Exact results for intrinsic electronic transport in graphene

Shijie Hu,$^{1,2}$ Wei Du,$^1$ Guiping Zhang,$^1$ Miao Gao,$^1$ Zhong-Yi Lu,$^1$ and Xiaoqun Wang$^1$

$^1$Department of Physics, Renmin University of China, Beijing 100872, China
$^2$Institute of Theoretical Physics, CAS, Beijing 100080, China
(Dated: April 13, 2011)

We present exact results for the electronic transport properties of graphene sheets connected to two metallic electrodes. Our results, obtained by transfer-matrix methods, are valid for all sheet widths and lengths. In the limit of large width-to-length ratio relevant to recent experiments, with zigzag interfaces the Dirac-point conductivity is $2e^2/\sqrt{3}h$ and a sub-Poissonian Fano factor of $2 - 3\sqrt{3}/\pi$ is obtained; with armchair interfaces these are respectively 0 and 1. Our results reflect both the intrinsic topology of the sheet and the electronic structure of the electrodes, giving a complete microscopic understanding of the unique transport properties of graphene.

PACS numbers: 72.80.Vp, 73.22.Pr, 74.25.F-,73.40.Sx