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Graphene zigzag ribbons: hidden multiferroic order and transport J. FERNANDEZ-ROSSIER, University of Alicante, F. MUNOZ-ROJAS, JUAN JOSE PALACIOS — A new type of electronic phase with coexisting magnetic and ferroelectric order is predicted for graphene ribbons with zigzag edges [1]. The electronic structure of the system is described with a mean field Hubbard model that yields results very similar to those of density functional calculations[2,3]. Without further approximations, the mean field theory is recasted in terms of a BCS wave function for electron-hole pairs in the edge bands. The BCS coherence present in each spin-channel is related to spin-resolved electric polarization. Although the total electric polarization vanishes, due to an internal phase locking of the BCS state, strong magneto-electric effects are expected in this system. We explore these by spin polarized transport across finite length zig-zag ribbons, connected to non-magnetic electrodes [4]. We demonstrate that such system can present very large changes in resistance due to application of lateral electric field that modify the magnetic structure [2,4]. [1] J. Fernandez-Rossier, arXiv:0710.3484 [2] Y. Son, M.L. Cohen, and S. G. Louie, Nature *444*, 347 (2006) [3] J. Fernandez-Rossier and J. J. Palacios, Phys. Rev. Lett. *99*, 177204 (07) [4] J. Fernandez-Rossier, F. Munoz-Rojas, J. J. Palacios, in preparation

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