Massless Dirac fermions in graphene superlattice on Fe(110)

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Abstract

An epitaxial interface between graphene and Fe can be created by Fe intercalation in the system graphene/Ni(111) and first angle-resolved photoemission (ARPES) data have been reported for this system [1]. The direct growth of graphene from the gas phase on Fe(110) has recently been described [2]. We have used the latter method and investigated the electronic structure of graphene grown on Fe(110) by means of ARPES and compared to the band structures of graphene on Ni(111) and Co(0001) where we recently discovered intact Dirac cones despite strong sublattice symmetry breaking [3]. The presence of massless Dirac fermions is evidenced by the observation of a fully intact Dirac cone. Unlike Ni(111) and Co(0001) [3], the Fe(110) substrate induces in the graphene a strongly anisotropic quasi-one-dimensional corrugation. Despite clear signatures of a superlattice effect observed in the dispersion of σ-bands, the Dirac cone in graphene on Fe(110) does not reveal detectable quantum-size effects. In addition, the modification of the Dirac cone by the gradual intercalation of Au is reported and discussed.

References

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Figure

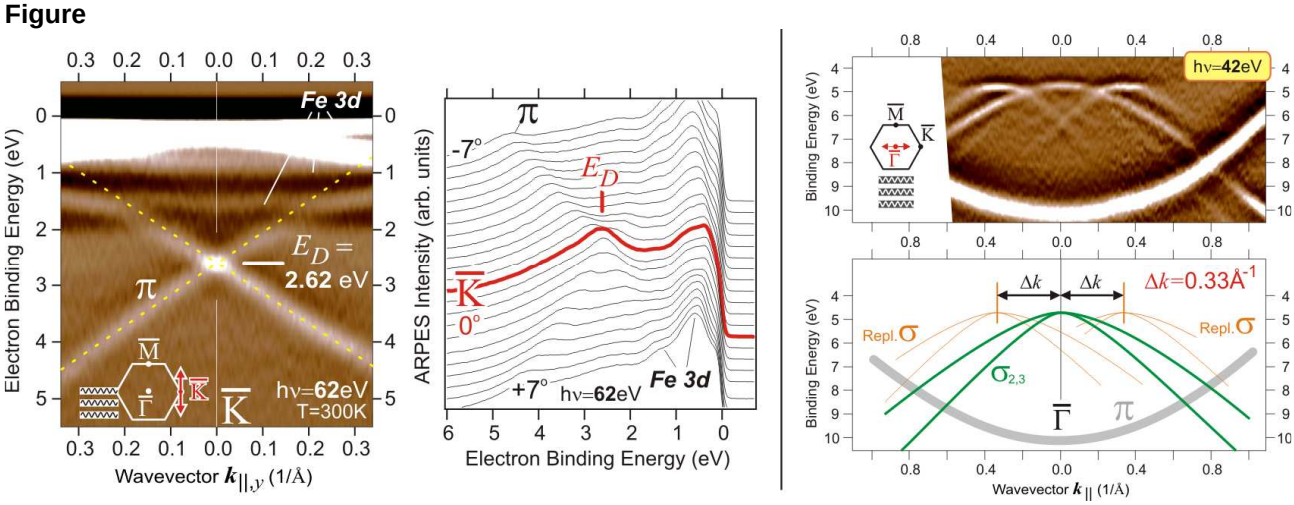

Fig. 1. Left and center: Intact Dirac cone of graphene/Fe(110). The hybridization with Fe 3d states is visible away from the Dirac point. The dotted lines show how the Dirac cone would appear without these hybridizations. Right: The 1D anisotropy of the (110) surface leads to replicas of σ-states while the Dirac cone does not show such effects.