Magnetic Field Driven Electron Dynamics in Graphene

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It has been realized that layered materials have potential for advanced technological applications. When layered materials thinned to its physical limits, they exhibit different novel properties compare to their bulk counterpart. [1] Therefore, these materials are referred to as two dimensional (2D) materials. Technologically relevant property- electron dynamics are influenced by momentum dispersion [2,3] in 2D materials such as in graphene, $MoSi_2$, and Bi_2Te_3 as they are periodic. However, computational modeling of momentum influenced electron dynamics under applied magnetic field remain challenging. Here, we perform non-equilibrium electron dynamics calculations in graphene using evolution operator for wave function in momentum space under interaction with applied weak magnetic field, $\vec{B}$. The non-adiabatic dynamics calculations are performed for thermal equilibration using Redfield equation of motion for density matrix. [4] Thermal lattice induced dissipation is completing with magnetic field induced coherence. Our result**s** show that both magnetic field and thermal fluctuations of lattice lead to violation of momentum conservation for charge carriers. Our work is expected to establish a fundamental understanding of magnetic field effect on non-equilibrium properties of graphene influenced by momentum sampling, which is critical for optoelectronic and photovoltaic applications.

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