Contribution ID: **55** Type: **not specified**

Implication of neutron star observations to the origin of nucleon mass

Tuesday 26 August 2025 15:40 (12 minutes)

We investigate the implications of neutron star observations for understanding the origin of nucleon mass using a framework that combines three complementary approaches: the parity doublet model for hadronic matter below 2n0, the Nambu-Jona-Lasinio (NJL) model for quark matter above 5n0, and a model-independent analysis of the intermediate density region based on fundamental physical principles. By systematically exploring parameter spaces and comparing theoretical predictions with recent observational constraints, we establish constraints on the chiral invariant mass in the PDM. Our results suggest that more than a half of the nucleon mass originates from sources beyond spontaneous chiral symmetry breaking, challenging conventional understanding of nucleon mass generation. These constraints arise solely from fundamental physical principles and observational data, independent of specific assumptions about the nature of the quark-hadron transition, providing robust insights into the microscopic origin of hadron masses.

Research field of your presentation

Theoretical Low-energy nuclear physics

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Session Classification: Young Scientist Session 3