

# Topological order in the color-flavor locked phase of (3+1)-dimensional U(N) gauge-Higgs system

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We study a (3+1)-dimensional U(N) gauge theory with N-flavor fundamental scalar fields, whose color-flavor locked (CFL) phase has topologically stable non-Abelian vortices. The U(1) charge of the scalar fields must be  $Nk+1$  for some integer  $k$  in order for them to be in the representation of U(N) gauge group. This theory has a  $Z_{Nk+1}$  one-form symmetry, and it is spontaneously broken in the CFL phase, i.e., the CFL phase is topologically ordered if  $k$  is not 0. We also find that the world sheet of topologically stable vortices in CFL phase can generate this one-form symmetry.

**Presenter:** Dr YOKOKURA, Ryo

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