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Quantum Anomalous Hall Effect with Cold Atoms Trapped in a Square Lattice XIONG-JUN LIU, XIN LIU, Department of Physics, Texas A&M University, College Station, Texas 77843-4242, CONGJUN WU, Department of Physics, University of California, San Diego, California 92093, JAIRO SINOVA, Department of Physics, Texas A&M University, College Station, Texas 77843-4242
— Realization of quantum anomalous Hall effect (QAHE) [1] not only has the potential applications through the study of topological phases such as the technologically important topological insulators, but also has great interest from a basic physics point of view. In this work we propose the realization of the QAHE in a square optical lattice which can be generated from available experimental set-ups of double-well lattices with minor modifications [2]. A periodic gauge potential induced by atom-light interaction is introduced to give a Peierls phase for the nearest-neighbor site hopping to break time-reversal symmetry. The quantized anomalous Hall conductivity is investigated by calculating the Chern number as well as the chiral gapless edge states of our system. We study in detail the experimental detection of the edge and bulk states with which one can determine the topological phase transition from usual insulating phase to quantum anomalous Hall phase. Reference: [1] F. D. M. Haldane, Phys. Rev. Lett. 61, 2015 (1988). [2] X. -J. Liu, X. Liu, C. Wu and J. Sinova, submitted to PRL for publication (2009).

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