Quasiparticle interferences in 30°-twisted graphene quasicrystal

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Quasicrystals, discovered in the 1980s (1), are materials that have clean diffraction pattern but no translational symmetry. The advent of van der Waals stacking has opened the possibility to engineer quasicrystals. For example, the moiré pattern in 30°-twisted graphene bilayers has 12-fold rotational symmetry which is not compatible with translation symmetry in 2D, hence it is a quasicrystal (2). Studying this system gives insight into the behavior of Dirac fermions in 2D quasicrystals. ARPES experiments (3) demonstrated the existence of multiple Dirac cone replicas, originating from the incommensurate interlayer coupling. The goal of this study is to determine to what extend these Dirac cone replicas influence the electronic properties of the Dirac fermions. Our low temperature scanning tunneling microscope (STM) experiments evidence the replicated Dirac cones by specific patterns in the local density of states patterns associated with scattering between them, contrary to previous STM experiments (4,5).

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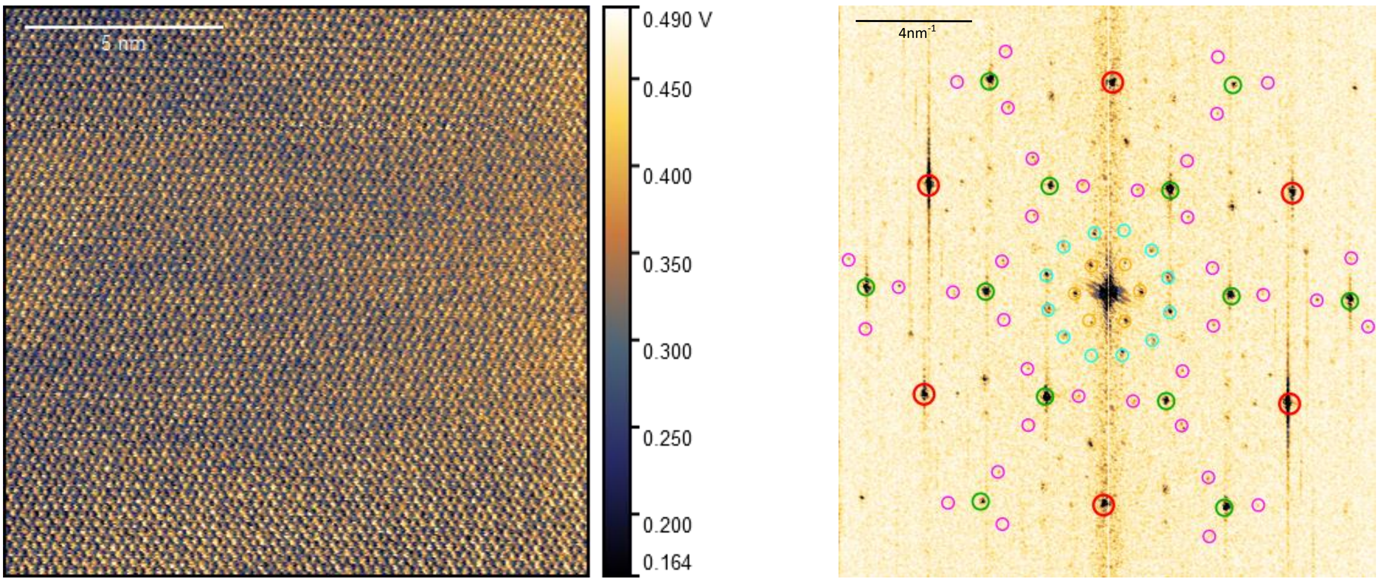

Left: Density of states of 30°-twisted graphene layers. V=8mV, i_t=75pA, V_{LI}=500µV. Right: Fourier transform of the density of states map on the left. The graphene reciprocal lattice, K,K' points, Moiré and interlayer scattering between Dirac cones and Dirac cone replicas are labelled by red, green, purple, and blue and orange circles, respectively.