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Electrostatically Defined Structure for Novel Fractional Quantum Hall States in Graphene SHAOWEN CHEN, REBECA RIBEIRO-PALAU, Columbia University, TAKASHI TANIGUCHI, KENJI WATANABE, National Institute for Materials Science (Japan), JAMES HONE, CORY R. DEAN, Columbia University — The electronic structure of graphene has a four-fold symmetry with spin and valley, which, together with the linear band dispersion is expected to lead to novel fractional quantum hall (FQH) states. Experimental probes of this regime however have remained limited. While compressibility measurement of high quality devices has rapidly progressed, enabling detailed measurement of the FQH bulk response, transport measurement, where the edge modes may be directly assessed, has remained limited. The reason for this is incompletely understood and may be due to a number of contributing effects. Here we report on BN-encapsulated graphene devices where we utilize an electrostatic gate to define the active device region, taking advantage of the properties of the nu=0 energy gap. In these structures the sample disorder, as measured by transport, is reduced and the FQH signature is enhanced. As a result, we observed FQH states at magnetic fields as low as 6 T with enhanced energy gaps compared with previous works. We also observed the clear presence of four-flux states from magnetic fields as low as 20 T. Our result provides a proof of principle demonstration that complex structures in the FQHE regime, such as quantum point contacts and quantum interferometers, are now accessible in graphene devices.

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