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Phases at finite winding number of an Abelian lattice gauge theory

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Pure gauge theories are rather different from theories with pure scalar and fermionic matter, especially in terms of the nature of excitations. For example, in scalar and fermionic theories, one can create ultra-local excitations. For a gauge theory, such excitations need to be closed loops that do not violate gauge invariance. In this talk, we present a study on the condensation phenomenon associated with the stringy excitations of an Abelian lattice gauge theory. These phenomena are studied through numerical simulations of a $U(1)$ quantum link model in 2+1 dimensions in a ladder geometry using matrix product states. We will give a numerical demonstration of the presence of the string excitations in the ground states.

Primary author: STORNATI, Paolo (DESY)

Co-authors: KRAH, Philipp (Technische Universität Berlin); Dr BANERJEE, Debasish (Saha Institute of Nuclear Physics); JANSEN, Karl (DESY)

Presenter: STORNATI, Paolo (DESY)

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