# Aharonov-Bohm Interference in Stepped Graphene

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Electron interference is one of the fascinating features in quantum physics and mesoscopic physics. In this regard, quantum hall systems have been demonstrated to be excellent building blocks for electron interferometers, due to their ideal 1D edge states with large coherence length, that can be formed in a 2D electron system when a high magnetic field is applied [1,2]. Designing interferometers in the quantum Hall regime however requires a mechanism for creating the electron transmission between the edge channels [3]. This has been extensively studied and realized in several 2D systems such as quantum point contacts, anti-dots and p-n junctions.

In this work [4], by investigating the magnetotransport in stepped graphene (see Fig.1), a new kind of Aharonov-Boh interferometers in the quantum Hall regime is explored. Actually, such non-planar graphene systems have been achieved in several experimental situations, e.g., growing graphene in SiC and/or draping graphene sheet on pre-structured substrates. In principle, a magnetic field applied to this stepped graphene system induces different effects on the electron motion in its terrace and facet zones. Using atomistic quantum simulation, we demonstrate that when the field is applied in a proper direction, oppositely propagating edge states can be achieved in these zones, leading to the edge states equilibration and hence a strong Aharonov-Bohm oscillation in the conductance in the quantum Hall regime (see Fig.2). The properties of this Aharonov-Bohm interference, depending on the carrier energy and structural parameters, were also systematically clarified. Moreover, taking place in the unipolar regime, our prediction represents a large range of possibilities to design Aharonov-Bohm interferometers, i.e., using also 2D materials beyond graphene.

References:

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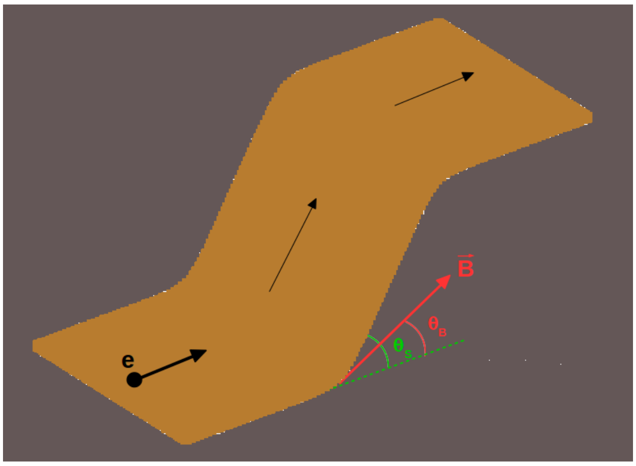


**Figure 1:** Stepped graphene system in a magnetic field.

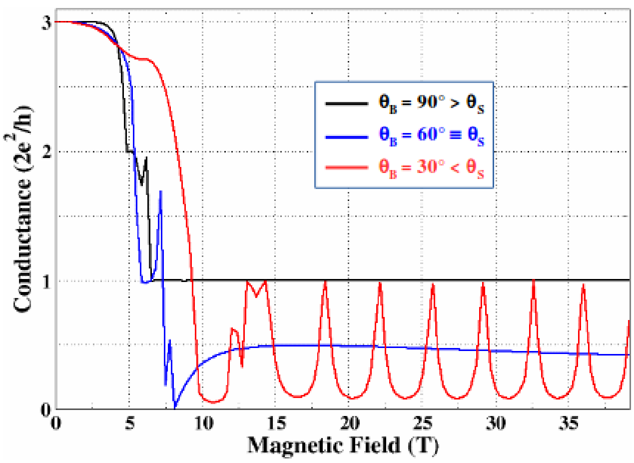


**Figure 2:** Conductance as a function of magnetic field applied in different directions.