Abstract Submitted
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The effective fine-structure constant of freestanding graphene measured in graphite[1] YU GAN, JAMES REED, BRUNO UCHOA, YOUNG-IL JOE, University of Illinois at Urbana-Champaign, DIEGO CASA, Argonne National Laboratory, EDUARDO FRADKIN, PETER ABBAMONTE, University of Illinois at Urbana-Champaign — Electrons in graphene behave like Dirac fermions, permitting phenomena from high- energy physics to be studied in a solid-state setting. A key question is whether or not these fermions are critically influenced by Coulomb correlations. We performed inelastic x-ray scattering experiments on crystals of graphite and applied reconstruction algorithms to image the dynamical screening of charge in a freestanding graphene sheet. We found that the polarizability of the Dirac fermions is amplified by excitonic effects, improving screening of interactions between quasiparticles. The strength of interactions is characterized by a scale-dependent, effective fine-structure constant, $\alpha_g^*(\mathbf{k}, \omega)$, the value of which approaches $1/7$ at low energy and large distances. This value is substantially smaller than the nominal $\alpha_g = 2.2$, suggesting that, on the whole, graphene is more weakly interacting than previously believed.

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