NUCLEAR THEORY, Vol. 43 (2026)
eds. M. Gaidarov, N. Minkov, Heron Press, Sofia

Effects of Short-Range Correlations on Quarkyonic Matter

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Abstract. In this work, we focus on investigating the impact of the short-range correlations on the properties of quarkyonic matter. These correlations induce the scattering of nucleons to momenta exceeding the Fermi momentum, thereby altering the momentum-space occupation distribution that underlies the quarkyonic framework. In particular, we examine to what extent the emergence of a high-momentum tail, due to the short-range nucleon-nucleon correlations, in the momentum distribution, for momenta exceeding the Fermi momentum, affects the fundamental properties of quarkyonic matter, such as the energy density, pressure, and speed of sound, among others. In fact, at high densities, the behavior of the momentum distribution has been established, both experimentally and theoretically, to follow a characteristic $\sim 1/k^4$ dependence at large momenta. To the best of our knowledge, this effect on quarkyonic matter has not yet been systematically investigated. Moreover, the relevant feature of the momentum distribution has been experimentally confirmed, suggesting that heavy-ion collision experiments may provide insight into the possible existence of quarkyonic matter. Conclusively, a quarkyonic model may be regarded as theoretically complete only if it incorporates short-range correlations, whose effects are fundamental and cannot be neglected.

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