Chiral SU(3) Linear Sigma Model and Properties of Dense Baryonic Matter

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The role of the strangeness in the dense baryonic matter is very inportant in relation to the charge and $SU(3)$ (instead of the isospin) symmetric energy. However our lack of the knowledge of the hyperon interaction makes it diffcult to construct a reliable model.
We propose a $SU(3)$ linear sigma model including the positive and negative parity baryons. This model have two types of meson-baryon coupling structure. One is the $F+D$[1] type coupling and the other is purely D type copling[2]. Therefore this model may reproduce the value of F/D ratio as the emplical value 0.575. In the scalar and pseudo-scalar meson sector, the spontanious chiral symmetry breaking occurs as usual and gives the mass splittings between positive and negative parity hadrons. The meson-baryon coupling constants and explicit chiral symmetry breaking parameters are determined simultaneously by fitting the octet baryon masses and the decay width to the hadron channel. Furthermore we introduce the vector and axial-vector mesons in this model. The vector meson baryon couplings can be determined by nuclear matter properties around the normal nuclear density, i.e. $\rho_0, E/B$, and symmetric energy.
It is to say that this model is just a phenomenological model based on the $SU(3)$ chiral symmetry, but there are no more free parameters which control the properties at high densities after fitting hadron properties in vacuum and matter properties at ρ_0. Thus we use this model to study the values of the equation of state of dense baryonic matter and discuss the application to neutron-rich matter in beta equilibrium and so on. The result will be reported in the conference.

References

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