Edge states and exact zero modes in topological 1D quantum magnets

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Motivated by recent STM experiments on chains of Co adatoms that have revealed a series of ground state level crossings as a function of an external magnetic field [1], and by their possible connection to Majorana edge states [2], I will discuss the coupling between edge states in two topological phases of 1D quantum magnets, the transverse field Ising model, and the Haldane phase of the spin-1 chain. I will show in particular that, for a fixed length, it is possible to monitor the coupling between the edge states by inducing incommensurate correlations inside the topological phase. This can be achieved by an additional spin-spin coupling in the tranverse field Ising model [3] and by a next-nearest neigbor interaction in the spin-1 chain [4]. This ability to monitor the coupling between the edge states allows one to induce level crossings and to realize exact zero modes in finite chains, hence to reach infinite coherence times without having to go to the thermodynamic limit [5], and to manipulate the edge states by changing the sign of their coupling [4].

References:

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