Electric field tunable bandgap in twisted double trilayer graphene

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Abstract

Twisted van der Waals heterostructures have recently emerged as a remarkably versatile platform for engineering interaction-driven, topological phenomena. Since the ground breaking discovery of correlated phases [1] and superconductivity [2] in twisted bilayer graphene, a plethora of moiré materials exhibiting fascinating electronic properties has surfaced. Despite the rapid advancements in twistronics, which now encompass a variety of multi-layered systems, moiré systems comprising double trilayer graphene have remained elusive. In this work, we present a comprehensive study combining electrical transport measurements with tight-binding calculations in twisted double trilayer graphene (TDTLG). Our investigation reveals that TDTLG with small angles (~1.7−2.0^0) exhibits an intrinsic bandgap at the charge neutrality point (CNP) [3]. Moreover, through modulation of the displacement field, we observe a gradual transition from insulator to semimetal to insulator at the CNP. This phenomenon is consistent with our tight-binding calculations. These findings establish TDTLG systems as a highly tunable platform for further exploration of magneto-transport and optoelectronic properties.

References

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