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Antikaon Condensed Dense Matter In Neutron Star with SU(3) Flavour Symmetry

Observations of massive pulsars indicate that the core densities of compact stars can greatly exceed nuclear saturation density, possibly giving rise to exotic forms of matter such as hyperons, meson condensates, and quark matter. Among meson condensates, anti-kaon (K^-) condensation stands out as a promising candidate, though the nature of kaon-meson interactions remains incompletely understood. Employing SU(3) flavor symmetry, we compute hadronic couplings in the mesonic sector, building upon and refining previous quark model approaches. Important parameters—including the mixing angle (θ_v), the octet-to-singlet coupling ratio (z), and the symmetric-to-antisymmetric weight factor (α_v)—are determined, with α_v treated as a free parameter. Our findings demonstrate that increasing α_v leads to a stiffer equation of state, postpones the onset of K^- condensation, and results in higher neutron star masses. The K^- condensation emerges through a second-order phase transition, with its onset being highly sensitive to the value of α_v.

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