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Topological phases in complex oxide interfaces and heterostructures[1]

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In this talk we highlight recent theoretical work from our group aimed at identifying complex oxide interfaces and heterostructures that are expected to support topological phases, namely the Z_2 time-reversal invariant topological insulator and the zero magnetic field Chern insulator, or quantum anomalous Hall state. We focus on two particular systems: (1) Perovskites of the form ABO_3 and (2) Pyrochlores of the form $A_2B_2O_7$ where A is usually a rare earth element and B is a transition metal element. One of our main results is that thin film growth along the [111] direction is favorable for the realization of topological phases in experiment. We lay out the most important film properties that appear to favor topological phases and discuss the different physics associated with realizing topological phases in 3d, 4d, and the heaviest 5d-based transition metal oxide systems. Key open questions and experimental challenges are presented, as well as the potential advantages that oxide systems offer over the Bi-based topological insulator material class in device applications.

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[2]X.Hu, A. Ruegg, G. A. Fiete, arXiv:1211.0562; A. Ruegg, C. Mitra, A. A. Demkov, G.A. Fiete, Phys. Rev. B 85, 245131 (2012); A. Ruegg, G. A. Fiete, Phys. Rev. B 84, 201103 (2011).