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The sexaquark dilemma in neutron stars and its solution by quark deconfinement

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Following the idea that a light, compact sexaquark state with quark content (uuddss) might might be a candidate for baryonic dark matter that has gone unnoticed by experiments so far because its decay channels are practically closed [1], we investigate its possible role in the physics of compact stars. We find that the stringent constraints on the equation of state from mass and radius measurements of the high mass pulsar PSR J0740+6620 and bounds on the compactness from the tidal deformability measurement for the binary neutron star merger GW170817 cannot be accommodated simultaneously when the sexaquark would survive under the conditions of high densities in neutron star interiors.
As a solution to this dilemma, we present the dissociation of the sexaquark by a deconfinement transition to color superconducting quark matter, fulfilling all present constraints from multi-messenger astronomy.
The sexaquark mass parameter favored by the present analysis has recently been used to predict within a thermal statistical model the yield of sexaquarks produced in heavy-ion collisions at LHC [2].
[1] G. Farrar, 6-quark Dark Matter, arXiv:1711.10971 [hep-ph]
[2] D. Blaschke et al., Int. J. Mod. Phys. A 36 (2021) 2141005; arXiv:2111.03770 [hep-ph]

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