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Electron transport nonlocality in monolayer graphene modified with hydrogen silsesquioxane polymerization[1]

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Physical properties of electrons in graphene offer not only functionality in terms of conventional charge transport, but also allow to explore spin and valley degrees of freedom. The presence of internal coupling between the nontrivial current states and normal charge current provides the effective mechanism for studying these properties. At the same time a nonlocal geometry of the transport experiments allows to separate the useful signal associated with either spin or valley degree of freedom from trivial charge contribution. In this work using the nonlocal geometry we study the transport properties of hydrogenated graphene Hall bar devices. The observed nonlocal signal is seen to substantially exceed the background ohmic contribution and, therefore, has to be understood in terms of nontrivial mediative current. The channel length dependence of the useful signal falls into direct/inverse spin Hall effect description, however, the absence of the modulation of the measured effect with the applied in plane magnetic field discredits the spin nature of the observed phenomenon. Our findings cannot be explained with the existing models suggesting that further investigation is required.

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