Theory of Electric Polarization Induced by Inhomogeneity in Crystals DI XIAO, The University of Texas at Austin, JUNREN SHI, Institute of Physics, Chinese Academy of Sciences, DENNIS CLOUGHERTY, The University of Vermont, QIAN NIU, The University of Texas at Austin — We develop a general theory of electric polarization induced by inhomogeneity in crystals. We show that contributions to polarization can be classified in powers of the gradient of the order parameter. The zeroth order contribution reduces to the well-known result obtained by King-Smith and Vanderbilt for uniform systems. The first order contribution, when expressed in a two- point formula, takes the Chern-Simons 3-form of the vector potentials derived from the Bloch wave functions. Using the relation between polarization and charge density, we demonstrate our formula by studying charge fractionalization in a two-dimensional dimer model recently proposed.

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