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Higgsless superconductivity from topological defects in compact BF terms

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We present a new Higgsless model of superconductivity, inspired from anyon superconductivity but P- and T-invariant and generalizable to any dimension. While the original anyon superconductivity mechanism was based on incompressible quantum Hall fluids as average field states, our mechanism involves topological insulators as average field states. In D space dimensions it involves a (D-1)-form fictitious pseudovector gauge field which originates from the condensation of topological defects in compact low-energy effective BF theories. In the average field approximation, the corresponding uniform emergent charge creates a gap for the (D-2)-dimensional branes via the Magnus force, the dual of the Lorentz force. One particular combination of intrinsic and emergent charge fluctuations that leaves the total charge distribution invariant constitutes an isolated gapless mode leading to superfluidity. The remaining massive modes organise themselves into a D-dimensional charged, massiv!
e vector. There is no massive Higgs scalar as there is no local order parameter. When electromagnetism is switched on, the photon acquires mass by the topological BF mechanism. Although the charge of the gapless mode (2) and the topological order (4) are the same as those of the standard Higgs model, the two models of superconductivity are clearly different since the origins of the gap, reflected in the high-energy sectors are totally different. In 2D this type of superconductivity is explicitly realized as global superconductivity in Josephson junction arrays. In 3D this model predicts a possible phase transition from topological insulators to Higgsless superconductors.

Summary

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