Title: Electronic polarization in topological nodal semimetal thin film

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Topological nodal semimetals are characterized by the topology of the electronic band structures. They are categorized into nodal point semimetals and nodal line semimetals. Famous examples of the nodal point semimetals are Dirac/Weyl semimetals. In the Dirac/Weyl semimetals, there are many physical properties which are closely related to the topology of their band structures. Recently, the nodal line semimetals also attract many researchers and there are many theoretical and experimental papers. One of the interesting physical response of the nodal line semimetals is the electronic polarization. The electronic polarization in the nodal line semimetals is theoretically studied, and they are closely related to the Berry phase of the nodal line semimetals. These studies, however, are applicable to only insulating phase.

In this work, we calculate electronic polarization in a nodal line semimetal thin film. We consider screening effect and our calculation is applicable to the metallic phase. We find the nodal line semimetals are characterized by the step of the polarization as a function of the external E-filed. This feature is observed even in the Fermi energy off the nodal line, and not observed in the Weyl semimetals.

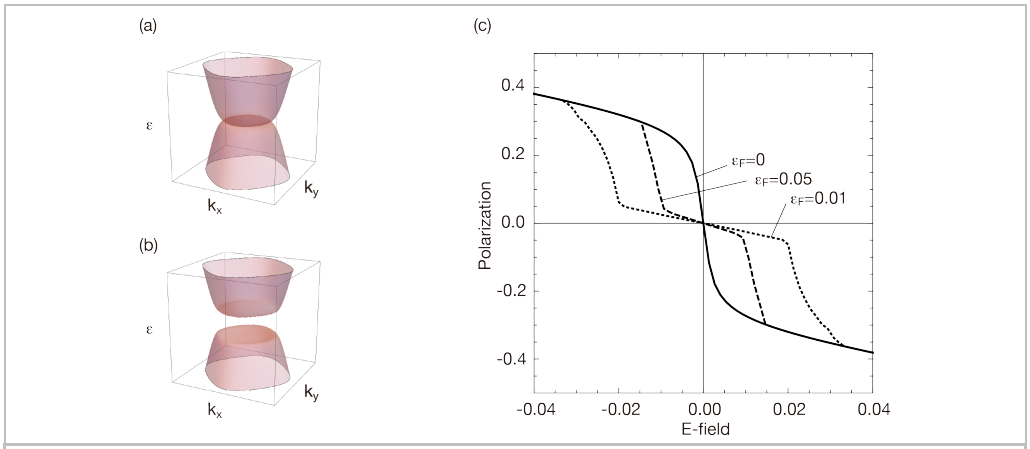

Figure 1:(a)/(b) Electronic band structure in the absence/presence of E-field.

(c) Electronic polarization as a function of E-field.