Abstract Submitted
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Enhanced quantum coherence in graphene by Pd cluster absorption and its Golubev-Zaikin zero-temperature saturation[1] FENGQI SONG, JUNHAO HAN, SHANYUE WANG, BAIGENG WANG, GUANGHOU WANG, Nanjing University — The absorption of functional impurities has been vastly proposed to mediate novel quantum coherent states, including quantum spin/anomalous Hall effects and Kondo effect etc, on graphene where the surface carriers dominate. However, such surface impurities will simultaneously introduce additional electronic scattering and suppress the electronic coherence of the Dirac fermions. This may eventually disable the expected quantum states. We report the increase of the dephasing lengths of the graphene sheet after the deposition of Pd nanoclusters, as demonstrated by the measurement of weak localizations. The dephasing lengths are found to reach some saturated values with the decreasing temperatures, essentially the zero-temperature decoherence. Detailed analysis is carried out on the temperature-dependent and saturated decoherence periods. The competition between the surface scattering and electrical field screening leads to the final improvement of quantum coherence. Our data agree well with the predication of Golubev and Zaikin, where such zero-temperature decoherence is induced by local fluctuations of the electrical fields near disorders.

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