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Topological color-superconductivity in QCD with one flavor

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Superconductive gaps have topologically protected nodes if the fermions form the inter-chiral Cooper pair [1]. We generalize this Li and Haldane's argument to the color superconductivity in QCD with one flavor. Among several order parameters with different spins and colors, we find that the nodes in the phases with a simple color-spin structure have the vortices characterized by the Berry monopole. On the other hand, the paring function has no nodes if the color and spin degrees of freedom are entangled, such as in the so-called color-spin locking phase. Even in this case, we find a non-trivial Berry curvature defined by the gap eigenvectors in the color-spin space. We argue that the topological phase transition should occur between the trivial low-density hadronic matter and the non-trivial high-density quark matter with well-defined chirality. Our preliminary results suggest the breakdown of the quark-hadron continuity scenario in QCD with one flavor studied earlier by T. Schäfer [2]. [1] Yi Li and F. D. M. Haldane, "Topological nodal Cooper pairing in doped Weyl metals," Phys. Rev. Lett. 120, 067003 (2018). [2] T. Schäfer, "Quark hadron continuity in QCD with one flavor," Phys. Rev. D 62, 094007 (2000).

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