Is suspended graphene an insulator? JOAQUIN DRUT, The Ohio State University, TIMO LAHDE, University of Washington — Graphene at low energies resembles massless quantum electrodynamics in a strongly coupled regime, away from the usual perturbative region where the fine structure constant is $\alpha \equiv 1/137$. Indeed, a single sheet of graphite in vacuum presents $\alpha \sim 1$. At such strong couplings the U(4) chiral symmetry of graphene can spontaneously break, inducing a gap in the quasiparticle spectrum. The question of whether chiral symmetry is broken represents a computational challenge that lies outside the domain of analytic techniques. In this talk, we will present the results of the first Monte Carlo simulation of the low-energy effective theory of graphene in vacuum (see abstract by T. A. Lähde). We have computed the chiral condensate, which is the order parameter for the insulating charge density wave state, as a function of $\alpha$, and found a chiral phase transition that is compatible with suspended graphene being in the gapped phase.

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