FRACTIONAL QUANTUM HALL EFFECT IN A FRACTAL SYSTEM

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The Hofstadter energy spectrum provides a uniquely tunable system to study emergent topological order in the regime of strong interactions. Previous experiments, however, have been limited to low Bloch band fillings where only the Landau level index plays a role. Here we report measurements of high mobility graphene superlattices where the complete unit cell of the Hofstadter spectrum is accessible. We observe coexistence of conventional fractional quantum Hall effect (QHE) states together with the integer QHE states associated with the fractal Hofstadter spectrum. At large magnetic field, we observe signatures of another series of states, which appears at fractional Bloch filling index. These fractional Bloch band QHE states are not anticipated by existing theoretical pictures and point towards a distinct type of many-body state.