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# Magnetotransport study of the energy band in bilayer graphene

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Bilayer graphene has a parabolic band structure with a zero gap. When an electric field is applied perpendicular to the layer a gap between the valence and conduction bands appears and increases with increasing voltage. The gap has a complex structure that resembles the shape of a Mexican hat (inset of Fig.1). The size of the gap was evaluated in numerous optical absorption measurements and temperature studies of conductivity.

One consequence of such a band structure is the simultaneous coexistence of electrons and holes, when the Fermi level is placed inside the Mexican hat. The Fermi surface in this case has the shape of a ring. The external side of the ring contains states of the major types of carriers and the inner side corresponds to the different type of carriers. Due to this structure one can expect to see features in the magnetoresistance. Up to now no magnetoresistance research have been done when all particles reside inside the Mexican hat. We demonstrate that, in the regime when the Fermi energy $E_F$ is smaller than the Mexican hat depth $E_H$ the magnetoresistance is positive (Fig.1.) and perfectly fitted with the two-carrier Drude model. It allows us to develop a new approach to probe parameters of electrons and holes in bilayer graphene. We deduce the carrier densities and scattering times for electrons and holes separately. Moreover positive magnetoresistance method using a top-gate structure permit to determine the parameters of the Mexican hat.

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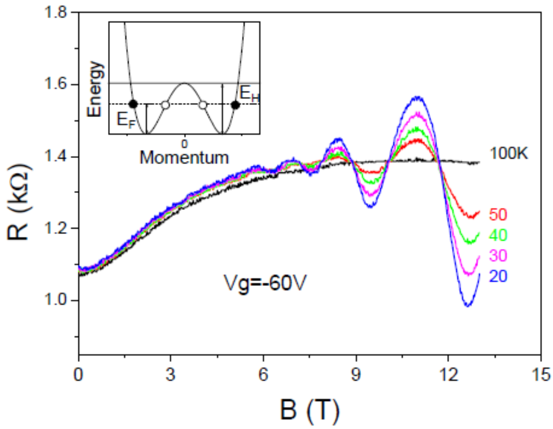


Fig.1. Longitudinal resistance R as a function of magnetic field B at gate bias $V_g$ = -60V and for various temperatures. Inset: “Mexican-hat” dispersion of a biased bilayer graphene near the bottom of the conduction band.