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Building Topological Quantum States in Two-Dimensional Optical Lattices[1] TUDOR STANESCU, West Virginia University, VICTOR GALITSKI, SANKAR DAS SARMA, University of Maryland — We propose the realization of topological quantum states with cold atoms trapped in an optical lattice with square symmetry. The proposed experimental setup generates a quasi-two-dimensional square superlattice in the presence of a light-induced periodic vector potential and represents the realization with cold atoms of a simple tight-binding model with a complex direction-dependent nearest-neighbor hopping and a real next-nearest-neighbor hopping that takes different values on adjacent plaquettes. We describe the properties of the topological edge states within a multi band tight-binding approximation and discuss possible transitions between topologically distinct states induced by an additional staggered potential or by variations of the parameters characterizing the optical lattice potential and the vector potential. We also discuss the stability of the edge states against finite size effects and their dependence on the confining potential that defines the boundaries of the system.

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