Charge-density excitations in bilayer graphene in high magnetic field

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The bilayer graphene is the unique object which combines the parabolic dispersion law of quasiparticles with their chirality exhibiting Berry phase 2π. In magnetic field there is a double-degenerate zero-energy Landay level incorporating two different orbital states with the same energy. Taking into account spin and valley degeneracies, the zero-energy Landau level in a bilayer is eightfold degenerate. Inter-Landau-level transitions in the bilayer graphene at high magnetic field have been studied. Because of the electron-electron Coulomb interaction these transitions are the charge-density excitations (magnetoplasmons). The charge-density excitations at small momenta are considered in the frame of the Hartree-Fock approximation. The case of filling-factor $\nu << 1$ is considered. This filling-factor means the absence of free carriers due to doping. The presence of small asymmetry of graphene layers is included. Without magnetic field, the asymmetry gives rise to the gap in the spectrum; in the presence of the field, the asymmetry splits the eightfold degenerate zero-energy Landau level into two fourfold levels. The energy of the magnetoplasmon excitations is calculated and the strong dependence of the energy on the form of the bilayer ground state is shown.