CFEL SCIENCE

April 13th, 2010 - 11:00

Seminar Room 108, DESY Bldg. 49

Max Planck Research Department for Structural Dynamics

SEMINAR

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X-ray analysis of the geometric and magnetic structure in low dimensional systems

The talk reviews some recent achievements in applying x-ray scattering to the study of the charge and magnetic structure of low dimensional systems.

In a first example the thickness dependence of the geometric structure in pure and cobaltdoped ZnO-film deposited on Ag(111) is discussed. A transition from the bulk Wurtzite (WZ)- type structure to the hexagonal-Boron-nitride (h-BN) phase is observed in the ultra thin film limit. Cobalt doping leads to a phase segregation in which WZ-type CoO-nanoclusters are coherently embedded into the h-BN host ZnO matrix (see Fig.1). The structure model involving locally confined antiferromagnetic (AF) CoO-clusters supports recent experimental results on the magnetic properties of diluted magnetic semiconductors. The effect of confinement is also decisive for the multiferroic (ferromagnetic/ferroelectric) properties of the $BaTiO_3$/Fe(001) interface. The structure analysis in combination with first principles calculations reveals the onset of polarization at a critical film thickness of two unit cells $BaTiO_3$.

The second part of the talk deals with the analysis of the magnetic structure using soft xray resonant scattering. Recent experiments on six monolayer thick iron films on Cu(001) have led to a new model for the spin structure of this archetype system involving strongly coupled AF spin blocks. The mutual orientation of the spin-blocks can vary easily involving noncollinearity of the spins.

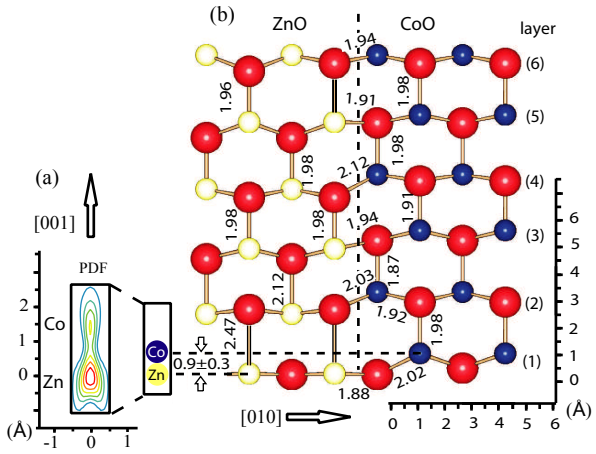

Fig.1: (a): Probability density function of the (Zn,Co) site in the first Zn(Co) O layer next to the Ag(111) surface. Maxima are related to Zn and Co. Boxes indicate different size scale between (a) and the structure model in (b). Wurtzite-type CoO is separated from h-BN-type ZnO. The vertical line indicates the phase boundary. Distances are given in Å, and layers arelabelled from (1), next to the Ag(111) surface to (6).
(taken from H.L. Meyerheim et al., PRL 102, 156102 (2009)

Host: Andrea Cavalleri, Condensed Matter Division, MPSD, CFEL