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The impact of non-zero quark masses on the Equation of State and the Maximum Mass of Strange Quark Stars

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This study explores the equations of state for strange quark matter as a superdense ground state within the MIT bag model, considering both fixed and baryon density-dependent parameters. We examine the structure of cold, self-bound strange stars capable of reaching masses above two solar masses, forming a continuous family with neutron stars along the mass–central density ($M(\rho_c)$) relation. The primary aim is to compare these theoretical mass predictions with recent precise pulsar mass measurements. By solving the Tolman–Oppenheimer–Volkoff equations numerically, we evaluate two scenarios: (1) fixed bag model parameters m_s, α_c, B ; (2) fixed m_s, α_c with $B=B(n_B)$. In this discussion, we address the solutions to the equations of state and subsequently examine the relativistic equations governing compact stars, incorporating the non-zero masses of first-generation quarks. Using numerical calculations based on their experimentally determined values with specified accuracy, we analyze the resulting relationships between these parameters and the various physical quantities.

Author: Dr SHAHINYAN, Hasmik (Yerevan State University)

Co-authors: Dr SARGSYAN, Tigran (Synopsis Armenia); Dr BABAJANYAN, Arsen (Yerevan State University)

Presenter: Dr SHAHINYAN, Hasmik (Yerevan State University)