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Symmetry breaking of zero energy landau level in monolayer graphene YUE ZHAO, Physics Department, Columbia University, PAUL CADDEN-ZIMANSKY, FERESHTE GHAHARI, PHILIP KIM — We experimentally study the nature of the symmetry breaking of the zero energy landau level (LL) in monolayer graphene using Corbino geometry and Hall bar geometry devices. At high magnetic fields, in the absence of the edge state channel connection in Corbino devices, we observe a gap opening in $\nu = 0$ QH state whose gap is independent of in-plane magnetic field. In Hall-bar geometry devices where edge state connection is allowed, we observe similar QH Insulator behavior independent of the in-plane magnetic field, indicating that the observed insulating behavior at the charge neutrality point of monolayer graphene at high magnetic field is originated from the degeneracy lifting of the zero LL via the valley pseudospin polarization rather spin polarization.

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