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Boundary Phenomena in one-dimensional Strongly correlated systems

Gapped -D systems with a symmetry are either in a Symmetry Protected Topological (SPT) phase, or in a Spontaneously Symmetry Breaking (SSB). I will confront two strongly correlated models: the intrinsic charge conserving superconductor, an SPT system and the XXZ antiferromagnetic spin chain, an SSB system.

I will begin by discussing the charge conserving superconductors (SC) using the Bethe Ansatz, semi-classical methods and DMRG. When open boundary conditions (OBC) are applied, the bulk superconducting instability determines the topological nature of a phase: the Spin-triplet superconductors (STS) exhibit a topological phase protected by the Z_2 spin flip symmetry. One finds two zero energy modes (ZEM) at each edge resulting in a four fold topological degeneracy of the ground states a fractional spin 1/4 localized at each edge. The spin-singlet superconductors (SSS) on the other hand, are topologically trivial with a unique ground state. Crossing from one regime to the other the superconducting gap closes.

I shall show, however, that the topological nature of a phase depends not only on the bulk superconducting instability, but rather on the interplay between the bulk and the boundary. In particular I will show that SSS phase exhibits topological properties when suitable *twisted* OBC are applied. I will show that a rich phase diagram emerges around the twisted topological boundary fixed point, exhibiting several regimes - topological and mid-gap regimes.

I will then study the boundary phase structure of XXZ spin chains and show many similarities to the boundary phase structure of the SC. Thus the presence of Majorana ZEM's does not guarantee the topological nature of the system and more criteria are needed such as entanglement spectrum degeneracy and non-local string order parameter.