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Accessing the coupled-channels dynamics using femtoscopic correlations with ALICE at LHC

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Systems as $\mathrm{K}^{-}\mathrm{p}$ and baryon–antibaryon ($\mathrm{B}\overline{\mathrm{B}}$) are both characterised by the presence, already at the production threshold, of strong inelastic channels which can affect the properties and the formation of bound states and resonances. In the $\overline{\mathrm{K}}\mathrm{N}$ system, the $\Lambda(1405)$ arises from the interplay between the $\overline{\mathrm{K}}\mathrm{N}$ and the coupled $\Sigma\pi$ channel. Experimental constraints on the different $\overline{\mathrm{K}}\mathrm{N}$ coupled-channels are needed to provide a full description of the nature and properties of the $\Lambda(1405)$. Similarly, baryon–antibaryon systems are characterised by the dominant contribution of several mesonic channels related to the presence of annihilation processes acting below 1 fm. The possible existence of baryon–antibaryon bound states is still under debate due to a limited amount of data for the $\mathrm{p}-\overline{\mathrm{p}}$ system available, and either scarce or absent experimental data for $\mathrm{B}\overline{\mathrm{B}}$ systems containing strangeness. The femtoscopy technique measures the correlation of particle pairs at low relative momentum. This method applied in small colliding systems, as pp and p–Pb collisions at ALICE provided high-precision data on several baryon–baryon and meson–baryon pairs showing a great sensitivity to the underlying strong potential and to the introduction of the different coupled-channels. In this talk, we will present femtoscopic correlations measured by ALICE in pp collisions at $\sqrt{s} = 13$ TeV, separately for data samples obtained with minimum-bias and high-multiplicity triggers, and in peripheral and ultra–peripheral p–Pb and Pb–Pb collisions at $\sqrt{s} = 5.02$ TeV. In particular, we will show results on the $\mathrm{K}^{-}\mathrm{p}$ correlation function which for the first time provide experimental evidence of the opening of the coupled isospin breaking channel $\overline{\mathrm{K}^{0}} - \mathrm{n}$ and on the $\Sigma\pi$ channel contributions. Finally, results from baryon–antibaryon pairs ($\mathrm{p}\overline{\mathrm{p}}$, p- and -) will be shown for the first time. The effect of annihilation channels on the correlation function and a quantitative determination of the inelastic contributions in the three different pairs will be discussed.

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