Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Artificially layered $PbTiO_3/CaTiO_3$ superlattices JOHN SINSHEIMER, YOUCEF BENKARA, JONATHAN DALEY, SARA CALLORI, MATTHEW DAWBER, Dept of Physics and Astronomy, Stony Brook University —
It has been shown that in artificially layered $PbTiO_3/SrTiO_3$ superlattices, a form of improper ferroelectricity occurs where the rotations of the oxygen octahedra at the interfaces couple with the polar mode and increase the ferroelectric polarization of the material when the layers are very thin. $PbTiO_3/CaTiO_3$ superlattices grown on $SrTiO_3$ substrates are also highly likely to display this kind of behavior, as the $CaTiO_3$ ground state is dominated by rotational distortions. This system should also play host to a competition between in-plane ferroelectricity (as $CaTiO_3$ is subjected to a large tensile strain when grown on $SrTiO_3$) and out-of-plane ferroelectricity (the usual result when in $PbTiO_3$ is grown on $SrTiO_3$). Using off-axis RF magnetron sputtering, we have produced high quality superlattices of $PbTiO_3/CaTiO_3$ with various layer thicknesses on $SrTiO_3$ substrates with $SrRuO_3$ bottom electrodes. The samples were analyzed using x-ray diffraction, electrical measurements, and atomic force microscopy. Our experimental results reveal a fascinating transition region at certain ratios of the relative layer thicknesses.

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Date submitted: 19 Nov 2010 Electronic form version 1.4