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Complex local structures in lead based perovskite relaxors GUANGYONG XU, ZHIJUN XU, JINSHENG WEN, Brookhaven National Lab, PETER GEHRING, NIST, CHRIS STOCK, RAL, U.K. — The lead-based, perovskite relaxors $Pb(Zn_{1/3}Nb_{2/3})O_3$ (PZN), $Pb(Mg_{1/3}Nb_{2/3})O_3$ (PMN) and their solid solutions with $PbTiO_3$ (PT) continue to receive significant attention because they exhibit huge piezoelectric responses and are therefore technologically important. It is widely accepted that many of the special properties of relaxors are related to local (charge, chemical, and polar) order. In particular, short-range polar order, a.k.a. "polar nano-regions" (PNR), is believed to appear in relaxors at temperatures well above the Curie temperature T_C. The PNR contribute to the frequency dispersion of the dielectric properties and have recently been suggested to be associated with the high piezoelectric response. We have performed series of neutron diffuse scattering measurements on PMN-x%PT and PZNx%PT single crystals. Our results indicate that the local polar structure is complicated, having T1 and T2-type components with different polarizations. In particular, the T1 component with $\langle 001 \rangle$ polarization can be partially suppressed by an [001] field, the T2 component with $\langle 110 \rangle$ polarization can be affected by a [111] field. The T2 component also exhibits a strong coupling to the acoustic phonon while the T1 component is associated with the polar optic phonon. We will discuss the complex nature of the local structure in relaxors and their implications.

Guangyong Xu
Brookhaven National Laboratory

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