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Towards a Rigorous Proof of Magnetism on the Edges of Graphene Nanoribbons[1] HAMED KARIMI, IAN AFFLECK, University of British Columbia — A zigzag edge of a graphene nanoribbon supports localized zero modes, ignoring interactions. Based mainly on mean field arguments and numerical approaches, it has been suggested that interactions can produce a large magnetic moment on the edges. By considering the Hubbard model in the weak coupling limit, $U \ll t$, for bearded as well as zigzag edges, we argue for such a magnetic state, based on Lieb's theorem. Projecting the Hubbard interactions onto the flat edge band, we then prove that resulting 1 dimensional model has a fully polarized ferromagnetic ground state. We also study excitons and the effects of second neighbor hopping as well as a potential energy term acting on the edge only, proposing a simple and possibly exact phase diagram with the magnetic moment varying smoothly to zero. Finally, we consider corrections of second order in U, arising from integrating out the gapless bulk Dirac excitations.

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