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Tunable Band Structure Effects on Ballistic Transport in Graphene Nanoribbons OLEKSIY ROSLYAK, GODFREY GUMBS, Hunter College, CUNY, DANHONG HUANG, Advanced E/O Space Sensors Group, Kirtland AFB — Recent advantages in the fabrication techniques of graphene nanoribbons (GNR) together with the long electron mean free path have stimulated considerable interest in their potential applications as interconnects in nano circuits. We have demonstrated that when GNRs are placed in mutually perpendicular electric and magnetic fields, there are dramatic changes in their band structure and transport properties. The electric field across the ribbon induces multiple chiral Dirac points, whereas a perpendicular magnetic field induces partially formed Landau levels accompanied by dispersive surface-bound states. Each of the fields by itself preserves the original even parity of the subband dispersion, i.e. $E_{n,k} = E_{n,-k}$, maintaining the Dirac fermion symmetry. When applied together, their combined effect is to reverse the dispersion parity to being odd with $E_{\mathrm{e},k} = -E_{\mathrm{h},-k}$ and to mix electron and hole subbands within an energy range equal to the potential drop across the ribbon. Broken Dirac symmetry suppresses the wave function localization and the Zitterbewegung effect.The Bütikker formula for the conductance holds true for the odd k symmetry. This, in turn, causes the ballistic conductance to oscillate within this region which can be used to design tunable field-effect transistors.

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