Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Chain representations of Open Quantum Systems and Lieb-Robinson like bounds for the dynamics[1] MISCHA WOODS, Imperial College — This talk is concerned with the mapping of the Hamiltonian of open quantum systems onto chain representations, which forms the basis for a rigorous theory of the interaction of a system with its environment. This mapping progresses as an interaction which gives rise to a sequence of residual spectral densities of the system. The rigorous mathematical properties of this mapping have been unknown so far. Here we develop the theory of secondary measures to derive an analytic, expression for the sequence solely in terms of the initial measure and its associated orthogonal polynomials of the first and second kind. These mappings can be thought of as taking a highly nonlocal Hamiltonian to a local Hamiltonian. In the latter, a Lieb-Robinson like bound for the dynamics of the open quantum system makes sense. We develop analytical bounds on the error to observables of the system as a function of time when the semi-infinite chain in truncated at some finite length. The fact that this is possible shows that there is a finite "Speed of sound" in these chain representations. This has many implications of the simulatability of open quantum systems of this type and demonstrates that a truncated chain can faithfully reproduce the dynamics at shorter times. These results make a significant and mathematically rigorous contribution to the understanding of the theory of open quantum systems; and pave the way towards the efficient simulation of these systems, which within the standard methods, is often an intractable problem.

[1]EPSRC CDT in Controlled Quantum Dynamics, EU STREP project and Alexander von Humboldt Foundation

Mischa Woods
Imperial College

Date submitted: 27 Nov 2012 Electronic form version 1.4