

Hyperon mixing and universal many-body repulsion in neutron stars

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In neutron-star matter, the three-nucleon repulsion (TNR) contribution increases rapidly in the high-density region, and leads to high values of the nuclear incompressibility. This effect is well known to be indispensable for the stiff equation of state (EoS) of neutron-star matter needed to reproduce large maximum masses of neutron stars. However, the hyperon (Y) mixing in neutron-star matter brings about the remarkable softening of the EoS, which cancels the TNR effect for the maximum mass, called "Hyperon Puzzle in neutron stars". One of ideas to avoid this serious problem is to consider that the TNR-like repulsions work universally for YNN , YYN YYY as well as for NNN

A multi-pomeron exchange potential (MPP) is proposed as a model for the universal many-body repulsion in baryonic systems on the basis of the Extended Soft Core (ESC) baryon-baryon interaction. The strength of MPP is determined by analyzing the nucleus-nucleus scattering with the G-matrix folding model. The interaction in ΛN channels is shown to reproduce well the experimental Λ binding energies. The equation of state (EoS) in neutron matter with hyperon mixing is obtained including the MPP contribution, and mass-radius relations of neutron stars are derived on the basis of the Brueckner-Hartree-Fock formalism, and neutron-star masses are calculated by solving the TOV equation. It is shown that the maximum mass can be larger than the observed one $2M_{\odot}$ even in the case of including hyperon mixing on the basis of model-parameters determined by terrestrial experiments [1].

- [1] Y.Yamamoto, T.Furumoto, N.Yasutake and Th.A.Rijken Physical Review **C90** (2014) 045805

Figure 1: Japanese characters indicating the pronunciation of HYP2015.

