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Tunable optical activity as a probe of the chiral anomaly in Weyl semimetals PAVAN HOSUR, XIAOLIANG QI, Stanford University — Weyl semimetals are a three dimensional gapless topological phase in which bands intersect at arbitrary points in the Brillouin zone. These points carry a topological quantum number known as the "chirality" and always appear in pairs of opposite chiralities. The notion of chirality leads to the "chiral anomaly," according to which charge associated with a given chirality is not conserved in an electromagnetic field E·B. Since Weyl nodes are separated in momentum space, it is difficult for ordinary real space probes to probe this anomaly. Here, we propose a technique to probe the chiral anomaly optically. In particular, we observe that an EB field induces a form of optical activity known as gyrotropy, which is directly proportional to the chirality of the underlying Hamiltonian, in Weyl semimetals. This dynamically induced gyrotropy can then be seen in routine Faraday and Kerr effect experiments. We estimate typical sizes of these effects and find them to be within experimental reach.

Pavan Hosur
Stanford University

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