Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Entanglement spectra between coupled Tomonaga-Luttinger liquids: Applications to ladder systems and topological phases REX LUNDGREN, Univ of Texas, Austin, YOHEI FUJI, Institute for Solid State Physics, University of Tokyo, Kashiwa, SHUNSUKE FUKUWARA, Department of Physics, University of Tokyo, Hongo, MASAKI OSHIKAWA, Institute for Solid State Physics, University of Tokyo, Kashiwa — We study the entanglement spectrum (ES) and entropy between two coupled Tomonaga-Luttinger liquids (TLLs) on parallel periodic chains. This problem gives access to the entanglement properties of various interesting systems, such as spin ladders as well as two-dimensional topological phases. By expanding interchain interactions to quadratic order in bosonic fields, we are able to calculate the ES for both gapped and gapless systems using only methods for free theories. In certain gapless phases of coupled non-chiral TLLs, we interestingly find an ES with a dispersion relation proportional to the square root of the subsystem momentum, which we relate to a long-range interaction in the entanglement Hamiltonian. We numerically demonstrate this unusual dispersion in a model of hard-core bosons on a ladder. In gapped phases of coupled non-chiral TLLs, which are relevant to spin ladders and topological insulators, we show that the ES consists of linearly dispersing modes, which resembles the spectrum of a single-chain TLL but is characterized by a modified TLL parameter. Based on a calculation for coupled chiral TLLs, we are also able to provide a very simple proof for the correspondence between the ES and the edge-state spectrum in quantum Hall systems. Based of arXiv:1310:0829

Rex Lundgren
Univ of Texas, Austin

Date submitted: 08 Nov 2013 Electronic form version 1.4