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Quantum Hall drag of exciton condensation in bilayer graphene double layer XIAOMENG LIU, Harvard University, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Material Science, BERTRAND HALPERIN, PHILIP KIM, Harvard University — Excitons are pairs of electrons and holes bound together by the Coulomb interaction. At low temperatures, excitons can form a Bose-Einstein condensate (BEC), enabling macroscopic phase coherence and superfluidity. We report exciton condensation under magnetic field in bilayer graphene double layers separated by a few atomic layers of hexagonal boron nitride (hBN). Driving current in one graphene layer generates a quantized Hall voltage in the other layer, signifying coherent exciton transport. Owing to the strong Coulomb coupling across the atomically thin dielectric, the observed $\nu_{tot} = 1$ exciton BEC state exhibits T_c of 8K, an order of magnitude higher than previously reported in GaAs systems. With the wide-range gate tunability, we surveyed the parameter space and discovered new exciton BEC phases selectively appearing at $\nu_{tot} = 3$ and -3, while many other integer ν_{tot} states are missing. We also discovered that changing displacement fields through each bilayer graphene can induce phase transitions of the exciton BEC. By comparing the exciton BEC phase transitions with symmetry-breaking quantum Hall phase transitions of each bilayer graphene, the selection rule for establishing exciton BEC phases was inferred.

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