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Landau level spectroscopy in small-angle twisted double bilayer graphene.

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A new field of moiré materials established itself soon after superconductivity and strongly correlated electronic states were observed in magic-angle twisted bilayer graphene (MATBG). A small mismatch in rotational alignment or lattice parameters generates a periodic moiré pattern in stacked van der Waals monolayers. In certain such systems, the moiré potential gives rise to emerging flat electronic bands which can host a variety of quantum phases due to enhance electron-electron interaction. Multilayer twisted systems, such as small-angle twisted double bilayer graphene (TDBG), offer further opportunities to engineer flat or narrow bands and reveal new phenomena. The physics in twisted Bernal-stacked graphene bilayers is broadly tunable by electric field, which can drive the system into a correlated phase in a continuous range of twist angles. Here, we use a multi-mode instrument combining force microscopy, tunneling microscopy, and electrostatic gating to study TDBG at 10 mK under magnetic field up to 15 T. We present high-resolution Landau level spectroscopy and provide the analysis of magnetic-field-induced behavior in TDBG. Spatially resolved local density of states measurements allow us to see the spatial interplay between the Landau levels and high-symmetry moiré sites. We use an analytical model to further interpret the complexity of this tunable system.