a few examples. We will show that in spinels and in some other frustrated systems a site-centered orbital ordering (ODW-Orbital Density Wave) may lead to the formation of bond-centered singlet Peierls-like states [1]. This picture gives a simple explanation of extremely strange superstructures observed recently below metal-insulator transitions in $MgTi_2O_4$ [2] and $CuIr_2S_4$ [3], and may be relevant for several other materials, such as $NaTiO_2$, $La_4Ru_2O_{10}$ [4] and some others. We will also give a general discussion in which cases bond-centered structures may be favourable, and discuss the role of orbital degrees of freedom for the insulator-metal transitions. [1] D.Khomskii and T.Mizokawa, cond-mat/0407458 [2] M.Schmidt et al., Phys.Rev.Lett. **92**, 056402 (2004) [3] P.G.Radaelli et al., Nature **416**, 155 (2002) [4] P.Khalifah et al., Science **297**, 2237 (2002)

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Date submitted: 17 Nov 2004 Electronic form version 1.4