Constraints for the X17 boson from compact objects observations

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Abstract:

We investigate the hypothetical X17 boson on neutron stars and Quark Stars (QSs) using various hadronic Equation of States (EoSs) with phenomenological or microscopic origin. Our aim is to set realistic constraints on its coupling constant and the mass scaling, with respect to causality and various possible upper mass limits and the dimensionless tidal deformability $\Lambda_{1.4}$. In particular, we pay special attention on two main phenomenological parameters of the X17, the one is related to the coupling constant g that it has with hadrons or quarks and the other with the in-medium effects through the regulator C. Both are very crucial concerning the contribution on the total energy density and pressure. In the case of considering the X17 as a carrier of nuclear force in Relativistic Mean Field (RMF) theory, an admixture into vector boson segment was constrained by 20% and 30%. In our investigation, we came to the general conclusion that the effect of the hypothetical X17 both on neutron and QSs constrained mainly by the causality limit, which is a specific property of each EoS, and it depends on the interplay between, the main two parameters, the interaction coupling g and the in-medium effects regulator C. These effects are more pronounced in the case of QSs concerning all the bulk properties.