

Strangeness content of rotating neutron stars with hyperons and WIMPs degrees of freedom in the pseudo-complex general relativity

A new constraint on the equation of state and matter composition of neutron stars has been provided by the measurement of the mass of PSR J0348+0432 ($2.01 M_{\odot}$). In this contribution, we investigate, in the domain of the pseudo-complex General Relativity (pc-GR) with baryons, mesons, electrons and weakly interacting massive dark matter particles (WIMPs) degrees of freedom, the role of the asymmetry parameter, which describes the relative neutron excess in the system as well as the behavior of the strangeness asymmetry parameter, which specifies the strangeness content in the system and is strictly connected with the appearance of the hyperon species in the system. We consider in particular the extreme case where the Sigma(-) experiences such a strong repulsion that it does not appear at all in nuclear matter. In the baryon sector, we consider the effective relativistic QHD-model with parameterized couplings which represents an extended compilation of other effective models found in the literature. Our model exhausts the whole fundamental baryon octet and simulates corrections to the minimal Yukawa couplings by considering many-body nonlinear self-couplings and meson-meson interaction terms involving scalar-isoscalar, vector-isoscalar, and scalar-isovector components. The dark matter sector consists of Standard Model (SM) gauge singlet Dirac fermions originated in the Higgs portal of dark matter. In our approach, we decouple the physical Higgs from the dark Higgs. This assumption also decouples dark matter from ordinary matter and transforms the fermion singlet system to a non-interacting Fermi gas of WIMPs. There is a residual interaction of the fermion singlets with the dark Higgs. However, after symmetry breaking in the dark sector, the fermion singlets acquire a mass, which we shall treat as a free parameter. In the pc-GR, the field equations have an extra term, associated to the nature of spacetime, of repulsive character, which is believed to halt the gravitational attractive collapse of matter distributions in the evolution process of compact stars. This additional extra term arises from micro-scale phenomena due to vacuum fluctuations, which simulate the presence of dark energy in the Universe. In this contribution, we explore the presence of this additional term and study the role of dark energy in the structure of rotating neutron stars composed by nucleons, hyperons, mesons, and dark matter held together by the presence of the nuclear and gravitational interactions superimposed to the repulsive background of dark energy. The corresponding version of the Tolman-Oppenheimer-Volkoff equations in the pc-GR formalism is solved and the mass-radius relations as well as the maximum mass of the star are determined for different parameter configurations. Star rotation is implemented via the Lorene Code.

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