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How does isospin asymmetry influence the onset of quark matter

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In contrast to symmetric nuclear matter, which has been extensively studied in laboratory experiments, the matter inside neutron stars is highly isospin-asymmetric. We investigate the properties of strongly interacting matter under both symmetric and neutron-star-like conditions to determine how electric charge neutrality and beta equilibrium influence the emergence of quark matter. In particular, we establish a relation between the quark onset density in electrically neutral, beta-equilibrated matter and that in symmetric matter. This relation is demonstrated across a broad class of hybrid equations of state and reveals a significant reduction in the quark onset density in highly asymmetric regimes. These findings are further tested through Bayesian analyses of astrophysical measurements, underscoring their relevance for dense matter. A direct consequence of our finding is

that a lower-limit constraint on the deconfinement transition in symmetric nuclear matter may imply that this transition could occur in neutron stars at densities even below nuclear saturation density. This study is of significant importance to both the heavy-ion collision and neutron star communities.

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