Spin-momentum Locking in an Array of Defect Lines within Gated Bilayer Graphene

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Abstract

Graphene few-layer structures still presenting exciting phenomena to discover. For instance, recent studies on twisted bilayer graphene show superconductivity [1], a fact that has expanded research on the stacking of few layer graphenes [2]. Patterning with domain walls in gated bilayer graphene produces a change between AB to BA stacking and presents topological states in the gap [3-4]. In fact, the domain walls can be due to defect lines with pentagons and octagons (8-55), see Fig. 1, that in layer graphene are inducing localized states [5,6]. In this work using density functional theory calculations, we investigate an array of these defect lines in bilayer graphene. We found that the band structure shows a magnetic phase in which the spin is locked to the momentum, as in topological insulators. We also follow the topological states that appear even without a gate because of the array of defect lines. We lastly study the differences in spin bands and identified topological states when engineering by doping and/or electric field. All these results are summing to the new interesting data of the correlated behavior of electrons with the stacking in two-dimensional materials.

References

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Figures

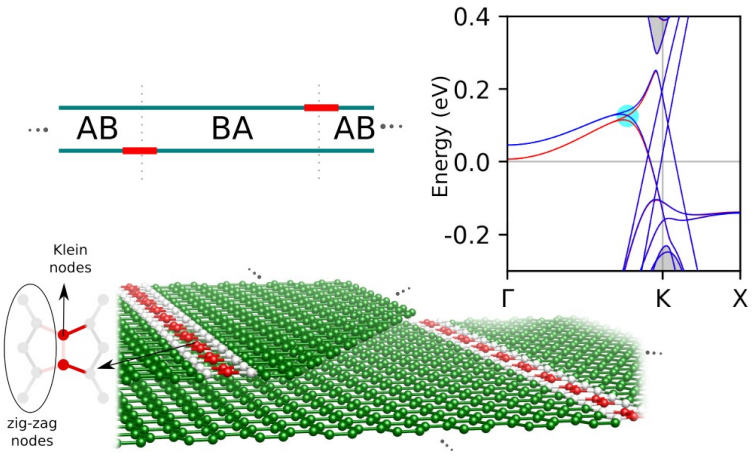

Figure 1: Scheme of the defect line array and band structure of the unperturbed defect line system. Note in the band structure the crossing with spin-momentum locking, as shown in the cyan circular region.