

# WPCF 2023 - XVI Workshop on Particle Correlations and Femtoscopy & IV Resonance Workshop 2023



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## Study of the three-body dynamics at short range via femtoscopy by ALICE at the LHC

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Femtoscopy measurements in small systems like pp collisions have been demonstrated to be very sensitive to the effects of the final-state strong interaction. Such studies face now a new challenge with the extension for the first time to three-body systems. The study of three- and many-body dynamics has been a long-standing goal in nuclear physics, particularly for understanding the structure of light nuclei and describing neutron-rich and dense nuclear matter.

We present results obtained using high-multiplicity pp collisions at  $\sqrt{s} = 13$  TeV recorded by ALICE at the LHC. The first measurement of the genuine three-body effects obtained from p-p-p, p-p- $\Lambda$ , p-p- $K^+$  and p-p- $K^-$  correlation functions are obtained by utilising the formalism of the three-particle cumulants. Such measurements provide information on the genuine three-particle interaction and constitute important inputs for the calculation of the equation of state of neutron stars and the formation of kaonic nuclei.

We present as well a new experimental method to study three-body nuclear systems by utilizing correlations deuteron-hadron pairs. Measurements of the  $K^+$ -d and p-d correlations are compared with effective two-body calculations anchored to results from  $K^+$ -d and p-d scattering experiments. An excellent description of the measured  $K^+$ -d correlation is achieved, but the calculations fail to describe the p-d system. This discrepancy can only be resolved by performing a full three-body calculation, demonstrating that nucleons are the explicit degrees of freedom and opening the possibility of investigating the effect of genuine many-body nuclear interactions at the LHC in the future, including as well systems with strangeness and charm.

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