Properties of strange quark stars with isovector interactions

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We have studied the properties of strange quark stars by employing a 3-flavor Nambu-Jona-Lasinio model with both scalar-isovector and vector-isovector interactions [1]. Using the constraint on the vector-isoscalar interaction strength obtained from the elliptic flow splitting between particles and their antiparticles in relativistic heavy-ion collisions [2], we have investigated the dependence of the properties of strange quark stars on the vector-isovector and the scalar-isovector interactions, and compared the results with the state-of-art astrophysical constraints on the compact star radius and mass as well as its tidal deformability from the GW170817 event [3]. Results from our study reinforce the prospect of using both heavy-ion collisions and astrophysical observations to provide constraints on the isovector coupling strength in quark matter and thus the quark matter equation of state as well as the QCD phase structure at finite isospin chemical potentials as shown in Fig.1.

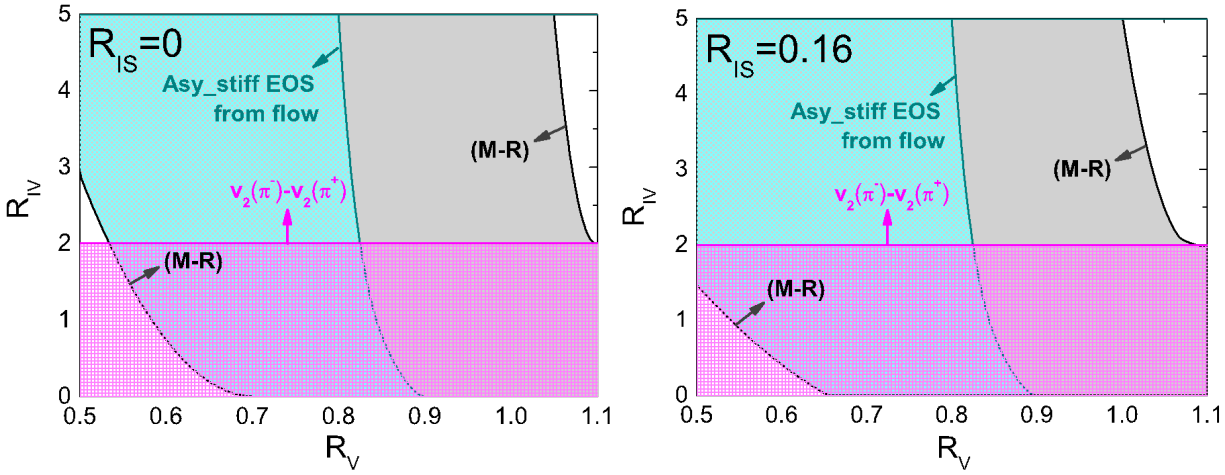

Fig. 1. Constraints on the strengths of the vector-isoscalar interaction R_V and the vector-isovector interaction R_{IV} from comparing with the hadronic matter EOS, the v_2 splitting results in relativistic heavy-ion collisions, and the mass-radius relation for strange quark stars. The left window is the case without the scalar-isovector interaction $R_{IS} = 0$, while the right window is for $R_{IS} = 0.16$.

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[2] J. Xu, T. Song, C.M. Ko, and F. Li, Phys. Rev. Lett. **112**, 012301 (2014).

[3] B.P. Abbott *et al.* [LIGO Scientific Collaboration and Virgo Collaboration], Phys. Rev. Lett. **121**, 161101 (2018).