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Cosmic $\overline{\mathrm{d}}$ and $\overline{\mathrm{He}}$: production mechanisms and latest constraints from ALICE at the LHC

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The formation mechanism of light (anti)nuclei in high-energy hadronic collisions remains an open question in high-energy physics. Their production mechanism is investigated by comparing experimental data with phenomenological models using statistical hadronization or a coalescence approach.

In particular, the coalescence mechanism finds an essential application in cosmic antinuclei studies for indirect dark matter searches with space-based experiments like AMS.
Cosmic $\overline{\mathrm{d}}$ and $\overline{\mathrm{He}}$ are supposed to be produced via coalescence of nucleons stemming from either dark matter particle interaction or decay, or by interactions of primary cosmic rays with the interstellar matter. Constraining the (anti)nuclei formation mechanism with experiments in controlled conditions at accelerators is essential to reduce uncertainties on cosmic antinuclei flux estimates.

Thanks to the excellent tracking and particle identification performance, the ALICE experiment has performed a broad set of precision measurements on (anti)nuclei produced in different collision systems (pp, p-Pb and Pb-Pb) since the beginning of its operations. Furthermore, the ALICE apparatus underwent a series of major upgrades to take full advantage of the luminosity increase of the LHC Run 3. The results of these latest Run 3 d ($\overline{\mathrm{d}}$) and ^{3}He ($^{3}\overline{\mathrm{He}}$) measurements, the most recent results on the measured formation probability of bound objects as a function of the final-state charged particle multiplicity in comparison to state-of-the-art models, will be widely discussed.

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