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Photoinduced Anomalous Hall Effects in Weyl Semimetals

CHING-KIT CHAN, PATRICK A. LEE, Massachusetts Institute of Technology, KENNETH S. BURCH, Boston College, JUNG HOON HAN, Sungkyunkwan University, YING RAN, Boston College — We examine theoretically the interplay between chiral photons and chiral electrons in Weyl semimetals. Owing to its monopole nature, a three-dimensional Weyl node is topologically-robust against a circularly polarized light. A driven Weyl system exhibits node shifts in the momentum space, in sharp contrast to the gap opening in a driven two-dimensional Dirac system. We show that the node shift leads to a change of the Chern vector which gives rise to a net photoinduced anomalous Hall conductivity, in the plane perpendicular to the light propagation. We shall describe the basic idea behind this generic photoinduced Hall effect, illustrate it with a concrete microscope model, and estimate its feasibility based on current optical experimental techniques.

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