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**Multi-state current switching by the interference between standing electronic waves in two misoriented crossed graphene nanoribbons**[1]
K.M. MASUM HABIB, ROGER LAKE, Dept of Electrical Engineering, University of California, Riverside — In semi-infinite armchair graphene nanoribbon (aGNR), the electronic wavefunctions are standing waves with energy dependent wavelengths. The wavelength of the electrons can be controlled by an external electric field. These standing electronic waves show some unique transport phenomena in crossed graphene nanoribbon (xGNR) consisting of two semi-infinite aGNRs with one placed on top of the other and a relative rotation of 90 degrees in between. At any given energy, the matrix element between a bottom aGNR state and a top aGNR state depends on the phases of the standing waves at that energy. The matrix element and hence the inter-aGNR transmission is strongly suppressed when a zero of the standing wave of either the top or the bottom aGNR falls inside the overlap region. An external bias applied between the aGNRs can control the wavelengths and hence the phases of the standing waves which in turn modulates the inter-aGNR transmission and current. Calculations show that the inter-aGNR current is an oscillatory function of the bias voltage with multiple negative differential resistance (NDR) regions and that the period of the oscillation is controlled by the length of the finite ends of the xGNR.

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