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Higgs-confinement continuity in light of particle-vortex statistics

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It is widely believed that gauge theories with fundamental matters exhibit a smooth connection between the confining and Higgs regimes. This Higgs-confinement continuity is of crucial importance to the quark-hadron continuity conjecture, which claims a smooth crossover between the nuclear superfluidity and color superconducting phases in dense QCD. Certain gauge theories with superfluidity, such as dense QCD, have nontrivial Aharonov-Bohm (AB) phases around vortices, or anyonic particle-vortex statistics, in the Higgs regime. It is under debate whether this nontrivial AB phase implies a Higgs-confinement transition. In this talk, we address this question by providing evidence for the Higgs-confinement continuity. By explicit calculations in relevant lattice models, we demonstrate how the AB phase exhibits a smooth connection between the confining and Higgs regimes. We argue that (A) the AB phase takes a constant nontrivial value in both confining and Higgs regimes if some symmetry constrains the AB phase to discrete values and that (B) in the absence of such symmetry, the AB phase can smoothly interpolate the confining and Higgs limits. This finding sheds new light on topological nature of gauge-Higgs systems and suggests that the quark-hadron continuity remains a consistent scenario. This talk will be based on arXiv:2303.02129.

Theory / experiment

Theory

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