Δ resonances and charged ρ mesons in neutron stars

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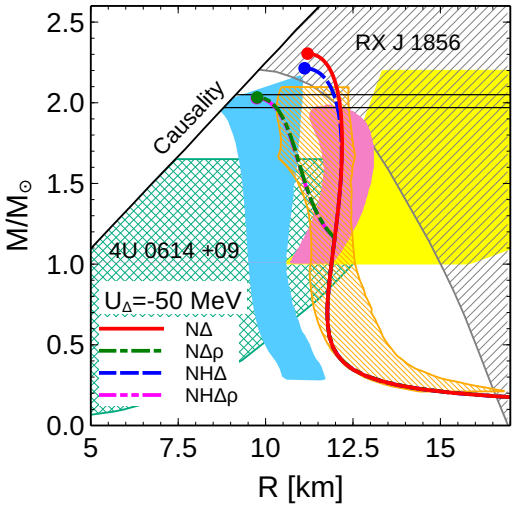

Figure 1: Neutron star mass-radius relation for MKVOR-based models confronted with various observational constraints. Key labels specify the included degrees of freedom: N – nucleons, H – the hyperon octet, Δ – Δ-isobars and ρ – the condensate of ρ^- mesons. Lines N$\Delta\rho$ and NH$\Delta\rho$ visually coincide. The constraints are described in [4].

We study the equation of state of cold and dense baryon matter within the relativistic mean-field framework with hadron masses and coupling constants dependent on the σ mean scalar field. We included $\Delta(1232)$ isobars into previously developed models with hyperons [1] which have resolved the "hyperon puzzle" and consider a possibility of charged rho-meson condensation discussed earlier in [2, 3]. Δ-isobars, being included with realistic values of attractive Δ in-medium potential, do not lead to a strong decrease of the maximum predicted neutron star mass [4]. Thus our models resolve also the "Δ-resonance puzzle" risen in [5]. Concerning the charged ρ-meson condensation, the results are shown to be strongly model dependent. In models of one type (KVORcut-based models described in [1]) the charged rho condensation does not significantly affect the value of the neutron star maximum mass. In other (MKVOR-based) models [1], the condensation leads to a substantial neutron star maximum mass decrease, shown in Fig. 1. However, the observational constraint on the minimal value of the maximum neutron star mass ($2.01 \pm 0.04\, M_\odot$, shown by the band in Fig. 1) remains fulfilled in both cases.

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