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Interface engineering of quantum Hall effects in digital transition-metal oxide heterostructures[1] SATOSHI OKAMOTO, DI XIAO, Materials Science and Technology Division, Oak Ridge National Laboratory, WENGUANG ZHU, Department of Physics and Astronomy, University of Tennessee & Materials Science and Technology Division, Oak Ridge National Laboratory, YING RAN, Department of Physics, Boston College, NAOTO NAGAOSA, Department of Applied Physics, The University of Tokyo & CMGR and CERG, RIKEN-ASI
— Based on tight-binding modeling and first-principles calculations, we investigate possible quantum Hall effects in transition-metal oxide heterostructures. Bilayers of perovskite-type transition-metal oxides grown along the [111] crystallographic axis are found to be potential candidates for two-dimensional topological insulators. The topological band structure of these materials can be tune-tuned by changing dopant ions, substrates, and external gate voltages. We predict that $LaAuO_3$ bilayers have a topologically-nontrivial energy gap of about 0.15 eV, which is sufficiently large to realize the quantum spin-Hall effect at room temperature. We also discuss intriguing phenomena associated with the nearly flat topologically-nontrivial bands found in eg systems, such as fractional quantum Hall effect.

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