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Monte-Carlo study of the phase transition in the AA-stacked bilayer graphene

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Tight-binding model of the AA-stacked bilayer graphene with screened electron-electron interactions has been studied using the Hybrid Monte Carlo simulations on the original double-layer hexagonal lattice. Instantaneous screened Coulomb potential is taken into account using Hubbard-Stratonovich transformation. G-type antiferromagnetic ordering has been studied and the phase transition with spontaneous generation of the mass gap has been observed. Dependence of the energy gap on the on-site electron-electron interaction is examined. It is found, that the energy gap vanishes at some finite value of the on-site interaction potential, which differs from the dependence, predicted by the mean-field approximation.

Primary author: Mr NIKOLAEV, Alexander (Far Eastern Federal University)

Co-author: Dr ULYBYSHEV, Maksim (Regensburg University)

Presenter: Mr NIKOLAEV, Alexander (Far Eastern Federal University)

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