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Circular Dichroism Observed by Photoemission from Ultrathin Bi_2Te_3 Films CAI-ZHI XU, YANG LIU, Department of Physics and Frederick Seitz Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801, USA, RYU YUKAWA, Institute for Solid State Physics, The University of Tokyo, Kashiwa, Chiba 277-8581, Japan, LONG-XIANG ZHANG, TOM MILLER, TAI-CHANG CHIANG, Department of Physics and Frederick Seitz Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801, USA — Circular dichroism (CD) observed by photoemission from the surface states of topological insulators has drawn much interest. It was initially attributed to the spin polarization or chiral orbital momentum of the initial states, but later proven to also involve the final states. The detailed mechanism remains controversial. To address this question, we have performed measurements of ultrathin films of the prototypical topological insulator Bi_2Te_3 over a wide range of film thickness and photon energy. The results show that the CD depends not only on the photon energy, but also on the film thickness in a nontrivial manner. A theoretical model has been developed that involves dipole transition, surface photoemission, and spin-orbit coupling. The computed results are in good agreement with the general trends of the data including sign reversals as a function of photon energy and film thickness. The complex behavior of the measured CD function is partially caused by modifications of both the initial and final states in the thin film geometry.

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