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Reassessing the flux tube formation via center-vortex ensembles in the lattice

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In this talk, we revisit the idea proposed by one of us in PRD 98 036018 (2018) where the nonoriented component, in 4d ensembles of percolating thin center-vortex worldsurfaces, was shown to be essential to understand the properties of confinement at asymptotically large distances between heavy quarks. The same physics was reobtained in the Schrödinger's wave (functional) representation PRD 106 114021 (2022), which deals with center-vortex lines and pointlike monopoles in 3d real space. In the present contribution, the 4d ensemble is reassessed by means of Weingarten's lattice representation for the sum over oriented surfaces. In the percolating phase, stabilized by repulsive interactions, the emergence of lattice gauge fields as the Goldstone modes for the oriented center-vortex condensate is straightforward. In addition, worldsurfaces attached to monopole worldlines (nonoriented component), as well as their fusion rules, can be easily characterized in the lattice. Thus, the original mechanism, where the Wilson loop ensemble average was given by an effective 4d Yang-Mils-Higgs model with frustration, is neatly confirmed. In this mechanism, percolating oriented and nonoriented center vortices trigger the formation of a flux tube that conciliates N-ality with Abelian-like profiles and one of the possible asymptotic scaling laws (Casimir).

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