Universal Moire Nematic Phase in Twisted Graphitic Systems

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Graphene moiré superlattices display electronic flat bands. At integer fillings of these flat bands, energy gaps due to strong electron-electron interactions have been observed. Other correlation-driven phases in twisted graphitic systems at non-integer fillings have been proposed, but their presence remains unclear. Here, we report scanning tunneling microscopy (STM) measurements that reveal the existence of threefold rotational (C3) symmetry breaking in highly uniform twisted double bilayer graphene (tDBG). We demonstrate that this C3 symmetry breaking cannot be explained by extrinsic factors such as heterostrain and argue instead that it is a manifestation of an interaction driven electronic-nematic phase. This talk will focus on the experimental characterization of C3 symmetry breaking in tDBG and how it compares to symmetry broken phases observed in other moire systems such as magic angle twisted bilayer graphene. Considerations stemming from both microscopic and phenomenological modelling suggest that the observed nematic phase in tDBG emerges from interactions on the scale of the moire lattice. We expect, therefore, that similar nematic phases will be found in a broad range of moire systems with electronic flat bands.