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Nonlinear Ballistic Transport in Graphene Devices M.JAVAD FARROKHI, MATHIAS BOLAND, MOHSEN NASSERI, DOUGLAS STRACHAN, University of Kentucky — Through the extreme size scaling of electronic devices, there is great potential to achieve highly efficient and ultrafast electronics. By scaling down the channel length in graphene transistors to the point where the mean free path exceeds the relevant channel length, the electron transport can transition from a diffusive regime to an intrinsic ballistic regime. In such a regime, both quantum tunneling at the electrode-channel interface and the screening length, as determined by electrode-channel barrier width, can have a strong effect on current nonlinearity and asymmetric gate response. Here we discuss our experimental results on nangap electrodes to graphene channels that show quantitative agreement with an intrinsic ballistic model. Moreover, this behavior persists to room temperature and on standard oxide substrates, providing strong evidence for a new regime of nonlinearity in graphene devices that could be of potential use for electronic applications.

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