



19th International Conference on QCD in Extreme Conditions (XQCD 2023)

Contribution ID: 37

Type: **Talk**

How baryons appear in low-energy QCD: Domain-wall Skymion phase in strong magnetic fields

Thursday 27 July 2023 16:25 (25 minutes)

Low-energy dynamics of QCD can be described by pion degrees of freedom in terms of the chiral perturbation theory (ChPT). A chiral soliton lattice (CSL), an array of solitons, is the ground state due to the chiral anomaly in the presence of a magnetic field larger than a certain critical value at finite density. Here, we show in a model-independent and fully analytic manner (at the leading order of ChPT) that the CSL phase transits to a domain-wall Skymion phase when the chemical potential is larger than the critical value $\mu_c = 16\pi f_\pi^2 / (3m_\pi) \sim 1.03$ GeV with the pion's decay constant f_π and mass m_π , which can be regarded as the nuclear saturation density. There spontaneously appear stable two-dimensional Skymions or lumps on a soliton surface, which can be viewed as three-dimensional Skymions carrying even baryon numbers from the bulk despite no Skyrme term. They behave as superconducting rings with persistent currents due to a charged pion condensation, and areas of the rings' interiors are quantized. This phase is in scope of future heavy-ion collider experiments.

This talk is based on arXiv:2304.02940 [hep-ph].

Primary authors: Prof. ETO, Minoru (Yamagata University); NISHIMURA, Kentaro (KEK); Prof. NITTA, Muneto (Keio University)

Presenter: NISHIMURA, Kentaro (KEK)

Session Classification: Parallel session B