Electrically-Driven Quantum Interference Effects in Mono-Layer Grapheme

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In graphene, single layer of graphite, carbon atoms are arranged in honeycomb structure, which is composed of two triangular sublattices. Therefore, charge carriers in graphene have an additional quantum number called pseudospin. The spinor wavefunction accumulates Berry's phase π when a charge carrier moves along a circular path on the surface of conic shape band structure and this phase suppresses probability of backscattering. Thus charge carriers tend to propagate without backscattering even though there exists a potential barrier in front. This exotic phenomenon reminds us an old relativistic quantum mechanics problem: 'Klein tunneling'. Furthermore, owing to gapless band structure, carrier type in graphene can be easily selected by applying voltage to top and bottom gate electrodes. Therefore graphene can be an ideal candidate for fabricating quantum interference devices. However, the electrical transport measurements in graphene p-n junctions so far depicted diffusive transport properties, which is mainly due to a very short mean free path below 100 nm, except a very recent experiment[1] adopting an extremely narrow top gate (~20 nm width). Here we present our current endeavors pursuing the ballistic p-n junction of graphene. As a first step, we report on the fabrication of periodic narrow top gate (40 nm width, 65 nm spacing) and preliminary results of Fabry-Perot type interference in our graphene devices.

Keywords: graphene heterostructure, quantum interference, Fabry-Perot interference

[1] A. F. Young and P. Kim, *Nature Physics* **5**, 222 (2009)