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Composition Dependence of Polaron Formation and Dynamics in $\mathbf{La_{1-x}Ca_xMnO_3}$ B.G. UELAND, Y. CHEN, J.W. LYNN, NIST Center for Neutron Research, Gaithersburg MD 20899, Y.M. MUKOVSKII, R. PRIVEZENTSEV, Moscow Institute of Steel and Alloys, Moscow 117936, Russia — The colossal magnetoresistive perovskites $La_{1-x}Ca_xMnO_3$ have generated much interest due to the intimate correlation between their magnetic and transport properties. It is well known that for the doping range $0.22<x<0.47$ a transition from a paramagnetic insulating to a ferromagnetic metallic state occurs upon cooling below T_C ~150-250 K, and experiments have shown that the transition between these states is closely tied to the formation of lattice polarons. Recent neutron scattering experiments have directly observed that these polarons freeze into a glassy state at $T=T_c$ for materials with x=0.33, which is responsible for the observed first order nature of the ferromagnetic transition at this level of doping. While it has been proposed that this glass state occurs as x~0, its dependence on doping and temperature has yet to be fully mapped out. Here we present results from elastic and inelastic neutron scattering experiments performed on single crystal samples of these materials for x=0.15, 0.2, and 0.25, which have been undertaken to determine the direction in which the boundary for the glass phase evolves with x. Preliminary results indicate that in the insulating state ($x<0.22$), no static polaron scattering is observed (in zero field), in contrast to the results for the metallic regime.

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