Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Two-dimensional electric vortices in soft ferroelectric cylindrical nano-particles BYOUNGHAK LEE, Department of Physics, Texas State University, San Marcos, TX 78748 USA, SERGE NAKHMANSON, Department of Materials Science & Engineering, and Institute of Materials Science, University of Connecticut, Storrs, CT 06269, USA, OLLE HEINONEN, Materials Science Division, Argonne National Laboratory, Lemont, IL 60439, USA, FERROELECTRIC VORTEX COLLABORATION — We present a theory of electric vortices in cylindrical nano-particles. Recently it was predicted that Goldstone-like states (collective, close to zero frequency excitations, requiring practically no consumption of energy) can be induced in a layered perovksite $PbSr_2Ti_2O_7$ material, manifesting themselves as "easy" rotations of the in-plane polarization vector [1]. Utilizing the results of the first-principles simulations, we fit a Landau-Ginzburg-type energy expression for this compound that couples the ferroelectric order parameter with elastic strains. We then use this expression to demonstrate that competition among bulk anisotropy, ferroelectric exchange, and surface Coulomb energies can lead to an emergence of a variety of polarization vortex arrangements in cylinder-shaped nano-particles. We also discuss the possibility of in-situ mechanical control of such vortex structures.

[1] S.M. Nakhmanson and I. Naumov, Phys. Rev. Lett. 104, 097601 (2010).

Byounghak Lee
Texas State Univ

Date submitted: 15 Nov 2013 Electronic form version 1.4