Non-equilibrium dynamics and topology in graphene

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Non-equilibrium dynamics in the Floquet states of Dirac materials are theoretically explored. Floquet Dirac cone of the graphene-like systems under the circularly polarized pulse pumping, we find a regime that exists between topologically trivial and optically induced nontrivial phases from the time-resolved dichroic photoemission spectroscopy (TRdPES), which we call the fluctuating topological order. The topological order fluctuation is a novel mixed phase, i.e., a dynamical mixture of trivial and nontrivial phases, as a precursor to the transient nontrivial phase. On the other hands, employing the non-equilibrium Kubo formular, we demonstrate the conductivity of the steady-state Floquet graphene under a circularly polarized continuous wave. In the study, we found that the topological phase transition can be clearly measured in contrast with the pump pulse case.

References

[1] Youngjae Kim, and J. D. Lee, Mater. Today Phys., 13 100525 (2021).

Figures

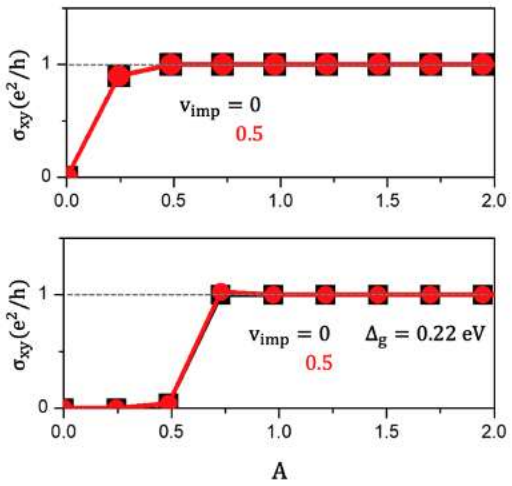

Figure 1: Calculated cnductivities of non-equilibrium topological phase transition in massless Dirac cone (upper figure) and massive Dirac cone (bottom figure). In contrast to the ultrafast optical pump excitation, the phase transition signals can be observed sharply regardless to the impurity scattering.