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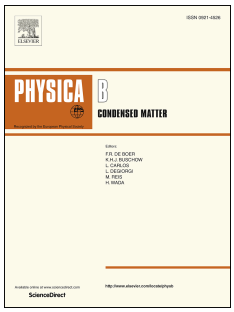

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A Topological Phase Transition in Topological Insulator Thin Films Exposed to an Off-resonant Light and its Associated Topological Configuration

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Abstract

Surface-related properties of the three-dimensional topological insulators with/without considerable thickness are thought as the furthermost demandable in the field of condensed matter physics because of its rich technological applications. Motivated by these properties, we consider low energy effective Hamiltonian of three-dimensional topological insulators having a negligible thickness in the presence of irradiated off-resonant circularly polarized light to assess it's topological features. By evaluating the surface psedu-spin Chern number analytically, we find that three dimensional topological insulator thin films pass through a phase transition from quantum pseudo spin Hall (QPSH) state to a photo-induced quantum Hall (P-QH) state when the effective energy induced by the circularly polarized light becomes greater in magnitude than the effective energy induced by the coupling between the top and bottom surfaces. We find that both the QPSH and P-QH states present a pronounced step-wise character. The phase-transition between these two topological states can be controlled by the degree of hybridization and off-resonant circularly polarized light. Additionally, we analyze the topological structure of QPSH and P-QH states by mapping the three-dimensional unit vector on a unit sphere and reveal that they display merons-like or anti-merons-like configurations in the real spin space.

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