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Exotic Charge Polarization near Dirac Cone Merging Transition in Graphene-based Systems NOAH WILSON, OWEN MYERS, TARAS LAKOBA, VALERI KOTOV, Univ of Vermont — Extreme strain in graphene yields a fascinating charge distribution around a Coulomb impurity. Graphene's band structure is characterized by gapless Dirac cones but can be made gapped by application of intense strain. The cones become increasingly elliptic continually merging, until the spectrum has an exotic, highly anisotropic, semi-Dirac, nature. This situation can also occur in various artificially engineered lattices. The unusual spectrum leads to an unconventional charge distribution around a Coulomb impurity. Crucially, unlike isotropic graphene, the polarization charge density exhibits long-range oscillatory tails far from the impurity. Such exotic behavior is due to the anisotropy of the polarization, and occurs even at zero chemical potential (i.e. unrelated to Friedel-type physics). The angular and radial functions are intrinsically coupled, hence a litany of distinct angular distributions is observed through multiple distance regimes. The density can approach infinity at angles where it was once close to zero, be negative all around the impurity, or have its polarity fluctuate along different directions. Thus our results could have important implications for STM experiments probing polarization charge around impurities in highly anisotropic Dirac systems.

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