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2D compressibility of surface states on 3D topological insulators[1]

DAVID ABERGEL, SANKAR DAS SARMA, University of Maryland — We develop a theory for the compressibility of the surface states of 3D topological insulators and propose that surface probes of the compressibility via scanning single electron transistor microscopy will be a straightforward way to access the topological states without interference from the bulk states. We describe the single-particle nature of the surface states taking into account an accurate Hamiltonian for the bands and then include the contribution from electron-electron interactions and discuss the implications of the ultra-violet cutoff, including the universality of the exchange contribution when expressed in dimensionless units. We also compare the theory with experimentally obtained $\frac{d\mu}{dn}$ as extracted from angle-resolved photoemission spectroscopy measurements. Finally, we point out that interaction-driven renormalization of the Fermi velocity may be discernible via this technique.

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