Experimental evidence of the topological obstruction in twisted graphene layers

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Twisted graphene layers have attracted much interest owing to the rich and tuneable strongly correlated electron physics that they host[1]. An important aspect of their physics is the topology of the electronic bands which determines how the strongly correlated electron physics expresses. However, accessing this topology experimentally is difficult. Here we use the local density of states (LDOS) probed by scanning tunnelling microscopy as a topological observable[2] to explore the relative chirality of the Dirac cones within a moiré valley. We discover a chiral pattern (Fig. 1) near a charged defect which results from the Dirac cones having the same chirality within a moiré valley. This is expected from the continuum low-energy model of twisted graphene layers[3] and has important consequences for the emergence of Chern insulating and orbital magnet states[4]. Also, this peculiar topology leads to a topological obstruction of the low energy description of twisted graphene layers[5] which is now confirmed experimentally.

References

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Figures

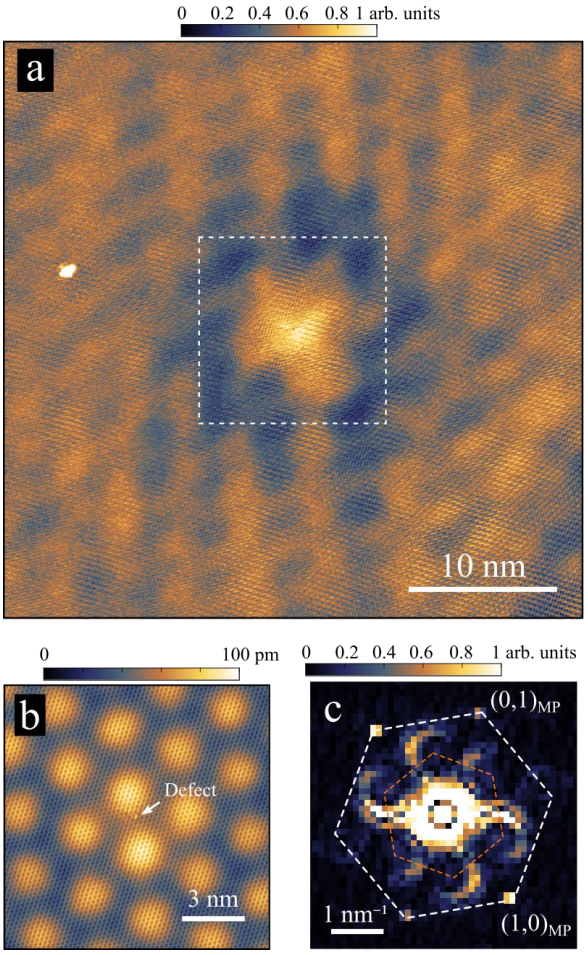

Figure 1: a) Tunnelling conductance map showing the LDOS measured near a charged defect in twisted graphene layers (V_b= 200 mV, i_t = 100 pA). b) STM topography image showing the defect and the moiré pattern. The dotted square in (a) shows the area. c) Low frequency FFT of the image in (a).