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Nano-electromechanical Rotation of Graphene and Giant Enhancement in Dielectric Anisotropy in a Liquid Crystal RAJRATAN BASU, DANIEL KINNAMON, ALFRED GARVEY, US Naval Academy — A nematic liquid crystal (LC) is doped with dilute concentrations of pristine monolayer graphene flakes (GP), and the LC+GP hybrids are found to exhibit a dramatic increase in the dielectric anisotropy. Electric field-dependent conductance studies reveal that the graphene flakes follow the nematic director that mechanically rotates on increasing an applied electric field. Further studies show that the $\pi - \pi$ electron stacking, between the graphene's honeycomb structure and the LC's benzene rings, stabilizes *pseudo-nematic domains* that collectively amplify the dielectric anisotropy by improving the orientational order parameter in the nematic phase. These anisotropic domains interact with the external electric field, resulting in a *nonzero* dielectric anisotropy in the isotropic phase as well. The enhancement in dielectric anisotropy, due to the LC – graphene coupling, is found to have subsequent positive impacts on the LC's orientational threshold field and elasticity that allows the nematic director to respond quicker on switching the electric field off.

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