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Cusp Spectroscopy, Hyperon-Nucleon Scattering, and Femtoscopy: Pioneering Tools for Next-Generation Hadron Interaction Studies

Cusp spectroscopy, hyperon-nucleon (YN) scattering, and femtoscopy are indispensable tools for unraveling the complexities of hadron interactions and hypernuclear physics. Cusp spectroscopy enables precise determination of scattering lengths and interaction strengths by analyzing threshold cusp structures. YN scattering experiments provide valuable information on hyperon-nucleon interactions, which are key to understanding the baryon-baryon interaction in the strangeness sector. These experiments, including hypernuclear spectroscopy, are actively conducted at J-PARC in Japan, where a strong focus is placed on studying hypernuclei.

At CERN, Femtoscopy is performed in the ALICE experiment to probe the space-time structure of particle emission by measuring two-particle correlations at small relative momenta. This technique, sensitive to final-state interactions, provides critical insights into hadronic interactions in high-energy heavy-ion collisions.

The synergy between these techniques provides a comprehensive understanding of hadron interactions and hypernuclear properties. Hypernuclear studies at J-PARC deepen our understanding of multi-strange systems and contribute to refining theoretical models of baryon-baryon interactions. %Simultaneously, femtoscopy measurements at CERN offer complementary information on short-range hadronic forces, enhancing the predictive power of theoretical models.
By integrating the results from J-PARC and CERN, a more profound understanding of hadron interactions, hypernuclear structures, and multi-baryon systems can be achieved, driving future discoveries in hadron physics.

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