Abstract Submitted
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Designer 2D bandstructures by superlattice patterning of van der Waals materials[1] CARLOS FORSYTHE, Columbia University, PILKYUNG MOON, New York University Shanghai New York University, MIKITO KOSHINO, Tohoku University, TAKASHI TANIGUCHI, KENJI WATANABE, National Institute for Materials Science, PHILIP KIM, Harvard University, CORY DEAN, Columbia University — Nanopatterning two-dimensional electron systems with long wavelength periodic potentials has long been used as a controllable way to modify the intrinsic electronic bandstructure of crystal lattices. In graphene, the combination of an extremely high mobility, linear energy dispersion, and direct access to the two-dimensional electron gas, provides an ideal platform with greater versatility than possible with conventional materials. However, efforts so far have been limited by the difficulty in patterning structures at the necessary small length scales while maintaining a high degree of fidelity over micron-sized device channels. Here we present transport data from graphene devices under superlattice potentials realized by dielectric engineering at the nano-scale. We observe clear evidence of both Brillouin zone folding and Hofstadter's fractal quantum Hall effect. This system is highly tunable, admitting a wide range of lattice symmetries and strength. Transport response is compared against theoretical modelling for a number of different superlattice symmetries, showing excellent agreement with theoretical modeling. This device architecture represents a new 2DEG system, the limitations of which are only starting to be explored.

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