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Gate-tunable Graphene Flakes Probed by Scanning Tunneling Spectroscopy at Atomic Scale YUANBO ZHANG, Dept. of Physics, UC Berkeley, VICTOR BRAR, Dept. of Physics, UC Berkeley/Lawrence Berkeley Laboratory, FENG WANG, Dept. of Physics, UC Berkeley, CAGLAR GIRIT, Dept. of Physics, UC Berkeley/Lawrence Berkeley Laboratory, YOSSI YAYON, MELISSA PANLASIGUI, Dept. of Physics, UC Berkeley, ALEX ZETTL, MICHAEL CROMMIE, Dept. of Physics, UC Berkeley/Lawrence Berkeley Laboratory — The nanometer scale electronic properties of mechanically cleaved graphene flake devices having tunable back-gates are resolved using scanning tunneling microscopy and spectroscopy. We observe an energy gap feature in the graphene tunneling spectrum that is unexpectedly pinned to the Fermi level (E_F) for different gate-induced electron densities. The Dirac point, on the other hand, is shifted by the back-gate by an amount prescribed by the graphene linear band structure. This energy gap is found to arise from a suppression of elastic electronic tunneling to graphene states near E_F and a significant enhancement of tunneling (seen as a more than factor of 10 increase in the conductance) at higher energies due to a phonon-mediated inelastic channel. This work reveals important new tunneling processes in gate-tunable graphitic layers.

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