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Effect of spin-orbit interaction on the conductance fluctuation in disordered graphene DUK-HYUN CHOE, K.J. CHANG, KAIST — Recent findings of topological insulators have demonstrated the importance of spin-orbit interaction in low dimensional systems. In particular, the spin-orbit coupling gives rise to the formation of topological surface states that are protected by time-reversal symmetry. The universal conductance fluctuation (UCF) in spin-orbit coupled systems, however, has received comparatively little attention. It has been known that the universality characterized by the value of UCF only depends on the dimensionality and symmetry ($\beta = 1,2,4$ according to the random matrix theory) of the system. Here, we investigate the effect of spin-orbit interaction on the UCF behavior in disordered graphene by considering Kane-Mele (KM) and Rashba type interactions. Following the random matrix theory, both KM and Rashba Hamiltonians belong to the circular symplectic ensemble ($\beta = 4$), because in both cases time-reversal symmetry is maintained while spin-rotational symmetry is broken. Interestingly, conductance fluctuation in the KM Hamiltonian exhibits the same UCF value as that for the circular unitary ensemble ($\beta = 2$). We reveal the origin of such inconsistency and furthermore find that there exist new types of universality class, different from the conventional ones.

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