Is the pseudogap a topological state?

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Resume :

The discovery of the high temperature (high Tc) superconductors brought new paradigms to the field of condensed matter physics. Three-dimensional superconductivity originates in two dimensional layers where Cooper pairs are formed and outlive elsewhere. The understanding of any layered compound demands its study at several doping, achieved by changing the number of carriers available in the layers. The pseudogap was revealed in 1989, soon after the discovery of Bednorz and Müller (1986), by the observation of a sharp decrease of the nuclear spin susceptibility. The nature of the pseudogap remains so far unknown and a true challenge to the field. Among the known properties of the pseudogap, are the new gap and the spontaneously broken symmetries, namely, the time reversal symmetry breaking, as shown by optical measurements, and the translational invariance symmetry breaking , firstly seen through scanning tunneling microscopy and coined as the checkerboard pattern, now recognized as a charge density wave state. Here we conjecture that the pseudogap is an inhomogeneous condensate above the homogeneous state, whose existence is granted by topological stability. We consider the simplest possible order parameter theory that provides this interpretation of the pseudogap and find that the normal state gap density, the breaking of the time reversal symmetry and an intrinsically associated charge density wave are naturally explained under this view. The pseudogap is a lattice of skyrmions and the inner weak local magnetic field falls below the experimental threshold of observation given by NMR/NQR and muSR experiments.