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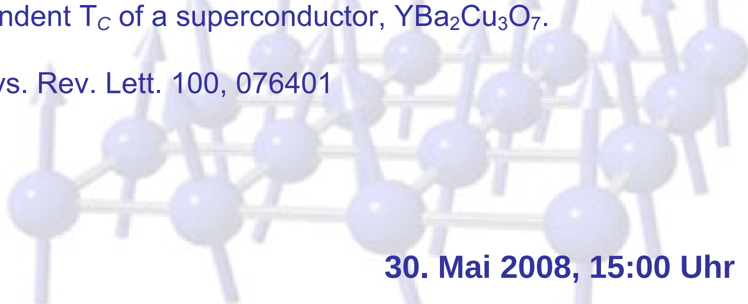
Reversible strain experiments on strongly correlated oxide films

Mechanical strain at interfaces in epitaxially grown thin films cannot be avoided. When considering strongly correlated oxides for new functions in electronics, lattice strain is a crucial challenge as well as a potential control tool. Extreme effects of strain on ferroelectricity, superconductivity and magnetism have been reported for *3d* transition metal oxides in recent years.
A versatile experimental method for the electrical control of quantitatively defined biaxial strain in thin films will be introduced which can give direct access to strain-dependent properties. It relies on using piezoelectric substrates of pseudocubic $Pb(Mg_{1/3}Nb_{2/3})_{0.72}Ti_{0.28}O_3$(001) (PMN-PT). Reversible and rather uniform piezoelectric in-plane strain of ≥0.4 % can be applied. In this way, strain dependences of the magnetization and electrical conductivity of colossal magnetoresistive manganites and of cobaltites, $La_{1-x}A_xMO_3$ (A = Sr, Ca; M = Mn or Co) have been explored. Giant responses to reversible strain of both magnetization and conductivity in manganites as well as an even larger strain effect on electron transport in $La_{0.7}Sr_{0.3}CoO_3$ [1] are observed. We employed x-ray measurements under reversible strain to study the elastic film response. Further experiments will be addressed such as step edge junctions and a first study of the strain-dependent T_C of a superconductor, $YBa_2Cu_3O_7$.

[1] A. D. Rata et al., Phys. Rev. Lett. 100, 076401



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