Optical properties of Wigner crystal and helical state in bilayer graphene

René Côté, Manuel Barrette, and Élie Bouffard

Département de physique, Université de Sherbrooke
Sherbrooke (Québec), Canada J1K 2R1

Rene.Cote@USherbrooke.ca

Abstract

In a quantizing magnetic field, the two-dimensional electron gas in Landau level *N=0* of bilayer graphene goes through a series of phase transitions at integer filling factors $\nu \in [-3,3]$ when the strength of an electric field applied perpendicularly to the layers is increased. At filling factor $\nu=3$, the electron gas in the different states behaves as an *orbital* quantum Hall ferromagnet. A Coulomb-induced Dzyaloshinskii-Moriya term in the orbital pseudospin Hamiltonian is responsible for a series of transitions first to a Wigner crystal state (see Fig. 1) and then to an helical state (see Fig. 2) as the electric field is increased. Both states have a non trivial orbital pseudospin texture indicated by the vectors in Figs. 1 and 2 that gives rise to a texture of electric dipoles in the plane of the bilayer. In this presentation, we discuss the experimental signatures of these nonuniform states in the electromagnetic absorption spectrum and in the Kerr rotation of the polarization vector of an incident electromagnetic wave [1].

References

[1] R. Côté, Manuel Barrette, and Élie Bouffard, arXiv: 1507.02003.

Fig. 1 Electric dipole texture (vectors) and modulation of the electronic density n(**r**) in the Wigner crystal state.

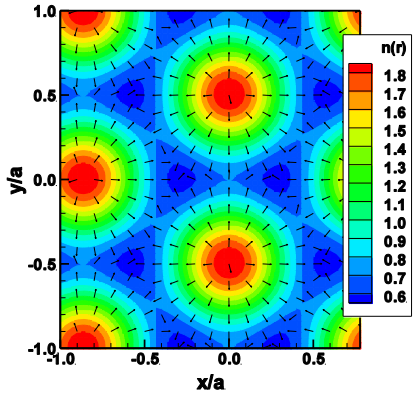

Fig. 2 Electric dipole texture (vectors) and modulation of the electronic density n(**r**) in the helical state.