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Extending the ALICE strong-interaction studies to nuclei: measurement of proton-deuteron correlations in pp collisions at $\sqrt{s} = 13$ TeV

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The large data sample of high-multiplicity pp collisions collected by ALICE allows for the precise measurement of the size of source producing primary hadrons, opening the doors to a study of the interaction of different hadron species using femtoscopy techniques. In this contribution, the momentum correlation between (anti)protons and (anti)deuterons measured in pp collisions at $\sqrt{s} = 13$ TeV with ALICE is presented for the first time. The measured correlation function for $(\mathrm{p})\mathrm{p}$–$(\mathrm{d})\mathrm{d}$ pairs is compared with theoretical predictions obtained considering Coulomb and Coulomb plus strong interactions and employing the Lednický-Lyuboshitz model with scattering parameters extracted from traditional scattering experiments for the p–d system. The measured correlation function can not be reproduced by any of the obtained predictions. This deviation can to large extent be interpreted as a demonstration of the late formation time of (anti)deuterons in hadron–hadron collisions. This conclusion is key for the understanding of the production mechanism of light (anti)nuclei, which is an open issue in high-energy physics. It has also important consequences for the study of antinuclei formation in the interstellar medium either from collisions triggered by high-energy cosmic rays or by decays of dark matter particles.

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