Structural Reasons for the Giant Oxygen Isotope Effect in $Re_{0.5}Sr_{0.5}MnO_3$ Perovskites

<u>Anatoly Balagurov</u>^a, Ivan Bobrikov^a, Vladimir Pomjakushin^b, Natalia Babushkina^c, Oleg Gorbenko^d, Anrej Kaul^d, ^a*FLNP JINR, Dubna, Russia.* ^b*LNS ETH&PSI, Villigen, Switzerland.* ^c"Kurchatov Institute", Moscow, Russia. ^dMoscow State University, Moscow, Russia. E-mail: bala@nf.jinr.ru

The giant oxygen isotope effect (a metal-insulator transition induced by ¹⁶O for ¹⁸O substitution) has been recently discovered in $Sm_{1-x}Sr_xMnO_3$ compound for x close to 0.5 [1]. We performed a neutron diffraction study for elucidating structural reasons of this transition. Both crystal and magnetic structures have been determined for several compositions with Re=Sm and (Nd_{1-y}Tb_y), y=0.228 and 0.456. These particular (Nd/Tb) ratios were chosen to model the average ionic radii of Sm and (Sm_{0.5}Nd_{0.5}) compositions respectively. In all studied samples the coexistence of ferromagnetic-metallic (FMM) and antiferromagnetic-insulating (AFMI) phases has been found at low temperature. From structural point of view both phases have the same Pnma-type structure but with strong difference in lattice parameters. The $d(x^2-y^2)$ orbital ordering in A-type AFMI phase leads to the huge shortening of Mn-O1 distances ($\approx 1.2\%$) (as well as of b lattice parameter) and stimulates strong intragranular strains, which stabilize phase separated state. The same situation, though with different type of magnetic and orbital ordering in AFMI phase, has been found in LPCM-y type manganites, which also exhibit the giant oxygen isotope effect [2].

[1] Babushkina N.A. et al., *Phys. Rev. B*, 2003, **67**, R100410. [2] Balagurov A.M. et al., *Phys. Rev. B*, 2001, **64**, 024420.

Keywords: manganites, neutron diffraction, isotope effect