Moire quasiperiodicity and topological Defects in twisted van der Waals Interfaces

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Heterogeneous interfaces between two dissimilar materials are an essential building block for modern semiconductor devices. The 2-dimensional (2D) van der Waals (vdW) materials and their heterostructures provide a new opportunity to realize atomically sharp interfaces in the ultimate quantum limit for the electronic and optoelectronic processes. By assembling atomic layers of vdW materials, such as hexa boronitride, transition metal chalcogenide and graphene, we can construct atomically thin novel quantum structures. We demonstrate the enhanced electronic optoelectronic performances in the vdW heterostructures, suggesting that these a few atom thick interfaces may provide a fundamental platform to realize novel physical phenomena. In this presentation, we will discuss the atomic reconstruction at twisted vdW interfaces and its effect on electronic structure and electrical transport behavior [1]. Furthermore, we note that multiple domain boundaries at the reconstructed interface join together to create energetically unfavorable nodes forming vortex-like structures. We will discuss our recent efforts to understand the topological nature of those defects.

References

[1] H. Yoo et al. ,Nature Materials 18, 448–453 (2019).