Stacking-Dependent Superstructures and Taxonomy at Armchair Intefaces of Bilayer/Trilayer Graphene

Asieh Kazemi[1,2], Simon Crampin[1,2], and Adelina Ilie[1,2]

[1]Centre for Graphene Science, [2]Department of Physics, University of Bath, Bath, BA2 7AY, UK
a.ilie@bath.ac.uk

We study quantum interference (QI) phenomena at bilayer-trilayer armchair interfaces, for different stacking sequences. The resulting QI patterns are discussed in terms of pattern taxonomy for graphene systems. Visualization using scanning tunneling microscopy (STM) and theoretical calculations (by STM image calculations and density functional theory) provide direct evidence that near armchair edges electron behavior is dominated by the "hard" edge, where the layer is abruptly truncated, as opposed to the "soft" edges, where layers continue across the boundary. Intervalley reflection causes universal quenching of the wavefunction with a periodicity of three C atoms, while the exact interference patterns depend on the stacking sequence and appear to be robust to disorder and chemical terminations. Lateral interfaces within multi-stacked graphene systems can provide unique system-specific opportunities for wave-function engineering to be exploited in devices employing quantum-interference.

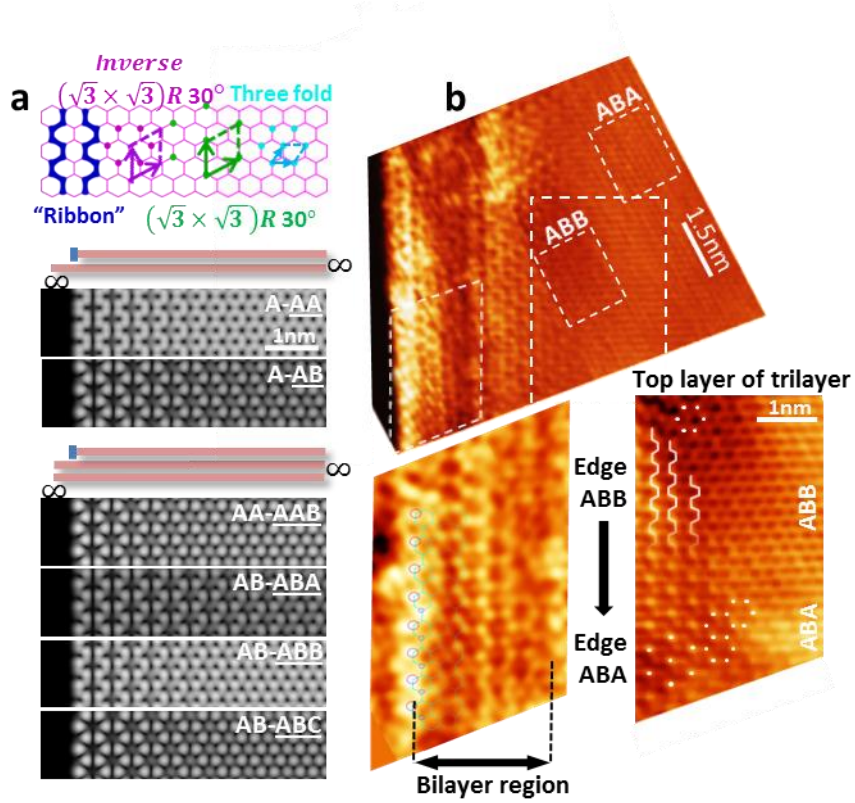

Figure 1: (a) Pattern taxonomy for stacked graphene systems at armchair edges/interfaces; STM image simulations of mono-bilayer and bilayer-trilayer armchair interfaces. (b) Experimental STM images at a bilayer-trilayer interface, showing a change in stacking on the top layer of the trilayer side; magnified regions show patterns that are interpreted based on scattering processes and the given taxonomy.