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Observation of a Massive Dirac Spectrum in Monolayer Graphene on Boron Nitride BENJAMIN HUNT, JAVIER D. SANCHEZ-YAMAGISHI, ANDREA F. YOUNG, Massachusetts Institute of Technology, T. TANIGUCHI, K. WATANABE, National Institute for Materials Science, PABLO JARILLO-HERRERO, RAYMOND ASHOORI, Massachusetts Institute of Technology — Graphene on hexagonal boron nitride (hBN) has emerged as the new standard for high-mobility graphene devices. However, the role of the hBN substrate in modifying the electronic properties of the graphene has only recently been investigated, with particular attention paid to the effects of the Moire produced by the interplay between the graphene and hBN lattices. Here we show that the hBN substrate can have a dramatic effect on the electronic structure of monolayer graphene, leading to the formation of superlattice Dirac points (SLDPs) and an insulating state at charge neutrality in zero magnetic field. The SLDPs imply that the insulator is related to the presence of a long-wavelength Moire. In samples which show the zero-field insulator, we also observe incompressible features associated with fractional quantum Hall (FQH) states at filling fractions $\nu=\pm 5/3$. Their absence in previous measurements has been attributed to the presence of low-energy valley excitations; in our measurement we find the strength of the $\nu=5/3$ gap is comparable to that of all other observed FQH states. Taken together, these observations imply that for small twist angles between the graphene and hBN substrates, the appropriate low-energy theory describing monolayer graphene features a mass.

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