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Spin-polarized Fermi surface, hole-doping and band gap in graphene with boron impurities

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Supplementary information

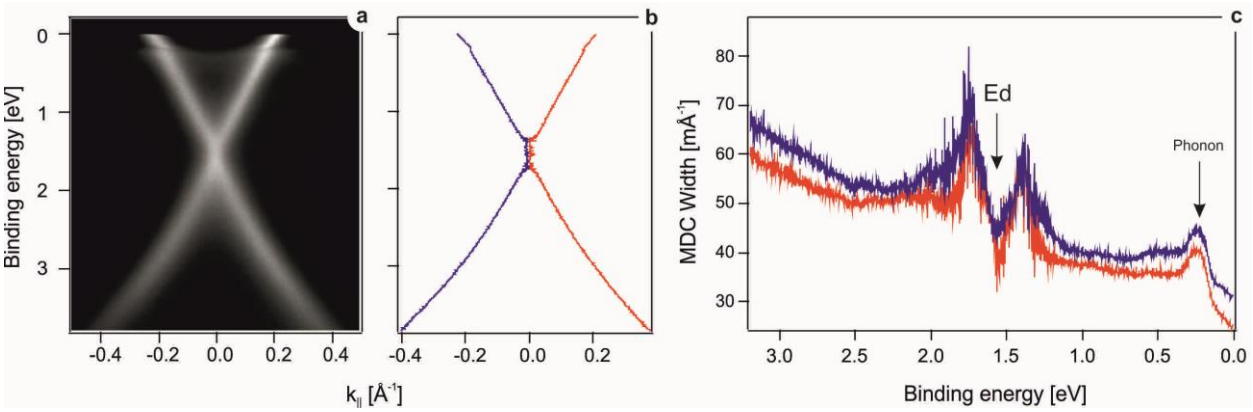

*Fig. S1 (a) ARPES intensity map of the graphene/Li/Co(0001) system taken perpendicular to the **ΓK** direction of the Brillouin zone and through the **K**-point. (b) Topology of the band structure (MDC peak positions) near the **K**-point derived from the ARPES data, (c) MDC widths derived from the ARPES data.*

Quasiparticle renormalization in heavily doped graphene is a well established phenomenon. While for conducting electrons the most relevant interactions are with phonons, the major effect on the band structure near the Dirac point is given by the interplay with plasmons. The latter can be derived from ARPES data and the first signature of plasmons is the sharpening of the Dirac cone band at the K-point as it was demonstrated in Ref.[1]. In this case, the ARPES data at the Dirac point imply the group velocity being close to infinity for the respective states. At first glance, this behavior is similar to appearance of a gap with a rather small width that is beyond the experimental resolution. The fundamental difference between these two phenomena is related to the quasiparticle lifetime. For instance, the gap does not change the lifetime while interaction with plasmon causes certain decreasing of its value, *i.e.* broadening of the spectral function. Therefore the route to discriminate between the gap opening and interaction with plasmons is to analyze the respective momentum distribution curves (MDCs) and derive the information on the properties of quasiparticles. As it was demonstrated in Ref. [1], the MDC width of the spectral function essentially increases upon entering the region of the interaction with plasmons, reaching its maximum at the Dirac point. In contrast, we observed considerable lowering of the MDC width close to the Dirac point for the graphene/Li/Co(0001) system. Thus, our observation indicates the gap opening with the width of 0.35 eV.

References

[1] A. Bostwick, T. Ohta, T. Seyller, K. Horn and E. Rotenberg, Nature Physics, 2007, 3, 36–40.