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Strong topological insulator phase in cold-atom systems PETER P. ORTH, STEPHAN RACHEL, KARYN LE HUR, Yale University — With the recent technological advance of creating (electromagnetic) gauge fields for ultracold atoms, the fascinating prospect of realizing novel topological phases in these systems arises. Specifically, we consider spin-1/2 fermions on a square lattice under the influence of various experimentally feasible gauge fields. In two dimensions and if particles with different spin are exposed to magnetic fields in time-reversed directions, the system displays a quantum spin Hall ground state. We then study the influence of hopping into the third direction (2D-3D crossover), and in the three-dimensional system, we are able to identify a strong topological insulator phase. We further elaborate on the influence of the external trapping potential as well as the unambiguous detection of the topological phases.

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