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Theory of Kerr and Faraday rotation in Topological Weyl Semimetals[1] MEHDI KARGARIAN, MOHIT RANDERIA, NANDINI TRIVEDI, Department of Physics, The Ohio State University, Columbus, OH 43210, USA — Topological Weyl semimetals are characterized by bulk Dirac nodes separated in momentum space by a distance $2b$ and lead to Fermi arcs in the surfaces electronic structure. We calculate the Faraday θ_F and Kerr θ_K angles for electromagnetic waves scattered from such a Weyl semimetal using the Kubo formalism. (1) For thin films with electromagnetic radiation incident on a surface without arcs, we show that $\theta_K = bd/\alpha\pi$ and $\theta_F = \alpha\pi/bd$ where α is the fine structure constant, and the film thickness $d \ll \lambda$, the wavelength. We further show multiple reflections give rise to giant Kerr rotation, under certain conditions, for a film on a substrate. (2) In the case when the electromagnetic radiation is incident on the surface with arcs, the wave propagating inside the material acquires a longitudinal component of the electric field proportional to b. We discuss the implications of our results for thin films of pyrochlore iridates, and also for the recently discovered Dirac semimetals in a magnetic field.

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