Textured spin-valley domain wall in bilayer graphene at $\nu=0$

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Abstract:

We investigate the interaction-induced spin-valley textured domain walls in bilayer graphene at the $\nu=0$ quantum Hall state, subject to a kink-like perpendicular electric field. Such a state can be realized in a double-gated suspended sample, where the electric field changes sign across a line in the middle of the sample. The non-interacting energy spectrum of the ground state is characterized by two domain walls, separating two valley-polarized regions by a spin-polarized strip centered around the kink. Using the Hatree-Fock approximation, we find that the Coulomb interaction opens a gap between the two lowest-lying states near the Fermi level, and yields a smooth spin-valley texture throughout the domain walls. Moreover, our results suggest possibilities to visualize the resulting texture via measuring the charge density difference between the two graphene layers, which is predicted to exhibit a charge density wave. The width of the smooth texture and the resulting pattern can be tuned by the interplay between the magnetic field and gate electric fields.