Exploring Λ and Σ Resonances near 1670 MeV with HypTPC at J-PARC

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Content

Understanding hyperon resonances in the low-energy regime presents a significant challenge due to overlapping states, broad widths and limited experimental separation. Our focus is on the 1670 MeV mass region, where both Λ and Σ resonances are expected but not yet fully understood. A precise investigation of this region can provide valuable insights into the dynamics of strange quark systems.

The J-PARC E72 experiment aims to measure cross sections for hyperon resonances in K^-p reactions near 1670 MeV using the Superconducting Hyperon Spectrometer (SHS) at the K1.8BR beamline. The central tracking detector of the SHS, the HypTPC, provides full three-dimensional tracking of charged particles with wide angular acceptance, enabling the simultaneous reconstruction of all K^-p reactions [1].

In the Λ sector, while $\Lambda(1670)$ ($J^P = 1/2^-$) and $\Lambda(1690)$ ($J^P = 3/2^-$) resonances have been reported, there is emerging evidence for a new narrow resonance in this region. This suggestion is supported by early observations of a non-even angular distribution in the differential cross section of $\eta\Lambda$ production from K^-p reactions [2].

In the Σ sector, the $\Sigma(1670)$ resonance displays notable discrepancies between formation and production experiments. Formation experiments report a single resonance with $J^P = 3/2^-$, while production experiments indicate two overlapping states with differing angular distribution of $\Sigma\pi$ and $\Sigma\pi\pi$ final states [3].

This presentation will discuss the anticipated results from the E72 experiment based on Geant4 simulation studies and evaluate the feasibility of clarifying the nature of these resonances.

Reference

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Field of Research: Interactions of mesons and baryons with strangeness
Experiment / Theory: Experiment
Contribution Type: Contribution talk