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New experimental frontiers in the study of many-body nuclear interactions with ALICE

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Exploring the strong interaction among hadrons, the ALICE Collaboration has for the first time extended the experimental measurements from two- to three-body interactions. These measurements provide unique information on many aspects of strongly-coupled systems, like the genuine three-body interaction, the formation of light nuclei and the search for exotic bound states. Among those, many-body interactions, also including hyperons, are an important ingredient in the calculation of the equation of state of neutron stars.

The results presented in this talk are obtained using high-multiplicity pp collisions at $\sqrt{s}$ = 13 TeV measured by ALICE at the LHC. The first measured three-body correlations include p-p-p and p-p-Λ. Their genuine three-body interactions are obtained by subtracting the known two-body effects from the measured correlation functions for the triplets. In both systems, a non-zero three-particle cumulant is observed, providing a hint to the existence of a genuine three-body effect. Another class of many-body interaction studies is identified in the correlations of hadrons with light nuclei. ALICE has measured proton-deuteron (p-d) interactions, a system containing three hadrons building up a pair of a hadron and a nucleus. The experimental correlation function is compared with theoretical predictions obtained employing the scattering parameters extracted from traditional scattering experiments for the p-d system. A clear deviation is observed, which may be interpreted as a demonstration of the late formation time of (anti)deuterons in hadron-hadron collisions.

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