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Hybrid-Monte-Carlo simulation of the tight-binding model of graphene with partially screened Coulomb interactions

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We report on the status of our ongoing Hybrid-Monte-Carlo simulations of the tight-binding model for the electronic properties of graphene, using a realistic potential for the two-body interactions.
Our short-range interactions thereby include the partial screening due to electrons in higher energy states from ab initio calculations based on the constrained random phase approximation [T.O.Wehling et al., Phys.Rev.Lett. 106, 236805 (2011)].
We also include a phenomenological model which describes the transition to the unscreened bare Coulomb interactions of graphene at half filling in the long-wavelength limit.
We present up-to-date results on the transition from the semimetal
to an antiferromagnetic insulating phase and outline a number of additional problems which will be addressed using our code.

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