Frontiers in Gamma Ray Spectroscopy FIG18

Contribution ID : 17

Appearance of Delta resonances in neutron stars in a modified quark meson coupling model

Content :

The determination of the mass of two millisecond pulsars, PSR J0348+0432 with a mass of $2.01 \pm 0.04 M_\odot$ [1] and PSR J1614-2230 with a mass of $1.928 \pm 0.017 M_\odot$ [2] with high precision has provided a challenge to develop an equation of state (EOS) stiff enough to give such high mass. It is natural to believe that such high mass neutron stars should have high density neutron matter in its core. At such high densities the nucleon chemical potential becomes large enough to facilitate the formation of hyperons and delta baryons. The EOS with the inclusion of delta baryons and hyperons become softer leading to the so called Delta puzzle. In the present work we study the possibility of the appearance of delta isobars in such high mass neutron star matter in a modified quark meson coupling model. The model has been successfully applied earlier to determine various bulk properties of symmetric and asymmetric nuclear matter [3, 4]. In such a model the quarks are assumed to be confined by a phenomenological average potential with an equal mixture of scalar-vector parts in harmonic form. The mass of the baryons are realized after making appropriate corrections. The inter-baryonic strong interactions are realized by making additional quark couplings to sigma, omega, and rho mesons through mean-field approximations. The parameters are fixed self-consistently by realizing the saturation properties. Using the model we analyse the dependence of the critical density of formation of delta baryons on the relative delta-rho coupling strength. The significance of the in-medium mass variation of delta baryon on the neutron star structure is studied. Our results predict the possibility of the formation of delta resonances at a density of around 2 times the saturation density and the maximum mass of $1.92 M_\odot$ with the corresponding radius 12.79 km, which lies within the observed mass of the pulsar PSR J1614-2230.

References
[1] J. Antoniadis et al., Science 340, (2013) 448.
[2] E. Fonseca et al., Astrophys. J. 832 (2016) 167.
[3] N. Barik, R. N. Mishra, D. K. Mohanty, P. K. Panda and T. Frederico, Phys. Rev. C 88, 015206
(2013).
[4] R. N. Mishra, H. S. Sahoo, P. K. Panda, N. Barik and T. Frederico, Phys. Rev. C

94, 035805 (2016).

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