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Electric field induced transition between spin to valley polarized ν=0 quantum Hall state in dual-gated graphene bilayers[1] KAYOUNG LEE, SEYOUNG KIM, BABAK FALLAHAZAD, EMANUEL TUTUC, The University of Texas at Austin — Graphene bilayers in Bernal stacking exhibit a transverse electric field dependent energy gap, thanks to the on-site electron energy asymmetry between the two layers. In a perpendicular magnetic field, the applied transverse electric field (E) will induce a quantum Hall state (QHS) at the charge neutrality point (filling factor ν=0) marked by a insulating behavior of the longitudinal resistance (ρ_{xx}), and a plateau in the Hall conductivity. Using dual-gated graphene bilayers, we investigate here the E-field dependence of the ν=0 QHS in high perpendicular magnetic fields (B), up to 30T. The temperature dependence of ρ_{xx} measured at ν=0 shows an insulating behavior, which is strongest in the vicinity of E=0 as well as at large E-fields. At a fixed B-field, as a function of the applied E-field the ν=0 QHS undergoes a transition, marked by a ρ_{xx}minimum, as well as a temperature independent ρ_{xx} at a finite E-field value. This observation can be explained by a transition from a spin polarized ν=0 QHS at small E-fields, to a valley (layer) polarized ν=0 QHS at large E-fields. The E-field value at which the transition occurs follows a linear dependence on the applied perpendicular magnetic field, with a slope of ~18 mV/nm·T.

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Kayoung Lee
The University of Texas at Austin

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