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Topological Triply-Degenerate Points Induced by Spin-Tensor-Momentum Couplings HAIPING HU, JUNPENG HOU, FAN ZHANG, CHUANWEI ZHANG, The University of Texas at Dallas, CONDENSED MATTER THEORY TEAM — The recent discovery of triply-degenerate points (TDPs) in topological materials has opened a new perspective toward the realization of novel quasiparticles without counterparts in quantum field theory. The emergence of such protected nodes is often attributed to spin-vector-momentum coupling (SVMC). Here we show that the interplay between spin-tensor-momentum coupling (STMC) and SVMC can induce three types of TDPs, classified by their different Chern numbers ($\mathcal{C} = \pm\in, \pm\infty, \prime$). Under a Zeeman field, type-I ($\mathcal{C} = \pm\in$) and type-II ($\mathcal{C} = \pm\infty$) TDPs can be lifted into two Weyl points carrying the same and opposite monopole charges, respectively, whereas a type-III ($\mathcal{C} = \prime$) TDP is broken into two pairs of Weyl points of opposite charges. We find that different TDPs of the same type are connected by intriguing Fermi arcs on surfaces, and that transitions between different types are accompanied by level crossings along high-symmetry lines. We further propose an experimental scheme for realizing such TDPs in cold-atom optical lattices. Our results provide a framework for studying STMC-induced TDPs and other exotic quasiparticles.

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