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Bound states in nanoscale graphene quantum dots in a continuous graphene sheet JIABIN QIAO, LIN HE, Beijing Normal University — Considerable efforts have been made to trap massless Dirac fermions in graphene monolayer, but only quasi-bound states are realized in continuous graphene sheets up to now. Here, we demonstrate the realization of bound states in nanoscale graphene quantum dots (GQDs) in a continuous graphene sheet. The GQDs are electronically isolated from the surrounding continuous graphene sheet by circular atomically sharp boundaries, which are generated by the strong interaction between graphene and substrate. By using scanning tunneling microscopy (STM), we observe single-electron charge states of the GQDs, seen as Coulomb oscillations in the tunneling conductance. Evolution of single-electron transport of the GQDs between the Coulomb blockade regime and the Coulomb staircase regime is observed by tuning the STM tip-sample distances. Spatial maps of the local electronic properties reveal concentric rings inside the GQDs with each ring corresponding to a single Coulomb oscillation of the tunneling spectra. These results indicate explicitly that the electrons are completely trapped inside the nanoscale GQDs.

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