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Multiple quantum dot behavior in short and wide graphene devices, with disorder[1] JOSEPH LAMBERT, STEVEN CARABELLO, Drexel University, ROBERTO RAMOS, Indiana Wesleyan University — Quantum dot (QD) behavior in graphene has been investigated previously in several different types of systems. These systems range from QDs etched in graphene, to impurity induced QDs in graphene nanoribbons. Here, we report on QD behavior in a new system where the graphene channel between two superconducting leads is short (a few hundred nanometers long) and wide (5-10 microns across). Measurements of conductance as a function of gate voltage and bias voltage at temperatures between 20 mK and 10 K revealed long-range tapestry patterns extending across a wide range of voltages, from -60 to +20 volts. Applying filtering techniques reveals Coulomb diamond features of varying sizes, suggestive of multiple QDs contributing to the conductance. The minimum conductance values for our devices range from $G_{min} \approx$ 40 e^2/h to 100 e^2/h, which are several orders magnitude larger than in typical QD systems. For several samples, measurements of conductance versus gate voltage show a broad and relatively flat minimum conductance region $\Delta V_g \approx$ 10V to 20V wide, with a center that is shifted in gate voltage to $V_g \approx$ -10V to -20V. This indicates impurity doping and the formation of electron/hole puddles on the graphene surface. The Coulomb diamonds uncovered by filtering is consistent with the presence of several low-barrier QDs in parallel.

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