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Effect of contact induced states on minimum conductivity in graphene ROKSANA GOLIZADEH-MOJARAD, SUPRIYO DATTA, School of Electrical and Computer Engineering, Purdue University, West Lafayette, IN-47906, USA — Recent experiments show that the conductivity of graphene tends to a minimum value in the range of $\sim$2-12e^2/h as the Fermi energy E_f approaches the charge neutral Dirac points ($E = 0$). We point out that contact induced states can help explain the structure dependence of the minimum conductivity observed experimentally even if the samples were purely ballistic. Contact induced states are similar to the well-known metal induced gap states (MIGS) in metal-semiconductor Schottky junctions, which typically penetrate only a few atomic lengths into the semiconductor, while the depth of penetration decreases with increasing band gap. However, in graphene we find that these states penetrate a much longer distance of the order of the width of the contacts. As a result, ballistic graphene samples with a length less than their width can exhibit a resistance proportional to length that is not 'Ohmic' in origin, but arises from a reduced role of contact-induced states. While actual samples are probably not ballistic and involve scattering processes, our results show that these contact induced effects need to be taken into account in interpreting experiments and minimum conductivity depends strongly on the structure and configuration (two- vs. four-terminal).

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