Minicolloque n° PMQ32 **• Oral** ~~**Poster**~~

Realization of the symmetry-protected Haldane phase in Fermi-Hubbard ladders

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The Haldane antiferromagnetic spin-1 chain constitutes a paradigmatic model of a quantum system which holds a symmetry protected topological phase. Such a system features a ground state with gapped bulk excitations and a non-local order parameter. In the case of open boundary conditions, the ground state is furthermore four-fold degenerate due to the presence of topologically protected edge states.

In this talk, I will present our experimental realization of the Haldane phase using Fermi- Hubbard ladders in an ultracold quantum gas microscope [1]. Site-resolved potential shaping allows us to create tailored spin-1/2 geometries which permit the exploration of such a topological chain and its comparison to a topologically trivial configuration. We use spin- and density-resolved measurements to probe edge and bulk properties of the system, revealing a clear distinction between the trivial and topological cases. The measurement of the non-local string order parameter, in particular, allows to directly capture the underlying protecting symmetry of the topological phase. We furthermore investigate the robustness of the topological phase upon the onset of density fluctuations by tuning the Hubbard interaction.

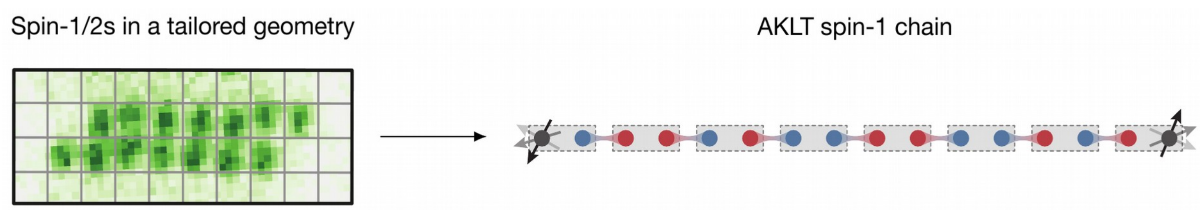

Figure 1 : Our system, composed of ultracold ^{6}Li atoms trapped in a tailored ladder geometry (site-resolved fluorescence picture, left), is analogue to the AKLT spin-1 chain (right) [2], featuring the characteristic properties of the Haldane spin-1 phase.

[1] P. Sompet et. al., arXiv:210310421 (2021).
[2] Affleck, Kennedy, Lieb & Tasaki, Phys. Rev. Lett. **59** 799 (1987).