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STM characterizations of a circular graphene resonator realized with p-p junctions

Using low-temperature high-magnetic-field scanning tunneling microscopy (STM) and spectroscopy (STS), we systematically study a graphene quantum dot (GQD) defined by a circular graphene p-p junction. Inside the GQD, we observe a series of quasi-bound states arising from the whispering-gallery-mode (WGM) confinement of the circular junction and directly visualize these quasi-bound states down to atomic dimensions. By applying a large magnetic field, a large increase in the energy of the quasi-bound states, which results from turning on a π Berry phase of massless Dirac fermions in graphene, is observed. Moreover, our experiment demonstrates that a quasi-bound state splits into two peaks when the Fermi level crosses the quasi-bound state, indicating that there is strong electron-electron interaction in the GQD. Furthermore, we demonstrate explicitly that the electron-electron interaction destroys the WGM-type confinement of the quasi-bound states in the GQD.

References

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Figures

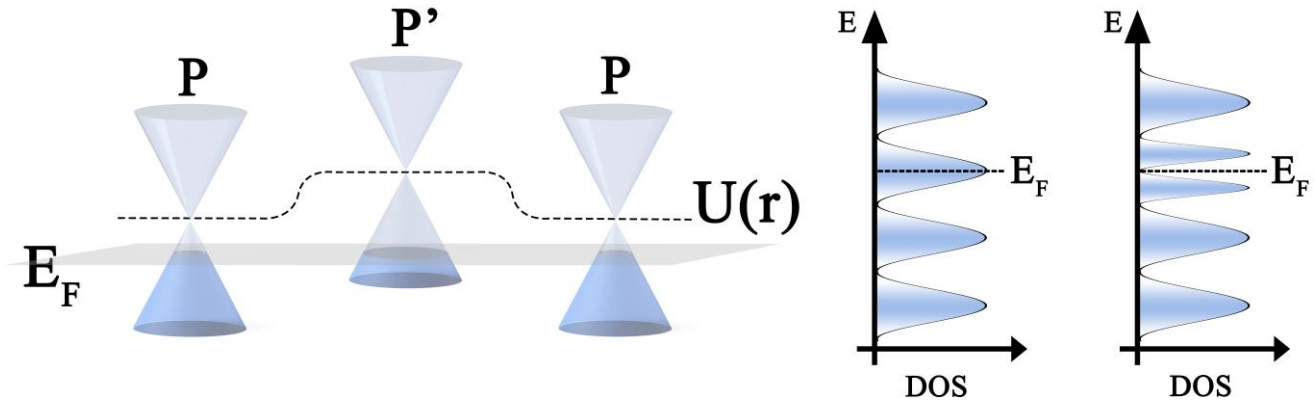

Figure 1: A circular graphene p-p junction resonator with the quasi-bound states splitting into two peaks