Magic continuum in twisted bilayer WSe_2: Correlated states under high magnetic field

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Emergent quantum phases driven by electronic interactions can manifest in materials with narrowly dispersing, i.e. “flat”, energy bands. Recently, flat bands have been realized in a variety of graphene-based heterostructures using the tuning parameters of twist angle, layer stacking and
pressure, and resulting in correlated insulator and superconducting states. Here we report the experimental observation of similar correlated phenomena in twisted bilayer tungsten diselenide (tWSe2), a semiconducting transition metal dichalcogenide (TMD). We observed that a Mott-like insulator appears at half band filling that can be sensitively tuned with displacement field over a continuum of angles, spanning 4° to 5.1°. We further study the system under high magnetic field. The interleaved Landau fans coming from band edge and full-filling of Moiré cell show the first observed Hofstadter butterfly pattern in TMD. The strength of correlated insulating state is modulated by magnetic field in an unusual way and the extra Landau fan coming from half-filling shows complex patterns. These exotic features allow us to study the interplay between topology, electronic correlations and magnetism in the flat band platform