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Half quantum spin Hall effect on the surface of weak topological insulators[1] CHAOXING LIU, Institute for Theoretical Physics and Astrophysics, University of Wuerzburg, 97074 Wuerzburg, Germany, XIAOLIANG QI, SHOUCHENG ZHANG, Department of Physics, McCullough Building, Stanford University, Stanford, CA 94305-4045 — We investigate interaction effects in three dimensional weak topological insulators (TI) with an even number of Dirac cones on the surface. We find that the surface states can be gapped by a surface charge density wave (CDW) order without breaking the time-reversal symmetry. In this sense, timereversal symmetry alone can not robustly protect the weak TI state in the presence of interactions. If the translational symmetry is additionally imposed in the bulk, a topologically non-trivial weak TI state can be obtained with helical edge states on the CDW domain walls. In other words, a CDW domain wall on the surface is topologically equivalent to the edge of a two-dimensional quantum spin Hall insulator. Therefore, the surface state of a weak topological insulator with translation symmetry breaking on the surface has a "half quantum spin Hall effect," in the same way that the surface state of a strong topological insulator with time-reversal symmetry breaking on the surface has a "half quantum Hall effect." The on-site and nearest neighbor interactions are investigated in the mean field level and the phase diagram for the surface states of weak topological insulators is obtained.

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