量子物理学・ナノサイエンス第 443 回セミナー

Baryon Structure Variations in Nuclear Matter within the Quark-meson Coupling Model

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概　要

The quark-meson coupling (QMC) model describes nuclear many-body systems in terms of quark degrees of freedom. In this model, quarks are confined inside each baryon and interact self-consistently with scalar- and vector-meson fields generated by the surrounding nuclear medium. As a result, the internal structure of baryons changes with density, producing density-dependent effective masses and baryon-meson couplings. This mechanism offers a microscopic interpretation of nuclear saturation and provides a natural bridge between baryon structure and nuclear many-body dynamics.

In this seminar, I will review the basic idea of the original QMC model and its applications to nuclear matter and finite nuclei, following the developments summarized in the review by Saito, Tsushima, and Thomas. I will then discuss several extensions and applications, including hyperonic matter, chiral effects, neutron-star equations of state, and the role of Fock terms and tensor couplings in dense matter. Finally, I will introduce a recent development toward quarkyonic matter, where baryonic and quark degrees of freedom coexist in a high-density regime. This talk aims to clarify how in-medium baryon structure variations can connect finite nuclei, dense matter, neutron stars, and possible quarkyonic phases within a common microscopic perspective.

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