H4. A 2D STRIPE SUPERSTRUCTURE REVEALED BY SPIN WAVES IN CUBIC FERROMAGNETIC $La_{1-x}Sr_xMnO_3$ (x = 0.125 and x = 0.15)

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Manganites $La(Ca,Sr)MnO_3$ belong to a large class of compounds in which the strong correlations among electrons are suspected to be responsible for nanoscale charge segregation effects. In these oxides, the hole concentration can be tuned by substituting Ca or Sr on the La-sites. At zero doping, the spins of Mn form ferromagnetic (***a***,***b***) planes stacked antiferro-magnetically along the ***c*** axis. Upon doping, a new ferromagnetic coupling resulting from the double-exchange mechanism becomes effective and stabilizes a ferromagnetic, metallic state beyond $x \sim 0.2$. However, the way this compound evolves towards the new phase is very peculiar, emphasizing the role of charge segregation. We have shown previously [1] that at low doping, *hole-rich* platelets embedded in a hole-poor matrix are formed within the (***a***,***b***) planes. Neutron scattering experiments enabled us to determine their size (~16 Å) and their liquid-like distribution. As x increases, these platelets grow and percolate for $x = 0.12$, while the antiferromagnetic coupling along ***c*** concomitantly becomes zero. Beyond this concentration, inelastic neutron scattering experiments show that the magnetic excitation spectrum consists of a dispersed branch at small q, and several discrete modes at larger q. The former indicates long-range ferromagnetically coupled spins, while the latter are attributed to standing spin waves within small ferromagnetic domains. Moreover, recent experiments carried out as a function of temperature in $La_{7/8}Sr_{1/8}MnO_3$ [2] and in $La_{0.85}Sr_{0.15}MnO_3$ [3] revealed the occurrence of a gap at $q = 1/8$, indicating a new periodicity of 4 lattice spacings within the (***a***,***b***) planes (Fig. 1*a*). In connection with the low doping regime, we propose an interpretation in terms of reverse charge segregation. In this picture, *hole-poor* 4 x 4 ferromagnetic clusters tend to form on manganese sites within the (***a***,***b***) planes. Those clusters are weakly coupled across hole-rich boundaries located on oxygen sites (Fig. 2), leading to a superstructure of orthogonal stripes. This picture is quite well supported by spin-wave calculations [3] (Fig. 1*b*). This is, to our knowledge, the first observation 0 of stripes in a ferromagnetic state.

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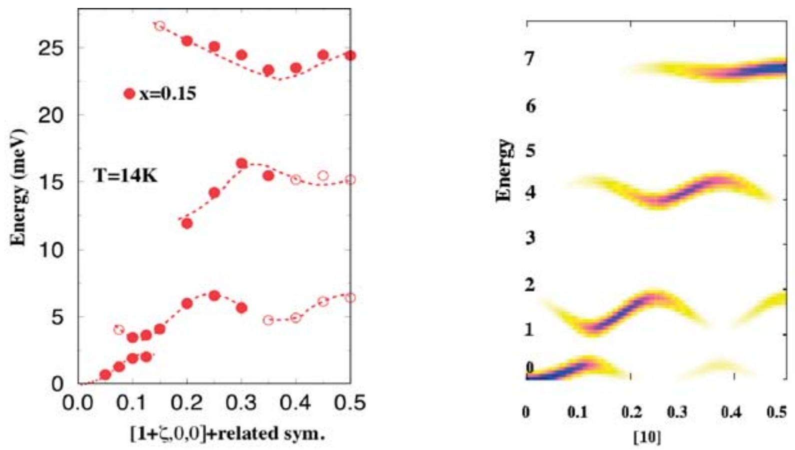

(a) *(b)*

Figure 1

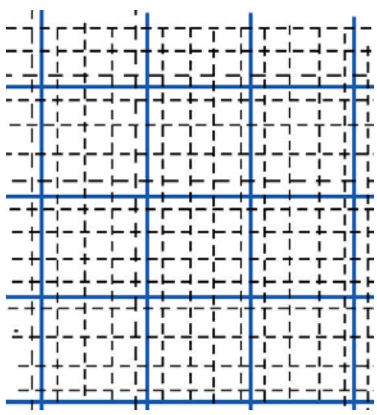

Figure 2