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Continuum Theory for Nanotube Piezoelectricity PAUL J. MICHALSKI, NA SAI, E. J. MELE, University of Pennsylvania — We develop and solve a continuum theory of the piezoelectric response in 1-D nanotubes and nanowires. We find that the piezoelectric response depends on the aspect ratio, the chiral angle, and two dimensionless parameters giving the relative strengths of the two elastic constants to the piezoelectric constant. Solutions for several limiting cases in the parameter space are discussed. The low dimensionality of the model system gives rise to several interesting effects not seen in conventional 3-D systems. We find that a uniform axial stress will induce a spatially non-uniform polarization and a non- linear variation of the electrostatic potential along the tube. The model predicts a strong coupling between longitudinal strain and torsional strain in chiral nanotubes and nanowires. The theory is applied to estimate the piezoelectric response of boron-nitride nanotubes.

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