

## Diffuse Scattering and Monte Carlo Studies of Relaxor Ferroelectrics

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A renewed interest in the field of ferroelectricity has taken place in recent years since the finding of exceptional piezoelectric properties in the lead-oxide class of relaxor ferroelectric (RF) materials typified by the disordered perovskites  $\text{PbMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$  (PMN) and  $\text{PbZn}_{1/3}\text{Nb}_{2/3}\text{O}_3$  (PZN) [1-5].

Although PMN, PZN and numerous related materials have been extensively studied over a long period a detailed understanding of the exact nature of their polar nanostructure has still not emerged. In this paper we describe experiments in which full three-dimensional diffuse neutron scattering data have been recorded from a single crystal of PZN using the time-of-flight (tof) Laue technique on the SXD single crystal instrument at ISIS.

Monte Carlo simulation has been used to demonstrate that the observed diffuse patterns are due to planar nano-domains oriented normal to the six  $\langle 110 \rangle$  directions. A simple model has been developed which explains the observed scattering. This is based on the fact that Pb atom possesses a lone-pair of electrons, which gives it directionality.

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