Justin Song[1,2]

[1] Institute of High Performance Computing, ASTAR, Singapore, and
[2] Division of Physics and Applied Physics, Nanyang Technological University, Singapore

justin.song.cw@gmail.com

Anomalous carrier dynamics in topological edge states

I will describe how the carrier dynamics of electrons in topological systems can display unconventional behavior sharply departing from that of normal metals. One particularly striking example are the plasmonic modes of carriers in domain wall edge states in gapped bilayer graphene, which exhibit a character distinct from its parent bulk. These domain wall plasmons possess a linear dispersion, and a valley polarization for forward/backward propagating waves. Strikingly, domain wall plasmons have long-lifetimes exceeding that of transport scattering time in the bulk. This contrasts with bulk plasmon decay times that are typically limited by bulk transport scattering time. A further example of unconventional carrier dynamics are the collective motion of carriers in Weyl-semimetal Fermi-arc surface states. Owing to the open and chiral nature of Fermi-arcs in Weyl semimetals (WSMs), Fermi-arc plasmons acquire a hyperbolic character supporting a large range of plasmon wavevectors at a given frequency. The unique behavior in these two examples above, arising from an interplay of both surface as well as bulk, provide clear examples of how materials hosting topological edge states can display new types of interacting behavior not realizable in conventional metals.