Tensor network approach to quantum feedback dynamics ARNE
GRIMSMO, Département de Physique, Université de Sherbrooke — In this talk I
consider the problem of a quantum system coupled to a bosonic reservoir creating
a coherent feedback loop. Since the system can be strongly correlated with the
in-loop field, this is in general a highly non-Markovian quantum problem where
no perturbative approach can be expected to work well. I will present the first
practical approach to model this type of dynamics for general quantum systems and
large delay times. Borrowing ideas from the intersection of condensed matter and
quantum information theory, I will show that a formal dynamical solution can be
found as the continuum limit of a tensor network, much like the recently introduced
continuous matrix product states for one-dimensional field theories. This gives rise
to a practical and efficient integration scheme in discrete time, which is numerically
exact as the time-step goes to zero. Besides opening the possibility to study a new
regime of quantum feedback control, this is also a novel application of tensor network
techniques that could pave the way for a new approach to non-Markovian quantum
dynamics in a broader context as well.

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