Electron beam splitting and interferometry with graphene nanoribbons

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In this talk I will describe our recent advances in understanding graphene nanoribbons (GNRs) as interesting building blocks for constructing electron quantum optics circuitry. We have previously shown by atomistic simulations that two crossed GNRs under suitable conditions can operate as an electron beam splitter [1]. Here we extend this work and combine this basic device to form more complex electronic networks. One example is a Mach-Zehnder type interferometer and we determine the impact of a perpendicular magnetic field on its electronic transport properties.

References

[1] P. Brandimarte, M. Engelund, N. Papior, A. Garcia-Lekue, T. Frederiksen, D. Sánchez-Portal, *A tunable electronic beam splitter realized with crossed graphene nanoribbons*, J. Chem. Phys. 146, 092318 (2017)

Figures

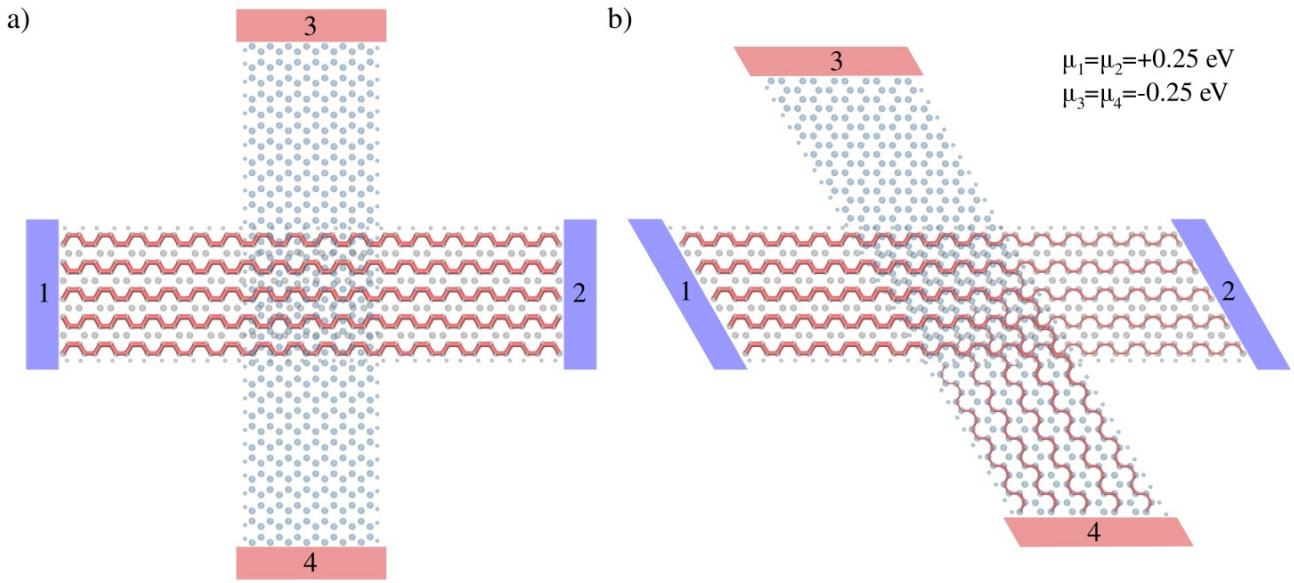

Figure 1. Electron beam splitting in devices of two crossed GNRs separated by a van der Waals-distance of ~3.3 Å. (a) In a 90 degree crossing, electrons injected from electrode 1 are mostly transmitted to electrode 2. (b) In a 60 degree intersection, the incoming electron from electrode 1 can be split with a near 50-50 probability into the outgoing electrodes 2 and 4, in analogy with an optical beam splitter. Adapted from Ref. [1].