



Contribution ID: 95

Type: **Talk (virtual)**

A (axial)vector meson extended quark-meson model to describe quark matter in the core of neutron star

Monday 5 September 2022 11:40 (20 minutes)

The existence of quark matter inside the cores of heavy neutron stars is a possibility which can be probed with modern astrophysical observations. We use an (axial)vector meson extended quark-meson model to describe quark matter in the core of neutron stars. We discover that an additional parameter constraint is necessary in the quark model to ensure chiral restoration at high densities. Since they significantly increase the radii of hybrid stars, large sigma meson masses are excluded –consistently with our purely particle physics-based parametrization. The vector coupling can be constrained by mass limits since the maximum mass of hybrid stars is only weakly dependent on the phase transition. We performed a full Bayesian analysis using multiple astrophysical constraints: GW170817, NICER measurements and mass constraints. The results for the quark model parameters are consistent with our simple M – R relation-based investigation, but in addition, we found that observations are best accommodated by a stiff intermediate region with a center at $\sim 4 n_0$.

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