Hyperon Interaction in Free Space and Nuclear Matter

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Baryon-baryon interactions within the SU(3)-octet are investigated in free space and nuclear matter. A meson exchange model based on SU(3) symmetry [1, 2] is used for determining the free space hyperon-nucleon and hyperon-hyperon interactions, which are then used to solve the Bethe-Salpeter (BS) scattering equation to find physical observables. Medium effects have been incorporated into the 3-D reduced Lippmann-Schwinger equation by inserting a two particle Pauli projector operator being multiplied with the two particle Green function, resulting in a medium-modified Bethe-Goldstone equation. The scattering-matrix is determined by ladder-summation of all orders of the tree-level interaction. The bare interaction contains all the two-particle irreducible Feynman diagrams. The coupling of the various baryon-baryon channels of total strangeness and conserved total charge is studied in detail. Special attention is paid to physical channel opening (e.g. ΛN-ΣN) thresholds. In the octet sector, additional channel coupling effects contribute because of the mixing of different channels of same strangeness and total charge. The main interest of this study is to find the medium effects on the hyperon interaction. This will reveal the density dependence of the interaction, which has been seen in the variation of the in-medium low energy parameters as a direct consequence of the medium effect.

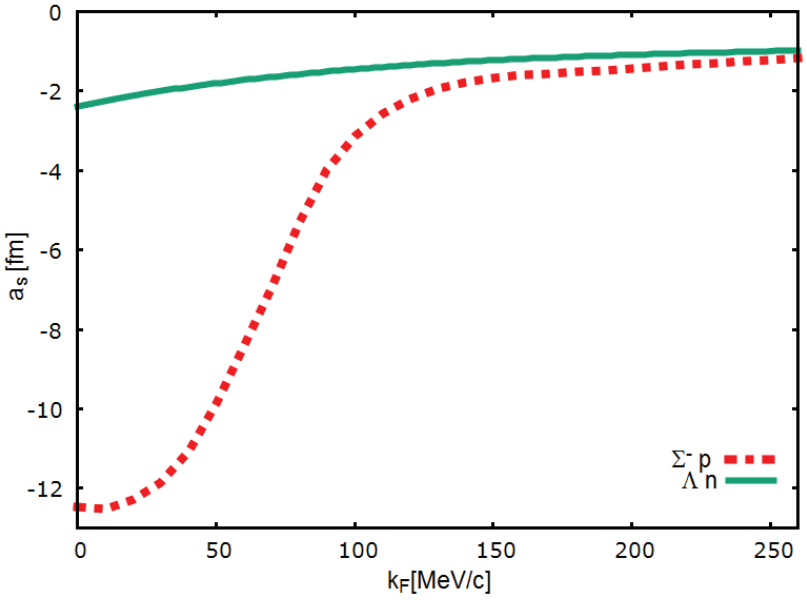

Figure 1: $\Lambda - n$ (solid) and $\Sigma^- - p$ (dashed) scattering length a_s with the variation of nucleon Fermi momentum $k_F (\sim \rho^{1/3})$. It is clear from the plots that the scattering lengths attend a steady value as density approaches its saturation value.

[1] B. Holzenkamp, K. Holinde, and J. Speth, Nucl. Phys. A 500 (1989)
[2] Th. A. Rijken, V. G. J. Stoks, and Y. Yamamoto, Physical Review C 59 (1999)