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Topological Imbert-Fedorov shift in Weyl semimetals QING-DONG JIANG, International Center for Quantum Materials, School of Physics, Peking University, Beijing 100871, China, HUA JIANG, College of Physics, Optoelectronics and Energy, Soochow University, Suzhou 215006, China, HAIWEN LIU, QING-FENG SUN, X.C. XIE, International Center for Quantum Materials, School of Physics, Peking University, Beijing 100871, China — When a beam of light (photons) is reflected at an interface, the wave nature of photons can result in spatial shifts at the interface in the plane of incidence (longitudinal shift) and normal to the plane (transverse shift), which are referred as Goos-Hänchen (GH) shift and Imbert-Fedorov (IF) shift, respectively. As the massless fermionic cousin of photons, Weyl fermions are expected to share certain similar characteristics as photons. Here, we report the GH and IF effects in Weyl semimetals—a promising material harboring low energy Weyl fermions. Our results show that GH effect in WSMs is analogous to that discovered in a 2D relativistic material—graphene; however, the IF effect has no 2D counterpart, since it is genuinely a 3D effect. We emphasize that the IF shift actually originates from the topological effect of the systems, and can further lead to valley-dependent anomalous velocities. Experimentally, topological related IF shift can be utilized to characterize the Weyl semimetals and further to measure the Berry curvature. The valley-dependent anomalous velocities provide new ways for designing valleytronic devices of high efficiency.

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