Winding number and optical conductivity of multi-Weyl semimetals
SEONGJIN AHN, Department of Physics and Astronomy, Seoul National University, EUGENE MELE, Department of Physics and Astronomy, University of Pennsylvania, HONGKI MIN, Department of Physics and Astronomy, Seoul National University — Multi-Weyl semimetals are a new type of Weyl semimetals which have anisotropic non-linear energy dispersion and a topological charge larger than one, thus exhibiting a unique quantum response. Using a unified lattice model we calculate the optical conductivity numerically in the multi-Weyl semimetal phase and in its neighboring gapped states, and obtain the characteristic frequency dependence of each phase analytically using a continuum model. The frequency dependence of longitudinal and transverse optical conductivities obeys scaling relations that are derived from the winding number of the parent multi-Weyl semimetal phase and can be used to distinguish these electronic states of matter.

This research was supported by the NRF under Grant No. 2015R1D1A1A01058071 and the DOE under Grant No. DE-FG02-ER45118. HM acknowledges travel support provided by the University Research Foundation at the University of Pennsylvania.