Contribution ID: **110** Type: **Oral**

Is there a "hyperon puzzle" problem in neutron star study?

Tuesday 20 August 2024 14:00 (30 minutes)

Neutron star physics has wrestled with the longstanding challenge of the hyperon puzzle, attempting to reconcile lowered theoretical predictions of maximum masses due to hyperons with astrophysical observations based on the measured masses of the heaviest pulsars. Recently, we conducted a comprehensive statistical analysis of equations of state (EoSs) for neutron stars with hyperons, including both laboratory data and astrophysical observations. Results from the statistical analysis reveal the important role of the correlations between the scalar and vector channels of hyperon-nucleon interactions deduced from available Λ-separation-energy data of single Λ hypernuclei. The analysis preliminarily quantifies uncertainties in hyperon star properties due to the uncertain hyperon-nucleon interaction in dense matter, and the maximum mass of hyperon star is found to be around 2.2 solar masses, challenging the existence of the hyperon puzzle. As part of a broader initiative connecting nuclear physics and astronomy to quantitatively determine neutron star EoS, the study provides valuable insights into the hyperon puzzle and its implications for our understanding of neutron star interiors. Moreover, the investigation addresses the lack of precise knowledge regarding hypersonic interactions, emphasizing the need for additional hypernuclear data through a combined effort involving theory, experiments, and observations.

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Session Classification: Nuclear and Astro-particle Physics

Track Classification: F: Nuclear and Astro-Particle Physics