Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

Topological order in 1D super-lattice Bose-Hubbard models[1]

MICHAEL FLEISCHHAUER, FABIAN GRUSDT, MICHAEL HOENING, Dept. of Physics, University of Kaiserslautern, Germany — After the discovery of topological insulators as a new state of matter and their consequent classification for free fermions, the question arises what kind of topological order can be supported by incompressible systems of interacting bosons. We consider a 1D super-lattice Hamiltonian with a non-trivial band structure (the Su-Schrieffer-Heeger model) and show that its Mott-insulating (MI) states can be classified by a quantized many-body winding number. This quantization is protected by sub-lattice and time-reversal symmetries, and it allows the implementation of a quantized cyclic pumping process (Thouless pump) in a simple super-lattice Bose-Hubbard model (BHM). For extended BHMs we discuss a connection of such a pump with the fractional quantum Hall effect. Furthermore we show that the quantization of the winding number leads to localized, protected edge states at sharp interfaces between topologically distinct MI phases which can be experimentally realized using Bose-Fermi mixtures in optical superlattices. DMRG simulations show that these edge states manifest themself either in localized density maxima or localized density minima, which can easily be detected.

[1]Supported by research center OPTIMAS and graduate school MAINZ.

Michael Fleischhauer
Dept. of Physics, University of Kaiserslautern, Germany

Date submitted: 28 Jan 2013 Electronic form version 1.4