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$\nu = 0$ quantum Hall ferromagnet in a monolayer graphene: bulk ground states and charged edge excitations[1] MAXIM KHARITONOV, Department of Physics and Astronomy, Rutgers University — The $\nu = 0$ quantum Hall state in a defect-free graphene sample is studied within the framework of the quantum Hall ferromagnetism. Starting from the low-energy electron Hamiltonian, in which all allowed by symmetry sublattice- and valley-anisotropic terms due to the Coulomb and leading electron-phonon interactions are taken into account, the energy functional for the quantum Hall ferromagnet is derived. Paying special attention to the signs of anisotropies, we find that the anisotropy due to the repulsive Coulomb interactions always favors the spin-polarized pseudospin-singlet state. On the other hand, the anisotropy due to the phonon-mediated attractive interactions favors the XY pseudospin-polarized spin-singlet state. It is then demonstrated that, in the case of the XY pseudospin bulk order and armchair boundary, the Skyrmion-type charged excitations are gapped at the edge, which makes the whole sample insulating. These findings suggest that the experimentally observed insulating $\nu = 0$ state is an XY pseudospin ferromagnet favored by electron-phonon interactions.

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