

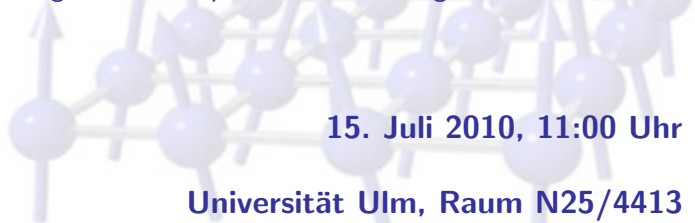


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### Engineering Long Range Distance Independent Entanglement in Kondo Spin Chains

We investigate the entanglement properties of the Kondo spin chain when it is prepared in its ground state as well as its dynamics following a single bond quench. We show that a true measure of entanglement such as negativity enables to characterize the unique features of the gapless Kondo regime. We determine the spatial extent of the Kondo screening cloud and propose an ansatz for the ground state in the Kondo regime accessible to this spin chain; we also demonstrate that the impurity spin is indeed maximally entangled with the Kondo cloud. We exploit these features of the entanglement in the gapless Kondo regime to show that a single local quench at one end of a Kondo spin chain may always induce a fast and long lived oscillatory dynamics, which establishes a high quality entanglement between the individual spins at the opposite ends of the chain. This entanglement is a footprint of the presence of the Kondo cloud and may be engineered so as to attain - even for very large chains - a constant high value independent of the length; in addition, it is thermally robust.



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