Contribution ID: **470** Type: **Oral**

New constraints to Chiral Effective Field Theories via Σ^+ -p femtoscopy with ALICE

Tuesday 8 April 2025 10:50 (20 minutes)

Experimental information on the strong interaction between Σ hyperons and protons is a crucial input for both the description of the equation of state of neutron stars with hyperon content and theoretical predictions regarding potential Σ-hypernuclei. Data on this interaction are scarce, solely based on scattering experiments. Since data points are only available at rather high relative momenta and their uncertainties are sizeable, theory calculations are not well constrained. Particularly the characteristics of the interaction in the triplet channel spin configuration are highly uncertain, and it is not yet clear if the interaction in this channel is attractive or repulsive. In this regard, two-particle intensity interferometry (femtoscopy) of Σ baryons and nucleons can provide valuable information.
The reconstruction of the weak decay of Σ^+ baryons is very challenging. Its decay into a proton and a neutral pion via the weak interaction has a branching ratio of around 50%, with the neutral pion decaying electromagnetically almost exclusively into two photons. In this talk, a novel reconstruction method will be shown which makes use of sophisticated reconstruction algorithms and machine learning techniques to improve the reconstruction efficiency and purity of the Σ^+ baryons, enabling the measurement of their correlation function with protons for the first time. The obtained correlation function will be discussed and related to latest theoretical calculations using Chiral Effective Field Theories, providing new constraints on the Σ–nucleon interaction.

Category

Experiment

Collaboration (if applicable)

ALICE

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Session Classification: Parallel session 17

Track Classification: Correlations & fluctuations