Λ-Σ^0 Mixing in Asymmetric Nuclear Medium Is it Large or Small?

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Recently, the hyperon compositions and their effect on EOS of neutron-star matter have been discussed intensively. We showed that the Λ-Σ^0 mixing is enhanced in high-density neutron matter and lowers drastically the critical baryon density of hyperon appearance. Based on the Brueckner theory, we found that typical YN inetractions (NSC97e,f and NSC89) give the mixing of 20-30% in neutron matter at $\rho = 3\rho_0$.[1] This large mixing comes from the coherent coupling, that is, the nondiagonal single-particle potential. In this talk, we discuss the dependence of the coupling and the mixing on the YN interactions.

On the other hand, the coherent Λ-Σ^0 mixing can be understood in the framework of the relativistic mean field(RMF) theory. In this case, isovector-scalar meson(a^0 meson) and isovector-vector meson(ρ^0 meson) play a crucial role in the coherent mixing. We found that not only the strengths but also the relative phases of the couplings $g_{\Lambda\Sigma a}$ and $g_{\Lambda\Sigma\rho}$ are essential to the mixing. In this talk, we discuss the various possibilities of the Λ-Σ^0 mixing in RMF theory.

In addition, very recently, using the QCD sum rules, Yagisawa et al. discussed the Λ-Σ^0 mixing in isospin-asymmetric medium.[2] They found a small Λ-Σ^0(a large $\bar{\Lambda}$-$\bar{\Sigma^0}$) mixing due to destructive(constructive) Lorentz-scalar and Lorentz-vector contributions. We will discuss the relation between their result in the QCD sum-rules and our results in the Brueckner and RMF theories.

References

[1] S. Shinmura, Khin Swe Myint, T. Harada and, Y. Akaishi, J. Phys. G 28, L1-L7, 2002.

[2] N. Yagisawa, T. Hatsuda and, A. Hayashigaki, Nucl. Phys. A699, 665-689, 2002.