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Valley Polarization and Transport in Dual Gated Bilayer Graphene PATRICK MAHER, Columbia University, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, PHILIP KIM, Columbia University — The low energy band structures of graphene and its bilayer contain a valley degeneracy due to the two inequivalent points in the Brillouin zone. In bilayer graphene, this degree of freedom can be experimentally controlled through the breaking of layer symmetry by a transverse electric field. Notably, this can open a band gap at charge neutrality. Additionally, breaking of layer symmetry can give rise to broken symmetry quantum Hall states, and there are predictions that it can be used to create topological kink states. We report on transport measurements of ultra high quality dual-gated bilayer graphene samples encapsulated in hexagonal boron nitride. Our fabrication method involves no direct exposure of the graphene to resist, resulting in exceptionally low-disorder. In a magnetic field, we observe tunable symmetry-broken quantum Hall states. In addition, through the use of aligned split top and bottom gates, we can study transport along the one dimensional boundary between electric fields of opposite polarity.

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