Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Photo-induced quantum Hall insulators without Landau levels TAKUYA KITAGAWA, Department of Physics, Harvard University, TAKASHI OKA, Department of Physics, Faculty of Science, University of Tokyo, LIANG FU, Physics Department, Harvard University, ARNE BRATAAS, Department of Physics, Norweigian University of Science and Technology, EUGENE DEMLER, Department of Physics, Harvard University — In this talk, we demonstrate that non-equilibrium transport of graphene under the application of off-resonant light displays a near quantization of Hall conductance. While previous studies of topological phenomena under coherent drives focused on the effective topological band structure, electron occupations in the non-equilibrium systems, which are so far neglected, play a crucial role to determine the transport properties. Using the formalism that consistently take this into account, we show that the topological band structures can directly manifest themselves in the transport properties in Landauer-type configurations under the application of off-resonant light. We give an intuitive explanation of the induction of Chern numbers in the band structure, by showing that the virtual photon absorption/emissions of electrons produces an effective second-order hopping with phase accumulation, leading to the effective Haldane model. Our proposal opens the perspective to realize so-called quantum Hall systems without Landau levels in materials such as graphene and three dimensional topological insulators under coherent drives.

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Date submitted: 03 Nov 2011 Electronic form version 1.4