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Quantum Spin Hall Effect in thin films of topological crystalline insulators. RYSZARD BUCZKO, SHIVA SAFAEI, MARTA GALICKA, PERLA KACMAN, Institute of Physics Polish Academy of Sciences, Warsaw, Poland — The quantum spin Hall effect (QSHE) is predicted to exist in topological crystalline insulator materials [1]. Using a tight-binding approach we demonstrate that in (111)-oriented thin films of SnSe and SnTe the energy gaps depend in an oscillatory fashion on the layer thickness. The calculated topological invariant indexes and edge state spin polarizations show that in the negative energy gaps regions (˜20–40 monolayers) a 2D topological insulator phase appears. In this range of thicknesses in both SnSe and SnTe, edge states are obtained with Dirac cones having opposite spin polarization in their two branches. While in SnTe layers a single Dirac cone appears at the projection of Γ point of the 2D Brillouin zone, in SnSe layers three Dirac cones at Mpoints projections are obtained. Unfortunately, in SnSe films an overlapping of bands at Γ and M diminishes the final band gap in the vicinity of all M points and the edge states appear either against the background of the bands or within a very small energy gap. We show that this problem can be removed by applying to the layers a biaxial strain [2]. This should enable observation of the QSHE also in SnSe layers. 1. S. Safaei, et al., New J. Phys. 17, 063041 (2015). 2. S. Safaei et al, arXiv: 1508.01364 [cond-mat.mtrl-sci].

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