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A novel technique to access the residual strong interaction among hadrons at the LHC

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The ALICE collaboration has delivered in recent years unprecedented precision information on the residual strong interaction for several hadron pairs in the strange quark sector. These results have been obtained by analyzing the momentum correlation of particle pairs produced in pp and p-Pb collisions at the LHC. In such colliding systems hadrons are emitted at relative distances of the order of 1 fm, therefore, the effect of the short range strong interaction is reflected in the measured correlation function. This observable has been employed to test for the first time lattice QCD calculations and also to challenge the effective field theory results. In this contribution, the first measurement of the p-ϕ and Λ–K$\pm$ correlations in high-multiplicity pp collisions at $\sqrt{s}$ = 13 TeV will be shown. The extracted scattering parameters will be presented and the implications for the corresponding theoretical models will be discussed. In particular, evidence of a spin-½ p-ϕ bound state has been recently found by interpreting the measured p-ϕ correlation function with the help of Lattice calculation for the spin 3/2 component. For Λ–K– system, the first experimental evidence of the Ξ(1620) decaying into Λ–K– pairs has been observed, with strong implications on the existing Λ-$\bar{K}$ interaction models. In the last part of the talk, the extension of such correlation studies by ALICE to the three-body sector will be discussed. It will be demonstrated that three-baryon systems can be precisely measured at the LHC and that light nuclei can be exploited for such studies as well, offering a new opportunity to investigate many-body nuclear forces with innovative methods.

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