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Inhomogeneous chiral condensed phases with an algebraic long-range order

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In recent theoretical studies of QCD at finite temperature and density, there is a growing consensus that spatially inhomogeneous chiral condensed phases appear in the region where a first-order chiral phase transition would occur. We present a study on the stability of a Fulde-Ferrell type inhomogeneous chiral condensed phase, the so-called dual chiral density wave (DCDW) phase, of dense quark matter against low energy fluctuations about a spatially modulated order parameter [1]. We find that the DCDW phase exhibits a flavor-translation locking symmetry from the symmetry point of view. We also show that the Nambu-Goldstone modes, whose dispersion relations are spatially anisotropic and soft in the directions transverse to the modulation, wash out the long-range order at non-zero temperatures, but sustain quasi-long-range correlations (algebraically decaying long-range correlations), starting with a Landau-Ginzburg-Wilson effective Lagrangian. Consequently, at finite temperatures the DCDW phase is found to be a quasi-one-dimensional ordered phase as in smectic phases of liquid crystals.
[1] T.-G. Lee, E. Nakano, Y. Tsue, T. Tatsumi, and B. Friman, arXiv:1504.03185 [hep-ph].

On behalf of collaboration:

NONE

Primary author: LEE, Tong-Gyu (Kyoto University)

Co-authors: FRIMAN, Bengt (GSI); NAKANO, Eiji (Kochi U.); TATSUMI, Toshitaka (Kyoto U.); TSUE, Yasuhiko (Kochi U.)

Presenter: LEE, Tong-Gyu (Kyoto University)

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